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"ELECTRIC RAILWAY JOURNAL" FOR 1914

With this issue we begin the forty-third volume of the ELECTRIC RAILWAY JOURNAL. We also present our usual tables of statistics and publish as a special feature a number of interesting reviews of the industry by outside contributors. This symposium should be found of especial value because all of the articles are on subjects of general interest. At the same time they relate so closely to the industry that there is hardly a single electric railway company to which each one of the topics considered should not appeal as a matter of purely local concern. We realize that many of our readers have given a great deal of attention to these and kindred matters, and as it was impossible to cover all phases of the industry in this number we cordially invite others to continue the discussion begun here in later numbers of this paper. Our statistics include as usual data in regard to orders during the past year for cars and new track and a list of foreclosures and receiverships among electric railway companies. We also present a list of the block signal installations during 1913, as this is a phase of the industry which is rapidly becoming more important. The statistics of cars ordered and built and miles of new track constructed during the year reflect conditions among electric railway companies with which most of our readers are well acquainted. The gross business of the companies is increasing and demands new rolling stock, but the low margin of profit at present deters capital from entering upon the construction of new lines. When the Empire State of New York shows added electric city and interurban mileage of only 40 miles, and New Jersey and Illinois can be credited with only 12 miles and 25 miles of new track respectively, something must be wrong with the conditions. It is the solution of this and of the other problems which are confronting the industry to which this paper will devote its energies during the coming year, and while expressing its great appreciation of the cordial support and assistance which it has received from its readers in the past, it solicits a continuation of the same co-operative help in its efforts toward improved conditions in the electric railway field.

ELECTROLYSIS MITIGATION VS. ELIMINATION

The report of two members of the Bureau of Standards on the subject of electrolysis published elsewhere in this issue is perhaps one of the most comprehensive, and certainly one of the most positive, statements on the problems which have ever been published. The authors take the general position that damage from electrolysis can be most successfully minimized by a process which is inherently one of elimination of the cause rather than one of mitigation of the evil effects, and it cannot be denied that they have made out a strong case. In the systems of mitigation which may be applied to the affected pipe lines they include the two best-known schemes, namely, the use of insulated joints and the installation of drainage connections to the pipes. Both are admitted to be of certain value as palliatives which may be properly introduced in exceptional locations; but in the end the authors openly condemn them for any further use. As the drainage system has been heretofore so generally commended and possibly put to wider use than any other, this conclusion must come as a distinct surprise, and the unequivocal support accorded instead to the insulated return feeder system without boosters is certainly a warrant for most of us to revise or at least consider a revision of our ideas on the question of the prevention of electrolysis of underground metallic structures.

STEAM BOILERS FOR LARGE TURBINES

The new 30,000-kw turbines for the Interborough Rapid Transit Company are a good example of the extraordinary progress made in power plant practice as well as in equipment design during the last decade. Each of these new units will displace an engine and generator about twelve years old and of 7500-kw capacity, because, even with their auxiliaries, each machine will occupy less floor space—the reduction in unit bulk being 75 per cent. At the same time, the boilers required for each will be only those originally installed to supply steam to a 7500-kw engine. Obviously this condition could not have been brought about by a 75 per cent reduction in unit steam consumption, because the improved efficiency of the tur-

bines over the best types of reciprocating engines is at most a question of fractions, which are important but small in actual amount. Instead, the condition which enables eight 520-hp boilers to supply steam for a 30,000-kw turbine with a water rate of at least 11 lb. per kw has been produced by changes in power plant practices alone. Extremely thick fires subjected to a heavy blast pressure have so reduced the excess air once considered necessary for complete combustion that, with all boilers working and an evaporation of more than 8 lb. per square foot of heating surface, the flue temperatures are actually too low to permit the effective use of economizers. Except for the installation of high-capacity stokers the boilers have not been changed since the time when an evaporation of 4 lb. was considered excessive. It is true, of course, that superheaters are to be added, yet the additional heating surface thus provided constitutes but a small part of the total and is not applied for the generation of steam. Each boiler is to be taken out of service for cleaning the two bottom rows of tubes once every two months and for general cleaning and inspection once in eight months, so that at least once a week the battery of eight boilers for each 30,000-kw turbine is reduced in effective rated capacity to 3640 hp—more than 8 kw per boiler horsepower—a figure which is extraordinary even when judged by the practice of the past five years.

TREND OF THE TECHNICAL BRANCHES OF THE INDUSTRY

In 1913, as shown in the statistics published elsewhere in this issue, there has been a slight lull in car building. This may be in part the cause of the small number of new car designs brought out during 1913 as compared with 1912. However, judging by the relative number of cars of the new designs placed in service in cities other than those in which they originated, there seems to be little hope that they are going to be as potent an influence in operation as was at first expected.

The fully inclosed vestibule with folding or inside steps seems to be coming rapidly into favor, the object being the reduction of boarding accidents as well as the superior degree of protection in cold weather. The elimination of bulkheads is a logical step beyond this, and more of such designs may be expected during the coming year. For city cars the use of the near-side stop seems due for very general adoption as it appears to meet with rapidly increasing favor from both operating men and the public, and as a corollary the increased use of the front platform by passengers seems also to be inevitable unless center-entrance cars should come into wide use.

Lighting of cars will undoubtedly take a prominent place among the technical subjects receiving special consideration during the next few months. The recent commercial development of the tungsten lamp affords an opportunity for the application of scientific methods of illumination as it cuts the power required for light to less than half that required with the old carbon lamps, thus permitting the consideration of indirect lighting schemes which a year or more ago would have been prohibitively expensive.

In motors and electrical equipment generally no marked changes have taken place, although there appears to be a tendency toward the use of indirect, or multiple-unit, control systems, even by railways which display no indication of trying two-car train operation. This lack of innovation is obviously due to the very thorough standardization which is being effected in this class of material. Mechanical features, however, have continued to display the gradual changes necessitated some time ago by the growing use of steel in place of wood. The use of steel for car wheels in place of cast iron is also increasing in certain localities, although there are numerous supporters of each type. Cars of light weight which have become a commercial possibility through advanced ideas in design are, generally speaking, continuing to grow in favor, not only on account of the consequent saving in power but also because of the reduction in track maintenance.

Few repair shops were built during the past year, and in view of the improved methods and equipment introduced on every hand it is hardly likely, without an extraordinary growth of business, that the necessity for more space will require many more shops to be built in 1914. Repair shop practice in many particulars has been undergoing rapid changes, and other modifications will no doubt continue to be developed. Welding processes have made enormous strides in the past year, and it is safe to say that the use of this great labor saver and means for renewing scrapped apparatus will become nearly universal during the next twelve months. In the painting and washing of cars the way has been pointed out whereby material savings can be made, and the new processes, namely, baked enamel painting and automatic washing, may be expected to come into increasing use.

In the field of operation it may be said that the use of trains in city service is still a moot question. However, with the test which the Public Service Railway of New Jersey has so generously undertaken to run, it is likely that the coming year will see a final settlement one way or the other. The year has been a good one as regards block signaling on electric railways, and it is to be hoped that this tendency toward procuring automatic means for reducing accidents will continue. The development of schemes to provide track-circuit block signals and indicators with a directional sense was an important recent step in the art, and these cannot fail to play a prominent part in the installations for the coming year.

The problems in generation of power have recently been characterized by a somewhat sudden awakening to the fact that steam boilers are capable of vastly increased outputs, operation without difficulty at 400 per cent of rating being an actual accomplishment. Turbo-generators are still growing, as exemplified by the new 30,000-kw units for the Interborough Rapid Transit Company, and the fact that these machines are of the pure reaction type would serve as evidence that the advantages of low steam velocities were too great to be

overlooked, in contradistinction to beliefs of the supporters of the combined type having reaction blading at the low pressure end and several impulse wheels with nozzles to handle high-pressure steam.

Power station construction during 1913 has been singularly limited, although part of this may be ascribed to the fact that comparatively few new roads have been built in this period. The compactness of new types of power units and their auxiliaries has also permitted extensions to take care of increased service with little, if any, increase in building capacity. The purchase of power from outside sources is still growing gradually in popularity and shows every indication of continuing in that direction, the most notable recent event in this field being the revision after five years' operation of the Chicago contracts between the railways and the Commonwealth Edison Company.

The past year also has seen two important accomplishments in the field of electric railway power transmission, namely, the adoption by the American Electric Railway Association of an approved overhead construction for 600-volt lines, including a standard cap and cone, and the completion of a report on the joint use of poles, the latter to be considered at the midyear meeting of the association. It is possible in some cases that the problems of power transmission may be affected by the introduction in this country of the locomobile, or small self-contained engine and boiler, which has been used for many years in Germany. Indeed, the agitation over both this type of prime mover and the Diesel oil engine might indicate a belief in some quarters that these European methods were about to gain a foothold here.

In steam railroad electrification the feature of the past year has been the large number of announcements of lines to be equipped. One of these lines, the Chicago, Milwaukee & Puget Sound Railroad, is undertaking the most extensive electrification project yet attempted outside of the New Haven work by equipping 168 miles of single track. This installation naturally overshadows all of the others, but it does not necessarily detract from their importance, because its successful operation after completion cannot fail to drive many other lines into the fold. In connection with the Norfolk & Western electrification a new system of electric traction has been originated, current being collected from a single-phase overhead conductor and converted to the polyphase form for use in induction motors, and as the installation will be completed in 1914 its operation will be watched with a great deal of interest. The most notable electrification completed during the year has been that of the Butte, Anaconda & Pacific Railroad—a 22-mile line handling heavy ore shipments from the mines along the route to the smelters in Butte, Mont.—because it is the first in this country to use direct current at 2400 volts. Notwithstanding the high voltage, no difficulties of any kind have developed in the first months of operation.

In regard to matters pertaining to maintenance of way it may be said that the division of opinion as to the advantages of concrete underneath the ties is still in existence. The use of stone ballast, sometimes with concrete above the ties and sometimes with it underneath the ballast, seems to have a slight preference numerically, steel-tie constructions being very limited in number. The grinding of rail joints, the building up of cupped rails with the electric arc and, in fact, the use of every refinement available for making a perfectly smooth rail surface have progressed in favor to a marked degree. Finally, a great deal of attention has been devoted to the still unexplained phenomenon of rail corrugation, for which a number of plausible but divergent theories have been advanced. Indeed, the true economy of ample expenditures in the track department is now generally recognized, and during the coming year this work cannot fail to receive still greater attention.

THE RAILWAY BUSINESS SITUATION

Conditions in the electric railway industry did not undergo serious change in their fundamental aspects during the year 1913. There was rather an extension of the same kind of problems that the preceding several years had seen. The questions of the times which were with us a year ago and are still prominent are mainly those of public relations, capital values, rates, regulation and high operating expenses. The labor problem was a little more insistent in 1913, but the pronounced development in welfare work on the part of some companies probably lessened the emphasis upon this feature of operation. The companies undoubtedly have a keener appreciation of the difficulties of their situation, and in many places corrective steps are being taken which would not have been thought necessary a few years ago.

We speak of the general problems of the industry as serious, but in fact where they really seriously concern individual companies they threaten grave results. Only those officials of companies who have gone through the mill of great changes enforced by the drastic public demands of the last few years realize what can happen to them and to the properties in their care. There was an example in Chicago which antedated the era of regulation, but which included in its settlement some of the changes that would have been required under regulation. The shock of the New York receivership, although almost coincident with the commencement of public utility regulation in New York State, might have been hastened by the new law, as some people said, but it was inevitable anyway. There are still many troubled points in various parts of the country, and they appear to increase rather than to diminish in number. The problems thus are localized, although they have identifying features which show the close resemblance of one to another.

It is impossible in any satisfactory survey to refrain from reference to Cleveland. The ideal conception of the ordinance there was that it would be automatic in action. When the interest fund increased the rate of fare would decrease; when the interest fund decreased the rate of fare would increase. The model of automatic action displayed for the admiration of beholders was very simple and attractive. In practice, however, the ordinance works automatically to reduce the rate of

fare when the interest fund increases. It does not work so smoothly and automatically to increase the rate of fare when the interest fund decreases. It is easier to let rates down than to force them up. The service can be disguised when the fare cannot. The public does not realize when the service is shaped to the end of a 3-cent fare. Its consciousness is keenly alert, however, when a change in the rate of fare is made. It is possible to make a change in service without public announcement. It is not possible to make a change in fare without immediate public notice. These considerations have fostered the low-fare experiment in Cleveland. How long they will be controlling, however, it is impossible to say. Unless in some way the influence of the increase in cost and the readjustment assured by the finding of the board of arbitration can be overcome, they point to a higher fare in the future.

There is unrest in other cities also. In Toledo the financially rehabilitated company is going ahead to render service without regard to the franchise situation. By so doing it should pave the way for an equitable settlement. The Detroit situation is still far from settlement. After long negotiation an ordinance providing for a new franchise for the Metropolitan Street Railway line in Kansas City has been introduced in the Council. It carries out many of the radical ideas advanced in the last few years in reference to public utility corporations. In Des Moines a new tentative franchise has been prepared. No solution of the San Francisco difficulties has been reached. In these cities there is a curious mixture of the old theory of operation under a limited municipal franchise with the modern theory of stringent regulation, except that one of the best features of the modern theory is lost to sight, namely, the elimination of the limited franchise and the substitution of a franchise that is indeterminate or perpetual if proper service is rendered. There are the cities fighting on the one hand for rigorous terms in municipal franchises, while on the other hand the modern policy of flexible regulation by state commission gains in strength. State regulation is greatly to be preferred to municipal regulation, and we believe that it is only a question of time when all states will assume full control. If time brings that about, one of the best of the results will be the elimination of the continuous and paralyzing controversies between city and company. The city electric railway is so easily the prey of politicians under the old-time conditions that effective state regulation would be a relief.

There is a tendency to dwell upon this issue because it means so much to the companies and because it is ever prominently before them in these days. Both this question and the more internal one of higher operating expenses insistently confront the companies and demand settlement. The solution to the problem, unfortunately, is not one that is capable of standardization. Each company has the issue to meet for itself. It cannot avoid it but must do the best that it can to reach a settlement that will be fair to its security holders and its employees. In so doing, however, it needs to have the co-operation and not the antagonism of the public that uses its facilities.

THE RELATIONS OF THE CITY AND THE PUBLIC UTILITY

Practically the entire gamut of theories as to the relationship between public utilities and the public was traversed at the meeting of the American Economic Association in Minneapolis during the past week, and among the speakers were several outspoken advocates of municipal ownership and operation. No one can deny that during the past ten or twelve years a great change has taken place in the generally accepted ideas on the proper relations between the utilities and the state. Previous to that time, it is true, there had been a strict regulation of public utility capitalization in a few states, notably in Massachusetts, but generally throughout the country the public utilities and their franchises were held to be a class of property with which the owner could do about as he pleased.

The development a few years later of the commission idea of regulation, under which the state began to take control over the rates charged and the services rendered by the utilities, was a logical outcome of the new theory of public regulation, which now gained tremendous impetus. This theory, if we define it briefly, is that while public utility enterprises are in a sense private property, they must be administered in such a way that the owners can obtain from them only a fair return upon a fair valuation and that all surplus from their operation above this amount should go in some form to the public. Hardly had this thought become generally accepted when the situation became complicated by a large and still growing demand for improvements and greater luxuries in the service required from the utilities as well as an increase in the cost of labor and of all the materials which the utilities have to purchase to conduct their operations. If it had not been for these circumstances, there would probably have been a country-wide demand for a great reduction in the rates charged by electric railways. But the cost of operation had gone up instead of going down, and the position of the electric and steam railroads has changed from that of fighting a decrease to that of pleading for an increase.

It would manifestly be impossible, in view of the complex nature of the question, to lay down any hard and fast rules which would apply in all cases, yet we believe that the main directions in which progress should be made can be determined to some extent at least by the process of elimination. Thus, one suggested solution which we believe should be discarded at the outset, certainly so far as electric railways are concerned, is that of municipal operation. The actual management of the electric railways of the country should be in private hands, regulated so far as is necessary, if politics in our large cities are to be kept free from a great opportunity to apply the spoils system upon a large scale. This danger alone would be sufficient to eliminate the possibility of municipal ownership from consideration, but it would also be the height of injustice to the individual taxpayers to allow the city authorities to use the city credit to engage in a business involving such risk of financial failure as that of the construction and operation of electric railroads.

If, then, it is decided that the properties are to remain in private hands, there remain for consideration three main questions, namely, the valuation to be placed upon the present business and property, the rate which the companies shall be allowed to make upon this valuation, and the status of the future relations between the two parties. If the problem is confined entirely to these points, we believe that it will not be difficult to reach a satisfactory agreement in individual cases. The rate of return will necessarily depend upon that which can be earned in other enterprises in the same locality involving a similar risk, for obviously if it is any less no more capital can be induced to engage in the business. Other conditions being equal, this rate would have to be higher in a rapidly growing community where there is greater demand for capital than in the older and more stable parts of the country. Again, where the city is a partner and the proportion of the returns to the city, taken either as service or as direct payments, are paid before the utility earns its return, the risk is increased and a higher rate would have to be allowed than if the property was first permitted to earn a specified rate of return and the profits were then divided. The first New York subway was built under the former plan, and the company took all the risk. The present extensions are being built under the second plan. There are a number of other precedents where different rates of return have been agreed upon, depending upon different degrees of risk. We ourselves believe that a profit-sharing plan between the company and the city, under which there is an incentive to the railway company to have an economical administration of its affairs, is far better than a fixed limit to the rate of return, as, for instance, in Cleveland.

In regard to the amount of investment or valuation upon which this rate of return shall be estimated, we believe that in general it should not be less than the actual investment made in good faith in the property plus the accrued return on this investment not paid out to the security holders. We say "in general" because adverse business conditions in which the public has had no part have adversely affected many of these enterprises. In some cases they have been built in locations where the possible traffic did not warrant the construction of any line; in other cases there has been bad management, and in still others conditions which probably could not have been foreseen or avoided have made reorganization and a reduction of capitalization necessary. But where a road has been encouraged by both the law and the public to install an electric railway and establish certain rates on a franchise presumably unchangeable in its conditions, and where it has been conservatively managed and has made such improvements as were required from time to time by the progress of the art, its existing investment should be recognized. Then, if the community wishes to permit a higher rate sufficient gradually to amortize the difference between present value and present investment, such a plan can be inaugurated. In the future we see no reason to expect similar problems to arise. With the valuation and rate of return fixed, the rate to be paid by customers for the service can easily be determined. These principles seem in general to be those which should be the controlling ones in the settlement of this question.

INTANGIBLE VALUES IN SETTLEMENT CASES

The propriety of assigning any value to the so-called intangible assets of a street railway at the time of sale or valuation is often assailed, one of the latest instances being in connection with the recent valuation for the proposed purchase of the Toronto Railway, which the city is thinking about taking over before the end of the franchise period. Just why the average layman should look with so much distrust upon the word "intangible" is not easily explainable, for the basic idea underlying intangible values is one that he can easily obtain if he wishes and, what is more, readily comprehend. Intangible values may be roughly divided into two classes, one connected with the organization and maintenance of the company as distinct from the property, the other concerned with the building up of the business. The former include the preliminary technical expenses, legal expenses during the formation of the company not connected with construction expenses, cost of consolidation and reorganization, reconstruction due to unforeseen contingencies, brokerage, discount on securities and a reasonable promoter's profit. All of these items represent expenditures that are not limited entirely in their application to the accounting or fiscal period in which they originate; they are connected with the vital corporate being as long as it is in existence. The outlays for these items are therefore properly spread over the entire franchise period, and the proportion for the time unexpired is treated as a deferred charge to expense, an asset to the company. Now, when from any cause a company sells out before the expiration of its corporate right, the vendee, a municipality for example, should reimburse the company for these expenses that are applicable to the remaining period when the municipality and not the company is receiving the income. In other words, these assets represent money values paid out the use of which has not been yet enjoyed—intangible values, in short, that must be recognized.

As for the second class of intangible assets, franchise rights, these should be even clearer to the average citizen, for they are not so involved with accounting principles. The important points are two: An electric railway often begins its operations at a loss, and for some years the net earnings are likely to be meager indeed. In fact, a surprisingly large portion of a franchise period is spent in perfecting the organization, instituting economies and efficiencies and building up traffic and good will so that in the last years of franchise life a real substantial return on the investment may be secured. Hence, when a company, in the belief that it has a certain number of years of life remaining, has succeeded in laying the foundation for future profits it is perfectly justified in asking that a municipality desiring to purchase the property make up for these profits at their present value.

Problems of the Electric Railway Industry

The Electric Railways Enter the Year of 1914 Facing Widely Diversified Problems, and Different Aspects of Many of These Are Discussed by Prominent Men in the Industry

Opportunities Before the American Association

By CHARLES N. BLACK, President American Electric Railway Association

The problems confronting the electric railway interests of the country to-day are many and varied, and there has been no more critical time in the history of the industry than the present. The remarkable growth of American cities and the demands of modern business have made the question of transportation one of the most important of those confronting our municipalities. While the solution of this question, even under the most favorable conditions and with the hearty co-operation of the public, the various commissions and other governmental agencies, would be far from simple, it is greatly complicated by lack of such co-operation, due in a large measure simply to ignorance.

It is idle to waste time in arguments as to what causes brought about the present hostile tendency of the public to all public service corporations. We are confronted with a fact, not a theory, and the task before the electric railway industry to-day is to clear away the ignorance which is so prevalent in all sections of the country and among all classes of society and which must be dissipated before it is reasonable to hope for the establishment of any real and permanent progress.

Isolated and spasmodic attempts have been made by some of the larger electric railways through the local press to dispel the prejudice which has arisen in the mind of the public and to give it a clearer conception of the many serious and difficult problems which have arisen, but apparently little real progress over the country as a whole has been made, and if we are to better these conditions concerted action on the part of every electric railway in the country will be required. No better tool for this work is available than the American Electric Railway Association, with its membership extending into every state in the Union and controlling more than 80 per cent of the mileage of the country.

While in the past the work of the association has been of inestimable value, it has been confined in a large measure to the technical side of the industry, and it has touched on the broader problems and public questions in more or less of a desultory fashion. A far wider and more important field of work now presents itself, and it is incumbent upon the association to undertake the solution of the present problems with the same energy and in the same broad-minded manner as it has taken up and solved many of the difficult technical questions in the past.

With this end in view, there has been appointed a committee on public relations, consisting of the ablest men in the industry, together with leading representatives from the principal manufacturing and banking interests which are closely allied with the electric railway companies. It is expected that this committee will formulate not only some comprehensive and effective publicity campaign but also a financial plan for carrying it out successfully, and it will then be the duty of every member of the association to lend most hearty and active co-operation. Upon the solution of this problem depends the very life of the industry, for unless the prevailing ignorance and prejudice can be dispelled it will be absolutely impossible to secure capital for additions and betterments to existing properties, to say nothing of the necessities for the financing of new projects.

During the past few years a large number of the states have appointed public service commissions, whose authority, generally speaking, is very broad. The members of these commissions have been recruited almost without exception from a class of men who have had no experience in the electric railway industry, and in order to avoid ill-advised and destructive orders from these commissions the task of educating the individual members has devolved upon the managers and operators of the electric railroads.

Generally speaking, this has been successfully accomplished, with the result that it has been the exception where any really pernicious or unfair requirements have been promulgated. While local conditions naturally control in a large measure the policy of any company in its dealings with a public service commission, the committee on public relations can advantageously study and discuss the effects on the industry as a whole, both financially and otherwise, of the appointment of these commissions.

Another vital matter which is coming up more frequently every year is the question of the renewal of expiring franchises. Municipal ownership numbers among its advocates a large proportion in every community, and unless a franchise can be drawn in such a manner as to be absolutely fair to the public, encourage the settlement and building up of the outlying districts of a community and, at the same time, hold out such promise of financial returns as will encourage capital to embark in the electric railway industry, municipal ownership will receive a really tremendous impetus.

These are but a few of the very important problems which are confronting the industry and will require the very best work of the ablest men connected with the association, if they are to be solved in a successful manner.

The affiliated associations of the American Electric Railway Association carry on a work that is practically continuous. The consideration of questions of technique and of operation is their province, and the constantly changing conditions incident to the marvelous progress in the science of transportation offer an opportunity for co-operative effort along the lines of their special activities which has been and is being taken advantage of in a most satisfactory manner. Among these may be mentioned the preparation and publication of the "Engineering Manual," which will undoubtedly prove of the very greatest use to the engineering staff of the various member companies of the association.

Any description of the work of the association would be incomplete without reference to the Fare Research Bureau, which has recently been organized under the charge of a recognized expert and which promises to be of great value in the settlement of a very serious question.

How to Have Good Public Relations

By C. LOOMIS ALLEN, of Allen & Peck, Inc.

The problem of public relations has been discussed for a good many years as an abstract question. It is, however, an intensely practical question. The results that flow from the attitude of the company on this problem are tangible. There cannot be bad public relations without a corresponding adverse effect upon the earnings and credit of a company. There cannot be good public relations without a favorable effect upon the credit and earnings.

The wisest thing that each company can do is to face this problem squarely. It should analyze conditions in its community. There is no use in disregarding plain facts. Conditions in each community are either favorable or unfavorable. There is not a middle ground. If bad public relations exist, the reasons ought to be clear. Such relations cannot exist unless at some time in its history the company has been at fault. If the company is still at fault in its attitude in any respect, that attitude should be changed without delay. If other agencies than the public are at fault, the company should exert every honest effort to set them straight. How this can be done is a problem by itself in each case, but satisfactory general policies will always help.

Suppose, for instance, the company has followed the policy of secrecy. It has not given information either to the public or the newspapers. It has the reputation of not giving satisfactory replies to inquiries. Neither the public nor the newspapers are met with courtesy when they ask fair questions about matters that ought to be of common knowledge. The way to overcome the result of such a mistaken policy is to enforce rigorously a new attitude of publicity. Let the company welcome the newspapers and the public. If they learn more than they have a fair right to learn the harm done will not be nearly so great as if they learn less than they have a fair right to learn. Furthermore, when they find that they can get easily the information that they ought to have, the basis is laid for a new feeling toward the company.

Public utility companies ought to make it possible for the newspapers to be their friends. They cannot expect the newspapers to have this attitude unless they try their utmost to solve the problems before them to the satisfaction of the public they serve. In their work of serving the public the newspapers seek the news in their communities. If they cannot get news worth printing about the company from its accredited officials, they are likely to try to get it in other ways. They know that the company has news. If the company makes it difficult or impossible for them to get the news, they try to get it through underground channels, and the result is a garbled report for which the company is, in the main, responsible.

There is plenty of legitimate news about an electric railway. The great difficulty is that the officials of the railway do not know what the newspapers would like to publish. The newspaper men on most papers want to be fair, and if the company is fair with them they will respect its confidences. No public utility official, however, can expect to treat newspaper men in the community unfairly and receive from them that considerate treatment which he, as a representative of his company, ought to have for the sake of his company as well as for his own sake.

The best medium of communication and friendship between the railway and the newspapers which carry the news about the railway to the public is a trained newspaper man in the employ of the company. This does not mean that if a newspaper representative calls to interview the president or the general manager of the company he is to be told that that official is busy and be referred to the publicity agent. A trained newspaper man should be in the employ of the company, not as a substitute for the officials but to supplement all that they can do to tell about railway matters which are of interest to the public. Such a man, if worth his salt, will be on the lookout for items of news in every department that the newspapers will be very glad to print.

He will write articles of the same kind that he would write if he were employed by the newspaper. When this is done he will, after discussing the items with the management of the railway company, offer them to the newspapers, always being careful to use the same judgment about news as a representative of the railway that he would use as a representative of the newspaper. He should not ask the newspapers to print what he knows they ought not to print.

The adoption of this policy will help the railway in one of its main difficulties, that of teaching the public that there is a railway side to the great and serious problem of public relations which ought to be understood better than it has been in the past. A clear public understanding of what the railway side of the story really is will help to pave the way for good public relations, which are absolutely necessary if the company is to become or remain prosperous.

Increased Cost of Electric Railway Operation

By CHAUNCEY ELDRIDGE, of Tucker, Anthony & Company, Boston, Mass.

The most serious problem confronting the electric railway at present is the increasing cost of operation, including fixed charges and taxes. Interurban and city roads both feel the pressure of rising expenses, and the situation is rendered doubly difficult by the demands of the investing public for higher returns upon capital —returns which would have been considered out of the question a few years ago. Hemmed in by the established 5-cent fare unit, the urban electric road is face to face with a financial problem of no small moment. In the Middle West many interurban lines started operation on the basis of an average fare of 1½ cents per mile, with commutation and other reduced rates yielding only 1¼ cents. It has been absolutely demonstrated that an interurban road cannot be properly operated to-day, paying its running costs, fixed charges and allowing anything for depreciation, on the basis of a 1½-cent fare per passenger mile. On city lines the inflexible 5-cent fare unit with nothing less than extraordinary transfer privileges frequently permits a maximum ride of 20 miles, and everybody knows that it costs a company two or three times the nickel unit so to transport the long-distance rider.

Analyses of the actual cost of operation in the city of Cleveland, Ohio, show that more than 4 cents per passenger must be collected if a reasonable amount is

to be laid aside for depreciation and maintenance, yet there is a constant cry from the public for decreased rates. The average community would embrace a proposition for a 2-cent urban car fare without regard to the actual cost imposed upon the operating organization. The 3-cent fare in Cleveland was undertaken by a former municipal administration as a temporary expedient, but the whole policy of the present city government seems to be to cut its cloth to the 3-cent standard rather than to maintain the best service and ascertain the limits which that service sets. Such a policy, if persisted in, leads to the junk heap.

The most apparent source of relief from the adverse conditions now bearing down upon electric railways is through the education of various state commissions to the point of appreciating the burdens imposed upon the companies, not only by popular demands for lower fares but by the growing costs of labor of material and of capital and by the urgent pressure upon railway managements for larger, faster and more luxurious cars and improved service in every way. There is a tendency on the part of these tribunals toward according to the transportation companies a fairer hearing than has sometimes been the case in the past, and these boards, in many cases, are much less inclined to drastic action, biased by the popular appeal, than they were a few years ago. On a typical interurban road, charging the legal steam railroad rate of 2 cents per mile, under the jurisdiction of one of the newer commissions, the board has resisted a demand on the part of the public for reduced fares and increased stops, the latter having been granted in but two or three instances where an absolutely valid reason could be shown for such interruption of the schedule. This commission has declared that the road has been in operation too short a time to justify any invasion of its charges along the lines proposed. Five years ago little likelihood of decisions of this kind existed in many states, and had the petition been presented at that time the tendency of such boards to use their powers almost exclusively on behalf of the public would have militated against the equitable treatment of the problem.

It is unlikely that the cost of operation can be reduced in any permanent way by electric railways, although there may be temporary decreases in the expense of labor and materials during periods of business recession. There is some opportunity for adding to income by the development of electric express and freight service, but in the main the relief needed must be sought through the commission channel. Ultimately, it is possible, the general public may awaken to the real situation and co-operate to some degree at least with public utility managers handling transportation service along the line of conceding a fair return upon the capital invested in the enterprise; but the direct education of the public is very costly, and it is probable that only after several unfortunate examples will the people as a whole give the matter its due consideration. The interurban road stands in a somewhat better position in regard to fare matters than the city system. Its average revenue per passenger may be five times that of the latter, and its management deals with a correspondingly small number of patrons. The existence of fare zones also affords a certain flexibility in the adjustment of rates. The state commission is the controlling factor in the situation, however, and the immediate future of the industry rests very largely in its hands.

The Central Electric Railway Association and the Interurbans

By ARTHUR W. BRADY, President Union Traction Company of Indiana

While the membership of the Central Electric Railway Association is made up of both urban and interurban companies, the principal work of the association has lain in the interurban field. In no part of the country has there been a greater development of interurban railways than in the Central West. This development has been due to several causes. The principal factors are found in physical conditions generally favorable to construction, the lack of other means of transportation furnishing the frequent service required and desired by the public and a population of sufficient density to appear to justify the necessary investments of capital.

The interurban lines were built under varying conditions and according to varying standards. Some of them were built by street railway companies as extensions of their systems. Others were built as independent railways, connecting perhaps at terminals and other points with street railway systems, over the lines of which the interurban cars were operated under trackage contract. Some of these lines were constructed out of funds furnished in ample amounts by strong groups of capitalists, while others were built out of local contributions, inspired by public spirit as much as the hope of profit and often made without knowledge of the requirements of railroad construction of any kind. It is not strange that the lines thus built differ greatly among themselves in the standards of construction employed. Many builders adopted urban street railroad standards as the standards for interurban construction. A few adopted steam railroad standards. Between these extremes practices varied greatly. Because franchises over highways were in many instances freely granted to the projectors of a desired interurban line, the cost of a private right-of-way was sometimes avoided, and the line was built on a highway. Because street cars could be operated without regard to gradients or curves, in many of the earlier interurban lines the steepness of grades and the sharpness of curves were frequently looked upon as items of little importance. In the rails, joints, ties, overhead construction, cars, motors—in practically everything—widely diverse standards ruled.

As it was with construction, so it was with maintenance and operation. Many of the operators and managers of the early interurban lines were men of little, if any, railroad experience. Some of the more experienced ones had gained their experience in street railway operation, others in steam railroad operation. Here, again, methods varied almost in proportion to the number of lines. So it was also with practices involving the patrons of the lines. On one line every effort would be made to induce the use of tickets by the traveling public, while on other lines no tickets at all were sold and fares were collected in 5-cent zones, so that the passenger would be called upon to pay his fare a number of times on a journey of any distance. On some lines baggage was carried in every car, while on others baggage was carried only on infrequent cars, if carried at all. On some lines baggage was carried free, while on others no baggage was carried without charge. Some lines carried freight in cars used also for the carriage of passengers. On other lines all freight was carried on express cars used only for that purpose, while on still others no freight at all was carried. The ticketing of passengers, the checking of baggage and the interchange of freight were practically unknown.

The lack of system and standardization which thus characterized interurban lines in the earlier development was largely due to the exceedingly rapid rate at which that development had proceeded. The resulting condition was serious. Several thousand miles of interurban railway existed in the Middle West, connected together at many points, but, because of diverse practices and standards and lack of harmonious co-operation, the lines were incapable of accomplishing for public or owners all that both could rightly demand of them.

The Central Electric Railway Association, which in its origin was the successor to certain state organizations, has a record of successful accomplishment in establishing order, system and standardization in place of the confused condition which formerly existed. The record thus made is not the work merely of the association named but also in large part that of its affiliated associations, the Central Electric Traffic Association and the Central Electric Railway Accountants' Association. The meetings of the association bring together men active in all branches of electric railway work, including representatives of the principal manufacturing concerns connected with the industry. The papers read and discussions had are of a highly practical nature. It is safe to say that, taken as a whole, no better presentations have been made at meetings of any other association of the best practices in electric railway construction, maintenance and operation. No two successive meetings are held in the same state. Generally one or more special cars bring members from distant points. The result is that, instead of the state of isolation which formerly existed, the men in charge of operation and maintenance on one line have now a fairly good knowledge of what has been done and is being done on other lines throughout a wide territory. This opportunity to make comparisons itself leads to improvement, as well as to uniformity and standardization, for what one line borrows from another almost universally means the displacement of an inferior by a better practice. The work of the active committee on standardization of the association has contributed greatly to the same result.

Only a few years ago it was almost impossible to secure reliable information with reference to a journey of length by interurban railways. It will be remembered that one of the great newspapers of the country, being unable to ascertain the facts from the electric railways themselves, some years ago started a representative from Chicago to New York to discover whether the through trip could be made by electric railway. So far as the territory of the Central Electric Railway Association is concerned, such information is now easily accessible.

Through the work of the Traffic Association, a well-engraved map has been published and widely distributed showing interurban lines between Chicago and eastern Illinois on the west and Pittsburgh and Buffalo on the east, taking in southern Michigan as its northern limits and northern Kentucky as its southern limits. Furthermore, elaborate tariffs for interurban traffic, freight and passenger, have been issued, and a convenient means of filing changes with interstate and state commissions is supplied. Any interurban agent is now enabled quickly and easily to give information as to routes and rates between all points in the Central Electric territory. Moreover, baggage regulations have been standardized and simplified, and provisions have been established for the interchange of rolling stock. Thanks to the Accountants' Association, standard methods of interline accounting have been adopted, so that the lines themselves are able to handle interline business without difficulty. It is now practically as easy and convenient for one desiring to travel or to make shipments throughout the Central Electric territory to use the interurban lines as to use the steam lines.

To the unification and standardization of the interurban railway work which has thus been brought about in Central Electric territory several factors have contributed. It may be safely affirmed, however, that one of the most potent of these factors is the continuous and energetic labors which the lines have themselves put forth through the Central Electric Railway Association, the Central Electric Traffic Association and the Central Electric Railway Accountants' Association

Purchased Power and the Street Railway

By CHARLES L. AYLING, of Baker, Ayling & Company, Boston, Mass.

The increased cost of operation on the modern street railway and the difficulty of offsetting it by raising the fare unit are fully appreciated in financial and administrative circles to-day. To preserve net earnings so far as possible under these conditions it is a great advantage to fix as many expenses as may be upon a definite basis. By such a policy the margin of a reasonable return from an established fare unit may be to some extent safeguarded. Could the cost of transportation as measured in wages have been fixed five years ago, conditions in the industry would have been very different to-day. Economies are being sought in many directions, however, and among these the use of purchased power is a positive factor in standardizing the expenses of operation.

Every probability points to a material increase in the cost of coal in the not distant future, and it is unlikely that station labor costs will be reduced per employee as time passes. The latter item has risen in parallel with platform costs in the last few years, not only through reductions in the length of shifts from twelve to eight hours in many plants but through direct increases in wages.

The production of power by large steam and hydroelectric stations is attaining new importance in many localities, however, and the street railway is beginning to realize that in most cases at any rate it cannot produce energy as cheaply as these large plants can supply it, thanks to the diversity factor resulting from non-coincident peaks. Investigations by the Commonwealth Edison Company of Chicago have shown that the combination of manufacturing, trolley and lighting loads saves certainly 20 per cent in plant capacity and hence in investment and corresponding fixed charges. Centralized power supply reduces the ultimate cost of electric transportation to everyone who may be concerned.

The Connecticut River Transmission Company and its affiliated organizations, with which the writer is most familiar on account of the financing of their developments through Baker, Ayling & Company and their management by Chace & Harriman, furnish a suggestive example of power supply for economical reasons to street railways in central New England. The high-tension steel tower lines of this system extend from Pittsfield and Adams on the west to Worcester, Marlboro and the Rhode Island line on the east.

During a period of operation which has covered less than four years these companies have been established and are now delivering power at the rate of 150,000,000

kw-hr. per annum, an output in excess of the combined production of all the central stations in those portions of Massachusetts inclosed by their lines. Power is supplied to the Worcester Consolidated Street Railway at three important points; the Massachusetts Northern Street Railways are operated entirely by hydroelectric service from Gardner to Athol; power is being delivered to the Springfield Street Railway at Palmer, and a contract for a large block of power has lately been closed with the Berkshire Street Railway. Arrangements have also been made to furnish power to the Boston & Maine Railroad at Zylonite, Mass., for the operation of the heavy electric locomotives in the Hoosac Tunnel.

One feature of operation which has been of much advantage to street railways purchasing power from large plants is the improved voltage regulation secured under traffic peak conditions. This results in a material betterment of the running time of the cars, especially on holidays and Sundays, and it cuts down wear on the motors as well. Again, the making of power contracts for a long period, often from ten to thirty years, definitely fixes the price of electricity and rids the operating company of this element of uncertainty in its running costs throughout the entire life of the agreement.

In other words, such a program gives stability to net earnings, and it does it by virtue of the economic advantages of wholesale power production and distribution. The cost of attendance in a steam generating plant in a large power system may be 20 per cent of the gross income, whereas in the hydroelectric plant it runs from 5 to 10 per cent of the gross. In the production, transmission and distribution of electric power from large hydroelectric plants with supplementary steam equipment, used only when water is short, unit costs tend to run low, permitting the quotation of favorable rates and offering the street railway at least a measure of escape from the conditions which at present heavily oppress it.

Rolling Stock Design

By E. W. HOLST, Superintendent of Equipment Bay State Street Railway

The selection of rolling stock for street railway service is pre-eminently a problem whose solution depends upon local conditions, and the design of passenger cars, particularly for operation in cities, is therefore a matter which cannot be settled in an off-hand way. To the layman the task of transporting the public on an urban street railway doubtless appears much the same in one place as in another. Most thickly populated communities have their rush hours and midday traffic, substantially all are served by electric roads upon the basis of the 5-cent fare with more or less liberal transfer privileges; the use of tracks laid in the public thoroughfares is universal, and there are other features of the service which make the passenger feel at home aboard a street car entirely apart from the city in which he happens to be traveling. From the popular viewpoint, therefore, it would seem to be a simple matter to provide an increase in rolling stock when the growth of traffic, existing or anticipated, exceeds the capacity of the operating equipment.

In reality, the ideal car for city service, the standard design which is capable of meeting local requirements pretty much anywhere, does not exist. One has only to review the tendencies in car-body design of the past five years to realize that the more local conditions are studied the less becomes the possibility of ordering cars from stock and putting them into service with the expectation that they will meet the approval of the traveling public and afford the most economical operation and maintenance. Each case must be studied on its merits.

A glance at some of the factors influencing car design will show why a single type or standard of construction cannot fulfil the requirements of diversified service in dissimilar communities. Were all cities alike the problem would be fairly simple, but each town has characteristics from the street railway point of view which individualize its transportation conditions. The width of streets, use of single-end or double-end operation, spacing of tracks, limitations of overhang, curvature of the line, presence and character of grades, bridge, station and platform clearances, facilities for loading and unloading passengers, strength of bridges, and the type of rolling stock units already in service, together with the schedule speeds and stop requirements in force or contemplated, are some of the features external to the car itself which influence the design.

Inside the car a still greater number of conditions must be taken into account before the best rolling-stock type can be determined in a given instance, and even here the test of actual service on a limited scale is generally desirable before large investments are committed to radical departures in design. The reason is not that the engineering features of a car may require modification but that the actual fitness of the equipment in caring for the comfort and convenience of the traveling public are best demonstrated by the use of the car by the passengers and operating crews. An inch or two added to the width of a seat or an aisle may be a powerful factor in deflecting traffic to an operating company under competitive conditions. The location of heaters, effectiveness of the interior illumination, shape of seat backs, width and length of window sills or arm rests, the percentage of the car side occupied by window glass—these and many other details bear upon the popularity of a car type.

In addition to these considerations the problem of fare collection, the desirability of keeping the conductor at work at a fixed point, the expediency of the center entrance, the disposition of seats and location of the aisle space, the proportion of standing space which should be allowed in specific instances, the necessities of internal circulation on the part of passengers after boarding the car and on approaching stops, the adaptability of the prepayment feature and the effectiveness of moving the passengers in a general forward direction through the car as a means of reducing congestion are all points whose importance varies not only in different cities but frequently on different divisions and routes of the same railway.

Methods of operation long accepted in one community may be most unfavorably received in another. In one case a desire to preserve the lowest possible fare may result in a density of car loading which would be regarded as abnormal elsewhere. In another adherence for local reasons to single-ended operation and the concentration of boarding and alighting at a single door may yield satisfactory service despite the fact that it pockets the passengers and possibly renders the collection of fares in rush hours a good deal of a problem. Local traffic regulations affect car design, as do also the character of patronage handled, the relation of midday to rush-hour travel, the motor equipment required to maintain the desired schedule and the limitations of

wheel diameter, truck design and requirements in heights of car steps.

In the development of different types of cars to meet the foregoing varied conditions in combinations peculiar to each community can be seen the advance of the industry toward the more scientific treatment of its transportation questions. There is little doubt that for city service the prepayment type of car bids fair to increase in popularity among electric railway managers, and in forms specially designed to prevent acidents due to improper boarding or alighting. Obviously, the reduction of car weights in new designs demands the attention of all those who appreciate the economies of such a program, and there is no question that this phase of car development is viewed with much greater interest than a few years ago. Again, the close attention now given to motor selection for stated service and the recognition by many of the wisdom of occasionally studying the fitness of such equipment to handle changed traffic conditions bear witness to improved conceptions of engineering responsibility.

With regard to the widely discussed question as to the use of all-steel or wooden construction, the writer is of the opinion that for a surface car designed for local operation all-steel construction will not be so desirable in the long run, for the reason that the metal post, roof, sash and fittings, whether riveted or braced, are in time subject to damage through jarring and loosening at joints, resulting in rusting, increased wear and excess maintenance besides having a tendency to be cooler in winter and noisier in operation. Better flexibility of construction is obtained by the use of combinations of wood and steel, the latter being particularly useful in underframing and side construction up to the window sills. To low cost of maintenance and economical operation must be accorded due consideration in the design and selection of every important detail of car equipment.

European Railway Electrification

By GEORGE GIBBS, Consulting Engineer, New York

In the summer of 1913 I spent about two months in a visit to Europe for both pleasure and professional purposes. On this trip I enjoyed the opportunity of discussing electrification problems with such men as Charles H. Merz, consulting engineer for the Melbourne electrification; Philip Dawson, consulting engineer for the London, Brighton & South Coast Railway, both at London; Dr. W. Reichel, director Siemens-Schuckert Works; G. Wittfeld, Geheimer Oberbaurat, in general charge of the Prussian State Railways electrification, and the managers of the Allgemeine Company, all at Berlin. In Paris I met M. Jullien, chief engineer of the electrification work of the Midi Railway in the Pyrénées. Every facility was offered to me to obtain information, and at Berlin, particularly, I had the pleasure of going through the works of the two great electrical manufacturing companies mentioned. On a previous visit to Europe I had inspected the Dessau-Bitterfeld line, but lack of time prevented a trip to the newly opened Lötschberg Railway during the course of this visit.

A study of the work done on the Continent shows that all of the electric railway engineers have followed the same principles as their steam brethren, namely, their constructions are very light as compared with American standards, even for like conditions. Line and equipment are much more complicated and refined than would be considered desirable for the rough-and-tumble conditions of America, but unquestionably the work done in Europe is beautifully designed and conscientiously maintained.

So far, the Dessau-Bitterfeld line has been used practically as an experimental ground. Every suggestion for the improvement of line and locomotives is being tried out there. The authorities now have an immense mass of data which still remains to be sifted out and classified for practical deductions. Mr. Wittfeld informed me that, although the Dessau-Bitterfeld side-rod locomotives looked so very light, almost flimsy in fact, the only trouble of consequence given by them had been the breakage of the forked ends of the main rods. Forged solid ends had been substituted, and he felt that the end of locomotive troubles was in sight. The maintenance of these and other foreign electric locomotives is so systematic and thorough that they do not carry protective devices against short-circuits, like slip joints between the armature and shaft, such as are considered necessary on American locomotives.

The electrification of the Berlin Stadtbahn is a project much favored by the public, but it has made its way to official adoption very slowly, partly on account of the opposition of steam interests and partly on account of the probability that electrification, while increasing capacity, will not be profitable at the present ridiculously low fares. To reduce the cost of electrification it was first proposed to use front and end locomotives in order to retain the passenger coaches, which are of special type and not readily available for use on other steam lines. Now the electrical interests appear to appreciate that motor car operation would be far better than the clumsy locomotive arrangement, but many lack the courage to recommend the former because of the additional expense. When locomotives were suggested, single-phase was proposed for their propulsion, for the reason that some of the trackage forms part of trunk lines. The whole question has now been reopened, however, and the authorities may decide to use another system for suburban work exclusively.

On the Continent generally, however, there is no question that single-phase is in the ascendant. In Germany all the authorities seem to be agreed upon it, and the same fact holds true of Austria and Switzerland. Both of the great manufacturers, the Siemens-Schuckert and Allgemeine companies, consider the single-phase system the proper one for heavy work, although these companies also build high-tension direct-current equipment for lines of interurban character. Both deprecated the controversial character of American discussions on choice of systems. In Italy the three-phase system is favored by the Italian State Railways, more particularly because of the mountainous character of so many lines, such as the present Valtellina and Giovi electrifications.

In France not much is going on at this time except the electrification of some suburban lines out of Paris and the experimental single-phase line of the Midi Railway. The latter is a forerunner for an ambitious electrification of some 250 miles of mountain branch railways which are to receive energy from hydroelectric sources. The types of locomotives have already been selected.

The confidential data on the London, Brighton & South Cost single-phase electrification show most satisfying results. The only electrical trouble of importance was a faulty design of brush holder, and this defect has since been corrected.

The Distribution of Power for Traction

By LOUIS BELL, Ph.D., Consulting Engineer, Boston, Mass.

The past year has shown singularly little development in the methods of transmission and distribution applied to electrical traction. There are interesting promises for the future, but for the present there is not much to boast about. So far as the pure transmission side of the work goes, railway working both here and abroad is on a comfortably conservative basis of voltage. There is not much occasion for going to extreme pressures. The Oregon Electric Railway and one or two others in this country take advantage of transmission at 60,000 volts or thereabouts, and the Dessau-Bitterfeld single-phase road in Germany transmits at 66,000 volts and is actually working underground cables at this pressure. Most electric railway transmissions are, of course, less than half such figures as these. On a few recent lines suspension insulators are in use, but for the most part pressures are not high enough to call for this type of construction, and railway transmission lines as a whole are of rather commonplace construction, such as has been long familiar in this country.

Abroad, steel poles are very much more freely used than here, and one interesting innovation in transmission line construction along railways is the use of a solid drawn tubular steel pole. These poles are about 40 ft. high and look as if made in three or four sections. They are, however, integral Mannesmann steel tubes, and the apparent joints are merely reductions in diameter. The poles start at the bottom at about 8 in. in diameter and are reduced to a scant 4 in. at the top. They are quite thin and are set in concrete bases a couple of feet square, more or less. Such poles are spaced at 150 ft., or a little more, and carry usually two circuits, one on each side. They are very strong and reliable and take up extremely little space above the ground on the right-of-way as compared with the ordinary square latticed construction used on the Continent for such cases. The tubular poles cost perhaps half as much again as the lattice, but they give great promise of durability and are extremely convenient, inasmuch as the danger of rusting and the care required are a minimum.

The distribution of the working current displays more interesting novelties than the distribution itself in recent railway practice, especially abroad. The working conductors on recent Continental lines are nearly always suspended from a catenary carried either by brackets or on the more important lines by overhead bridges, and late constructions generally show two trolley wires in the same horizontal plane, a few inches apart, the spacing being regulated according to convenience on curves and sidings. The trolley wires are very commonly of figure 8 form and of cross-section equivalent to something like 000 B. & S. The advantage seems to be threefold, namely, first, added conductivity; second, added collecting surface for heavy work, and, third, the lessened wear on the bow collectors, which are universally employed on recent European roads. The supports of the catenary are 150 ft. to 175 ft. apart commonly, and where steel bridges are used they are of very light and graceful construction, which might be followed to very good advantage by builders in this country.

There does not seem yet to be very much change in the trolley voltages either abroad or here. There are a few excellent examples of 1200-volt practice on a large scale scattered over this country and over Europe, and a very few at higher voltages. Twenty-four hundred volts is a pressure frequently talked about, but it is not much beyond the experimental stage at present any more than it has been in the past. Nearly all these high-voltage d.c. lines are, as the readers of the Electric Railway Journal well know, of substantially standard apparatus with the motors running in series at the higher voltage. The Midi railway in France is trying some 850-volt motors on a three-rail system, and a few experimental machines of still higher voltage are in use elsewhere.

On the other hand, in the case of single-phase lines, there seems to be a distinct upward tendency in the working pressure, taking full advantage of the transformation on the locomotive. Ten thousand volts is frequent enough. The Midi railway before referred to is working its a.c. electrified line at 12,000, and the Mittenwald railway running out from Innsbruck has gone to 15,000 on the working conductor. Experience seems to show no particular difficulty in collecting at these voltages. Indeed, the experiments tried a decade since on the Zossen line made it very evident that high-voltage collection is on the whole rather easy. Of course, for such voltages as those referred to, the matter of insulation is comparatively simple, and if one is going to transform on the locomotive it can be done just as comfortably from 15,000 as from 5000, with material gain in the conducting system.

It is worth noting that on recent European roads the locomotives are quite generally made with coupled driving wheels driven from a jackshaft with a single gear reduction by herringbone gears from the motor or motors, an arrangement which the Continental engineers believe gives considerable advantage from the standpoint of motor construction and operation. Meanwhile, at engineering meetings this year, both at home and abroad, there have been most vigorous, not to say violent, discussions regarding the relative methods of a. c. and d.c. operation. It is very doubtful whether anybody has really been converted from either system to the other by any of the arguments advanced, as the differences of opinion seem to be constitutional. It is extremely easy to estimate on hypothetical cases which favor one or the other construction. Meanwhile the a.c. traction motors seem to be "making good" from a practical standpoint and retain a very considerable advantage in the matter of cheap distribution and easy collection of energy.

The writer would very much like to see, however, the d.c. contingent break away from conventional motor voltages and push on to much higher pressures on the working conductor than have yet been tried. With the positively coupled motors used on Continental locomotives there ought to be no particular difficulty in going up to 5000 volts on the trolley wire, which would put quite a different phase on the relative costs of distribution. Anyone who has seen the big Thury machines in actual operation ceases to worry about the difficulties of commutation in such a case, particularly since the Thury commutators are quite short, and there seems to be no difficulty whatever in increasing the output of the machines so far as amperage may be concerned.

It is very evident that the last word has not been said on high-voltage d.c. work for traction. Nor is there any difficulty in building the motor generators necessary to supply such a line as that here considered, and it is an open question whether the motor generator very commonly used in Europe for supplying railway circuits from transmission lines does not gain in the stability of operation all that it loses through its inherently lower efficiency.

The Design of Electric Locomotives

By A. H. ARMSTRONG, Railway and Traction Department General Electric Company

Many years of experience in the operation of steam locomotives have resulted in the recognition of more or less standard designs of its running gear and superstructure. Minor difference may exist as to wheel arrangement and valve gear, but the side-rod drive common to all steam locomotives is the natural means of transmitting the power of the expanding steam in the cylinder to the rotating drivers.

The electric locomotive, on the contrary, presents a wide diversity in methods of drive. The extreme flexibility of the electric motor and its adaptability to many successful forms of construction account in part for the many experimental locomotives built. It is also undoubtedly true that the type of motor adopted, whether alternating or direct current, may impose its limitations upon the mechanical design of the locomotive structures. For example, the simplicity of gearless construction used in the New York Central direct-current motor locomotives can be approximately reached with alternating-current motors only by resorting to an undesirable combination of quill and spring drive. We may, therefore, in some cases, look for the reason for unusual forms of construction not to any mechanical superiority or excellence offered by the design adopted but rather to the type of motor used, the limitations of which may enforce a departure from simpler and more familiar methods of drive.

It was natural that the earlier design of electric locomotives should follow the construction found successful in the operation of double-truck motor cars with four motors which drive the four axles through single gearing. Many locomotives of this design, weighing 40 to 60 tons total, have given long years of satisfactory service, and it cannot be doubted that this type of construction constitutes commonly accepted practice for moderate operating speeds. With the need of heavier freight locomotives it was found desirable to introduce twin-gear drive between motor and driving axles in order to equalize stresses. There also came the introduction of the hinged joint between the two trucks constituting the running gear of the locomotive, and this found expression in the forms of construction evidenced in the Detroit tunnel, B. & O. tunnel, Great Northern, and Butte, Anaconda & Pacific locomotives. All of these locomotives comprise the same general design of twin-geared drive and bogie trucks connected by articulated joint, and all are operating with unqualified success at the moderate freight speeds for which they were designed. Two of the Butte, Anaconda & Pacific locomotives are equipped for passenger service with a gear ratio that permits reaching a speed of approximately 50 m.p.h., and the riding qualities of the locomotive at this speed appear to be entirely satisfactory.

Judging from the success attending the operation of twin-geared motor drive, it appears justifiable to look upon this form of construction as well adapted to meet the requirements of moderate-speed freight locomotive service. It would appear also that locomotives of the large capacity demanded for the heaviest freight service can be built with this type of construction without exceeding accepted practice of weight limitations per axle. This statement applies, however, only to electric locomotives equipped with direct-current motors, as the alternating-current motor locomotive design must make adequate provision for a transformer and possibly a phase converter in addition to the motor and control equipment. It is evident that a combination locomotive comprising both driving motors and substation equipment cannot be worked out so satisfactorily as the simpler direct-current type equipped with motors and control only. The locomotive cab provides none too ample space in which properly to install direct-current motor control, air compressor, blower, etc. When, in addition, space must be provided for the transformer and possibly the phase converter required with alternating-current motors which themselves may project up in the cab if side-rod drive is used, then the limited cab space available makes it extremely difficult to locate the several pieces of apparatus so as to afford convenient access for inspection and repairs. Very large alternating-current motor locomotives will probably require idle axles to carry the additional weight of auxiliary control apparatus. The use of guiding axles on freight locomotives therefore may become more a question of type of motor used, whether alternating or direct current, rather than be due to any necessity to use such guiding axles for moderate-speed freight locomotives in order to get good riding qualities.

It may sometimes be overlooked that the whole argument for electrification rests upon the superior qualifications of the electric over the steam locomotive. The fundamental principle of design should therefore provide for the greatest simplicity of motor construction and drive as well as afford ready access to wearing parts. Simplicity and accessibility both contribute to the reliability, high efficiency and low cost of maintenance characteristic of the direct-current motor locomotive, and two general types of construction appear to have demonstrated their fitness for freight and passenger service respectively.

Heavy freight service seems to demand a locomotive weighing approximately 200 tons upon the drivers and capable of delivering continuously a tractive effort of 16 per cent of the weight on drivers, or 64,000 lb., at a speed of approximately 15 m.p.h. For convenience in making shop repairs it seems desirable that this locomotive shall comprise two half units of 100 tons each, carried on two four-wheel bogie trucks connected by a hinged joint. The motors will, of course, be cooled by forced air and will drive through twin gears. Usually such a locomotive may conservatively have a trailing tonnage rating of 1300 tons on 2 per cent ruling gradients where curves are compensated and should also be capable of hauling 2600 tons on level tangent track at a maximum speed of 30 m.p.h. In general, these are the locomotive requirements upon mountain grade divisions, and they can be admirably met by direct-current motor locomotives of similar type but somewhat larger capacity than those now in successful operation on the Butte, Anaconda & Pacific Railway.

For high-speed passenger service it is desirable to provide a locomotive having superior riding qualities at maximum speeds approaching possibly 75 m.p.h. It is in this class of service that the simplicity of gearless construction is more fully appreciated, as evidenced in the latest New York Central type of locomotive, which is capable of hauling a 1000-ton train at a speed of 60 m.p.h. with an efficiency averaging 90 per cent throughout its operating range. The direct current is the only type of motor possessing the inherent qualifications necessary for gearless construction, and the direct-current gearless motor locomotive of low or high voltage may be looked upon as particularly adapted to meet the requirements of high-speed service.

One of the serious problems of mountain division operation is the matter of braking heavy trains on

down grades. During the past year a method of motor control has been perfected which will permit the motors to reverse their function, act as generators driven by the descending train and return electric energy to the trolley distributing system. This so-called "regenerative electric braking" feature of the electric locomotive should insure greater safety in handling heavy trains on down grades and effect some economy by reason of power returned to the system.

American practice in electric locomotive construction differs materially from that abroad, as has been very well brought out in the editorial columns of the Electric Railway Journal. This is partly due to the necessities of train operation, but also in some measure to the methods obtaining in shop practice and in roundhouses. The electric locomotive in America should not only be designed of proper capacity for the service to be performed but should be of such simple, rugged construction as to minimize its liability to break down as well as its cost of upkeep with the character of labor available.

The two types of locomotives briefly touched upon in this article, twin-geared construction for freight service and gearless construction for high-speed passenger service, both reflect the greatest simplicity in the character of the direct-current motors and control used as well as mechanical transmission of power from the armature to the driving wheels. While other forms of construction may show special merit in some particulars, it is safe to say that these two types of construction are capable of meeting all requirements of main-line freight and passenger train haulage.

Correction of the Street Railway Situation

By E. H. GAY, Banker, Boston, Mass.

The present street railway situation parallels that of the steam railroads in that the need of increased revenue for the service performed applies equally to both. In Massachusetts, despite conservative capitalization represented by issues composed of one-half bonds and one-half full-paid capital stock, the margin of surplus earnings over fixed charges is so narrow, owing to increasing cost of operation and especially because of growing demands of labor, that the only salvation of the roads, both urban and interurban, lies in higher fares. This situation is shown in the fact that the street railways of this state whose bonds are eligible for savings bank investments may be counted on the fingers of one hand, all the other companies having failed to earn the necessary 5 per cent dividends upon their stock for the period prescribed by law, although that stock represents $100 paid in for each share of the same face value.

The situation of the Boston Elevated Railway Company is typical of the inability of the 5-cent fare to meet the demands of the public for extended service on the one hand, of labor for increased compensation on the other, and the reasonable return to the investor as the third party in interest. Here is a great system upon which fall the heavy burdens of constantly increasing fixed charges resulting both from the enlarged demands of labor and the necessity of building subways costing in the vicinity of $1,000,000 a mile, and which nevertheless result in carrying the passenger far beyond the profitable limits of the 5-cent fare, with a freedom of transfer which would be difficult to parallel, either in this country or abroad. It would seem that ultimately a fare unit in excess of 5 cents must be adopted under such conditions and that sooner or later the transfer privileges must be curtailed, since it has been figured that barely 2 mills out of each nickel are left the company after the cost of operation, fixed charges and interest are met. It seems to be clear that the city road must ere long depart from the rigid 5-cent fare unit and that some measure at least of increased income must be accorded it by regulating authorities. The city of Cleveland is an example in point, where the late Mayor Johnson's pet theory of a 3-cent fare was put into practice by the authorities on certain of the city lines, only to be abandoned after a few months' trial when it was ascertained that heavy losses in operation were resulting from it.

Those who look to municipal ownership as the panacea for the present difficulties of the street railway may not be aware of the findings of the independent experts of the National Civic Federation, who discovered in examining the accounting methods of municipally owned systems abroad like that in Glasgow, Scotland, that wholly inadequate provision had been made for depreciation, with the result that a serious situation will soon confront these enterprises. Comparing services in Boston and Glasgow, one finds that the zone system in use in the latter city is not so cheap as the single-fare unit of the former, outside a very limited radius. Again, the incompetency of applicants for responsible positions under the political conditions of municipal ownership as they would exist in America is not a thing to view with complacency. Abroad, the public service is considered from an entirely different angle than here, and the usual conditions of American politics are foreign to the situation.

There are many splendid street railway properties in this country, and if encouraged to develop upon the basis of a reasonable return to the investor, great good will result. One of the most important ways in which the street railway situation can be bettered is by cooperation on the part of municipal authorities in granting long-term franchises—an action which encourages the spending of money for facilities not now available under limited franchise concessions. The twenty-five-year limit of Ohio, for example, greatly handicaps the sale of bonds whose customary term of life expires with the franchise or close to the time when the latter is yielded up. Under such conditions there is a strong tendency to strip a property of its needed facilities as the term of the bonds approaches its end, whereas with a long-term franchise the very opposite practice would be encouraged. Funds would be put into the property for its constant betterment, and an assured length of years accorded in a long-term agreement would go far to insure first-class facilities as well as to maintain the investment on a sound basis. Experiences in Detroit and Minneapolis illustrate this point. In Detroit, an otherwise excellent street railway field, expiring franchises on a portion of the lines have led to such uncertainty between the city officials and the company's officers that further development and improvement of the lines affected are at a standstill pending the final settlement of the terms of extension. In Minneapolis and St. Paul, on the other hand, we find the premier street railway system in America, if not in the world, largely attributable to the company's franchises having been declared by the courts in effect perpetual, which furnishes a constant incentive to the company to furnish to the riding community the ideal transit facilities which they now enjoy.

The legitimate economies of street railway operation, like those of the steam roads, appear to have been

worked close to the limit, notwithstanding the pronouncements of Messrs. Brandeis et al. Nearly everything but labor has been liquidated in the transportation world, and sooner or later the great laws of supply and demand will accomplish this unfinished task. Conditions are by no means hopeless in the electric traction industry, but unless the communities served show more disposition to recognize a reasonable return upon the capital invested, both through the sanction of a higher fare commensurate with the increased demands of labor and greater cost of all materials entering into the cost of operation and by the granting of more liberal franchises for the encouragement of permanent improvements, the development of street railways with all the benefits which they confer in assisting to develop centers of population will be held back to the lasting injury of the public welfare, to the employees themselves and to private enterprise.

Buying and Building Cars

By JOHN J. CUMMINGS, President M'Guire-Cummings Manufacturing Company

During the past few years sharp competition in many lines of enterprise has been eliminated, but this condition in no wise applies to the manufacture and sale of street cars. The manufacturer of such equipment must figure very closely indeed to secure a sufficient business to maintain the requisite volume of work in his plant in order to minimize his overhead expense and fixed charges, and it is evident that this competition is of great benefit to the purchaser of such products. Nevertheless, the length to which competition can go and still benefit business is sharply defined.

In drawing up specifications covering the construction of street cars the purchaser may work a severe hardship on the manufacturer with no resultant advantage, because the desire on the part of the buyer for opportunities is an ever-present menace to the wholesome benefits of reasonable competition. When buying reaches the point of bargaining alone on prices computed on cold and rigid specifications, the transaction is not mutually satisfactory, and the best specifications are those which can enlist the skill of the manufacturer in full and place upon his shoulders the burden of responsibility for ultimate values. Indeed, the tendency of to-day among buyers is to take more advantage of the manufacturer's ability, his character and his reputation, and the wisdom of this tendency is evidenced more and more in the actual values delivered for the purchase money and the better satisfaction of both parties to the transaction. There are qualities in the products of street car manufacturers over and above those which can be produced under the specifications alone. It is the latent and ultimate value put into the product that has made the industry of street car manufacture worthy of its present high place.

To argue for loosely drawn specifications would be as unwise as it is unbusinesslike. Specifications should be comprehensively drawn, it goes without saying, but room should be left for letting in the knowledge, skill and experience of the manufacturer. The plain argument of this is that specifications may be too good. They may be too specific. They may be so exact and so finely detailed and so comprehensive in their minuteness that nothing is left to the genius of the manufacturer.

If certain materials made by others than the car builder are specified and if no deviation is allowed therefrom, it effectually forbids the car builder to reap any benefit from that competition which the purchaser has himself used to his great advantage. If it is deemed advisable by the railway company to insist upon certain specialties being used, it should contract for such material from the maker and ship to the car builder's plant, allowing him a fair cost and margin of profit for the handling and installation and for assuming the responsibility for delays in shipment and the possible errors in manufacturing such specialties; in fact, such delays and errors might seriously hamper the work at a great cost to the car builder, tying up the facilities of his plant to such an extent that other work could not proceed on its scheduled time.

While sharp buying may result, as it sometimes does, in picking up opportunities, the wisest buyers of to-day are realizing that the manufacturer must have a living profit if a real bargain is to be obtained. Buying at the expense of the manufacturer rather than to the mutual advantage of both manufacturer and user is a makeshift in business and is not of any permanent value.

The history of companies that have been engaged in the manufacture of street cars does not show the receipt of abnormal profits. On the other hand, the business has been fraught with peril; and certainly, taking into consideration the value of the plants, the necessary working capital involved and the special knowledge and ability required to operate successfully in this business, the manufacturer should be allowed an equitable profit over and above his cost. Moreover, consideration must be given to those dull periods that invariably overtake even the most successful business every few years, and for which provision must be made.

If the manufacturer is called upon to furnish equipment of a highly complicated nature and of a small volume, which requires considerable original thought and research, or if he must procure special machinery or erect or install additional apparatus, he is then entitled to a special profit.

The tendency of railway companies has been to discontinue the manufacture of their own equipment, as the apparent savings thus obtained have been offset by costs and problems that were not realized at the outset. Many things have to be taken into account in the manufacture of street cars, and it is not unreasonable to believe that many such things were overlooked in the beginning, because, in order to manufacture economically, large sums of money have to be invested in the erection of special plants, and their direction and supervision have to be accompanied by special knowledge. Deficiency at any point means either loss of quality in the product or unexpected and oppressive increases in the initial costs. The managements have also been confronted with the problem of keeping the men in the new departments engaged in work that would give the full productive value of their efforts and skill, insuring maximum productive efficiency, and thus keep the capital invested at a reasonable figure.

Another disadvantage experienced by the railway companies in the manufacture of their own equipment has been the consequent detraction from attention in the operation of their properties. The officials of such companies were already heavily burdened by their duties, and they found themselves engaged in two distinct undertakings, neither of which received the attention it required.

In the matter of purchasing materials the railway companies did not enjoy the advantage of the car builder. The one bought at wholesale, the other at re-

tail. To illustrate the point—the car manufacturer bought for the full capacity of his plant, which was necessarily greater than that of the individual railway company's shops, so that the latter were restricted to the purchase of materials in comparatively small quantities in accordance with their limited requirements. The manufacturer is also in position to dispose of his overplus of material, inasmuch as he has diverse outlets, while the railway company has only its own needs to take up its manufacturing output.

The railway company is not, therefore, to be regarded as a serious competitor of the car manufacturer. There will be railways now and then which will insist on having the experience before being convinced, but in the main the car manufacturer will continue to be the great source of production, and the railways will best be served by leaving the manufacture of cars to the car builder, whose knowledge and experience and desire really to give value received work to improve quality of product at a lessened cost.

The Design of Rapid Transit Cars

By F. M. BRINCKERHOFF, of L. B. Stillwell, Consulting Engineer, New York

The success which has attended the use of "stepless" or center-entrance cars in city service has been of great interest to car designers as well as to operating officials, whose common problem has been the rapid and safe loading and unloading of passengers with a minimum of platform expense. Combined with the prepayment system of fare collection, the center-entrance car seems to be making a favorable record. The low-step feature of this type of car permits a loading and unloading rate approximating that of cars at elevated station platforms, and the access to the doorway from both directions when within greatly facilitates passenger movement.

Similarly, when designing cars for use in rapid transit or subway service, full consideration must be given to their ability to develop the full capacity of the exceedingly costly right-of-way upon which they are to be operated. As the permissible headway fixes the number of train units per hour, it is obvious that in order to handle the maximum number of passengers per hour the cars composing the trains not only must be as commodious as possible but must be arranged also for rapid loading and unloading of passengers and their free circulation when within the car.

For rapid transit cars the two matters of seating arrangement and door arrangement are so interdependent that they must be treated together. In arranging the seats the designer of to-day endeavors to strike such a balance between maximum seating capacity and maximum total capacity that the cars will be effective during periods of extreme congestion but will not fail to provide a large number of seats under the ordinary conditions of traffic. Obviously, the longitudinal seat gives a minimum seating capacity and a maximum of standing room. On the other hand, and especially where the cars are wide, in accordance with the recent tendency in subway design, the transverse seat gives a very high seating capacity but a limited standing room; moreover, transverse seats interfere seriously with the opportunity for providing freedom of movement inside of the car. A combination of transverse and longitudinal seats, therefore, seems to be desirable under many conditions.

The most important requirement for the location of door openings is that they shall be accessible from both directions inside of the car. The old-style end door for cars used in dense passenger service is, in many instances, being displaced by center-entrance doors, and where the requirements of the service warrant the use of large cars more than one door is necessary. The result is that the unit method of seat and door arrangement seems to be most desirable. By the unit arrangement is meant the division of each car into a series of practically similar units, each unit or section having one door and a carefully determined number of longitudinal and transverse seats, the relative number of the two types depending upon the relative importance, under the existing conditions, of total capacity and seating capacity. Involved in the design of each unit are numerous other problems mainly surrounding the question of passenger movement inside of the car. A sufficient open space must be provided in front of the doorway to avoid interference between passengers because the impatience of passengers desiring to enter the car often leads to a certain amount of crossing of the lines of movement inside the car. This condition makes advisable the use of stanchions, preferably grouped near the door of each unit, but so spaced that persons holding to the stanchions will not interfere with the movements of passengers desiring to enter or leave the car.

Hand straps, it may be said, do not afford the same degree of confidence and sense of security that is inherent in the vertical stanchion, which offers a firm hand hold to invite passengers to approach the exit door while the car is still in motion. The tendency in this direction is displayed even in surface-car design, as most of the new center-entrance types have stanchions near the door rather than hand straps along the aisle.

With the arrangement of doors and seats is involved to a considerable extent the matter of framing, because when the doors are placed in the sides of the car between bolsters it is, of course, necessary to provide means for carrying the load strains across the door openings. Some form of truss-type side framing is becoming the rule in the present-day car. By carrying the load upon the side-framing of the car, which acts as a truss, the weight of the structure is minimized and the cost of maintenance is very greatly reduced. When the entire car body, including sills, side frame and roof, acts as a whole in developing the structural strength of the car to support the load, there will be a notable reduction in weight of structure and a very desirable stiffness will be secured.

In the day of wooden cars the type of framing which included a heavy supporting structure below the car floor and a light roof above it was permissible because the wood had sufficient inherent elasticity to permit considerable deflection without destructive motion at the joints. This is not the case with steel.

A seating and door arrangement as outlined above naturally obviates any necessity for vestibules at the ends of the car, the units at the ends having their side doors located near the bolsters, with provision as required for a motorman's cab. For cars which have to operate in the open, as on an elevated structure, in distinction from a subway, the closed vestibule has a certain value as an aid in keeping the car warm in cold weather. In many cases, however, the loss in seating capacity will overbalance any advantage gained in this way.

With regard to car flooring, it may be said that the present state of the art of car design takes full cog-

nizance of all sanitary considerations. Non-absorbent material for car floorings and non-corrugated surfaces are the rule, and every effort is made to avoid abrupt changes in outline which might form pockets for collecting dirt. Such fundamental considerations are imposed by the desire for improved appearance as well as to reduce the cost of car cleaning. The actual materials used for the floors of rapid transit cars are of various compositions, of a cement-like nature, applied upon a metal sub-flooring. The surface can be reduced during the process of setting to any desired degree of smoothness, although a high polish for a car floor, while greatly aiding in the work of cleaning, is obviously not desirable. All of the composition floorings in general use are of such a character that no slipping is likely to occur. Carborundum as an admixture has been tried as a means for producing an anti-slip tread together with increased life, but has been given up because it has been found that part of the carborundum ultimately became freed from the cement in which it was embedded, acting in the loose form as an abrasive of the floor itself.

Car roofs are changing rapidly from the monitor-deck type with movable deck sash, which provided as much ventilation as was formerly considered necessary. To-day a great number of cars with plain arched and compound arched roofs are being constructed, although with the plain arch it is, of course, necessary to use some form of the projecting type of ventilator. Abundant ventilation is difficult of attainment in winter without a cooling effect upon the air in the car, so that it is interesting to note the recent experiments which demonstrate that agitation of the air in a closed compartment eliminates much of the mental and physical effect of insufficient ventilation. It might be said that approved practice is for a car design such that ample ventilation can be secured even at the most congested periods, the amount of air actually admitted being modified by shutters to suit the requirements of the periods of ordinary traffic. With regard to lighting, the introduction of the tungsten lamp has made indirect and semi-direct schemes of illumination at least a possibility, and much thought is being given to perfecting systems which avoid the unpleasant effect of the direct rays from high-power incandescent lamps. Many experiments are now being made to determine the commercial advantages of both indirect and semi-indirect lighting, and it is not impossible that the practice in lighting cars will be revolutionized within the next year or two.

Street Railway Motor Control Systems

By CLARENCE RENSHAW, Railway Engineering Department, Westinghouse Electric & Manufacturing Company

In the persistent search for operating economies which has become one of the important activities of most railway companies, the cost of power offers a shining mark. Unit costs of power, as a rule, afford little opportunity for economizing, but the amount consumed is usually susceptible to reduction. Decreased weight was the first means proposed for taking advantage of this opportunity, and drastic requirements that apparatus must be light in weight are, on occasion, still written into the specifications of railway companies with this idea in mind. However, the fact that high service efficiency rather than mere reduction in weight is the real object to be sought is now being more generally recognized, and there is much less talk than formerly of the 5 cents per pound per year which reductions in weight are supposed to effect. On account of this awakening to the true conditions, the advantages of slow-speed motors and field control are receiving more attention.

A full year's service has now been obtained in various parts of the country with considerable numbers of field control equipments. These cover a wide range of sizes and have been operated under a variety of conditions, both in city and interurban service, and the results have fully confirmed the claims made as to the importance of this innovation in railway engineering.

In city service the combination in one equipment of the equivalent of a low-speed gearing for efficient acceleration with a high-speed gearing for free running, as secured by field control, results not only in economy of power but in many cases enables a smaller size of motor to be employed than otherwise would be necessary.

In interurban service the effective action of this combination has permitted the more general employment of a common-standard equipment for both local and limited service. In one instance, on certain cars for fast limited service, a number of equipments of quadruple 125-hp non-field-control motors were replaced by quadruple 100-hp motors with field control. The new motors in this case were able not only to handle the limited service equally well with the old, but on account of the superior starting characteristics, due to the field control, were able also to operate local trains. This the larger motors had been unable to do.

The results which have been secured with field control and its adoption in New York, Brooklyn, Chicago, Indianapolis, Rochester, Elmira and other places assure its standing for city service. The use of nearly 200 equipments by the Michigan United Traction Company, Pacific Electric Railway, British Columbia Electric Railway, Public Service Railway, Maryland Electric Railways and others indorses its superiority for interurban service.

One of the most noticeable points in the general control situation is the tendency to seek simplicity and reliability rather than refinements and to omit every piece of apparatus and all complicating features which are not absolutely necessary. This is evidenced in the line of drum control by the omission of the bridging feature from some of the latest forms of standard controllers. Instead of the bridging transition, a return has been made to the simpler shunting method, and this has been found entirely satisfactory for traction purposes.

The large proportion of equipments which are now supplied with indirect or multiple-unit control has been due apparently to the production of equipments such as type "HL" in which the principle referred to above has been followed. In doing this many of the desirable but not absolutely necessary features which complicated former equipments have been rigorously excluded in the interest of simplicity and reliability.

Although a number of equipments for the smaller sizes of motors have been installed, the general use of multiple-unit control has been confined largely to equipments of quadruple 40-hp or 50-hp motors or even larger. For such sizes its weight has been less, or at least no greater, than that of the corresponding drum-type equipment. The many advantages which this control has shown in such applications have now led to the production of similar equipments for less powerful motors, and in these the fundamental pieces of apparatus have been made smaller and lighter. This has been

done without sacrificing the ruggedness and reliability of the larger type, and while the small multiple-unit-control equipments have not been on the market sufficiently long to have come into wide use, it seems probable that they will play a considerable part in extending the use of train operation.

An interesting innovation in the field of train control has been the new type applied to the stepless cars of the New York Railways. In these equipments multiple-unit operation has been obtained not by the use of power-operated switches or contactors but by the synchronous movement of drum-type controllers on the various cars in a train by pneumatically operated driving heads. This arrangement is a return to the same general principle in use on the earlier types of equipments of the Brooklyn Rapid Transit Company. As compared with these early types, however, the mechanism of the new equipment has been greatly simplified. Just what place it will assume in the general scheme of railway control it is, as yet, too early to predict. It offers, however, many interesting possibilities.

In view of the general effort which is being made to improve the service to the public, it is not surprising that train operation has been discussed more actively, perhaps, than any other single subject. Comprehensive tests in city service made by one large company have shown conclusively that, when operated in a train, two cars could clear a congested crossing in 80 per cent of the time required when operated singly. This means that under some conditions 25 per cent more cars can be operated during rush hours. The tests also seemed to indicate that many other advantages could be secured.

In theory, at least, the use of the multiple-unit train for interurban service has generally been indorsed without question. On account of the simple and reliable character of the apparatus now available few equipments are being sold for such service which do not provide for train control. Even for strictly city service, cars are being equipped with it in many cases, regardless of whether train operation is contemplated immediately or not. This is shown by the latest orders from Boston, Brooklyn, New York and elsewhere, and the fact that control of the multiple-unit type was furnished with over 40 per cent of the total number of railway equipments sold by one of the large manufacturers during the year is an even stronger indication of the tendency of the times.

The Manufacturer and the Industry

By GUY E. TRIPP, Chairman Westinghouse Electric & Manufacturing Company

As the electric railway industry is generally described it includes only the companies directly conducting electric railway operation. There is, however, a larger electric railway industry which is much greater in the number of its employees and the totals of its investment responsibilities than the statistics shown by the electric railway companies alone. In this larger industry the manufacturers of electric railway apparatus have an important place. They are part of the great body of people of this country that in whole or in part are dependent directly or indirectly upon the prosperity of the electric railway industry. The prosperity of electric railways affects them just as surely as it does the families of employees of electric railways and holders of stock and bonds of the railways. The manufacturers, as large employers, have a responsibility for the success of their own properties and for the welfare of their employees and the families dependent upon them. They cannot discharge this responsibility properly without doing what they can to make the consuming part of the electric railway industry prosperous and to keep it in that condition.

The bond between the manufacturer and the railway is necessarily much closer than that of the ordinary seller and buyer in many walks of life. It should be a co-operative relation. If in the past this co-operative relation has not been as close as it ought to have been, there is every reason why we should make a fresh start and have it well defined and developed in the future. The electric railway cannot solve its problems alone. It needs the help of friends. It needs to have voices raised not only in its defence but in its praise where praise is due. Manufacturers understand the problems of the electric railway company. They have helped to solve many of them. To the extent that they have done so they have indirectly helped their own business. To the extent that they have failed to do so they have indirectly hurt their own business.

Manufacturers have used their best efforts and the efficiency of their organizations in order to solve mechanical problems confronting electric railways. At present the chief problems of the railways are not mechanical in nature. They are more serious. They are partly financial but more largely of the nature of public relations. If the manufacturers could apply the same energy and ability to aiding in the settlement of the public relations problems of their customers that they have in settling the mechanical problems, they would help to turn the current of public opinion. It is not so easy for the manufacturers to do this as to study and settle the problems they find within their own establishments, but it is a task that they have no right to ignore. They make up a large and influential element of the community and their views on public questions concerning the railways will be heard with respect.

The duty of the manufacturers, then, should be to do what they can to create a favorable sentiment on the part of the public toward the electric railways. They can help to explain what the railways are trying to do and why it is necessary for them to have adequate earnings in order that they may provide such enlargements of facilities as are constantly needed in a growing community. They can help to show what the railway will do if it is permitted to have the prosperity which it needs in order to attract investors to its securities.

The manufacturers have so intimate a knowledge of the affairs of most of the companies with which they come in contact that they may be able in some cases to give advice as to ways and means of solving the problems that create the present unrest in relations with the public. I believe that executives of the railway companies will find the great body of the manufacturers sincerely anxious to do all that they can to promote the welfare of the industry. If the manufacturers who are especially familiar with railway conditions are asked individually to point out conditions which in their judgment might be remedied in the interest of a better understanding of railway affairs, they will be glad to comply. This is a part of the service that the manufacturer ought to render the railway. Serving and speaking from the outside, he can often do for the railway company what it cannot do for itself. In so doing he promotes the stability of the industry and thus promotes the stability of his own business.

The Manufacturer's Relation to the Industry

By CORNELL S. HAWLEY, President of the American Electric Railway Manufacturers' Association

The manufacturers of electric railway equipment and material are among the best friends of the industry. They occupy a vantage point from which the work of the transportation companies is far better understood than when viewed by the man in the street or by the ordinary passenger on the cars. Many of the manufacturers' representatives are technically trained men; others formerly were engaged in operating work or some branch of electric railway activity closely related to their present business connections, and few employees of traction companies better appreciate the conditions under which the service is conducted. All this means that when unfair or uninformed criticisms are raised in the hearing of the manufacturer or his alert representative the railway company's side of the case is often quietly but effectively put forth, hasty opinions being discarded and a measure at least of understanding being inculcated regarding the obstacles which the electric transportation system is constantly trying to overcome. In guiding public sentiment into the channel of truth the manufacturers of the country are not only helping their customers to obtain the "square deal," but they are indirectly putting their own industry upon a sounder foundation.

On the engineering side the interests of the manufacturers and the operating companies are constantly growing closer. The former are earnestly striving to eliminate equipment defects and are naturally very much alive to possible improvements brought to their attention by operating or other railway officers. The thorough study given in many cases by manufacturers when new or modified equipment is placed in service is not always realized, but it is frequently true that the detection of minor difficulties during service "try-outs" is brought about as a result of a patient and inconspicuous program of investigation which now and then keeps a man traveling about on a road for weeks and even months after the apparatus has been delivered. When research work is undertaken at the initiative of the railways, the manufacturers practically without exception are glad to co-operate in the undertaking, realizing that whatever benefits the operating companies in the long run is good for themselves. Progress in design and construction of equipment depend largely upon the freedom with which the apparatus user makes his desires known to the manufacturer, but the latter is doing a large amount of original work which is of value to the industry as a whole, based simply upon his observation and that of his representatives in the trying domain of practical service.

The manufacturers are co-operating along broader lines, also, as illustrated in the coast-to-coast trip with representatives of the American Electric Railway Association in 1912. The good results of this trip, which contributed to bring about better public relations everywhere between public utilities and the inhabitants of their respective territories, are due to both branches of the industry's greatest organization. More advanced standards of equipment are sought, with correspondingly better service plans as an outcome of this co-operative work. It was an excellent thing for local boards of trade and other business organizations to see the unanimity of purpose among all the interests represented on this trip and to realize that the railways and the equipment shops are mutually related in their general views as well as in the rôles of buyers and sellers. In brief, the Manufacturers' Association and all its individual members stand in somewhat the same relation to the electric railways and the public as the Railway Business Association does in the steam railroad field, and will not be found wanting whenever the need for real co-operation arises.

Municipal Ownership Versus Private Enterprise

By EVERETT W. BURDETT, General Counsel of the National Electric Light Association, Boston, Mass.

In the operation of public utilities there are two extremes to be avoided. The first is the exploitation of public services by irresponsible and unchecked private enterprises, left unrestricted as to the methods they employ, the service they give or the rates they exact. The selfishness and cupidity of men is such that they cannot generally be trusted to promote or even regard the rights of others in connection with their endeavors to promote their own interests. To give to private bankers or promoters a free rein in the capitalization of agencies for public service and in the exaction of the rates thereby made necessary for such service as they see fit to give is to make the interests of the public entirely subservient to those of private persons. It cannot now be tolerated, although it has not been long since that condition prevailed in this country. And it was largely, perhaps principally, because of that fact that the movement for municipal ownership and operation of public utility agencies acquired its greatest momentum here.

No such condition now exists, and therefore no such basis can now be claimed for the establishment of municipally owned and operated public services.

The other extreme condition to be avoided is that of municipal ownership. While this is open to none of the objections attaching to unrestrained and unregulated private enterprise, it involves difficulties and disasters all its own. Good public service is one which not only adequately meets present necessities but has an eye to the future, and it grows and expands and improves with the increases of the demands laid upon it. Such a live, progressive, expanding and ever out-reaching policy can rest upon only one foundation —individual initiative and enterprise. Men must have some reward in sight to excite their best efforts and achieve the best results. Bureaucracy never invents, initiates or expands in business matters. In the nature of things it cannot achieve the best results, because it lacks the incentive to bring them about. It has no interest it must earn, no dividends to pay, no salaries to raise. In municipal work it is the position, not the man, which fixes the compensation. In private enterprise it is the position *and* the man which determine the compensation. And it is not stagnant or stationary. The manager who is engaged at $5,000 a year may be found to be easily worth twice or thrice that sum. And if he is, he gets it; because if one private enterprise will not pay him what he is worth another will. The great difficulty is to find the men—not to fix or pay their salaries.

There is a middle course between the two extremes which have been mentioned, which best solves the problem under the conditions existing in this country. It is the employment of private capital under private

management but subject to such restrictions and regulations as may be imposed in the public interest. This course preserves the advantages of private enterprise and prevents the abuses which the unrestricted exploitation of private business is almost certain to create. It avoids the stagnation and lack of initiative which make the results of municipal operation so unsatisfactory and yet safeguards the interests of the public in the only particulars in which the public is legitimately interested—namely, in the quality and adequacy of service and in the rates exacted for it. Fortunately, this is the principle which has now been accepted nearly everywhere in this country, the practical application of which will (or ought to) deprive the theory of municipal ownership of the advocacy of all intelligent persons not bent on the application of a theory without reference to its results. Of course, the latter kind of people will follow their theory, right or wrong, and no effort need be wasted to convince them of the practical fallacy inherent in their ideas.

I am not saying that municipal ownership and operation cannot succeed under bureaucratic conditions. I think it does succeed under such conditions in Germany and measurably in Great Britain, although it is attended with results to private enterprise and initiative which are most unfortunate, especially in Great Britain. But, assuming all one pleases in favor of municipal enterprises in those countries, it is no argument for the trial of the experiment in the United States. The conditions are so totally different in the different countries that no conclusive argument can be drawn from one to the other. The burgomaster of a German city is an expert on municipal problems and administration, obtained wherever he can be found, just as a railroad president is in this country. He is surrounded by other experts, and so far as he is controlled by the popular voice at all, it is through a municipal council chosen principally by the taxpaying members of the electorate.

In Great Britain the scheme of municipal administration is entirely unlike that in Germany, but it has peculiarities of its own which are highly calculated to produce good results. Space does not here permit of even the briefest analysis of these conditions, interesting as it might be.

Suffice it to say that neither the German nor the British methods or ideals prevail in this country, and —what is more important—they cannot be made to prevail here until there has been a radical and complete change both in our theories respecting municipal activities and in the methods of working out those theories in practice. That day, alas! is far away. Until it comes, if it ever does, the wise thing to do is to accept and promote publicly regulated private enterprise.

The Advantages to the Public of Centralized Management of Public Utilities

By EDWIN S. WEBSTER, Stone & Webster, Boston, Mass.

A great deal has been said in regard to the advantages to the investor of centralized management in public utilities. A phase of the question which is not so well understood is the benefits which are enjoyed by the general public through this plan of operation. They are equal to those derived by the stockholders, if, indeed, they are not of greater magnitude.

The first benefit which we might consider is that which results from expert ability in engineering and management. A centralized organization, while retaining the best features of local administration, permits the local railway company or lighting company, as the case may be, to utilize the technical experience of the home office and the services of a corps of engineers, operating men and accountants in a way impossible to a single and isolated property. The economies of construction and operation in this manner enable the local company to render a better service for a given price than would otherwise be possible. To refer to the question of engineering only. A great deal depends upon proper engineering in these days of rapid technical progress, not only as regards the financial success of the enterprise but in the safeguarding of the public against the installation of unsuitable types of apparatus and the use of equipment of uncertain reliability and of doubtful efficiency. The same is true in regard to the business management of the affairs of the company. The past contains too many examples of properties built where the demand for service was insufficient to warrant the investment, of existing properties unwisely extended and developed, of defective bookkeeping methods and consequent failure to appreciate the real financial conditions, of inadequate provision for maintenance and physical renewal. Faults of judgment like these, if they impair the ability of the company to give proper service or make necessary extensions, are no less serious to the community than to the company.

Again, no more important service is rendered in consolidated management than the handling of the securities which are usually placed in its charge. In this connection a large organization with important banking and financial relations throughout the continent can do a great deal in broadening the market for such securities, in distributing information to bankers, institutions and investors, and in providing a recognized channel through which individual purchasers and sellers may be brought together. Here, again, the advantage to the public is as great as that to the company because if it is unable through inability to raise capital to keep pace with the demands for service, the public interests suffer. It is not too much to say that there are many towns in this country enjoying electric light and power as well as railway service which would have been without these conveniences if it had not been for the activities and enterprise of those managing a group of such properties.

A consolidated management with large financial resources can afford to build for the future and provide a larger and better service than a purely local management. This is partly because it can obtain the necessary capital more easily and partly because through its greater facilities for analyzing the technical and business conditions surrounding enterprises of this kind it can determine where extensions will be profitable and can act promptly upon such conclusions. Few isolated companies are in as good a position to make these decisions or to take as favorable advantage of the conditions in the material and equipment market as the centralized organization to which such action is a matter of daily experience.

It is sometimes maintained that the cost of centralized management is an obstacle to its adoption, but experience has shown that the increased financial stability resulting, the conservative yet healthy de-

velopment encouraged, the savings in running expenses frequently effected and the economy brought about in the application of capital to the needs of the property are worth far more than the moderate percentage of revenue which represents the compensation of the administering organization. The larger the property, the less this percentage should be, since the cost of management does not increase in proportion to the gross volume of business. Neither can the tendency apparent in some industries toward decentralization be urged as an argument against the consolidated management of public utility companies.

This kind of management does not exist for the purpose of monopoly or to acquire one property for the sake of its effect on another. It is not even necessary that the ownership in the different properties managed be the same. Frequently different properties under central management are quite separate and distinct in their operation, ownership and finances, and the benefits that accrue are those that apply in other cases where things are done in a large way by those who have the training and experience to do them well.

Is Regulation by Commission a Permanent Part of Our Economic Scheme?

By J. D. MORTIMER, Vice-President the North American Company

The recollection of the attempt in the seventies by granger legislatures to regulate railroad rates and operation, its failure and its subsequent revival through the creation of the Interstate Commerce Commission and state railroad and public service commissions naturally lead us to examine the causes of the present movement and inquire as to whether there is reason to expect any cyclic changes in this present popular economic principle. This inquiry may further be justified by the murmur of discontent that is heard at intervals, arising from other cults, when a commission's decision does not satisfy the supposed popular appetite or when the expense of sustaining commissions is brought into sharp relief with the apparent results achieved.

The popular economic theory upon which public utility laws are based is that the utilities are enjoying valuable franchises granted by the people for which the latter receive nothing compared with the values given, while the corporations are earning large dividends on franchises by charging exorbitant rates or overcrowding the straphangers. In point of fact, the only bases upon which regulation can be justified are:

(a) That rates of charge for service shall be based on the cost of production, and the minimum production costs and lowest rates can be obtained only with maximum output and density of business, that is, through monopolistic production; but monopolistic production is detrimental to the interests of the public, unless owned or controlled by the state.

(b) That the services rendered by public utilities are necessary for the maintenance of the present system of distribution and mode of living of the people; that is, they are of the same general nature as streets, parks, police protection, tribunals of justice, etc., and as such so seriously affect the social welfare of every being that they must be placed at the disposal of each under like conditions and be subjected to special treatment in law to attain this end, pending the actual merger into the general functions of the state.

The knowledge that rates in turn depend upon requirements in the way of service caused the framers of the public utility laws to vest in the regulating commissions some control over service rendered by the utilities, and the belief that rates might in some way be affected by the issue of capital obligations or tend to impair the ability of the utility to perform its public duty led to the control of new issues of securities. In the desire to control rates, the theory of a regulated monopoly has in large part been recognized, and most statutes give to the commissions power to determine whether there should be monopoly or competition.

Concurrently with the development of the theories of regulation and their enactment into laws or their appearance in decisions, a school of municipal government has been developing the principles of municipal "home rule." The demand for "home rule" comes from those most strongly supporting initiative and referendum and principally from the largest urban centers of the state. They express a dislike of having the countryfolk legislators frame the general laws for their metropolitan cities. The growing concentration of population in the larger cities does not make it appear that the "home rule" movement is being opposed by many strong natural economic forces.

In the ultimate development of "home rule" powers, there is necessarily a sharp conflict as to where the control of municipal public utilities shall lie. Thus there appears to be a movement which, if continued, may result in breaking down in places the principles upon which state-wide regulation is now being prosecuted. The municipal control of public utilities would bring with it a return to the politics of the past, and much harm may arise from ignorance and impelling political motives on the part of the electric regulators, be they commissioners or aldermen.

On the other hand, the more thoughtful students and people of every urban community appreciate the fact that few municipalities are so organized in the way of government that the same can be said to be other than most inefficient. The more general recognition of this fact has brought forth many suggestions, the most promising of which in theory proposes the conduct of municipal affairs along lines which would guide any well-organized business.

Although experience may develop isolated instances where successful municipal government will from time to time obtain, it is unsafe to predict that the administration of municipalities can be placed on a business basis so long as the personnel of the municipal government is in large part determined by popular suffrage. However, with an increasing efficiency of government, it is not unreasonable to expect a lessened desire on the part of municipal officials to regulate privately owned utilities. Should these very marked improvements in municipal government come to pass, the day of municipal ownership and operation of public utilities will probably draw nearer. In the advent of general municipal ownership, state regulation would be almost entirely excluded from the cities, unless it were vested with new functions not now developed.

The economic principles underlying the theory of vesting in the state the right to regulate public utilities have not been completely developed or adequately recognized. With the more complete recognition of these principles there will be changes in the theory of law, and there will naturally follow changes in the law itself. That there will be different schools of economics,

with different resulting theories and consequently variations in the principles of law, seems certain, but in the long run and to the extent that regulation becomes a part of our permanent economic scheme, there will be a stronger association of legal responsibility and authority that is or may be administrative in its nature. The lack of responsibility and absence of any real sobering influence on the individual members of regulating commissions are serious defects in the economic structure of regulation. While time works changes and mistakes eventually produce competent commissioners, the general knowledge of these facts does not seem to prevent each new commissioner from undertaking his office in the firm conviction that he has been specially chosen to right in one year all the imagined wrongs of eons gone by.

In developing the economic structure it seems desirable that the laws should give to the regulating body all the authority necessary to perform all the acts required in the complete scheme. That this authority will come in time, no one can, with any certainty, deny, and until this condition does obtain, regulation will not have a fair trial as the panacea for the ills it is hoped to correct thereby. And if with increased authority there comes a feeling of responsibility, what may now seem to some as the worst that could possibly happen may, in this event, prove to be the best.

Commissions in determining their courses of action naturally, in many cases, are influenced by conflicting emotions. On the one hand, they may fear popular clamor in case of a decision adverse to the end sought in the name of the people, and on the other hand they are often impressed with the necessity of preserving the integrity of the capital invested in the utility under review. While commissions must be guided by the laws granting them their powers, most of the problems presented to them cannot be solved by reference to the present statutes but require consideration and recognition of many other factors and usually the exercise of broad judgment. This permits widely different decisions under substantially similar sets of facts and conditions, varying with the mental attitude and capacity of the individual commissioners. That an attempt will be made to make more definite the principles of law governing commissions seems certain, if regulation by commission is to be long continued.

A regulating commission to perform its functions requires a rather extensive staff and office organization. The annual cost may vary from a few thousand dollars to in excess of $1,000,000, depending upon the scope of the work undertaken by the commission.

It is true that in almost every state there has been a rapid increase in the state tax burden. While this is in part due to expenditures which naturally fall within the scope of the old-time activities of the state, it seems certain that important increases have come through the recent multiplication of the functions of the state government. Most of these newer functions were begun in the anticipation that they would be self-supporting, but from various causes such has not proved to be the case. Among these functions assumed by the state and calling for support by taxes is that of regulation of the public utilities.

There are many people who, in these days of declining purchasing power of money, seriously complain of increased taxes and are prone to question whether these new state functions are attaining the end which at first seemed to justify their undertaking. It is not improbable that in many states reform administrations will seriously curtail the activities of the regulating commissions by reducing the appropriations for their operation. With decreased activity and the lengthening of the time required to reach decisions on complaints, there will be an increase in the dissatisfaction with this branch of government. Whether this will result in the enactment of radically different legislation depends upon the circumstances that obtain in the particular case. In fact, it seems probable that all these various forces are self-corrective in the long run and an extreme tendency either of the law or the practice of regulation will subsequently be followed by a reversion to conservatism as the apparent need therefor develops.

After the foregoing review of the causes leading to the enactment of laws providing for the regulation of public utilities and an examination of the popular forces which are working for and against the continuation of these laws it seems a reasonable conclusion that, while regulation may form a part of our permanent economic scheme, it will be subject to cyclic changes, either in law or practice, arising from requirements for political issues and from forces which cannot be controlled but must be permitted to expend their energy or otherwise prove self-corrective.

Management by Large Operators

By ARTHUR ST. GEORGE JOYCE, E. W. Clark & Company

There are many reasons why the management of public utilities on a large scale brings about economy in operation and better service.

Large operators in any line of business can usually do everything a little better and a little cheaper than small operators, and this is particularly true of such public utilities as electric railway, light and power companies.

In the first place money must be raised, and here large firms constantly in touch with the market have great advantages. They know exactly how and when to finance any proposition and through their high standing can secure money at lower rates of interest than would be possible for a local concern. This question of raising money is of particular importance in the public utility business, because the investment and consequently the interest charges are so great in comparison to gross earnings. The development of water-powers frequently depends primarily on the rates which must be paid for money, and this is true to a less extent in other branches of the business.

When the money has been raised, large operators turn the work over to their own construction departments. On account of their wide experience all over the country, they are able to do any kind of construction much better and more economically than it could be handled locally.

By purchasing in the wholesale markets the materials needed by all their companies for either construction or operation the very lowest prices are obtained, which in the aggregate produce a large saving. In this way the individual companies have the advantage of the best materials at bottom prices.

In operation the large scale of doing business makes it possible to secure and hold the very best managers and engineers for the benefit of the various properties. In legal matters, also, large operators have advantages for they are able to secure the services of attorneys of the widest experience in many states. Just at the present time, for instance, this is of special advantage in connection with rate and valuation cases before public utility commissions.

Where the properties are in the same general region or are simply a consolidation of street railway and electric light companies, additional saving can be made through the construction of a large central power station. Such a plant is generally cheaper to construct per kilowatt of capacity and also requires a smaller proportion of reserve than would be necessary in a number of local stations. Then, of course, the operating expenses per kilowatt-hour would be decreased. If the properties are in the same locality, the system can be tied together with transmission lines and the old power stations may then be shut down entirely or used only for reserve.

Greater efficiency in transmission of electrical power is resulting all over the country in the development of large water-power plants and steam stations, which supply the electrical requirements within a very wide radius.

There are many other ways in which the large operator can make economies, which at the same time improve service and leave a reasonable return for stockholders.

Public Relations

By FRANK W. ROLLINS, of E. H. Rollins & Sons, Boston, Mass.

The serious situation which confronts the railways of this country at present is due to two primary causes—constantly rising cost of operation in the face of a fixed fare unit and a one-sided regulation. The latter makes it extremely difficult for properties to charge an adequate price for the service rendered, and the public demands the best possible facilities with little appreciation of their real cost. Unless the transportation industry is permitted to readjust its rates and schedules to meet present conditions, it appears that government ownership, with all its possibilities of inefficiency and demoralization of initiative, will be the only outcome.

I do not believe in public ownership except in the case of such enterprises as water-works and sewers, and in common with many other observers of industrial conditions in the United States, I look to a wise publicity on the part of the burdened railways as the "way out" of the present unsatisfactory situation. Certainly it is not unreasonable to ask for rates which will enable the best service to be rendered, pay its entire cost of operation and fixed charges, and include a fair dividend of say 6 per cent upon the investment. The good sense of the American people ought to respond to a clear presentation of the street railway's case and enable the industry to push forward to a larger usefulness and a more enduring reward for its broadened services to civilization.

The Holding Company—Its Advantages and Disadvantages

By FRANK R. FORD, of Ford, Bacon & Davis, Consulting Engineers, New York

The holding company to-day is politically and popularly under suspicion. It is not so much a question as to whether its field of activities will be enlarged as whether it will survive the present attack and continue as a part of the economic machine. Therefore it is of interest to consider the extent that this corporate device has been used in the electric railway industry and to weigh its advantages and disadvantages from the standpoints of both the public and the share owners.

The development of the holding company as applied to electric railways took place largely in the decade from 1895 to 1905, following immediately the period of electrification of horse car lines and during the period of rapid financial development of these properties.

Among other public utilities the great development of the holding company within the past six or eight years has been in the lighting and power field, during which time electric railways have been considered either as a positive disadvantage to holding companies formed mainly to acquire lighting or power companies or have been taken in under sufferance because already consolidated with lighting companies.

Consequently, the electric railway holding company of to-day is usually of a more settled character than the newer public utility holding company, and while its difficulties are more evident, it may be only because they are better understood.

STATISTICS OF ELECTRIC RAILWAY HOLDING COMPANIES

As far as the limitations of published reports render it possible, information has been obtained of the electric railway companies of the United States concerning their relationship to holding companies. As of June 30, 1912, or Dec. 31, 1912, there were 951 companies operating 41,754 miles of track. Of this total 27.1 per cent, which operated 49.5 per cent of the mileage, were controlled by holding companies. The tabulation of operating companies is summarized as follows:

TABLE I.—PROPORTION OF OPERATING ELECTRIC RAILWAY COMPANIES HELD OR INDEPENDENT

	Number of Operating Companies	Per Cent of Total	Miles of Track	Per Cent of Total
Held operating companies..	257	27.1	20,717	49.5
Ind. operating companies...	694	72.9	21,037	50.5
Total	951	100	41,754	100

In the following statistics a holding company is considered as one which does not of itself operate a railway but has control of one or more operating companies through the medium of stock ownership. If such control is also through a lease, the lessee company is considered as an operating company. In cases where the operating company controls another operating company through ownership of stock the former is considered as an operating company. Elevated railways, subways and interurban electric railways are included. Electrified steam railroad mileage is omitted, but electric railway companies controlled by steam railroad companies are included.

KINDS AND DEGREES OF CONTROL

The character of the holding organization may be subdivided into:

1. Incorporated holding companies.
2. Steam railroads.
3. Voluntary associations or trusts.
4. Management associations.

The first class is further differentiated into (a) holding companies controlling one connected operating system of electric railways, even though a number of other kinds of business in the same place or in other places are also controlled, and (b) holding companies controlling more than one separate operating electric railway system, these being generally located in several states. These two classes are referred to as holding companies controlling single systems and holding companies controlling two or more systems.

The steam railroads referred to control in some instances one company and in others more than one. In the case of one operating electric railway company at least there is a joint control by two railroads.

The voluntary associations are almost entirely the Massachusetts form of trust, managed by trustees and issuing certificates of ownership in the securities controlled by them.

Management associations denote those banking or engineering firms, corporations or organizations holding either directly or indirectly through affiliated companies a stock control of the subsidiary operating companies. In some cases such control may be only through management contracts. In many instances the method or extent of such control is not contained in published reports and undoubtedly a number of cases of such control are not included as they are not evidenced by public records.

A summary of these various kinds of control is as follows:

TABLE II—KINDS OF CONTROL

Character of Holding Concern	Number of Primary Holding Concerns
Incorporated holding companies (single system)	60
Incorporated holding companies (two or more systems)	27
Steam railroads	10
Voluntary associations or trusts	9
Management associations	10
Total holding concerns	116

In many instances the holding company whose securities are owned by the public controls the operating electric railway company through one or through several holding companies in succession, and in some cases the succession of control is from a holding company through an operating company to one or more operating companies. These degrees of control are shown in the following table:

TABLE III—DEGREES OF CONTROL

Degree	Number of Concerns		Total
First	66	holding companies	66
Second	35	holding companies	
	153	operating companies	188
Third	14	holding companies	
	76	operating companies	90
Fourth	1	holding company	
	21	operating companies	22
Fifth	6	operating companies	6
Sixth	1	operating company	1
Total	116	holding companies	
	257	operating companies	373

Explaining the figures given in Table III and the various degrees of control, it may be stated that the sixty-six primary holding concerns control thirty-five underlying holding companies and 153 operating companies, or a total of 188 companies. Part of these companies in turn control fourteen holding companies and seventy-six operating companies, or a total of ninety. Part of these in turn control one holding company and twenty-one operating companies, or a total of twenty-two. Some of these in turn control six operating companies, and one of these in turn controls one separate operating company. There is, therefore, one operating company which is five degrees removed from the primary holding company, while there are, as shown, a number of operating companies or holding companies that are several degrees removed from the primary holding company which controls them directly or indirectly.

CENSUS STATISTICS

Unfortunately the United States "Census of Electric Railways" for 1912 has not yet been published, as doubtless it will contain reliable information and statistics on the subject of the holding company.

The 1907 "Census of Street and Electric Railways" reported upon seventy financing or holding companies having a total capitalization outstanding of $954,695,373, but these figures and the few details published were not complete.

STATE OF INCORPORATION

The three most popular states of incorporation of the holding company are New Jersey, Maine and Delaware, these comprising over one-half of the incorporated holding companies. The following table gives the state of incorporation of various holding organizations, including not only the sixty-six primary holding concerns but also holding companies of the other degrees of control shown in Table III. The state containing the principal office of the management firm or association is given in some instances instead of the place of incorporation.

It is of interest to note that two of the holding companies are incorporated in Canada, although, as stated, the operating electric railway company in each case is located in the United States.

TABLE IV—STATE OF INCORPORATION OF HOLDING CONCERNS

States	Incorporated Holding Companies Controlling Two or More Systems	Single System	Steam Railroads	Voluntary Associations	Management Associations	Total
New Jersey	9	11	..	..	..	20
New York	4	3	2	..	5	14
Massachusetts	..	2	1	8	2	13
Maine	3	9	..	..	..	12
Delaware	2	9	..	..	..	11
Pennsylvania	1	3	2	..	1	7
Illinois	1	2	..	1	2	6
Connecticut	2	1	1	..	..	4
California	..	4	..	..	..	4
Virginia	1	2	..	..	..	3
Colorado	1	1	..	..	..	2
Indiana	..	2	..	..	..	2
New Hampshire	1	1	..	..	..	2
Georgia	..	1	..	..	..	1
Kansas	..	1	..	..	..	1
Louisiana	..	1	..	..	..	1
Montana	..	1	..	..	..	1
North Carolina	..	1	..	..	..	1
Ohio	1	..	..	..	..	1
Texas	..	1	..	..	..	1
West Virginia	..	1	..	..	..	1
Wisconsin	..	..	1	..	..	1
Kentucky	..	1	..	..	..	1
Minnesota	..	..	1	..	..	1
Utah	..	..	1	..	..	1
Washington	..	..	1	..	..	1
Arizona	..	1	..	..	..	1
Canada	1	1	..	..	..	2
Total	27	60	10	9	10	116

KINDS OF BUSINESS DONE

There are many varieties of business other than the electric railway business done both by the holding companies and by the operating electric railway companies. Of the sixty-six primary holding concerns only fourteen do exclusively an electric railway business. Of the remaining fifty-two concerns a large proportion do an electric light, power and gas business, these being apparently the natural adjuncts to the electric railway. A summary of these kinds of business is as follows:

TABLE V—KINDS OF BUSINESS DONE

	Primary Holding Concerns	Held Operating Companies	Independent Operating Companies
Total number of concerns	66	257	694
Deduct those doing electric railway business only	14	177	576
Remaining concerns doing other business of following kinds:	52	80	118
Electric light and power	44	80	118
Gas	33	40	29
Heating	14	10	7
Water	12	4	8
Steam railroad	9	..	..
Ice	3	2	3
Irrigation	2	..	..
Manufacturing	2	..	..
Real estate	1	..	4
Oil	1	..	1
Telephone	1	..	..
Steamboat	..	..	2

CONTROL OF LARGE CITY RAILWAY SYSTEM

Of the twenty-eight cities of over 200,000 population in the United States, the principal electric railway systems may be classified as in Table VI.

It is interesting to note that of these twenty-eight cities there are only four which contain more than one principal operating system, and of these there are probably only two cities which can be said to have separate and independent ownership. It thus appears that the

TABLE VI—KIND OF CONTROL OF LARGE CITY RAILWAY SYSTEMS

Character of Control	Number of Companies	Miles of Track
Held operating companies (single system)	7	3,123
Held operating companies (two or more systems)	12	4,968
Independent operating companies	14	5,079
Total	33	13,170

street railway industry in large cities in the United States has become a natural monopoly, subject as a general rule to the regulation of a public service commission.

ADVANTAGES OF THE HOLDING COMPANY

A list of the principal advantages of the holding company follows:

1. Financial.

(a) Better market for construction securities of subsidiary companies on account of the wider market and also of the larger and more regular supply of securities for the banking outlet.

(b) More stable and larger market for stock of holding company than for smaller issues of the independent operating companies.

(c) Holding company can finance temporarily with its own surplus funds or through the large metropolitan banks, as well as the local banks, thus providing reserve financing until the securities of the subsidiary companies can be marketed.

(d) Holding company can finance the subsidiary companies with the proceeds of its own collateral trust bonds based on securities of subsidiary companies, or with its own debentures, notes, preferred or common stocks.

2. Operating.

(a) Holding company has a wider field for selection of local officers and can also promote from its own and the subsidiary companies' trained organizations.

(b) Holding company can, with its more experienced and more complete organization, efficiently supervise the operating results of the subsidiary companies, drawing comparisons between them and with other properties, and can apply remedies for conditions that are out of line.

(c) In case of local calamity or extraordinary difficulties the holding company can assist with all of its organizations or furnish a financial reserve to be drawn upon.

(d) Holding company can standardize operating methods and policies, thus securing greater economy and higher efficiency for the company and better service for the public.

3. Engineering.

(a) Holding company can standardize its designs and methods to the benefit of the public and also of financial results.

(b) On larger volume of work holding company can employ more experienced and efficient engineers for general supervision of the construction work.

4. Purchasing.

(a) Owing to purchases on a large scale, holding company can buy more cheaply the construction and maintenance materials, machinery and supplies.

(b) Holding company can standardize specifications.

(c) Holding company can purchase in larger markets and keep more closely in touch with current prices.

5. Accounting.

(a) Holding company can supervise and audit accounts of the subsidiary companies, besides bringing to bear upon the problems arising more experienced men. It can also standardize accounting and statistical forms and methods and can assist the operating officials to establish proper policies as to depreciation and other reserve funds, insurance, damages, etc.

6. Legal.

(a) Corporate and general legal matters can be better cared for by the holding company, whose legal department is usually of larger experience than is ordinarily found in a small local company.

(b) Services of trained engineers and attorneys are always available for testimony and counsel in cases before courts and public service commissions.

7. General.

(a) The combination of revenue and earnings of widely separated properties produces an assurance of normal income.

(b) Various economies of production on a large scale are secured.

DISADVANTAGES OF THE HOLDING COMPANY

1. Financial.

(a) Overcapitalization of the holding company. While this has been the case with some holding companies, it is not believed to be a general condition of these concerns. In many cases it is the subsidiary company that is overcapitalized. On the other hand, objection has been raised that through moderate stock capitalization and large collateral trust bond issues of some holding companies control of large and valuable equities is obtained through a small investment by a few persons.

(b) Opportunity for general misapprehension by the public as to the character and value of the collateral trust bonds and notes of the holding company and the preferred and common stocks following such debt by reason of complex intercorporate relationships.

(c) The minority stockholders of the subsidiary companies generally have no market for their securities and little if any voice in the company's management.

(d) Tendency to monopolize industry. There is a distinct tendency toward the control by one or more large interests of such a considerable group of public utility companies as to influence a large section of this field, and thus possibly to prevent fair competition in various departments of the business and to favor affiliated banking, manufacturing and other interests to the disadvantage both of the utilities controlled and of fair competition in those lines.

2. Operating, engineering, purchasing.

(a) Operation of subsidiary companies from a distance is not desirable. To obviate this disadvantage as far as possible, the local management and organization should be autonomous and conducted by the best obtainable talent. The directors should be strong local men who would not hesitate to direct the affairs of the company, although not largely interested financially. Moreover, the central organization of the company should be experienced, capable and competent to supervise the operations of the subsidiary companies. If this work is not properly looked after and if all centralized services for which charges are made, such as financing, purchasing, etc., are not efficiently performed, the holding company develops merely into a device for collecting tribute from minority stockholders of the subsidiary companies, or from the public. On the whole, notwithstanding the possible disadvantage of foreign control, it is believed that where the holding company's management is efficient, benefits to the public have always resulted.

(b) Loss of initiative of subsidiary officials. It is a question in some cases whether the officers of the subsidiary companies do not lose initiative and individuality by leaning too much upon the organization of the holding company and failing to take their proper responsibility. Experience shows, however, that if the supervision of the holding company is properly exercised

and the subsidiary officials are men of ability, they will feel that their work is being compared with that of a number of other organizations, and that they are being held responsible for results.

3. Accounting.

(a) The revaluation of assets is sometimes subject to abuse. This method has been used at times to misrepresent profits or to conceal losses.

4. General.

(a) Profits of subsidiary companies are sometimes impossible to realize in cash, so that there should always be a large margin between book profits and dividends paid.

(b) Multiple taxation of the assets and income of holding companies and their subsidiaries is a serious problem of increasing importance.

CHARGES FOR SERVICES OF HOLDING COMPANY

It is interesting to note various methods which have been employed to charge the subsidiary companies for the services of the holding company or its officials. In some cases these charges are made by management associations of engineers or bankers and in some cases by the holding company itself acting in such capacity. Usually the purchase by the holding company of the issues of securities of the subsidiary companies is the subject of a special arrangement for each instance with varying compensation in addition to the payments referred to below.

Some holding companies make no charge whatever for their services to the subsidiary companies, making no profit out of their control and meeting their own operating expense from dividends and interest received from the subsidiary companies. Others, while making no profit upon the operation, apportion part of their operating expenses to the subsidiaries. Others again charge the entire amount of such expenses to the subsidiary companies.

Those making charges for services which represent more than the expenditure by the holding company do this by one or more of the following methods:

1. A fee is charged for management supervision based on a percentage of the net earnings of the subsidiary companies. In this case the percentage fee for supervision covers the cost of purchasing. No charge is made for engineering except in special cases where large contracts are entered into.

2. A fee is charged based upon a percentage of the gross earnings of the subsidiary companies. This charge includes supervision of management, auditing and some legal work. In addition a percentage engineering fee is paid on all construction charges by the subsidiary companies and a percentage fee is also charged for all articles purchased by the holding company organization.

3. A fee in round amount is charged each subsidiary company both for management and central accounting by the holding company, with an additional percentage fee for articles purchased. No additional charge is made for supervision of engineering.

4. Each subsidiary company is charged a salary for the president of the holding organization, who is chairman of the board of directors of the subsidiary company, the total of such charges being a reasonable amount and paid direct to the said president. In this case no fee is charged for management supervision but a separate fee of a percentage of construction expenditures of the subsidiary companies is charged for engineering supervision.

5. A fee is charged the subsidiary companies of a percentage of the gross earnings for management and each subsidiary company is also assessed for the direct expenses paid for its benefit by the holding company. In addition for engineering services a percentage fee is charged upon all construction items of the subsidiary company together with reimbursement for expenses of the engineering organization of the holding company.

6. Various representatives of the holding company are elected to executive positions in each of the subsidiary companies, each position paying as large a salary as the company can afford or as it should pay if the same position were filled locally. The salary checks from the local companies are taken possession of by the holding company and its officials paid at merely their market value by the holding company. In this way the excess of these salaries defrays the other general expenses, clerk hire, rent, etc., of the holding company. In addition the subsidiary company is charged a percentage on all construction expenditures.

Unless in the division of traffic, business or rates, in general it may be said that steam railroads and industrial holding companies have not gone nearly so far in the matter of making a profit from charges for the management of the subsidiary companies as have some of the public utility holding companies. The usual practice is to prorate the actual expenses of the holding company among the subsidiary companies. This condition is due probably to the more compact and interrelated organizations or physical connection of railroad and industrial properties rather than the widely separated company units common in the electric railway holding organizations.

While the holding company has within its power the possibility of securing much improved results for the securities of the subsidiary companies and for the local public, worth generally much more than its charges, in some cases the reverse is undoubtedly true. Here the holding company may be merely a device to secure unearned profits through a stock ownership controlling both parties to the management or engineering contract. In the latter cases doubtless the stockholders and the public will eventually correct the situation.

SOME LEGAL LIMITATIONS

As shown in the above statistics, the favored states for the incorporation of holding companies are New Jersey, Maine, Delaware, Massachusetts, Connecticut and Virginia. New Jersey has always been in the lead, but the recent passage of what are known as the "Seven Sisters" laws through the efforts of former Governor Wilson has changed the legal status of these companies. It is now probably unlawful for them to enlarge their stock ownership or to purchase the stock of other companies, which with other disabilities hamper their operations. Consequently, it is believed that a number of these corporations will re-incorporate in other more favorable states in spite of the difficulties of this course. At least one of these New Jersey companies has already proposed this reincorporation to its stockholders. Another is contemplating the same course, for which it has greater facility due to having originally incorporated in its charter a "migratory clause" permitting it, with the consent of a majority of the stockholders, to liquidate and re-incorporate in another state.

Some states, notably New York, have of recent years amended their corporation laws so as not to permit the incorporation of holding companies which may control operating electric railway companies. The same result is secured in a number of states under public service corporation laws which prevent the acquisition of more than a small percentage of the stock of a street railway company by any other corporation.

Owing to the popular objection that the corporation of one state is largely relieved from responsibility or from supervision in another, legislation may later be secured permitting holding companies doing business in more than one state to secure a federal charter so that all subsidiary companies could become merely local

branches of the main company but subject to federal regulation.

While the laws of few if any of the states permit local street railways to be physically owned and operated by a foreign corporation, this is usually not the case with manufacturing companies, a number of which while incorporated in one state own and operate separate properties and plants in several other states.

CONCLUSIONS.

In general the holding company in some form is believed to be an approved, economic device for insuring financial results, standardizing operations and strengthening financial, operating and engineering methods and organizations, and while it is susceptible to misuse it has also, as stated, definite economic advantages and has come to stay.

MEETING OF AMERICAN ASSOCIATION FOR LABOR LEGISLATION

The annual meeting of the American Association for Labor Legislation was held in Washington on Dec. 30 and 31. Among the subjects discussed were "Administration and Industrial Relations," "Sickness Insurance" and "Working Hours in Continuous Industries."

One of the papers presented before the association was by Charles H. Crownhart, chairman Wisconsin Industrial Commission, on the subject "Labor Laws—Enforcement Through Administrative Orders." In his paper Mr. Crownhart said in part:

"The Wisconsin Legislature of 1905 enacted the rule as to railroad rates that 'all such rates should be reasonable.' What *is* a reasonable rate is a question of fact. The Legislature created the Railroad Commission to determine the fact in the first instance and to establish that fact by order. This act has been sustained in the courts.

"Following this, in 1911 the Legislature applied the same principle to labor legislation. It has been found impracticable, if not impossible, for the Legislature to keep abreast of the times in safety legislation. The elements of safety in industry are so many and so complex that details could not be expressed in the law without vital omissions and often without bad mistakes of inclusion. Safety in industry was found to be an expert's problem quite as much as fixing rates of public utilities. So the Legislature laid down the simple rule that all places of employment must be safe, and 'safe' was defined to mean 'such freedom from danger to the life, health or safety of employees or frequenters as the nature of the employment will reasonably permit.' Then the Legislature created the means appropriate for enforcing the rule. It created an Industrial Commission, with the duty of determining the facts as to safety and promulgating such facts by order. The order is really the declaration of the legislative rule as applied to the particular fact found.

"The Wisconsin commission has the authority to publish bulletins for the information of all concerned. In this way it is able to bring home to those affected by its orders knowledge of the orders and of the duty of the employer and employee under them. The orders are direct, simple and easily understood. When people understand the justice of laws it is not hard to secure enforcement. The commission does not require any safeguard which cannot be proved to be practical, nor does it require any which the commission cannot show how to install.

"The Wisconsin commission has representatives of employers' associations, workmen's associations, insurance companies and experts from the department, selected as a committee on safety to draft tentative orders. The members of the committee are clean-cut, practical men of affairs. They approach the subject earnestly and devote much time and attention to it. The tentative orders are drafted, printed, submitted to all employers and others interested and criticisms invited.

A hearing is granted where any interested party may make objections. The tentative orders are then revised and adopted by the commission. Additions and alterations are made from time to time as necessity requires. We now have twenty general orders common to all industries; five general orders applicable to woodworking establishments; five as to safety in laundries; three as to sanitation in laundries; fifty-three as to safety of elevators; eighteen as to ventilation and exhaust systems; six as to shop lighting, and twenty as to toilet rooms and general sanitation. Orders are in course of preparation covering the subjects of a building code, outside construction work, electrical construction and boiler manufacture, installation and operation.

"The result of this plan of enforcement of safety orders has been excellent. No prosecutions have been necessary in a period of two years. Extensions of time to comply with the orders have been granted by the commission as the occasion required. Employers and employees have actively co-operated with the commission to secure safety, and the standard of safety in Wisconsin is now higher than it has ever been in its history, and yet the employees are but obeying and carrying out the details of law which they have been largely instrumental in creating and making.

"With us the workmen's compensation act is an added incentive for a high standard of safety. The act is administered by the Industrial Commission. Not only does the employer have to pay compensation where his employee is accidentally injured, but if the injury results from failure to conform to the commission's orders, 15 per cent is added to the injured workman's compensation as a penalty. Likewise employees are required to obey the commission's orders on pain of 15 per cent reduction of compensation if injury results from their failure."

One of the sessions was a joint meeting with the American Political Science Association. Prof. W. W. Willoughby, of Johns Hopkins University, president American Political Science Association, addressed this meeting on "The Individual and the State." Prof. W. F. Willoughby, Princeton University, president American Association for Labor Legislation, addressed the meeting on "The Philosophy of Labor Legislation."

At the annual business meeting reports were presented by the following committees: workmen's compensation, industrial hygiene, women's work, enforcement of labor laws, one day of rest in seven, social insurance, standard schedules and tabulations and the New York legislative committee.

A paper on "The Practicability of Compulsory Sickness Insurance in America" was read by Joseph P. Chamberlain, Legislative Drafting Association, New York. The leading points in the paper were that the present insurance of the poor is enormously and hopelessly expensive and promotes extravagant funerals; that workmen do not oppose compulsory insurance, and that contribution by employers is already accepted in principle; that the enormous value of the organization of hospital funds, fraternal society and trade union benefits, so that their combined force can be brought to bear upon the problems of sickness, on the spread of information, on the enforcement and improvement of legislation, is at present entirely dissipated, and finally that the problem of sickness insurance through legislation is the problem of the immediate future in America.

New Electric Railway Track Built in 1913

A Compilation of Statistics on New Track Made Up from Reports Received from the Different Electric Railway Companies in the United States and Canada

The new track built and placed in service during 1913 by city systems, interurban lines and electrified steam railroads is tabulated in the accompanying lists. The statistics were compiled from reports received from the railway companies themselves, and the record is complete except in the case of a few of the smaller properties whose replies were not received in time for inclusion in the list. All items which appear are, of course, accurate. It is possible, however, that there may be some omitted mileage, either because of the failure of the companies to report it or because the construction was reported during 1912 and hence appeared in the statistical table published in the issue of this paper for Jan. 4, 1913.

The following summary shows the electric railway mileage built or put into operation each year since 1907 in the United States and Canada:

1907	1,880 miles.
1908	1,258.5 miles.
1909	887.1 miles.
1910	1,397.2 miles.
1911	1,191.5 miles.
1912	950.2 miles.
1913	1,018.9 miles.

Texas heads the list of states with 177.77 miles reported. This total includes the longest interurban railway built in the United States during 1913, namely, the Southern Traction Company, which built 154 miles of track connecting Waco, Dallas and Corsicana, Tex.

Missouri is second with 74.52 miles of track constructed. The largest part of this mileage is represented by the Kansas City, Clay County & St. Joseph Railway, which was completed and placed in operation during the past year. This line is 69.17 miles long and extends from Kansas City to Liberty, Excelsior Springs, Dearborn and St. Joseph.

Pennsylvania with 55.79 miles is third, of which the Philadelphia Rapid Transit Company built 21.58 miles. The Hershey Transit Company completed a 10-mile line connecting Hershey and Lebanon.

In Minnesota, which has a total of 54.22 miles, the Electric Short Line Railway and the Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company built 25 and 18 miles of track, respectively. Two long extensions were built in Iowa. The Iowa Railway & Light Company completed a 17-mile line between Cedar Rapids, Bertram, Mount Vernon and Lisbon. A 20-mile line was built by the Waterloo, Cedar Falls & Northern Railway between Laporte City, Brandon and Urbana, Ia. In Massachusetts the majority of new track is credited to the Berkshire Street Railway, which completed a 24.44-mile line connecting Lee, Becket, Otis, Blandford and Huntington. The electric railways of Canada built 147.86 miles of track, compared with 78.37, or an increase of 47 per cent over 1912.

ALABAMA	Miles.
Alabama City, Gadsden & Attalla Ry.—Between Gadsden and Noccalula Falls	3.10
Birmingham, Ensley & Bessemer R. R.—Birmingham	6.00
Birmingham Railway, Light & Power Co	6.26
Mobile Light & Railroad Co	1.25
	16.61
ARIZONA	
Phoenix Railway	3.50
	3.50
CALIFORNIA	
City Railway Company of Los Angeles	12.80
Crescent City Railway—Between Bloomington and Rialto	3.43
Glendale & Eagle Rock Ry.—Between Glendale and La Cresenta	4.00
Petaluma & Santa Rosa Ry.—Between Liberty and Two Rocks	5.37
San Diego Electric Railway—San Diego	0.50
San Francisco-Oakland Terminal Rys	9.02
Santa Barbara & Suburban Ry	0.63
Stockton Terminal & Eastern R. R	3.20
United Railroads of San Francisco	2.25
	41.20
COLORADO	
Denver City Tramway	0.85
Denver & Northwestern Ry	1.15
	2.00
CONNECTICUT	
Connecticut Co.	1.46
New London & East Lyme Street Ry	13.26
Shore Line Electric Ry.—Between Deep River and Chester	4.66
Waterbury & Milldale Tramway	3.60
	22.86
DISTRICT OF COLUMBIA	
Washington Utilities Co.—Between Clarendon and Arlington Junction, Va	2.25
	2.25
FLORIDA	
St. Johns Electric Co.—Between South Beach and Chautauqua Beach	1 50
St. Petersburg & Gulf Ry.—Davista	7.00
	8.50
GEORGIA	
Georgia Railway & Power Co.—In Atlanta and between Decatur, Clarkston and Stone Mountain	14.50
Rome Railway & Light Co	0.75
Waycross Street & Suburban Ry.—Waycross	2.92
	18.17
IDAHO	
Caldwell Traction Co., Ltd.—Between Summit, McCrory, Lake Lowell, Divide, Homestead, Sunny Slope and McNeil	3.50

IDAHO (*Continued*)	Miles.
Idaho Railway, Light & Power Co.—Boise	3.50
	7.00
ILLINOIS	
Centralia Traction Co.—Between Centralia and Wamac	3.00
Chicago City Ry	9.50
Chicago & Joliet Electric Ry	0.85
Chicago Railways—Chicago	2.00
Decatur Railway & Light Co	0.70
East St. Louis Ry	1.50
Freeport Railway & Light Co	1.00
Kankakee & Urbana Traction Co	0.75
Quincy Ry.—Quincy	4.00
Rock Island & Southern Ry	1.50
	24.80
INDIANA	
Chicago, South Bend & Northern Indiana Ry.—South Bend	1.00
Union Traction Company of Indiana—Between Cowan, Oakville, Springport and Mount Summit	16.90
	17.90
IOWA	
Cedar Rapids & Marion City Ry	4.00
Clinton Street Ry	3.00
Iowa Railway & Light Co.—Between Cedar Rapids, Bertram, Mount Vernon and Lisbon	17.00
Tri-City Ry	1.54
Union Electric Co	1.00
Waterloo, Cedar Falls & Northern Ry.—Between Laporte City, Brandon and Urbana, Ia	20.00
	46.54
KANSAS	
Arkansas Valley Interurban Ry.—Between Newton and Bethel College	2 00
Joplin & Pittsburg Ry	1.61
Manhattan City & Interurban Ry	2.50
Salina Street Ry	1.50
Topeka Ry.—Topeka	1.50
	9.11
LOUISIANA	
Baton Rouge Electric Co.—Baton Rouge	2.31
New Orleans Railway & Light Co	0.72
	3.03
MAINE	
Aroostock Valley R. R. Co.—Between Carson and West Caribou	7.13
Bangor Railway & Electric Co.—In Bangor and through Hampden	1.33
Rockland, South Thomaston & St. George Ry	1.25
	9.71
MARYLAND	
United Railways & Electric Co.—Baltimore	0.33
	0.33

MASSACHUSETTS	Miles
Bay State Street Ry.	1.86
Berkshire Street Ry.—Between Lee, Becket, Otis, Blandford and Huntington	24.44
Interstate Consolidated Street Ry.	0.13
Nahant & Lynn Street Railway Co.	0.50
Northampton Street Railway Co.	0.25
Oak Bluffs Street Ry.	0.60
Springfield Street Ry.	1.62
Union Street Ry.	0.55
Worcester Consolidated Street Ry.—In Tatnuck and Worcester	2.28
	32.23

MICHIGAN	
Benton Harbor-St. Joe Railway & Light Co.—Between Coloma and Watervliet	2.50
Escanaba Traction Co.	1.00
Michigan United Traction Co.	1.80
Saginaw-Bay City Railway	1.00
	6.30

MINNESOTA	
Electric Short Line Ry.—Between Minneapolis and Minnetonka	25.00
Minneapolis, St. Paul, Rochester & Dubuque Electric Trac. Co.	1.75
St. Paul Southern Electric Ry.—Between St. Paul and Hastings	18.00
Twin City Rapid Transit Co.	9.47
	54.22

MISSISSIPPI	
Hattiesburg Traction Co.	2.00
Meridian Light & Railway Co.	0.93
	2.93

MISSOURI	
City Light & Traction Co.—Sedalia	1.50
Grand View Railroad—Between Luxemburg, Point Breeze and Continental	1.50
Kansas City, Clay County & St. Joseph Ry.—Between Kansas City, Liberty, Excelsior Springs, Dearborn and St. Joseph	69.17
St. Joseph Railway, Light, Heat & Power Co.	1.51
United Railways Company of St. Louis	0.84
	74.52

MONTANA	
Billings Traction Co.	1.00
Butte Electric Ry.—Butte	0.75
Great Falls Street Ry.	0.75
Missoula Street Ry.—Missoula	0.56
	3.06

NEBRASKA	
Omaha & Council Bluffs Street Ry.	1.00
Omaha, Lincoln & Beatrice Ry.	0.75
	1.75

NEVADA	
Fallon Electric R. R.—Between Fallon, Stillwater, Harrigan and Harrigan South	20.00
	20.00

NEW JERSEY	
Atlantic Coast Electric Ry.—Through New Jersey State camp grounds	0.76
Cape May, Delaware Bay & Sewell's Point R. R.—Through East Cape May	1.00
Jersey Central Traction Co.	0.50
Public Service R. R.—Between Elizabeth, Linden Township, Roosevelt Borough and Woodbridge Township	5.93
Public Service Ry.	4.25
	12.44

NEW YORK	
Black River Traction Co.	0.30
Brooklyn Rapid Transit Co.	0.14
Cortland County Traction Co.	0.28
Dry Dock, East Broadway & Battery R. R.	0.46
Elmira Water, Light & Railway Co.	0.38
Hornell Traction Co.	1.00
International Ry.	2.68
Jamestown Street Ry.—Jamestown	0.84
Manhattan Bridge Three-Cent Line—New York	2.00
Manhattan & Queens Traction Corporation—New York	13.62
New York, Auburn & Lansing R. R.	0.40
New York & Queens County Ry.	1.92
New York State Rys., Rochester Lines	3.42
New York State Rys., Utica Lines—In Utica and through German Flatts, Ilion and Mohawk	6.06
Suffolk Traction Co.—Between Blue Point and Bayport	0.50
Union Ry.	2.14
Westchester Electric R. R.	0.77
Yonkers R. R.	3.14
	40.05

NORTH CAROLINA	
Charlotte Electric Ry.—Charlotte	5.00
	5.00

OHIO	
Dayton, Covington & Piqua Traction Co.	1.14
Northern Ohio Traction & Light Co.	17.00
Ohio River Electric Railway & Power Co.	0.60
	18.74

OKLAHOMA	
Oklahoma Ry.—Between Moore and Norman, Okla.	9.00
Sand Springs Ry.	5.50
	14.50

OREGON	
Oregon Electric Ry.—A 5-mile line from Orenco to Bowers Junction and a 5-mile line from Gray to Corvallis	10.00
Portland Railway, Light & Power Co.	12.67
	22.67

PENNSYLVANIA	Miles
Altoona & Logan Valley Electric Ry.—Altoona	0.77
Butler Passenger Ry.—Butler	0.50
Conestoga Traction Co.—In Lancaster and between Lancaster and Rohrerstown	1.77
Harrisburg Rys.—Harrisburg	0.50
Hershey Transit Co.—Between Hershey, Hummelstown, Campbellstown, Mount Pleasant and Lebanon	10.00
Lehigh Valley Transit Co.—Allentown	2.50
Philadelphia Rapid Transit Co.—Philadelphia and between Philadelphia and Chester	21.58
Pittsburgh Rys.	6.04
Pottstown & Phoenixville Ry.	2.50
Scranton Ry.—Scranton	1.94
West Side Electric Street Ry.—Between Ellsworth, Bentleyville, Weaver and Jonestown	6.00
York Rys.	1.69
	55.79

RHODE ISLAND	
Rhode Island Co.	2.96
	2.96

SOUTH CAROLINA	
Charleston-Isle of Palms Traction Co.	0.25
	0.25

TENNESSEE	
Chattanooga Railway & Light Co.	1.00
Knoxville Railway & Light Co.	8.73
Lookout Mountain Ry.	6.00
	15.73

TEXAS	
Corpus Christi Street & Interurban Ry.	2.00
El Paso Electric Ry.	2.33
Houston Electric Co.	5.24
Northern Texas Traction Co.	6.50
Port Arthur Traction Co.	0.50
San Antonio Traction Co.	1.70
Southern Traction Co.—Between Waco, Dallas and Corsicana	154.00
Texas City Street Ry.—Texas City	3.00
Uvalde & Leona Valley Interurban Ry.	2.50
	177.77

UTAH	
Ogden Rapid Transit Co.—Ogden	4.00
Utah Light & Railway Co.—Between Salt Lake City, Bountiful and Centerville	10.30
	14.30

VIRGINIA	
Charlottesville & Albemarle Ry.	0.25
Norfolk & Southern R. R., Electric Div.—From Lake Station to State Rifle Range	2.50
Virginia Railway & Power Co.—In Richmond and Petersburg	1.86
	4.61

WASHINGTON	
Puget Sound Traction, Light & Power Co., Bellingham Div.	9.87
Puget Sound Traction, Light & Power Co., Seattle Div.	3.01
Seattle Municipal Ry.—Seattle	7.67
Washington Water Power Co.	0.27
Willapa Harbor Ry.	0.20
Yakima Valley Transportation Co.—Between Selah and Taylor, Wash.	6.60
	27.62

WEST VIRGINIA	
Charleston-Dunbar Traction Co.	2.50
Charleston Interurban R. R.	0.32
Monongahela Valley Traction Co.—Between McWhorter, Lost Creek, Janelew and Weston	18.00
Ohio Valley Electric Ry.	1.00
Parkersburg, Marietta & Interurban Ry.	0.60
	22.42

WISCONSIN	
Milwaukee Electric Railway & Light Co.	7.33
Southern Wisconsin Ry.	0.38
	7.71

CANADA	
Berlin & Waterloo Street Ry.—Berlin	1.50
British Columbia Electric Railway Co., Ltd.—Includes new track in Vancouver and suburban system, also Victoria City system Saanich interurban line	36 07
Calgary Street Ry.	12.00
Edmonton Radial Ry.	13.67
Hull Electric Co.—Extension to Connaught Park Jockey Club	1.50
International Transit Co.	0.50
London Street Ry.—London	1.74
Montreal & Southern Counties Ry.—Includes electrification of 18-mile section of Central Vermont Ry. between St. Lambert and Marieville	21.50
Montreal Tramways	8.00
Niagara, St. Catharines & Toronto Ry.—Through St. Catharines	12.00
Ottawa Electric Ry.—Ottawa	5.00
Port Arthur & Fort William Electric Ry.	5.00
Quebec Railway, Light & Power Co.	1.54
Regina Municipal Ry.	3.25
Sandwich, Windsor & Amherstburg Ry.	1.32
Saskatoon Municipal Ry.—In Saskatoon and extension to Sutherland	7.00
Toronto Ry.—Toronto	2.21
Trans St. Mary's Traction Co.	0.08
Winnipeg, Selkirk & Lake Winnipeg Ry.—Includes a new line between Middle Church and Stony Mountain	13.98
	147.86

GRAND TOTAL	
United States and Canada	1,071.94

Electric Rolling Stock Ordered in 1913

A Tabulation Showing the Number, Type, Length and Manufacture of All Cars Built During the Year Compiled from Official Returns Made by the Railway Companies

The tables below show in detail the number of cars of all kinds as well as electric locomotives which were either purchased by electric railways or else built in the companies' shops during the past year. The total number of rolling equipments of all kinds was 5514, a decrease of approximately 8 per cent from the number listed for the previous year. The tables, in accordance with the usual procedure, have been made up from the orders noted from week to week in the rolling stock columns of the ELECTRIC RAILWAY JOURNAL and from returns made at the close of the year by the electric railways of the United States, Canada and Mexico. These figures were checked against reports received from practically all of the car builders, and every effort has been made to make the record complete, although there may be some omissions of a minor character.

The following summary shows the records in condensed form for the past seven years, and gives the number of cars, classified in accordance to the service in which they are used, from 1907 to 1913.

Year	City Cars	Interurban Cars	Freight & Misc. Cars	Total
1907	3483	1327	1406	6216
1908	2208	727	176	3111
1909	2537	1245	1175	4957
1910	3571	990	820	5381
1911	2884	626	505	4015
1912	4531	783	687	6001
1913	3820	547	1147	5514

The number of electric locomotives ordered was sixty-eight, as against sixty-five in the preceding year. The largest order is that of the Norfolk & Western Railway which has placed an order for twenty-four electric locomotives for freight service. The New York Central & Hudson River Railroad ordered fifteen locomotives.

The total number of cars of all types built in companies' shops was 772 as compared with 429 cars in 1912, or an increase of 44 per cent.

Purchaser	*No.*	*Class*	*Length*	*Serv.*	*Truck*	*Builder*
Ala. Cy., Gads'n & Attalla Ry..	1	Open	34-0	Int.	Brill	Pullman
	1	Closed	39-0	Int.	Brill	Pullman
Albany Southern R. R.....	1	El.Loco.	34-7	Fght.	Was'n	Gen.Elec.
Alton, Granite & St.L. Tr. Co..	7	Closed	33-4	Int.	Brill	American
	10	Closed..	26-0	City	Brill	American
Altoona & Logan Vy. El. Ry...	1	Sweeper	28-3	City	M'G-C.	McGuire-C.
Amarillo St. Ry.....	2	Closed	20-8	City	Brill	American
Asheville & East Tenn. R. R...	1	Closed	41-0	Int.	Tav.	Southern
Asheville Pwr. & Lt. Co.....	6	Closed	20-8	City	Brill	Brill
Ashtabula R. T. Co.....	1	Closed	25-4	City	Brill	Kuhlman
Athens Ry. & Elec. Co.....	1	Closed	39-6	City	Brill	Southern
	1	Closed	28-6	City	Dup.	Southern
Aurora, Elgin & Chicago R. R..	6	Closed	53-8½	Int.	Bald.	Jewett
	4	Closed	28-0	City	Bald.	St. Louis
Austin St. Ry.....	4	Closed	23-0	City	Brill	American
Bangor Ry. & Elec. Co.....	3	Closed	30-8	Int.	Brill	Wason
	1	Ex.&Ft.	35-0	Int.	Brill	Wason
Bartlesville Int. Ry.....	1	Closed	21-0	City	St. L.	St. Louis
Bay State St. Ry.....	50	Closed	28-0	Int.	St. L.	Laconia
	12	Express	39-0	Int.	Bald.	Laconia
Belt Line Ry.....	79	St.Bat.	18-0	City	Brill	Brill
Berkshire St. Ry.....	1	Substa.	38-0	Int.	M'G-C.	McGuire-C.
Berlin St. Ry.....	1	Flat	30-0	Int.	Lacon.	Laconia
Billings Trac. Co.....	1	St. Bat.	18-0	City	Brill	Brill
	2	St. Bat.	27-6	City	Beach	Ry.St.Bat.
Binghamton Ry.....	2	Open	41-4	Int.	.....	Jones
Birmingham, Ens. & Bes. R.R.	5	Closed	....	Int.	.....	Southern
	20	Dump	21-0	Constr.	Oliv.	Oliver
	6	Flat	40-0	Const.	Oliv.	Oliver
Birmingham Ry. L. & P. Co...	3	Closed	....	City	.....	Co. Shops
	1	Express	45-0	City	M'G-C.	McGuire-C.
Black River Trac. Co.....	1	Sweeper	28-3	City	M'G-C.	McGuire-C.
Boston Elevated Ry.....	30	Closed	37-2¼	City	Brill	Pr. Steel
	25	Closed	37-2¼	City	Brill	A. C. & F.
	100	Closed	34-4	City	Tay.	Jewett
Boston & Worcester St. Ry....	2	Closed	36-0	City	.....	Wason
	4	Express	40-2	Int.	.....	Osg.-Brad.
Brandon Munic. Ry.....	1	Sweeper	46-0	City	M'G-C.	Preston
Bristol Trac. Co.....	2	Closed	....	City	.....	Southern
Brit. Columbia Elec. Railway..	3	Closed	43-4	Int.	Std.	Co. Shops
	2	Closed	38-0	Int.	Std.	Co. Shops
	30	Ft., Box	40-0	Int.	Seat.	Seattle
	30	Ft., Flat	41-0	Int.	Seat.	Seattle
	3	Sweeper	28-3	City	Otta.	Ottawa
	15	Logging	42-0	Int.	Seat.	Seattle
Brooklyn R. T. Co.....	2	El.Loco.	34-7	Swit'h	Wason	Gen. Elec.
	100	Closed	67-3½	Sub.	——	A. C. & F.
Burlingame Elec. Co.....	1	St. Bat.	27-6	City	Beach	Ry. St. Bat.
Butte Elec. Ry.....	4	Closed	40-6	City	Co.	Niles
Caldwell Trac. Co.....	1	Closed	44-6	Int.	Bald.	Niles
Calgary St. Ry.....	6	Pass.Tr.	44-0	City	Brill	Brill
	1	Flat	44-0	City	Brill	Co. Shops
	2	Sprinkler	30-0	City	Brill	Preston
California St. Cable R.R.....	3	Closed	30-0	City	Co.	Co. Shops
Canadian Northern Railway...	6	El.Loco.	37-4	Term.	G.E.	Gen. Elec.
Canadian Pacific Ry.....	4	El.Loco.	38-4	Main	G.E.	Gen. Elec.
Cape Breton Elec. Co., Ltd....	3	Closed	31-4	City	Bald.	Cincinnati
Cape May, Del. Bay & Sew. Point R. R.....	2	St.Bat.	21-0	City	Brill	St. Louis
Capital Trac. Co.....	5	Closed	30-8	City	Std.	Brill
Cedar Rap. & Marion Cy. Ry..	10	Closed	44-8	City	St. L.	St. Louis
Centerville Lt. & Traction Co..	1	Closed	20-8	City	Brill	American
Central Illinois Pub. Ser. Co...	4	Closed	30-0	City	Brill	Brill
Charleston Con. Ry. & Ltg Co	1	Closed	20-8	City	Brill	Cincinnati
Charleston-Dunbar Trac. Co ..	1	Closed	52-0	Int.	Brill	Jewett
	4	Closed	45-0	City	Bald.	Niles
Charleston Int.R. R.....	4	Closed	35-0	Int.	Std.	Jewett
	2	Closed	35-0	Int.	Std.	Jewett
Charleston-Isle of Palms Trac. Co.....	2	Ft., Flat	30-0	Int.	Co.	Co. Shops
Charlotte Elec. Railway.....	20	Closed	40-0	City	Brill	Southern
Charlottesville & Albemarle Ry.	5	Closed	21-0	City	Brill	Brill
Chattanooga Trac. Co.....	4	Closed	45-1	Int.	Brill	Brill
	1	Bag.&Ex.	40-0	Int.	Brill	Brill
Chicago City Ry.....	100	Closed	32-0	City	Brill	Brill
	1	Sweeper	28-3	City	M'G-C.	McGuire-C.
Chicago Elevated Rys.....	62	Closed	48-0	Elev.	Bald.	Cincinnati
	66	Pass.Trail.	48-0	Elev.	Bald.	Cincinnati
Chicago & Joliet Elec. Ry.....	10	Closed	28-0	City	Brill	St. Louis
Chicago & West Towns Ry....	30	Closed	45-0	City	M'G-C.	McGuire-C.
Chicago, Ottawa & Peoria Ry..	4	Closed	57-0	Int.	St. L.	St. Louis
	3	Closed	28-0	City	St. L.	St. Louis
	4	Pass.Tr.	57-0	City	St. L.	St. Louis
	2	Work	....	Int.	St. L.	St. Louis
Chicago Rys.....	50	Closed	32-5	City	Brill	Southern
	50	Closed	32-5	City	Brill	American
	100	Closed	32-5	City	Brill	Co. Shops
	1	Sn.-Plow	....	City	.....	Wason
	6	Sweeper	28-3	City	M'G-C.	McGuire-C.
Cin., Milf'd & Lov'l'd Trac. Co.	4	Work	.....	Int.	War.	Warner
Cincinnati Trac. Co.....	60	Pass.Tr.	43-0	City	Bald.	Cincinnati
City Railway, Dayton, Ohio...	20	Closed	29-6	City	Std.	Cincinnati
City Ry. Co. of Los Angeles....	75	Cent.Ent.	46-7	City	St. L.	St. Louis
Cleveland Ry.....	100	Closed	35-5½	City	Brill	Kuhlman
	2	Closed	35-5½	City	.....	Kuhlman
	100	Pass.Tr.	48-0	City	Brill	Kuhlman
	2	Sweeper	28-3	City	M'G-C.	McGuire-C.
	10	Dump	33-6	City	Std.	Oren.-Arthur Koppel
Clinton St. Ry.....	7	Closed	26-6	City	St. L.	St. Louis
	1	Sweeper	28-3	City	M'G-C.	McGuire-C.
	1	Sprinkler	25-6	City	M'G-C.	McGuire-C.
Columbia Ry., Gas. & El. Co...	1	Closed	45-0	City	Brill	Co. Shops
	1	Closed	53-0	City	Bald.	Co. Shops
Columbus, New Albany & Johnstown Trac. Co.....	1	Closed	50-0	Int.	M'G-C.	McGuire-C.
	1	Express	40-0	Int.	M'G-C.	McGuire-C.
Columbus Railway & Light Co.	1	D'le-deek	45-6	City	Brill	Brill
Connecticut Co.....	5	Dump	48-10	Both	Wason	Wason
Connecticut Valley St. Ry.....	1	Open	41-7½	City	.....	McGuire-C.
Cumberland Co. Pwr. & Lt. Co.	10	Closed	30-8	City	Brill	Wason
Dallas Consol. Elec. St. Ry....	23	Closed	26-6	City	Brill	St. Louis
	1	Closed	26-6	City	Bald.	St. Louis
	1	Const.	....	City	St. L.	American
Dayton, Springfield & Southern Xenia Southern Ry.....	2	Closed	30-0	City	M'G-C.	McGuire-C
Dayton & Troy Elec. Ry.....	2	Trail.Bx.	46-0	Int.	B. & S.	Bar. & Sm'
Decatur Ry. & Lt. Co.....	4	Closed	28-0	City	St. L.	St. Louis
Delta Elec.Lt.,Pwr.& Mfg.Co...	11	Closed	16-0	City	Peck.	Jones
Denver City Tramway.....	26	Pass.Tr.	38-0	City	Woeb.	Woeber
Detroit River Tunnel Co.....	4	El.Loco.	39-6	Tun.	G. E.	Gen. Elec.
	1	Wr'ck Cr.	....	Tun.	Ind.Wk.	Gen. Elec.
Detroit United Railway.....	50	Closed	23-1½	City	Std.	Cincinnati
Dominion Pwr. & Trans. Co., Ltd.....	3	Closed	56-0	Int.	Bald.	Preston
	12	Closed	43-0	City	Brill	Preston
	2	Ft. Ex.	59-0	Int.	Tay.	Preston
	2	Ft. Ex.	59-0	Int.	Tay.	Tillsonburg
	2	Dump	35-0	City	Std.	Oren-Arthur Koppel
Duluth St. Ry.....	2	Closed	27-9	City	Co.	Co. Shops
Easton Rapid Transit Co.....	6	Closed	20-8	City	Brill	Brill
E. St. L., Col. & Waterloo Ry..	3	Closed	55-0	Int.	Brill	American
	2	Pass.Tr.	40-0	Int.	Brill	American
East St. Louis Ry.....	5	Closed	28-8	City	Brill	American
East St. Louis & Sub. Railway.	3	Closed	33-4	Int.	Brill	American
Edmonton Int. Ry.....	1	Gasoline	48-6	Int.	M'G-C.	Drake
Edmonton Radial Ry.....	35	Closed	23-3¾	City	Std.	Preston
	1	Closed	48-0	Int.	M'G-C.	McGuire-C.
	1	Sprinkler	30-6	City	M'G-C.	McGuire-C.
	1	Dump	....	City	Can.	Canadian
	1	Line	38-0	City	Bem.	Co. Shops
Electric Short Line.....	1	Gasoline	56-0	Int.	St. L.	Drake
	1	Gas.-El.	50-0	Int.	Was'n	Gen. Elec.
Emigration Canyon R. R.....	2	Closed	47-0	Int.	Bald.	Niles
Ephrata & Lebanon St. Ry....	1	Sto.Bat.	27-6	City	Beach	Ry. St. Bat.
Evanston Trac. Co.....	1	Sweeper	28-3	City	M'G-C.	McGuire-C.
Five-Mile Beach Elec. Ry.....	2	Open	34-0⅜	City	Brill	Brill
Ft. Dodges, Des Moines & Southern R. R.....	500	Ft., Box	36-0	Int.	H&K	Hask.&Bar.
Fort Wayne & No. Ind. Tr. Co.	1	Closed	55-0	Int.	Bald.	Co. Shops
Fox & Illinois Union Ry.....	1	Substa.	27-0	Int.	M'G-C.	McGuire-C.

Purchaser	No.	Class	Length	Serv.	Truck	Builder
Frankford, Tac. & Holmes. St. Ry	2	Closed	33–4	Int.	Brill	Brill
Gary & Int. Ry	4	Closed	44–0	Int.	M'G-C.	McGuire-C.
Gastonia (N. C.) Trac. Co	2	Closed	....	Int.	.....	Southern
Georgia Ry. & Pwr. Co	25	Closed	40–0	City	Brill	Co. Shops
	6	Closed	47–0	Int.	Brill	Co. Shops
	2	Pass.Tr.	40–0	Int.	Brill	Co. Shops
	1	Express	42–0	Int.	Brill	Co Shops
	2	Sand	25–0	City	Brill	Co. Shops
Grand Rapids, Hol. & Chic.Ry.	4	Closed	50–0	Int.	Bald.	Jewett
	6	Closed	61–0	Int	Bald.	St. Louis
Great Falls St. Railway	4	Closed	25–9	City	Brill	Brill
Greenville, Spartanburg & Anderson Ry	6	El.Loco.	37–4	Fght.	Wasou	Gen. Elec.
Guelph Radial Ry	3	Closed	46–6	City	Std.	Preston
Gulfport & Miss. Coast Trac. Co	1	Closed	....	City	.....	Southern
Hagerstown & Frederick Ry	7	Closed	34–6	Int.	Brill	Brill
Halifax Elec. Tram	6	Closed	21–0	City	Co.	Nova Scotia
Ham. Whiting & East Chi. Ry.	1	Sweeper	28–3	City	M'G-C.	McGuire-C.
	1	Sprinkler	29–6	City	M'G-C.	McGuire-C.
Hattiesburg Trac. Co	3	Closed	....	City	Brill	Co. Shops
	2	Closed	....	City	Brill	Southern
	1	Work	....	City	Brill	Co. Shops
Harrisburg Railway	7	Closed	30–8	City	Brill	Brill
Hershey Transit Co	2	Closed	30–8	City	Brill	Brill
	1	Sprinkler	18–0	City	Peck.	Co. Shops
Hillsboro Ry	2	Closed	30–0	City	M'G-C.	McGuire-C.
Holyoke St. Railway	5	Closed	30–8½	City	Bald.	Wason
Hornell Trac. Co	1	Closed	28–0	Int.	Brill	Brill
Houston Elec. Co	10	Closed	26–6	City	Brill	St. Louis
Hudson Valley Railway	3	Closed	38–6½	Int.	A. L.	Wason
Hull Elec. Co	4	Pass.Tr.	43–0	Int.	Brill	Ottawa
Illinois Trac. System	6	Closed	57–0	Int.	St. L.	St. Louis
	6	El.Loco.	....	Int.	St. L.	Co. Shops
	4	Work	....	Int.	St. L.	St. Louis
	1	Parlor	57–0	Int.	St. L.	St. Louis
	1	Sleeping	....	Int.	St. L.	St. Louis
Indianapolis & Cin. Trac. Co	3	Express	56–0	Int.	A. L.	Cincinnati
Indianapolis Trac. & Term. Co.	25	Closed	33–2½	City	Std.	Cincinnati
International Ry	100	Closed	34–1½	City	Brill	Brill
	12	One-Man	21–0	City	Brill	Brill
	1	El.Loco.	35–2	Fght.	Bald.	Westingh.
	2	Derrick	....	City	Co.	Co. Shops
	1	Trail Flat	....	City	Co.	Co. Shops
	2	Flat	....	City	Co.	Co. Shops
	1	Supply	29–0	City	Brill	Co Shops
	10	Dump	13–4	City	K-J.	Kil. & Jac.
Inter-Urban Ry	60	Express	38–0	Int.	M'G-C.	McGuire-C.
Interurban Ry. & Term. Co	5	Closed	50–0	Int.	Std.	Cincinnati
	2	Freight	50–0	Int.	Std.	Cincinnati
	1	Sweeper	28–3	City	M'G-C.	McGuire-C.
Iowa Ry. & Lt. Co	2	Closed	60–0	Int.	M'G-C.	McGuire-C.
	5	Closed	32–0	City	M'G-C.	McGuire-C.
	6	Closed	44–0	City	M'G-C.	McGuire-C.
Jackson Lt. & Trac. Co	3	Closed	32–6	City	M'G-C.	McGuire-C.
Jacksonville Trac. Co	10	Closed	26–6	City	Std.	St. Louis
	1	Sprinkler	29–6	City	M'G-C.	McGuire-C.
Jefferson County Trac. Co	4	Closed	....	Int.	.....	Southern
	4	Pass.Tr.	....	Int.	.....	Southern
	1	Baggage	....	Int.	.....	Southern
Jefferson Trac. Co	2	Closed	20–0	City	Brill	Brill
Jersey Central Trac. Co	1	Sn.-Plow	35–0	City	Co.	Co. Shops
Johnstown Pass. Railway	5	Closed	28–0	City	Brill	Kuhlman
Kankakee Elec. Ry	1	Closed	32–0	City	St. L.	Kan.Con.Co
Kankakee & Urbana Trac. Co	2	Closed	53–0	Int.	Brill	American
Lehigh Valley Transit Co	6	Closed	56–0	Int.	.....	Jewett
	3	Exp.Car	50–0	Int.	.....	Jewett
	6	Flat	20–0	Int.	Old	Co. Shops
Lewiston, Augusta & Waterville St. Ry	3	Flat	36–0	Int.	Lacon.	Laconia
	1	Work	45–0	Fght.	Brill	Laconia
Lewiston & Reedsville El. Ry	3	Closed	28–0	City	Brill	Brill
London St. Ry	6	Closed	20–8	City	Brill	Preston
Long Island R. R	12	Pass.Tr.	54–0	Int.	AC&F	A.C.&F.
	58	Closed	54–0	Int.	AC&F	A.C.&F.
	20	Baggage	40–0	Int.	AC&F	A.C.&F.
	3	St.Bat.	33–0	Steam	Beach	Ry.St.Bat.
Lookout Mountain Ry	10	Closed	28–8	Int.	Brill	American
Los Angeles & San Diego Beach Ry	2	Pass.Tr.	42–0	Int.	Beach	St. Louis
	3	St.Bat.	40–0	Int.	Beach	Ry.St.Bat.
Louisville Ry	10	Pass.Tr.	36–4	City	St. L.	Co. Shops
Lynchburg Trac. & Light. Co	1	Work	40–0	City	Brill	Brill
Mahoning & Shenango Ry. & Lt. Co	2	Sweeper	28–3	City	M'G-C.	McGuire-C.
Manhattan Bridge Three-Cent Line	6	Closed	33–2½	City	Bald.	Cincinnati
Manhattan & Queens Tr. Corp.	25	Closed	46–0	City	St. L.	St. Louis
	1	Closed	46–0	City	St. L.	Smith-Wal.
	1	Sn.-Plow	21–0	City	Brill	Brill
	1	Sweeper	....	City	S.-W.	Smith-Wal.
Marine Ry	1	St.Bat.	27–6	City	Beach	Ry.St.Bat.
Maryland Elec. Co	12	Closed	56–0	Int.	Brill	Wason
Mason City & Clear Lake R.R.	1	Line	30–0	Int.	Peck.	Co. Shops
Meridian Lt. & Ry. Co	8	Closed	....	City	Brill	Southern
	2	Closed.	....	City	Brill	American
	2	Closed	21–0	City	St. L.	St Louis
Mesaba Ry	5	Closed	40–0	Int.	Bald.	Niles
Metropolitan St. Ry	2	Dump	38–1½	City	.....	Oren.-Arthur-Koppel
Michigan United Trac. Co	6	Closed	61–0	Int.	Bald.	St. Louis
	7	Closed	70–0	Int.	Bald.	St. Louis
	10	Closed	52–0	Int.	Bald.	St. Louis
	4	Pass.Tr.	61–0	Int.	Bald.	St. Louis
	4	Baggage	50–0	Int.	Bald.	St. Louis
	4	Express	50–0	Int.	Bald.	St. Louis
Middle West Utilities Co	1	Exhib.	60–0	Int.	M'G-C.	McGuire-C.
Milledgeville Railway	1	St.Bat.	18–0	City	Brill	Brill
Milwaukee Elec. Ry. & Lt. Co.	30	Closed	47–0	City	Bald.	Co. Shops
	10	Closed	32–0	City	Brill	Co. Shops
	8	Sweeper	32–4	City	M'G-C.	McGuire-C.
	2	Work	40–0	Gen.	Co.	Co. Shops
	25	Dump	15–10	Gen.	W.W.S.	West. W. Scraper Wks
	10	Flat	15–4	Gen.	W.W.S.	West. W. Scraper Wks
Minneapolis, St. Paul, Roch. & Dubuque Elec. Trac. Co	5	Gas.-El.	72–0	Int.	Wason	Gen. Elec.
	3	Gas.-El. Loco.	35–0	Int.	Wason	Gen. Elec.
Modesto Empire Trac. Co	1	St.Bat.	27–6	City	Beach	Ry.St.Bat.
Monongahela Val. Trac. Co	6	Closed	42–0	Int.	Brill	Jewett
	2	Closed	20–0	City	Brill	Kuhlman
	2	Closed	42–0	Int.	.....	Jewett
Montreal & Southern Counties Ry	8	Closed	54–2	Int.	Nat.S.C.	Nat.Stl.Car
	2	Express	49–4	Int.	Nat.S.C.	Nat.Stl.Car
Montreal Tramways	100	Closed	45–6	City	Can.	Canadian
	100	Closed	45–6	City	Brill	Ottawa
	25	Closed	37–6	City	Brill	Brill
	25	Pass.Tr.	37–6	City	Brill	Brill
	1	Sweeper	....	City	Can.	Ottawa
	2	Prison	47–7	City	Brill	Co. Shops
	2	Rail, Tr.	63–0	City	Can.	Co. Shops
	1	Supply	44–0	City	Brill	Co. Shops
Morris Co. Trac. Co	1	Sweeper	24–1¾	City	Brill	Brill
Newbern-Ghent St. Ry	1	St.Bat.	18–2	City	Cin.	Cincinnati
New York, Auburn & Lansing R. R	1	El.Loco.	30–0	Fght.	Rus.	Russell
New York Central & Hudson River R. R	24	Closed	53–0	Int.	Std.	Pr. Steel
	9	El.Loco.	55–2	Main	A. L.	Gen. Elec.
	6	El.Loco.	56–10	Main	A. L.	Gen. Elec.
New York Rys	45	St.Bat.	28–9	City	.....	A.C.&F.
N. Y. State Rys., Roch. Lines.	25	Closed	39–11	City	Brill	Kuhlman
	25	Pass.Tr.	47–7¼	City	Bald.	Kuhlman
	1	Sweeper	28–3	City	M'G-C.	McGuire-C.
N. Y. State Rys., Utica Lines.	10	Closed	30–11	City	Brill	Cincinnati
	4	Closed	34–4	Int.	Brill	Kuhlman
	12	Sweeper	24–1¾	City	Brill	Brill
Niagara Gorge R. R	1	Express	40–0	Int.	Brill	Co. Shops
Nipissing Central Ry	1	Sn.-Plow	30–0	Int.	Rus.	Russell
Norfolk Southern R. R	5	Closed	52–0	Int.	Brill	Southern
Norfolk & Western Railway	24	El.Loco.	52–0	Main	Bald.	Westingh.
Northampton St. Ry	2	Open	43–0	City	Std.	Wason
	2	Closed	30–8	Int.	Bald.	Wason
	2	Closed	30–0	City	Std.	Brill
North Carolina Pub. Ser. Co	6	Closed	....	City	.....	Southern
Northern Massachus. St. Ry	4	Closed	25–0	Int.	Tay.	Wason
Northern Ohio Trac. & Light Co	6	Gondola	36–0	City	.....	.....
Northern Texas Trac. Co	4	Closed	51–0	Int.	Bald.	St. Louis
	10	Closed	26–6	City	Brill	St. Louis
Northwestern Penn. Railway	2	Closed	51–0	Int.	Bald.	Niles
	2	Closed	51–0	Int.	Bald.	Niles
Oakland, Antioch & East. Ry	4	Closed	56–0	Int.	.....	Wason
	8	Closed	56–0	Int.	Bald.	Cincinnati
	2	El.Loco.	39–0	Int.	Bald.	Westingh.
	1	Parlor	58–0	Int.	.....	Wason
Ogden R. T. Co	2	Observ.	....	Int.	Co.	Co. Shops
Ohio Elec. Ry	5	Cl.Exp.	49–0	Int.	Cin.	Cincinnati
	2	Tr. Exc'n	60–0	Int.	Std.	Cincinnati
	5	Express	50–0	Int.	Bald.	Cincinnati
	15	Fr't Trail	38–6	Int.	Std.	Cincinnati
Ohio Valley Elec. Ry	8	Closed	30–0	City	Old	St. Louis
	10	Closed	38–0	City	St. L.	St. Louis
	1	Crane	42–0	Int.	Rus.	Russell
Oil Belt Ry	2	Gasoline	70–0	Int.	M'G-C.	Brake
	1	Ex.-Loco.	40–0	Int.	M'G-C.	Brake
Oklahoma Ry	1	Bag.&Ex.	35–0	Int.	Std.	Co. Shops
	1	Line	35–0	Int.	Std.	Co. Shops
Omaha & Council Bluffs St. Ry.	15	Closed	42–0	City	Brill	Co. Shops
	10	Pass.Tr.	46–0	City	Bald.	Co. Shops
	1	Dump	30–8	City	M'G-C.	McGuire-C.
Oregon Elec. Ry	6	Express	62–8½	Int.	Bald.	St. Louis
	6	Exp.Tr.	62–8½	Int.	Std.	St. Louis
Ottawa Elec. Ry	10	Closed	45–3	City	Brill	Ottawa
	2	Sweeper	....	City	Brill	Ottawa
Pacific Pwr. & Lt. Co	1	Closed	21–0	City	Brill	Brill
Park, Marietta & Int. Ry	2	Closed	41–0	Int.	Brill	Co. Shops
	2	Express	38–0	Int.	Brill	Co. Shops
	2	Box	38–0	Int.	Brill	Co. Shops
	2	Gondola	38–0	Int.	Ralst.	Co. Shops
	1	Work.	24–0	City	Brill	Co. Shops
Pascagoula St. Ry. & Pwr. Co.	4	Closed	18–0	Int.	Brill	American
Peninsular Ry	8	Closed	55–6½	Int.	.....	Jewett
People's Ry	1	Closed	28–0	City	Std.	Cincinnati
People's St. Ry	2	Closed	36–0	Int.	Brill	Brill
Peoria Ry	4	Closed	28–0	City	St. L.	St. Louis
Phila. & Garrett. St. Ry	2	Closed	51–0	Int.	.....	Jewett
Philadelphia R. T. Co	500	Closed	34–1⅜	City	Brill	Brill
	1	Ft., Box	36–0	Int.	Brill	Brill
	6	Flat	40–0	City	Brill	Brill
	5	Sweeper	27–6	City	Brill	Brill
Phoenix Ry	4	Calif.	38–8	City	Brill	American
Phoenixville, Valley Forge & Staf. Elec. Ry	2	Open	43–0	Int.	Brill	Brill
Piedmont & Northern Lines	8	Pass.Tr.	....	Int.	.....	Southern
	2	Parlor	....	Int.	.....	Southern
Pine Bluff Co	1	Sprinkler	22–6	City	M'G-C.	McGuire-C.
Pittsburgh & Butler St. Ry	1	Express	50–0	Int.	Rus.	Russell
Pittsburgh Rys	50	Closed	45–2	City	St. L.	St. Louis
	5	Doub. D'k	47–2	City	M'G-C.	McGuire-C.
	1	Substa.	27–0	City	M'G-C.	McGuire-C.
Port Arthur & Ft. William. Elec. Ry	2	Closed	47–6	City	Brill	Ottawa
	4	Closed	45–3	City	Brill	Ottawa
	2	Pass.Tr.	46–6	City	Brill	Ottawa
	6	Closed	30–0	City	Brill	Ottawa
	1	Sweeper	....	City	Otta.	Ottawa
Portland, Gray & Lewiston R. R	1	Flat	35–0	Int.	.....	Wason
Public Service R. R	10	Closed	34–5¾	Int.	Std.	Co. Shops
	2	Closed	32–0	City	Std.	Co. Shops
	1	Sn.-Plow	30–0	Int.	Tay.	Russell
Public Service Ry	7	Closed	32–0	City	Std.	Co. Shops
	20	Closed	34–5⅜	City	Std.	Co. Shops
	2	Sn.-Plow	30–0	Int.	Tay.	Russell
	11	Work	40–0	Int.	Tay.	Co. Shops
	1	Work	28–8	Int.	Tay.	Co. Shops
	1	Private	44–0	Int.	Std.	Co. Shops
Public Utilities Co	8	Closed	28–0	City	Bald.	St. Louis
Puget Sound Trac. Lt. & Pr. Co., Bellingham Division	1	Closed	50–0	City	Std.	Co. Shops
Puget Sound Trac. Lt. & Pr. Co., Seattle Division	9	Closed	38–4	City	Std.	Cincinnati
	1	Closed	38–4	City	Bald	Cincinnati
Quebec Ry. Lt. & Pwr. Co	1	Sweeper	28–3	City	M'G-C.	McGuire-C.
Quincy Ry	4	One-Man	21–0	City	St. L.	St. Louis
Regina Munic. Ry	6	Closed	22–0	City	Brill	Preston
	16	Closed	28–0	City	Brill	Preston
	6	Dump	8–0	City	Vel.	Veleter

Purchaser	No.	Class	Length	Serv.	Truck	Builder
Regina Munic Ry	6	Flat	14–0	City	Brill	Ry. Shops
	1	Sweeper	36–0	City	M'G-C.	McGuire-C.
	2	Work	9–0	City	City	Ry. Shops
	1	Haul.	28–0	City	Brill	Ry. Shops
Rio Grande Valley Elec. Ry	4	Closed	40–0	Int.	St. L.	St. Louis
	1	Baggage	40–0	Int.	St. L.	St. Louis
Rockford City Trac. Co.	6	Closed	28–0	City	Bald.	St. Louis
	4	Closed	28–0	City	St. L.	St. Louis
	13	Work	14–0	Gen.	W.W.S.	West. W. Scraper Wks
Saginaw-Bay City Ry	2	Open	32–1	City	.....	Kuhlman
	6	Closed	28–0	City	Bald.	St. Louis
Saginaw & Flint Ry	1	Express	48–0	Int.	Bald.	St. Louis
St. Joseph Valley Ry	1	St. Bat.	52–0½	Int.	Beach	Ry.St.Bat.
St. Petersburg & Gulf Ry	2	Closed	30–8	City	Brill	Brill
Salt Lake & Ogden Ry	8	Closed	56–0	Int.	Bald.	Niles
	1	Work	....	Int.	Bald.	Co. Shops
Salt Lake & Utah .R R	3	Gas.Mot.	....	Int.	.....	Hall-Scott
San Antonio Trac. Co	14	Closed	28–10	City	Brill	American
San Diego Elec. Ry	35	Closed	48–7	City	Brill	McGuire-C.
Sand Springs Ry	4	Pass.Tr.	34–0	Int.	St. L.	St. Louis
	1	El.Loco.	34–4	Sw'ch	Bald.	Westingh.
Sand., Wind. & Amherst Ry	2	Closed	20–8	City	Brill	Kuhlman
	2	Closed	31–3	City	Brill	Kuhlman
Santa Barbara & Sub. Ry	5	Closed	39–4	City	Brill	Brill
Saskatoon Elec. Ry	12	Closed	46–6	City	Brill	Preston
Savannah Elec. Co	3	Closed	28–0	City	Std.	St. Louis
Schenectady Ry	7	Closed	28–0	City	Tay.	St. Louis
Scioto Valley Trac. Co	2	Tr., Box	36–0	Int.	B.&S.	Bar.&Smith
Scranton & Binghamton Ry	1	Coal	....	City	Brill	Brill
Scranton Ry	5	Closed	30–6	City	Tay.	Southern
Seattle Munic. St. Ry	12	Closed	31–1	City	Std.	Cincinnati
Selma St. & Sub. Ry	1	Closed	26–0	City	Phila.	Co. Shops
	1	Closed	24–0	City	Co.	Co. Shops
Sheboygan Ry. & Elec. Co	2	Flat	30–0	Int.	Co.	Co. Shops
Shore Line Elec. Ry	8	Closed	30–8	Int.	Brill	Wason
	1	Express	40–0	Int.	Brill	Wason
Shreveport Trac. Co	3	Closed	28–10	City	Brill	American
Sioux Falls Trac. System	1	Closed	26–6	City	.....	St. Louis
South Carolina Lt. Pwr. & Rys. Co	5	Closed	20–8	City	Brill	American
So. Covington & Cincinnati St. Ry	20	Closed	21–0	City	Brill	Cincinnati
	1	Substa.	27–0	Int.	M'G-C.	McGuire-C.
Southern Trac. Co	22	Closed	54–0	Int.	Brill	St. Louis
	6	Closed	26–6	City	Brill	St. Louis
	10	Pass.Tr.	53–0	Int.	Brill	American
	8	Express	52–0	Int.	Brill	American
	2	Work	52–0	Int.	Brill	American
Southern Trac. Co. of Illinois	6	Closed	....	City	St. L.	St. Louis
Southwestern Trac. & Pr. Co	1	Closed	40–5	City	Brill	American
South Oregon Ry	1	Closed	21–0	City	St. L.	St. Louis
Southwest Missouri R. R	3	Closed	44½–0	Int.	Tay.	Co. Shops
	1	Line	31½–0	City	Brill	Co. Shops
Springfield Ry	10	Closed	28–0	City	Bald.	Cincinnati
Springfield St. Ry	4	Closed	35–0	Int.	Std.	Wason
	9	Closed	28–0	City	Std.	Osg.-Brad.
	6	Closed	30–3½	City	Std.	Wason
	1	Express	40–0	Int.	Std.	Wason
	2	Sweeper	23–11	City	Rus.	Russell
Stark Elec. R. R	2	Closed	45–0	Int.	Bald.	Jewett
Ster. Dixon & East. Elec. Ry	1	Closed	30–0	City	M'G-C.	McGuire-C.
	1	Closed	48–0	Int.	M'G-C.	McGuire-C.
Suburban R. R	10	Closed	45–0	City	M'G-C.	McGuire-C.
	1	Sweeper	28–3	City	M'G-C.	McGuire-C.
Syracuse & Suburban Ry	2	Closed	34–4	City	Brill	Brill
Terre Haute, Ind. & East. Trac. Co., Terre Haute Div.	2	Gondola	32–0	Both	Co.	Co. Shops
	2	Flat	34–0	Both	Co.	Co. Shops
	1	Line	42–0	Both	Bald.	McGuire-C.
Texas City St. Ry	2	Closed	30–0	City	M'G-C.	McGuire-C.
	2	Closed	28–9	City	M'G-C.	McGuire-C.
Third Avenue Ry	4	Sweeper	22–6	City	Brill	Brill
Tidewater Southern Ry	3	Closed	51–0	Int.	.....	Jewett
	1	Express	45–0	Int.	Brill	Jewett
Toledo Rys. & Lt. Co	30	Closed	44–10	City	.....	McGuire-C.
	10	Closed	....	City	.....	Co. Shops
	3	Sweeper	28–3	City	M'G-C.	McGuire-C.
Toronto Ry	24	Closed	23–0	City	Can.	Co. Shops
	1	Closed	27½–0	City	Can.	Co. Shops
	75	Closed	30–0	City	Can.	Co. Shops
	1	Work	40–0	City	Co.	Co. Shops
Toronto Sub. Ry	2	Closed	33–0	City	Tay.	Preston
	2	Closed	46–0	City	Brill	Preston
Tri City Ry	25	Closed	28–0	City	St. L.	St. Louis
	35	Closed	30–8	City	Brill	American
	3	Sweepers	28–4	City	M'G-C.	McGuire-C.
Twin City R. T. Co	107	Closed	46–8	City	Co.	Co. Shops
	1	Crane	43–10	City	Co.	Co. Shops
Twin Falls Ry	2	St.Bat.	35–0	Int.	Beach	Ry.Sto.Bat.
Union Elec. Co	3	Closed	27–4	City	Brill	American
	3	Closed	27–4	City	Bald.	American
Union St. Ry	12	Closed	30–0	City	Std.	Osg.-Brad.
	1	Closed	26–0	City	Brill	Brill
	1	Closed	26–0	City	St. L.	St. Louis
	1	Line	30–0	City	Std.	Co. Shops
Union Trac. Co. of Indiana	2	Exp.	55–0	Int.	Bald.	Co. Shops
United Rys. Co. of St. Louis	6	Open	47–0	City	Co.	Co. Shops
	100	Closed	42–3	City	Co.	Co. Shops
	3	Closed	45–0	City	Co.	Co. Shops
	13	Closed	47–2¾	City	Co.	Co. Shops
	34	Pass.Tr.	45–0	City	Co.	Co. Shops
	2	Dump	40–6	City	Co.	Oren.-Arthur Koppel
	1	Line	35–6¼	City	Co.	Co. Shops
United Rys. & Elec. Co	60	Closed	30–8	City	Brill	Brill
	2	Dump	....	City	.....	Co. Shops
	1	Crane	....	City	Brill	Co. Shops
United Trac. Co	12	Closed	30–11	City	Tay.	Cincinnati
Urbana & Champaign Ry. Gas & Elec. Co	3	Closed	28–0	City	St. L.	St. Louis
Valley Trac. Co	4	Closed	30–8	City	Brill	Brill
Vicksburg Lt. & Trac. Co	2	Closed	21–0	City	Old	St. Louis
Virginia Ry. & Pwr. Co	20	Closed	48–8	City	Brill	Cincinnati
Washington Ry. & Elec. Co	5	Closed	46–0	City	Bald.	Southern
	1	Dou.D'k	42–0	City	Bald.	Southern
Washington Utilities Co	2	Flat	36–0	Int.	Brill	Co. Shops
	1	Line	18–0	Int.	Brill	Co. Shops
Waterbury & Milldale Tramway	2	Closed	30–8	Int.	Brill	Wason
Waterloo, Cedar Falls & North. Ry	6	Closed	32–0	City	M'G-C.	McGuire-C.
Western N. Y. & Pa. Trac. Co	1	Closed	20–8	City	Brill	Brill
	1	Express	40–0	City	Brill	Wason
	1	Sn.-Plow	....	Int.	.....	Russell
Western Ohio Ry	4	Tr., Box	46–0	Int.	B.&S.	Bar.&Smith
West Jersey & Seashore R. R	6	Open	....	City	.....	Southern
	26	Closed	34–1⅜	City	Brill	Brill
Westside Elec. St. Ry	2	Closed	48–0	Int.	Bald.	Niles
Wichita R. R. & Lt. Co	6	One-Man	21–0	City	St. L.	St. Louis
Wilkes-Barre Ry	4	Closed	28–0	City	Brill	Brill
	6	Closed	36–8	Int.	Brill	Brill
Williamsport Pass. Ry	6	Closed	28–0	City	Brill	Brill
Wilmington, New Castle & Del. City Ry	1	St.Bat.	35–6	Int.	Beach	Ry.St.Bat.
Windsor, Essex & Lake Shore Ry	2	Closed	55–0	Int.	Bald.	Tillsonburg
Winnipeg Elec. Ry	40	Closed	33–0	City	Co.	Co. Shops
	1	Flat	....	City	Co.	Co. Shops
Wisconsin Ry. Lt. & Pwr. Co	4	Closed	21–0	City	St. L.	St. Louis
Worcester Consol. St. Ry	15	Closed	28–0	City	Std.	Osg.-Brad.
	6	Closed	35–0	Int.	Std.	Wason
	4	Express	40–0	Int.	Std.	Wason
Yakima Valley Trans. Co	2	Closed	45–0	Int.	Brill	Jewett
	1	Express	45–0	Int.	Brill	Jewett
York Rys	3	Closed	34–0	Int.	Bald.	Brill
	1	Pass.Tr.	44–0	Int.	Bald.	Co. Shops
	1	Sweeper	24–1¾	Int.	Brill	Brill
Youngstown & Ohio Riv. R. R.	1	El.Loco.	37–6	Fght.	Bald.	Westingh.

BLOCK SIGNAL INSTALLATIONS IN 1913

As the past year has been an exceptionally active one in electric railway signaling, a list has been compiled of the installations made during that period. The statistics show, in addition to the name of the road making each installation, the number of signals, the route mileage protected—where this is known—and the name of the manufacturer. In the column headed "Remarks" the type of signal has been indicated, whether of the trolley-contact, cab-signal or track-circuit type, and in the latter case the style of indication, either semaphore or light or both, is noted. Where the protection is furnished for double track this fact is indicated, all installations without the notation being on single track.

Name of Road	No. Sig.	Miles	Manufacturer	Remarks
Alabama Cy., G. & A. Ry.	2	..	Nachod	Trolley Contact
Altoona & Logan Valley	5	..	Nachod	Trolley Contact
American Railways	2	..	U.S. El. Sig	Trolley Contact
Bangor Ry	12	..	C. N. Wood	Trolley Contact
Bay State St. Ry	50	..	U.S. El. Sig	Trolley Contact
Birmingham Ry	14	..	U.S. El. Sig	Trolley Contact
Brooklyn R. T	26	2.4	Gen. Ry. Sig	Track Circ.-Light D.T.-Auto stops
Beaumont Trac	4	..	U.S. El. Sig	Trolley Contact
Boston El. Ry	8	..	U.S. El. Sig	Trolley Contact
Butte, A. & P	16	3.8	Union S. & S	Track Circ.-Sema. D.T.
British Col. El. Ry	4	..	U.S. El. Sig	Trolley Contact
Burlington C. T	2	..	Nachod	Trolley Contact
Chicago, L.S. & S.B	80	55	Union S. & S	Track Circ.-Sema.
Chicago, S. B. & N. I	20	9.5	Union S. & S	Track Circ.-Sema.
Chicago, S. B. & N. I	2	..	Nachod	Trolley Contact
Chicago, S. B. & N. I	2	..	U.S. El. Sig	Trolley Contact
Chicago & Milwaukee	2	..	Nachod	Trolley Contact
Chattanooga Ry	46	..	C. N. Wood	Trolley Contact
Citizens' Traction	10	..	Nachod	Trolley Contact
Columbus Ry	12	..	C. N. Wood	Trolley Contact
Connecticut Co	13	..	U.S. El. Sig	Trolley Contact
Detroit M. & T	2	0.6	Union S. & S	Track Circ.-Sema.
Dallas Consol. St. Ry	1	..	U.S. El. Sig	Trolley Contact
E. St. Louis, C. & W	4	..	Nachod	Curve Protection
E. St. Louis & Sub	2	..	Nachod	Trolley Contact
Easton Transit Co	6	..	U.S. El. Sig	Trolley Contact
Elmira St. Ry	4	..	U.S. El. Sig	Trolley Contact
Fort Wayne & N. I. T	24	24.4	Gen. Ry. Sig	Track Circ.-Light.
Fitchburg & Leo's't'r	1	..	U.S. El. Sig	Trolley Contact
Fonda J. & G	2	..	Auto. Sig.&App	Trolley Contact
Galesburg & K	2	..	Nachod	Trolley Contact
Gray's Harbor Ry	2	..	Nachod	Trolley Contact
Gary & Int	4	4.8	Gen. Ry. Sig	Track Circ.-Light.
Halifax El. Tr'way	8	..	U.S. El. Sig	Trolley Contact
Holyoke St. Ry	2	..	C. N. Wood	Trolley Contact
Holyoke St. Ry	4	..	U.S. El. Sig	Trolley Contact
Illinois Traction	79	77.	Union S. & S	Track Circ.-Sema.
Illinois Traction	1	..	U.S. El. Sig	Trolley Contact
Indianapolis C. & S	54	23.8	Union S. & S	Track Circ.-Sema. and Light
Ind'p'ls & Cin. Trac'n	81	27.	Northey-Simmen	Cab Signals
International Ry	4	..	C. N. Wood	Trolley Contact
International Ry	6	..	U.S. El. Sig	Trolley Contact
Jackson L. & T. Co	2	..	U.S. El. Sig	Trolley Contact
Joliet & Southern	5	..	U.S. El. Sig	Trolley Contact
Kansas City Western	8	..	C. N. Wood	Trolley Contact
Knoxville Ry. & Lt	10	..	U.S. El. Sig	Trolley Contact
Kokomo, M. & W	4	5.5	Gen. Ry. Sig	Track Circ.-Sema.
Lake Shore Elect	6	..	Auto.Sig.&App	Tr'y Cont.(4 D.T.)
Lehigh Valley T. C	5	..	Nachod	Tr'y Cont.(1 D.T.)
Lewiston, A. & W	4	..	C. N. Wood	Trolley Contact
Louisville & Northern	8	3.5	Union S. & S	Track Circ.-Sema. and Light.
Manhattan & Queens	2	..	U.S. El. Sig	Trolley Contact
Manchester St. Ry	2	..	U.S. El. Sig	Trolley Contact
Mesaba Railway	34	36.	Northey-Simmen	Cab Signal
Mass. & Northeastern	4	..	U.S. El. Sig	Trolley Contact
Mansfield Ry	4	..	U.S. El. Sig	Trolley Contact

Name of Road	No. Sig.	Miles	Manufacturer	Remarks
Michigan United	10	..	Nachod	Trolley Contact
Middlesex & Boston	6	..	U.S. El. Sig	Trolley Contact
Mahoning & Shenango	8	..	Nachod	Trolley Contact
Monongahela V. T. Co	6	..	U.S. El. Sig	Trolley Contact
Muskegon T. & L.	2	..	Nachod	Trolley Contact
Nashville-Gallatin	38	24.	Northey-Simmen.	Cab Signal
Nashville Ry.	2	..	U.S. El. Sig	Trolley Contact
N. Y. State Rys.	90	39.	Gen. Ry. Sig.	Track Circ.-Sema.
N. Y. State Rys.	123	39.	Gen. Ry. Sig.	Track Circ.-Sema.
N. Y. State Rys.	18	9	Union S. & S.	Track Circ.-Sema. D.T.
Northampton St. Ry.	4	..	U.S. El. Sig	Trolley Contact
Norwest. Pacific	2	0.25	Union S. & S.	Track Circ.-Sema. D.T.
Northwest Penn	2	..	C. N. Wood	Trolley Contact
Northern Ohio Traction	6	..	Nachod	Curve & Gantlet Protection
Northern Illinois L. & T.	2	..	U.S. El. Sig	Trolley Contact
Northern Electric	4	0.2	Union S. & S.	Track Circ.-Light
Oakland A. & E.	51	83	Union S. & S.	Track Circ.-Light
Ogden R. T. Co.	2	..	U.S. El. Sig	Trolley Contact
Ohio Electric	8	4.7	Union S. & S.	Track Circ.-Sema. and Light
Ottawa El. Ry.	2	..	U.S. El. Sig	Trolley Contact
Pacific Electric	101	13	Union S. & S.	Track Circ.-Sema. and Light-D.T.
Parkersburg M. & I.	23	..	Nachod	Trolley Contact
Phila. R. T.	10	..	Nachod	Contactors for Subway Signals
Phila. & Westchester	2	..	Nachod	Contactors for Subway Signals
Portland (Ore.) Ry.,L&P.	28	..	U.S. El. Sig	Trolley Contact
Portland (Me.) Ry.	2	..	C. N. Wood	Trolley Contact
Puget Sound El. Ry.	55	28	Gen. Ry. Sig.	Track Circ.-9m. D.T., 19m. S.T.
Public Service Ry.	28	9.5	Union S. & S.	Track Circ.-Sema. and Light
Rhode Island Co.	62	..	C. N. Wood	Trolley Contact
Roanoke Ry.	2	..	Nachod	Trolley Contact
San Francisco,-Oakland...	4	..	U.S. El. Sig	Trolley Contact
Schenectady Ry.	2	..	Nachod	Trolley Contact
Springfield St. Ry.	8	..	C. N. Wood	Trolley Contact
Springfield St. Ry.	2	..	U.S. El. Sig	Trolley Contact
Scranton & Binghamton	36	10.1	Union S. & S.	Track Circ.-Sema. and Light
Shore Line El. Ry.	2	..	U.S. El. Sig	Trolley Contact
Southern El. Dev. Co.	2	..	Nachod	Trolley Contact
South. Wisconsin	2	..	Nachod	Trolley Contact
Southern Pacific	14	2.5	Union S. & S.	Track Circ.-Sema. D.T.
Southwestern T. Co.	1	..	U.S. El. Sig	Trolley Contact
Staten Island Midland	4	..	U.S. El. Sig	Trolley Contact
T.H., I. & E.	6	..	C. N. Wood	Trolley Contact
T. H., I. & E.	26	33	Gen. Ry. Sig.	Track Circ.-Light
Texas Traction	6	..	Nachod	Trolley Contact
Transit Supply Co.	5	..	Nachod	Spur Tracks
Union Trac. of Ind.	43	39	Gen. Ry. Sig.	Track Circ.-Light
Union Ry., New Bedford.	2	..	C. N. Wood	Trolley Contact
Union Ry., New Bedford.	2	..	U.S. El. Sig	Trolley Contact
Valley Traction Co.	10	..	Nachod	Trolley Contact
Virginia Ry. & Pr. Co.	18	..	Nachod	Headway Recorders
Wash. & Great Falls	10	..	Nachod	Trolley Contact
West. Penn. T. Co.	2	..	Nachod	Trolley Contact
Wheeling T. Co.	8	..	Nachod	Trolley Contact
Wilkes-Barre Ry.	3	..	Nachod	Trolley Contact
Wilkes-Barre & Hazl'n	2	..	Nachod	Third-Rail Contact
Worcester Cons.	57	..	U.S. El. Sig	Trolley Contact

RECEIVERSHIPS AND FORECLOSURE SALES IN 1913

Records of electric railway companies for which receivers were appointed in 1913 show that the number of companies which became involved in financial difficulties and their total single-track mileage were smaller than in the preceding year, but that the amounts of outstanding stock and the outstanding funded debt were much larger in 1913. This was caused by the receivership of the American Waterworks & Guarantee Company, which, being only a holding company, did not increase the mileage total, but with its $20,000,000 of stock and its $37,589,000 of summarized subsidiary funded debt caused a large rise in the outstanding stock and funded debt totals. The record of receiverships for 1913 compares with the preceding four years as follows:

	No. of Companies	Miles of Track	Outstanding Stock	Outstanding Funded Debt
1909.....	22	558	$29,962,200	$22,325,000
1910.....	11	696.61	12,629,400	75,490,735
1911.....	19	518.9	29,533,450	38,973,293
1912.....	26	373.58	20,410,700	11,133,800
1913.....	18	342.84	31,006,900	47,272,200

A number of the companies placed under receivership had not reached the stage of operation of completed systems, and the mileage given is for the number of miles in actual operation, wherever that figure was ascertainable. In all cases where both steam and electric service were given the mileage represents only the sections devoted to electric operation, although the entire capitalization is included in the table. It has been attempted in all cases to take the figures from the latest sources; but with some companies, especially those newly constructed and those that do not publish a yearly report, the information secured has been vague and sometimes even useless for the purposes of this table. As will be noticed from the accompanying list, most of the companies under receivership in 1913

ELECTRIC RAILWAY RECEIVERSHIPS IN 1913

	Mileage	Outstanding Stock	Outstanding Funded Debt
American Water Works & Guarantee Co.	....	$20,000,000	$37,589,000*
Bowling Green Railway	7.50	50,000	20,000
Buffalo Southern Railway	25.35	547,200	600,000
Cincinnati & Columbus Traction Co.	53.00	1,904,500	748,000
Cincinnati, Lawrenceburg & Aurora Street Railway	32.20	808,900	750,000
Fayetteville Street Railway & Power Co.	4.00	.....	.....
Goldsboro Traction Co.	6.00	200,000	12,500
Kansas City, Ozark & Southern Ry.	15.00	300,000	.....
Loramie & Minster Electric Ry.	17.70	20,500	42,700
Mansfield Railway, Light & Power Co.	21.00	1,000,000	942,000
Mexico, Santa Fé & Perry Traction Co.	27.00	850,000	1,600,000†
Northern Illinois Electric Ry.	12.00	.....	.....
Pekin & Petersburg Interurban Ry.	7.00	50,000†	50,000
Richmond & Henrico Ry.	9.12	1,250,000	1,250,000
Sunbury & Susquehanna Ry.	7.00	1,000,000†	1,200,000†
Titusville Electric Trac. Co.	17.50	300,000	300,000
Tri-City Railway & Electric Co.	75.47	2,575,800	2,168,000
Watsonville Railway & Navigation Co.	6.00	150,000	.....
	342.84	$31,006,900	$47,272,200

*Holding company has no bond issues; figure represents summary of funded debt of subsidiaries.
†Authorized amount; outstanding amount not known.

operated a small mileage. An interesting fact in connection with this table is that two of the receiverships, those of the Cincinnati & Columbus Traction Company and of the Cincinnati, Lawrenceburg & Aurora Street Railway, were the direct result of the disastrous flood that visited the Ohio valley in the spring.

The record of electric railways sold at foreclosure during 1913 is as extensive as far as the number of companies is concerned as the list of 1912, and the mileage, outstanding stock and outstanding funded debt all show substantial increases over the previous year. It should be noted in this connection that the foreclosure sale of the Geneva & Auburn Railway, included in the 1912 table, did not actually take place until March, 1913, and, furthermore, that the 1912 sale of the Illinois and Wisconsin divisions of the Chicago & Milwaukee Electric Railroad was set aside by the court in 1913 on the ground of suppression of bids and has not yet been legally consummated. The adjustment of the 1912 totals to reflect these facts gives the amounts as shown in the accompanying comparative table for the last five years:

	No. of Companies	Miles of Track	Outstanding Stock	Outstanding Funded Debt
1909.....	21	488	$22,265,700	$21,174,000
1910.....	22	724.36	19,106,613	26,374,065
1911.....	25	660.72	91,354,800	115,092,750
1912.....	18	267.18	14,197,300	10,685,250
1913.....	18	311.28	15,743,700	19,526,000

As has been found to be the case in previous years, when a table of foreclosure sales has been compiled, some electric railways for which receivers were appointed in 1913 were able to carry out a reorganization plan through a foreclosure sale before the end of the year, as is shown by the accompanying list. The Lackawanna & Wyoming Valley Rapid Transit Company, too, is included among the foreclosed companies, although it is not an operating company. The sale of the South Shore Traction Company represents the sale of 9 miles of line between Babylon and Amityville and various other unconnected sections and construction material in Nassau and Suffolk Counties, Long Island; the sale of the property of this company in New York County was included in the 1912 table. Although the sale of the Chicago & Oak Park Elevated Railroad was ordered by the United States District Court of Chi-

cago on July 17, 1913, the company is omitted, for no date of sale has been selected by the receiver.

In addition to the properties mentioned in the foregoing lists other companies have undergone various forms of reorganizations, readjustments and change of ownership, but they have been omitted because of a lack of formal receiverships and foreclosure sales.

Electric Railway Foreclosure Sales in 1913

	Mileage	Outstanding Stock	Outstanding Funded Debt
Bowling Green Ry.	7.50	$50,000	$20,000
Cassville & Western Ry.	5.00	100,000	.....
Columbus, Marion & Bucyrus R. R.	17.18	500,000	510,000
Dedham & Franklin Street Ry.	9.50	75,000	100,000
Erie & Central Pennsylvania Ry.	....	1,000,000	40,000
Fayetteville Street Railway & Power Co.	4.00	.....	.....
Fort Dodge, Des Moines & Southern R. R.	106.00	3,200,000	6,600,000
Geneva & Auburn Ry.	17.85	450,000	400,000
Goldsboro Traction Co.	6.00	200,000	12,500
Highland Park & Lake Burien R. R.	9.00	.....	.....
Lackawanna & Wyoming Valley Rapid Transit Co.	....	6,500,000	7,683,000
Medfield & Medway Street Ry.	11.25	100,000	100,000
Mexico, Santa Fé & Perry Trac. Co.	27.00	850,000	1,600,000†
Nebraska Traction & Power Co.	20.00	248,700	214,000
Pittsburgh, McKeesport & Westmoreland Ry.	9.00	500,000	431,500
South Shore Traction Co.	9.00	600,000	435,000
Springfield, Clear Lake & Rochester Interurban Ry.	11.00	120,000	60,000
Toledo & Chicago Interurban Ry.	42.00	1,250,000	1,320,000
	311.28	$15,743,700	$19,526,000

†Authorized amount; outstanding amount not known.

ILLINOIS TRACTION SCHOOL FOR STEAM BOILER OPERATORS

The Illinois Traction System has made an arrangement whereby it will conduct a school of instruction in boiler-room operation at its Peoria (Ill.) generating station for its superintendents, stationary engineers and boiler-room foremen. This is probably the first school of the kind to be established in a street railway power plant. It is planned to equip one boiler in the Peoria plant with a full set of both indicating and recording instruments to show and record all draft and temperature changes which take place under different methods of firing, and both the coal and the water consumed by the boiler will be measured continuously, so that a test of considerable refinement may be conducted at a moment's notice. It is planned to have large-scale diagrams of the boiler on which the actual draft instruments will be shown. This will permit the draft changes throughout the entire boiler to be observed at a glance, and the effect of damper and fuel bed changes may be noted immediately. The following recording instruments will be installed: A recording Venturi meter; a coal weigher; a recording steam-flow meter; a recording gas analysis instrument; recording thermometers for the feed water, flue temperature and steam temperature; recording gages for the furnace and damper drafts, and a thermo-electric pyrometer for furnace temperatures.

The management believes that this course of instruction will indicate to engineers and firemen the value of different parts of the boiler, the most efficient methods of firing, the use of the various instruments necessary in detecting heat losses, the possibility of smokeless combustion, the effect of soot and scale accumulations, the results obtained from various sizes and kinds of coal, and the influence of various percentages of CO_2 in the flue gases. When a condition of high efficiency is obtained, the attendant methods of firing will be immediately duplicated in the operation of the rest of the plant as a practical demonstration of the possibilities in applying improved methods. The school will be established by Harrington & Peebles, advisory engineers on boiler-room economy.

ELECTRICAL EQUIPMENT FOR THE CHICAGO, MILWAUKEE & PUGET SOUND ELECTRIFICATION

As announced last week, the Chicago, Milwaukee & St. Paul Railway, after careful consideration, has decided to use the 2400-volt d.c. catenary system for the proposed electrification of its Rocky Mountain division between Three Forks and Deer Lodge, Mont., a distance of 113 miles, corresponding to approximately 168 miles of single track. This covers one freight division.

The trolley will be fed from five substations containing synchronous motor-generator sets, step-down transformers and necessary switching apparatus installed at the following sites: Morel, 17 miles east of Deer Lodge; Newcomb, 46 miles east of Deer Lodge; Grace, 63 miles east of Deer Lodge; Piedmont, 78 miles east of Deer Lodge, and one at Three Forks. The sites of these substations may be varied slightly if later investigation shows such changes desirable. These stations will receive energy from the 100,000-volt transmission line of the Great Falls (Mont.) Power Company, as mentioned in the preliminary description of the line which follows.

LOCOMOTIVES

No decision has been reached with regard to the type of either the passenger or the freight locomotives. It is probable that twelve locomotives will be needed for freight service. The freight locomotives will be required to haul a trailing load of 2500 tons up a 1 per cent grade at a speed of approximately 15 m.p.h. The passenger locomotives will be required to handle a trailing load of 800 tons on level track at approximately 50 m.p.h. and on a 2 per cent grade at approximately 24 m.p.h. The current will be taken by means of roller pantograph collectors. Heat for trains will be obtained by means of oil-burning steam boilers, for which ample room will be provided. All the locomotives, both freight and passenger, will have regenerative control. The air brakes will be used only for making stops and in emergencies.

SUBSTATIONS

Based upon the investigation of the locomotive performance on the ruling grades in the electrified zone, it has been decided to install in each substation supplying gradients of more than 1 per cent a capacity of three 1500-kw units, two being in operation and the third held in reserve. Although the starting of a train calls for practically 100 per cent overload upon the two units in operation, a 200 per cent overload for five minutes' guarantee will furnish ample capacity to start a train of maximum tonnage on a maximum grade.

For gradients up to 1 per cent energy will be furnished from a two-unit substation containing two 1500-kw motor-generator sets, each having a maximum load capacity of 4500 kw for a period of five minutes. It is the intention to use one 1500-kw unit in operation with the second as reserve, to be used in emergencies such as disablement of the operating unit or a congestion of trains requiring them to be operated in fleets.

Basing the substation capacity and location on the foregoing limitations, it is proposed to install three three-unit and two two-unit substations on the 113-mile division between Deer Lodge and Three Forks, Mont. In each case the substation building will be designed to accommodate an additional unit which may be installed when future traffic conditions make it desirable.

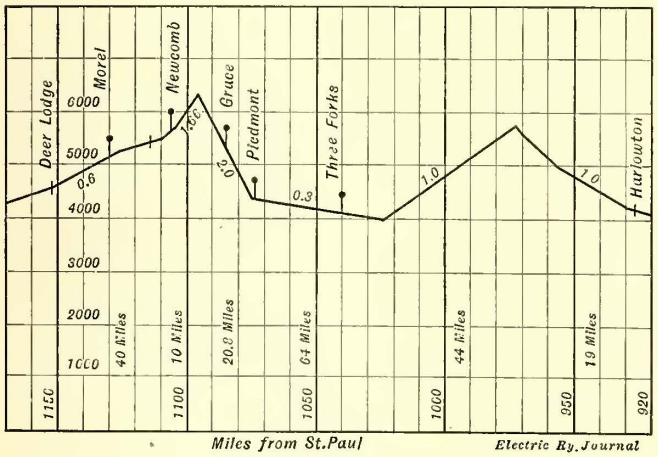
All of the substation units are to be of the same size and will comprise a sixty-cycle synchronous

motor direct-connected to two 750-kw, 1200-volt d.c. generators connected in series for 2400 volts. Each motor-generator set will be fed from three single-phase step-down transformers reducing from a transmission potential of 100,000 volts to 2300 volts at the synchronous-motor terminals. Each motor-generator set will be equipped with two exciters, one for the synchronous motor and the other for the fields of the generators, thus making the motor-generator set, step-down transformer and exciting generators, together with the controlling switchboard, a complete unit in itself.

It is proposed to erect the substation buildings of brick on concrete foundations with a concrete roof supported on steel girders which will provide a foundation for the overhead high-voltage busbars. Each building will be equipped with a crane of sufficient capacity to move the heaviest part of the substation apparatus. The transformers will be of the self-oil-cooled type, placed in a roofed transformer room with tracks, to facilitate installation and repairs. An accompanying table presents the equipment and capacity of each substation.

TROLLEY CONSTRUCTION

Energy will be supplied to the locomotives by means of roller pantographs from an overhead copper trolley



C., M. & P. S. Electrification—Profile of Line Between Limits of Ultimate Electrification

wire at least 24 ft. above the rail. The trolley wire will be of No. 0000 copper and suspended from a steel catenary cable. This catenary construction will be supported by bracket arms extending from wooden poles, except on the sharper curves, where two poles

SUBSTATIONS AND THEIR EQUIPMENT

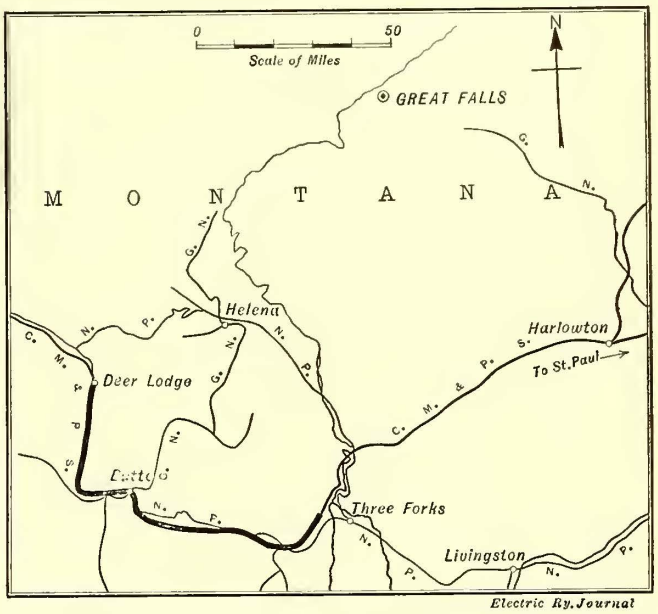
Location	Equipment, Kw	Total Capacity, Kw
Morel	Two 1500	3000
Newcomb	Three 1500	4500
Grace	Three 1500	4500
Piedmont	Three 1500	4500
Three Forks	Two 1500	3000

and span wire construction will be employed. The single-pole bracket construction is to be followed wherever possible, because it affords less obstruction to view and is also less expensive than span construction. Where two or more tracks are to be spanned span construction with wooden poles will be employed. Where the number of tracks exceeds four steel construction will serve.

The overhead trolley will be supplemented by feeder copper in order to restrict the energy losses in the 2400-volt conducting circuit to a reasonable amount. However, only a portion of the complete feeder system will be installed until such time as the maximum tonnage of trains has been reached and the frequency of train service more definitely determined. For immediate installation the feeder copper will be as follows: Deer Lodge to Colorado Junction, 750,000 circ. mil; Colorado Junction to Piedmont, 1,000,000 circ. mil; Piedmont to Three Forks, 500,000 circ. mil. The details of track bonding have not yet been decided.

TRANSMISSION LINE

The Great Falls (Mont.) Power Company purposes to construct new transmission lines where necessary to deliver electricity to the Chicago, Milwaukee & St. Paul Railroad electrified zone. This power will be supplied in about the following capacities: Deer Lodge, 20,000 kw; Butte, 10,000 kw; Three Forks, 3000 kw. This arrangement necessitates building a new duplicate transmission line from Great Falls to Deer Lodge. As the proposed feeding-in points of the Great Falls Power Company do not coincide in all cases with the location of the substations, the railway will install a transmission line to tie in these feeding



C., M. & P. S. Electrification—Map Showing Electrified Section of Line

points to each of the several substation sites. This transmission line will follow the railway company's right-of-way, except at some points where it is possible to cut across the country and save distance.

Owing to the great distance from the right-of-way of the railway company to the source of power at Great Falls, it was found necessary to adopt a transmission potential of 100,000 volts both for the Great Falls transmission lines and for the single-circuit transmission line on the railway company's right-of-way. This high potential permits a shift in loads to different parts of the system without excessive loss. The transmission line built along the railway company's right-of-way and connecting the several substations will include the 100,000-volt line suspended upon 45-ft. wooden poles by means of a six-unit suspension-type insulator.

It has been recently reported that an engineer in Rio de Janeiro has applied to the Municipal Council for a concession to construct an underground electric railway to connect the suburb of Cascadura with the center of the city. It is stated that there will be considerable difficulties to overcome owing to the marshy and sandy nature of the subsoil.

American Economic Association Meeting

During the First Two Days of This Convention, Which Was Held in Minneapolis on Dec. 27-30, the Discussion Centered on Valuations and Rate Making

Public utility relationships occupied a large share of the attention of those attending the twenty-sixth annual meeting of the American Economic Association, begun in Minneapolis Dec. 27. The first session was devoted entirely to the presentation and discussion of a paper on "Control of Public Service Corporations" by Prof. John H. Gray, of the University of Minnesota. President David Kinley, of the University of Illinois, was in the chair, and the attendance at the opening session was about 200.

PROFESSOR GRAY ATTACKS RATE MAKING BY VALUATION

In presenting a brief summary of a voluminous paper, Professor Gray advanced as his main thesis the pronouncement that public service commissions were on the wrong track in making valuation the basis of rate control. He said that public utility commissions were on trial; they would have to win success or the people would go to public ownership. There was no ground whatever for valuing public utilities. It should be remembered that these utilities were public enterprises in every sense of the word. The relation of the state or sovereign power to them was that of principal and agent. The speaker discussed some of the vagaries of valuations. The rule, "a fair return on the fair value of the property used for the convenience of the public," was the finding of the courts. In law the country was now committed to it, but the effort to put this rule into practice would lead to chaos.

Private owners were true pioneers. Like other pioneers, say like a man who owns a gold mine, they were unwilling to accept the fair return dictum of the courts; they still wanted speculative gains, and they were honest in their belief. The Supreme Court had not laid down any rule for arriving at fair value. Professor Gray ridiculed the cost-of-reproduction-new theory of making valuations. In the last analysis all value ascertained by this method rested on human judgment. The companies, with their combined wealth, hired men of large intellect as experts in rate cases. Such men received more credence, when they gave their opinion in evidence, than perhaps less able experts representing the side of the public. The speaker cited the Des Moines gas case, where the company was said to have paid $150,000 for expert evidence in a comparatively unimportant case. In the matter of the so-called intangible values the gates were opened for the wildest flights of fancy. Some of these intangibles were reviewed, such as interest during construction, charges for engineering and for general organization, promoters' expenses, contractors' profits, etc. Going value and good will likewise received the speaker's disapproval as elements to be taken into consideration in fixing rates.

The commissions had proved to be but as the fifth wheel to the wagon. The courts were still the controlling bodies. This would continue to be the case until the constitution was changed by a formal action or by interpretation. The theory of principal and agent was the only one upon which to arrive at a satisfactory relation between the public and the utilities. The sovereign state was the principal. After allowing a fair wage to the agency, it should have the benefit of all gains and also stand all the losses. There should be no valuation for rate regulation but history—that is, a statement of outlay of money spent and services rendered—nothing more.

In relation to franchise contracts, Professor Gray gave it as his opinion that the Supreme Court had already discovered that contract ordinances were inconsistent with the modern theories of regulation. He also thought that "the courts, state and federal, are moving very rapidly to a point where, without any formal reversals, they will find a way to abolish most of the existing franchises by a strained interpretation, which leads to the conclusion that the franchises were invalid from the beginning for lack of power on the part of the municipality."

Early losses should be repaid, but they should not be added to value, but rather repaid by higher rates through a reasonable term of years. They should not be capitalized for all time. Professor Gray also made the point that the commissions were reviewed by the courts and were not responsible in any proper sense. The courts in their turn were influenced by the findings of the commissioners. The speaker referred to "learned courts and tethered commissions." He cited the Fall River case where the Supreme Court of Massachusetts not only completely overruled the commission in that state in relation to the issuing of stock for extensions where a large surplus existed, but virtually abolished the powers of the commission by ruling that in such matters the commission was acting in a quasi-judicial capacity and must proceed on the same principles as the court would do.

DISCUSSION

E. W. Bemis, public utility expert, Chicago, urged that courses on rate regulation and the court decisions relating to them be established in universities. He believed that regulation was here to stay and was doing a great deal of good in many directions, such as uniform accounting, control of service, control of rates and the training of men in the study of public service problems. But regulation had serious dangers. Giving too much of the unearned increment to the companies was one. The state should not ignore the investor, but its chief solicitude should be to protect the consumer. If monopoly earnings were not too large there could be no watered stock. There was great danger, also, in the attitude of commissions toward municipal ownership. The city should have the right to make or lose as it pleased, considering the question of municipal utilities. Mr. Bemis thought that in relation to regulatory commissions the country was at a stage where it should pause and study.

Prof. J. E. Brindley, Iowa State College, did not agree with Professor Gray in the latter's declaration that rate making based on valuation was a fallacy. It was impracticable to fix rates on the basis of a statement of outlay. Some of the statements in Professor Gray's paper were criticised as extreme. Regulating boards should regulate and control and should not destroy private initiative—"if we are to have private initiative," added Professor Brindley. Professor Gray's principal-and-agent plan, if put into execution, would probably result in poor service, receiverships and state ownerships.

Prof. James E. Boyle, University of North Dakota, said that Professor Gray had presented his criticisms in a striking manner. It was to be regretted that the author did not give more attention to suggesting remedies. At the present time public ownership of utilities would be a dangerous undertaking. The speaker expressed his belief that private initiative was not due

wholly to hope of speculative gains, and he cited the examples of art, literature and science. The Cook plan of one single private company owning all the railroads of the country, controlled by the government, and with its earnings guaranteed by the government, looked feasible, but was, perhaps, too radical for the present day. There seemed to be an inevitable drift toward public ownership.

James E. Allison, consulting engineer, St. Louis, and formerly a member of the St. Louis Public Service Commission, thought Professor Gray too pessimistic. He said that the author of the paper set up men of straw to demolish. There was a contractual relation between principal and agent. What that contract was, in the case of public utility regulations, was the crux of the question. To fix rates there must be a valuation or something to take its place. Original-cost and reproduction-cost valuations would often work out to about the same results. Mr. Allison said that Professor Gray was unduly alarmed about interest during construction. This was a real construction charge. The fair rate of return was that return at which capital could be induced to go into the enterprise. To attempt to set up a lower rate was to run counter to an economic law.

Prof. William F. Gephart, Washington University, asked if it was indeed true that the time of risk and speculative profits had passed in public utility enterprises. Utilities that involve risks were planned to-day in large cities and in small ones. Commissions do valuable work in improving the character of service as well as in regulating rates. There was a widespread belief that a large portion of public utilities were over-capitalized and charge rates that were too high. This might lead to public ownership, but there would still be difficulties to encounter, for many men believed that governments exist to grant gratuities of some kind. Professor Gephart remarked that there was not much of a constructive character to show as the result of a decade of work by public utility commissions.

Howard C. Hopson, of the staff of the New York Public Service Commission for the Second District, Albany, N. Y., said that commissions were going back in making valuations to the plan based on investment, gradually abandoning the cost-of-reproduction theory. There could be no mathematical formula to be used in working out a correct public utility rate. The personnel of the commission was very important. This speaker also pointed out that even where the principle of monopoly in public utility service was conceded, there was still to be considered the element of competition between utilities for capital. In a few years the country would be face to face with the problem of securing the maximum amount of service from utilities without bringing about an increase of rates.

Prof. R. E. Heilman, University of Iowa, discussed the subject of the authorization of securities by commissions, intimating that in years to come the commissions might have to grant higher rates to take care of all the securities which they had themselves sanctioned.

Roger W. Babson, financial writer, Wellesley Hills, Mass., remarked tersely that theory will have little to do with the settlement of the public utility question. This question will be settled when it is determined who has the larger number of votes—the men who use the utilities or the men who hold investments in them.

Several local speakers advocated public ownership vigorously. One said that the system of regulating public utilities by state commissions was fundamentally wrong. Another announced that he did not believe that a law creating a public service commission would be passed in the State of Minnesota. The Governor has become convinced that it would be unwise to call a special session of the Legislature for this purpose. This gentleman referred to the Chicago traction settlement ordinances of 1907 as "infamous" and said that they meant disguised taxation. Another local speaker said that organized labor had something to say on the question, and that the matters in dispute could not be settled on the scientific basis of political economy.

In a brief closing speech, Professor Gray declared that commissions had practically arrived at a point where the companies were guaranteed against losses. As to private initiative, he wanted to know if there could be in fact any system of control that would be effective without destroying the opportunity for private gains.

DR. MEYER AND OTHERS DISCUSS RAILROAD RATE MAKING

Prof. W. A. Scott, of the University of Wisconsin, presided at the third session of the annual meeting of the American Economic Association, which was held in the main auditorium of the New College of Engineering of the University of Minnesota, Minneapolis, on Dec. 29. The main feature was a paper on "Certain Considerations in Railway Rate Making," by Dr. B. H. Meyer, of Washington, D. C., member of the Interstate Commerce Commission. The subject was considered under three main divisions—value of the property, cost of service and the considerations of sound public policy involved. Each of these must be interpreted in the light of the others. The speaker intimated that even if public ownership was brought about, the question of rates would still arise. He remarked that the competitive theory of railroad rate making had been practically abandoned. In making a valuation the securities issued should not be recognized as the equivalent of property for rate-making purposes. Cost accounting by railroads was advocated. In attempting to fix railroad rates it was more important that justice be promoted in a large way than that a standard be sought which might be used as a yardstick in all cases.

DISCUSSION

Prof. Josef Schumpeter, University of Graz, Austria (exchange professor at Columbia University), declared that the actions of politicians, commissions and judges were apt to be considered rather primitive from the viewpoint of political science. He said that the phrase "what the traffic will bear" did not always indicate such a bad condition as was sometimes thought; many systems of monopolistic prices were not injurious. Railroad monopoly was quite different from all other monopolies; it could not be taxed without injuring development. Perhaps the theories underlying rate making were understood by economists, but the working out of details in practice was drudgery, and most theoretical economists were unwilling to undertake it. The speaker did not see the relevance of valuation of property in fixing railroad rates. It should be remembered, however, that what economists contributed was only one of many factors to be considered in the problem. Society should be rather careful not to drive the entrepreneur out of human progress. In Europe the establishment of railroad rates by the State had caused dissatisfaction and also losses to the public purse. The United Sates had the most splendid system of railroads the world had ever seen.

Prof. A. A. Young, Cornell University, agreed with Dr. Meyer in relation to the latter's three fundamentals. He thought it rather humiliating that what progress had been made had been due to commissions and courts rather than to economists. He discussed the equitable ascertainment of railroad rate unit costs. "What we want," he said, "is that system of rates that will insure the most advantageous distribution." Under existing circumstances, rates based on cost of service were hardly a debatable proposition. A long-time view

of the case should be taken. In that view fixed charges then became variable charges; they increased largely on account of the growth of traffic. Charging "what the traffic will bear" was sometimes allowable, as where a railroad had made long extensions in a sparsely settled country to develop it. Rate systems tended to equalize rates of distribution from different communities. This necessitated delicate adjustments, and Professor Young thought that railroad rates were more difficult to adjust than tariff schedules. Even on other than economic grounds the cost of service principle must be given great weight, as it satisfied the demand for justice, which had to be reckoned with. It was the fundamental system of railroad rate making, but individual deviations might be allowed if justified.

Prof. E. R. Dewsnup, University of Illinois, argued that if railroad competition was really complete, normal prices would be determined by normal cost of service. Theoretically, competition was capable of producing better results than the best regulation. But practical conditions intervened, because real free competition could not be made to exist. During a period of development should the railroad not be allowed to pay its way by a discriminating tariff? Few railroads anywhere were pure monopolies. The speaker devoted part of his time to a discussion of the application of "joint costs" to railroad transportation.

Prof. F. H. Dixon, Dartmouth College, agreed in general with the reasoning of Dr. Meyer's paper. He discussed the extension of the cost principle in rate making. Railroads had themselves employed the cost methods in presenting their figures and asking for increase of rates. A more complete and accurate knowledge of costs would benefit both the railroads and the public. Cost accounting was not exactly the same in railroading and in industry. The railroad manager had a much more complex problem than the industrial manager in determining the relation of cost and price. The speaker advised caution in enforcing the demand on railroads for this new accounting. "Let us not," he said, "spend $5 to save 30 cents."

Prof. A. J. Boynton, University of Kansas, considered the general aspect of the question, and remarked on the number of conflicting theories. "Is there," he asked, "any real theory of rates justifying the name?" What was needed was an amalgamation of theories with such additions and modifications as might be found necessary. But theories now existing were not sufficiently refined for that purpose. Professor Boynton looked forward to the refining, but not over-refining, of theories, and to the fusing of them into a composite system. However, theories were not of much use unless based on statistical studies. Then, too, the adequate financial needs of the railroad corporations in the future should not be overlooked.

Prof. Lewis H. Haney, University of Texas, made a valuable contribution to the discussion. He said that he was convinced that only perfected accounts and more interpretative statistical data were needed to make "joint costs" logically and rationally assignable. Discussing valuation, Professor Haney said that the cost of the property, whether "original" or "reduplication," should be learned, so that the interest charges might be correctly determined and distributed. After a theoretical consideration of this branch of the subject he said that he believed that much remained to be done in applying marginal analysis to the determination of railroad values. Taking up another branch of the subject, the speaker said that he believed that no conflict existed between a cost basis and the so-called "principle of public policy." To ignore costs meant much more than throwing rate making into politics; it meant economic waste on a gigantic scale. It was specious to urge that coal, sand and other low-grade commodities could not be moved at cost rates. By what right was their low price assumed? Was it expedient that the railroads, backed by government, should take it upon themselves to supply goods at less than cost? In the long run the only way to prevent waste of energy and natural resources was to let competitive prices determine. As a practical matter, particular exceptions had to be made, but these cases should frankly be put on the ground of charity, just as poorhouses were provided for those who cannot pay for their own subsistence. Rates should be fixed, if possible, as they would be fixed under normally competitive conditions. Until recently few men realized the extent of the railroad's public character or the significance of the doctrine of "joint costs." Now that the ground had been cleared and the true economic nature of the common carrier established, the time was ripe for a co-ordination and a synthesis of the fragmentary partial theories now receiving attention. Competition could not obtain in the railroad field, but that did not mean that the forces of demand and supply were not operative there. Why, then, not set out to solve the problem of constructing a rate yardstick by the demand and supply route? Taking for granted railroad monopoly, why not seek to approximate the effect of competition on rates by constructing schedules of shippers' demand prices and carriers' supply prices? Difficulties will arise, and a rule must be sought to determine the portion of joint expense that each class of traffic would bear under competition. This was the heart of the problem. The speaker then discussed normal demand and supply curves and also described what he called the "distance utility" of the service. This "distance utility" should be combined with the "specific value" of the commodity to get the total utility of the service and determine the final or specific demand curve. The interesting basis of rate making proposed by Prof. Haney proceeded from a recognition of joint expenses and was intended to take into consideration elements of truth in various theories. While costs were estimated as a supply-limiting force, demand forces were also taken in consideration. It was intended to be one composite principle that could be applied in all normal cases, the uniformity lying in the rule, the variety in its applications. It was based on the fact that demand and supply were the ultimate forces, however, joint and composite they might be. It gave the result that these forces would bring about under fair competition if railways could compete.

DR. BROOKS DISCUSSES SYNDICALISM

At the morning session of Dec. 30 Dr. John Graham Brooks, of Cambridge, Mass., gave a summary of his paper on "Syndicalism." He said that this movement is a part of the great reaction all over the world against capitalism, the imperfections of the parliamentary system and the law's delays. Another feature of the plan contemplates an ideal state of labor co-partnership without the complicated organization of force based on law. Syndicalism may be justified as a sort of stinging whip from without to awaken society to the need for better things. The syndicalists believe that labor will eventually control capital. The general idea of Dr. Brooks' remarks was that, while syndicalism does not deserve serious consideration at present, economists should give serious attention to the movement to see if it does not contain some measure of truth. At the afternoon session of the same day Prof. Willard E. Hotchkiss, of the Northwestern University, Chicago, read a paper on "Recent Trust Decisions and Business." An abstract of the discussion on these two papers will appear next week.

Methods of Mitigating Electrolysis from Street Railway Currents

The Authors, Who Are Respectively Chief Physicist and Associate Physicist United States Bureau of Standards, Washington, D. C., Discuss the Most Important Methods of Electrolysis Mitigation and Present Definite Conclusions Regarding Their Relative Merits

BY E. B. ROSA AND BURTON M'CULLOM

In the effort to reduce or eliminate damage to pipe systems and other subsurface structures due to stray earth currents from street railways, a great many methods have been tried or proposed. Some have been widely used with more or less benefit in many instances and apparent failure in others. In the case of most of these little systematic effort has been made to develop them to meet most advantageously the requirements of practical service. In this paper is given a brief discussion of the most important methods of electrolysis mitigation that have been proposed, together with conclusions as to their relative merits.

SURFACE INSULATION OF PIPES

Painting or otherwise insulating the surface of pipes, as by the use of treated papers and textiles, was early resorted to as a possible means of protecting pipes from electrolysis, and this method is still used in some instances. It is doubtful, however, whether there exists any instance in which it has been definitely proved that insulating paints have effectively protected pipes from electrolysis for any considerable period of time, while there are many instances where they have failed and where their presence has actually done harm. Practically all paints are classed as insulators, but in practice a given paint may endure for a long period in some places, while in other places in the same city it may deteriorate rapidly and become worthless in a comparatively short time. This is due partly, no doubt, to differences in soil conditions, but the general failure of these paints under conditions where electrolysis was to be expected indicates that the stray currents themselves have much to do with the destruction of the coatings. We have carried out a considerable number of experiments with a view of throwing further light on this point and also to determine if possible something of the relative value of different coatings as a possible protection against electrolysis. In all, about forty different kinds of commercial paints have been tested, and of these not a single one has withstood the action of the very moderate test voltage of 4 volts for any considerable length of time, failure of the coating with consequent pitting of the pipe occurring within a few months in all cases.

The explanation of the failure of the coating lies in the fact that none of the paints tested is absolutely impervious to moisture, and when brought into the presence of water a slight trace of moisture ultimately permeates the coating. When this occurs at any point the coating becomes slightly conducting, and if any electromotive force is applied, a trace of current flows at first, giving rise to slight electrolysis which is accompanied by the formation of more or less gas beneath the coating. As this gas accumulates and expands the coating is finally ruptured, after which the current flow is greatly increased at the point of break-down and rapid electrolysis of the exposed iron follows. In some cases, if the coating is sufficiently porous to permit the gases to escape, it may remain intact and electrolysis may continue beneath the coating, eating through the metal without any superficial evidence of failure of the paint. This phenomenon is frequently observed in practice. The vital weakness of all the paints thus far tested is due to the fact that they are not entirely non-absorbent. If a paint could be secured which is absolutely impervious to soil moisture and which would remain so for an indefinite period, it would prove an effective preventive of electrolysis, and all efforts to produce such a protective paint should be directed to this one point of making it absolutely and permanently moisture-proof.

The manner in which these paints usually fail under electric stress shows that they may under certain circumstances increase the trouble from electrolysis. Breaking down as they do at isolated points, the discharge of current from the pipes is concentrated at those points and the pitting is likely to be more serious than if the paint were not used at all. In all areas, therefore, where the pipes are strongly positive to the earth these paints are likely to do more harm than good, and it would be better to omit them altogether. But in places where the pipes are practically neutral, or negative to earth, they can do no harm even if they do fail in spots, and in such places they may be of value in reducing current flow in pipes and in preventing soil corrosion.

The method of coating pipes with treated textiles or tarred paper is open to somewhat the same objections that have been made to the use of insulating paints, the only difference being that the time required for their initial failure is usually greater than in the case of paint. The principal reason for this is the greater thickness of the coating that usually results from this method of insulation. We have tested a considerable number of such coatings with uniformly disappointing results, failure always occurring within a few months whenever a low potential difference is impressed on the coating. Where no electromotive force is impressed on the pipes provided with such a coating it appears often to remain in good condition for several years, and for this reason it appears to be at least of temporary value as a preventive of self-corrosion. Its use is probably justified in neutral or negative areas, but in all positive areas it would tend to aggravate rather than reduce the rate of deterioration of the pipes. Its use is not, therefore, to be recommended except in neutral or negative areas, where it would undoubtedly be beneficial, the only question being whether or not it is worth the cost. As a means of preventing or even reducing electrolytic damage in positive areas this method of surface insulation does not appear to be practicable at the present time.

INSULATING JOINTS IN PIPES

Another method of reducing current flow in pipes, and one which has found rather extensive application within the last few years, is that of breaking up the continuity of the pipe lines by the use of insulating or resistance joints. In ordinary wrought-iron or steel mains with screwed or riveted joints the resistance of the joints is usually small in comparison with that of the pipes, and when such pipes are laid in localities where there is an appreciable potential gradient in the direction of the pipe, currents of considerable magnitude will usually be carried by the pipes. In the case of

cast-iron mains the resistance of the joint is often as great as, or greater than, that of the section of pipes, and it is not uncommon to find a lead joint having a resistance equal to that of several hundred feet or more of pipe. It is due largely to this high joint resistance and to some extent also to the higher specific resistance of cast iron that cast-iron mains usually carry less current under similar conditions than wrought-iron or steel mains. Experience has shown, however, that the resistance of lead joints is not sufficient to reduce the current to a safe value, and attempts have been made still further to increase the resistance of the pipes by the introduction of specially designed joints of high resistance.

We cannot here go into detail in regard to the merits of this method or the proper procedure in applying it. These have been treated in the technological papers referred to at the end of this paper. It is sufficient to state here some of the conclusions at which we have arrived as a result of our investigation of this method. If properly installed, with joints of proper construction and used with sufficient frequency, it can be made very effective in minimizing electrolysis troubles. The higher the potential gradients in different parts of the system the more frequently the insulating joints must be used. In most cases it would not be necessary to make every joint insulating, one-third or one-fourth of the joints being usually sufficient even under severe voltage conditions while in many parts of the system a much smaller percentage would suffice. Where new lines are being laid it is a comparatively simple matter to insert the necessary number of such joints, but in the case of old systems the expense becomes great unless the potential gradients in the earth are first reduced by other means, so that a comparatively small number of insulating joints will suffice. Chiefly for this reason, we do not in general recommend this method as the principal means of protecting pipe systems already laid with the lead joints. When, however, proper precautions are taken, such as those described in detail in a later part of this paper, to reduce potential gradients to a comparatively low value, this method of insulating joints may well be applied for the purpose of eliminating such residual electrolysis as might otherwise remain if the system were not so protected. With potential gradients reduced to as low a point as practicable under a properly designed negative return, a comparatively small number of insulating joints not exceeding 5 or 10 per cent of the total number would be sufficient to give practically complete protection to the pipes. We wish to emphasize, however, that we regard this method as valuable chiefly as an auxiliary method which may be used in connection with and supplementary to a negative return system of proper design.

PIPE DRAINAGE SYSTEMS

A system of electrolysis mitigation which has received wider application in this country than any other method is that which is best characterized as the "pipe drainage system." This method has taken a variety of forms, among the principal ones being direct taps between pipes and rails. In this form no extensive negative feeder system is used, but at various points throughout the positive areas where the pipes are close to the tracks short heavy cables are connected between the pipes and rails with the view of keeping the pipes at nearly the same potential as the tracks. It is true that by the use of a sufficient number of such taps it would be possible to prevent any considerable difference of potential between pipes and tracks, but this does not insure relief from electrolysis. In order that such equality of potential may exist it is necessary that the potential gradients along the pipes throughout the region affected shall be the same as in the rails, and under the conditions which commonly prevail in the positive areas this potential gradient is quite high, often reaching 5 volts to 10 volts per 1000 ft. and even higher. Such gradients are sufficient to produce heavy current flow in the pipes, and in case occasional high-resistance joints are encountered the heavy fall of potential across the joint will generally cause large leakage of current from the pipes resulting in rapid injury to the pipes. In case of local defects developing in the track bonding, practically all of the railway current may be forced to return by way of the pipes or cable sheaths, and the danger of excessive leakage from the pipes and overheating of cable sheaths is largely increased and may sometimes reach very serious proportions.

Another form of pipe drainage consists in running negative feeders direct from the negative bus to various points of the pipe system. This form of pipe drainage has three practical embodiments. In one of these uninsulated negative feeders are run from the busbar and tied to the pipes, some directly at the power house and others at more remote points. In this case the longer feeders have to have a very large cross-section, or else the resistance will be so large that they will draw very little current from the pipes and their purpose will be thus defeated. In some cases it has been proposed to run these long feeders parallel to the pipes and tap them to the pipes at frequent intervals. It will be quite evident that this arrangement is open to the same objection as the plan of using uninsulated negative feeders to rails, in that it leads to large expense for copper, particularly in case it becomes necessary to carry the feeders to points far from the power house. In order to overcome this difficulty in some installations, boosters have been connected to the longer feeders, in which case they can be made much smaller and by proper excitation of the booster any desired amount of current can be taken from the pipes of each feeder. There seems to be no reason why the same results cannot be obtained by omitting the boosters and inserting resistance in the power house taps to pipes and in the short feeders, since in this way any desired distribution of current in the feeders can be obtained without the complication and operating cost of the boosters. The advantages of this latter plan would be very great in the case of a large system, since with the booster system a separate booster would be required for each feeder. The use of resistance taps can, as a rule, be made both economical and effective when used in connection with a somewhat similar system applied to rails, as described later.

We cannot here go into detail in regard to the advantages and disadvantages of the pipe drainage system, but will mention a few of the more important considerations respecting it.

First, it has been objected that it is not a permanent system, requiring constant watching and changing when the distribution of the street railway load or of the pipe systems undergoes any marked change. This objection is no doubt an important one where the uninsulated system of pipe feeders is used, but it would not be of serious moment in the case of the insulated feeders with resistance taps, since by the insertion of proper resistances in the various feeders they could be adapted to widely varying conditions as regards load distribution.

A second objection, already referred to, is the fact that any form of pipe drainage will necessarily increase to a greater or less degree the amount of current carried by the pipes, which is accompanied by the ever-present danger of trouble developing in the vicinity of high-resistance joints at obscure and unlooked-for places. This objection is much more serious in the case of direct taps between pipes and rails and uninsulated

pipe feeders than when boosters or resistance taps are used, since in the latter cases a proper distribution of current can be maintained that will greatly reduce this danger, although we do not believe that it is in general practicable to eliminate it to a satisfactory degree, unless at the same time measures are taken to reduce potential gradients in the earth to a relatively low value.

A third objection is that the connection of the pipe system to the busbars or rails lowers the potential of the pipes and tends to make them negative to other pipe and lead cable systems, thereby endangering the latter. The advocates of this system attempt to avoid this objection by recommending that all pipe and cable systems be included in the installation. This is sometimes practicable and sometimes not, depending on local conditions; but in any case it would greatly extend the area in which acute troubles might be expected and the expense of watching and guarding against trouble would be largely increased.

A fourth objection, resulting from the great tendency of this system to increase the current flow in the pipes, is the increased life and fire hazard which it introduces, particularly in connection with gas systems. The failure to bond the pipes properly before making any disconnections, or the accidental opening of the bond while the pipe line is broken, is likely to ignite escaping gas with more or less disastrous results to both life and property. Although serious accidents of this kind are comparatively infrequent, they are nevertheless worthy of consideration. Further, the possibility of such accidents increases the labor and cost of making repairs on account of the precautions that have to be taken.

A fifth objection, and an important one, is that the application of this system requires that all pipe systems to which it is applied shall be electrically continuous throughout. In addition to the possibility of high-resistance lead joints already pointed out, we are confronted with the fact that in a great many installations, cement joints, rubber gasket joints and other insulating joints are now largely used. Where used, these will usually be found distributed to a greater or less extent throughout the system, and if the drainage plan were applied to a pipe system containing any considerable number of these insulating joints it would result in the certain destruction of the pipes near many of them within a comparatively short time. As a rule the points at which isolated insulating joints occur or those in which the insulating jointed sections connect to the lines having lead joints would be the ones that would be in greatest danger. For this reason the application of a general plan of pipe drainage as the chief means of electrolysis mitigation would be particularly unfortunate in case any one of the pipe systems contained any considerable number of insulating joints.

A sixth objection to the general application of the pipe drainage system as a means of electrolysis mitigation arises from the tendency toward the production of an excessive amount of alkali at the surface of a negative electrode embedded in earth. This will occur to a much greater extent in some soils than in others, depending on the chemical content of the soils. The concentration of alkali at the negative terminal will have no detrimental effect in the case of iron pipe but may tend considerably to increase the self-corrosion in the case of lead service pipe. If the soil is of such a nature as to present favorable conditions for the production of alkali at the negative terminal, considerable increase in the corrosion of lead services may be expected from this source provided the pipes are maintained too strongly negative throughout a large part of the day. Further, the application of the pipe drainage system makes the pipes more strongly negative throughout the entire system, and it is undesirable to create this condition unless it is known that local soil conditions are such as not to give rise to any serious increase in alkalinity under the voltage conditions that would exist.

What appears to us, however, as being the greatest objection to the pipe drainage system, and this applies also to all the other methods applied directly to the pipes, is the fact that they are designed to relieve the symptoms rather than to remove the cause of the trouble. They are, therefore, fundamentally in the nature of a palliative, rather than a remedy. In general, our study of the pipe-drainage method has convinced us that while it may under certain conditions be useful as a secondary means of lessening trouble, its installation as the principal means of electrolysis mitigation is an unwise procedure, not so much because the immediate consequences are bad, since the contrary is quite the rule, but because of the ultimate consequences to which this method, when once resorted to, must inevitably lead.

In its practical working out it exhibits two opposing tendencies, namely, (1) the reduction of the difference of potential between pipes and rails in the positive areas, with consequent reduction of damage at those points, and (2) an increase of the danger to the pipes throughout the entire system, as indicated above.

As a rule, in the early stages of its application the effect is apt to be apparently beneficial, reducing the danger in positive areas more than it increases it elsewhere. As the system grows and the load increases, more and heavier bonds or cables become necessary, and the current in the pipes may become so great that the consequent damage due to the causes above mentioned will be of greater moment than the reduction of troubles in the positive areas, and any further extension of the drainage becomes a menace to the system. It is due largely to the slow and obscure manner in which trouble develops that this method has come to be so widely used. Since it transfers the trouble from where it has been most evident to a new locality, where perhaps it may require several years to manifest itself anew, there is sure to be a lull in the storm which creates a favorable impression very difficult to dispel even when trouble later recurs. Recently it has been proposed to limit these secondary effects by placing a limit on the amount of current taken from the pipes by the drainage cables, the plan being that when this total drainage current reaches, say, 10 per cent or thereabouts of the total railway load, the track conductivity is to be increased by copper cables in order to keep the drainage current below the prescribed limit. In some systems which we have investigated in which the unlimited pipe drainage system has been applied it has been found that in order to reduce the potential conditions to the desired limits it was necessary to draw from the pipes from 40 to 50 per cent or more of the total railway load. It is evident that if we attempt by means of ordinary uninsulated negative copper cables in parallel with the track to decrease the total leakage to 10 per cent, the cost of the copper required will be so great as to render the plan wholly impracticable. We confidently believe that a system worked out on these lines will ultimately lead to much greater expense and less satisfactory protection than will result from other installations designed along the lines outlined in a later section of this report.

CHEMICAL PROTECTION

Among other methods proposed for protecting pipes from electrolysis may be mentioned chemical protection, which contemplates surrounding the pipes with certain chemicals, such as lime, etc., which are known to have a tendency to inhibit corrosion under certain circumstances; the use of cement coatings on the pipes; cathodic protection, or protection of pipes by maintaining

them negative to certain structures by means of battery, motor generator, etc.; favorable location of pipes with respect to rails; the use of non-corrodable conducting coatings, and what may be termed electric screens, which are sheets of metal placed near to or surrounding a portion of the pipe and electrically connected thereto. While certain of these may have a temporary value for reducing electrolysis troubles under very special conditions, our investigations have convinced us that none of these methods can be seriously considered in connection with the permanent mitigation of electrolysis under average conditions of practice.

METHODS APPLIED TO THE RAILWAY RETURN SYSTEM

None of the systems of electrolysis protection mentioned above has to do with the nature or condition of the street railway return system, and in the practical working out of such methods the railway return system is usually ignored. It would appear more logical to attack the problem by beginning at the source of the evil and to prevent, to a large extent at least, the leakage of the currents from the railway return conductors into the earth.

Of the various methods that have been proposed for application to the negative return of the railway system, the majority are either inadequate or impracticable under ordinary conditions when considered solely as means for reducing electrolysis troubles. Among these may be mentioned alternating-current traction, grounding of tracks and busbars, periodic reversal of trolley polarity and the use of the double-trolley system. There is no question, of course, that the double-trolley system, if properly installed, would entirely eliminate electrolysis from railway currents. This system as at present used in Cincinnati, Ohio, and Havana, Cuba, and the corresponding underground conduit system as used in Washington and in New York City eliminate almost completely the danger of electrolysis, the small leakage which does occur being of no practical consequence. The chief objections to their use are the cost of installation and the increased operating difficulties which are involved. The cost of installation in fact does not appear to be justified merely as a means of electrolysis protection, inasmuch as a very satisfactory degree of protection can be obtained by other and much more economical means.

PROPER CONSTRUCTION AND MAINTENANCE OF TRACK

Proper maintenance of the track in order to secure high conductance is everywhere recognized as a necessary condition in electric railway operation, but it does not always receive the attention that its importance justifies. Experience to date indicates that welded or other types of electrically continuous joints are very satisfactory in all cases where the tracks are laid in paved streets or otherwise suitably reinforced. As a precautionary measure, however, some engineers prefer to bond also over all joints. Cross bonding between the rails is also much resorted to as a precaution against the troubles arising from bad joints. These cross bonds are usually placed at intervals of from 200 ft. to 500 ft. and those distances are sufficient if the cross bonds and rail joints are fairly well maintained. All special work should be shunted by copper cables capable of carrying all of the current passing over the tracks at that point. A properly drained roadbed is also a very effective aid in reducing the leakage of stray currents from the rails, since the conductance of the leakage path is mainly dependent on the amount of moisture which is contained in the material forming the roadbed and the earth beneath. Indeed, we have made tests on long lines of track without intersections to cause complications, in which it was found that leakage from the rails to earth was almost entirely eliminated because of the high resistance of the leakage path.

UNINSULATED NEGATIVE FEEDER SYSTEM

The uninsulated negative feeder system has been much used in this country as a means of increasing the conductance of the track, especially in the regions near the power houses, where, as a rule, the current densities become high. The benefits that accrue from its use are threefold, namely: (1) the reduction in potential drop in the rails, thereby lessening damage due to electrolysis; (2) the saving in power; (3) the maintenance of a more uniform voltage on the cars, especially at times of peak load, thus giving rise to improved car service and better car lighting and reducing the maximum demand.

When these benefits are carefully considered it seems somewhat surprising that the use of negative feeders is not more common than it is. While we do not regard this as being in general an economical system, it is proper to consider here its merits as compared with systems in which no feeders are used. In the matter of the second item—the saving in power—it is easy to show that in this feature alone much can be gained by the addition of negative copper provided the drop of potential in the track is fairly high. With feeders costing $4,000 per mile installed for cables of 1,000,000 circ. mil section, the most economical potential gradient to allow in the rails is about 3 volts effective per 1000 ft. (root mean square for twenty-four-hour period) with energy costing 1 cent per kw-hr. Wherever the potential gradient exceeds that figure the addition of copper in parallel with the rails produces an annual saving more than sufficient to pay all proper charges, including interest, taxes and depreciation on the copper required to reduce the mean effective potential gradient to 3 volts. With energy costing 2 cents per kw-hr. the most economical gradient limit is a little over 2 volts per 1000 ft. When these values are exceeded in any locality, that section of the track is not only being operated at an unnecessary loss but conditions as regards electrolysis are unnecessarily bad, much worse in fact than they would be under the more economical installation. If we attempt to carry the voltage limit below this value, the cost of the necessary copper increases very rapidly and soon becomes prohibitive. On the other hand, it is generally recognized that a mean effective potential gradient of 3 volts per 1000 ft. is much too high to permit a reasonable degree of immunity from electrolysis, since under ordinary conditions of load factor this would correspond to a peak value of about 6 volts per 1000 ft., so that some other method must be employed if a fair degree of economy is to be maintained. Such economy is afforded in varying degree by the insulated negative feeder systems which we shall now consider.

INSULATED NEGATIVE FEEDER SYSTEM

In the insulated negative feeder system, instead of tying the track rails directly to the negative bus and depending on the rails and such copper as may be in parallel therewith to return the current to the power house, the connection at the power house is either removed or given a suitable resistance, and insulated feeders are run from the negative bus to various points of the track, as shown in Fig. 1. By this means two important results may be achieved. In the first place, the current being drawn from the rails at numerous points, high-current densities, and consequently high-potential gradients in the rail, are avoided. In the second place, it is possible, by so designing the system that the drop of potential on all of the feeders is the same, so to subdivide the current flow in the tracks that the direction of the flow will be frequently reversed, thus preventing the accumulation of large potential differences between points on the tracks some distance apart. It will be evident that in this case the

actual drop of potential on the different feeders is of secondary importance so long as it is practically the same in all, in so far as the potential difference in the track are concerned. We can thus impose any desired potential restrictions on the track and still be free to design the feeders to give maximum economy, something we cannot do when the feeders are connected in parallel with the tracks, as is most commonly the case in practice.

A graphic representation of what can be accomplished

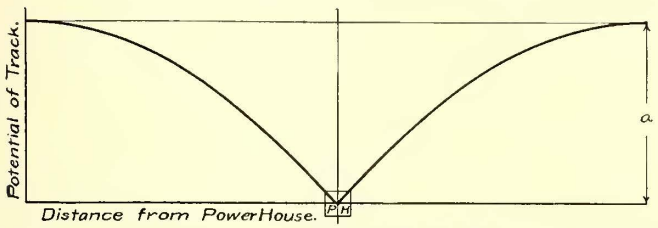


Fig. 1—Electrolysis—Potential Drop in Rail with Uninsulated Feeders

by using a system of insulating feeders of this sort is shown in Figs. 1, 2 and 3. Fig. 1 shows the arrangement of a negative return in which no negative feeders or simply uninsulated cables are used and the rails are tied directly to the negative bus at the power house, a uniform distribution of load being assumed. The curve at the top shows how the potential of the rails vary from point to point.

The curves of Fig. 2 show the result in the same system with insulated negative feeders run to a number of points on the track and so arranged that the drop of potential is the same on all during an average condition of load. It is seen that the current flow in the tracks is here so subdivided that the total differences become very small, and consequently the tendency to set up large differences of potential between rails and surrounding structures is practically eliminated.

An examination of the two curves shows that the maximum potential difference in the rails has been reduced to one-sixteenth of its former value by the installation of only two negative feeders on each side of the station. It is evident, however, that these great reductions in potential differences in the tracks are obtained at a sacrifice of the track conductance of which very little use is made in the latter case.

Between these two extremes any desired compromise can be obtained; that is, if instead of making the drop

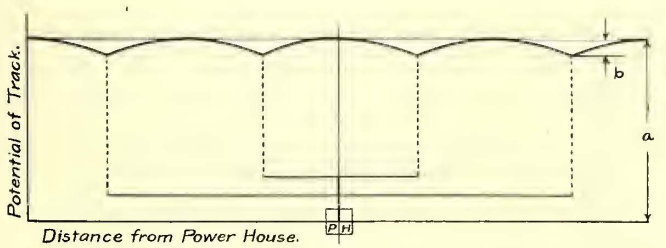


Fig. 2—Electrolysis—Result from Use of Several Insulated Feeders Having Equal Potential Drop

on all of the feeders the same we make the drop on the feeders smaller as we approach the power house, we shall have a continual gradient in the rails all the way to the station, thus utilizing the conductance of the tracks to any desired extent. This will result in a more economical installation but at the expense of somewhat greater potential differences in the track return system, as shown in Fig. 3. These insulated-feeder systems embrace a number of modifications, chief among which are the following scheme:

BOOSTERS IN SEPARATE FEEDERS

A method which has found considerable application in Europe but is comparatively little used in this country is that of carrying insulated negative feeders to various points on the track and inserting a booster in each feeder. The two advantages of this method are that a great economy of copper in the negative feeders can be obtained as compared with uninsulated negative feeders and, by varying the voltage of the individual boosters, almost any desired potential condition can be obtained in the track network. To offset these advantages we have the large first cost of the boosters and an increased depreciation and operation cost. In a large district as many as a dozen or more negative feeders may be required, and the use of a booster with each of these would obviously introduce considerable complication in the operation of the station.

In this, as in all other insulated negative feeder systems, the most important characteristic is the fact that the potential gradients in the tracks may be reduced to any desired degree independently of the current density used in the feeders. If the voltage of the booster be kept about equal to the total drop on the cable to which it is connected, the potentials of the various points of tap to the rails will be approximately the same, so that large differences in potential between different points in the track will not occur. In consequence of this the copper feeders can be designed solely from the point of view of economy, and thus a much more economical installation can be obtained than would

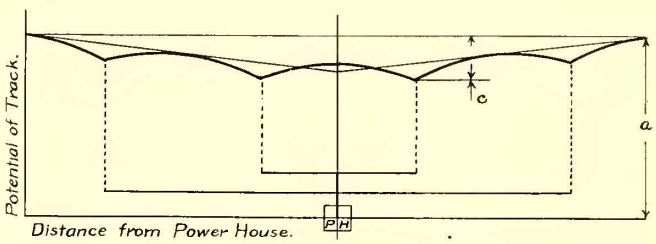


Fig. 3—Electrolysis—Result from Use of Insulated Feeders Having Drop in Potential Adjusted to Utilize Conductance of Rail

be possible with an uninsulated feeder system, in which the drop on the cable must be no greater than the drop on the rails. When it is desired to reduce the potential gradients in the tracks to 1 volt per 1000 ft. or lower this method will be, under most conditions, much more economical, all cost considered, than the uninsulated negative feeder system mentioned above, the saving of first cost of copper being more than sufficient to compensate for the cost of the boosters and the capitalized value of the annual depreciation and increased energy loss.

While this system is capable of giving very satisfactory results, so far as potential conditions in the tracks are concerned, we do not believe that the expense and complication of it are justified, particularly in view of the fact that practically as good results can be obtained by other methods which are simpler to install and to operate and at the same time much cheaper in point of first cost and maintenance. The sole advantage of this system over those described below is that a somewhat more flexible control over the individual feeders is obtained, but this is of doubtful value, since the simpler methods afford practically all that is needed in this respect, as will presently appear.

INSULATED NEGATIVE FEEDERS WITHOUT BOOSTERS

If insulated negative feeders are used without boosters, the layout of the negative feeder system will be very similar to that in the case of the booster system

described above, the chief difference being in the elimination of the boosters. The potential drop necessary to force the required current through the negative feeders without the use of additional copper is obtained by removing the direct tie between negative bus and rails at the power house and substituting in its place a properly designed resistance tap. The layout then becomes substantially as shown diagrammatically in Fig. 4.

In designing the feeders a careful study is made of the load distribution over the entire territory supplied by the station under consideration, and from this study the most natural points for taking off the current are selected and the number of amperes to be taken off at each point determined. A preliminary value of potential drop on the first feeder is then assumed and from this drop and the current to be carried by the feeder, together with its length, the cross-section of the feeder must be designed consistently with the first, so as to avoid potential gradients in the tracks greater than the value determined upon as the limiting allowable average gradient. Beginning thus the drop on feeder No. 2 is the drop on No. 1 minus the allowable drop on the distance *a* between the points at which the two feeders tap the rails. For instance, if the assumed drop on No. 1 is 15 volts and the distance between the two taps is, say, 1200 ft. and we are permitting a maximum drop of 1 volt per 1000 ft. in the tracks, the average

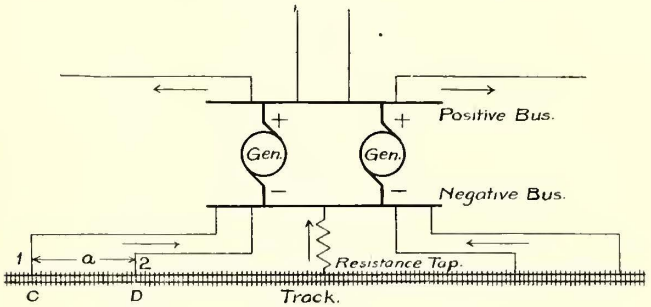


Fig. 4—Electrolysis—Insulated Negative Feeder System

gradient between *C* and *D* will, in general, be less than this figure, depending on the amount of load originating between these points. The average value of this can be determined from the car schedule. Assuming it to be 0.7 volt, for example, the total drop between *C* and *D* will be 0.84 volt. The total drop on feeder No. 2 will therefore be 15 — 0.84 = 14.16 volts. From this value and the current assigned to this feeder its cross-section can be calculated, the length being, of course, already fixed.

We proceed in a precisely similar manner for the other feeders and the resistance taps near the power house. Sometimes the cross-section of the feeder as thus calculated will be too small to carry the required current without overheating, and when this is the case the feeder must be made sufficiently large to carry the current and an additional resistance inserted, preferably at the power house, to give the necessary voltage drop.

When this calculation is completed we are ready to determine whether the original assumption made in regard to voltage drop on the first feeder was the one that would give approximately the most economical installation. To determine this we sum up the total cost of the feeders installed, and determine the proper annual charge, including interest, taxes and depreciation, and also calculate the total annual value of the energy lost in the feeders and resistance taps. If these are approximately equal, the voltage drop assumed was the proper one. If, however, the annual charge on the feeder system is less than the cost of lost energy,* the voltage assumed is too high and vice versa, and a correction must be made. This correction can be very easily and simply applied without recalculating the feeder system, as in the first instance. For example, if the annual cost of the feeders is found to exceed that of the energy lost by 20 per cent, we must increase the mean voltage drop by 10 per cent and reduce the area of the feeders by about 10 per cent, which change will bring the cost to approximate equality, the condition for most economical installation. If E_1 is the original voltage drop calculated for any given feeder and E_2 is the weighted mean voltage drop for all feeders, then the increase of voltage on any feeder being $1/10\ E_2$ we must reduce the cross-section of the feeder by the factor

$$\frac{E_1}{E_1 + \frac{E_2}{10}}$$

The value of E_1 in each case is the initial voltage drop calculated for that particular feeder, so that each feeder is corrected by a different factor. When the correction is made in this way there is no change in the potential gradient assumed for the rails.

The simplicity of this system as compared with the negative booster system is obvious. In fact, the chief objections that have been urged against the negative booster system are overcome, namely, the cost of booster equipment, together with elaborate switchboard apparatus for controlling it, the space occupied by the boosters, which is out of all proportion to their kilowatt capacity because of the large number of small machines required, and, finally, the time and expense involved in caring for these machines. In the matter of power loss there will in most cases be an advantage in favor of the plain insulated feeder system. In either case the loss in the cables would be approximately the same, since all but the very short cables would be designed for maximum economy. The difference in power loss would be approximately the difference between the losses in the boosters and the loss in the resistance taps. The efficiency of such small motor-driven boosters operating at a low load factor would hardly exceed 50 per cent, so that if the loss in the resistance taps is less than 50 per cent of the total feeder loss, the latter plan would give rise to even less power loss than the booster method.

Against these decided advantages of the resistance tap method over the booster method may be set the possible objection that the former is less flexible than the latter and cannot be made to respond as readily to meet the exigency of shifting loads. This objection is apparent rather than real, since the really important consideration is to take care of average normal conditions, and this the system will do automatically if properly designed. Abnormal conditions, such as blockades or other temporary bunching of the load in one locality, are usually of so short duration that such disturbances in the rail gradients as would result therefrom would have no appreciable influence on the electrolysis problem. This method is a thoroughly practical one, and if properly installed can be made to reduce potential gradients in the rails to any desired degree, and under many circumstances it is the most economical effective means that can be installed for reducing electrolysis.

Several modifications of these feeder systems may be used under certain conditions, but space does not permit a discussion of them here. A combination of the two insulated feeder systems above discussed may also be

*More precisely, the condition for maximum economy is that condition which gives a minimum total annual cost. Under most conditions this will be practically the same as the conditions of equality of cost of lost energy and annual charge on the copper.

used in some cases, as, for instance, in case of a number of comparatively short feeders going to nearby points, and one or two very long feeders extending much farther from the station. In such a case the plain insulated feeder system may be applied to the district near the power house and a booster inserted in the long feeder to provide the voltage necessary to bring the average current flow in the cable up to the most economical value.

CONCLUSIONS

The insulated feeder system is available for general application, is comparatively cheap to install and introduces but slight complication into the operation of the system. It is possible by the proper application of this method to reduce the potential gradients in the earth to almost any desired degree at a comparatively small cost, and it can consequently be made very effective in relieving electrolysis troubles. In special cases, however, it may sometimes be better, where conditions are favorable, to combine one of these methods with either the insertion of a moderate number of insulating joints in pipes or with the use of a very limited amount of pipe drainage, the insulated feeder system being applied to reduce potential gradients throughout the system to a very low value and one or the other of the previously mentioned auxiliary systems used to practically eliminate any residual electrolysis that might still remain.

Insulated feeder systems of the general type described have in recent years been advocated by a number of engineers in this country, but their application has been limited to a few instances, and for the most part to rather special conditions, and for this reason no adequate experimental data as to their actual performance under practical conditions of service have been published. The writers have recently had opportunity to carry out somewhat complete investigations on feeder systems of this character, and the results of these investigations will be published in the near future. To those desiring to study in greater detail the principles so briefly referred to in the foregoing paper we refer to the following technological papers issued by the Bureau of Standards, which can be secured at any time upon request: "Methods of Preventing Electrolysis from Street Railway Currents," "Special Studies in Electrolysis Mitigation," and "Electrolysis from Street Railway Currents and Its Prevention."

COMMITTEE ON LIFE OF RAILWAY PHYSICAL PROPERTY

President J. H. Hanna of the American Electric Railway Engineering Association has appointed the following members to represent that association on the joint committee with the American Electric Railway Accountants' Association on the life of railway physical property: Martin Schreiber, Public Service Railway of Newark, N. J.; R. B. Rifenberick, Detroit United Railway, and Edwin Gruhl, Milwaukee Electric Railway & Light Company.

A recent meeting of the Boosters' Club of the public utilities of New Albany, Ind., including the Louisville & Northern Railway & Lighting Company and the Louisville & Southern Indiana Traction Company, was largely devoted to a discussion and description of the new block signal installation on the Louisville & Northern between Watson Junction and Sellersburg, Ind. The signaling system covers a distance of 4.13 miles. In 1914 signal equipment will be installed between Watson Junction and Jeffersonville, Ind., and ultimately all of the lines of both of the traction companies referred to will be protected by interlocking automatic signals.

PROGRAM OF MIDYEAR MEETING

As already announced, the midyear meeting of the American Electric Railway Association will be held in New York on Jan. 29-31. Jan. 29 and Jan. 31 will be given up to meetings of the various committees, and the general meeting of the association will be held on Friday, Jan. 30, in the Engineering Societies Building, where the meetings of the various committees will also be held. The annual dinner will be held at the Waldorf-Astoria on the evening of Jan. 29.

PROGRAM OF GENERAL MEETING

The program for the general meeting on Jan. 30 is being arranged by the subjects committee of the American Association. Although it is not as yet complete in all its details, it will include:

An address by Halford Erickson, of the Railroad Commission of Wisconsin, on "The Economic Aspects of Regulation Compared with Profit Sharing with Municipalities."

An address by F. W. Hild, general manager Portland Railway, Light & Power Company, Portland, Ore., on "The Effect of Rate of Fare on Riding Habit."

An address on "Inherent Hazards of the Electric Railway Industry," by a speaker whose name will be announced later.

An address on "Present-Day Influence of Labor on Legislation," by a speaker whose name is yet to be announced.

The report of the committee on the joint use of poles, which was referred back to the committee on that subject by the Atlantic City Convention, with instructions to secure the criticism, comment and objections of member companies thereto and embody them in a supplemental report.

A report by Martin Schreiber, acting for the committee on company sections and individual membership, dealing with the question of company sections.

ARRANGEMENTS FOR DINNER

The arrangements for the annual dinner are in the hands of a joint committee of the American and Manufacturers' associations, the names being published in a recent issue of this paper. President Black of the American Association will preside. The speakers already selected are: Guy E. Tripp, chairman board of directors Westinghouse Electric & Manufacturing Company, and H. W. Anderson, of Richmond, Va. In addition there will be another speaker of national reputation. President Cornell S. Hawley, president of the Manufacturers' Association, has also been invited to make remarks.

The committee in charge announces that the dinner will start promptly at 7 p. m. The tables seat eight persons each. Members of the American Association will make their reservations with Secretary Burritt; members of the Manufacturers' Association will make their reservations with Secretary McConnaughy. The price of the tickets will be $10 each. A letter containing full information and inclosing the necessary blanks, etc., will be sent to each member in ample time.

CORNELL REUNION

As a result of the dinner held at Atlantic City during the last convention by the Cornell men who were in attendance at the big meeting, a committee was appointed to assemble the Cornell men at the association's midyear dinner. The committee consists of Prof. Henry H. Norris, chairman, and R. E. Danforth, Thomas Farmer, Jr., H. C. Holloway and E. A. Stillman. Chairman Norris would like to have all Cornell men who are engaged in electric railway business, directly or indirectly, send their names to him at Ithaca, N. Y. He is also anxious to secure the names of those who will attend the dinner, so as to make seating arrangements.

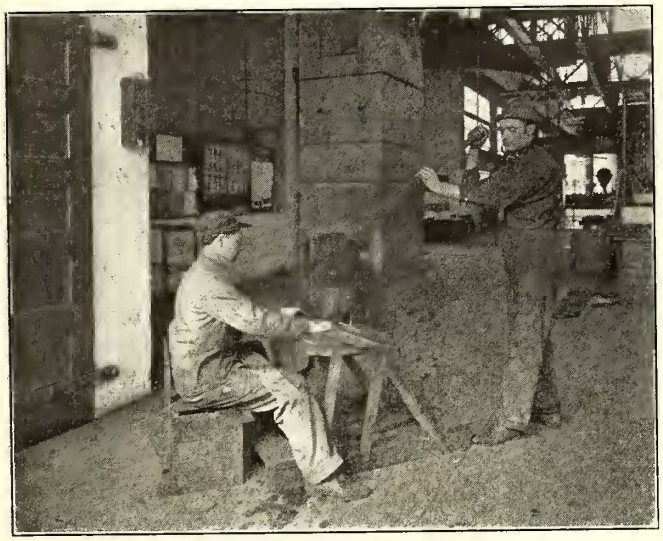
Shop and Equipment Practice

This Department Is Devoted to Short Articles of Especial Interest to Men in the Power Stations, Shops and Carhouses of Electric Railways

MANUFACTURING SIGN BOXES AND SIGNS

BY P. V. SEE, SUPERINTENDENT CAR EQUIPMENT HUDSON & MANHATTAN RAILROAD

Small car shops seldom have the opportunity to manufacture any article in such large quantities that the



Hand Punch for Making Signs

refinements of tools and machinery that are secured in factories can be adopted. At the Jersey City shops of the Hudson & Manhattan Railroad, however, the cost

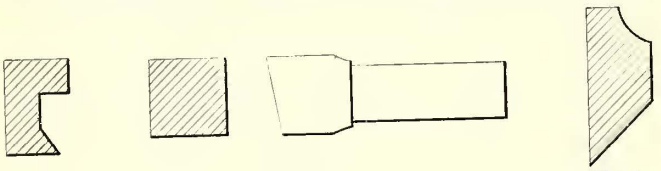


Fig. 1 Fig. 2 Fig. 3

Electric Ry. Journal

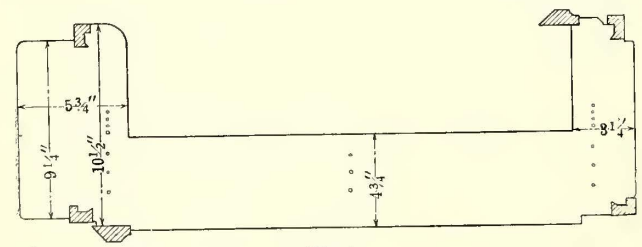
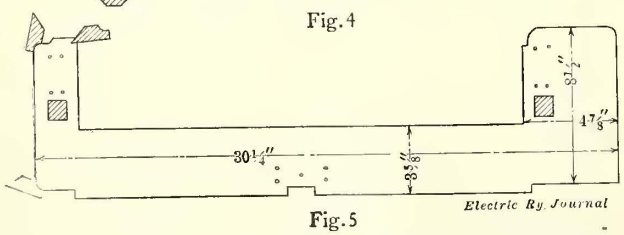


Fig. 4



Electric Ry. Journal

Fig. 5

Details of Dies and Applications of Same to Sign Boxes

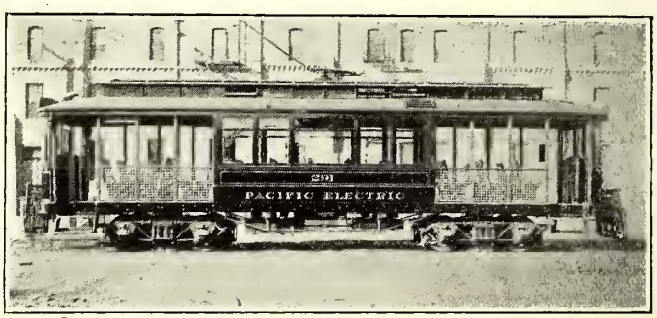
of making 400 sign holders and 2000 signs has been greatly reduced by the use of some very cheap dies.

An old sheet-metal geared hand punch was used for the work, as shown in the half-tone view. The dies were made from scrap tool steel left over from lathe tools which had become too short to use in the wheel lathe. This steel was annealed and rough-forged and then shaped and hand-filed. The edges of the die shown in Fig. 1 were so designed that the same die would work in various places on the box, so that it was used six times on each box. The die shown in Fig. 2, which was used twice on each frame, cut out three sides of a square and bent the metal at the same stroke. The three edges of the die shown in Fig. 3 were so designed that the die was used in ten places on each box. The applications of the dies are shown in the diagrams Figs. 4 and 5.

When the proper stops were placed on the punch the most ignorant laborer could be used to do the work. All the boxes were found to set together perfectly, and the dies were still in good shape after the job was finished.

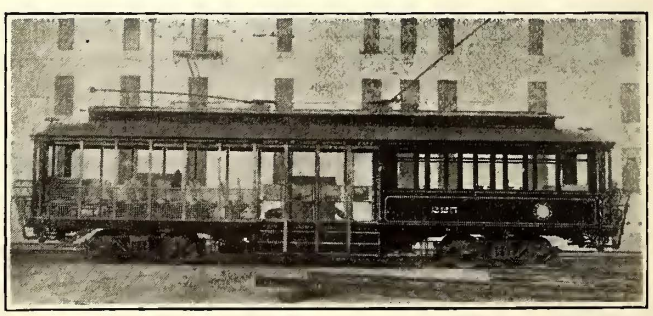
COMBINATION CAR REBUILT FOR PREPAYMENT SERVICE

The Pacific Electric Railway, of Los Angeles, Cal., has recently reconstructed one of its standard combination cars for center-entrance prepayment service.



Pacific Electric Railway—Center-Entrance Car Before Conversion

These cars are those used in local service, for which the company's standard in the past has been a California type of car with closed section in the center 14 ft. 8 in.

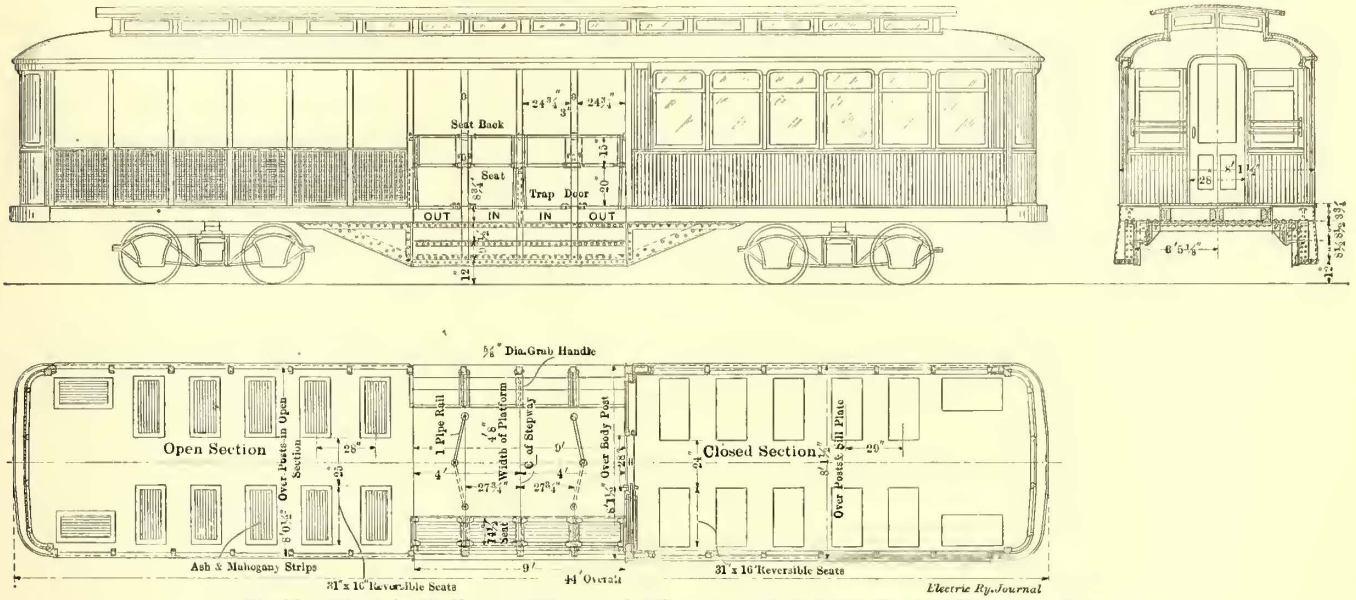


Pacific Electric Railway—Center-Entrance Car After Conversion

in length, with ten cross seats, and an open section at each end 12 ft. 2 in. in length over bumper, with six cross seats.

*[Articles on new methods and apparatus for publication in this department are solicited.—EDS.]

The halftone illustration of car No. 291 shows the present standard California type of car of the Pacific Electric Railway for local service, as described. The seating capacity is forty-four. The second halftone engraving, that of car No. 225, shows this same car converted for center-entrance prepayment operation. This center entrance has two entering and two exit gangways, and as the car is operated from either end, the entrance not in use is provided with collapsible seats of an ingenious pattern, to be described later.



Pacific Electric Railway—Plan and Elevation of Rebuilt Center-Entrance Cars

The car was converted by cutting it directly through the center and inserting a middle section 9 ft. in length, reinforced at the bottom by three plate girders, one at the center and one 2 ft. 4 in. each side of the center. A section and side elevation of this center platform with reinforcement is shown on one of the drawings, in which it will be seen that the angles forming the steps for each center entrance are part of the reinforcing structure, which is bolted to the side sills of each end of the divided car.

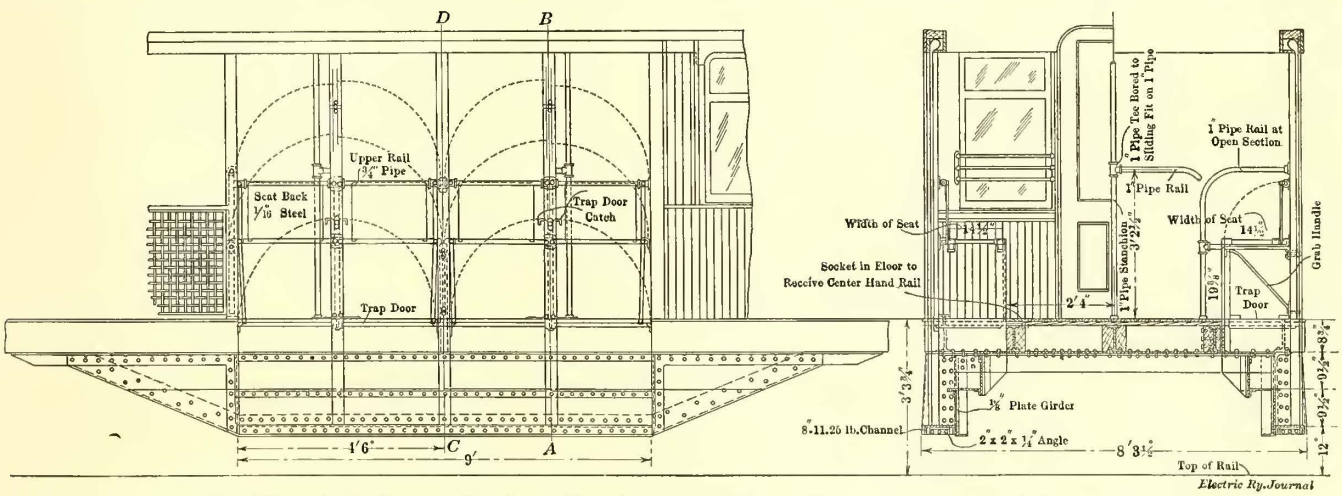
The platform arrangement is also shown. As will be seen, the two entrances in the center are separated on the platform from the two exits, one at each side, by sections of 1-in. pipe rail, which hinge to a center stanchion and can be swung around when the direction of movement of the car is changed. The four collapsible seats on the center loading platform opposite the steps are 27¼ in. in length, and with the flooring under them fold up vertically when not in use, as shown in the side elevation. The angle supports for these seats serve as grab-handles when the seats are not in use and are made of ⅝-in. pipe.

To reach the necessary height of the car floor, four steps are used, respectively 12 in., 9½ in., 9½ in. and 8¾ in. in height. The step tread adopted is of the Mason safety carborundum type. The car has been equipped with fixed headlights of the Crouse-Hinds pattern.

As yet only one of these cars has been reconverted, and as it is in trial service no plans have been made to change any other cars in the same way. It is expected that the cost of conversion if others were changed would be about $1,100 per car.

INSTANTANEOUS ELECTRIC WATER HEATER FOR CAR WASHING

Home-made water-heating devices of many descriptions have been employed in the car-washing departments of street and interurban railways and have usually involved the combination of a heater and a hot-water storage tank. Such a plant, however, was not considered practicable by the mechanical department of the Cincinnati Traction Company owing to



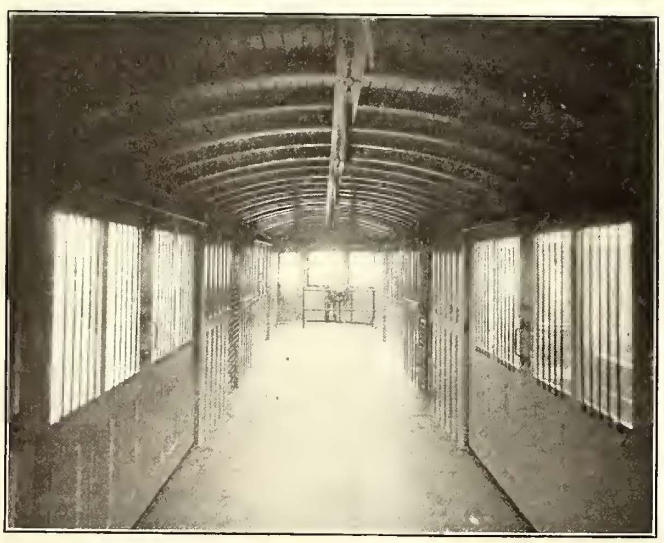
Pacific Electric Railway—Sections Showing Framing at Center Entrance of Rebuilt Cars

several controlling factors imposed by local conditions. Hot water was desired throughout the year, and therefore it could not be furnished by the steam-heating plant. Again, car washing was done in one end of the paint shop bay, so that a coal heater could not be employed unless it was installed at some outside point, and, finally, it was desirable to have hot water at a pressure, a condition which could not be obtained continuously with an ordinary coal-type heater with a tank. With these limits in mind a home-made electric water heater was designed and installed. Although the cost of heating water electrically was greater than by other methods, the device met all the requirements, and the quantity of current used was so small as not to make the cost prohibitive.

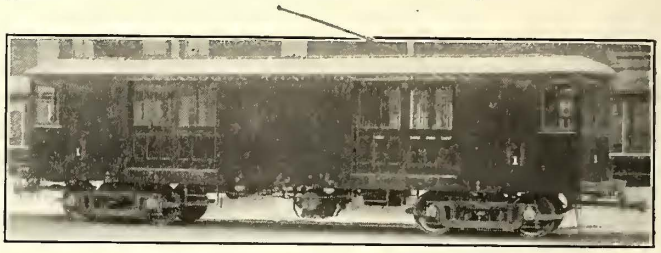
For all practical purposes this home-made water heater is instantaneous. It consists of a box 8 ft. long by 2 ft. square in section, built of 1¼-in. yellow pine. The box is lined with ¼-in. transite board to insulate the wood from the heater coils. Eight 17-amp electric-coil heaters are installed on the bottom and sides of the box, arranged in two circuits, with four heaters in each. These are supplied with energy through a direct connection to the 550-volt trolley by way of a knife switch, and they are sufficient to maintain a temperature of 210 deg. in the box. The heater coils on the bottom of the box serve as supports for the 1-in. wrought-iron pipe coils which are arranged in a rack four coils high and six coils wide. These pipes form a continuous coil which is connected with the city water supply at one end and to a hose connection at the other. When the valves provided at each end of the coil are open, cold water flows through and the heat maintained in the box by the electric heaters is sufficient to raise the temperature of the water to a point suitable for car washing before it reaches the hose connection. In actual service this heater has been found of ample capacity to supply four scrubbers with all the hot water they can use in a ten-hour day.

EXPRESS BAGGAGE CAR FOR CHATTANOOGA

The Chattanooga Traction Company has recently purchased from The J. G. Brill Company the baggage-express car shown in the two accompanying illustrations. A notable feature of this car is the great amount of glazing used. This will be seen from the construction of the double doors on each side and the windows at the ends. This arrangement naturally makes for the very light interior which is so well shown in the second illustration. The doors are barred, of course, to avoid breakage. This car is 40 ft. long over the crown pieces and 8 ft. 6 in. wide over the sills. Its general construction is of wood with a plain arch roof.



The Light Interior of the Chattanooga Express Car

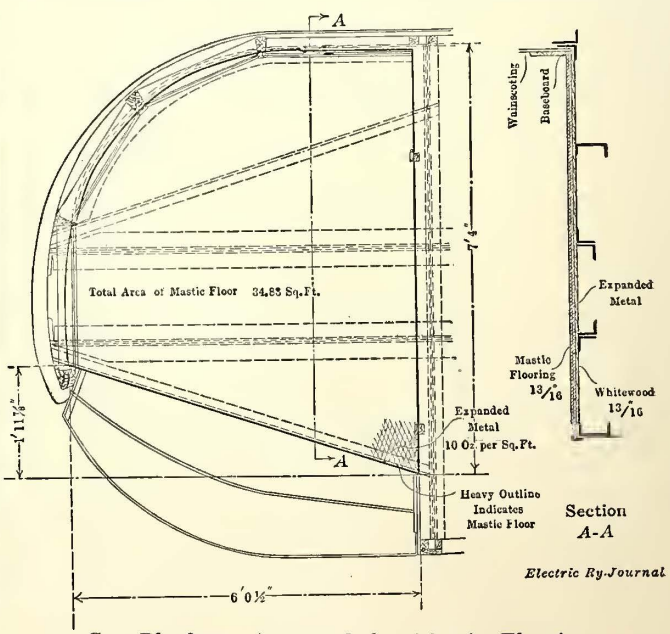


Side View of Express Car Showing Large Glazed Areas

The weight of the car body itself is 22,700 lb. It is mounted on No. 27 M.C.B.-1 trucks fitted with Carnegie rolled-steel wheels and operated with four GE-210 inside-hung motors. Other equipment features include Ohio Brass sanders, Tomlinson couplers and arc headlights. This car is a good example of high-grade equipment for other than passenger service.

TWIN CITY CAR DETAILS

The Twin City Rapid Transit Company, which maintains a car-building plant, has embodied in its cars several constructional features which are believed to be original with the company. For example, in the flooring which is planed and matched in the woodmill the useful wear is increased by placing the tongue and groove lower than usual. One sketch shows that the car wheels carry "squeak deadeners." These are round wooden blocks 4 in. in diameter and ⅞ in. thick, clamped on both sides of the wheel web near the rim. Canvas-rubber pads are placed under the blocks and the whole deadener is bound together by means of a ½-in. bolt. While the noise made when a car takes a crossing is not eliminated entirely by this muffler, it replaces the shrill squeal with a dull low-pitched rumble. The company is also trying other noise-muffling attachments, such as softer brakeshoes and canvas-rubber pads for insertion under the equalizer bar springs and even under the window sash.

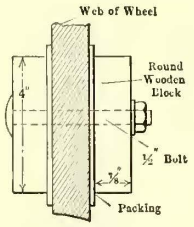


Car Platform Arranged for Mastic Flooring

Part of the trucks in use were made by the Baldwin

Locomotive Works, but at present all are made by the railway. These trucks are a light M. C. B. design. They are made complete with the exception of the journal boxes. General Electric motors (the standard now being Nos. 203 and 216) are used, but their riveted steel gear cases and all motor repair parts are made in the shops. The two sizes of Bessemer steel axles which suffice for the entire system have given absolutely no trouble from cracking. Truck parts, as well as other standard pieces, are made interchangeable and kept in stock so that a car injured in a collision can be repaired without delay by replacing damaged parts.

The rear platform of the Twin City cars, as shown in an accompanying drawing, is interesting in several ways. It is 6 ft. long with double steps set within the line of the side sills, the deep channel knees being set close together. Between the knees are floor supports made by two pairs of light angles. This steel frame carries a whitewood flooring on which a mastic flooring is troweled. The mastic is held together by 10-oz. expanded metal. The steps are of the standard pattern made up of corrugated strip in the shops. At the foot of the steps are four woven-wire safety gates which are operated by the motorman. Aside from these features the platform equipment is standard, including, for the interurban cars, red tail lamps.



Details of Squeak Deadener

Two car improvements now under way are of particular interest. The sheet-iron covers of the controllers on several hundred of the older cars are being replaced with wooden ones of oak veneered on both sides and supplied with a poplar foundation. These covers will eliminate frequent cause of short-circuits. Another safety installation is the equipment of all cars with a simple switch cabinet of transite board built on a wooden frame. This cabinet is located close under the hood against the front bulkhead of the car and is ventilated to the roof. It contains the circuit-breaker, pump switch, fuses and lamp switches.

DETROIT UNITED TRAIN NUMBER SIGN

A novel illuminated train number sign for the interurban cars of the Detroit United Railway Company, Detroit, Mich., has been designed by its mechanical department within the last year. The novel features include illuminated numerals, which may be easily changed to any series of three numbers in a cheap yet substantially constructed sign box, and the method of mounting this box in the car window.

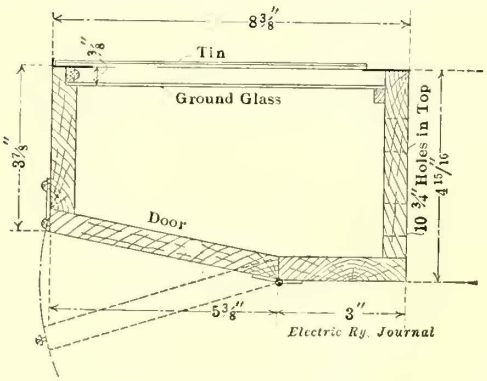
Essentially the sign consists of a box 5 in. wide by 8½ in deep by 23¾ in. long, constructed of ⅝-in. poplar. The back of the sign, which tapers from 5 in. at the top to 3⅞ in. at the bottom, is provided with a 5⅜-in. door. The front is covered with 18-gage tin, through which three openings, 6½ in. by 6⅜ in. in size, have been cut. Each opening is provided with guides to take the number slides. Just back of this tin frame, and separated from it by an air space of ⅜ in., is a ground-glass partition which incloses the lamp compartment and serves as the illuminated background for the train numbers when in position in the metal front. The interior of the box is painted white, and a 16-cp lamp mounted near the center of the top supplies sign illumination. Properly to distribute the light to the three numbers, a piece of close-meshed wire screen slightly larger than the vertical cross-section of the lamp is attached to the top of the sign between the lamp and the number plates.

In order to prevent the numbers from being placed in the sign incorrectly a rivet is set in one metal guide of each pair 2 in. from the bottom. The numbered slide, which is similar to an ordinary metal stencil, is notched on one side up 2 in. from the bottom and is 5/32 in. wide. This simple arrangement makes it impossible to

Back View of Illuminated Train Number Sign

insert numbers in the sign box in the reverse position. Ventilation is provided by ten ¾-in. holes bored through the top of the box.

When mounted in the cars these sign boxes are placed in the upper sash to the left of the front vestibule, being hinged to the sash rail at the bottom and hooked to the upper rail. This arrangement permits the sign to be unhooked and dropped so that the numbers may be changed as required by the different runs. The sign lamps receive their energy from the car-lighting circuit, being in series with the lamps in the car.



Cross-Section Through Box

Illuminated Train Number Sign on Interurban Car

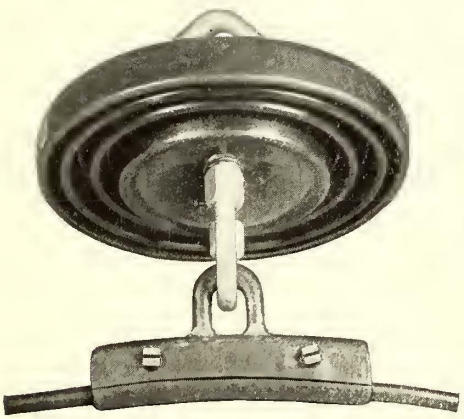
Each box is provided with a receptacle and the front vestibule has a cord and plug so that electrical connection may readily be made. A case containing a series of ten numbers, three of each kind, letters "W" and

"X" for work train and extra, and one blank slide, has been placed conveniently in the motorman's cab of each car. A view and sketch of this sign are shown in the illustrations.

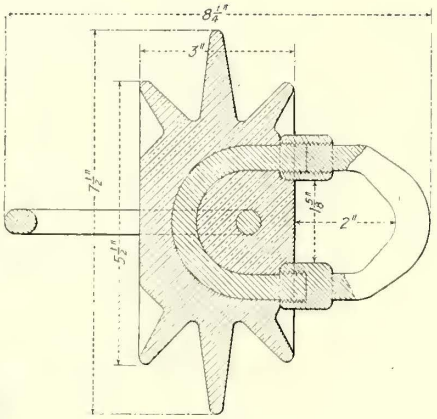
LINE AND STRAIN INSULATORS

The line and strain insulators illustrated herewith were invented by Louis Steinberger and are being put on the market by the Electrose Manufacturing Company, Brooklyn, N. Y. Each insulator is made up of an integral and uniformly solid mass of insulating material with a strain or suspension member embedded therein. The latter is interlinked in such a manner that even if all the insulating material should be removed or destroyed, it would be impossible for the line to fall to the ground.

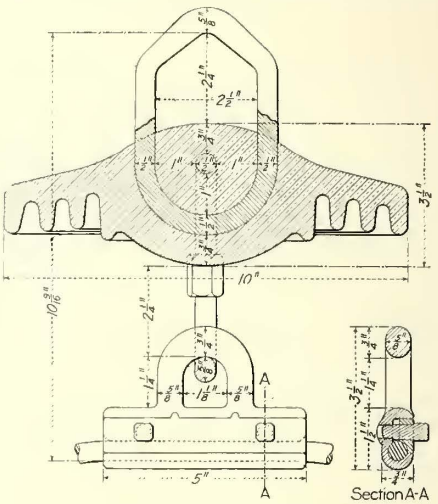
The line clamp has a smooth bore for gripping the wire or cable, thereby preventing crystallization and the possible breaking of the conductor at or near the clamp. The clamp is designed to grip conductors of various diameters. It is light in weight, but it is sufficiently strong to break the conductor before any slippage can take place. The metal parts of these insulators are made of galvanized drop-forged steel.



Insulator with Clamp Attached



Strain Insulator



Section of Suspension Insulator

The disk strain insulators are made in sizes having diameters of 5½ in., 7½ in., 10½ in., 12½ in. and 14½ in., and the disk strain and suspension insulators in diameters of 8 in., 10 in., 12 in., 14 in. and 16 in. The accompanying table gives test values obtained with the 7½-in. disk strain insulator and the 10-in. disk strain and suspension insulator.

TEST VOLTAGES

	7½-In. Disk Strain Insulator. Volts	10-In. Disk Strain and Suspension Insulator, Volts
Line voltage	25,000	25,000
Rain arc value	55,000	55,000
Dry arc value	74,000	100,000
Puncture value, under oil	120,000	150,000

In addition to the excellent electrical characteristics of the insulators, they possess many desirable features from the mechanical point of view. There are no loose parts to be lost and no special tools are required for connecting or disconnecting the units. By means of a plain wrench, a nail or even a piece of wire two or more units may be connected or disconnected in a fraction of a minute.

The Topeka (Kan.) Railway was host to 350 employees at a recent company dinner. A performance at one of the Topeka theaters also was seen at the company's expense. Special cars were provided to take the employees between the theater and the banquet hall.

RAILWAY-CROSSING ACCIDENT STATISTICS COMPILED

In making an effort to ascertain wherein the responsibility for crossing accidents might rest, some observations were recently made by one of the railroads with offices in San Francisco. The observations were made in San Francisco, Oakland, Stockton, Lodi and Sacramento. The total of the pedestrians and drivers of teams and motor vehicles who crossed during the period of observation was 25,296. Of this number thirty-five stopped and looked in both directions before crossing, 8950 kept moving and looked in both directions, 1694 kept moving and looked in one way only, and 14,617 kept moving and looked straight ahead.

ELECTRIFICATION OF CHRISTIANIA-DRAMMEN RAILWAY APPROVED

The Norwegian Royal Commission on Water Power has recently issued a report on the question of the power supply for the electrification of the Norwegian railroads. At present there are 1850 miles of steam railroads in Norway, and, according to this report, the maximum demand of all these lines, if electrified, would be about 85,600 kw and the annual consumption 118,000,000 kw-hr. The State owns twenty-nine waterfalls, which could develop more than 500,000 kw. Of these falls, thirteen have been purchased expressly for railway supply. It is estimated that the railways in the southern half of Norway could be supplied almost entirely from one large station to be erected at the Nore falls west of Christiania. The cost of this development is put at $17,250,000, or about $150 per kw, for a maximum load of 117,000 kw, and the cost of supply at $20 per kw per annum. It is intended to develop all the power stations at fifty cycles, three-phase, and to utilize a large proportion of the available energy for power and lighting supply. Calculations on the relative cost of steam and electric traction show that all that the existing railways could afford to pay for electrical energy would average only 0.66 cent per kw-hr. for the same total operating costs as with steam, or less than $10 per kw per annum as compared with the generating cost of $20 per kw per annum estimated above. On certain lines with comparatively dense traffic electrification would be economical at the latter power cost, and in view of the rising price of coal and the economic advantage to the nation of a universal power supply, the commission recommends its gradual introduction.

LONDON LETTER

(From Our Regular Correspondent)

Preliminary arrangements have been made for a tramway and light railway exhibition in the Agricultural Hall in 1915. The exhibition will be promoted by the *Tramway and Railway World*, which was responsible for the exhibitions of 1900, 1902 and 1905. Since 1905 there have been no tramway exhibitions.

The highways committee of the London County Council has reported that it has been impressed for some time with the necessity of linking the existing dead-end termini and of otherwise consolidating the Council's tramway system. It expresses the opinion that the lack of success of the many schemes which have been put forward from time to time has been due partly to the failure of the Council to submit to Parliament a comprehensive scheme of development which could be defended in its entirety as essential for the efficient working of the undertaking. The committee has directed the chief officer of tramways, the comptroller, the chief engineer and the appraiser to prepare a report on the subject. Application for sanction of the running of a large number of trail cars on certain of the southern tramways has been made to the Board of Trade. The idea of the highways committee is to provide 150 new trailers and equip 200 of the existing electric cars with couplers. It is also reported that in consequence of the falling off in tram receipts as a result of motor-bus competition reductions have been obtained in the assessment of the tramways in nearly all the boroughs affected. A proposal for the operation of "express" tramcars on the "skip-stop" for the suburbs is also being considered. At present the speed of the cars averages 9 m.p.h. The highways committee has decided to install automatic chocolate machines on the Council's tramcars running from the Hammersmith depot for a period of six months as an experiment. Another recent development of London traveling is the all-night bus service, and the first owl cars were run a few months ago as an experiment. The first service was from Cricklewood in North London to Liverpool Street via Piccadilly Circus and the Strand. A second all-night service, covering a different part of the city, has just been started.

The annual report of the Morecambe Tramway is interesting on account of the fact that it is the only tramway in Great Britain which is being operated by petrol-driven tramcars. At the annual meeting the secretary stated that had it not been for these cars the tramway would have gone into bankruptcy. During the year the cars traveled 52,065 miles and carried 424,136 passengers. A dividend of 3 per cent has been declared.

J. M. McElroy, general manager of the Manchester Tramways, is preparing a comprehensive report dealing with the transportation question of Manchester. Some of his recommendations will be based on his recent study of electric railway practice in the United States. The tramway system in Manchester is very profitable, but there are serious complaints of insufficiency of traveling facilities, and there is great congestion of traffic in certain streets. Many accidents, also, occur in Manchester to passengers while boarding or leaving cars, and the chief constable and the chairman of the watch committee have visited several of the large Continental cities to investigate the traffic methods adopted in these places, with a view to minimizing accidents. The result of their investigations will be embodied in a report to be issued simultaneously with that of Mr. McElroy. With a view to warning tramway passengers of the danger of accident as they are leaving the cars, the tramways committee has recently placed a notice on the cars warning people about passing vehicles as they alight from the cars.

Three provisional orders to be presented to Parliament by the Corporation of Glasgow ask powers for considerable engineering constructional work and for new governing regulations within the city. With respect to tramways there are twenty-eight separate proposals, most of them either of a minor character or prolongations of existing routes, varying in length from a few furlongs to about 3 miles and extending in the aggregate to 21 miles of double track. Perhaps the most interesting proposal is that the Corporation should run lines across the proposed new Clyde bridge close to the present Broomielaw Bridge, powers for the construction of which have also been asked. The Corporation also desires running powers over the Airdrie and Coatbridge tramways, so that its cars may connect directly with these towns. Included in this order there is also a proposal for the construction of a bridge across the River Kelvin for carrying tramways, of certain new streets, and of several short railways giving the railways working connections with Merklands Cattle Wharf.

The tramway committee of the Edinburgh Council has recommended that a service of motor omnibuses should be procured for a southern route in the city, giving a ten minutes' service with six buses, the probable cost being £5,100.

The estimates of the engineer in connection with the ambitious scheme of tramways being promoted by the urban district councils of Wombwell, Wath, Bolton-on-Dearne and Thurnscoe, under the title of the Dearne Valley Light Railway Board, are now available. The capital cost of the traction undertaking is estimated at £151,891. The cost of construction and equipment and acquisition of land and buildings is estimated at £90,046. The estimate of the cost of constructing the permanent way is based on three scales of cost per mile—£2,640, £3,360 and £4,880—according to the changing character of the districts traversed. Rolling stock is put down at £22,560, which, supposing the cars to cost an average of £800 apiece, would make provision for twenty-six. This, over the length of route proposed, would be adequate for a ten to fifteen minutes' service over all the route. If the scheme is carried out in its entirety, there will be direct intercommunication with the towns of Barnsley, Mexbrough, Rotherham and Sheffield, with provision for linking up with Doncaster at Thurnscoe. It will be possible to have through running on the tramway systems of the Corporations of Barnsley, Rotherham and Sheffield, as well as on that of the Mexbrough & Swinton Tramway.

The process of linking up the tube railway system with the various main line termini in London has been completed by the extension of the Bakerloo line to Paddington Station. All the principal London stations are now in direct communication with every important district in the metropolitan area. The new tube station has been constructed under the railway approach on the arrival side, and access to the platforms is by escalators. The rise is 39 ft. 4 in. and both the up and down escalators have been built in a large single tunnel with a flight of steps between them. The railway is being continued from Paddington to Queen's Park, a distance of about 2½ miles. It is expected that this work will be completed by Jan. 15. Escalators will be installed at all three stations on this extension—Warwick Avenue, Maida Vale and Kilburn Park—and it is proposed to construct escalators at Tottenham Court Road, Piccadilly Circus, Trafalgar Square, and at the Oxford Circus station of the Central London Railway Company.

With a view to bettering the service on the Central London Railway during the busiest hours, changes have been introduced in the running of the trains. In future from about 8 a. m. to 10 a. m. and from 4 p. m. until about 7 p. m. one station will be omitted by all trains of the company. The stations through which trains will run without stopping are restricted to three, Lancaster Gate, Queen's Road and Holland Park. Another great improvement to be carried out is the removal of the British Museum station to a site next to that of the Holborn station on the Piccadilly tube. The distance between the stations has long been a source of inconvenience. The new stations will be connected, and there will be "glides" to and from the platforms. The through journey from Piccadilly and stations west of it to the Bank and the city generally will be greatly shortened.

Within three months electric trains will be running on the London & North-Western Railway line between Willesden and Earl's Court. This is the first section of the company's electrification scheme to be completed. The work on this stretch of line is now virtually finished, and within a few weeks the new rolling stock will be delivered.

A. C. S.

News of Electric Railways

Company's Side in Indianapolis Arbitration

The Indianapolis Traction & Terminal Company on Dec. 22 commenced the presentation of its side of the case in the hearings before the Public Service Commission of Indiana, which body is sitting as an arbitration board to decide for a term of three years the wages and working conditions of the employees of the company. W. H. Latta, attorney for the company, introduced as witnesses retail grocers from different parts of the city, representing all classes of trade. These men testified that in general the prices of foodstuffs are very little higher than five years ago, but said that people insist on having everything in packages in preference to buying in bulk at a much cheaper rate and require 60 per cent of their purchases delivered. It was shown that delivery service adds 8 to 10 per cent to the cost of the provisions thus purchased. It was shown by some of the grocers that the increase in the price of meats applies particularly to the choice cuts and has been brought about by the increased demand for these cuts, and that there has been little, if any, increase in the price of the cheaper cuts. Canned goods were shown to be selling at about the same price as in the last few years, but it was stated that the quality was better. Witnesses testified that vegetables were much higher out of season than in season, but that their sales of these vegetables were larger when out of season.

The credit system was blamed by the grocers for inducing people to overbuy and also to purchase many things they do not actually need. The owner of the largest retail shoestore in the state testified that just as good wearing shoes could still be purchased for $3.50 as for $5, $6 or $7, but that they did not have the same "style," and as the working people now insist on buying much more stylish shoes than formerly, they pay the increased price for style and not for service.

A member of the City Council of Indianapolis, who is connected with one of the large clothing stores, testified that clothing prices have not advanced materially in the last twenty years, but that more high-grade goods are manufactured and sold now than formerly, and the tendency of the people is to dress better. He stated that a street car man's uniform costs $9 to $10, which is a dollar or so higher than a few years ago, due to the increased prices of blue cloth. Rental agents testified that the rental prices of medium-priced houses have not been materially increased during the last five years.

The company then filed reports with the commission showing the number of hours worked by the motormen and conductors at the different carhouses, as compared with what the men might have earned if they had not taken time off. At the College Avenue carhouse the motormen could have earned an average of $75.68 per month; the actual earnings averaged $70.44. The average earnings of the conductors at this carhouse if they had worked full time would have been $72.81 a month; actual earnings averaged $64.74. At the Louisiana Street carhouse the average actual earnings of the motormen were $60.02 a month, although the schedule called for a possible earning of $73.01. The conductors could have earned $70.10, but their actual average on account of time off was $57.37. At the West Washington Street carhouse the motormen actually averaged $63.98 a month, against a possible average of $74.27. Conductors at this carhouse actually earned an average of $61.67, whereas their possible earnings would have averaged $71.74 a month.

In order to bring testimony to bear on the contention made by employees that power house and shop men are not receiving the prevailing rate of wages, officials of other utilities of the city of Indianapolis appeared as witnesses for the company. Mr. Darrow, general manager of the Merchants' Light & Heat Company, testified as to the scale of wages paid the employees of that company. Under the chief engineer there is an assistant engineer in charge of each power house, receiving $29.25 per week. Other power station engineers are paid $18, $19 and $22 a week; firemen, $15 and $16 a week; switchboard men, $12 to $15 a week; turbine men, $15 to $18 a week; ash and coal handlers, $14 and $15; watchmen $10.50. The men work twelve hours a day. Mr. Darrow said that his company is able to get competent men to operate its plants for these wages. The West Washington street plant of the company develops about 15,000 hp.

Thomas A. Wynn, vice-president of the Indianapolis Light & Heat Company, testified that his company operates two power stations in the city, generating approximately 17,000 kw at each plant. The general supervising engineer of the company receives $200 a month. At each of the power stations the chief operating engineer receives $150 a month; assistant engineer, $110 a month; engineers, $90 a month; switchboard operators, $70 a month; substation operators, $65 a month; firemen, $60; repair men, $85; boiler washers and ash and coal handlers, $55; head firemen, $70; oilers, $60; laborers, $2 a day.

Charles H. Hurd, vice-president of the Indianapolis Water Company, read the scale of wages maintained in the power house of that company, as follows: chief engineer, $150 a month; assistant engineer, $100 a month; engineers, $80 and $83.33 a month; head oilers, $67.50; oilers, $64 and $60; head firemen, $75; firemen, $70; assistant firemen, $66; repair men (machinists), $75; common laborers on construction work where they do not work steadily, 20 cents an hour.

L. M. Clark, master mechanic of the Indianapolis Traction & Terminal Company, testified that about 160 men are employed in the West Washington Street shops of the company, and that during the six years he has been master mechanic there has never been any difficulty experienced in obtaining competent workmen at the rate of wages paid by the company.

Charles Hogate, chief engineer of the two power plants of the company, stated that the day men worked eleven hours and the night men thirteen hours, and that the shifts were exchanged every two weeks. The main load is carried by the new power station at West Tenth Street, the West Washington Street plant being operated during the peak loads and shut down from 8.30 p. m. to 5 a. m. Mr. Hogate stated that there was no dissatisfaction in the power stations prior to the recent labor troubles, and that he has always been able to obtain and hold competent men at the present rate of wages.

Harvey G. Shafer, superintendent of the Nordyke & Marmon Company, a large manufacturer of machinery, automobiles, etc., testified that at that plant pattern makers received 30 to 40 cents an hour, machinists 25 to 32½ cents, helpers 22½ cents, carpenters 25 to 31½ cents, painters 25 to 37½ cents, laborers 17½ cents up, firemen 21 cents, toolmakers 32½ to 40 cents an hour. This plant is operated as an open shop.

Eugene Darrach, treasurer of the Interstate Car Company, testified that his company pays the following wages; foreman blacksmiths, $25 a week; blacksmiths, 35, 29½, 27½, 25 and 22 cents an hour; blacksmiths' helpers, 19 to 22 cents an hour; laborers in car department, 17 to 20 cents an hour; laborers in foundry, 20 to 21 cents. Car builders average about 40 cents an hour; mill hands, 22½ to 27½ cents; helpers, 19 to 21 cents; laborers, 19 to 20 cents.

Foremen of the different carhouses of the company testified on Dec. 23 that prior to the strike they had never heard of any complaints from the men as to the way they were being treated by the officers of the company, and that when labor agitators were in the city and talk of a strike was started many of the men went to the foremen and expressed themselves as not being in favor of any such action. The foremen explained to the commission the method of assignment of runs, the revolving board for the extra men, etc. They stated very positively to the commission that the discipline among the men since the strike and the formation of a union has not been nearly so good as prior to that time, that extra men did not report on time, and that regular men who used to "ask" off now told the foremen when they intended to lie off.

On account of the Christmas holidays, the commission adjourned after the hearings of Dec. 22 and Dec. 23 until Dec. 29, when the company continued the presentation of its testimony.

The business men of Indianapolis have issued a statement, "Indianapolis Industrial Condition," in which they have set forth the facts in regard to labor conditions in Indianapolis, in an effort to set the city right before the country.

Annual Report of the Interstate Commerce Commission

The twenty-seventh annual report of the Interstate Commerce Commission dated Dec. 15 was sent to Congress on Dec. 19. A number of matters of direct interest to the officers of electric railways are contained in the report. Referring to the case of the commission against the Omaha & Council Bluffs Street Railway, which was followed from time to time in the ELECTRIC RAILWAY JOURNAL and involved an order of the commission reducing rates for the transportation of passengers from Council Bluffs to Omaha on a street railway operated between the cities, the commission says:

"In deciding that the order of the commission was void for want of jurisdiction the Supreme Court held that the act to regulate commerce does not apply to street railways, even though they cross State lines, where passengers are the only traffic carried and the railway serves but one community."

Under the heading "Division of Carriers' Accounts" the commission says:

"A system of accounts for telegraph and cable companies has been completed and will be made effective Jan. 1, 1914. The remaining classifications to complete the systems of accounts for electric railways, express companies, and sleeping car companies are still in preparation, substantial progress having been made during the year. A list of the accounting classifications of the commission, so far as completed at that time, was given in the last report, and it is considered unnecessary to repeat the information here.

"The act to regulate commerce prohibits the destruction of any accounts, records, or memoranda of carriers, except upon specific orders of the commission naming the records that may be destroyed and prescribing the length of time such records shall be preserved before their destruction. Prior to July 1, 1912, such orders had been issued applying to steam roads, express companies, and sleeping car companies. During the past year similar orders have been issued applying to electric railways and water carriers."

Under the heading "Investigation of Accidents" the commission says:

"In previous reports the commission has recommended legislation requiring the standardization of operating rules. It is vital to the safe movement of trains that rules shall be explicit and uniform in character, so that they may be easily understood and that there may be no doubt as to their application. To this end federal legislation is necessary. Such legislation also should require proper supervision of employees to insure that the rules are obeyed, as well as systematic instruction and examinations at stated intervals to make certain that no employee is permitted to be in a responsible position unless he is thoroughly familiar with his duties and competent to perform them."

Under the heading "Valuation" the commission outlines the plans which it has adopted for carrying out the provisions of the act of March 1, 1913, providing for the valuation of the property of all common carriers subject to the act to regulate commerce. Reference is made to the division of the county into districts for the purpose of facilitating this work. As to the preliminary method of procedure the commission says:

"The present plan is to select a railroad in each one of these divisions which can be valued in an experimental way. An attempt will be made to choose railroads of different classes so that as great a variety of problems will be presented as possible. This initial work will be undertaken with deliberation, and no attempt will be made unduly to expand or hasten operations until the result of these preliminary studies can be appreciated. After a few months of this kind of work in different parts of the country and under varying conditions the commission and its engineers will better understand the exact difficulties which must be met and the methods by which the work can be prosecuted to the best advantage. To make more certain of its ground the commission referred its scheme of organization and its plans for the beginning of this work to a committee consisting of John Skelton Williams, Charles F. Staples, Henry C. Adams, Edward W. Bemis, and Oscar T. Crosby. This committee, after mature consideration, approved our plans with certain suggestions for modifications, most of which have been adopted."

In the recommendations which it makes the commission says in part:

"We recommend that the commission be authorized to make orders, after investigation, respecting the construction and maintenance of the physical properties of railroads engaged in interstate commerce and rules and regulations pertaining to the use and operation of such properties. In previous reports the commission has indicated the desirability of legislation upon the subject of control over railway capitalization. Without attempting to add to the reasons previously advanced, we renew those recommendations."

The summary of casualties to persons on interstate electric railways reporting to the commission for the years ended June 30, 1913 and 1912, follows:

Item	1913 Killed	1913 Injured	1912 Killed	1912 Injured
Passengers:				
In train accidents	10	1,252	7	1,462
Other causes	26	1,789	28	1.400
Total	36	3,041	35	2,862
Employees on duty:				
In train accidents	18	154	14	144
In coupling accidents	1	19	2	18
Overhead obstructions, etc.	6	34	..	22
Falling from cars, etc.	8	138	13	96
Other causes	17	203	17	159
Total	50	548	46	439
Total passengers and employees on duty	86	3,589	81	3.301
Employees not on duty:				
In train accidents	..	5	..	11
In coupling accidents	..	....	..	....
Overhead obstructions, etc.	..	....	..	1
Falling from cars, etc.	1	19	1	11
Other causes	2	4	..	1
Total	3	28	1	24
Other persons:				
Not trespassing—				
In train accidents	1	8	..	7
Other causes	196	860	118	652
Total	197	868	118	659
Trespassers—				
In train accidents	..	....	..	....
Other causes	117	123	100	128
Total	117	123	100	128
Total accidents involving train operation	403	4,608	300	4,112
Industrial accidents to employees not involving train operation	19	798	24	550
Grand total	422	5,406	324	4,662

Increase in Accident Claims in Cleveland

At the regular meeting of the City Council of Cleveland on the evening of Dec. 16, a resolution offered by Councilman Lyman O. Newell, calling for a report on the number of accidents, deaths, amount of damage claims paid and cost of operating the cars of the Cleveland Railway during October, as compared with the same month in 1912, was referred to the street railway committee without instructions as to when to report on the measure.

It is stated that the figures in the company's office show that 3702 persons were injured during the first eleven months of 1913, or almost 1000 more than during the same time in 1912. Thirty persons were killed during the eleven months this year, it is said, while only seventeen were fatally injured during the same period in 1912. The amount paid for damage claims for the eleven months of this year was $245,819 and in 1912 the aggregate for the same time was $193,869. It is said that in September and October, 1913, the company paid $18,000 more in damage claims each month than for the corresponding months in the previous year.

Pennsylvania Railroad Contracts for Energy for Its Philadelphia Lines

The Pennsylvania Railroad has announced that the contract for the electrical energy for the electrification of its lines between Broad Street station, Philadelphia, Pa., and Paoli, and also between the Broad Street station and Chestnut Hill, has been let to the Philadelphia Electric Company. All of the local trains on those lines will probably be operated by electrical energy before the end of 1914 and the first electric trains out of Broad Street station are expected to be running about September next. The contract is for five years. At the beginning the Pennsylvania Railroad will use about 4500 hp, a minimum of 3750 kw, with a load factor of 25 per cent, being specified. The energy is to be furnished for the main line to Paoli and any addition or extension thereto, the railroad reserving the right to call on the Philadelphia Electric Company for any additional energy that may be necessary for its general system from time to time. With the completion of the present work as planned, the Pennsylvania Railroad will have 32 miles of electrified lines in the Philadelphia suburban district. The cost of the energy to the railroad for the Paoli line for the first year will be about $150,000.

The Philadelphia Electric Company now feeds a load of 35,000 hp daily for the Philadelphia Rapid Transit Company. J. B. McCall, president of the company, says that no change or enlargement beyond the usual will be necessary for supplying the energy for the Pennsylvania lines. At present, the Christian Street station of the Philadelphia Electric Company has equipment with a rated capacity of 115,000 hp, and during the next year the addition of steam turbines will bring this rating up to 187,000 hp. Until the contract between the Pennsylvania Railroad and the Philadelphia Electric Company is actually signed, none of its details will be available for publication.

Terms of Purchase of Presidio & Ferries Railroad, San Francisco, by the City

The Supervisors of San Francisco, Cal., acting on behalf of the city, and the Presidio & Ferries Railroad, represented by George Newhall, president and general manager, have agreed upon $300,000 minimum and $360,000 maximum as the price at which the property of the company is to be taken over by the city. The exact figure will be arbitrated within seventy-five days from the date of the contract, which was Dec. 3, 1913. The franchise of the company expired on Dec. 10. The terms of the contract follow:

1. The price to be between $300,000 and $360,000.
2. A board of arbitration to fix the value upon a reproduction cost basis, minus depreciation on all property purchased.
3. The arbitrators named are Thomas H. Mullins, the engineer who rebuilt the line after the catastrophe of 1906, representing the company, and the city engineer, representing the city. In case these arbitrators fail to agree in sixty days, the points in controversy are to be referred to A. M. Hunt, whose decision shall be binding on both parties to the contract.
4. The city was to pay $50,000 in cash on Dec. 10 to the company.
5. The balance agreed upon by arbitration is payable within sixty days from the date in which the agreement is reached.
6. In event of failure on the part of the city to sell sufficient bonds to complete the purchase within the stipulated time the company is either to purchase sufficient bonds to make up the deficiency, or find purchasers therefor, and agrees further that bonds so purchased shall not be sold within one year for less than par value and accrued interest.
7. The loop upon Larkin, Vallejo and Gough Streets, and upon three blocks of cable road, for which franchises were more recently granted to expire with the franchise upon the main system, with the proviso that the city should not be required to purchase track or other stationary equipment, is expressly omitted from those properties which the city is to purchase.
8. The city is to rent the carhouse at Gough and Filbert Streets for a period of one year at $150 a month, with an option of two more years on the same terms.

In addition a resolution was passed at the request of Mr. Newhall that provides that wherever possible and whenever necessary the city will give employment to present employees of the company. This is subject, of course, to the restrictions of the charter. Employees of the company will be obliged to take the usual civil service examinations, but having passed these, will have preference over other eligibles to the same position.

C. W. Barron and Colonel Williams on Corporation Publicity Methods

At a recent hearing before the Public Service Commission of Massachusetts concerning miscellaneous expenditures of the New York, New Haven & Hartford Railroad covering seven months preceding last July C. W. Barron, publisher of the Boston *News Bureau*, made some very interesting statements in regard to the publicity campaign of the company and read some correspondence which he had with the company in which he made suggestions concerning publicity work by public corporations that should be of interest to electric railway managers who are conducting such campaigns or have such campaigns in contemplation. The New York, New Haven & Hartford Railroad in November, 1912, sent to Mr. Barron's office certain data to be made up into the form of an advertisement for the newspapers. Mr. Barron objected to the advertisement or to the railroad spending money for any such advertising as was suggested. He declared it was not the business of a public service corporation to spend money to tell how good it was or who owned it. It could properly spend money only tobuild up business, and building up business it would secure both credit and goodwill.

In his correspondence with Edgar J. Rich, general solicitor of the company, and with Charles S. Mellen, then president, Mr. Barron laid down some rules on advertising. In one of his letters he said:

"Advertising at random and giving advertising under pressure, or sporadically, as may be persistently demanded, is very bad policy. It encourages persistency and application and causes a bad impression, not only upon the man who receives the advertising—he knows he is getting it because of his persistency—but upon the publisher and all the staff upon higher class papers in the same field, who know the reason the moment such an advertisement appears why that publication gets it and they do not. Every advertisement from a public service corporation is very carefully scanned by publishers, news men and editors, the moment it appears.

"It is highly important that the impression be given that the advertiser handling the funds of the public service corporation knows his business and that the management of the corporation is straight and square, for the newspaper men will judge the management right in the field where they themselves are experts.

"Next to securing the safety of passengers there is nothing more important in my judgment in railroad direction than the policy of the management as presented in public view. An unfilled promise direct or implied to the public or a newspaper may have dire consequences years afterward.

"J. Edward Addicks lost the gas field in Boston and his fortune by two false steps with the newspapers, although these never came into public view.

"I think Mr. Riggs (executive assistant to the president in charge of publicity) agrees with me that the policy in his handling news respecting the railroad is that he is there with his staff to give full information to the newspapers so far as they want it, and the impression should never go forth anywhere that he is there to get something into the newspapers in the interests of the corporation which he represents.

"I explained to Mr. Riggs where I thought the dangers were if his department in any way undertook to hand out advertising. In brief, the smaller papers will publish columns of news and demand expanding advertising, according to the news space they give, and then it would be found later that the traffic department could not indorse such advertising expenditures from any results obtained, and the cutting down of this expense or the cutting out of newspapers leaves a trail of consequences."

In a letter to Mr. Rich dated Jan. 30, 1913, Mr. Barron said:

"The mistake has been that Mr. Mellen has believed the public would see his upbuilding for New England and in the end appreciate it, but the public and private agitators got in ahead. While Mr. Mellen did nothing but work, the agitators agitated and inflamed public opinion with cries of 'monopoly,' 'wrecks' and 'financial jugglery' until corporation credit and good-will with investors and the people and even the safety of the working organization and the lives of passengers were in danger from the demoralization of such attacks. There was only one thing to do, and that was to win the people. Therefore, whenever any publishers have called me and solicited advertising, I have said: 'What is your circulation?' and when they have responded, 'Circulation does not count. New Haven wants friends and advertising is the way to get them and we are entitled to that advertising,' I have responded as follows: 'The New Haven Railroad is not through me buying any newspaper friendship, or paying any indebtedness to any newspaper or newspaper publisher. I am placing advertising that speaks to the people. If you reach the people show me your circulation and the character of the people you reach. Otherwise there is no obligation so far as I am concerned, or so far as I know, concerning the New Haven Railroad or the New England lines.'"

Mr. Barron explained that while the New Haven, Boston & Maine, and Maine Central, separately, could not afford to educate the country to "sail from Boston" or visit New England, the united New England lines could afford such a campaign.

The attitude of the management of the Brooklyn Rapid Transit Company toward its patrons and the newspapers has been dealt with before on numerous occasions in the ELECTRIC RAILWAY JOURNAL. As recently as the issue of this paper for Nov. 22, 1913, extracts were published from an article which appeared in the New York *Evening Post* dealing with Timothy S. Williams, president of the Brooklyn Rapid Transit Company, and the results which have been obtained under the "open-door" policy in Brooklyn. Colonel Williams in the current issue of *Printers' Ink* has outlined his views on the use of paid space for influencing public opinion. Like Mr. Barron he believes in the straight, forceful story backed by deeds. Colonel Williams is quoted in part as follows:

"The essential thing, I think, is for a public service corporation to convince the public—not only by its utterances and its attitude but by its acts—that it is honestly and intelligently trying to conduct its business, and then not to hesitate fully to inform the public of all the facts and conditions which attach to honest and intelligent administration. If a corporation is imbued with high purposes and intelligent policies it has nothing to fear from taking the public into its confidence, and it can afford to hit out straight from the shoulder at all those influences—official or otherwise—which interfere with honest and intelligent administration.

"Properly conducted, the advertising columns of the newspapers can be used to great advantage by a corporation. Assuming that the corporation is right, it can afford to be perfectly frank in its advertising utterances. No matter what views the newspaper may hold editorially on subjects relating to corporations, the advertising space at the disposal of a corporation can be utilized not only in defensive but offensive campaigns. The same situation prevails as to official or individual complaints and attacks. If a corporation is unjustly treated, either by the public or by public officials, I see no reason why it should not make the facts known, so that all intelligent people may form their independent judgments.

"We are all in one sense or another servants of the community in which we live. Each has his own part to play, and to the extent that that part involves common actors each must respect the rôle of others. In this great play, in which public officials, public service corporations and the public generally have their respective parts, the joint performance should be such that lookers-on may determine which players are responsible for failures. I am thoroughly convinced that frank talk straight from the shoulder is a good policy for corporations, as it is generally for individuals."

Bids Opened for Section of Seventh Avenue Subway, New York

The Interborough Rapid Transit Company, New York, N. Y., through its subsidiary, the Rapid Transit Subway Construction Company, has put in the lowest bid for the construction of the section of the new Seventh Avenue subway line stretching from a little north of Thirtieth Street to 100 ft. south of Forty-third Street. This includes two express stops, one at Thirty-third Street, to serve the traffic to and from the station of the Pennsylvania Railroad and the other at Forty-second Street, on account of the large number of passengers starting their trips from that point and the connection with the shuttle service to the Grand Central Station and the Steinway tunnel line to Queens. The names of the bidders and the prices bid were as follows:

Rapid Transit Subway Construction Company	$2,292,000
United States Realty & Improvement Company	2,303,000
Booth & Flinn	2,365,000
Godwin Construction Company	2,397,000
Franklin Contracting Company and Coleman Brothers	2,442,000
Holbrook, Cabot & Rollins Corporation	2,576,000
E. E. Smith Contracting Company	2,600,000
Oscar Daniels Company	2,606,000
Hugh Nawn Contracting Company	2,611,603
Canavan Brothers Company	2,616,000
Degnon Contracting Company	2,625,658
Carter Construction Company	2,712,000
Mason & Hanger Company	2,749,117
P. McGovern & Company	3,178,000

On Dec. 31, 1913, the commission awarded the contract for the construction of this section of the subway to the Rapid Transit Subway Construction Company.

Valuation of Cincinnati Traction Company's Property Urged.—Alfred Bettman, city solicitor of Cincinnati, and E. W. Doty, member of the Public Utilities Commission, conferred with Governor Cox of Ohio on Dec. 15 and urged him to arrange for an appropriation by the commission for the purpose of making a physical valuation of the Cincinnati Traction Company's property. The state officials are now engaged in making up the budget to be presented to the Legislature at the special session which will be called within a short time.

Plans for Unified Operating in Chicago Approved.—The ordinance providing for unified operation of the surface lines in Chicago has been approved by the stockholders of the Chicago City Railway and Chicago Railways and acceptance of the ordinance has been filed with the city clerk by the companies, and also the Calumet & South Chicago Railway and the Southern Street Railway. The ordinance will go into effect on Feb. 1. A summary of the terms of the surface railway unification ordinance was published in the ELECTRIC RAILWAY JOURNAL of Nov. 22, 1913, page 1112.

The Newark Terminal Plans.—The Board of Public Utility Commissioners of New Jersey has announced its attitude toward the terminal improvement plans of the Public Service Railway for Newark as follows: "The Board of Public Utility Commissioners has not disposed of the applications for the approval of the ordinances of the city of Newark affecting the Public Service Railway. The board has decided to ask the company for further information as to the system of transfers it proposes to install prior to the building of the terminal and the contemplated re-routing of cars prior to the building of such terminal."

Plans for Municipal Ownership in Seattle.—In the estimate furnished by City Engineer A. H. Dimock, of Seattle, Wash., the cost of rehabilitating and extending the Highland Park & Lake Burien Railroad, the property of which within the city was recently donated to the city, is placed at more than $2,000,000. It is regarded as likely that the City Council will authorize an issue of bonds to provide funds to make the improvements, the bonds to be a lien on the railway property. The negotiations looking toward the city taking over the property of the company within the city were referred to in the ELECTRIC RAILWAY JOURNAL of March 22, 1913, May 24, 1913, Aug. 2, 1913, and Aug. 23, 1913.

Kansas City Ordinance in May.—Indications now are that the Metropolitan Street Railway franchise ordinance will not be presented to the people of Kansas City for a vote until after the municipal election in April. It was ex-

pected until recently that the special election would take place before the regular one scheduled for April. The committee of the Council which is considering amendments has been deliberate about its work and the ordinance will probably reach the Council shortly. Reviews by Federal Judge Hook and the Missouri Public Utilities Commission also must take place before the ordinance is ready for a vote. Prospects, therefore, are that Kansas City residents will vote on the franchise some time in May. No important action was taken during the week ended Dec. 27, 1913, though the joint committee of the Council resumed its sessions.

Road in Batavia to Be Sold to City.—At a conference before Public Service Commissioner Hodson recently the representatives of the city of Batavia and Godfrey Morgan, one of the owners of the Buffalo & Williamsville Electric Railway, agreed to have their respective engineers determine the value of the property of the company in Batavia with a view to agreeing upon terms for a transfer of the property to the city. If the representatives of the city and the company fail to agree, a third engineer will be chosen and the amount fixed by him will be accepted by the railroad and paid by the city. The application of the Buffalo & Williamsville Electric Railway for permission to abandon its line in Batavia has been before the Public Service Commission for several months. Just prior to the last hearing engineers for the New York Central & Hudson River Railroad inspected the property with a view of buying and it was reported that road would operate heavy interurban cars between Buffalo and Batavia and later to Rochester over this line. The city of Batavia is in the market, according to Mayor Louis Wiard, for a number of small cars to be operated over the tracks which it is about to buy.

Separate Contracts for Rails for New York Subways.—The Public Service Commission for the First District of New York has decided to make separate contracts with manufacturers for the supply of steel rails and other track equipment for the new subways and elevated railroads to be built by the city of New York under the dual system plan. Formerly the practice was to let contracts for the work and allow the contractor to purchase the materials. Under the new plan the commission will advertise for bids for the supply of such materials, and after awarding the contracts will make another contract with contractors experienced in building railroads to do the work of track laying, etc. Of the 324 miles of single-track construction called for by the dual system contracts, the work on city-owned lines will cover 260 miles. As the specifications call for steel rails weighing 100 lb. to the yard, it is calculated that the commission will purchase about 520 miles of single rails, which, at 100 lb. to the yard, will weigh about 45,760 tons. On account of sidings, etc., it is probable that the actual amount will exceed these figures. A public hearing on the form on contract for supplying such materials will be held by the commission on Jan. 9.

Results Under First of New Rapid Transit Operating Contracts in New York.—The New York Consolidated Railroad, which is the Brooklyn Rapid Transit operating company under the new subway contracts, has filed with the Public Service Commission for the First District of New York a report showing the result of operations under contract No. 4, the main operating contract for the New York Municipal Railway Corporation's part of the dual system. The report covers the month of October, as well as the period from Aug. 4, 1913, when the operation of the Centre Street loop subway began, to Oct. 31. It shows that the gross receipts for October fell $54,426 below the amount needed to pay rentals, taxes, operating expenses, maintenance and depreciation, the preferential due the company and the interest on its investment, while for the whole period the shortage was $61,679. Counting in the interest and sinking fund paid by the city on the cost of construction, the deficit for October was $82,863 and the deficit for the entire period $144,239. During August, the first month of operation, the company made a much better showing, as the gross revenue for that month came within $2,814 of paying all charges, including the city's interest and sinking fund. The difference is accounted for by the fact that the summer traffic is very much heavier than at other seasons, especially on the Coney Island lines.

Financial and Corporate

Stock and Money Markets

Dec. 30, 1913.

The tone of the trading on the New York Stock Exchange to-day was irregular. There were moderate gains in many issues following the opening. The demand was broad throughout the day. A declining tendency prevailed in the afternoon and the leading issues sold off around a point from the midday range. Rates in the money market to-day were: Call, 2@6 per cent; thirty days, 4½@5 per cent; sixty and ninety days, 4½@4¾ per cent; four, five and six months, 4½@5 per cent.

The early trading in Philadelphia to-day was confined largely to local issues. The market closed weak. Local issues were lightly dealt in despite the early tendency.

A steady tone and fair activity ruled on the Chicago Stock Exchange to-day. Bonds were dull but steady.

The Boston market was fairly broad to-day. In the afternoon the heavy tone of the New York market was reflected in the trading in Boston.

The trading in Baltimore was broader to-day, but the total of transactions was small. The sales of stock totaled 273 shares, while the sales of bonds totaled $38,300, par value.

Quotations of traction and manufacturing securities as compared with last week follow:

	Dec. 24	Dec. 30
American Brake Shoe & Foundry (com.)	86	90
American Brake Shoe & Foundry (pref.)	126½	127
American Cities Company (com.)	36	36
American Cities Company (pref.)	60	61
American Light & Traction Company (com.)	334	335
American Light & Traction Company (pref.)	106	106
American Railways Company	38	38
Aurora, Elgin & Chicago Railroad (com.)	a42	42
Aurora, Elgin & Chicago Railroad (pref.)	a84	83
Boston Elevated Railway	86½	85½
Boston Suburban Electric Companies (com.)	7	7
Boston Suburban Electric Companies (pref.)	58	58
Boston & Worcester Electric Companies (com.)	*6½	*6½
Boston & Worcester Electric Companies (pref.)	37	36½
Brooklyn Rapid Transit Company	88	87⅞
Capital Traction Company, Washington	110½	111
Chicago City Railway	160	160
Chicago Elevated Railways (com.)	25	25
Chicago Elevated Railways (pref.)	75	75
Chicago Railways, ptcptg., ctf. 1	91½	90
Chicago Railways, ptcptg., ctf. 2	28¼	28
Chicago Railways, ptcptg., ctf. 3	7	7
Chicago Railways, ptcptg., ctf. 4	1¾	1¾
Cincinnati Street Railway	107½	102
Cleveland Railway	103½	103½
Cleveland, Southwestern & Columbus Ry. (com.)	*5½	*5½
Cleveland, Southwestern & Columbus Ry. (pref.)	*30	30
Columbus Railway & Light Co.	18	18
Columbus Railway (com.)	59¼	59¼
Columbus Railway (pref.)	88	88
Denver & Northwestern Railway	*80	*80
Detroit United Railways	80	80
General Electric Company	140	138¾
Georgia Railway & Electric Company (com.)	119¼	120
Georgia Railway & Electric Company (pref.)	84	84
Interborough Metropolitan Company (com.)	15	14¾
Interborough Metropolitan Company (pref.)	60¼	60
International Traction Company (com.)	*30	*30
International Traction Company (pref.)	*90	*90
Kansas City Railway & Light Company (com.)	*20	*20
Kansas City Railway & Light Company (pref.)	*30	*30
Lake Shore Electric Railway (com.)	*6	*6
Lake Shore Electric Railway (1st pref.)	*92	*92
Lake Shore Electric Railway (2d pref.)	*24	*24
Manhattan Railway	125	125
Massachusetts Electric Companies (com.)	10¼	13
Massachusetts Electric Companies (pref.)	63	63½
Milwaukee Electric Ry. & Light Co. (pref.)	*95	*95
Norfolk Railway & Light Company	24¾	*24¾
North American Company	67	67
Northern Ohio Light & Traction Co. (com.)	70	58
Northern Ohio Light & Traction Co. (pref.)	101	101
Philadelphia Company, Pittsburgh (com.)	39	40⅞
Philadelphia Company, Pittsburgh (pref.)	39	40
Philadelphia Rapid Transit Company	18	18½
Portland Railway, Light & Power Company	53	53
Public Service Corporation	105	107
Third Avenue Railway, New York	41⅝	41⅝
Toledo Traction, Light & Power Co. (com.)	30	20
Toledo Traction, Light & Power Co. (pref.)	80	80
Twin City Rapid Transit Co., Min'apolis (com.)	105½	106
Union Traction Company of Indiana (com.)	*11½	*11½
Union Traction Company of Indiana (1st pref.)	*80	*80
Union Traction Company of Indiana (2d pref.)	14	14
United Rys. & Electric Company (Baltimore)	24⅞	25
United Rys. Inv. Company (com.)	20	21¼
United Rys. Inv. Company (pref.)	37	39
Virginia Railway & Power Company (com.)	56	50
Virginia Railway & Power Company (pref.)	99¼	98
Washington Ry. & Electric Company (com.)	85	85½
Washington Ry. & Electric Company (pref.)	87	87
West End Street Railway, Boston (com.)	68	69
West End Street Railway, Boston (pref.)	90	90
Westinghouse Elec. & Mfg. Company	65	65½
Westinghouse Elec. & Mfg. Co. (1st pref.)	114	116¼

*Last sale. a Asked.

Changes in Personnel of the Rhode Island Company

A. E. Potter, A. T. Potter and L. S. Storrs, were elected directors of the Rhode Island Company, Providence, R. I., on Dec. 27, 1913, succeeding C. F. Brooker, James Hemingway and William Skinner. Mr. Potter was also elected president of the company and Howard Elliott was elected chairman of the board. Announcement was also made that E. D. Robbins, heretofore general counsel for the New York, New Haven & Hartford Railroad, which controls the Rhode Island Company, had been appointed general counsel for the board of directors. He will be called upon for advice relative to the corporate, intercorporate and financial relations of the allied companies. Edward G. Buckland, a vice-president of the New York, New Haven & Hartford Railroad and of the Rhode Island Company, will take charge of the general legal business and litigation of the company and will represent the New Haven Railroad in its dealings with Congress, Legislatures and other government bodies. Howard Elliott, chairman of the board of the New Haven company, following the meeting on Dec. 27, gave out a statement in which he declared that no plan had been formulated for the segregation of the properties of the company. He stated that the subject of separation had been discussed, together with other matters, including the ratification of an amendment to the contract regarding the Grand Central terminal. Mr. Elliott, speaking of the new officers of the Rhode Island Company, said:

"They will be charged with the important duty of looking after the affairs of the Rhode Island Company, getting close to the people, and handling the great bulk of the business without interference or advice from any other source. Of course, on large questions like capital expenditures and long-time contracts it will be right and proper for them to consult with me."

Speaking about the probable segregation, he said:

"Just now our financial and governmental problem is a serious one, but I hope in time both will be solved, and that I can have a little time to see the properties and the country they serve. We have decided upon no plan. We discussed segregation as we do at every meeting. I can say that we are making progress. The board of directors met for the purpose of ratifying an amendment to the contract with the New York Central & Hudson River Railroad in regard to the Grand Central terminal. This amendment had been under consideration for some time and negotiations were only just completed, and it was necessary to authorize the amendment by the full board. The amendment made more clear the relations of the companies in regard to the so-called 'aerial rights,' or the use of the space above the tracks."

Brooklyn Rapid Transit Absorbs Coney Island & Brooklyn Railroad

The Public Service Commission for the First District of New York has authorized the Coney Island & Gravesend Railway, a subsidiary of the Brooklyn Rapid Transit Company, to purchase 26,370 shares of the capital stock of the Coney Island & Brooklyn Railroad at par. The total authorized capital of the Coney Island & Brooklyn Railroad is 30,000 shares at a par value of $100 each, and of this amount 29,839 shares are outstanding. Commissioner George V. S. Williams, in his opinion recommending the authorization, says that while transfers are not exchanged between the Coney Island & Brooklyn Railroad and the Brooklyn Rapid Transit lines, "it does appear from the testimony of Mr. Meneeley, the vice-president and treasurer of both the Coney. Island & Gravesend Railway and the Brooklyn Rapid Transit Company, that he expects to make recommendations for transfers between the lines of the Coney Island & Brooklyn Railroad and the Brooklyn Heights Railroad and the Nassau Electric Railroad lines (both subsidiary companies of the Brooklyn Rapid Transit system) at a number of intersections, and the commission has under consideration a proposition made on behalf of the Brooklyn Rapid Transit Company to issue transfers at every intersection of any of the lines controlled by it, which, of course, would mean transfers from the Coney Island & Brooklyn Railroad at every intersection of other trolley lines in the borough, in case the order should be granted."

Commissioner Maltbie has written an opinion dissenting from the action of the Public Service Commission in authorizing the merger of the companies.

The Coney Island & Brooklyn Railroad operates 48.24 miles of single track and 472 passenger cars. Except for the Van Brunt Street & Erie Basin Railroad, 3 miles long, it was the only line in Brooklyn not included in the system of the Brooklyn Rapid Transit Company. The company was chartered in 1860 and it absorbed the Prospect Park & Flatbush Railroad on April 1, 1891. On Sept. 1, 1897, the company leased the Franklin Avenue division of the Brooklyn City & Newtown Railroad. On Dec. 4, 1897, the entire system of the Brooklyn City & Newtown Railroad was leased for 999 years, and in 1910 it was absorbed. The company also owns and operates the De Kalb Avenue & North Beach Railroad and the New York & Brooklyn Bridge Extension. The dividend record of the company follows: in 1893, 4 per cent on $500,000, 3 per cent on $1,000,000; in 1894, 1895, 1896 and 1897, 6 per cent; in 1898, 9 per cent; in 1899, 9½ per cent; in 1900, 10 per cent; in 1901, 12 per cent; in 1902, 1903 and 1904, 16 per cent; in 1905, 14 per cent; in 1906, 8 per cent on $2,000,000; in 1907 (February only), 2 per cent on $2,000,000; none since.

Results of Hudson & Manhattan Readjustment

The Hudson Companies, which controls the Hudson & Manhattan Railroad, is sending out a circular to its shareholders outlining the results of the recent voluntary readjustment. The circular reads in part as follows:

"The readjustment of the debt of the Hudson & Manhattan Railroad and the provisions in connection therewith for paying the then outstanding $21,157,000 of notes of the Hudson Companies have been carried out. The resulting condition of the Hudson Companies is as follows:

"Assets: Hudson & Manhattan preferred stock, $2,307,600; Hudson & Manhattan common stock, $25,171,200; Greeley Square Realty Company 5 per cent bonds, $2,450,000; Greeley Square Realty Company preferred stock, $1,000,000; Greeley Square Realty Company common, $1,000,000; real estate, cost less mortgage, $127,254; accounts receivable, $26,382; mortgages receivable, $10,000; cash, $498,329.

"Debt—Note issue, 5 per cent, $1,500,000; accounts payable, $33,081.

"The Hudson Companies' 5 per cent note issue is increased by $500,000, from $1,000,000 to $1,500,000. On the other hand, the companies' cash is increased by practically the same amount. This additional cash was procured in this way, in order to provide for a payment upon the principal of the underlying mortgages upon the property of the Greeley Square Realty Company. This company owns the property at Thirty-third Street and Broadway under lease to Gimbel Brothers, subject to two underlying mortgages or the principal sum of $6,500,000."

Alton, Granite City & St. Louis Traction Company, Alton, Ill.—The stockholders of the Alton, Granite City & St. Louis Traction Company have voted to increase the capital stock of the company from $3,000,000 to $3,400,000.

Bloomington & Normal Railway & Light Company, Bloomington, Ill.—The Bloomington & Normal Railway & Light Company has filed with the Secretary of State a certificate of increase in the capital stock of the company from $1,500,000 to $1,650,000.

Bowling Green (Ky.) Railway.—Master Commissioner W. R. Speck, who had been acting as receiver for the Bowling Green Railway, has sold the property of the company at auction, following an order of court. John S. Lewis was the purchaser at $20,600. The only other bidder was T. Lindsey Fitch, of the Kentucky Public Service Company, who bid $20,550. The sale was made following a petition of the Fidelity & Columbia Trust Company, Louisville, trustee for the bondholders.

Cairo Electric & Traction Company, Cairo, Ill.—The stockholders of the Cairo Electric & Traction Company have voted to increase the capital stock of the company from $150,000 to $300,000.

Chicago & Milwaukee Electric Railroad, Highwood, Ill.—An order has been entered by Federal Judge Landis, instructing W. O. Johnson, receiver for the Chicago & Milwaukee Electric Railroad, to pay $27,000 in interest to holders of the $1,080,000 of bonds of the road. This figure represents the semi-annual interest payment. It is to be made Jan. 14, on which day the interest falls due.

Galesburg Railway, Lighting & Power Company, Galesburg, Ill.—The Galesburg Railway, Lighting & Power Company, which was incorporated in Illinois some time ago by the McKinley interests with a preliminary capital of $50,000, has increased its stock to $3,500,000 and arranged to take over the Galesburg Railway & Light company, the Galesburg Gas & Electric Light Company, the Knoxville Electric Light & Power Company, the Abingdon Light & Power Company and the People's Traction Company, Galesburg.

Interborough Rapid Transit Company, New York, N. Y.—Supreme Court Justice Van Siclen in Brooklyn has dismissed the complaint in a suit brought by Clarence H. Venner, a minority stockholder in the Interborough Rapid Transit Company, against the directors of the corporation, including August Belmont, Cornelius Vanderbilt and others. The action was brought to compel the defendants, as directors of the company to account for 15,000 shares of capital stock involving $4,500,000 which it was alleged had been issued to Belmont's firm illegally. In dismissing the complaint Justice Van Siclen said: "This court is not convinced that the essential facts in the complaint have been admitted or proved by a fair preponderance of evidence, and without deciding whether the facts will permit a recovery by an action of some other character, feels compelled to dismiss the complaint and direct judgment for the defendant with costs and allowances. Obviously no weight or virtue can be added to this court's memorandum by indulging in invectives or branding the plaintiff, Venner, or his so-called vehicle, the Continental Security Company. If heretofore the judicial records and published opinions of various state and federal courts tend to establish that said Venner is an artificer of litigation and a menace to corporate society, an added curse will work no cure."

Ohio Service Company, Dennison, Ohio.—The Ohio Service Company has been authorized by the Public Utilities Commission of Ohio to issue its capital stock of the total par value of $30,000 to be delivered in full payment of the purchase price for the assets, physical property and rights owned by the Twin City Traction Company in Dennison and Uhrichsville, Ohio, the purchase of which property by the Ohio Service Company was consented to and approved by the commission on Oct. 10, 1913.

People's Traction Company, Galesburg, Ill.—The stockholders of the People's Traction Company have approved an increase in the capital stock of the company from $150,000 to $300,000.

Public Service Corporation of New Jersey, Newark, N. J.—As a result of the refusal of the Board of Public Utility Commissioners of New Jersey to sanction the sale of $620,000, par value, of first mortgage bonds of the North Hudson County Railway, to the Fidelity Trust Company, at 97 and accrued interest, an invitation was extended by the company for competitive bids. Julius S. Rippel, who protested previously to the commission that he had not had an opportunity to bid for the issue originally, offered to buy the issue at 99. Clark, Dodge & Company submitted a bid on behalf of themselves and W. E. R. Smith & Company offered 99½ and interest for the issue. F. A. Peters, Paterson, bid 99 for a lot of $10,000. The Fidelity Trust Company notified the Public Service Corporation that it was unwilling to increase its bid of 97, and that it therefore withdrew from the competition. The Public Utility Commission has now made an order authorizing the sale of the bonds at a price not less than 99½. The plans for issuing these bonds were referred to in the Electric Railway Journal of Nov. 29, 1913, and Dec. 13, 1913.

Puget Sound Traction, Light & Power Company, Seattle, Wash.—The stockholders of the Puget Sound Traction, Light & Power Company have authorized an issue of notes or short-time bonds to refund two-year mortgage notes, of which $7.500,000 mature on Feb. 1, 1914, and to provide for extensions and improvements. Part of the $7,500,000 of notes are to be met out of the proceeds of the $2,686,200 of preferred stock sold recently.

Reading Transit & Light Company, Reading, Pa.—The Reading Transit & Light Company proposes to create a limited open-end mortgage for $50,000,000 to provide funds to retire the $750,000 of ten-year 6 per cent debentures now outstanding and provide for extensions and improvements. The total amount of bonds which it is proposed to issue at this time has not been announced.

Shore Line Electric Railway, Norwich, Conn.—The stockholders of the New London & East Lyme Street Railway have ratified the lease executed by that company to the Shore Line Electric Railway on Aug. 1, 1913, for the period of twenty-one years of all the properties and franchises of the company.

Youngstown & Ohio River Railroad, Leetonia, Ohio.—The Youngstown & Ohio River Railroad has declared a dividend of 1 per cent on its preferred stock. This is a reduction of one-quarter of 1 per cent as the stock is 5 per cent cumulative preferred.

Dividends Declared

Boston (Mass.) Suburban Electric Companies, quarterly, $1, preferred.

Cincinnati, Newport & Covington Light & Traction Company, Cincinnati, Ohio, quarterly, 1⅛ per cent, preferred; quarterly, 1½ per cent, common.

Citizens' Traction Company, Oil City, Pa., $1, preferred.

Denver & Northwestern Railway, Denver, Col., quarterly, 1 per cent.

Manchester Traction, Light & Power Company, Manchester, N. H., quarterly, 2 per cent.

Nashville Railway & Light Company, Nashville, Tenn., 1¼ per cent, preferred.

New England Investment & Security Company, Springfield, Mass., $2, preferred.

Stark Electric Railroad, Alliance, Ohio, quarterly, three-quarters of 1 per cent.

Union Passenger Railway, Philadelphia, Pa., $4.75.

West Philadelphia (Pa.) Railway, $5.

ELECTRIC RAILWAY MONTHLY EARNINGS

FORT WAYNE & NORTHERN INDIANA TRACTION COMPANY, FORT WAYNE, IND.

Period			Gross Earnings	Operating Expenses	Net Earnings	Fixed Charges	Net Surplus
1m.,	Oct.,	'13	$157,218	$91,713	$60,760	$45,177	$15,583
1 "	"	'12	144,752	85,291	54,870	43,583	11,287
10 "	"	'13	1,492,471	875,961	569,722	436,373	133,349
10 "	"	'12	1,405,674	840,277	520,408	424,410	95,998

JACKSONVILLE (FLA.) TRACTION COMPANY

1m.,	Oct.,	'13	$57,663	*$35,348	$22,315	$13,067	$9,248
1 "	"	'12	47,619	*30,393	17,226	10,174	7,052
12 "	"	'13	622,741	*410,292	212,448	138,986	73,462
12 "	"	'12	593,491	*380,387	213,105	116,013	97,092

PENSACOLA (FLA.) ELECTRIC COMPANY

1m.,	Oct.,	'13	$25,399	*$15,769	$9,630	$7,240	$2,390
1 "	"	'12	24,759	*15,858	8,900	6,377	2,523
12 "	"	'13	285,168	*181,560	103,609	79,479	24,130
12 "	"	'12	286,942	*178,167	108,775	75,184	33,591

PUGET SOUND TRACTION, LIGHT & POWER COMPANY, SEATTLE, WASH.

1m.,	Oct.,	'13	$744,519	*$419,485	$325,034	$174,468	$150,566
1 "	"	'12	715,378	*396,814	318,564	169,366	149,198
12 "	"	'13	8,506,260	*4,952,648	3,553,612	2,056,446	1,497,166
12 "	"	'12	.....	.....	.....	.....	.....

REPUBLIC RAILWAY & LIGHT COMPANY, YOUNGSTOWN, OHIO

1m.,	Nov.,	'13	$251,260	*$151,014	$100,246	$43,517	$56,729
1 "	"	'12	233,971	*133,957	100,015	43,662	56,353
12 "	"	'13	2,979,608	*1,817,448	1,162,161	536,967	625,194
12 "	"	'12	2,638,427	*1,578,557	1,059,871	529,417	530,454

SAVANNAH (GA.) ELECTRIC COMPANY

1m.,	Oct.,	'13	$69,381	*$47,654	$21,728	$22,803	†$1,075
1 "	"	'12	63,886	*48,639	15,247	16,336	1,089
12 "	"	'13	813,665	*555,473	258,193	250,636	7,557
12 "	"	'12	740,582	*548,567	192,015	191,737	278

VIRGINIA RAILWAY & POWER COMPANY, RICHMOND, VA.

1m.,	Oct.,	'13	$454,126	$222,402	$231,724	$134,962	$96,762
1 "	"	'12	414,561	204,673	209,888	124,725	85,163
4 "	"	'13	1,771,933	882,086	889,847	532,888	356,959
4 "	"	'12	1,649,490	817,535	831,955	496,114	335,841

* Includes taxes.
† Deficit.

Traffic and Transportation

Seattle Company Appeals from Rate Decision

Formal notice has been filed with the Public Service Commission of the appeal taken by the Puget Sound Traction, Light & Power Company, Seattle, Wash., from the commission's decision in ordering the company to sell six street car tickets for 25 cents on the cars in Seattle. Three allegations are set forth as the basis for the writ: that the commission had no jurisdiction to issue the order without first having determined the reasonableness of the 4-cent fare; that in fact the 4-cent fare will result in inadequate returns to the company, and that the order virtually abrogates the terms of the franchise existing between the city and the company. The writ of review is returnable Jan. 14, 1914.

A statement addressed to the public by Jacob Furth, president of the company, setting forth the reasons for the appeal to the courts from the order of the commission, follows in part:

"The company is about to apply to the courts to reverse the order recently made by the Public Service Commission requiring the company to sell upon its cars 25 tickets for $1 and six tickets for 25 cents. The provisions of the contract between the city and the company establishing street railway fares and regulating the sale of tickets are just as plain and clear now as they were when the city deliberately executed the contract in consideration of benefits to be received by it and which ever since such execution it has continued to receive.

"The city had endeavored to have the franchise read that the grantees should sell upon their cars twenty-five tickets for $1. The applicants for the franchise had notified the city that they would neither bid for nor accept a franchise containing such provision. The franchise was then worded so that the grantees should not be obliged to sell commutation tickets upon the cars, but should be obliged to keep them on sale 'at their main office and power stations within the city.' From 1900 until 1911 no claim was ever made that the company was under any obligation, legal or moral, to sell commutation tickets except at the places agreed on in the franchise. In the summer of 1911 the company, at the request of the city, established twelve places for the sale of commutation tickets in addition to the places required by the franchise. In October, 1911, after the company had complied with such request of the city, the Council, against the protest of the company that its action was a violation of the contract between the city and the company, was a breach of good faith and was without authority, passed a bill requiring the company, under penalty of not exceeding $100 fine or thirty days' imprisonment for each offense, to sell upon all cars twenty-five tickets for $1 and six for 25 cents. The Mayor vetoed the bill. The Council passed the bill over the veto of the Mayor and against the protest of the company, and the bill became an ordinance of the city.

"The evidence of the company before the commission showed that the company was not earning a fair return upon the value of its property and there was no evidence introduced to the contrary. The commission held that even though the company was complying with all of the provisions of its franchise, even though its rates did not exceed the maximum fixed in the franchise and the statute, and even though a franchise requiring the sale of tickets upon the cars at six for 25 cents would not have been accepted, the company could be forced by order of the commission at the instance of the city and in advance of a valuation, to yield $60,000 a year which under its contract with the city it was entitled to earn. The decision, while so reducing the earnings of the company, left the city free to collect 2 per cent on the gross earnings of the street railway, amounting to more than $70,000 a year.

"The company believes that the commission has made an honest but serious mistake in the decision rendered. It does not believe that the decision is maintainable either at law or in equity, or that it is in accordance with sound business principles. The decisions of the commission are, under the law creating the commission, reviewable by the courts, and to the courts the company is forced to appeal for relief from an order which impairs its contract and deprives it of its property without due process of law."

Change in Display of Route Signs.—At the suggestion of the Public Service Commission of the Second District of New York, the International Railway, Buffalo, which operates in Buffalo, Niagara Falls and Lockport and between these points, will place the route number of its cars on the side instead of in the front. This applies merely to the new near-side cars.

Amendment Proposed to Kansas City Traffic Code.—An amendment to the traffic code has been presented in the Kansas City Council, as the result of the confusion attending the various interpretations of the motor ordinance. This has been changed to provide that automobiles shall stop at least 10 ft. in the rear of a street car which has stopped at a street intersection. One or two police judges recently held that motorists could pass street cars provided they maintained the distance of 10 ft. The amendment will eliminate such rulings.

Suburban Fare Concession at Birmingham.—A concession in reference to transfers from Wylam and Fairview to the central part of Birmingham has been announced by the Birmingham Railway, Light & Power Company, Birmingham, Ala. At this time it is necessary to pay 10 cents to travel from Fairfield to Birmingham or from Wylam to Birmingham. It is anounced that the company will grant a reduction in this fare. The plan is to charge 5 cents fare from Wylam or Fairfield to the central part of Birmingham without, for instance, giving a transfer to East Lake or to Powderly.

Petition for Smoking Cars Dismissed.—The Public Service Commission for the First District of New York has dismissed the proceeding instituted to inquire whether the street railroad corporations of Greater New York should be required to operate smoking cars or cars containing smoking compartments on the surface and elevated lines. No opinion was written, the order simply reciting that the commission is of the opinion "that under the circumstances appearing it would not be reasonable to require said street railroad corporations to operate smoking cars or cars containing smoking compartments."

Christmas in Missouri.—Two special cars were necessary to hold the Christmas gifts of J. R. Harrigan, of the Kansas City, Clay County & St. Joseph Electric Railway, to the 200 employees of the road. Mr. Harrigan presented every attaché of the line with a basket containing a chicken, a quart of oysters, celery and other accompaniments. The Metropolitan Street Railway, Kansas City, distributed cigars to its men. The Topeka (Kan.) Railway gave turkeys to the married employees, silverware to their wives and gloves to the bachelors. A vaudeville performance also was tendered at the company's annual entertainment to the employees.

Dinner of Missouri Railroad Employees.—The ninth annual dinner of the Electric Railway Club, composed of all the officers and employees of the Southwest Missouri Railroad, Webb City, Mo., was held recently. The dinner this year was notably successful. Many leading citizens of the communities through which the company operates attended as guests. The club owns a very attractive club house, which was illustrated on the back of the menu card used at the dinner. Members of the club receive a stipend when incapacitated for work by injury or sickness. The company is also carrying group insurance in the Equitable Life, New York, to which members of the club are eligible. The company pays half of the premium on these policies and the insured pays the other half. Each policy is for $1,000.

Decision in Seattle Transfer Case.—The Supreme Court of the United States has dismissed the appeal of William R. Crawford, former president of the Seattle, Renton & Southern Railway, from the decision of the Washington Supreme Court upholding the requirement for the exchange of transfers between the cars of the Puget Sound Traction, Light & Power Company and the Seattle, Renton & Southern Railway on a basis of 50 per cent of the fare received to each company. A. G. Linhoff, appearing as relator, brought suit in the King County Superior Court several years ago against the two companies to require them to exchange transfers

on a 50 per cent basis. Judge Wilson R. Gay held in favor of the city and directed the issuance of such transfers, and the Supreme Court of the State of Washington affirmed that decision. The issuance of transfers began at that time and has continued since.

Protest Against Re-routing in Buffalo.—Application has been made to the Public Service Commission of the Second District of New York by Main Street merchants and property owners to require the International Railway to reroute its Hoyt and Elmwood cars, the two most important lines from the West Side residential district, down Main Street, as formerly. The cars were taken off Main Street last spring because of the heavy traffic on Buffalo's principal thoroughfare. Property owners and merchants say business has dropped off and property depreciated in value since these two lines have been routed down Franklin Street, two blocks to the west of Main Street. At a hearing before Commissioner Hodson held in Buffalo, E. G. Connette, president of the company, and Thomas Penney, former president, but now legal adviser, explained that sixty cars a minute are operated both ways in Main Street and during the rush hours 120 cars a minute are operated in both directions. They said it would be almost impossible to maintain schedules with two more lines operating up and down Main Street. Decision was reserved by the commission.

Praise for the Public Service Railway.—In commenting editorially on the increase in the wages of its trainmen announced recently by the Public Service Railway the Newark *News* said: "The spirit underlying the announcement of an increase in wages for employees of the Public Service Railway is laudable for more reasons than one. It is generous, it is good business and it has an element of consideration for the public. The rate of increase is sufficiently large to enable each of the employees to better his mode of living. Increased wages will enable the company to set a higher standard in the personnel of its operating force through widening the field of available men. This means greater efficiency in smoother operation, a decrease in the wear and tear—because of carelessness and incompetency—on its rolling stock, and in diminished proneness to accidents, which are expensive both in injury to the company and frequently in damage suits. The public will be benefited, obviously, in greater safety, better service and more considerate treatment. The Public Service Railway has plenty of rules, and good rules, for observance by its employees, the difficulty having been in getting them carried out. With a greater incentive for the employees to obey the rules more carefully, the reward of the Public Service Railway should be found in greater facility and economy of operation."

Ordinances in Interest of Interurban Lines Introduced in Little Rock.—Negotiations between the promoters of the Little Rock, Pine Bluff & Eastern Traction Company, the officials of the Little Rock Railway & Electric Company and representatives of the city of Little Rock which have been in progress since Sept. 8, 1913, have resulted in three ordinances being presented to the City Council to provide for an interurban railway to Pine Bluff and street railway connection with Argenta. These three ordinances, which represent the three-cornered agreement, have been read once and referred to the Mayor, city attorney, street, finance and ordinance committees. Mayor Taylor has effected an agreement with the Little Rock, Pine Bluff & Eastern Traction Company, the Little Rock Railway & Electric Company and the Inter-City Terminal Railway, which is to take control of the Argenta lines and extend street car service into Little Rock, whereby a 5-cent fare is guaranteed from all points in Argenta to all points on the downtown loop, and transfer privileges are secured to all points in either city at the rate of 7 cents for one continuous passage. The Inter-City Terminal Railway is to permit interurban cars to come in over its lines and along the downtown loop, which extends down Spring Street, Capitol Avenue, Main and Markham Streets. The city is to receive compensation from both the Inter-City Terminal Railway and the Little Rock, Pine Bluff & Eastern Traction Company for entering the city, and each is to put up a $20,000 bond.

Personal Mention

Mr. Robert E. Wirsching has been appointed to the Board of Public Utilities of Los Angeles, Cal., to succeed Mr. O. O. McReynolds.

Mr. D. W. Pontius has been appointed traffic manager of the Visalia Electric Railroad, with headquarters in Los Angeles, Cal.

Mr. C. B. Vorce has resigned as construction engineer for the British Columbia Electric Railway, Vancouver, B. C. Mr. Vorce became connected with the British Columbia Electric Railway in October, 1910, coming from New York, where he was connected with the engineering firm of Sanderson & Porter.

Mr. Howard Elliott, chairman of the board of directors of the New York, New Haven & Hartford Railroad, president of the Connecticut Company, New Haven, Conn., and president of the Rhode Island Company, Providence, R. I., has been elected chairman of the board of the Rhode Island Company, a newly created position.

Mr. Frank H. Funk has been appointed a member of the Illinois Railroad & Warehouse Commission by Governor Dunne in place of James A. Willoughby, resigned. In making this appointment the Governor let it be known that Mr. Funk would be a member of the new Public Utilities Commission when it is formed. Mr. Funk was the Progressive nominee for Governor in 1912, and served several terms as State Senator from the Bloomington district.

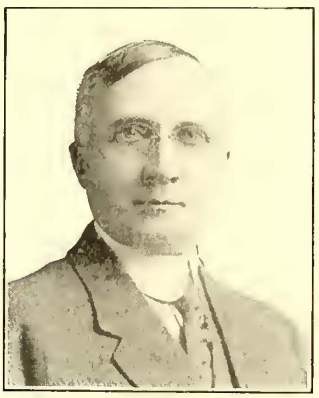
Mr. A. E. Potter, general manager of the Rhode Island Company, Providence, R. I., has been elected president of the company to succeed Mr. Howard Elliott, who has been elected chairman of the board of directors, a newly created position. Mr. Potter is a native of Providence, and is forty years of age. He entered the employ of the Union Railway, Providence, out of which grew the Rhode Island Company, in 1892, as assistant to the superintendent of tracks. He served in this capacity until 1895, when he was appointed superintendent of transportation, the duties of which office he was subsequently elected to perform after the Union Company was absorbed by the Rhode Island Company in 1902. In 1906 Mr. Potter was promoted from superintendent of transportation of the company to general manager, to succeed Mr. R. I. Todd, who resigned to become general manager of the Indianapolis Traction & Terminal Company. Mr. Potter has served continuously as general manager of the company since that time. The system of the Rhode Island Company in Providence and elsewhere in Rhode Island comprises 583 miles of track.

A. E. Potter

Mr. J. H. McClure has been appointed general superintendent of the Citizens' Traction Company, Oil City, Pa., one of the public utility properties operated by Day & Zimmermann, Philadelphia, as general managers. In the early part of the year Mr. W. W. Cole, of Day & Zimmermann, was sent to the Citizens' Traction Company property as acting general manager, to perfect a reorganization of the property and to direct a large amount of construction work. Mr. Cole has spent most of his time during the past nine months on the property, and has successfully concluded his labors. Mr. McClure has entered upon his duties and will be permanently located at Oil City. He has for several years been a member of the Day & Zimmermann forces and is one of the firm's prominent efficiency engineers, having given particular attention to schedules and car operations. Mr. McClure has in the past few years made a number of visits to the Citizens' Traction Company property on expert work.

Mr. T. L. Miller, assistant to Mr. F. R. Coates, president of the Toledo Railways & Light Company, Toledo, Ohio, has been appointed purchasing agent for all the properties operated by this company to succeed Mr. C. T. Munz, resigned. Mr. Miller's appointment as assistant to the president was announced in the May 18, 1912, issue of the ELECTRIC RAILWAY JOURNAL, accompanied with his biography.

Mr. John F. Calderwood resigned as vice-president and general manager of the Brooklyn Rapid Transit System on Jan. 1, but will retain his connection with the company in an advisory capacity. He will take a year's vacation before resuming active work. Mr. Calderwood became connected with the Brooklyn Rapid Transit Company in 1902 as assistant to Mr. J. L. Greatsinger, then president of the company. He had previously been comptroller of the Twin City Rapid Transit Company, Minneapolis, Minn. Mr. Calderwood was born at Reford near Detroit, Mich., on May 27, 1859. He was educated in the public and high schools of Fenton and at the University of Michigan. After teaching a year in a normal college he entered the employ of a lumber company at Bay City, Mich., and later became accountant and credit manager of a carpet concern in Minneapolis. In 1888 he was elected comptroller of Minneapolis and at the close of the term accepted the office of comptroller of the Minneapolis Street Railway, which with the St. Paul City Railway was afterward consolidated as the Twin City Rapid Transit Company. For some time previous to the purchase of the Third Avenue Railroad in New York by the Metropolitan Street Railway in 1900 Mr. Calderwood spent some time in the East at the request of the owners of the property to rehabilitate it. The knowledge of street railway finance and management displayed by him during this period as well as his previous record led to his appointment with the Brooklyn Rapid Transit Company. The lines which were under Mr. Calderwood's management in Brooklyn constitute a system of 542½ miles of surface single track and 71¼ miles of elevated single track, while the extensive subway system under the dual plan now under construction will add very considerably to what is probably the largest trackage under any one city railway in the world. Mr. Calderwood was one of the founders of the American Electric Railway Accountans' Association and one of its first presidents. He was largely instrumental in the establishment and adoption of the standard system of accounts of that association. Mr. Calderwood was a frequent contributor to the STREET RAILWAY JOURNAL on accounting topics, but was compelled to discontinue this work on account of the exactions of his duties in Brooklyn. When Mr. Calderwood came to Brooklyn he took charge of a system which was still loose-jointed in many parts and operating with steam on the elevated lines and out-of-date cars on the surface lines. He leaves it as one of the most progressive electric railway organizations in the United States and one that has before it wonderful possibilities of still greater expansion through the development of the new rapid transit routes. The company has announced that with Mr. Calderwood's retirement the position of general manager will be abolished.



J. F. Calderwood

Mr. W. W. Cole, who has been acting general manager of the Citizens' Traction Company, Oil City, Pa., to perfect the reorganization of the property and direct reconstruction work, will return to the eastern part of Pennsylvania and again take up his important field of work with Day & Zimmermann, Philadelphia, Pa., who operate the properties at Oil City. Mr. Cole will divide his time largely between the Philadelphia and New York offices of Day & Zimmermann, as he did before he located temporarily in Oil City and will only occasionally visit the Citizens' Traction Company property hereafter, as it is necessary to look after certain expert work. As an indication of their recognition of his work and the high personal esteem in which he is held by the people in general, a number of the prominent citizens of Oil City tendered a complimentary banquet to Mr. Cole on the occasion of his leaving Oil City to return to Philadelphia and New York.

Mr. Edward D. Robbins, general counsel of the New York, New Haven & Hartford Railroad, has been appointed general counsel of the board of directors. He will be relieved of the administrative legal work by Mr. Edward G. Buckland, vice-president. Mr. Robbins will be called upon for advice regarding the corporate, intercorporate and financial relations of the company and the legal rights and duties of the several parts toward one another and about other important matters that may be assigned to him by the board. He will report to Mr. Howard Elliott, the chairman, and will maintain offices in Boston and New Haven.

Mr. A. D. Furlong, who has been third vice-president, general manager and purchasing agent of the Springfield (Ill.) Consolidated Railway, has been appointed general manager of the Saginaw-Bay City Railway and has been elected vice-president of the Saginaw & Flint Railway, Saginaw, Mich., to succeed Mr. John A. Cleveland, who as noted in the ELECTRIC RAILWAY JOURNAL of Dec. 27, 1913, has been appointed to a position in the office of Hodenpyl, Hardy & Company, New York, N. Y. Mr. Furlong entered the service of the Hodenpyl, Hardy & Company syndicate in the summer of 1906 as a collector in the gas and electric light department of the Pontiac (Mich.) Light Company. Later he filled the position of stenographer to the local manager of the Pontiac Light Company. Subsequently he held the positions of bookkeeper and chief clerk and secretary and general manager of the same company. On Feb. 1, 1912, he left the employ of the Pontiac Light Company to assume the position of general superintendent with the Springfield properties. In January, 1913, he was elected vice-president and appointed general manager of the Springfield Consolidated Railway, Springfield Gas Light Company and the Springfield Light, Heat & Power Company.

Mr. Edward Karow, who for the past year has been in the office of Mr. Horace Lowry, vice-president of the Twin City Rapid Transit Company, Minneapolis, Minn., as assistant, has been appointed superintendent of the Minneapolis division of the Twin City lines. Mr. Karow was born in 1884 and was graduated in 1905 from Princeton University, with the degree of civil engineer. In 1907 he received the post-graduate degree of electrical engineer from Princeton. He spent one year in the testing department of the General Electric Company at Schenectady, N. Y., one year in the office of the same company designing direct-current machinery, and three years in the railway commercial department of the company. He then became connected with the Twin City Rapid Transit Company as assistant to the vice-president.

Edward Karow

Mr. Slaughter W. Huff, president and general manager of the Coney Island & Brooklyn Railroad, Brooklyn, N. Y., has been elected vice-president of the Transit Development Company, Brooklyn, and will be elected vice-president of the Brooklyn Rapid Transit Company and the other companies in the Brooklyn Rapid Transit System, with assigned duties, to succeed Mr. J. F. Calderwood, whose resignation is announced elsewhere in this column. As stated on page 57 of this issue the Public Service Commission of the First District of New York has authorized the Coney Island & Gravesend Railway, a subsidiary of the Brooklyn Rapid Transit Company, to purchase 26,370 shares of the 29,839 shares of stock of the Coney Island & Brooklyn Railroad now outstanding.

Construction News

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

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

RECENT INCORPORATIONS

*Wisconsin, Illinois & Indiana Electric Railway, Chicago, Ill.—Application for a charter has been made by this company in Illinois to build an electric railway from the northern line of McHenry County south through the counties of Cook, Dupage, Kankakee, Will, Livingston and McLean. Capital stock, $500,000. Incorporators: J. C. Williams and H. M. Walker, Evanston; J. B. Hubling, Downers Grove, and James L. Clark and C. H. Seeberger, Chicago.

Fort Scott & Pittsburg Railway, Fort Scott, Kan.—Incorporated in Kansas to build a 38-mile line from Fort Scott to Pittsburg via Frontenac, Garland, Arcadia and Mulberry. Capital stock, $100,000. Incorporators: A. P. Dickman, C. D. Samble, W. J. Calhoun, A. N. Keene, J. R. Kearns, Robert B. Barr and Walter Glunz. [E. R. J., May 17, '13.]

*Dan River Railway, King, N. C.—Incorporated in North Carolina to build interurban electric railways in Stokes and other counties adjacent. Headquarters, King. Capital stock authorized, $500,000. Incorporators: Harlee Miller, Clemmons, N. C.; E. T. Knapp, Bethania, N. C., and Ernest C. Butler, Hamilton, N. Y.

*Saluda-Hendersonville Interurban Railway, King's Mountain, N. C.—Chartered in North Carolina to build an electric railway from Saluda to Hendersonville, 10 miles. Capital stock authorized, $125,000. Incorporators: J. M. Torrence, W. A. Mauray, C. E. Neisler and J. S. Stanton, Henderson, N. C.

*Charleston Northern Railway, Darlington, S. C.—Incorporated in South Carolina to build an electric or steam railway from Andrews to Charleston, 57 miles. Capital stock, $28,000 to $1,000,000. Officers: D. T. McKeithan, Darlington, president, and George S. Dargan, Darlington, secretary.

*Shelbyville, Petersburg & Decatur Railroad, Shelbyville, Tenn.—Incorporated in Tennessee to build a steam or electric railway from Shelbyville, Tenn., to Decatur, Ala. Capital stock, $10,000. S. P. Kirkpatrick, incorporator.

FRANCHISES

Little Rock, Ark.—The Little Rock, Pine Bluff & Eastern Traction Company has asked the Council for three franchises in Little Rock.

Winslow, Ariz.—J. F. Mahoney, Winslow, has asked the Council for a franchise for an electric railway in Winslow.

Jacksonville, Fla.—The Jacksonville & St. Augustine Public Service Corporation has received a franchise from the Council through South Jacksonville. This 40-mile line will connect Jacksonville and St. Augustine. Thomas R. Osmond, Jacksonville, general manager. [E. R. J., Aug. 23, '13.]

Atlanta, Ga.—The Georgia Railway & Electric Company has asked the Council for a franchise for extensions of its lines in Atlanta.

Baltimore, Md.—The United Railways & Electric Company has received the approval of its franchise on Callow Avenue from the Public Service Commission of the State of Maryland.

Springfield, Mass.—The Springfield Street Railway has received permission from the Public Service Commission for a double-track location in North Main Street in Springfield.

High Point, N. C.—The Yadkin River Railway has received a franchise from the Council in High Point.

Sewickley, Pa.—The Pittsburgh Railways has asked the Council for a franchise for a line from the Edgeworth borough line to the approach of the Coraopolis bridge along the old Fort Wayne right-of-way.

Dallas, Tex.—The Dallas Consolidated Electric Railway has received a franchise from the Council to double-track certain sections of San Jacinto Street and Washington Street in Dallas.

TRACK AND ROADWAY

Birmingham Railway, Light & Power Company, Birmingham, Ala.—Among the extensions planned in the near future will be a 1-mile line from Vinesville to Fairfield and a 1½-mile line from Boyles to Dolcito Quarry.

Northern Electric Railway, Chico, Cal.—Work will be begun in the spring on a 40-mile extension from Woodland to Colusa.

Pacific Electric Railway, Los Angeles, Cal.—A contract has been awarded to Robert Sherer & Company, Los Angeles, for 5 miles of grading between Hawthorne and El Segundo for a new short line from Ionia Avenue on Rodondo Beach line to El Segundo, via Hawthorne. Plans are being considered to extend the Daisy Avenue line from its present terminus at State Street to the new residential section in the northwest section of Long Beach.

Sacramento Valley West Side Electric Railway, Willows, Cal.—This company has asked the permission of the State Railroad Commission to begin the construction of the section of its line from Red Bluff to a point on the Oakland, Antioch & Eastern Railway 11½ miles south of Dixon or a few miles from Denverton. The line will be extended to Rio Vista on the Sacramento River, where it will have water connections. This 160-mile line will extend through the west side of the Sacramento Valley. C. L. Donohoe, Willows, president. [E. R. J., Dec. 20, '13.]

Kellogg, Idaho.—An electric railway to be built and operated between Wardner and Kellogg is being promoted by local interests headed by C. Wiese. It is reported that the Bunker Hill-Sullivan Mining Company, Wardner, will be financially interested in the project. [E. R. J., Dec. 6, '13.]

Southern Illinois & St. Louis Railway, Harrisburg, Ill.—This company has increased its capital stock from $2,500 to $3,500,000. This line will connect Marion, Harrisburg, Benton, Johnson City and Herrin. William Rothman, Chicago, is interested. [E. R. J., Dec. 27, '13.]

*Kansas City Southwestern Electric Railway, Kansas City, Kan.—Plans are being made to build this line between Olathe and Ottawa. W. B. Strang, Overland Park, Kan., president.

Madisonville, Ky.—James R. Rash, referred to recently in connection with a proposed electric line from Madisonville to Nortonville, Ky., states that the project has about been given up. [E. R. J., Aug. 16, '13.]

Madisonville-Nortonville Light, Power & Traction Company, Madisonville, Ky.—Surveys have been completed between Madisonville and Earlington, 4 miles, and construction will be begun in April on this 12-mile railway to connect Madisonville and Nortonville via Earlington, Martons, Barnsley and Victoria. James Breathitt, Jr., Hopkinsville, is interested. [E. R. J., Nov. 22, '13.]

Osage, Ozark & Springfield Electric Railway, Fristoe, Mo.—It is stated that this railway has not yet developed beyond the preliminary stage on account of being unable to secure financial backing. E. E. Trippe, Fristoe, is interested. [E. R. J., April 15. '11.]

Missouri & Kansas Interurban Railway, Kansas City, Mo.—Plans are being considered to build an extension to Lawrence, 25 miles.

Omaha & Council Bluffs Street Railway, Omaha, Neb.—Residents of Kenwood and Fairfax additions to the city of Omaha have asked this company for an extension of the Dodge Lake Street line to Fontanelle Park.

*Fair Haven, N. Y.—Frank Hendrick, Sterling, and associates are considering plans to build an electric railway to connect Oswego, Sodus and Fair Haven, along the shore of Lake Ontario.

Long Island Railroad, New York, N. Y.—Surveys are being made to double-track the section of the line between Easthampton and Montauk.

Waynesville & Canton Electric Railway, Waynesville, N. C.—Work will not be begun on this line until financial backing has been secured. This 12-mile railway will connect Hazelwood and Canton via White Sulphur Springs, Waynesville, Clyde and Lake Junaluska. Headquarters, 48 Patton Avenue, Asheville, N. C. Henry T. Sharp, Asheville, promoter. [E. R. J., June 28, '13.]

*Beach, N. D.—Preliminary arrangements are being made to build an electric line between Beach, Burkey, Williams, Alha, Carlyle and Dennis to Baker, Mont. Terminals will be at Beach, N. D., and Baker, Mont. No names are yet given of those interested in the project.

Cincinnati (Ohio) Traction Company.—This company has received permission from the Park Commissioners to build the new Bond Hill line in Cincinnati over the Reading Road.

Cleveland (Ohio) Railway.—This company has placed in operation its new line through the Shaker Heights district.

Cleveland, Alliance & Mahoning Valley Railway Company, Cleveland, Ohio.—The Warren division was placed in operation between Ravenna and Newton Falls on Dec. 15. Two-hour service is given between these points. It is planned to have the Alliance and Warren divisions merged into a line that will be extended to Cleveland. [E. R. J., Oct. 25, '13.]

Toledo Traction, Light & Power Company, Toledo, Ohio.—Plans are being considered to build a line from Alvordton to Hillsdale.

Ardmore & Western Interurban Railway, Ardmore, Okla.—Plans are being made to begin work in the spring on this 100-mile electric railway to connect Ardmore, Springer, Glenn, Woodford, Milo, Oil City, Cornish, Orr and Brock. John Owens, Ardmore, president. [E. R. J., June 28, '13.]

Imperial Traction Company, Ottawa, Ont.—Plans are being made to begin work in the spring on the line from Smithsville to Bridgeburg via Hamilton. [E. R. J., Nov. 8, '13.]

Niagara, St. Catharines & Toronto Railway, St. Catharines, Ont.—The new St. Catharines-Niagara-on-the-Lake line of this railway has been placed in operation.

Lehigh Valley Transit Company, Allentown, Pa.—Plans are being made to straighten and shorten the line between Norristown and Allentown.

Hershey (Pa.) Transit Company.—Plans are being made to build a line between Hershey, Grantville, Ono, Jonestown and Fredericksburg, via the counties of Lebanon and Dauphin.

Montreal (Que.) Tramways.—Work will be begun early in the spring on the extension along Van Horne Avenue to the western limits of Montreal.

*Jackson, Tenn.—The Merchants & Manufacturers' Association, Jackson, Tenn., is negotiating with New York interests for the construction of a trackless trolley line to Bemis. R. S. Fletcher, Jr., is secretary of the association.

Nashville (Tenn.) Traction Company.—Preliminary arrangements are being made to begin work on Feb. 1, 1914, on the 34 miles of new track in Nashville. The Detroit & Nashville Construction Company is being organized for the purpose of doing the construction work for the traction company. W. O. Parmer, Nashville, president. [E. R. J., Dec. 20, '13.]

Ogden (Utah) Rapid Transit Company.—Surveys have just been completed for another possible route for a line between Ogden and Logan.

Twin State Gas & Electric Company, Brattleboro, Vt.—An extension through Esteyville in the near future is being contemplated.

*Blaine-Lynden Electric Railway, Blaine, Wash.—This company has been organized to build an electric railway between Blaine and Lynden and will connect with the British Columbia Electric Railway's extension from Cloverdale to White Rock.

Seattle (Wash.) Municipal Railway.—Construction of 38.4 miles of double track, or 84.25 miles of single track, as an addition to the municipal line, now consisting of a line 4 miles long extending from Third Avenue and Stewart Street to Salmon Bay, is the plan of the city utilities committee of the City Council in Seattle.

*Minneapolis, Merrill & Marinette Railway, Madison, Wis.—An amendment to the articles of incorporation of this company has been filed to change its route from Merrill northwest to Prentice to a new plan to build from Merrill northwest to Antigo. John O'Day, president, and F. W. Kubasta, Merrill, secretary.

SHOPS AND BUILDINGS

Geary Street Municipal Railway, San Francisco, Cal.—Plans are being made to build a one-story addition to the Geary Street carhouses in San Francisco. The structure will be of reinforced construction. The cost is estimated to be about $60,000.

Cedar Rapids & Iowa City Railway & Light Company, Cedar Rapids, Ia.—Plans are being contemplated to purchase a site in Davenport on which the company plans to build new carhouses.

Interstate Street Railway, Attleboro, Mass.—Work will be begun soon on a new passenger station at Jay Street in North Attleboro.

Mesaba Electric Railway, Duluth, Minn.—Plans are being considered by this company to build a new carhouse next spring in Virginia, Minn.

Public Service Railway, Newark, N. J.—A new office building will soon be built in West Hoboken, where all commercial offices of the company will be located.

Salt Lake & Ogden Electric Railway, Salt Lake City, Utah.—This company and the Salt Lake & Utah Railway plan to build soon a new joint interurban terminal on the block bounded by Main Street, West Temple Street, Second Street and Third South Street in Salt Lake City.

POWER HOUSES AND SUBSTATIONS

Pacific Electric Railway, Los Angeles, Cal.—Work will be begun at once to build two new power houses. One will be located at San Bernardino and the other in the vicinity of Etiwanda. Contracts for construction of these will be let in the near future. Both structures will be of reinforced-concrete construction.

Danbury & Bethel Railroad, Danbury, Conn.—This company has ordered one 600-kw steam turbine with exciters and two 600-volt, 200-kw rotary converters with transformers and switchboards from the General Electric Company.

New York Central & Hudson River Railroad, New York, N. Y.—This company has ordered two 2000-kw rotary converters and six 735-kw transformers from the General Electric Company.

New York State Railways, Rochester, N. Y.—Work has been begun by this company on its new substation in Rochester. The structure will be of brick and reinforced concrete construction. There will be a main machine room with a separate room for office and separate transformer room. The equipment for the station has been ordered.

Sand Springs Railway, Tulsa, Okla.—One 200-kw, 600-volt d. c., two-phase, sixty-cycle, 1200-r.p.m. a. c. self-starting rotary converter, two 110-kva, 2200-volt to rotary voltage, single-phase, sixty-cycle, O. I. S. C. transformers and one switchboard to control above will be installed by this company at its power plant in Tulsa. The apparatus has been ordered from the Westinghouse Electric & Manufacturing Company.

Chambersburg & Shippensburg Railway, Chambersburg, Pa.—This company will install one 200-kw, 600-volt d. c. three-phase, sixty-cycle, 1200-r.p.m. a. c. self-starting rotary converters, three 75-kw, 13,500 to rotary voltage, single-phase, sixty-cycle transformers and one switchboard for the control of the above apparatus in its power house in Chambersburg. The contract for this apparatus has been placed with the Westinghouse Electric & Manufacturing Company.

Greenville (S. C.) Traction Company.—One 500-kw, 600-volt d. c., six-phase, sixty-cycle, 900-r.p.m. a. c. and d. c. self-starting rotary converter, three 185-kva, 12,900-volt to rotary voltage, single-phase, sixty-cycle, O. I. S. C. transformers and one switchboard to control the above apparatus will be installed by this company at its power plant in Greenville. The apparatus has been ordered from the Westinghouse Electric & Manufacturing Company.

Greenville Railway & Light Company, Greenville, Tex.—This company has placed an order with the Westinghouse Electric & Manufacturing Company for one 200-kw, 600-volt d. c., three-phase, sixty-cycle, 1200-r. p. m., compound-wound, self-starting a. c. rotary converter and one switchboard for the control of same.

Manufactures and Supplies

ROLLING STOCK

Greenville, Spartanburg & Anderson Railway, Greenville, S. C., has ordered two parlor cars and ten trailers from the Southern Car Company.

City of Batavia, New York, N. Y., is reported to be in the market for a number of small cars to be operated over the tracks of the Buffalo & Williamsville Electric Railway in Batavia, which the city is about to purchase.

Brooklyn (N. Y.) Rapid Transit Company, noted in the ELECTRIC RAILWAY JOURNAL of Oct. 4, 1913, as having issued specifications for 100 steel subway cars, has ordered these cars from the American Car & Foundry Company.

Chicago (Ill.) Elevated Railways, noted in the ELECTRIC RAILWAY JOURNAL of Dec. 6, 1913, as being in the market for 120 cars, has ordered 128 cars from the Cincinnati Car Company, including sixty-two motor and sixty-six trail cars. Wide and center-entrance doors, Baldwin M. C. B. trucks, General Electric field control motors, Westinghouse multiple-unit control and automatic air brakes are specified.

TRADE NOTES

United States Electric Signal Company, West Newton, Mass., has appointed Roland F. Gammons, 2d, vice-president and treasurer of the company.

Railway Traction & Supply Company, Chicago, Ill., has sold a trial order of 120 Wyoming vacuum sanders to the Cincinnati Traction Company, Cincinnati, Ohio.

Griffin Wheel Company, Chicago, Ill., has elected Thomas A. Griffin as chairman of its board of directors. Franklyn L. Whitcomb, formerly vice-president of the company, has been appointed president to succeed Mr. Griffin.

Barnes & Kobert Manufacturing Company, New Haven, Conn., has organized a sales department and appointed as sales manager R. H. Harper, who for the past ten years has been manager of the railway department of the Western Electric Company.

Manning, Maxwell & Moore, Inc., New York, N. Y., have appointed E. M. Chadwick, formerly with the Fairbanks Company, as manager of their Buffalo branch. D. A. Hamilton, formerly with the Reed Prentice Company, has been appointed assistant at the Detroit branch of the company.

General Electric Company, Schenectady, N. Y., has received an order from the Detroit United Railway for 252 two-motor car equipments. This item is a correction of one in the ELECTRIC RAILWAY JOURNAL of Dec. 27, 1913, in which an error was made in regard to the number of motor equipments ordered.

Weir Frog Company, Cincinnati, Ohio, announces that after litigation extending over seven years it has successfully defended its right to make its well-known derailing device, in general use where steam roads are crossed by interurban roads and where the law requires that the derailing device be operated at a distance from the railroad crossing.

Standard Underground Cable Company, Pittsburgh, Pa., has appointed E. J. Pietzcker Western and Southwestern sales manager in charge of its Chicago and St. Louis offices. W. M. Rogers has been appointed as assistant Western sales manager and R. C. Houck as assistant Southwestern sales manager. E. E. Woodbury has been transferred from the Pittsburgh to the St. Louis office.

Lord Manufacturing Company, New York, N. Y., announces that hereafter it will manufacture and sell the standard railway appliances which for the past twenty years have been handled by the Sterling-Meaker Company, Newark. N. J. These specialties are Giant brakes, Sterling safety brake, roller-bearing trolley bases, fenders and wheelguards, sand boxes and ticket punches.

American Abrasive Metals Company, New York, N. Y., received an order for its Feralun safety treads to be used on the hundred new cars which were ordered by the Chicago City Railway from The J. G. Brill Company. This item is a correction of one which appeared in the ELECTRIC RAILWAY JOURNAL of Dec. 13, 1913, in which it was erroneously stated that the step treads ordered were Universal safety treads.

Nichols-Lintern Company, Cleveland, Ohio, has received orders for sander equipment for 376 cars of the Columbus Railway & Light Company and fifty cars of the Cleveland Railways. Other sander orders have been received from the Scioto Valley Traction Company, Northern Ohio Traction & Light Company, Toledo & Western Railway; for selector switches from the G. C. Kuhlman Car Company; for switches from the New York State Railways; for ventilators from the Union Traction Company of Indiana, Muncie & Portland Traction Company, Scioto Valley Traction Company, Northern Ohio Traction & Light Company, Fairmont & Mannington Railway, Youngstown & Ohio River Railroad, Lake Shore Electric Railway, Mahoning & Shenango Railway & Light Company.

ADVERTISING LITERATURE

Universal Trolley Wheel Company, Northampton, Mass., has issued a New Year's circular describing its composite self-lubricating trolley wheel.

Trussed Concrete Steel Company, Detroit, Mich., has issued a catalog describing its various methods of waterproofing and dampproofing by means of its technical points.

The J. G. Brill Company, Philadelphia, Pa., printed in the December, 1913, issue of the *Brill Magazine* an illustrated biography of J. B. Hamilton, general manager of the Leeds Corporation Tramways, Leeds, England. Among the feature articles are the following: "Conditions which Govern the Type of Cars for City Service in Copenhagen, Denmark," "Semi-Convertible Cars for the Lacroze System, Buenos Aires," "Cars of Various Types for Brazil," "Double-Deck Cars for South Africa," "Longitudinal Seat Car for Concepcion" and "Passenger and Freight Cars for Piraju."

NEW PUBLICATION

Illinois Public Utility Commission Law and Municipal Ownership Law. By William J. Norton, M.E., Chicago, Ill. Published by the author. Size, 8½ in. x 11 in., 200 pages. Price, $2.

Mr. Norton's work as secretary of the rate research committee of the National Electric Light Association and his former position as assistant secretary of the New York Public Service Commission, First District, especially fitted him to prepare the valuable volume which he has issued in reference to the new Illinois law. An index-digest arranges in convenient form references to the sections of the law which relate to special subjects, such as definitions of the principal terms used, references to administrative powers, points relating to proceedings before the commission, what the utility may do and what it must do. One of the most interesting features of this unique volume is the series of comments on different sections of the Illinois law appended at the bottoms of the pages. These do a great deal to interpret the measure for the benefit of public utility operators in Illinois who are confronted with regulation in 1914 and for others who want to study the measure. To those who study the subject of regulation and the affairs of the various commissions, the notes of Mr. Norton are the most interesting part of his work, because they throw into relief the conflicting practices of various commissions and provisions of various laws dealing with this topic. For instance, in the reference to valuation, Mr. Norton calls attention to the importance of the clause providing that the commission shall have power to ascertain any fact which in its judgment may or does have any bearing on the value of the property of public utilities. He calls attention to the clause of the Indiana law requiring that the commission shall give weight to the reasonable cost of bringing the property to its then state of efficiency and also cites various cases dealing with the subject of valuation. Again, Mr. Norton, in his reference to another clause, states that the Indiana commission in 1913 used a clause similar to that in the Illinois law to require utilities to give the value of all property useful to the public and to state the estimated amount of going value included. He adds: "This was a real abuse of authority and unnecessarily worried the utilities." In many ways the book invites careful study by observers of public utility regulation.