Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Volume 53 New York, Saturday, March 22, 1919 *Number* 12

Electrification Demands a New Type of Engineer

LAST WEEK the American Institute of Electrical Engineers held an all-day meeting in Boston, and devoted the morning session to steam railroad electrification. In the paper by Calvert Townley and the discussion which followed its presentation, the subject was viewed from an angle different from that usual at electrical engineering meetings. The emphasis was laid upon financial considerations, particularly limitations, and upon the personal element. The technical difficulties of electrification were properly assumed to have been largely overcome, and difference of system to have become negligible. What was particularly interesting was the reference to the parts played in the matter by the steam and electrical engineers, each of whom was acknowledged to lack certain elements. The "steam man" would naturally be bound by certain engineering and operating prejudices, while his electrical brother would by temperament and inclination tend to overoptimism in his vision of an all-electric railroad system for the country. A new type of engineer is needed, therefore; shall we call him an "electrification engineer," or better, a "transportation engineer"? He must be able to perform the very difficult feat of approaching the electrification proposition from two directions at once. Even a few big men of this type can be very useful during the next decade.

Economical Maintenance Has the Floor This Week

IF THIS ISSUE of the Electric Railway Journal does not help master mechanics, way engineers, power plant men and others in making a dent in maintenance costs it will have failed of its purpose. While the presidents and general managers are struggling with the questions of fares, franchises and publicity the men mentioned above must keep the cars going, and going well. It is a perfect marvel how they have succeeded in doing this under the conditions which have prevailed during the last three or four years. If it had not been for a combination of ability and loyalty on their part the problems of the executives would have been even more difficult to solve than they are. The editors of this paper have had the conviction, and there is reason for it, that under war-time stress new or improved maintenance methods would be developed that would be greatly in advance of those used heretofore. Evidence is accumulating to show that this is the case. Look over this issue of the paper with a view to picking out some of the things that show improvements in maintenance methods. There are many of them. They all help to lessen the burdens of the men higher up.

The writers of the articles in this issue have been asked and urged to hold primarily in mind the thought of keeping down costs. Of course by this we mean long-run costs, not necessarily first costs. The writers are all men who speak from practical experience; there is no theorizing here. On behalf of the industry we express appreciation for the efforts of many busy men to make this the most helpful Maintenance Issue the paper has ever published.

Spirit of Compromise Should Control Valuation Work

THE electric railway industry is breaking down. We are sure, however, that neither the prominence of the speakers at the mid-year meeting of the American Electric Railway Association last week nor the vehemence of their utterances made the above-stated fact more apparent to the delegates than it was before they came to New York. The industry has known for a long time that it was facing a catastrophe. How to avoid this is the real question, and it is this phase of the discussion at the meeting to which the closest possible attention should be given.

A readjustment of the relations between electric railways and the public is inevitable in the majority of cases, and where this is necessary, according to Mr. Gadsden, only two ways are open—the acceptance of the service-at-cost principle or the submission to public ownership. For reasons which have appeared often in these columns, we believe that the service-at-cost principle gives the better promise of success from the point of view of the utility, municipality, commission and investor. Hence we welcome, as a most commendable sign of progress, the determination of the association through the committee on readjustment to analyze the service-at-cost idea in all its theoretical and practical aspects and directly aid companies and communities in the application of this idea.

But, as Mr. Gadsden, Mr. Kealy and others pointed out, the primary requisite of any service-at-cost plan or of public ownership, too, for that matter, is a valuation. This subject has been discussed by a multitude of men during the last few years, and the fundamental principles have been definitely determined. They are clearly stated, for example, by Mr. Taylor. Unfortunately this does not mean that such valuation figures can always be obtained, so that some companies may have to decide whether business expediency may not sometimes dictate the acceptance of a lower valuation than theoretical justice would require.

To Mr. Kealy's mind, the day for a new phase of valuation work—that of compromise—has indeed come, and we believe he is right. This does not mean that electric railways should hasten to sacrifice their property value. It means simply that many details in valuation work, regardless of the mutual acceptance of principles, are matters for bargaining and therefore

compromise. It means that a point should without great difficulty be reached where the immediate assurance of protected investment and prompt returns through agreement can well be deemed more beneficial to all concerned than the insecure investment and defaulted returns almost certain to accompany a continuance of the controversy.

The question is a grave one upon which, as Mr. Gadsden pointed out, the association must in the near future take a positive stand. Some interests may not be benefitted under a valuation and a service-at-cost plan, but, as Mr. Taylor stated, corporations which through gross overcapitalization are unable to accept his principles constitute an abnormal class which the association cannot justly sustain. Without a doubt the great majority of electric railways would be helped by valuation compromises leading to service-at-cost franchises.

A Promising Element In Electric Railway Power Distribution

THE automatic substation is not perfect, of course. No reasonable person would expect it to be so after less than four years of commercial development, especially with a world war going on during most of this period. However, on visits made to typical automatics during the past year the writer has yet to hear anyone say that the principle of automatic control is not sound and that such minor imperfections as still exist in the equipment are other than those naturally incidental to such a new and important improvement.

When the automatic plan was first promulgated it was a rather general belief that very little modification in standard apparatus would be needed to provide everything necessary for making substations automatic. It was soon found, however, that there were certain specific service requirements in such substations that made some modification necessary. For example, switches which had ample rupturing capacity for the very occasional opening which occurs in a manually-operated substation were found to need modification when operated many times a day. Relays which were all right in a uniform temperature were found to vary in time of operation when subjected to fluctuating temperature. Such things as these are, however, mere trifles when compared with the wonderful development of the equipment as a whole.

Unfortunately for the automatic substation, practically its whole life has been simultaneous with high prices, scarce labor, discouraging conditions of the industry generally, and war. In spite of all this a great deal has been accomplished, and the record has been placed before the industry in a series of articles in this paper, the latest being in the present issue. Other important articles are in preparation. A review of these at this time will prove very profitable to anyone vitally interested in improving power distribution conditions on his property. The subject also might be well discussed at the coming convention of the American Electric Railway Engineering Association. This association has held practically no meetings since the automatic substation became a factor in power distribution. Many members of the association have now had practical experience with its operation. A frank comparing of notes would therefore be benficial, not only to those who have installed these substations but also to the larger number who hope soon to install them. We suggest therefore that a liberal space on the program be assigned to this topic. There will be no difficulty in getting qualified engineers to handle it.

Talk About What The Public Is Thinking and Feeling

THE replies to our recent questionnaire to public representatives, of which two sections have been printed, indicate, as we have said before, that the present ignorance and distrust on the part of the public can only be removed by publicity and proper service on the part of the railways. Furthermore, in speaking particularly of publicity, the great majority of the commissioners, mayors, leaders of chambers of commerce and others said that there was a need of complete data, frankly given, on the subjects of operating expenses, increaces in costs, investment and rate of return.

This question of what facts to give the public is of fundamental importance. Not all that is published as publicity should really be called by that name. Many electric railway publicity campaigns which have been conducted have been distinguished by one or both of two features—a good-humored or satirical commentary upon the foibles of the traveling public, or an ingenious presentation of matters about which the railway wants the public to think. Such campaigns are all right in their way, but after all they are merely the adjuncts of publicity. They talk about the patrons, rather than to them about the company; or they tell what the railway thinks the patrons should know about utility problems in general rather than what the patrons want to know about their company's problems.

Now do not mistake our argument. The individual patron and the public as a whole have shortcomings and need to be educated, but campaigns should begin at the right end. The real publicity campaign—and consequently the only successful one—is that which concerns itself with matters about which the public is clamoring for information. There is no substitute for a frank, truthful answer to what the public wants to know. Other information is by nature, and should be by position, supplementary.

Hope that Time Will Correct the Situation Probably Illusory

A FAVORITE argument used to deny the need of higher fares on electric railways is that the higher prices during the war were temporary only and now that the armistice has been declared and the soldiers are returning to peaceful occupations, prices will go back rapidly to the level of five years ago. For these reasons, it is claimed, the need for the higher fare is over or will be within a few months and it is not worth while now to go to the trouble of making a change. Some electric railway men may have had the same thought and have believed that if they could keep their properties out of the hands of a receiver until next summer or at latest in the fall, they would reach a time when their troubles would be over.

Those who think the coming of low prices is only the question of a few months can well read the comments quoted by the Public Service Railway from leading authorities on economic matters in the company's petition for a zone system of fares. The authorities mentioned include the Federal Reserve Board, Mr. Vanderlip, the National City Bank and the Mechanics & Metals

Bank of New York. These opinions, while naturally conservative as regards the future trend of prices, are far from supporting the idea that there is to be any early return of the prices of 1914-15. For the most part, these opinions were given early in the year. Since then, Prof. Irving Fisher of Yale has expressed himself even more strongly in support of the view that we are definitely on a new high-price level which presumably is as permanent as anything in the way of prices can be. In fact, Professor Fisher says "Business men should face the facts. To talk reverently of 1913-14 prices is to speak a dead language to-day."

He bases his opinion, which was presented at the conference of governors and mayors at Washington early this month, on the increase of the country's gold supply, the increase in deposit banking throughout the world, the continuation of government loan issues connected with reconstruction throughout the world and other pertinent factors. In reply to the statement sometimes made that prices will have to fall when we begin to feel European competition, Professor Fisher points out that since the war, prices have risen in Europe more than here, and in his opinion they are no more likely to fall there than here and for the same reasons.

We are quoting these facts so as to remove any false impression of the probable future trend in prices. But even those who believe that prices will come down have no valid reason for denying a higher fare to electric railways. If prices do fall and the railway profits become excessively large, the Public Service Commission has absolute right to reduce the fares. Hence the last vestige of any reason for keeping fares on a low level has disappeared.

There's a Broad Field for the Proposed Welding Society

WELDING operations cover a field in which all branches of engineering are interested. At present all the technical papers in this country and abroad are having a good deal to say about welding. One reason for the attention thus being focused on the industry has been the pressure which the welding committee of the Emergency Fleet Corporation has placed on manufacturers of welding equipment to develop their apparatus to supply the urgent needs that were required during the war. Another reason is the popular interest excited by certain welding repairs which were carried out on the disabled German ships in this country. This set all branches of industry to asking why welding had not been applied more extensively to the work in their particular fields.

Previous to the war the development of all types of welding was hindered by the fact that a great amount of work done by welding had proved unsatisfactory. This resulted from lack of proper attention to underlying principles. Industries which have a broad field for the application of welding thus came to consider that special skill is required to produce good welds. It was further assumed that good and bad welds look alike and that there was no efficient method for checking up a completed weld to assure perfection. Another cause for the distrust which has been felt toward welding operations has been the endeavor of some manufacturers of welding apparatus to build up business for their particular lines of welding equipment upon the basis of mistakes or failures of the apparatus of other manufacturers. When users have pointed out that welding has proved unsatisfactory, rival manufacturers have sometimes stated that the poor results were due to the use of improper apparatus and that if their particular equipment had been used the fault would not have occurred. Here is where the new association of welding engineers will come in, for welding investigations conducted by an interested and dependable society will prove of great benefit both to those who use welding in their production and to the manufacturer of welding apparatus and supplies.

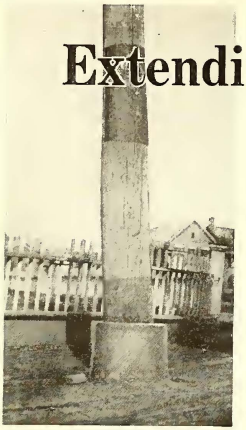
Road Supervisors Draw Attention to Weaknesses in the Service

COMPLAINTS about the quality of electric railway service received by a company from its patrons or published in the newspapers may have a real foundation or they may not. In some cases they undoubtedly come from a person who expects what is equivalent to taxicab service, or better than taxicab service, for a street car fare. All such complaints, when addressed to the company, should be answered, and if definite should be investigated. It is not, however, to the method of handling these complaints as to the lessons from a transportation standpoint which they may teach to which we wish here to draw attention. They often point out real weaknesses in the service which otherwise might escape observation.

In this connection, a recent analysis of the operating statistics of various electric railway companies reveals some strange comparisons, and shows perhaps a way for getting improved service in some cases without the expenditure of additional money. The item to which we have particular reference is that entitled "Cost of Superintendence." We will find, for instance, two properties of practically the same size and with similar local conditions, and one has a much larger expenditure for "superintendence" than the other. A first-hand study of service on the two systems reveals the astonishing fact that the company which paid out the most for "superintendence" makes the poorer showing in handling passengers. Investigation reveals the probable reason in the fact that the company which paid most for superintendence has an unusual number of starters or terminal men but is short of supervisors or inspectors traveling over the lines.

An experienced transportation man, in discussing this point, expressed his belief that the best results are not to be obtained in employing a great number of men to act as starters at the ends of routes. He had found that the platform men are likely to be spoiled by such practice, being trained to depend on others for the observance of scheduled leaving time and in the absence of such supervision the service had a tendency to become irregular. Said this official: "There is such a thing as too much supervision, or rather improper distribution of supervision. These starters as a rule have no disciplinary power and merely act as machines in telling the crews when to start. Trainmen are thus likely to lose initiative, and when starters are not on duty all day long or at all terminals the result is inefficient service. The same money paid for a few more intelligent supervisors, responsible for the regulation of service over a given territory, will always get more beneficial results."

We are inclined to put much faith in this point of criticism, and we offer it as a suggestion to transportation officials who really desire to please their patrons by distributing their facilities to the best advantage.



Extending the Life of Wood Poles

By CHARLES R. HARTE
Construction Engineer, The Connecticut Company, New Haven, Conn.

Many Methods Are in Use for Prolonging the Life of the Various Woods—The Author Describes These, Discusses Their Relative Advantages and Points Out How Different Preservatives Keep Out and Destroy the Destructive Germs

THE seasoning of wood is a much more complicated process than the mere drying out of the contained water; chemical changes occur in the contents and in the walls of the cells which have a marked effect upon the characteristics of the wood; but the amount of water content in the wood is the simplest and the most universal test of seasoning. This water occurs in three forms: First, what is commonly known as the sap, which fills to a greater or less extent the cavities in the wood fibers, particularly of the sapwood; second, water saturating the walls of the cells themselves; and third, water in the contents of the living cells, which constitutes more than 90 per cent. It is estimated that fresh sapwood of white pine is 50 per cent water, so that in 200 lb. of such sapwood 100 lb. is water and of this latter 60 lb. is sap, 35 lb. is in the cell walls, and 5 lb. is in the cell contents. In the heartwood, however, mineral salts from the sap, and gums, resins and the like produced by the action of the living cells, to a considerable extent take the place of the water. In consequence, the heartwood is not nearly so favorable to the growth of decay as is the sapwood; on the other hand, these deposits seal in such water as remains, and make the thorough seasoning of the heartwood a long-time procedure.

The rates at which the water dries out of several kinds of poles, and for different times of cutting are clearly shown in the accompanying curves, which are taken from Bulletin 84 of the United States Forest Service. These curves cover the usual practice in air seasoning, but in dry air the process goes on for a much longer period than shown, although the loss of water after the first few months is, speaking comparatively, very slow.

If, instead of piling in the air, the poles are first soaked for a few weeks, it is found that seasoning after their removal from the water proceeds at a much faster rate than in the case of the entirely air-dried ones; this is due to the fact that much of the gum and mineral matter is washed out, giving the contained water a more porous material through which to be evaporated.

Reduction in Weight Should Be Considered

While the chief purpose of seasoning is to cut down as far as possible the food supply of the fungi causing decay, and in case of preservative treatment, to put the wood in condition to absorb the maximum amount of the chemical used, the reduction in weight, and consequent saving in freight charges, is no small matter, ranging, as it does, from about 16 per cent in the case of chestnut to nearly 50 per cent for Western yellow pine. In the experiments described in Forest Service Bulletin 84 the results were as follows:

Species	Length of Treatment Months	Size of Pole Top	Size of Pole Length	Weight of Pole Pounds Green	Weight of Pole Pounds Seasoned	Loss of Weight Pounds	Loss of Weight Per Cent
Chestnut	4 to 6	7 in.	30 ft.	1120	940	180	16
Northern white cedar	6 to 12	7 in.	30 ft.	581	440	141	24
Western red cedar	3 to 5	8 in.	40 ft.	902	683	219	24
Southern white cedar	3 to 8	7 in.	30 ft.	768	540	228	30
Western yellow pine	3 to 9	8 in.	40 ft.	1697	862	835	49

These figures are for commercial air seasoning; a longer treatment under the same conditions of reasonably free circulation of air about the poles will result in still further loss of water, but at a rate which as a rule does not warrant it; kiln drying removes more water in very short time, and if immediately followed by treatment is often desirable, but great care must be taken that the heat is not high enough to affect the strength of the wood, and that the dried pole is at once treated, as otherwise it will absorb moisture from the atmosphere and will go back to the condition of an air-dried pole.

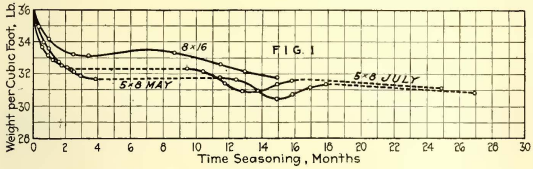
It has been mentioned that for air seasoning the poles should be so piled that the air has a free circulation about them; it is at least as important that they be held clear of the earth and that the supporting skids be of sound timber; and it is hardly less important that all undergrowth be cleared away.

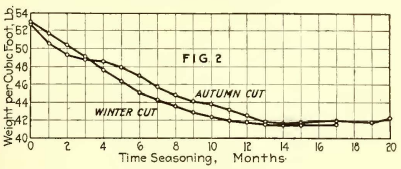
As a result of the removal of the sap itself there is little mechanical disturbance of the wood fibers, but as soon as the water in the cell walls begins to diminish the walls contract and set up stresses which are the chief cause of checking or cracking. The contraction is very slight in the direction of the grain, but across the grain it is considerable. It is about twice as great tangent to the growth rings as it is in the direction of their diameters and as a result the heavy checks are radial, and "ring checks" are apt to be very small or lacking unless the seasoning has been rushed. With most woods the larger part of the sap dries out before the cell wall water is affected, and the deposit in the wood of the solids held dissolved in the sap tends to choke up and to check the drying out of the cell wall water. With normal conditions little trouble is experi-

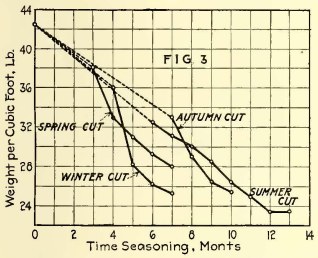
enced, the contraction being so slow that the wood adjusts itself to the stresses without actual splitting, and even with some speeding up the checks are chiefly at the butt, and being buried below the range of the decays, give little trouble. Such checked poles, however, should be carefully inspected to be sure that the checking is not serious at or close to the ground line.

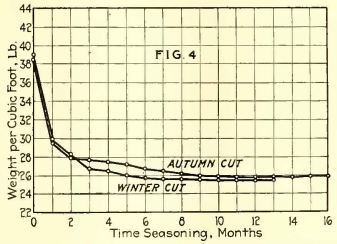
Circumference of Poles Remains Practically Unchanged with Seasoning

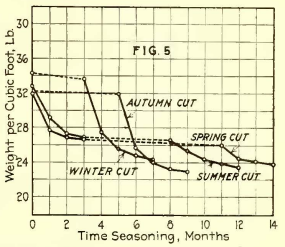
It is believed by many, particularly if they have poles to sell, that seasoning shrinkage materially reduces the circumference, so that poles well within specification requirements when cut, after seasoning often fail to pass, and the writer, and probably every other overhead man, has had many a doleful tale of such unfair shrinkage. As a matter of fact, however, very extensive measurements made by the Forest Service show











SEASONING OF POLES AND TIMBER, SEVERAL KINDS OF WOOD

Fig. 1—Douglas fir timbers, Eugene, Ore.
Fig. 2—Chestnut poles, Thorndale, Pa.
Fig. 3—Western red cedar poles, Wilmington, Cal.
Fig. 4—Southern white cedar poles, Wilmington, N. C.
Fig. 5—Northern white cedar poles, Escanaba, Mich.

that the external circumference is practically unchanged even when there is heavy checking, the shrinkage from green to air-dry condition averaging from three-tenths to one-half of 1 per cent of the circumference at the ground line, and from three-fifths of 1 per cent to nearly 1 per cent at the top, equivalent on the usual sizes of poles to from $\frac{1}{8}$ to $\frac{1}{4}$ in. in both cases, or a little less than one-third of this for the reduction in diameter.

A large proportion of the poles of to-day are innocent of any treatment other than seasoning; indeed, an appreciable number do not even get properly seasoned, but there is a steadily increasing percentage of the poles used which have had more or less extensive treatment with preservative of one kind or another. Some, as the paints, serve chiefly to keep out the germs mechanically, and if improperly applied afford them the best of conditions for growth. Others are more aggressive, and destroy any germs attempting to get a foothold.

The paints are used practically never except as local ordinances compel. A good paint, carefully applied to a smooth, dry pole, gives a coat which while unbroken is excellent armor against decay. Unfortunately—for it is comparatively easily applied—a paint coat is not only easily broken through, but if spread over a partially seasoned pole it seems materially to speed up fermentation of the sealed-in sap and the growth of forms of decay which require little oxygen, and which destroy the strength of the timber with practically no outside indication of the fact until under a load a little heavier than usual the pole fails. The artistic and restful effect of painted wood poles has led many city fathers to demand them; their consistently bad behavior leads wise overhead men to be equally insistent against their use.

Various tars have been used substantially as paints, with but little better success; the coat is more elastic, and therefore less liable to mechanical injury, and it does have a little greater antiseptic effect, but it does not penetrate and decay can and does occur under it almost as badly as in the case of oil paint. The practice of casing with concrete belongs in this general class. Oddly enough, although it might well be considered that in principle this is little different from painting and that internal decay would be promoted with the concrete treatment, the reverse is true, due apparently to absorption of salts from the green concrete, and the subsequent protection against their dissolving out given by the hardened concrete. The cost of the treatment bars it as a rule unless the concrete also serves as a foundation help; when used, the top of the concrete should slope sharply down from the pole, and care should be taken that there is no opening between the wood and the concrete in which rain water could pocket.

Still another treatment of the type surgeons would descrbe as aseptic, or keeping the "bugs" out, rather than the antiseptics, which are active poisons to the little scoundrels, is that of charring, but while this is comparatively simple and cheap it is unfortunately very uncertain in its action, and is very little used. To this uncertainty of result there is added, as further disadvantages, the facts that the charring is very easily carried to a point where the strength of the pole is affected, and the pole after treatment is much more readily lit up in case of a brush or grass fire.

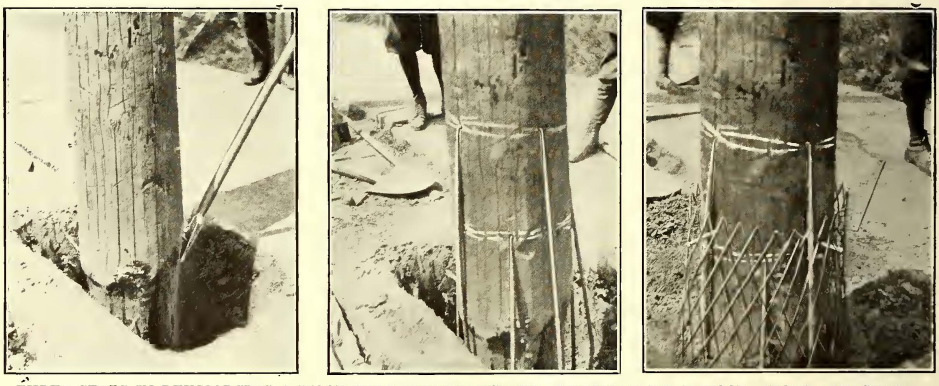
Of the antseptics there are two groups, the mineral salts and the oils. Of the first the chief are chloride

of zinc, bichloride of mercury, and sulphate of copper, the last two better known as "corrosive sublimate" and "blue vitriol" respectively. All three would be excellent if it was not for one common and very serious fault. They dissolve readily in water, and unless they are given some additional treatment they soon leach out except in very dry climates. The oils used are chiefly the creosotes and similar compounds.

When any organic matter is distilled, or heated so that it cannot burn, there are given off vapors some of which are permanent gases which do not change, while others condense as liquids and may be broken up into other combinations by suitable redistilling. In fact, the proportions of these different compounds in the first distillation can be greatly altered by varying the temperature and the speed of its increase. Eventually there is left in the still a solid mass of carbon and other solid matter, but just before this there comes over an unsavory syrup which has been given the general name of tar. This is really a most wonderful mixture and furnishes in addition to the other innumerable dyes, medicines, etc., the creosotes and the similar preservatives. Until comparatively recently the bulk of the creosote used resulted from the distillation of bituminous coal, either for illuminating gas or for coke. In the last few years, however, much creosote has been produced from the tar obtained in the manufacture of water gas. It will be remembered that water gas is made first by passing steam through a bed of glowing coal or coke, producing carbon monoxide, the "furnace gas" which every now and then wipes out a careless family, and then passing this gas, which gives almost no light when burned, and petroleum, through a very hot chamber or series of chambers where the oil is "cracked" into various compounds, some of which enrich the water gas while others condense out as it cools, forming a tar. The creosote obtained from this tar lacks the carbolic oils or tar acids of coal tar creosote, but while it was long believed that these tar acids were the important element of creosote, investigations by the Forest Service indicate they are far less important than was supposed.

Commercial creosote, it might well be pointed out, is the product obtained by the distillation of tar, after the first volatile oils have come over, and before "pitch" has been reached in the still. In the case of coal tar it is given off between the temperatures of about 450 deg. and 520 deg. Fahr., and contains carbolic oils or tar acids, napthalene, creosote oil and anthracene oil, the relative proportions varying considerably, depending on the coal, how the tar was produced, and whether or no a market demand for any of the constituents makes it desirable to remove them. Water gas tar creosote, as stated, lacks the more volatile tar acids, while wood tar creosote although also an excellent antiseptic and similarly obtained from wood tar, is chemically very different and the oil similary obtained from petroleum tar, which has been used to some extent in the West, apparently acts mechanically, but by filling the wood structure rather than by coating it, as in the case of the paints.

The preservative treatments may be grouped into two general classes, either of which is applied under one of several systems by one of several methods. In each of the classes the wood is first as nearly saturated with the preservative as may seem practicable; in the "full cell" class of treatment it is left in this condition; in the "empty cell" class a considerable portion of the preservative is withdrawn, on the theory that with good penetration it is only necessary to coat the cavities, and that any additional preservative is practically wasted. A high pressure system is the most effective for actual preservation, but the plant required is expensive; too expensive in fact for any but large users of wood in sections where either climatic conditions or high cost of long-lived timber compel treatment of everything. Under all other conditions it will usually be found that the somewhat less effective other systems are enough cheaper to be really more economical.



THREE STEPS IN REINFORCING A WOOD POLE WITH CONCRETE—REMOVING DEAD WOOD—IRONS ATTACHED—REINFORCING LATTICE WORK IN PLACE

High pressure full cell systems require a treating tank long enough to take the longest piece to be treated and of sufficient diameter to insure the required output. The charge is usually piled on one or more little cars which remain in the tank during the treatment and serve to transport the treated material to the storage yard. There is also required a boiler to furnish steam, pumps for handling the preservative and the condensation, tanks for storing the fresh and the used preservative and in a plant of any size, apparatus for purifying the used preservative, and for reclaiming the preservative from the condensation, in addition to the track system and loading and unloading derricks in the yard.

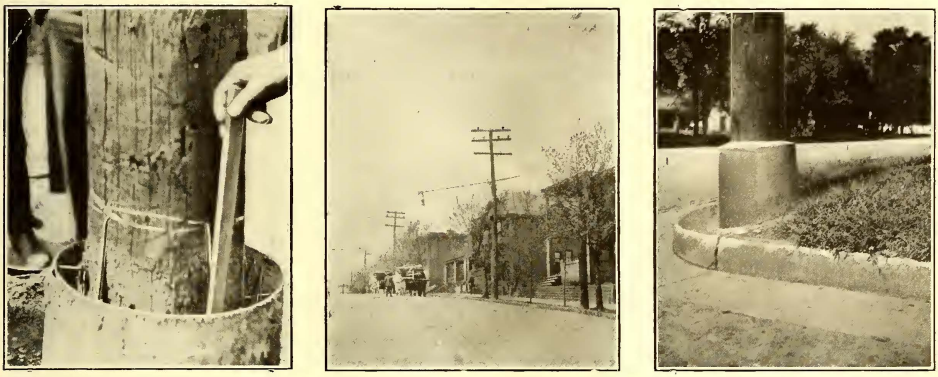
Substantially the process consists of steaming the timber to be treated for several hours at a pressure of 20 lb. per square inch or even higher. The steam is then condensed and the resulting vacuum increased by the pump which removes the condensation, after which the tank is filled with preservative and enough pressure is put on to secure the desired absorption. The remaining preservative is now run off into the storage tanks, and after draining for a short time the treated wood is withdrawn and the tank is ready for a new charge. Of the methods under this system, the Bethell employs straight creosote oil; the Burnett employs a 2 or 3 per cent solution of zinc chloride; the Wellhouse "Burnettizes" and then gives an injection of glue and tannin, which is insoluble in water and seals the zinc chloride against the leaching effect of water; while the Ruepping, Card and Allardyce methods employ zinc chloride and creosote, the first two mixing them, the Card keeping them thoroughly mixed by mechanical means during the treatment, while the Allardyce first treats with zinc chloride and then follows with the creosote.

In the high pressure empty cell systems the material must be seasoned before treatment. The plant omits the boiler, at least as far as steaming is concerned, but an air pump is required in the Ruepping method, which first puts the material in the tank under an air pressure of about 75 lb. per square inch, then fills the tank with preservative without releasing the pressure; next raises the pressure to about 225 lb., and finally suddenly draws off the preservative. The expansion of the air trapped in the cells blows out all but a film of preservative. In the Lowry method the preservative is run into the tank at the start, pressure is applied to it, and then it is not only withdrawn, but a vacuum is quickly created, and, as in the Ruepping method the trapped air blows out all but a film.

The low-pressure systems employ a full-size treating tank, and in general they differ from the high-pressure systems chiefly in that the pressures used are quite low, thus permitting a marked saving in the cost of the treating tank, and further savings in the cost of the auxiliary apparatus.

The no-pressure or open-tank methods are of two types. In the simplest the well-seasoned material is simply soaked in cold preservative, and while this has proved effective in the bichloride of mercury treatment (Kyanizing) of cut timber, it is little used otherwise. The more common procedure is the "hot and cold" treatment, in which the material is first soaked in hot preservative until it reaches the same temperature (about 200 deg. Fahr.) by which time the consequent expansion of the inclosed air has forced out of the material much of that air and quite a little of the sap still remaining in the case of air seasoning. The charge is then given a bath of cold preservative, and the resulting contraction of the air still in the wood creates a partial vacuum, into which the atmospheric pressure forces the preservative. In the empty cell process the cooling material is taken out of the bath when at a temperature of about 200 deg. Fahr. and allowed to complete the temperature reduction in the air, securing an absorption of the preservative which is on the outside when the material first comes from the bath, so that the finish finds a dry surface. This scheme necessitates one or two treating tanks depending upon whether the bath is changed or the material is shifted. In a large plant the latter plan is usually best; in a smaller plant the former is more economical, while for very small lots it may pay to use but one bath and leave the charge in it until both bath and contents have cooled. For long material, as poles, which require complete treatment the tank will naturally be horizontal, but except for those regions or species of wood in which decay occurs in the upper portion as well as at the ground line of poles, a butt treatment to a point about 18 in. above the ground is usually sufficient and for this a vertical tank is best. In addition to the open tank or tanks there are required means for heating the first charge, pumps for handling the preservative, storage tank or tanks and a derrick for handling the material, and if much work is to be done, storage space and an industrial track system are necessary.

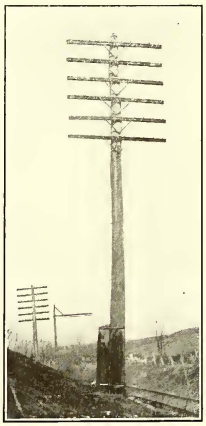
A method which is increasing in use, and which has the marked advantage that it is applicable to poles already set, although it is the least effective in terms of actual protection, is the brush treatment in which hot preservative is brushed or mopped on the dry pole or other subject. This method requires only the means of heating the preservative, the necessary brushes or mops and some form of support for the poles during



REINFORCING WOOD POLES WITH CONCRETE—AT LEFT, TAMPING THE CONCRETE; AT RIGHT, A FINISHED JOB; IN CENTER, THE REINFORCING OUTFIT ON THE WAY

treatment and until the coat is absorbed. At best the absorption is less than with any of the other methods, and the penetration is by the lighter tar acids rather than by the heavier and more lasting constituents in the case of creosote treatment. Better results are usually secured when the preservative used is one of the proprietary types, which have compositions designed to give good penetration and which for any one hand vary very little, rather than the commercial creosotes. In general the brush treatment gives a penetration about one-half as great as that obtained by the open-tank method. For the best results the preservative should be at a temperature of about 200 deg. Fahr., the pole should be well seasoned and dry, and two coats should be given; the second only after the first has been absorbed.

The metallic salts used in preservative treatments are definite chemical compounds and any adulterant is readily "spotted" by the chemist if not by the layman, but "creosotes" may vary within wide limits and characteristics, and yet be properly so called. The National Electric Light Association recommends the requirements given below for coal gas tar creosote, water gas tar creosote, and mixed tar creosote respectively as producing the best results. The Western Union Company uses substantially the same specification for coal gas tar creosote, and for comparison the latter company's specification for carbolineum is also given. The treatment used for any particular case will depend largely on local conditions. For yellow pine or other woods which decay readily in the upper portion, and for almost all woods used in the South a heavy treatment is necessary and this practically requires the closed tank method. In general, however, this method is employed for piling and lumber or other forms of wood which must have deep penetration of the preservative. Extensive new work in sections where conditions are not adverse will generally employ open-tank treatment, largely with creosote, either in commercial or in proprietary forms, although the zinc chloride treatment is excellent for dry climates or when properly sealed in; while for a great deal of work, particularly in projects of small size, or for the smaller companies, the brush treatment will be used. Incidentally it is claimed that a mop is much better than a brush for the actual application.



POLE REINFORCED WITH I STUB

When it comes to the question of increasing the life of poles already installed, however, the choice of treatments is more limited. If decay has already begun, there will be an affected belt at the ground line, usually about a foot in width, the rot depth depending upon the length of time it has been proceeding. If not checked, it works toward the center of the pole at a much slower rate upward, and at a still slower rate downward (unless the ground line is lowered) until eventually the pole fails. Meantime the soil about the pole has become infected; spores and the hyphae or the plant proper of the fungi are scattered in it, and conditions are favorable for quicker destruction of a new pole unless something is done either to remove or to kill the causes. In addition to the decay, insects which attack decayed wood are usually present, and help the attack on the old pole and its substitute.

Whether the damage is to be repaired or the pole is to be replaced by a new one, the infection danger must be reduced, and by far the safest plan is to remove the earth for a depth of 2 or 3 ft., and an equal distance all around the pole. If then the pole is to be restored the decayed wood must be cut out, for which purpose a broad chisel on a long handle, or a scraper, such as butchers use for their chopping blocks, similarly mounted will be found very convenient. Whatever the tool, the pole must be freed from all dead wood.

If this leaves sufficient solid stock the pole can be given only a preservative treatment. Quite a little work has been done to develop a small cylinder which, being in two parts, would be clamped over the critical section and would then allow a local pressure treatment, but while some promising results have been had, so far as the writer knows there is as yet no device which is really successful, the problem of sealing the ends being the chief difficulty. This leaves the brush treatment practically the only method. With a dry pole, hot preservative and two good coats produce very good results. Unfortunately it is a difficult matter to secure such conditions, and many companies feel that the cost of good work, or the short-lived effect of cheaper work, does not warrant the trouble.

Out of this condition there have developed two ways of avoiding a renewal, while some of the communication

N. E. L. A. AND W. U. SPECIFICATIONS FOR PRESERVATIVES

Preservative Specification	Coal Gas Tar Creosote N. E. L. A.	Water Gas Tar Creosote N. E. L. A.	Mixed Tar Creosote N. E. L. A.	Carbolineum W. U.
Must *not* contain	Raw or partly distilled tar of any kind; other creosote nor petroleum oil	Raw or partly distilled tar of any kind, other creosote nor petroleum oil	Petroleum oil nor its distillates, nor water gas nor oil tars or their distillates which contain more than 10 per cent of paraffine oil.	Any other tar, oil or residue from petroleum or any other source
Specific gravity at 38 deg. cent	Not less than 1.03.	Not less than 1.03.	Not less than 1.04	Not less than 1.09
	Not more than 1.08	Not more than 1.08	Not more than 1.10	Not more than 1.135
Residue soluble in hot benzol, not more than	1 per cent	1 per cent	3 per cent	0.25 per cent
Water, not more than	2 per cent. Shall mix with absolute alcohol, volume for volume	2 per cent	3 per cent	Flashpoint not below 140 deg. Burning point not below 170 deg.; ash on ignition not more than 1 per cent
Residue after sulphonation not more than	1 per cent	5 per cent	5 per cent	Fraction between 300 and 360 deg., 0.25 per cent
Tar acids, not more than or between	8 per cent		Not less than 2 per cent, nor Not more than 8 per cent.	Below 300 deg. (not more than 2 per cent)
Distillate up to 205 deg. Cent; not more than	5 per cent	2 per cent	3 per cent	
Distillate up to 235 deg. Cent.; not more than	35 per cent	10 per cent	25 per cent	2½ per cent
Distillate up to 315 deg. Cent.; not more than	80 per cent	60 per cent	80 per cent	At 300 deg., 20 per cent
Coke residue not more than	2 per cent	2 per cent	Above 360 deg., 35 per cent.	Above 360 deg., 35 per cent
Distillate between 205 and 235 deg. when cooled to 15 deg. Cent	Shall deposit naphthalene			

lines "duck" the issue by resetting the old pole until the lowest crossarm has reached the lowest possible limit. Obviously, however, such treatment can rarely be followed except on private way location.

The simplest proposition is to strengthen the affected pole by setting against it a stub which goes as deep as the pole and extends 5 or 6 ft. above the surface. The two are then tied together top and bottom by lashings, of wire and, if the pole has heavy service, by bolts through both. The old pole should be scraped, the adjacent earth replaced with fresh, and both pole and stub should have preservative treatment. This was for a long time the standard practice of the telegraph and telephone companies, but it, like resetting, is obviously restricted in most cases to private way location.

The Orr plan of reinforcement is a development to permit strengthening poles in highways. In this process the decay is cleared out as for the other treatments; the "necking" is then spanned by rods parallel to the pole, with their sharpened ends, which are at right angles to the main part of the rod, driven into the pole above and below the space decayed out. Outside of these is placed a belt of expanded or similar mesh steel reinforcement. Outside of this a steel split form can be easily placed, and finally the entire space is filled with concrete which is carefully worked to insure that all spaces are filled. The top is then sloped outward, and when the form is removed the pole shows a concrete base 3 or 4 in. thick all around which extends about a foot above the surface. If properly done, the appearance is good; unless the decay had progressed too far the pole is as strong as it was originally, and the concrete acts as a preventive of further decay. Care should be taken that the rods are entirely buried in the concrete, and that the top has enough outward slope to shed water. The pole should be scraped to live wood, and the concrete must be well worked into the spaces, but none of these requirements is hard to meet and the method is being used to a considerable extent, particularly where there are enough poles to be treated to warrant equipping one or more teams for the work. On trolley lines the plan of employing a work car has been tried, but unless traffic is infrequent the car will spend most of its time on sidings, with serious results to the temper of the dispatcher, and a greatly augmented cost of the work.

Maintenance Practice of the San Francisco Municipal Railway

Results of Five Years of Operation of this City Railway System, with Special Reference to the Relation of Construction to Upkeep

BY N. A. ECKART
Railway Engineer Bureau of Engineering, San Francisco, Cal.

A STUDY of the engineering design and the construction methods and practices of any railroad property will often reveal reasons for high or low maintenance costs. Unfortunately defects or faults in original design often may not be apparent for several years after operation has commenced, when some weakness develops in the track or equipment resulting in excessive maintenance charges. Sometimes these weaknesses may be remedied in the repair but as often as not the effects will continue to be reflected in the operating expenses until the time of reconstruction. The value of sound engineering design and practice in the original construction cannot be too strongly emphasized in view of the bearing that it has on the cost of maintenance. In each railroad system there are employed certain features of design and construction and methods and practices in construction and repair, which while confessedly not original are perhaps not in general use on other properties. These features have been adopted with the idea of avoiding troubles which have been observed to have developed in other properties where different practices have been the rule. Some details of the practice of the Municipal Railway of San Francisco which have aided in keeping down maintenance costs may be worthy of mention, although no claim for originality with respect to any of them is made.

On this system the standard construction specifications require that the subgrade shall be thoroughly flushed with a fire hose and rolled with a roller weighing not less than 10 tons. Where the subgrade is of clay it is not flushed, and likewise if of sand it is not rolled, although after 6 in. of ballast has been placed in the trench the sub-ballast is rolled with a 10-ton roller.

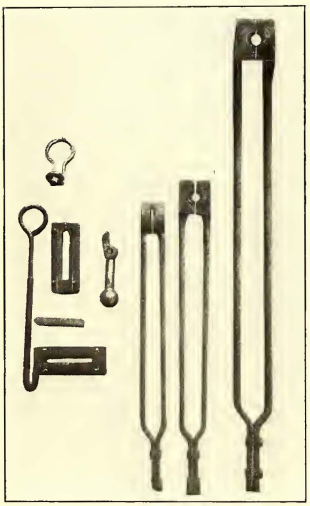
This practice has proved to have particular value in its effect in reducing the cost of maintaining the pavement adjacent to the tracks and likewise in adding to the permanency of the track surface. Where this practice has been followed the pumping of header blocks, which is a common occurrence on many roads, has been eliminated.

SPECIAL WORK STANDARDS WERE DEVELOPED

In 1913, when the city started to work on the lines which were to serve the Panama-Pacific Exposition and later, to form the main part of our system, a very complete set of special-work standards were worked out comprising thirty-five pieces. These in combination permit of making up all layouts for right-angle street intersections, from a grand union to a simple branch-off and right- and left-hand crossovers. Standard specifications for the manufacture of this special work, which is all of solid manganese, were prepared. These established the limits of variation in dimensions of each of these parts, so that each part is interchangeable for a similar part in any layout. This interchangeability of parts proved of great value in the original construction, where time was of the utmost consideration, and it reduces the number of parts which must be carried in

stock for replacements and extensions to the system.

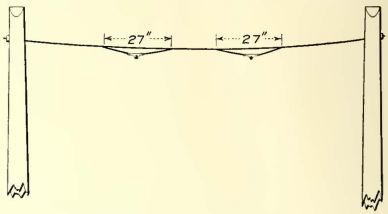
A rather interesting design of special-work layout was one installed at the intersection of Columbus Avenue and Taylor Street, and Columbus Avenue and Mason Street, where the Municipal Railway standard construction intersects a cable-operated line of the United Railroads in a curve, in both cases forming a rather acute angle and a point of intensive wear in an extremely expensive layout. To increase the durability the solid manganese crossing parts were made with insert plates, likewise of manganese steel, so as to permit of renewal in case of excessive wear or breakage at the crossing points. This layout has worn very well and although no renewals have been made up to date there is no question but that when the renewal is necessary it will more than double the life of this complicated and expensive piece of special work. The bonding practice adopted as standard on this system is the use of the electrically welded bond; of the concealed type in the girder rail construction and of the exposed type in the open T-rail construction. These bonds, which have been in service for five years, have not as yet had time to develop any weaknesses, and they show under test the same conductivity as when first installed. Concrete poles were adopted as standard practice at a slightly higher first cost than the steel poles with a particular view to reducing the maintenance charges in connection with the painting of steel poles. In San Francisco the salt air and fog corrode iron and steel very rapidly, particularly in the outlying and beach districts. The use of concrete poles has been found to be satisfactory and there have been no reasons developed which would warrant a change back to the steel pole. The concrete pole has permitted construction of extensions in short periods of time when deliveries of steel poles would have made their use prohibitive, and it is unnecessary to carry in stock any amount of concrete poles as they can be readily cast when required.



DROP FORGING DIES AND SAMPLES OF WORK DONE WITH THEM

STANDARDIZATION OF EQUIPMENT SIMPLIFIES OPERATION

Wherever it has been possible the type of rolling-stock equipment in use has been standardized, with the result that the electric equipment of all passenger cars, with the exception of twenty-eight small cars which were purchased with the Union Street line of the Presidio & Ferries Company, are identical. This feature of standardization in equipment has a double value; first, in that all operators have only to familiarize themselves with the operation of one type, which avoids a great deal of unnecessary abuse; second, in that when repairs have to be made the repairmen have only the one type with which to become familiar, and of course standardization reduces the number of spare parts which must be carried. It is true, of course, that these conditions cannot always be realized, and that conditions on this system are more or less ideal in comparison with conditions which have developed during a long period of time rather than practically within two or three years as in our case.

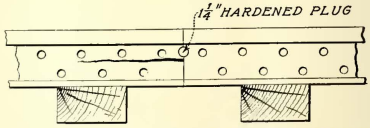


FLEXIBLE SUPPORT FOR TROLLEY WIRE AT "HARD SPOTS"

PRACTICAL KINKS WHICH AID IN MAINTENANCE

Some repair methods or kinks which have been worked out by the master mechanic of this property and which have proved of value are outlined in the following paragraphs.

One of our cars was damaged in a collision with a large auto truck which tore holes in the side plates for a distance of 3 ft. and over a width of 18 in. Repairs on these were made by cutting out the entire damaged section with an oxy-acetylene cutting torch. Into this space a new plate of the same thickness was fitted and welded along the edges and the joint was ground smooth with the aid of a portable grinder. After the car was painted and varnished the patch was not discernible. To have inserted a new plate would have required the removal and replacing of approximately one hundred $\frac{7}{8}$-in. rivets, the removal of the butt straps and about 60 sq.ft. of painting.



SCHEME FOR REPAIRING A RAIL JOINT INJURED BY SPLITTING OF WEB

During the war when bronze castings were up to 55 cents and 60 cents a pound and deliveries were extremely uncertain, the following method of reclaiming worn axle liners was adopted: These bronze liners were bored out $\frac{1}{4}$ in. and brought to standard dimensions with a medium babbitt. These reclaimed bearings are babbitted to exact size and require no further finishing. The average mileage obtained with the babbitted liner is approximately 40,000 and they can be rebabbitted many times before the bronze shell breaks.

It has also been found economical to substitute for certain small castings forgings which could be made in one heat. This forging work is done with a 300-lb. Bowdry power hammer by the use of several dies made up in the shop.

Two of the articles thus forged are shown in an accompanying illustration, one in the upper, left-hand corner. The procedure is this: A gate lock is first roughed out in the tong die shown just to the right. The piece thus "roughed" is inserted in the die of which the parts are shown just under the gate lock where the center portion is punched out. The slot thus formed is rounded out to the completed shape and the end is turned on the anvil. The illustration also shows a bell tapper which is forged out by the use of the longer two tong dies shown on the extreme right. In addition to the parts shown this method has been found useful in turning out a special bolt used for carrying the exit gate wheels, leaving the cutting of the thread as the only machine work to be done. We also make a peg for the motorman's stool, which is inserted in a 1-in. pipe and coupled thereto with a standard 1-in. coupling. The threading of the peg is, likewise, the only machine-tool work on this piece.

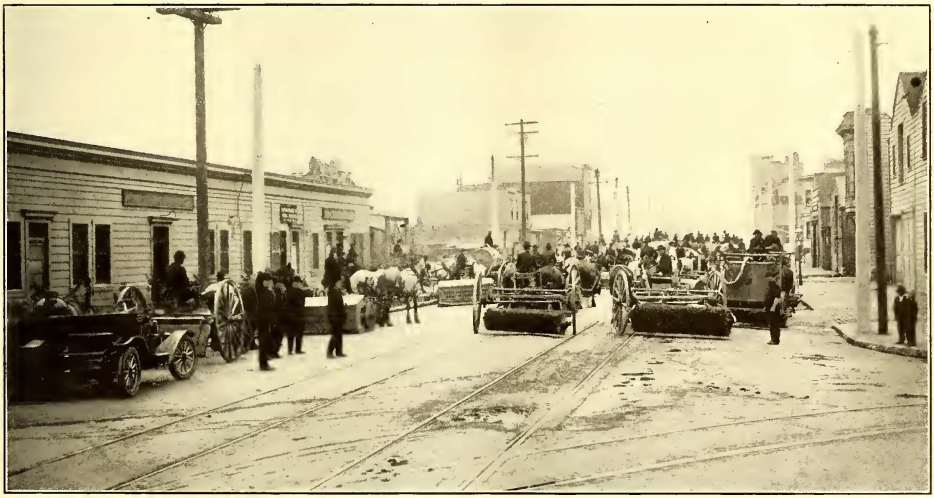
Where "hard spots" have been found in the trolley wire, caused by the blow of the trolley wheel at the point of support the trouble has been materially decreased by making the suspension from a subspan, which subspan has a great deal less initial tension and mass than the main suspension span. The construction is illustrated in the accompanying sketch.

Switch-group units which have been removed on account of wear have the poles filled in by oxy-acetylene welding. They are then fitted with case-hardened pins and bushings. This method has resulted in prolonging the life of these parts to three times that of the plain untreated pins.

In several instances where a rail has split along the web at the joint, the break has been repaired without cutting back and installing a short length of rail. The rail is drawn up under pressure by means of a heavy clamp applied at the head and base so that the crack is tightly closed. Then a 1¼-in. hole is drilled and reamed in the web or the split so that one-half of the hole is in the adjoining sound rail. Into this reamed hole a 1¼-in hardened steel plug is driven and the joint is replaced. While this method of repair might not at first glance appear mechanically sound, nevertheless it has stood up well under service and no weakness has developed. The economy over replacing the broken rail is very apparent, especially under existing prices.

Suggestions for Safety Councils

At the Seventh Annual Safety Congress, F. M. Rosseland, president Chicago Safety Council, made suggestions regarding the work of local councils. He said that the territory of the local council should be carefully divided into districts with a chairman and committee for each. The work in all districts should be the same, except as local conditions may indicate a definite change, and should be divided in three parts: (1) industrial safety; (2) public safety; (3) home safety. Industrial safety will receive first consideration, of course, and efforts should be directed in five different channels: (1) Safety rallies for workers; (2) instruction classes for safety supervisors; (3) inspirational meetings for foremen and superintendents; (4) monthly safety dinners for executives; (5) the investigation of unusual industrial accidents. The safety rallies should be held at least once every four or five weeks, should be opened at schedule time and, if held in the evening, should close at 9.30 or not later than 9.45. They may be held indoors or out of doors; may consist entirely of moving pictures or include moving pictures as part of a program. These meetings are principally inspirational and are of definite value to the plant safety supervisors.



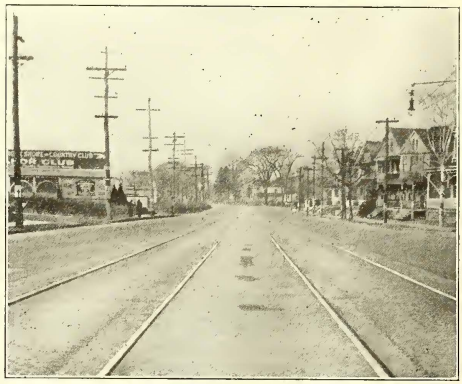
OVERHEAD CONSTRUCTION, SAN FRANCISCO MUNICIPAL RAILWAY, SHOWING CONCRETE POLE CONSTRUCTION

Some Results of Rail Conservation

Extended Trials Have Shown That by Careful Rehabilitation Old Rails Can Be Aligned and Low Joints Eliminated, Giving the Track a New Lease of Life—The Saving Thus Effected Is Illustrated by Various Examples—Other Track Practices Described

BY W. R. DUNHAM, JR.
Engineer Maintenance of Way, The Connecticut Company

AS EARLY as 1909, the writer believed there were great possibilities in the conservation of old rail. Perhaps it would be a happier term to say the non-renewal of rail, which it had been the custom to relegate to the scrap heap or sell for relayers, substituting a new and heavier section therefor. In that year I had the chance to try out the theory on a construction job, which consisted of relocating an existing single track suburban line on side location and laying a second track. The old rail in the single track was a 58-lb. low T, laid in 1894 and in good condition as far as the rail was concerned but in need of heavier joint plates, as the old plates were a light section. Heavier plates were installed, and the track is still in service and compares favorably with the second track laid in 1909 with 80-lb. low T rail. It was not until 1914, however, that it was possible to try out extensively the theory of rail conservation. In that year I was given actual charge of the maintenance of about 725 miles of track. It may be of interest to state here that in the past five years 4776 tons of old rail has been saved by the methods to be described, and the track is still in good condition. The net saving to the company during this period has been $200,000 in the net cash value of rail. This figure is based on pre-war prices of new and scrap rail and represents the actual cash saving, taking into account the cost of the heavier rail which would have been laid and crediting the scrap value of the old rail.



REHABILITATION CASE NO. 1. THIS TRACK WAS CONDEMNED IN 1908 AND PAVED IN 1915 WITH CONCRETE. THIS PICTURE WAS TAKEN IN 1919. THE APPARENT CRACK IN THE PAVING IS A JOINT

Most of the rail was of plain girder or T section, a greater portion being 7-in. 70-lb. rail that had seen from fifteen to twenty years' service. A large portion was in streets paved with macadam, a pavement which was replaced, under municipal orders, with a so-called permanent pavement. In one case the rail was apparently so far gone in 1908 that a welding company had refused to weld it, its representative declaring that "it isn't worth welding." This particular piece of track was overhauled in 1914 and '15, is still in good condition and will last for a number of years. In 1914 the writer estimated eight years of life for it, but from present appearances this figure is 50 per cent low. A view of this track, taken in 1919, is given in the engraving above. The maintenance charges have been low for the past four years, as can be seen from the figures under "Case No. 1" in the table.

The maintenance consists of building up "cups" as fast as they appear and grinding to a smooth surface. The success of most of the saving in rail was found to vary with the type of pavement used, and after investigation and study a compressed concrete pavement known to the trade as "Hassam" was adopted.

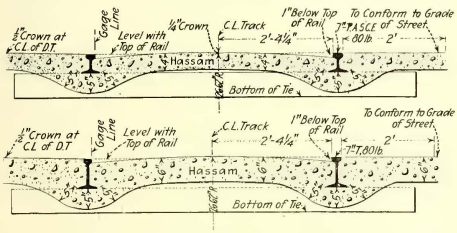
It may be of interest to say that the writer reported as follows to the general manager in 1914 on the condition of the track covered by the figures in the table under Case No. 2: "The rail on this street will last for eight years for one-third of the length, and fifteen years on the remainder, if we use the proper pavement and can purchase a welding and grinding outfit with some of the money saved. I will guarantee the joints from the bottom up, if you will give me the equipment to maintain the joints from the top down." He agreed to the proposition for this job, and in the following years to 1917 inclusive, we saved more than 12 miles of track on one division, as shown by the figures in the table on page 564.

The line in question was a double track main line with five minute headway. As the city had ordered the track paved, it was obligatory for the company to do the work.

The actual work on this division was the same as if new rail was to be laid, but two innovations, as far as the company was concerned, were introduced. Steel shims were used on the ties and Abbott plates were used under the joints. The concrete extended under the base of the rail to a depth of 5 in. in pockets between the ties and then sloped up to 16 in. in depth. The rail was completely embedded for its full height, plus 5 in., and, in effect, was laid on concrete ties 16 in. wide and 5 in. thick, between the wooden ties. The concrete pavement represented one cubic yard for each 5 ft. of single track and cost less per square yard than the pavement on the city's portion, which was 3-in. Topeka on the old macadam highway as a base. The two sections of track, on page 563, show this construction. The way in which the concrete adheres to the rail is clearly illustrated in the accompanying photo-reproduction of a section of a 7-in. 70-lb. T in pavement. This rail had

been in service for twenty years and the concrete pavement was put in place during July and August, 1915. The 4-ft. section shown was cut out in March, 1917, for inspection, the rail ends being cut 6 in. outside of the block. The 2-ft. shoulder of the paving is shown at the left-hand side of the picture. This photograph was taken in 1919.

Of course the writer understands that a cash saving in one year may be more than offset the next year by a greater expenditure; in other words, it is not true economy. The results so far obtained, however, show that the work has been a true economy, as may be seen from the statistics in the table under Case No. 3. The track to which these figures relate is shown in two ac-



AT TOP, CROSS SECTION OF TRACK WITH 5-IN. RAIL IN HASSAM PAVEMENT; AT BOTTOM, CROSS SECTION OF TRACK WITH 7-IN. RAIL IN HASSAM PAVEMENT

companying views, one having been taken before and the other after the track was overhauled.

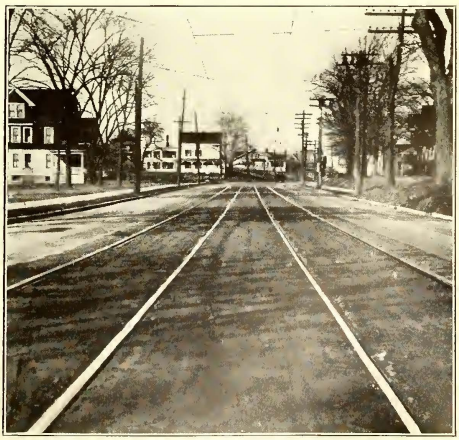
In some cases it is true the saving is so small that it is a question as to the best method to pursue, and in Case No. 4, had the company been able to get new rails, doubtless the old rails would have been scrapped. Personally the writer is glad the rails were left in, however, as while they represent only a small saving they give a tangible base for judgment for work coming in the future.

Generally speaking it has been our experience that the greatest saving is made where the work must be done on the company's initiative, that is, where the

THIS SECTION SHOWS THE ADHESION OF THE CONCRETE TO THE RAIL

track structure is so far gone that apparently the entire structure must be renewed, since this entails a charge for entire paving as well. If the track can be saved by welding the joints and grinding, a great part of the pavement is not disturbed and the cost is thereby reduced, thus decreasing the annual charges and showing a larger saving.

The double track line represented in Case 5, on which cars ran on a five-minute headway, was in such condition that the mechanical department could tell by the condition of the cars those which ran over this line. The track was electric welded in 1908, but was so full of "dutchmen" that it looked like a Hun trench. This section was 8000 ft. long. This line had been scheduled for entire renewal every year since 1908, but other work called for by the city cut it out every year. The estimated cost for the entire renewal in 1916 was $80,000. We overhauled it in 1917 and maintained it through 1918 at a total cost of $2900. It was done as a temporary expedient to last until after the war. We estimated it would last three years, but from present appearances it will last five years and perhaps eight years. Views of the track before and after the work was done are published. Basing our maintenance charges for the next three years on the actual maintenance for one year, but increasing 33⅓% each year, we



TRACK COVERED BY CASE NO. 3. THIS RAIL IS 9 IN. IN HEIGHT, LAID IN 1894 AND ELECTRICALLY WELDED IN 1909. THE FIRST VIEW WAS TAKEN BEFORE REHABILITATION IN 1918, THE SECOND AFTER REHABILITATION

REHABILITATED TRACK COVERED CASE NO. 4

shall have saved over $21,000 at the end of three years, as shown by the tabulation below, after allowing for interest on the investment and for depreciation.

Three years charges (new rail)	$25,245.00
Three years maintenance (old rail)	3,540.00
Three years savings (old rail)	$21,705.00
Annual average saving (old rail)	$7,235.00

The writer does not believe that electric welding machines and track grinders will prolong the life of rail to such an extent that the rail mills will go out of business, nor do all types of rail permit of the methods herein outlined, nor are the methods claimed as fitting for all properties. This statement is simply a description of what has been done on one property and may enable others under like conditions to make conservation of rail a success.

RAILS ARE BEING TILTED

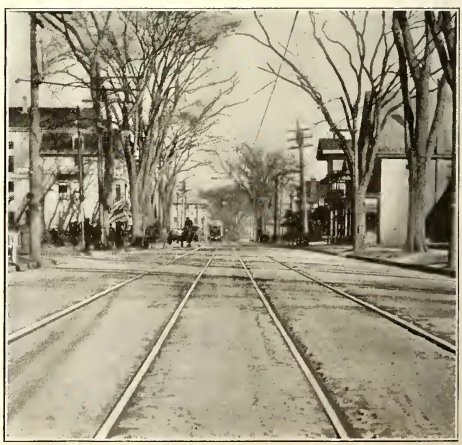
We are also tilting our rails when possible; always on new construction and also when a general tie renewal is made. So far as our knowledge extends, but one other company is doing this in this country, and that is the Cleveland Railway under C. H. Clark. We are getting good results so far and understand that he is also. We believe that by tilting the rail we get less vibration with consequent less pavement maintenance. We also get better rail wear, and where old rail is head worn on the gage line, by tilting, we move the wear toward the back of the rail, and it gradually comes to the center of the head, thus increasing the life. On tram girder rail which is flanging, we can by this method throw the line of contact up from the tram and so overcome the flanging and increase the life of the rail.

On joints which have become loose and are surface bent, we use Abbott plates. The joints then "iron out" and can be kept tight. If they are cupped in addition, we build up with the arc welder and grind smooth.

We also use a vertical rail bender with good success to remove surface bends before placing the Abbott plates, if the rail is to be permanently paved. The theory in all this treatment is to provide as smooth a wearing surface at the joint as at any other part of the rail, and if possible to have the whole rail rigid. By this I do not mean a rigid base only nor a rail partly em-

TABLE SHOWING SAVINGS EFFECTED IN RAIL REHABILITATION

	Case 1	Case 2	Case 3	Case 4	Case 5
Length of track, measured as single track, ft.	15,922	64,685	8,480	2,270	8,000
Date of rehabilitation	1915–16	1914–18	1918	1917	1917
Cost of new rail less scrap value of old rail	$19,130.00	$52,920.00	$9,375.00	$2,490.00	$76,500.00
Interest and depreciation on new rail, per annum	$1,722.32	$4,015.44	$1,030.25	$273.90	$8,415.00
Actual maintenance of old rail, per annum	$513.12	$895.92	$815.76	$142.08	$2,900.00
Annual saving from use of old rail	$1,209.20	$3,119.52	$214.49	$131.82	$7,235.00
Interest and depreciation per year per foot of track for new rail	$0.108	$0.062	$0.122	$0.121	$1.051
Annual maintenance per foot of track for old rail	$0.032	$0.017	$0.096	$0.063	$0.146
Annual saving per foot of track for old rail	$0.076	$0.045	$0.026	$0.058	$0.905
Saving to date	$18,617	$52,025	$8,560	$2,348	$5,515.00



THIS SECTION COVERED BY CASE 5, IS SHOWN BEFORE AND AFTER REHABILITATION. THE WORK WAS DONE IN 1917

bedded, but by a rigid rail I mean one entirely embedded in concrete except for the head and gage side. This theory has shown good results after five years practice with rail which had been condemned as too poor to weld, six years before we paved it. It has now been paved five years, or eleven years extra in all, and is apparently good for as long again. During that five years there has been no paving maintenance, and the track maintenance has been cut to $500, or 3 cents per foot of track. On one division alone we have 12 miles of this construction, and the actual maintenance has been $900, or one cent per foot of track.

In addition to prolonging the life of rails, we have, with the use of the electric welders and grinders, saved on one division, in one year, $3534; also, in repairing rail breaks in permanently paved streets, the sum of $2000 was saved, as we repaired 127 broken rails at a cost of $225, which under the old methods would have cost $2286.

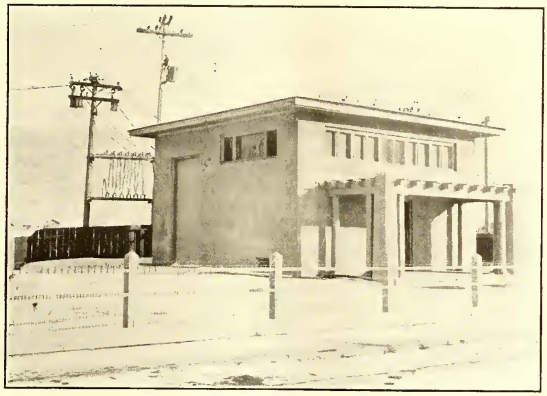
We have on our system three electric welders of the Atlantic type, five welders of the Indianapolis type, eight rotary and seven reciprocating grinders. In addition, we have other labor saving machines, such as steam and electric shovels, which reduce our excavating costs on large jobs 88.6 per cent below the cost by hand and pneumatic tie tampers, which give us better work at 16⅔ per cent less than the cost by hand, and are additionally useful in breaking out old concrete pavement at a reduced cost. We also use the pneumatic tie tampers for cleaning cement grout from salvaged paving brick. Two men with one machine can clean 250 brick per hour, making the cost 35 cents per hundred.

A Year of the Automatic Substation at Butte

Maintenance Cost for First Year Was About $355, More Than 40 Per Cent Less Than Estimate—Company Plans to Extend Automatic Operation

By E. J. NASH
Electrical Engineer Butte (Mont.) Electric Railway

THE design and construction features of the automatic substation have received considerable space in the ELECTRIC RAILWAY JOURNAL of late, but there has been comparatively little regarding operating records. The first year's operating records of one of these stations may, therefore, be of interest to the readers of the paper, particularly in view of the fact that reliability of service is of primary importance. In the following article are mentioned also a few features wherein the automatic substation of the Butte Electric Railway differs, so far as known, from any thus far described or installed. A few comparisons are given also as to the relative characteristics of automatic and manually-operated stations containing machines of the same type, style and capacity.



AN ATTRACTIVE HOUSING FOR THE AUTOMATIC SUBSTATION AT SOUTH BUTTE, MONT.

The accompanying photographs show the general appearance of the substation inside and out, the equipment being that found in substations of this type generally. By way of explanation of the presence of the chicken wire netting seen on the poles in the exterior view of the substation, it may be said that this is used for resistance between the rail at the station and the negative side of the rotary in order to insure the desired condition that the voltage drop from the rail at the station to the negative bus be the same as the drop from the rails at any other point to the bus. On account of the termination of a contract for power, and also because the company wished to take care of the return current more satisfactorily, it recently became desirable to install a new system of distribution and to use the negative insulated return-feeder system for the mitigation of electrolysis. The location of a substation at the load center of the system was considered, the cost would have been $19,800 more for copper, plus additional annual line loss of $1,700, than if a substation was located at the center of load distribution for the uptown district and another was located in the South Butte residential district where approximately 25,000 people reside. Even under these conditions it would have been more economical to use the copper and suffer the line loss than to install a manually-operated station in South Butte because the company pays each operator $7 per day for an eight-hour shift. As this station would have to run at least sixteen hours a day, making an annual operating charge of $5,110, it is obvious why the automatic substation was the economical solution of the problem regardless of an additional cost of $9,000 for buildings, land and equipment for the rotary.

It was estimated that one day's work per week was sufficient for cleaning and inspecting the apparatus, amounting to $364 annually, as an electrician receives $7 per day. It was estimated that materials would cost $256 per year, including necessary incidental supplies such as oil, waste, brushes, contacts, etc. The total annual charge for material and maintenance was thus estimated at $620; the actual cost was $355.80. Of the latter amount $292 was for labor.

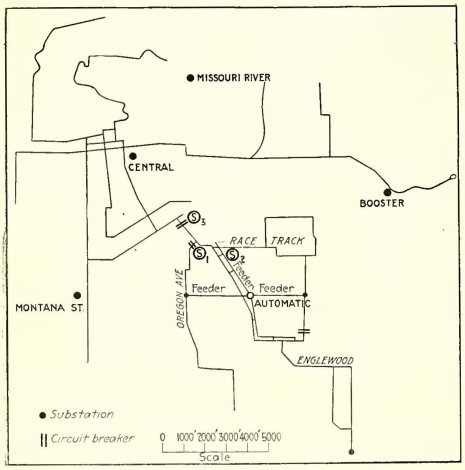


DIAGRAM OF DISTRIBUTION SYSTEM, BUTTE ELECTRIC RAILWAY

The automatic substation has given very reliable service, for during the year it failed but four times. On two occasions the auxiliary to relay No. 27 failed to open. This relay, as described in previous issues of the JOURNAL, keeps the station from starting when the alternating-current voltage is low. In failing the first time the clutch and trip coils were damaged, as the voltage was too low for the oil-switch motor to complete the closing operation. The damage would not have occurred had the circuit been properly fused, as it was the next time the relay failed. This time the damage was simply a blown fuse. The manufacturer of the equipment, the General Electric Company, replaced the auxiliary to relay No. 27 with a relay of a later type and no further trouble has been experienced.

On another occasion the rotary was stopped on a very hot day by the operation of the bearing thermostat. This thermostat had a lower temperature setting than was necessary and the rotary simply remained idle until an electrician arrived. On another occasion, before electrolytic lightning arresters were installed on the direct-current feeders, lightning entered the station. All the damage in this case consisted in a blown fuse and the burning off of the insulation from the wire of the lighting circuit which was tapped to the feeder.

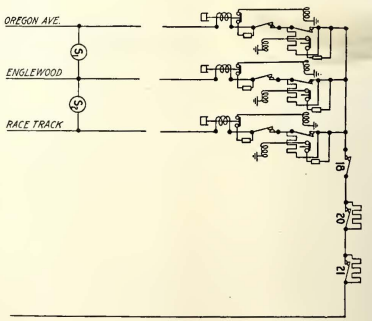
AUTOMATIC IS MORE RELIABLE THAN MANUALLY-OPERATED STATION

It happens that the machines in the railway company's central substation are of the same type, style and capacity as that in the automatic, so that there is an excellent opportunity to compare the operation of these two substations. The rotaries are 500-kw., 60-cycle, 600-volt, six-phase General Electric machines, diametrically connected. The full load rating is 834 amp., and they are designed to carry 50 per cent overload for two hours and 100 per cent overload momentarily. They have flash suppressors, or arc coolers, as shown in one of the accompanying illustrations. These are the devices described by Messrs. Linebaugh and Burnham in their paper on "Protection from Flashing" delivered before the 1918 convention of the A. I. E. E., and abstracted in the issue of this paper for July 6, 1918, page 9.

The two rotaries in the central substation have flashed over, and have flashed to the pedestal. The short-circuit current for the manually-operated substation has been limited to less than 3000 amp. Although on one of the 500,000-circ.mil feeders the nearest trolley tap is more than 10,000 ft. from the substation, a pedestal flash was experienced from this circuit. By way of contrast to this the automatic substation has demonstrated its ability to handle a short-circuit without flashing. Several times when the short-circuit current would have reached a value in excess of 4000 amp., the only indication of trouble was a faint squeak. In one test the trolley wire was short-circuited to the rail within 1000 ft. of the station. In this case a flash started but it was extinguished by the wire arc coolers. This non-flashing feature of the automatic substation is worthy of consideration. It is, of course, due to the use of the flash guards and the load-limiting resistors which have a cushioning effect. These resistors could be used in a manually-operated substation to supplement the circuit breakers.

HOW THE AUTOMATIC CONTRIBUTES TO RELIABILITY OF POWER SUPPLY

As stated previously, lightning entered the automatic substation practically without doing any damage. It also entered the manually-operated substation, where it jumped to the low-voltage release of the rotary circuit breaker and blew the instrument fuses. A bearing was burned out in the manually-operated station, also, which would not have occurred with automatic control.



SIMPLIFIED DIAGRAM OF SUBSTATION CONNECTIONS AND FEEDERS

The automatic substation, as will be seen from the accompanying map of the system, is located in South Butte and operates in parallel with the central substation through an automatic sectionalizing switch. The

automatic feeds three separate trolley sections, utilizing practically but one 500,000-circ.mil feeder and the double trolley of the same circuits. This is accomplished through the use of two General Electric type SW-4 automatic sectionalizing switches at a point where two lines branch from the main line. The Oregon Avenue and the Race Track lines receive their power from the Englewood or South Butte lines through sectionalizing switches S_1 and S_2.

BACK OF SWITCHBOARD, WITH RESISTORS ABOVE, HEAVY CONTACTORS IN CENTER AND CONTROLLER COVER IN FOREGROUND

The contactors in the automatic substation for the Oregon Avenue and Race Track feeders are used to energize these circuits to close the automatic sectionalizing switches in case they open through overload, as the breakers for the Englewood or South Butte feeders would not open to equalize the separate sections. The Oregon Avenue and Race Track feeders will (with a reduction in voltage) carry the loads of these stations in case the power is not on the Englewood section.

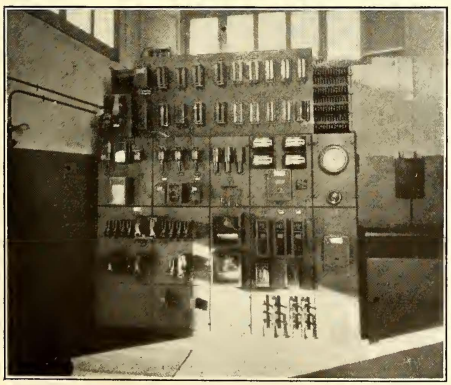
Instead of using a single contactor for the feeders from the automatic substation, which is in parallel with the resistor, use is made of two contactors in each circuit so that in case of a trolley break only the affected section is disconnected from the bus. As will be seen from the accompanying diagram of connections, one contactor shunts the resistor and the other is in series with the line on the line side of the contactor and resistor.

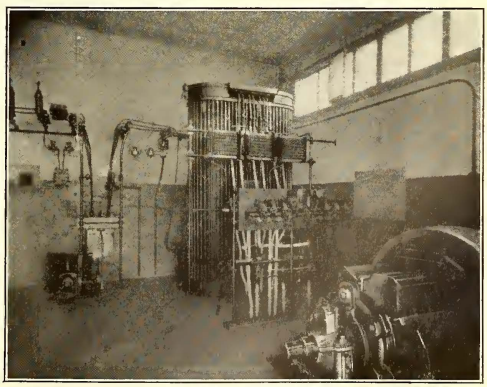
The holding coil of the series contactor is wired from the bus through the contact of a thermostat placed over the resistor of that circuit. When the shunted contactor opens, through the opening of the contact of a series overload time-limit closing relay, current passes through and heats the resistor. If the temperature of this reaches a predetermined value the contacts of the thermostat open, thus opening the holding circuit of the line contactor which disconnects the feeder from the bus. By the use of the connection of the holding coils as shown in the diagram the contactors are closed whether the station is running or not. This is necessary, for at night when the automatic substation is not running, the closed contactors furnish power for Oregon Avenue and Race Track to close the sectionalizing switches in case they open on account of overload.

The operation of the South Butte automatic substation has been so satisfactory that plans are now being made to add another substation of the same type to the system and to make the central substation automatic. By the addition of a second substation, copper to the value of $6,000 would be recovered and this station would be available in case one of the other units failed to function. That this would be economical is evident from the fact that the three operators in the central substation are paid $7,665 per year.

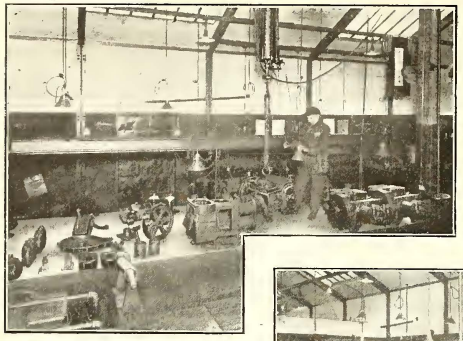
In conclusion, and for purpose of completeness, it should be stated that the population of Butte is given by the 1910 United States Census as 39,165. This figure is misleading as it includes only the inhabitants of the small area within the city limits, covering about 5½ sq. miles. There are a number of towns and residential sections adjoining the city with an aggregate population of about 70,000. Consequently the total population served by the railway is at least 100,000.

[EDITORS' NOTE. Mr. Nash refers to articles on automatic substations that have appeared in this paper. In this connection the table printed in the issue for Jan. 4, 1919, page 54, is of interest. It, of course, includes the equipment described by him. Helpful articles will be found in the following issues: Jan. 11, 1919, pages 84 and 104; Dec. 14, 1918, pages 1035, 1038 and 1051; Nov. 30, 1918, page 979; Oct. 12, 1918, pages 651 and 665; July 27, 1918, page 157; July 20, 1918, page 118; April 13, 1918, pages 689, 692, 705 and 707; March 16, 1918, reference by Charles R. Harte, in general article on power distribution.]

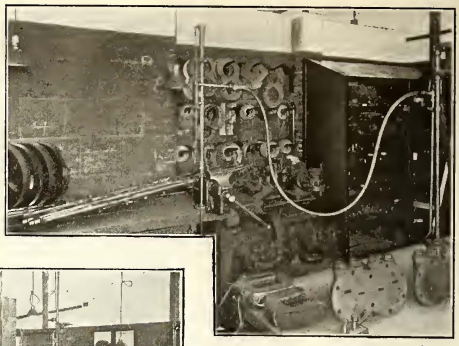


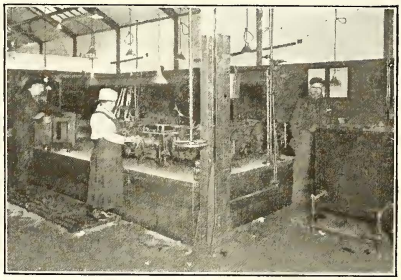


AT LEFT, MAIN SWITCHBOARD WITH CONTROLLER IN BACKGROUND; AT RIGHT, TRANSFORMERS, ROTARY AND AUXILIARIES



Compressor Overhauling Bench with Working Space on All Sides Gives Easy Access to All Parts and Centralizes Work



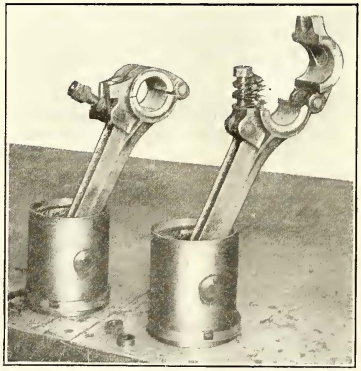


At Left (Top), Lowering a Compressor into Position for Overhauling.

In Center, Dismantling Compressors for Overhauling —Oil Reclaiming Tank Conveniently Located at Right.

At Right, Air Connection for Testing Door Engines—Gasket Rack and Air Brake Equipment Closet in the Background.

Compressor Overhauling and Testing Bench at One of the Shops of the Brooklyn Rapid Transit Company

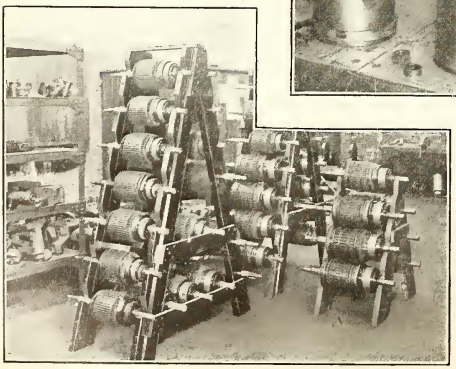


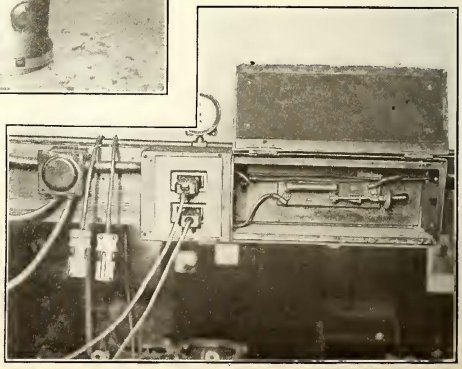
Storage Racks and Convenient Testing Equipment Facilitate the Work of Overhauling and Insure Proper Workmanship

At Left, Racks for Storing Compressor Armature and Air Brake Equipment Parts.

In Center, Connecting Rod Bearings with Shims to Provide Adjustment.

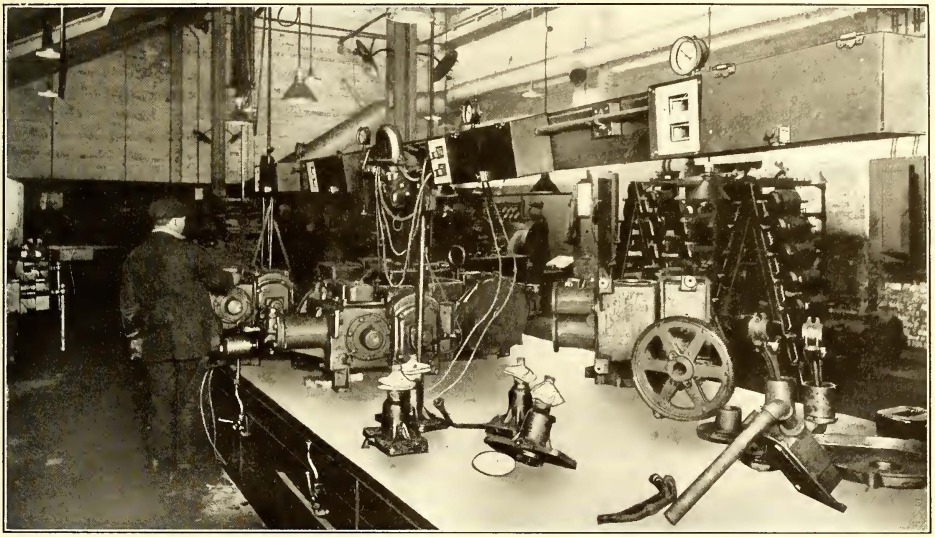
At Right, Switch, Fuse and Contact Receptacle for Testing Compressors.





Up-to-Date Practice in Compressor Maintenance

Methods of Inspection and Overhauling Are Covered and Details Given of a Compressor Overhauling and Testing Bench with Other Labor-Saving Devices



CLEANING COMPRESSORS WITH COMPRESED AIR ON THE OVERHAULING BENCH

THE best air-brake equipment in the world is worthless unless a sufficient supply of compressed air is available. Compressors are the source of air supply and the fountain head of the air-brake system. Their proper maintenance is of the utmost importance in order to avoid accidents, to prevent annoying delays and to insure an efficient service.

The maintenance work on air compressors is properly divided into two parts. The first includes the regular inspection and light repairs that are necessary to keep wearing parts in proper adjustment. The second comprises general overhauling, which requires the dismantling and cleaning of all parts together with their renewal and reassembling with proper lubrication for the wearing parts. Both classes of work can be most effectively carried out if done on a mileage basis. Where roads have equipment that operates only in limited service, as during the rush-hour or peak-load periods, it is desirable to put a limit on the time that may elapse between inspections, otherwise a greater interval than would be safe might elapse.

The mileage allowed between inspections or overhaulings depends largely on the age and general condition of the equipment and on the service conditions that must be met. Each road can best determine this for itself, as the standard used for one class of equipment may prove entirely unsatisfactory for another.

The work necessary in inspecting electrically-driven compressors is conveniently divided into: (1) Oiling the crank case, bearings, etc., and (2) inspecting and adjusting the operating parts. Most compressors are now provided with elbows and plugs or with oil openings for determining the amount of oil in the various compressor oil chambers, and for convenience in adding necessary oil. These openings are located so that when the oil reaches to the opening there is sufficient for operation. The oil hole for the crank case commonly consists of a street elbow installed about 2 in. above the bottom. The inspector removes the plug from the elbow and inserts his finger to remove anything that might clog the opening. As he removes his finger the oil will "kick back" if the opening is free. Where the opening cannot be cleared with the finger a strand of rope with wire center will be found of value. If the oil follows back to from $\frac{3}{4}$ in. to $\frac{1}{2}$ in. of the top no additional oil need be supplied, otherwise sufficient oil is added to bring it up to the required height.

A careful record should be kept of the quantity of oil added, together with the car number. The first form shown on page 570 is used by the shop department of the Brooklyn Rapid Transit System for recording the amount of oil used. When the work of oiling is finished the inspector hands this report to the foreman of air brakes who checks it over carefully. Where the report shows that more than 3 pints of oil has been added to a compressor, the reports for the previous inspections of that compressor are checked. If the compressor received no oil or but a small amount on

the previous inspection the report is considered satisfactory, but if the previous report shows a large amount of oil used, the car is withheld from service for a detailed inspection to determine the cause of the excessive consumption.

The inspecting and adjusting of the operating parts is usually done by another inspector. This inspection is preceded by a wiping of the compressors with dry waste and the brushholders and insulators with cheesecloth. All brushes are examined and if too short to last until the next inspection are replaced. Brushholder tension is checked and the tension springs are kept in good condition. After this inspection the compressor is operated to see if there is any pounding of the valves or gearing or any sparking at the commutator. If sparking occurs the commutators are cleaned with a pad of cheesecloth. (Commutators should never be sandpapered. Where brushes do not fit the brushholders properly, sand paper may be used to rub them down.) Where brushes do not seat properly on the commutator a piece of sandpaper is placed on the commutator under the brush and this is worked back and forth. (Emery cloth must never be used for this work.) The leads and terminals of the compressor are inspected to eliminate loose connections. Pump valves and strainers are given a more general inspection about once every sixty days.

N. S. 405 — 50 Pads 7-16-18 A4652

BROOKLYN RAPID TRANSIT SYSTEM
MECHANICAL DEPARTMENT

March 19, 1919

Inspect the following MOTOR cars for
Coil Used in Compressors
and put in good condition.

Car No.	Parts Added	Car No.	Parts Added	Car No.	Parts Added
721	1	1046	1	2075	2
745	2	1053	1	2086	6
754	0	1059	2	2096	3
844	0	1069	2	2105	3
850	0	1086	1	2111	6
853	1	1105	1	2131	3
854	3	1114	1	2135	5
1001	0	2004	2	2142	0
1011	1	2035	1	2155	2
1023	0	2049	1	2186	2
1006	1	2071	4	2225	5

I have inspected and put above in good condition, except the following, which must have special attention.

(Sign) C. W. S. Inspector
No. 2114

Form N. S. 836 — 50 Pads 3-7-18 A4849B

BROOKLYN RAPID TRANSIT SYSTEM
MECHANICAL DEPARTMENT

COMPRESSOR REPORT
DIVISION

So. Div. 3+0 Shop Date March 14 1919

Car No. 2122

Type of Compressor D2 F

REMOVED	CAUSE	PUT IN
Motor No. 19501 Comp. No. 50122 Arm No. 19710	Overhauled	Motor No. 19500 Comp. No. 50125 Arm No. 19796
Repairs Made		
Work Done By Overhauler and Helper		

B — Foreman

AT LEFT, FORM FOR RECORDING OIL USED. ABOVE, COMPRESSOR REMOVAL AND REINSTALLATION REPORT FORM

Systematic Overhauling Reduces Costs and Prevents Annoying Delays

The term "overhauling" is used to include the removal of the compressor from the car, the dismantling of all parts, the cleaning and renewing of the parts as necessary, the replacing of all broken or excessively worn parts and their reassembling with proper lubrication. After the compressors are placed in the best possible condition they are given a running test of about six hours duration before reinstallation on cars.

Such an overhauling can be best and most quickly done on an overhauling bench specially constructed for convenience and thoroughness in carrying out the work. The compressor overhauling bench shown in the accompanying illustrations is installed at the Southern Division inspection and overhauling shop of the Brooklyn Rapid Transit System. It consists of a zinc-covered platform 19 ft. long, 7 ft. wide and 25 in. high, with an open space on all sides. Such a bench will accommodate eight compressors, and all the auxiliary piping, electrical connections, storage reservoirs, etc., are arranged with eight units, so that the work of overhauling and testing on one compressor need not interfere with that being done on others.

Sixteen 14-in. x 48-in. reservoirs are installed underneath this overhauling bench. They are connected in series and piped in pairs so that each compressor can be used to charge two reservoirs. The air thus compressed in these tanks is used for various operations in the air-brake room. At the center of each side of the bench is a tap for attaching a hose so that the air may be used for blowing out and cleaning the compressors being overhauled. At one end of the bench a connection is provided so that the air may also be used for testing and adjusting door engines, more than 7000 of which are used on this property. At the other end of the bench there is a connection to the air hoist which is used for handling the compressor while it is being overhauled.

A bench for overhauling other air-brake parts extends along the wall at the side of the compressor bench, and the reservoirs also supply air to this bench. A board extends over the top of the compressor overhauling bench for supporting the various contact boxes, switch and fuse boxes, gages and governor used with the electrical connections to the compressors. This board is 11½ in. wide and is supported by a 1-in.-pipe framework 4 ft. above the top of the bench. The contact boxes have two contact fingers, one for the positive and the other for the negative side of the compressor connections. The boxes are made of asbestos lumber and are fireproof. At one end of the leads used for connecting to the compressors is a plug contact. This consists of a flat piece of hard rubber with copper plates on either side. By shoving this between the contact fingers in the box the electrical connections are made.

At the other end one of the leads is provided with a knuckle joint connector for connecting to the compressor field and the other has a brass ferrule for insertion in the brushholder. These connections can be made very readily. Each individual testing circuit is protected by a 10-amp. fuse and a knife switch. A single governor regulates the cutting in and out of the compressors while being tested but each is provided with a separate air gage.

The bench is lighted with eight drop lights with shades. Extension cords are used where the light is needed closer to the work.

Various Steps in Compressor Overhauling

When a compressor is removed from a car, the car number is painted on one of the compressor cylinders for reference and use in making future records. The compressors are handled from the cars to the overhauling room on low shop trucks, and all handling inside the air-brake room is by means of an air hoist which runs on an I-beam the entire length of the room and directly over the air-compressor overhauling bench. All control of the hoist is from the floor. An accompanying illustration shows a compressor being placed in position on the bench for overhauling.

The work of overhauling a compressor can best be carried on by two men. One should be a skilled workman and the other a helper. The helper can place the compressor on the bench and clean off all grit and dirt carefully, which is the first work to be done on the bench. He can then dismantle the various parts by removing the crank and gear case heads, the connecting rods, gear and pinion. The overhauler should take out the crankshaft, the armature, brushholders and both fields. All of these parts are placed alongside the compressor on the bench.

When all parts but the bearings have been removed from the shell, the helper can drain off the oil and empty it into the reclaiming and settling tank. He should then clean the inside of the shell carefully and paint with an insulating paint. The foreman makes a record of the compressor number, the car number from which it is removed, the motor number and the number of the armature. The armature is then removed from the bench and placed in an armature rack. Later it is sent to the electrical repair shop for a thorough overhauling and testing before it is again returned to service.

The work done in the electrical repair shop to compressor armatures received consists first of a thorough cleaning, after which they are given a careful inspection and test to determine just what repairs are necessary. Any grounds or short-circuits in the winding are cleared, open-circuited coils are replaced and in some cases the armature is entirely rewound. It is the practice to slot all commutators of compressor armatures, and when received in the electrical repair shop they are reslotted where necessary. After the repairs are completed and tests show everything in proper condition, the armatures are dipped and baked. This process of dipping and baking complete armatures was described in the ELECTRIC RAILWAY JOURNAL for June 15, 1918, page 1149. On the Brooklyn Rapid Transit System it is the practice to bake the armatures until the reading on a voltmeter connected as below is less than 10 volts. These tests are made without removing the armatures from the oven by connecting one terminal of a voltmeter to the 550-volt shop circuit while the other is connected to the commutator segments, the armature shaft being grounded during the test. Results from these tests show that this voltage reading increases when the baking is first started, due to the expanding of the coils and the evaporation of moisture. After a certain maximum is reached the voltage reading decreases again. In testing armatures during this process it is thus necessary to take a sufficient number of readings to make certain that the voltage drop will decrease with further baking after the specified minimum of 10 volts is reached. After baking, the commutators are given a light cut to remove the insulating compound, and after a final test of the voltage drop between each coil the armature is returned to the maintenance shop for reinstallation.

Upon removing the fields from the compressor they are tapped and sounded to determine if they have become overheated or baked so as to damage the insulation. The fields are then washed off with gasoline and painted with three coats of insulating paint. No special attempt is made to return the same fields that are

MO FORM 88 — BROOKLYN RAPID TRANSIT SYSTEM — 3M 4-18

MECHANICAL DEPARTMENT
COMPRESSORS, RECEIVED - OVERHAULED
DAILY REPORT

Southern Division Insp. & Overhauling Shop, Date, March 15, '19

Received: Cmprsr Number	Type	From Car	From Shop	Type	Overhauled: Cmprsr Number	Armature Nos Removed	Armature Nos Instld	Returned to Car	Returned to Shop
	D2F	10122	2122	SD	D2F	10122	21501	2095	SD

J. McL
Superintendent

COMPRESSOR OVERHAULING REPORT FORM

removed to the compressor. Several spare fields are used for carrying on the work and to prevent delay in finishing the work of overhauling.

Wearing Parts Should Be Carefully Gaged

With all parts cleaned the overhauler begins by gaging the bearings. This is done by putting the crank shaft in place and testing for excessive play. The tendency of the bearings is to wear egg shaped from the continual lifting action. If the overhauler finds too much slack he calls this to the attention of the foreman who decides on the renewal of all bearings. With the pistons and rings cleaned the overhauler tries these for wear in the main cylinders. The crank shaft is placed first in one piston and then the other and worked around to determine the amount of slack there is on the connecting rod. When originally installed these connecting rods have about eight shims between the edge of the housing. If there is any play these shims are removed one at a time until the play is properly taken up. The connecting rods run for two or three overhaulings after which it is necessary to rebabbitt them at which time the original number of shims is again used. The gears and pinions are inspected for wear and are renewed as found necessary. The pinions of course wear much faster than the gears.

Electrical Parts Are Assembled Last

With all mechanical parts assembled attention is next given the electrical end of the compressor. The fields are first installed and connected up, then the armature is installed. Before installing the armature, however, this is tested with 550 volts through a four-

light cluster. This final voltage test saves much trouble and time as it insures the armature as being free from grounds or short circuits. As the armature now put in is not the one removed, the armature bearings may not fit. If such a condition is found new bearings will have to be installed which match up with the armature shaft.

The brushholders removed are taken apart and carefully cleaned. Insulators are inspected for any weakness and renewed where necessary. When the brushholders and brushes are reinstalled the brushholder springs are adjusted. These are usually set with a tension of from 2½ to 3 lb.

With all parts reassembled sufficient lubricant is added to last till the next inspection and the compressor is given a running test of six hours' duration. Any imperfectly fitting gaskets or improperly tightened connections will be weeded out by this test so that when the compressor is again installed on a car there is no danger of something unexpected happening.

Simple and accurate records are necessary for an intelligent following of the work of overhauling. For compressors ordinarily a card record system showing numbers of compressors, motors and armatures that are installed on each car with the dates of overhauling and armature changes should be sufficient. For furnishing this information to the record department some specific forms are necessary for shop use. Accompanying illustrations show two such forms used by the Brooklyn Rapid Transit System. One shown on page 570 is a compressor overhauling report made out by the overhauling foreman to show the changes in compressor equipment for a particular car. The other form shown on page 571 follows the course of a particular compressor in removing, overhauling and reinstalling it.

A Convenient Signal Testing Board

A Portable Device Well Adapted for Instructing a Class of Men and for Testing Signal Equipment

AFTER a block of automatic signals has been overhauled in the shop, the signals should be completely tested as a pair and with normal operating current before being put out on the line again. This involves considerable temporary wiring which must be duplicated each time. To obviate this the Nachod Signal Company of Louisville, Ky., has designed a combined testing and demonstration board which is furnished complete, or if desired the blueprints and specifications will be furnished separately so the board may be made by the railway company. A pair of signals need merely be connected to the fanned-out cables at each end of the board, the power switch closed, and the signals can be actually operated by touching the miniature "contactors" on the trolley plan.

The accompanying illustration shows the board complete, which is self-contained and portable, so that it may be hung on any wall and connected to the 600-volt source of power. The middle part of the test board is occupied by a plan of the trolley wire with its branches at the ends for turn-out or double track. In relative position near the frogs are the trolley contactors, formed of bare wire and adapted to be bridged by the improvised trolley held in the hand, and made of insulated wire bared. To avoid distraction all connections are on the rear of this demonstration section, and the remainder of the board is curtained off. The signals are connected to the cable and placed on stands about in their relative positions, but turned 90 deg. from their normal position so that the indications at both ends of the block may be seen from the front of the testing board.

This portable arrangement is well adapted for use in instructing a class of platform men, since any operating condition may be produced at will and the signal simultaneously observed. Of course this only supplements without displacing instruction in actual operation on the line itself.

At each end of the trolley plan are the switches and fuses as arranged in the junction or fuse box on the line; and the maintainer may duplicate the actual code of line tests here. At the extreme right, besides the fuse and power switch, are some special connections embracing two switches, five lamps and a pair of testing

TESTING A PAIR OF SIGNALS BEFORE RETURNING THEM TO SERVICE

pointers with insulated handles. These enable one signal without its mate to be tested out at reduced current for observation, the several individual circuits being energized by throwing the proper switches. One combination connects the pointers to a "live" bank of five lamps for testing grounds, open circuits, etc. Such a board may thus be used to compare a damaged with a perfect signal, or parts of a signal, to reproduce any questioned signal operation, to locate any difficult signal trouble, to study the circuits and to hold an emergency block in readiness while utilizing it for instruction purposes.

Skip-Stop Operation Gives 11 Per Cent Reduction in Power Consumption

THE United Railways of St Louis inaugurated the skip stop on Sept. 22, 1918, in accordance with the request of the United States Fuel Administration. The distances between stops in the residence districts were selected to comply with the recommendations of the Fuel Administration although little change was made in the business district. The consumption of energy in kilowatt-hours per car-mile in the months of October, November and December, 1917, was 4.34, 4.32 and 4.38 respectively. With little change in the schedules the figures for the same months of 1918 were 3.74, 3.88 and 3.96, indicating a reduction of about 11 per cent. It is expected that a much greater saving would have been effected by the further rearrangement of schedules which was under consideration at the time the company was compelled to abolish the skip stop on Jan. 25 of this year.

There Is an Intimate Relation Between Bond and Joint Maintenance

Practice on Harrisburg Railways Shows Economy of Keeping Up the Joints in Connection with Testing and Repairing of Bonds

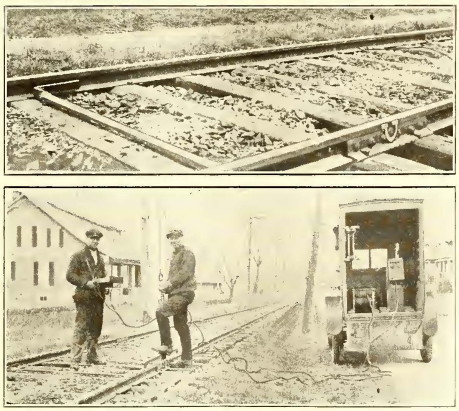
By G. B. MOIST
Engineer Harrisburg (Pa.) Railways

UNTIL recently the entire system of the Harrisburg Railways, comprising about 73 miles of city and suburban track, and operating about sixty cars, was supplied with power from one central direct-current power plant. On several lines the transmission distance was more than 10 miles, necessitating for satisfactory operation that the track bonding be maintained in the best possible condition.

Steel Bar Used as Cross Bond

The standard type of bonding on this property has consisted of two No. 00 capacity, screw compressed terminal bonds, installed under the plates of each joint. Around special work, 36-in. cable bonds, lengthened by cutting in two and soldering in lengths of annealed trolley wire to give the desired length, were used. In addition at least one bond was installed in every joint.

Cross bonds were used about 600 ft. apart in city districts and 1000 ft. apart in suburban districts. In open track some trouble has been experienced with these cross bonds due to their being cut off and stolen. Where such theft is liable to occur, a bar of iron is laid parallel with the ties, having about 6 in. at each end bent parallel with and close to the webs of the rails, as shown in an accompanying illustration. These ends are drilled and short bonds are installed to connect the bar with the rails. In order to secure uniformly good results in bonding work it was considered necessary that the workmen be made to appreciate the importance of the job. To insure this the work was placed under the direction of the electrical department, and a special group of men possessed of the necessary training was assigned to it. Their responsibility starts with the lining up of the rails and the drilling of the holes with an electric drill. The holes are then polished by drawing a clean rag back and forth through them, an important operation, especially if a drilling lubricant is used. The bond terminals are polished also, and the terminals are inserted in the holes and compressed with as great a pressure as can be secured with the tools available. In purchasing bonds we specify that the terminals shall be machine finished, instead of cast, so that a neat driving fit can be obtained.



ABOVE, STEEL BAR CROSS BOND FOR OPEN TRACK. BELOW, TESTING CREW WITH COMPLETE OUTFIT, AT WORK ON OUTLYING SECTION OF TRACK

In applying the bond terminals we are particular to see that the screw point is at least $\frac{1}{16}$ in. smaller than the hole in the rail. (See sketch.) Experience indicates that proper compression is sometimes prevented by too great a diameter of screw point.

After the bonds have been compressed, the bonding gang applies the plates, a part of the work which we regard as very important. All scale or rust that may be on the contact points of the rails and on the joint plates is first removed with a wire brush. A lubricant is then brushed over the surfaces, and the plates applied and tightened, care being taken that they settle back evenly at the top and bottom. For the past few years we have used heat-treated bolts, thus reducing considerably the troubles from loose bolts and joint plates. We found that many bolts are damaged when first drawn up, as it is easy for a man pulling on the end of a 3-ft. wrench to twist off the end of an ordinary $\frac{7}{8}$-in. bolt. Even when bolts are not actually stretched, they are brought very near to the elastic limit so that the additional stress due to passing cars stretches them and eventually produces loose joints. Heat-treated bolts, with an elastic limit of not less than 75,000 lb. per square inch, are unlikely to be damaged in this way. Our maintenance work is confined almost entirely to track laid on open ballast. In first-class construction, as used in paved streets, we never have broken bonds, and practically no depreciation of the terminal contacts or the strands. As representative of the results obtained in track of this character, the results of a series of tests on twelve joints in track that was constructed in 1908 are given in the table on page 574. The data given are the milli-voltmeter readings taken on 3 ft. of solid rail, as compared with simultaneous readings on 3 ft. of rail including the joint. One set of readings was taken in 1915, and the other set in 1919. There are no corresponding records of the joint conditions at the time of construction. The piece of track containing these joints is not far from the power plant

and has been carrying a fairly heavy current continuously for about eleven years.

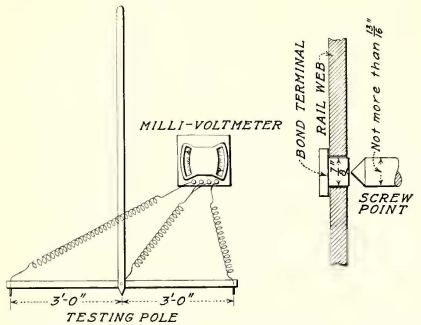
In track laid in open-ballast construction, where expansion and contraction must be allowed for in the joint,

MILLI-VOLTMETER JOINT READINGS ON DATES FOUR YEARS APART

Joint Number	1915 Rail	1915 Joint	1919 Rail	1919 Joint
1	13	13	10	10
2	12	14	10	12
3	12	17	10	10
4	10	14	6	10
5	14	16	7	7
6	10	14	7	8
7	12	15	8	10
8	13	14	9	11
9	10	10	5	7
10	11	11	12	12
11	14	17	9	10
12	10	11	12	13

the strands of the bonds frequently break. It often happens that the expansion and contraction of several rail lengths take place in one joint, breaking the bonds in comparatively short time. It has been our practice to test track of this type of construction once or twice each year.

The testing outfit used consists of a milli-voltmeter having two faces. A frame which carries three contact points spaced 3 ft. apart is placed on the rail, the joint being between the center contact and one of the outside contacts. This arrangement gives the drop in



OUTFIT FOR BOND TESTING—RELATION OF COMPRESSOR POINT AND BOND TERMINAL DIAMETERS

3 ft. of solid rail on one face of the instrument and a like amount of rail, including the joint, on the other. To insure good contact with the rail pieces of hacksaw blade have been found to be most effective. These are located as shown on the diagram of the test outfit.

When Is a Joint in Need of Repair?

Our standard in determining the condition of the bonds in a joint is that the drop, in milli-volts, of 3 ft. of rail including the joint shall not exceed twice the drop of 3 ft. of continuous rail. Any joint exceeding this amount is opened and repaired. Operators on these tests become quite skillful in observing the readings, and are able to detect a defective bond that has even less than 25 per cent of its strands broken.

On some lines, especially toward the outer end of a line, the current flowing in the rails is small and intermittent in character, making slow work of the testing. Obviously the best results are secured when the current is reasonably steady and of a magnitude sufficient to yield reasonably large deflections of the pointers of the milli-voltmeters. This makes it necessary on outlying track to draw some current for measuring purposes specifically. In such cases we use a few standard car resistance grids mounted on a light auto truck for connection to the trolley and track some distance beyond the point where the tests are being made. This outfit draws about 100 amp. of current, which is sufficient for ordinary testing.

The most satisfactory procedure in making tests and repairs is to assemble a force of four or five men equipped with the testing outfit and all tools and materials necessary to make the repairs, taking them to the work on the auto truck. On arrival at the track to be tested, two men start out with the testing outfit and are followed by the others, who repair the joints marked by the testers. A fair day's work will cover the repairs of from fifteen to sixteen joints, distributed over 2 miles or more.

We find that the auto truck is extremely convenient in transporting the extra tools and supplies, and in getting the men to and from the work. The truck is not assigned exclusively to this work, but is used as a general utility truck, and is constantly in demand. Repairs to bonding and joints are made at such times as the men and equipment can be spared from larger construction jobs.

Two to Three Per Cent of Joints Need Repair Annually

The number of joints tested each season is from 7000 to 8000. Of this number from 2 to 3 per cent require repairs. The repair work covers track equipped with several types of joints, including ordinary channels, Weber and continuous joints. No type seems to be exempt from some necessity for repair. The labor cost per joint repaired is from $1.25 to $1.50. This cost may seem high when compared with those involved in applying the bonds on the outside of the plates by the acetylene or arc-welding methods. We are inclined to believe, however, that we gain a great deal in the fact that our bond maintenance includes the correcting of mechanical defects in the joints, such as loose bolts, worn joints, plates, etc. This is really a part of track repairs, and a portion of the expense could properly be charged to that account.

To replace the bond without correcting the cause of its failure invites a second failure in short time. Removing the plates and replacing worn parts with new where necessary, insures that the joint is left in the best possible condition.

About three years ago we changed the type of bonding in track laid in paved streets. The copper bonded joint was replaced by an arc-welded joint. Standard channel plates, with the addition of a heavy sole plate, were arc-welded to the base of the rail. Tests made at that time showed the joint equal to the rail electrically and without a doubt it is a good joint mechanically. Recent tests show the joints to be in the same condition as when installed. This practice is now standard with us for the given type of construction, but we are not yet convinced that the application of the welding method of applying bonds to open ballasted track is a superior method as to final results. For the reasons outlined above, it is likely that we shall continue to use our present methods of construction in such track for some time to come.

Equipment Inspection on a "Kw.-Hr." Basis

Reasons for the Superiority of Maintenance on an Energy Basis, as Compared with a Time or a Mileage Basis, Are Pointed Out

BY WALTER C. BOLT
Investigating Engineer Bay State Street Railway, Boston, Mass.

THE Bay State Street Railway, operating more than 900 miles of line in eastern Massachusetts, recently completed an installation of the Economy railway watt-hour meters.

While the meters were installed primarily for the purpose of saving power, they have been found to be of equal value and importance in other ways, the principal additional value being their use as a basis for determining when car inspections should be made. Until recently cars on the Bay State were inspected on the time basis, but it has been the ambition of the management for some time to replace the time basis of inspection by the mileage basis. In view of the scattered distribution of cars and the interchange of cars among the several divisions of the property, it was found practically impossible to obtain mileage data with a sufficient degree of promptness to enable car inspection to be done on the mileage basis. With the advent of the Economy railway meter a solution of the problem presented itself.

Regarding the use of the meters in connection with power saving it is too early to permit concrete figures to be given as to the extent to which power is being saved, but in general the results are very satisfactory and a good saving is being made. The motormen over the entire system are taking hold of the power-saving campaign in good spirit and are displaying very much interest.

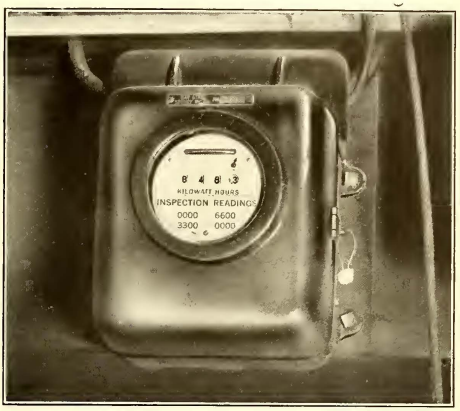
Pending the development by the manufacturers of a device to be used in connection with the meter dial to indicate when a car has used a predetermined number of kilowatt-hours, and thus to show without reference to any other records that the car is due for inspection, the Bay State is using paper auxiliary dials on which are printed the readings at which the car is due for inspection.

This plan of using the "power-saving" meters to show when cars should be inspected was first tried out for two months on one of our divisions, and it proved so satisfactory that our entire system was placed on the kilowatt-hour inspection basis in November, 1918. The following are some of the principal reasons why car and equipment inspection on a kilowatt-hour basis is more proper than inspection on a mileage or time basis:

1. When a car has consumed a predetermined number of kilowatt-hours, the information is made immediately available, and the car can be inspected without delay and without any clerical labor. At best on roads where inspection is based on mileage the necessary data are usually not available until at least 24 hours have elapsed.

2. Elapsed time between inspections is not necessarily a measure of work done, particularly where the car-mileage is not somewhat equally pro-rated as between cars.

3. Most parts of a car require inspection at intervals proportionate to work done. Mileage run between inspection intervals is not necessarily a measure of work done.



CAR METER WITH CARD ON DIAL SHOWING ENERGY CONSUMPTION INSPECTION INTERVAL

4. Kilowatt-hour consumption between inspection intervals is a more nearly correct measure of work done by the essential parts that wear and need inspecting. (a) All electrical equipment depreciates and wears in direct proportion to the power consumed by motors. (b) The wear of truck parts, brakeshoes and wheels is dependent upon speed, stops per mile, condition of track, etc., all of which have an influence upon power consumption.

5. If a motor is working unsatisfactorily for any reason, such as faulty connection, open armature coils, short fields, etc., more power will be consumed and the car will therefore be brought in more frequently for inspection on the kilowatt-hour basis than on the mileage basis.

6. If a car is on an easy-schedule line, having infrequent stops and low grades, it will consume less power than a car operating on a difficult schedule with frequent stops and severe grades. On a mileage or time basis each car would receive an equal number of inspections. On a kilowatt-hour basis less inspection would be given the car operating on the easy schedule and thus a substantial saving in labor would be effected.

7. If two cars of the same type and same motors are running in the same service but with different gear ratios, the car with an improper gear ratio will consume more power and therefore come in for inspection more frequently.

8. If a car has binding or tight brakes, or a tight center bearing, it will consume more power and automatically come in more promptly for inspection and correction of trouble.

9. If a car is handled roughly or improperly by motormen it will consume more power, and therefore

will need inspection more frequently than one which is properly handled. Inspection on a kilowatt-hour basis automatically brings this car in for inspection more promptly.

10. Another factor which tends to make kilowatt-hour inspection more accurate is that power used by cars in switching at carhouses and between carhouses and shops is recorded. The meter is on the job every minute and records even when a car is used only for a very short distance. This miscellaneous mileage is usually totally lost in figuring mileage by cars and is, therefore, not taken into account when cars are inspected on a mileage basis.

It is interesting and gratifying to note that the kilowatt-hour method of inspection is not only more accurate and prompter than the older methods, but it also brings about very substantial economies in decreasing the number of car inspections and yet makes provision for care of cars and equipment in accordance with actual work done. The following is an abstract of the general instructions regarding local inspection of cars:

Extract from General Instructions Regarding Local Inspection of Cars

In carrying out the plan for inspecting cars on an energy basis the following forms have been developed:

The Economy meter inspection cards will be used by the rolling stock department, carhouse repair men and inspectors to record inspection of individual car parts. A rack will be installed at the carhouses on which these cards will be placed.

The form previously used for entry of nightly meter readings has been modified to provide an additional column headed "Due for Inspection." This form has been filled out by the transportation department representative, who took the register readings and at the same time filled in the meter readings. This form is made up in duplicate, the original being forwarded immediately to the power-saving department, Boston. The duplicate is turned over to the local rolling stock department carhouse foreman. Prior to turning the form over to the carhouse foreman the local transportation department carhouse foreman notes the cars due for inspection on the following day and so arranges his car assignments, traffic permitting, that the cars may be inspected. Upon receipt of the form by the rolling stock department carhouse foreman the Economy meter inspection cards are placed in the rack indicating the date and the number of the cars to be inspected.

The first car inspector removes the cards from the rack and places them in metal containers attached to some part of the car. The several car inspectors then proceed with their inspections and place their initials opposite the names of the parts inspected together with the dates. The last inspector removes the card container and the card from the car and returns the card to some specified place in the rolling stock carhouse foreman's office. The foreman then, in general, goes over the inspection work and signs the card.

Dial sections have been developed and placed on all meters to indicate the energy consumption inspection interval (see halftone illustration). As soon as the energy consumption as shown by the meter dial approximates any of the readings on this supplementary dial, notation or check mark is placed opposite the car number and the meter reading on the form described above.

Both meter inspection cards and reports of daily meter readings are filed in the local rolling stock carhouse office. On the

BAY STATE STREET RAILWAY COMPANY
WALLACE B. DONHAM, Receiver

FOREIGN CAR INSPECTION NOTICE

Date.....

Mr. ..... Trans. Foreman ..... Car House.

Confirming telephone notification of this date you are hereby advised that the following cars require inspection on ..... 19....., as indicated by meter readings.

Car No.	Meter Reading	Car No.	Meter Reading

These cars will be scheduled to reach your car house.

Signed .....
Foreman.
..... Car House.

FORM USED TO NOTIFY TRANSPORTATION DEPARTMENT FOREMAN OF FOREIGN CARS DUE FOR INSPECTION

BAY STATE STREET RAILWAY COMPANY
WALLACE B. DONHAM, Receiver

DAILY ECONOMY METER READINGS

Division ..... Car House .....

Foreman ..... Date 191

CAR NO.	METER READING	*DUE FOR INSPECTION	CAR NO.	METER READING	*DUE FOR INSPECTION	CAR NO.	METER READING	DUE FOR INSPECTION

(White) Original to Power Saving Department.
(Yellow) Duplicate to Rolling Stock Department.
*Place Check in this Column opposite Car No.
Due for inspection as indicated by tabulation on Meter Dial.

IN CHARGE

FORM (8 IN. x 11 IN.) SHOWING CARS DUE FOR INSPECTION

POSTER SHOWING INSPECTION INTERVALS FOR CARS OF SEVERAL WEIGHTS

Car Weight in Pounds	Watt-Hours Per Ton-Miles	Kilowatt-Hours Per 1000 Car-Miles	Kilowatt-Hours Inspection Interval	Car-Miles Per Inspection Interval
18,000	150	1,350	1,250	930
19,999	150	1,500	1,250	835
20,000	150	1,500	2,000	1,330
29,999	150	2,250	2,000	890
30,000	150	2,250	2,500	1,110
39,999	150	3,000	2,500	835
40,000	150	3,000	3,300	1,100
50,000	150	3,750	3,300	880
59,000	150	4,400	3,300	750

The above is the basis in which inspection intervals were determined. We endeavored as nearly as possible to place cars on a 1000-mile basis, but until such time as a special mechanical device is developed, we are limited in choosing inspection intervals to such units as are a multiple of 10,000, the capacity of the meter. It is obvious in this inspection method that a car of any given weight, equipped with old and inefficient type of meters, will come in for inspection more often for a given mileage than will a car of the same weight equipped with modern and up-to-date motors.

Moreover a car that has improper gear ratio for the conditions under which it operates will come in more often for inspection than will a car with proper gear ratio.

FORM 6411A
CAR No. ..... DATE DUE ..... INSP. No. .....
CAR STATION ..... METER READING .....

BAY STATE STREET RAILWAY COMPANY
WALLACE B. DONHAM, Receiver

ECONOMY METER INSPECTION CARD

PART INSPECTED	DATE	BY WHOM	PART INSPECTED	DATE	BY WHOM
Motors			Spare Lamps		
Arm. Clearance			Arc Headlights		
B. H'ld'rs & Yokes			Inc'nd'sc't H'd'l'ts		
Leads			Roofs		
Gears & Pinions			Motormen Steps		
Gear Cases			Roof Handle		
Bolts			Signs		
Trucks			Drawbars		
Wheels			Fenders		
Journals			Snow Scrapers		
Air Brakes			Grab Handles		
Air Equipm't			Sand Boxes		
Hand Brakes			Sand Spouts		
Brake Valves			Foot Gongs		
Air G'ge & Lamps			Bells		
Master Controller			Bell Cords		
Motor Controller			Registers		
Meter			Register Cords		
Contactors			Buzzer and Buttons		
Reverser			Seats		
Resistance			Cushions		
Circuit Breaker			Curtains		
Cir. Brkr. Reset			Door Glass		
Fuse Boxes			Doors—Body		
Spare Fuses			Door—V'tibule		
Switches			Window Glass		
Lt'ning Arresters			Window—Body		
Trolley			Window—V'tibule		
Trolley Hooks			Hand Straps		
Trolley Catchers			S. Bars on O. Cars		
Door Engines			Floors and Traps		
Car Wiring			Steps & R'n'g B'ds		
Heaters			Screens		
Lt'ting Circuits					

REMARKS .....

SIGNED ..... FOREMAN CAR REPAIRS

CAR No. ..... DATE ..... INSP. No. .....

THIS CAR HAS BEEN INSPECTED AND IS RELEASED FOR SERVICE AT ..... A.M. / P.M. ABOVE DATE.

SIGNED .....
FOREMAN OF REPAIRS.

INSPECTION RECORD FORM, ON CARDBOARD, 3¼ IN. x 8½ IN. IN SIZE

inspection card a space is provided for entry of a number of the inspections. For example, the card covering the first inspection of any car on this basis is card No. 1, the next card is No. 2, etc.

Cars marked for inspection are to be reported immediately by telephone, confirmed in writing, to the transportation carhouse foreman of the carhouse from which the car regularly operates. A foreign car should be routed so that it may be taken in at the carhouse from which it regularly operates, for inspection at the earliest possible time.

A special form has been developed for notification regarding foreign car inspection. This is printed in triplicate, the original and duplicate to be forwarded to the transportation department foreman in the car house from which the car regularly operates, the original being retained by the foreman and the duplicate being turned over to the rolling stock department carhouse foreman. The triplicate copy is retained by the man making out the notification.

The above instructions are not to be interpreted in such a manner as to relieve the rolling stock department carhouse foreman of the responsibility for proper inspection of cars when due. Close co-operation between the rolling stock and transportation departments' representatives and the several carhouses is required, and it is hoped that this plan will be successfully inaugurated on the Bay State system.

The above is signed by W. C. Bolt, investigating engineer, and approved by F. D. Ward, superintendent of rolling stock, and R. M. Sparks, transportation manager.

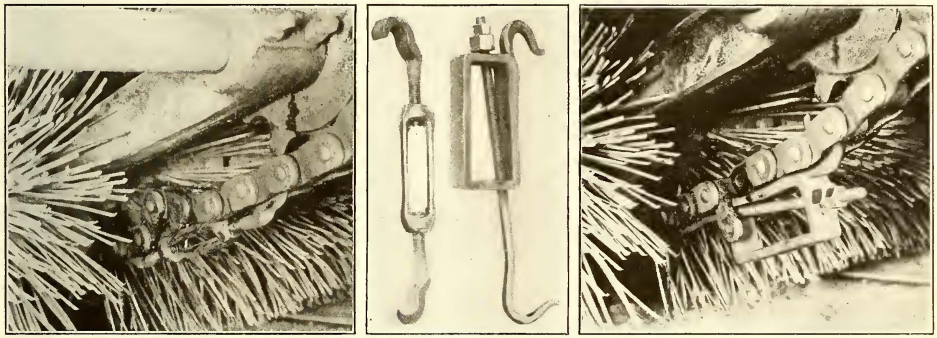
Fare Boxes Help Speed Up Service

The Capital Traction Company and the Washington Railway & Electric Company of Washington, D. C., which have recently equipped several divisions of their lines with fare boxes, report that the number of fares turned in showed a decided increase after the installation, and continues to remain high. The traveling public has now become accustomed to this method of fare collection and this has had a considerable effect in speeding up the car service and obviating delays and long stops. No complaint has been made to either of the two companies in regard to the operation of the fare boxes and the passengers seem well satisfied with the innovation.

"Butterfly" Turnbuckle Provides for Straight Pull

As a Shop Tool It Is of Great Convenience for Producing the Necessary Slack in Sprocket Chains to Renew Broken or Worn Links and Pins

IN REPLACING broken links in the sprocket chains of sweepers and other miscellaneous railway equipment, it is necessary to bring the broken ends of the chain together sometimes under considerable tension. One of the most common methods for doing this is to insert a turnbuckle at the point where the link is to be renewed and by tightening this the ends are brought sufficiently close so that the new links may be applied. The ordinary form of turnbuckle as manufactured is rather inconvenient, as the ends must be provided with hooks which project above the center line of the turnbuckle. The pull on the turnbuckle is then not straight through its center and it is often found very difficult to take up sufficient slack in the chain for inserting the new links. It is also somewhat inconvenient to turn the ordinary type of turnbuckle, as the sides of this project out from the center line so that in turning it interferes with the surface of the chain.



AT LEFT, OLD TYPE OF TURNBUCKLE USED FOR RENEWING LINKS OF SPROCKET CHAIN ON SWEEPER; IN CENTER (A) AT LEFT, OLD TYPE OF TURNBUCKLE; (B) AT RIGHT, BUTTERFLY TYPE OF TURNBUCKLE; AT RIGHT, BUTTERFLY TYPE OF TURNBUCKLE USED FOR REPLACING BROKEN LINKS IN SPROCKET CHAIN OF SWEEPER

A form of "butterfly" turnbuckle has been devised by the Brooklyn Rapid Transit Company, which overcomes this difficulty. The center part of the turnbuckle consists of a rectangular forging with a hook attached at the top. The hook for providing the adjustment and furnishing the tension is at the other end of this center portion, and is inclined at an angle so as to project through both the ends of the center portion of the turnbuckle. The extreme end of this hook is threaded and by the use of nuts the proper tension can be applied. This construction gives a straight pull on the hook which is furnishing the tension and also gives plenty of clearance between the lower part of the chain and the nuts for the use of a wrench to tighten them.

The accompanying illustrations show the method of applying this to a sprocket chain of a sweeper for renewing a broken link. Both the old type and the "butterfly" type of turnbuckles are illustrated.

This "butterfly" type of turnbuckle is also of service for connecting parts of the brake rigging, especially where there is a chain that must be pulled tight.

Winding Coils for Old Armatures

Additional Insulation Is Necessary at Corners and Between Leads Where Clearance with Core Is Small and Large Radius Bends Give Greater Flexibility for Rewinding

FIG. 1—BUSY SCENE IN A COIL MANUFACTURING DEPARTMENT

GREATER precautions are necessary in winding coils for repairing armatures than when the coils are to be installed in new armature cores. These, cores, especially on the older type armatures, open up with service. This increases the length of the slots and so crowds the coils at the corners and ends. These are the points where short-circuits and grounds most frequently occur as vibration soon causes the cores to cut through the insulation at these points of small clearance. The laminations of the armature core are sometimes bent and sharp projections are formed from rubbing the pole faces; from wire bands loosening and becoming tangled about the armature, and from careless handling. In winding such armatures it is sometimes necessary to pull and distort the coils in order to get them into the slots. Where bends are sharp this pulling is liable to crack the tape and weaken the insulation at that point. These conditions as well as many others which result from operation must be met by a satisfactory armature coil. In the belief that railway operating men would appreciate some pointers regarding armature coils from manufacturers the editors of this paper requested the proprietors of the Columbia Machine Works & Malleable Iron Company, Brooklyn, N. Y., to permit them to study the practices followed in their armature department. They did so and the present article is the result. The article should prove helpful to master mechanics who make their own coils as well as to those who buy their coils. There is still a great demand for armature coils for what are usually considered as old motors, such as the G.E.-1000 and G.E.-800. Many improvements in the shape of the coils, the method of bringing out the end connections and provision for extra insulation at corners have been made in the later designs of motors that are not possible with the older types. A more substantial type of construction has also been used with most late designs while many of the older coils are frail and easily bent out of shape.

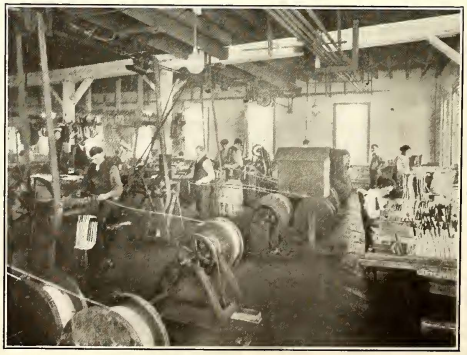


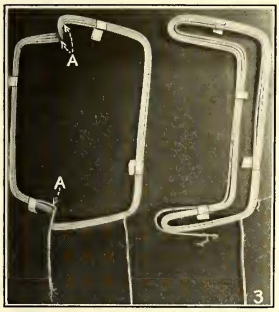
FIG. 2—WINDING COILS AND APPLYING INSULATION

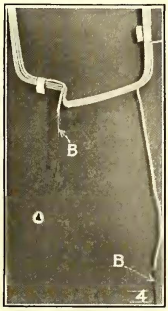
Accompanying illustrations show several types of armature coils in various stages of manufacture in the Columbia works. After the coil is wound it is opened up and care is taken to see that the bends are not too sharp. While short bends make a coil of neat appearance they are difficult to insulate properly and the tape which is applied later to the two bends at the forward and back ends will crack if the armature winder has to spread the coils apart, as he most certainly will in winding. Furthermore, in order to get the coils into shape after spreading, the winder hits the bends with a mallet and when they are sharp the insulation is sure to be damaged. A coil with large radius bends is shown in Fig. 3.

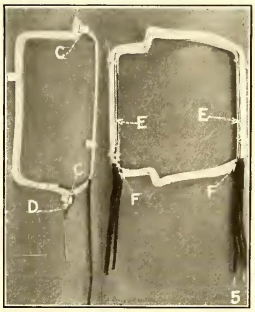
It is necessary to flatten the ends of the leads on some types of coils to provide for connecting to the commutator. This flattening tends to harden the copper at a point where flexibility is most desirable. The next step in the coil manufacture is to tin these ends. It has been found that by quenching the ends in cold water after they have been dipped in the hot solder the copper is softened. This affords an easy means for giving increased flexibility to these ends. Fig 4 shows a GE-100 armature coil with ends of leads flattened and tinned.

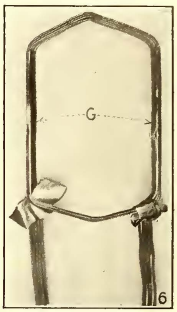
When complete coils consist of two or more single coils they are assembled side by side. Fish paper, 0.010 in. thick, is placed between the coils in assembling. In order to hold these coils tightly together and prevent movement of one coil on another the fish paper is varnished. After assembling the coils are heated either in ovens or hot presses and the individual coils are pressed firmly together, and are kept in this position by the varnish. It is important that the varnish on the fish paper be not allowed to dry out as it then fails to hold the coils together. To avoid the drying out of this varnish it has been found best to varnish the fish paper in small lots which will be used within a few days after they are varnished. Experience at the Columbia works has shown that this varnish holds better if applied with a brush. On sheets which were dipped to provide the coating of varnish it was found that the varnished peeled off very readily, but when the varnish is applied with a brush it enters the pores of the paper and holds firmly. Of course extreme care should be used in drying the sheets to make sure that no dirt or material which would be detrimental to the insulation gets on the varnish while the latter is soft.

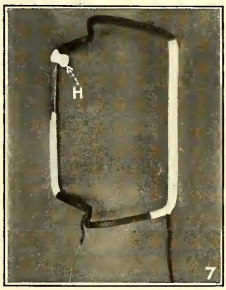
Before the coils are taped with the linen tape a wrapping of varnished cambric is applied around the middle coil, at the corners, and as an additional precaution a figure-eight-shaped piece of varnished cambric is applied to the outside of the coil at the corners of the short side as shown in Fig. 7. The sides of the coil are also double-wrapped with varnished cambric. On the short side of the coil the bend comes right at the end

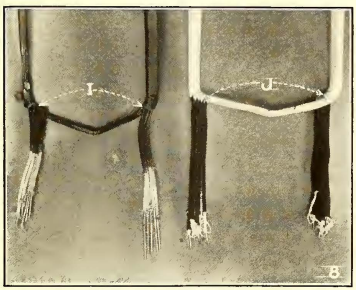


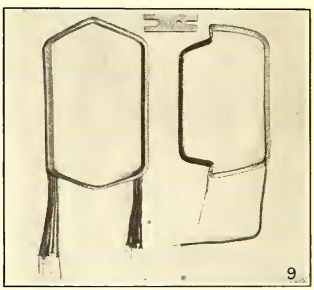












SEVERAL TYPES OF ARMATURE COILS IN DIFFERENT STAGES OF THEIR MANUFACTURE

Fig. 3—GE-1000 Armature Coil Immediately After Winding (Right) and When Opened Up (Left). "A"—Large Radius Bends.
Fig. 4—GE-1000 Armature Coil with Ends of Leads (B) Flattened and Tinned.
Fig. 5—GE-1000 Armature Coil (Left). "C"—Varnished Cambric Around Center Wire. "D"—Tape Where Lead Extends Over Coil. At Right, GE-58 Coils Assembled. "E"—Fish Paper Between Layers. "F"—Sleeving Extending Over Coil.
Fig. 6—Westinghouse 307 Coil with Sleeving Applied. "G"—Sides Double Wrapped with Varnished Cambric.
Fig. 7—GE-1000 Coil. "H"—Varnished Cambric Applied at Corner.
Fig. 8—Westinghouse 307 Coils. "I"—Bad Arrangement, Leads Bunched. "J"—Tape Between Leads.
Fig. 9—Westinghouse 307 and GE-1000 Coils Finished and Gaged Ready for Shipment.

of the armature core and vibration soon wears this insulation. In taping the corners the tape is inserted between the leads where they emerge from the coil so as to provide against short-circuits and keep the leads securely in place (see Fig. 8). These leads should also be brought out so that all unnecessary bending in bringing them down to the commutator will be avoided and all sharp cross-overs done away with.

Coils Should Be Tested Under Pressure While Hot

In applying the linen tape there will be some creases, wrinkles and rough spots that can only be pressed out in a hot press. The hot steam press will also square up the corners and make the coils tighter. Testing the coils for short-circuits and grounds is best made while they are hot and under pressure in the steam presses. The usual 500 to 600-volt railway circuit should be satisfactory for making these tests. Where hot presses are used these should be constructed and provided with connections so that cold water can be circulated through them for rapid cooling, and the coils should be kept under pressure till cold. If the coils are removed from the presses while hot they will round off in cooling and lose shape.

Small coils are sure to get out of shape during the different operations of their manufacture and an air press is needed to put them in shape again. After the coils are dipped, baked and gaged they are ready for installation in the aramture. Where coils have to be shipped to their destination extreme care must be used in packing, otherwise they will be distorted and injured before they are used.

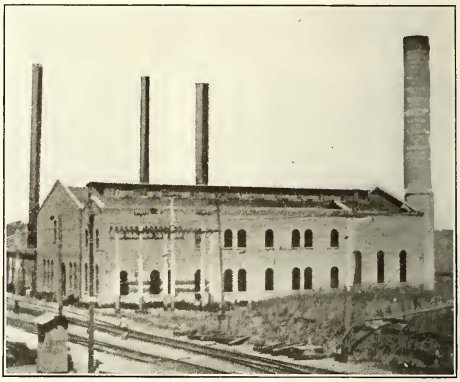
How a Steel Stack Was Removed from Old Power Plant and Reinstalled in a New One

Method of Taking Down a Smokestack from a Power House Where It Was No Longer Required and Reinstalling It at a New Plant

By Clifford A. Elliott
Cost Engineer Maintenance of Way Department, Pacific Electric Railway

THE removal of a steel smokestack 7 ft. in diameter from the Vineyard power house of the Pacific Electric Railway and its reinstallation at a new power plant located at Torrance was decided upon as an economical measure. The boilers which this stack served at the Vineyard Station were no longer in service, and so the stack was not being used. It rested upon boilers 12 ft. high. Forty feet of the stack extended between the top of the boiler and the roof, while the remaining portion 55 ft. in length projected beyond the top of the roof.

Due to limited building space, the removal of this stack intact was not possible as it could not be lowered through the roof of the power house and be removed through the doors or windows of the building. A contractor was found, however, who was willing to undertake the removal of the stack in two sections. This was the method finally adopted. A large steel beam which extended through the roof as a part of the construction of the Vineyard power house offered a most favorable and substantial support for the installation of a gin pole and its rigging for handling the stack. A gin pole was installed and the hoisting line was run down through an opening in the roof to the boiler room and outside the power house to a donkey engine. The section of the smokestack extending beyond the roof was first released and was lowered by the aid of the gin pole to the roof. It was then moved over the surface of the roof on rollers for a distance of approximately 40 ft. to the building line. The gin pole was then reset, and by its aid the stack was lowered over the side walls of the building to the adjoining power-house grounds, a height of approximately 50 ft. The second section of the stack, 40 ft. long, extending between the top of the boilers and the roof, was then lifted and placed on the roof, from which it was lowered to the ground in the same manner as the upper section had been handled. The total expense of



VINEYARD POWER HOUSE BEFORE STACK (THE LARGE STEEL ONE) WAS REMOVED

this removal and relocation of the stack will not exceed $600 and will show a substantial saving over the cost of a new stack at the present high market prices. The distance between the two power houses is 20 miles and the stack was transported with auto trucks. The Torrance power house is at present about 35 per cent completed and when finished will serve the new power repair shops of this company. The stack when re-erected, will serve two 250-hp. Sterling boilers, which are also being transferred from the Vineyard power plant to the new power house.

Cleaning Condenser Tubes

The *Electrical Engineer*, London, mentions a novel method of cleaning condenser tubes by blowing through them water with sand in suspension. Originally an air pistol was used to project the water, but subsequently sand was introduced by means of the circulating water, about 1½ cu.yd. being added to the water daily. After three weeks of this treatment, it is stated, the condition of the condenser was much improved. The size of the condenser is not stated.

Advantages of A.C. Welding

Some of the advantages claimed for the use of alternating current for arc welding are the following:

Simplicity of apparatus: no motor-generator sets, resistance grids, contactors, exciters, etc., are required. Portability of apparatus. Low power consumption. Ease of operation. Constant heat of arc. Deeper penetration. Remote liability of "burning" the weld.

Saving Motor Shells from the Scrap Heap by Welding

The Different Steps in the Thermit Method of Welding Motor Shells as Used by a Large Electric Railway System Are Described and Some Suggestions for Relining Crucibles and Keeping Welding Tools in Proper Repair Are Given

THE amount of welding repair work which electric railways are carrying out has increased rapidly during the past three years. Much of this has been caused by the difficulty experienced in obtaining proper repair parts. Also in many parts deferred maintenance has resulted in breakages and an increased opportunity for welding repair methods. Thus bad track conditions increase the duty on the car equipment, and excessive wear of various equipment parts causes additional stresses from shock and vibration. Crystallization is also caused by vibration, and additional strains then cause breakage. A striking example is furnished by the breakage of motor cases. Most of the breakages occur through the axle bearing bore at the gear end of the motor where one end of the gear case is supported. This throws additional duty on the casting at this point. Wear in the axle bearing, and between the bearing and housing, also allows the motor to be raised and dropped a distance equal to the amount of wear every time the car is started or stopped. This wear is continually increasing and becoming more dangerous. Sharp blows are thus delivered at a vital point in the casting. In late designs of motors the manufacturers have worked out a construction to withstand these blows, but in the older types breakage occurs.

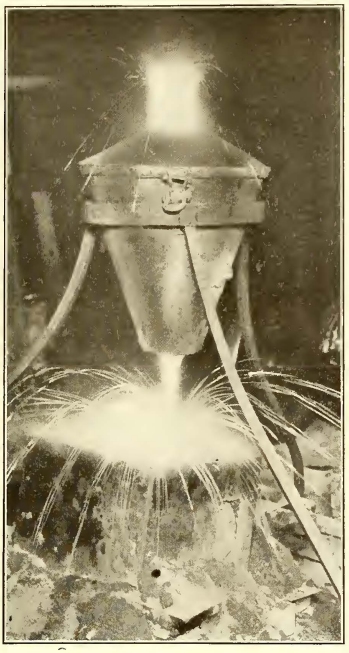


FIG. 1—MAKING A WELD WITH THERMIT

The thermit process has been used extensively in the repair of motor cases, and the purpose of this article is to explain the procedure which has proved most satisfactory in this work.

First Steps in Welding Motor Shells

Nearly all motor shells requiring welding have some part entirely broken off. Where cracks exist it is desirable to cut or break the pieces apart, as the contraction of the welded side of the repaired casting will produce shrinkage strains, which might be sufficient to cause fracture during cooling.

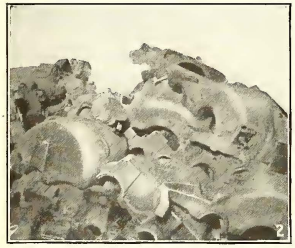
When the parts have been separated the metal along the line of the fracture should be cut out so that approximately 1 in. of space is provided between the parts to receive the thermit. There are two ways of doing this, the better and quicker being to employ a cutting flame of gas or an electric arc. If necessary apparatus for this is not available a series of holes may be drilled along the line of fracture and all metal between the holes removed. In cutting this metal off it is best to cut from the longer piece so as to favor the shorter end. If the break runs diagonally, it is advisable when cutting out, to make the opening as nearly vertical as possible. If the cutting is done with a gas flame there will be a certain amount of oxidization left on the cut surface. This should be chipped off carefully and the metal parts cleaned of all dirt and grease as far back as the mold box will reach. This is essential as otherwise when the mold is rammed up and the heat applied for preheating, grease or other combustible material will burn out and leave a space between the mold and the frame through which the thermit will run out. After the parts have been properly cleaned they should be lined up and clamped to prevent movement, the use of a surface plate being recommended for this purpose. An accompanying illustration shows a motor shell lined up in this manner. Where a surface plate is not available a solid foundation with rails for conveniently fastening the holding-down bolts will prove satisfactory. Where the break is through the axle bore, as shown in the illustration referred to, the welding can best be carried out with the shell laid on its finished surface. With the shell in this position the riser will come on the outside of the shell and can be readily cut off, and so reduce the machining to a minimum. In setting up the parts it is necessary to allow for the contraction of the thermit in cooling by setting the parts away from each other a distance of $\frac{3}{32}$ in. per 1 in. of space greater than that desired in the finished shell.

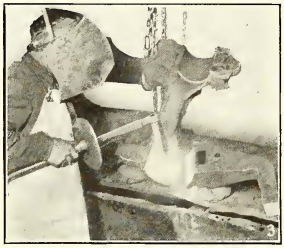
With the frame ready to receive the wax pattern this is next shaped around and between the parts to be welded. Yellow wax is used for this and it should be warmed until it becomes plastic enough to work readily or melted and allowed to cool until it reaches the proper consistency. This is most readily accomplished by pouring the melted wax into a pail of water from which it may be taken with the hand and formed into the space intended to receive the thermit. In applying the wax

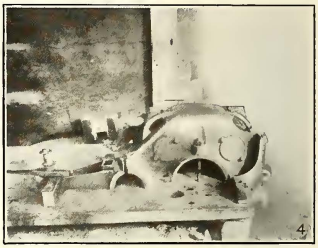
to a broken gear case lug of a motor frame it should be spread out so as to strengthen the parts when welded as much as possible. The bearing bore, which is usually found to be worn somewhat, should have a wax lining so that the thermit will fill in sufficiently to bring the bore to exact size when rebored.

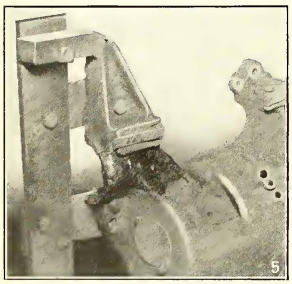
The mold box should then be placed in position and supported so as to remove all weight from the frame. Mold boxes can be readily made up in the railway shops from sheet iron. A box $\frac{3}{16}$ in. thick and 18 in. x 18 in. x 18 in. is a good size for welding motor shells. The bottom edges of this will need to be cut out to fit around the casting. In case the holes thus cut out should be kept level and rammed hard. There should be a wall of molding material at least 4 in. thick between the wax pattern and the mold box at all points, as the thermit steel is intensely hot and ample molding material should be provided to hold it. The material underneath the casting can usually be rammed up more conveniently if the ramming is done before the mold box is put in position.

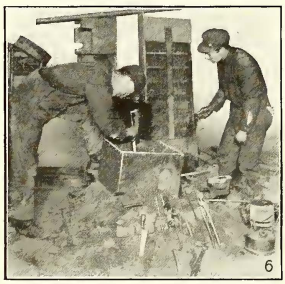
A preheating gate, a pouring gate and a riser should be provided in the mold. Wooden patterns should be used for these openings. The pattern for the heating gate should be about 3 in. in diameter at the outside end and tapered to $1\frac{1}{2}$ in. at the inside. The pouring

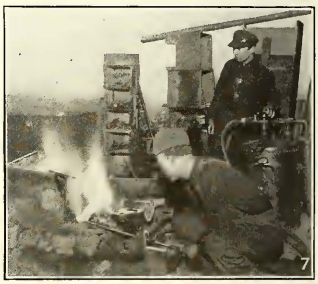












PRELIMINARY WORK FOR MAKING MOTOR SHELL WELDS WITH THERMIT

Fig. 2—A Pile of Broken Motor Shells.
Fig. 3—Cutting Out Metal from the Fracture with Electric Arc.
Fig. 4—Broken Motor Shell Lined Up on Surface Plate.
Fig. 5—Wax Mold Applied to Break at Axle Bearing.
Fig. 6—Finishing the Mold and Removing the Riser Pattern.
Fig. 7—Preheating the Casting.

too large they can be closed with pieces of steel in such a manner as to retain the molding sand properly.

CONSTRUCTING THE MOLD

The facing of the mold, or the part that comes in contact with the thermit, should consist of equal parts of fire clay, crushed fire brick and fire sand. The manufacturers of thermit supply these materials where they cannot be readily obtained in the immediate vicinity of the railway. This mixture should be well riddled, mixed dry and then moistened with just enough water to make it pack well. It can be used for the entire mold where the welds to be made are small, but for welds of the size necessary on motor shells it is more economical to use it only for facing and to use loam or a mixture of one part fire clay to two parts of good sharp sand for backing. The facing should have a thickness of from 1 in. to $1\frac{1}{2}$ in. all around the wax.

In ramming up the mold, 3 in. to 4 in. of molding material should be placed in the box and rammed with a small rammer first around the edges and working toward the center. The molding material should be

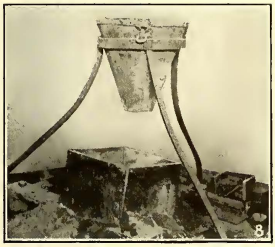
gate pattern should be about $1\frac{1}{2}$ in. at the top and slope to 1 in. at the bottom. The riser may be rectangular and about 2 in. x $3\frac{1}{2}$ in. at the top and tapered $\frac{1}{2}$ in. in its length. The pattern for the preheating opening should be set at the lowest point of the wax pattern and should project outside the mold box. Where the sections to be welded are of the same size this preheating gate should be set in the middle of the lowest part of the wax pattern so that both sides of the casting may be heated equally. When the two sections to be welded are of different sizes the preheating opening should be set more to the side of the heavier section as this will require longer to heat than the lighter section.

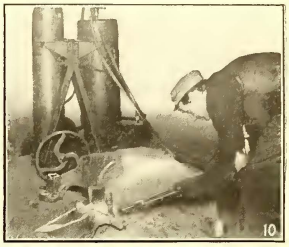
The pattern for the pouring gate should be set directly above that for preheating and about 1 in. away from the wax pattern. This should also be set at an angle as indicated in an accompanying illustration.

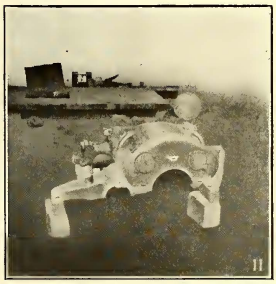
The riser pattern should be placed at the highest point of the wax pattern. If there is more than one high point, a riser should be placed over each. The function of the riser is to hold a supply of steel which will remain liquid for a considerable time, to take care

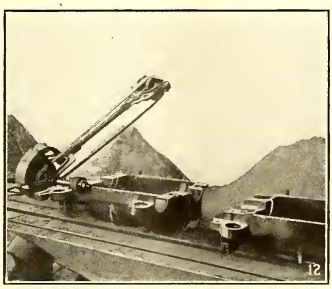
of all shrinkage and to act as a depository for loose sand or other material which will be washed into the riser by the action of the thermit in passing through the mold.

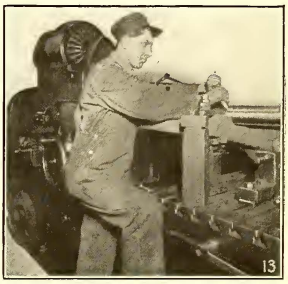
After the mold has been rammed up, the top should be hollowed out to form a basin in which the slag can collect so as not to overrun the box. The mold should be vented by making holes with a No. 8 or No. 10 gage steel wire so that all gases in the liquid metal can escape readily. The patterns for the gate, riser and preheating opening can be readily withdrawn by rapping them slightly. A molder's slick, trowel and lifter are very useful for wiping away any loose sand that might fall into the mold. After the patterns are withdrawn the various openings should be covered and the crucible set up, with the bottom about 3 in. above and directly over the pouring gate.











FINISHING OPERATIONS AFTER WELDING REPAIRS HAVE BEEN MADE

Fig. 8—Crucible in Place Ready for Making the Weld.
Fig. 9—Cleaning Off Sand from Casting.
Fig. 10—Trimming Off Gates and Riser with Oxy-acetylene Torch.
Fig. 11—Casting Cleaned, Ready for Machining.
Fig. 12—Grinding Axle Bearing to Remove Rough Metal.
Fig. 13—Boring out the Axle Bearing in a Boring Machine.

PREHEATING IS ESSENTIAL

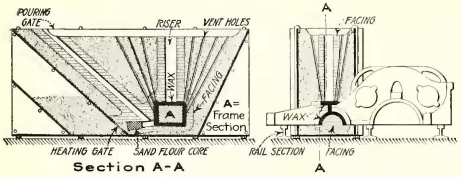
The parts to be welded must be brought up to a good, red, workable heat, and the mold should be dried out thoroughly. The Metal & Thermit Corporation has developed a preheater for this purpose which operates with compressed air and either gasoline or kerosene. Gasoline is recommended for fuel, as it gives a clean, hot flame, with no deposit of carbon. Cleanliness is essential to insure satisfactory results in welding, and even a small deposit of carbon may prevent complete fusion. This type of preheater is fitted with either one or two burners as desired, and the needle valve gives a close regulation of the mixture of air and fuel.

The preheater shown in the illustration on page 585 should be connected with the compressed air supply at *A*, which admits the air to a water separator. The air pressure used should be at least 50 lb. per square inch, but higher pressures can be safely used, as the tank is tested to 250 lb. Valve *B* allows the compression air to flow into the top of the tank and places the gasoline or kerosene contained therein under pressure, driving it up through the pipe *C* into the needle valve *D*, which regulates the amount of fuel to be mixed with the compressed air which flows across the by-pass around the needle valve and through the check valve *F* into the hose and so on to the burner. Fuel and air become mixed together at the needle valve and also through the passage from *D* to the burner *G*. Valves *D* and *E* are used to regulate the torch, controlling the fuel and compressed air respectively.

In starting the torch is placed in position in front of the preheating gate of the mold, but about 1 in. away. Oily waste, or a flame of some kind at the end of the burner pipe is used to keep the burner lighted until it is satisfactorily regulated. The air valve *B* is opened wide and then the air valve *E* is opened from one-half to one full turn, according to the air pressure used; and the gasoline valve *D* is opened one-half to three-quarters of a turn, the amount depending upon the air pressure. The burner will take a few minutes to start properly, because the mold is cold, tending to liquify the vapor. Gradually, as the preheating gate becomes hot, the flame becomes steady. The burner is lighted more easily if at first a slight excess of fuel is used. Unless the mold is intricate, so that a strong flame would tend to break it, the air flow can be increased after the flame is well started, and then the fuel increased correspondingly. Too much air will tend to extinguish the flame; too much fuel will produce a long, yellow and smoky flame. Shortly after the burner is started the wax will melt and burn out, coming from the riser in the form of a heavy white vapor. This may

be ignited at the top of the riser and pouring gates to eliminate the fumes. If the mixture is right there should be no flame at the end of the burner pipe when it is taken away from the mold. If there is a flame the air valve at the top of the gasoline valve should be opened wide.

After the wax has burned out, small sheet-iron plates should be placed over the riser and over the pouring gates to hold the heat in the mold. The plate over the riser should be left in place to cover the opening until after the weld is poured and to prevent any slag which may slop over from the crucible during the reaction from entering the riser openings and spoiling the welds.



DETAILS OF MOLD FOR WELDING MOTOR SHELL WITH THERMIT

At the end of the preheating, the burner is placed in the riser and in the pouring gates for a short time so that any loose sand may be blown out through the heating gates. In stopping the burner, the fuel valves *B* and *D* are turned off completely, but the air valve *E* is left turned on, or perhaps opened wider to blow all vapor out of the burner pipe. The water should be drained out of the water separator from time to time through the test cock at the bottom.

How the Crucible is Plugged and Charged

While the preheating is in progress the crucible may be plugged and charged with thermit. To do this the opening at the bottom of the crucible is closed by first inserting a thimble wrapped with one thickness of uncreased paper. The tapping pin is then suspended through the thimble, and over this are placed an asbestos washer and metal disk. These are covered with refractory sand.

After the thermit crucible has been plugged, the charge of thermit may be added. It is important to put in a few handfuls first before dumping in the rest of the charge so as not to disturb the plugging material. The thermit charge should be mixed carefully before putting it in the crucible. No ignition powder should be added till the thermit charge is ready to be ignited.

When the preheating has been finished and all preparations made for pouring, the preheating opening should be plugged with a piece of fire brick ground to fit, or with an iron plug. The plug should be backed up with several shovelfuls of molding material between the mold box and a steel plate provided for the purpose. The sand should be packed down hard with a rammer. This will prevent the possibility of the thermit steel running out through the preheating opening. All heating apparatus should be removed a safe distance before the thermit is ignited.

To ignite the thermit, the contents of the ignition powder can are mixed and a half teaspoonful of the powder is placed on top of the thermit in the crucible. Thermit will not ignite from the heat of the preheater,

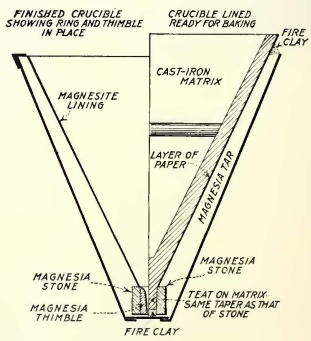
TABLE I. QUANTITY OF THERMIT FOR DIFFERENT SIZE WELDS

Width of Frame, Inches	Depth of Frame, Inches	Width of Thermit Steel Collar, Inches	Thickness of Thermit Steel Collar at Center, Inches	Quantity of Railroad Thermit Required for Weld, Pounds
3	2	4	1	40
3	2½	4	1	40
3	3	4	1	45
3	3½	4	1	50
3	4	4	1	55
4	4	4	1	65
4	4½	4	1	65
4	5	4	1	70
4	5½	5	1¼	75
4	6	5	1¼	75
4½	4½	5	1¼	70
4½	5	5	1¼	75
4½	5½	5	1¼	75
4½	6	5	1¼	80
5	5	5	1¼	75
5	5½	5	1¼	80
5	6	6	1⅜	85
5	7	6	1⅜	90
5½	5½	6	1⅜	85
5½	6	6	1⅜	90
5½	7	6	1⅜	110
6	6	6	1⅜	100
6	6½	6	1⅜	120
6	7	7	1⅜	130
6½	6½	7	1⅜	130
6½	7	7	1⅜	150
6½	8	7	1⅜	160
7	7	7	1⅜	155

Space cut out between frame ends should be the same as the thickness of the collar (see fourth column).

and the reaction cannot be started without ignition powder. This ignition powder can be ignited with a match, or with a red-hot iron. After the reaction has started, it is best to wait at least thirty-five seconds before tapping the crucible. This is accomplished by knocking up the tapping pin at the bottom of the crucible, using for this purpose a tapping spade or a piece of iron about 4 ft. long.

After the mold has been poured, it should be allowed to remain in place as long as possible, preferably overnight, so as to anneal the steel in the weld, and in no case should it be disturbed for at least three or four hours after pouring. Where a night shift is worked, it is found very convenient to do the pouring in the afternoon shortly before quitting time of the day force,



CONSTRUCTION OF CRUCIBLE FOR THERMIT WELDING

then the mold can be broken up by the night gang before they leave in the morning and all parts can be properly cleaned up.

Table I gives the amount of thermit required for different size welds. It is usually advisable, however, to calculate the amount of thermit necessary from the wax used. Care should be taken to have the entire space filled with wax, which later is to be filled with thermit steel, so that not only the collar, but the space between the frame ends are filled with wax. By weigh-

TABLE II—CAPACITY OF THE DIFFERENT SIZES OF CRUCIBLES

Size of Crucible	Capacity in Pounds of Railroad Thermit	Outside Diameter at Top, Inches	Height, Inches	Size of Magnesia Stone for Relining	Size of Magnesia Thimble o Fe Used	Size of Plugging Material to Fe Used	Weight of Magnesia Tar Required for Relining, Pounds	Gross Shipping Weight, Pounds
No. 1	6	8½	8½	No. 1	No. 1	No. 2	8	40
No. 2	8	10	10	No. 1	No. 1	No. 2	20½	60
No. 3	15	12½	13½	No. 2	No. 2	No. 2	42	110
No. 4	25	14½	15	No. 2	No. 2	No. 2	61½	125
No. 5	35	16½	15	No. 2	No. 2	No. 2	87	150
No. 6	70	20	21	No. 2	No. 2	No. 2	141	250
No. 7	140	25½	25	Nos. 1—2	No. 2	No. 2	216	450
No. 8	210	28	28	Nos. 1—2	No. 2	No. 2	258	525
No. 9	280	30½	29½	Nos. 1—3	No. 3	No. 3	327	650
No. 10	400	34	34	Nos. 1—3	No. 3	No. 3	408	775

ing the wax before and after the completion of this operation, the difference will be the quantity of wax used. For every pound of wax one bag of railroad thermit, which holds 25 lb., is allowed. This rule provides ample thermit steel, not only for the weld proper, but also for the pouring gate and riser. Where the welds to be made are small, it is necessary that extreme care be used in weighing the wax, otherwise a small error will make a considerable difference in the amount of thermit to be used.

An Average Motor Shell Weld Costs $30

In checking over the material used by one railway company in making a number of welds to broken gear case lugs on motor shells, it was found that an average weld takes about 2 lb. of wax or approximately 50 lb. of railroad thermit. Table II gives the different sizes of crucibles necessary for different quantities of thermit. It will be seen from this table that a No. 6 crucible has a capacity of 70 lb. of railroad thermit and is the size most suitable for most welds of motor cases. One man and a helper can make one weld a day. This includes cutting out the material for the thermit, cleaning the casting, setting up the mold and making the weld. The time taken for grinding and machining will be in addition to this. The total cost of making a weld to a gear case lug will average about $10 for labor and about $20 for material, making a total of $30.

In comparing the time taken for making similar welds by the electric welding method, it was found that to weld a gear case lug electrically required about twelve hours as compared with eight hours for thermit. The cooling of the thermit welds takes from three to four hours additional, and there is more machining to be done where thermit is used, so the total time taken is about the same for the two processes. Railways which have had experience with both classes of welding state that the principal advantage of thermit over the electrical process is, that it does not take such a skilled operator to carry out the process, so that when a weld is completed they feel that there is less danger of the work proving unsatisfactory.

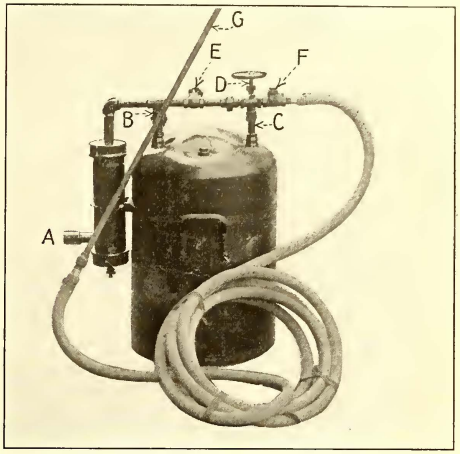
Crucible Lining Is an Important Factor

The crucible and the thimble through which the metal runs after the reaction are two of the important factors in the thermit process. The high temperature together with the ebullition of the molten metal during the reaction, necessitates a lining which is not only mechanically strong, but of a very highly refractory substance. It has been found that magnesite-lined crucibles are the only ones which satisfy these conditions. This material is furnished in the form of magnesia tar. The tar acts as a binder for the magnesite and is burned out in the process of baking the lining.

In the usual operation required for welding motor shells, a crucible lining will stand about twelve reactions before it becomes so thin as to endanger the metal casing. Ordinarily the point at which it is necessary to have the crucible relined can be determined by watching for heating of the outside sheet iron. If a dull red spot should appear during the reaction, the crucible should not be used again until it is relined.

Crucibles should be handled very carefully as the lining is liable to crack and fall out under rough treatment. It is also always important that they be stored in a dry place, as the lining, being porous, will absorb moisture, and produce a violent thermit reaction.

A certain amount of slag will be found adhering to the inside of crucibles after they have been used. It is



SINGLE BURNER PREHEATING EQUIPMENT

not necessary to clean out this slag, as it is a very refractory material itself and can do nothing but help preserve the crucible if left on. At the bottom, however, in the vicinity of the stone and thimble, the slag must be removed so as to clear the opening of the thimble or permit the old thimble to be knocked out and a new one inserted. Very often it is possible to increase the life of crucibles by patching the linings with magnesia tar. This is particularly the case where they wear away in spots, or at the bottom. In the latter case, care should be taken to patch the lining at the bottom with magnesia tar so as to cover the stone. This magnesia tar should be thoroughly baked before the crucible is used. In some cases fire clay has been used for patching crucibles. This method is not recommended, however, and it will be found that if magnesia tar is used instead, it will stand up much better under the heat of the thermit reaction.

Preparation of Materials and Lining of Crucibles

To line the sheet-iron shell of the crucible, the magnesia tar should be heated until it becomes plastic. A few handfuls should then be placed in the bottom of the crucible shell and a magnesia stone, as shown in an accompanying illustration, should be inserted in this

material and centered over the hole. More magnesia tar should then be rammed around the stone to hold it firmly in place. The cast-iron crucible cone should then be placed in position with the small projecting teat at the lower end set in the hole in the magnesia stone. The upper part can then be centered inside the shell by means of wedges inserted at equal distances along the circumference. The magnesia tar can then be rammed into the space between the cone and the shell a little at a time and tamped hard, for upon the density or hardness of the lining depends the life of the crucible. Special iron tools should be made up for this tamping and should have flat ends. Good hard blows should be struck with a hammer on the upper end of the tool when ramming, or what is better still, a pneumatic bench rammer can be used for this purpose. The material should be added a little at a time, as the better and more uniform the tamping the longer the crucible will last. As the mass nears the top the wooden wedges should be removed, as the lining already in place will hold the cone in position.

It is necessary to remove the cone before baking and to place a layer of wrapping paper or newspaper over the tar lining so as to prevent the sticking of the cone to the lining after baking. Before the cone is taken out, a mark should be made with a piece of chalk on the cone, and the point opposite it should be marked on the lining, so that when the cone is withdrawn it may be placed exactly as before. After the cone has been replaced, a crucible ring should be placed around the top and luted carefully with fire clay to protect the upper part of the lining from the heat while baking. It is also good practice to place damp fire clay around the bottom of the crucible and inside of the stone for the same purpose.

The baking of the lining is carried out in an oven. The heat should gradually be raised until the cast iron cone becomes red hot, and this temperature should be maintained until fumes stop rising from the tar, after which it can be allowed to cool gradually before removing from the oven. If the crucible is baked too long, the lining will appear crumbly and the life of the crucible will be very much shortened. Baking for too short a time will leave some of the tar in the lining and cause a violent thermit reaction. When cool, the luting may be removed and the cone taken out, when the crucible is ready for use.

Worn Thimbles Should Be Replaced with New Ones

The portion that has to withstand the most severe strain of all is the part at the bottom of the crucible, or the walls of the hole through which the metal is tapped. It has to stand the wash and pressure of the moving liquid metal and slag under great heat. The magnesia stone, which is centered in the bottom of the crucible and around which the material for lining is packed, has a tapered hole in the center. The thimbles are of the same taper as the holes in the magnesia stone and are set into the latter as shown in the illustration on page 584, which gives the various details in the construction and lining of a crucible. When the thimble requires replacing either due to enlargement of the hole or to the thimble becoming split or cracked, it can be knocked out and replaced with a new one, so that the full life of the crucible may be utilized. The thimbles should be wrapped with one layer of uncreased paper before being placed in position.

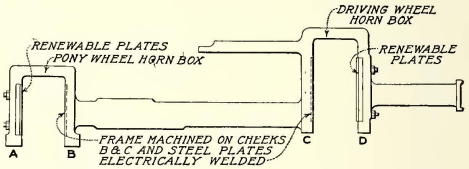
The Restoration of Truck Frames by Electric Welding

By J. M. Calder (A.M.I.E.E.)
Chief Assistant Engineer Reading (Eng.) Corporation Tramways

AN AMERICAN critic recently observed that upon the conclusion of hostilities most of the rolling stock of street railways which had been in use for any lengthy period would be consigned to the scrap heap.

When an opportunity presents itself to this individual to witness some of the excellent repair work now being executed on rolling stock by the application of electric welding he may have reason to withdraw his somewhat bold statement.

The introduction of this method of restoring worn parts and so saving expensive renewals commends itself to the attention of engineers associated with the upkeep of all tramway material. To cover the whole repair ground work would be a somewhat comprehensive task, consequently the writer has chosen to deal with that part of the truck upon which much depends as regards the stability of the tramcar—notably, the side frame. As this class of work is so general in character, the side



SIDE FRAME OF BRILL MAXIMUM TRACTION TRUCK

frame of a Brill maximum-traction truck, which has just been under overhaul and repair, will be the subject of our consideration.

Prior to the stripping of the trucks for overhaul it was found that no satisfactory setting of the brakes could be effected because of the excessive clearance due to severe wear on the cheeks of the horn boxes of the side frames, and also on the cheeks of the journal boxes. Measurements of the journal boxes taken showed that the vertical sides which ride under the horn boxes were not parallel, consequently these were machined so as to make them parallel. This point is worthy of note, chiefly because the measurement of the horn boxes which are under repair are inter-dependent on the size of the respective journal boxes belonging to them. The journal boxes now being trued up, we turn our attention to the side frames. Measurements taken showed that the side wear varied from $\frac{1}{4}$ in. to $\frac{3}{8}$ in., chiefly on the cheeks marked "B" and "C" (see sketch). Temporary centers were placed on the horn boxes and vertical parallel lines were scribed on the face around the horn box, showing the depth of recess which would accommodate the steel plate about to be inserted, and so form a new working face. The frame was then "set up" in a shaping machine and the cheek machined to the line marked thereon.

When this was done the steel plate, suitably dimensioned, was carefully fitted to the recess. On the opposite cheek of this horn box is fitted a renewable cheek plate secured to the side frame by means of two bolts. To renew this plate (see "A" and "D" on sketch) it was necessary only to replace the same by a new one, in order to make good this side or cheek of the horn box. Upon bolting up the latter plate, the other one, which

is now ready to be welded on, was temporarily inserted in position, and held there by means of a steel rod of about $\frac{3}{8}$ in. diameter, and about $\frac{1}{16}$ in. longer than the actual gap of the horn box. This rod was used to fasten the loose plate in position, and so keep it in place ready for the electric welding operation. The simplicity of the latter operation needs no lengthy explanation. The supply voltage was about 50 to 100 volts and a current of about 120 amp. was taken. The electrode used for welding was composed of Swedish iron positive in polarity while the truck frame was connected to the negative side of the supply circuit. After the welding was finished the surplus metal around the newly-welded plate and frame was cleaned off. The horn box of the side frame had every appearance of being a sound job, likely to endure for many years to come the hard service wear which would probably be imposed.

Were it not possible to apply electric welding to the repair work of these frames the job would certainly be much more difficult and expensive. A glance at the sketch will reveal to any engineer the trouble likely to be experienced in setting up special drilling gear, if bolted instead of welded plates were to be fitted to the sides. The ordinary drilling tackle could not possibly be applied owing to the peculiar design of the frames. Furthermore, the depth of the metal to be drilled and other incidental work, such as specially fitted bolts, recesses to be machined, etc., all contribute to increased costs, which electric welding is likely to relieve.

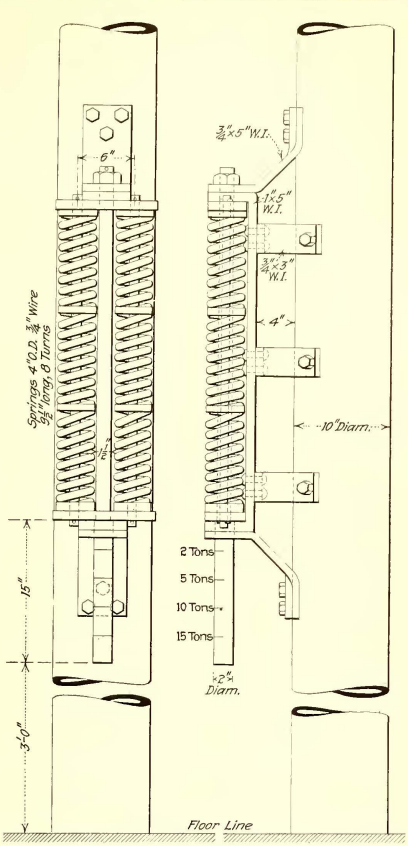
Machine for Testing Jacks Under Pressure

By E. R. Pike
Assistant to Superintendent, Fifty-second Street Surface Repair Shop, Brooklyn Rapid Transit Company

THE device shown in the accompanying illustration was built for testing jacks after they had been repaired in the Fifty-Second Street surface repair shop of the Brooklyn Rapid Transit Company. It has proved very efficient and in addition to being very simple and inexpensive to build, there have been absolutely no maintenance charges of any kind for its upkeep since its installation a number of years ago.

The device consists of a forging or yoke long enough to permit the three coil springs, which were old springs removed from Brill 22E truck side bearings, to go in between when placed end to end. It will be seen from the accompanying illustration that there are six springs or two batteries of three springs each used in this construction. By this arrangement the necessary spring resistance was obtained without the necessity for placing all six springs end to end. This latter construction would have required a yoke twice the length of the one now in use. A piece of 2-in. round steel passes up between the two sets of springs. The upper portion of this rod is turned down to $1\frac{1}{2}$ in. diameter and this forms a shoulder on which the plate rests that supports the springs at the bottom. Two pieces of $1\frac{1}{2}$ in. round cold-rolled steel pass up through the center of the springs and through the collar on which the springs set, so as to keep them in central position. The yoke is riveted to three brackets which are in turn fastened to an iron column with a thrust forging at both top and bottom to relieve the shearing strain on the tap bolts used for fastening these brackets to the post. As no castings are used in making this device the labor and material cost are greatly decreased.

Before the device was placed in position and fastened to the column, it was taken to a hydraulic wheel press and calibrated. Indicating marks were put on the lower part of the push rod to correspond to the reading of the gage on the hydraulic press. Calibration marks of 2, 5, 10 and 15 tons will be seen in the accompanying illustration.



CONVENIENT MACHINE FOR TESTING CAR JACKS

To test a jack, it is placed on the floor directly under the center of the push rod and then raised by working the jack handle. Either hydraulic or the automatic lowering types of trip jacks may be tested. The jack under test is raised until the push rod of the testing machine has been pushed up and the springs compressed to correspond to the capacity of the jack being tested.

With the above method of testing it is evident that the jack is subjected to practically the same strain as it would be were it being used in actual service and all possibility of failure is thereby eliminated. The method of supporting and installing such a testing machine can be varied to suit the condition where it is installed. It may be fastened either to the wall or to any other sufficiently strong part of the shop which will stand the strain. Any coil springs may also be used which are on hand and have sufficient capacity.

Maintenance of Door Operators

The Writer Outlines the Methods Used for Operating and Controlling the Movement of Doors, Gives the Provisions Desirable for Emergency Operation and Describes the General Methods Used in the Inspection and Overhauling of Door Operators

BY GEORGE E. OAKLEY
Sales Engineer Consolidated Car-Heating Company, Albany, N. Y.

PNEUMATIC engines for the operation of doors of surface, elevated and subway cars are now considered as a necessary component of the car equipment. This is true of all new subway, elevated, center-entrance and one-man surface cars, and is rapidly approaching this condition in the case of the end entrance type of car, although I noticed in a recent issue of one of the trade papers that certain air-brake engineers class this part of the car equipment as "parasites." Pneumatic door operators are used for operating sliding doors, with and without folding steps, and folding doors with folding steps.

There are various methods used for controlling the operation of the doors, briefly described as follows: The door operator is provided with a main valve which in one position connects the closing cylinder of the operator with the air supply and the opening cylinder to exhaust, and in the other position of the valve the opening cylinder is connected with the air supply and the closing cylinder to exhaust. In some cases this valve also cuts off the air supply at the end of the piston travel and connects both cylinders to exhaust. This valve is of the rotary, slide, or pin-valve type and is mechanically, electrically or electro-pneumatically operated. When the main valve is mechanically controlled there is a system of levers connecting the valve with an operating staff located at the conductor's station to which is fitted a small immovable operating handle. In the case of electrically operated valves, the main valve is operated direct by solenoids which are energized by means of push buttons or switches so located as to be convenient for the conductor. The electro-pneumatic control is obtained by the use of an auxiliary set of electric valves, operated from push buttons. These valves are of the pin-valve type, and when the coil of one of the valves is energized by pushing one of the buttons, say the opening button, the valve is opened and this produces an unbalanced condition of air pressure between the two sides of a small piston, and the resulting movement of this small piston is communicated to the main valve, thus throwing the valve to the opening position. By pressing the closing button the other auxiliary valve is energized, which throws the main valve to the closing position. These methods of control are all satisfactory, the one to be used depending upon the conditions of service, operation and class of car.

In the case of sliding doors the general practice is to provide an operator for each door, but in some cases the door operator is located above the doors and one operator works two doors. For folding doors, one operator controls two two-leaf doors and the folding step and is located above the doors or underneath the car.

TWO TYPES OF DOOR OPERATORS USED

There are two general types of door operators in use —the direct drive and the geared type. In the direct drive type the movement of the piston is communicated direct to the door through levers or a connecting link. In the geared type, the movement of the piston is communicated to the door through a rack and pinion in the operator and an arm pinned to the pinion shaft.

The latter type drive is coming into more general use, as it can be installed to better advantage in cars of the cross-seat type. Also in geared type operators for sliding doors provision is made for automatically cutting off the air supply to the cylinders when the stroke of the piston is completed, so that there is no air pressure in the cylinders except while the door is in motion. This reduces to a minimum the consumption of air and prolongs considerably the life of the piston leathers. Although there is no air pressure in the cylinder to hold the door in the closed position, it is impossible to open the door by pushing against it, nor will it work open due to the vibration of the moving car, as the driving arm of the door operator travels down to a locked position when closing the door, and the only way to open the door is by means of an emergency handle keyed to the door operator shaft.

As a number of surface and subway cars have all the doors equipped with this type of door operator it is necessary to provide means whereby one door on each side of the car, in the case of surface cars, and one door on each side and the two body end doors, in the case of subway cars, may readily be opened from the outside in case the car is laid up in the yard with all doors closed. Where the doors are controlled by means of push buttons, provision is made for opening the doors from outside the car by providing special push buttons so constructed and located as not to be readily operated by passengers from the station platforms or the street. It is also desirable to provide some means for opening these doors by hand from the outside of the car in case certain switches inside the car should be open, thus cutting off the current supply to the push buttons or should there be no air on the car. Thus in addition to having the external push buttons a mechanical device is provided by means of which the driving arm of the door operator can be raised to a height sufficient to allow the door to be pushed open by hand.

PROVISION FOR EMERGENCY OPERATION OF DOORS IS ESSENTIAL

It is always possible to open the doors from inside the car in case the current supply or air, or both, should fail, but in some instances public service commissions have requested that provision be made in connection with the door equipment of surface cars for easily and quickly accomplishing this by the conductor or the passengers in case of accident and resultant excitement. Hence in some installations when the direct drive door operator is used there is a disconnecting device for each door, so arranged that by pulling a handle located in a convenient place the door is disconnected from the door operator and is then easily pushed open by hand. Another method of accomplishing the same result, and

which is probably more satisfactory as it is less complicated and requires very little maintenance, is to arrange the emergency opening device so that the pulling of the emergency handle will throw the door valve to the opening position. Then if there is any air on the car the door will immediately open; if there is no air, the door can easily be pushed open by hand. When the cars are equipped with the geared-type machine which cuts off the air at the end of the stroke, the emergency opening device is so arranged that by pulling the emergency handle the driving arm of the door operator is raised up high enough to allow the doors to be pushed open by hand.

Two other special features in connection with door operator installations are the collapsible shoe as applied by the Interborough Rapid Transit Company to the front edge of the doors of subway cars and the collapsible driving arm of door operators used by the New York Municipal Railway and the Long Island Railroad. With the collapsible shoe equipment, in case the door when closing strikes a passenger the movement of the door is reversed and the door then travels in the opening direction until the obstructing pressure on the shoe is removed, when the movement of the door is again automatically reversed and the door goes on to the closed position. With the collapsible driving arm, which is for the purpose of guarding against passengers getting caught and held by the door when it closes, it is possible to push the door open about 4 in. from the fully closed position, which is sufficient to allow a person to free his arm or foot if caught by the closing door. When the pressure against the door is released, the compression springs of the collapsible driving arm return the door to the fully closed position.

Easy Access to All Parts Reduces Maintenance Costs

In taking up the question of maintenance of pneumatic door operators it might be well to first consider the question of installation at the time the cars are built, as the nature of the installation will to a large extent affect the service obtained and the maintenance required. The railroad engineers, car builders and manufacturers should work together with the object in view of obtaining an installation which will provide for maximum ease of access to all parts of the apparatus, consistent, of course, with the essential features of the particular car design. If the equipment is so installed that it is difficult or unhandy for the shopmen to inspect or work on the apparatus, it simply means that the equipment is going to be slighted and not given the proper attention; or, in case the shopmen and foremen are conscientious and do their work properly irrespective of time and trouble required, it means that the cost of maintenance will be excessive—two results which are absolutely unnecessary. It is not to be inferred from these remarks that pneumatic door operators require an unnecessary amount of attention, but any part of the car equipment having moving parts requires more or less attention and should be inspected regularly, and the door operators are really an important part of the equipment. Not only should the question of accessibility be considered when making the original layout, but also ample clearance should be allowed for the doors and any moving external part of the operators. It is quite essential that these points be kept in mind when details of the installation are being worked up, in order that the best results be obtained from the pneumatic door operators.

The basis of inspection and overhauling should be the same as for the control and air-brake equipment, whether this be time or mileage. The mileage basis, when the mileage is accurately kept, is undoubtedly the more equitable, but in any case there is no reason for a separate basis of inspection for the pneumatic door operators.

Attention Necessary on Inspection

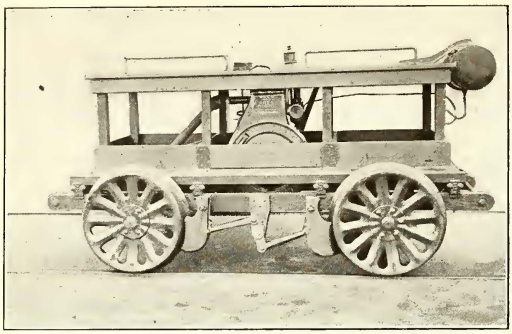
In inspecting this part of the car equipment, the doors should first be operated to see whether or not they operate properly and at the required speed. If the operation of the doors is all right, the door slides, driving arm, levers or connecting links and door hangers should then be examined to see that there are no loose screws, pins or bolts, and that there are no excessively worn parts; the door slides and door sheaves should be given a little oil if necessary, and the valves should be inspected to see that they are not leaking. In the case of some of the older type equipments with a rotary valve not attached to the engine body, these valves should be oiled on inspection. I will not attempt to state what to do in case the doors do not operate properly, as the shopmen soon learn where to look for the trouble from the manner in which the doors behave. It is quite essential that the doors, door hangers and tracks be maintained in good condition, and that the doors work freely, as any trouble here will seriously affect the operation of the door equipment. Where collapsible shoes or disconnecting devices are used, they should be tried out and their various parts carefully inspected.

The older types of door operators should be overhauled once a year, while the later types, the construction of which permits of the piston leathers and other moving parts being kept in better condition due to improved lubrication facilities, can easily be placed on the same overhauling basis as for the car.

Operators Should Be Removed From Car for Overhauling

The door operators should be removed from the car, taken to the overhauling bench and completely taken apart and the various parts thoroughly cleaned. The piston leathers should be removed and new leathers (a supply of which should be kept in oil of the same kind as used in the door operator) installed. The leathers which are removed should be examined and those found to be in good condition saved, as these leathers can be used to replace leathers which might become defective between overhauling dates. The various parts of the operator should be carefully examined and those parts replaced, the condition of which would indicate that they might cause defective door operation before the next overhauling date. The valve parts and ports should be thoroughly cleaned and valves ground in or renewed where found necessary. The overhauling bench should be equipped with air connections so that the door operators after being assembled may be tested out in order to make certain before putting the operators back in the car that they work properly and that there are no leaks.

While the door operators are being overhauled on the bench, the doors, hangers, levers, etc., should be gone over and put in good condition; the air pipes blown out and the air strainers removed and cleaned.



MOTOR SIDE OF CAR SHOWING SECTION REMOVABLE FOR CRANKING PURPOSES

CONTROL SIDE OF CAR SHOWING BRAKE LEVER ON OUTSIDE AND CLUTCH LEVER INSIDE

Interurban Motor Section Cars

Detroit United Railway Is Equipping Interurban Divisions with Section Cars—Built to Obtain Low-Speed Feature for Safety

THERE is little need to emphasize the value of motor section cars for an interurban road of any considerable mileage. The energy of the men that is saved for their more necessary work and that for which they are primarily employed will more than pay for the cars in a short period. Instead of reaching the job fagged out and ready for a rest they arrive full of "pep" after an exhilarating ride in the morning air. In addition, due to the labor shortage of the last few years, it has been almost impossible to get section men to pump the old style hand car. And then there is another point which generally carries considerable weight, and that is the matter of time consumed in getting to the job. The Detroit United Railway, which operates some 584 miles of interurban lines, claims that the case of an electric line differs from that of a steam line and that speed is not the only point to consider.

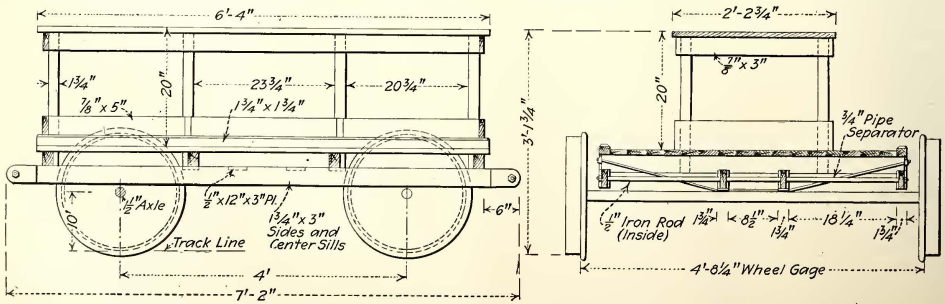
John Kerwin, superintendent of tracks, places more value on the safety of his men than he does on a little time saved, and he does not believe that they should travel over the road in a section car at 30 m.p.h. It is his opinion that even on steam roads at the present time safety is sacrificed for speed much more than is necessary. Consequently, much investigating and experimenting have been done, and failing to find a car that entirely filled the requirements laid down the Detroit United Railway is building its own motor section cars.

The general design of the car bodies is as shown in the accompanying drawings, the wooden members being oak throughout. The wheels are standard 20-in. steel wheels and are purchased from an outside source. The motor used on this car is a New Way, one-cylinder, 4-horsepower, 4-cycle engine with clutch control and one-way one-speed operation. The engine is air cooled, equipped with Holly carburetor and Bosch magneto, and the flywheel travels at a speed of 800 r.p.m.

The car is chain driven from a sprocket on the rear axle with a gear reduction of four to one, there being sixty teeth on the axle sprocket and fifteen teeth on the motor sprocket. The motor sprocket is made in the track department shops and is keyed onto the axle. The resultant speed ranges from 5 to 12 m.p.h.

The motor weighs about 250 lb., and the car complete weighs 450 to 500 lb. This makes it possible for two men to handle the car with comparative ease and four men can lift it bodily. There is a total seating capacity for eight men. The car is braked on all four wheels by means of a hand lever the brakes being wood blocks lined with strips of leather belting.

At the present time there are five cars which have been in operation for several months, and more will be built from time to time as necessary. The cars make 20 miles to the gallon of gasoline, giving an estimated total operating cost of approximately 1¼ cents per mile. The total cost of the machine is about $250, of which $125 is for the motor.



END AND SIDE ELEVATIONS OF MOTOR SECTION CARS BUILT AT DETROIT

Conditions Govern the Choice of Rail Bonds

Several Common Types of Rail Bonds Are Discussed and Their Adaptation to Conditions Is Pointed Out

By G. H. McKELWAY
Engineer of Distribution, Brooklyn Rapid Transit System

THE first bonds used to connect track rails were of iron wire and were riveted into the web of the rail. These very much resembled the bonds now used for the track circuits controlling signals, except that the material differed. When it was found that greater conductance than that afforded by iron wire was desirable, a change was made to copper and the cross-section of the conductor was increased until solid bonds of No. 0000 capacity are now common. There is very little danger of a heavy solid bond being broken by the movement and vibration of the rails, as is the case when strands or ribbons are used for the conductors. On account of the stiffness of solid bonds, however, they act as levers which tend to loosen the bond terminals as the rails move. Therefore, while the conductor itself is not so liable to be damaged as when made in another form, the bond as a whole is less efficient because of its weakness at the terminals.

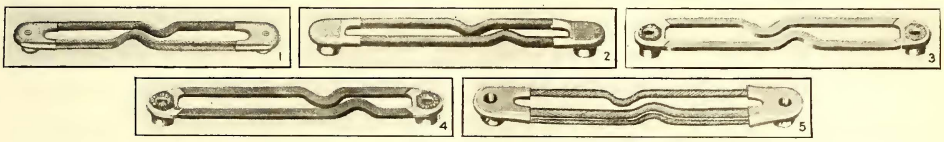


FIG. 1—TYPE F-3-T BOND; FIG. 2—TYPE C. S.,—04 CROWN BOND; FIG. 3—TYPE U. P.,—01 UNITED STATES BOND; FIG. 4—TYPE U. P.,—04 UNITED STATES BOND; FIG. 5—CROWN TRIPLEX RAIL BOND

In order to avoid this lever-like action a more flexible conductor was needed and stranded wire was naturally made use of. This is much more satisfactory and does away entirely with the twisting action on the terminals. At the same time, if the bond is properly designed and made and if the individual strands are of sufficient length and of proper cross-section there is but little chance of their becoming broken. It is no fault of the stranded bond that it is not used universally. In some forms, it costs more than other bonds similar in length and conductivity but the principal drawback to its use is due to the poor design of the joint plates with which so many rails are equipped. This trouble does not appear when the bonds are used outside of the plates but it becomes serious when space must be found for the bonds between the plates and the rails.

The most common size of bond is No. 0000. A stranded bond of that size requires a space at least $\frac{17}{32}$ in. square to pass through, and in order to avoid pinching still more room is really needed. There are few joints made with such a large clearance so that the most obvious step is to make a bond with two conductors connecting its terminals. If both of the conductors are of the same size then for a No. 0000 bond the size of each of the conductors will be No. 0 and the opening needed by each one can be reduced to $\frac{3}{8}$ in. x $\frac{3}{8}$ in. With many joints even this requirement is too great and two openings of that size cannot be found, although often below the line of the track bolts there will be a somewhat larger opening, with a smaller one above the bolts. When this condition occurs it can be met by the use of "unbalanced" branches in the conductor, that is, one of the branches will be of smaller cross-section than the other, although the total cross-section of both of the branches will equal the section desired for the bond. Often the openings are rectangular rather than square and the distance above and below the bolt holes are greater than that between the web of the rail and the joint plate. In such a case the round stranded wire is not suitable and a rectangular form must be found that will pass through the rectangular holes. Then, instead of making up the conductors from round wires, they are formed from flat ribbons of copper, these ribbons being approximately $\frac{1}{32}$ in. thick and generally about $\frac{3}{16}$ in. wide. Sometimes ribbons are of nearly double that width and on other occasions they are hardly half as wide. The number of ribbons in the branches varies with the size of the bond and these are usually from one and a half to two times as many on the lower branch as in the upper.

There is still another type of bond conductor used under the plates where the clearances are limited. This is a stranded two-branch bond but, instead of leaving the conductor round, it is squeezed into the shape shown in one of the illustrations and it then takes up no more room than a ribbon bond. The most recent developmen is known as the "triplex" bond and consists of three branches, a fairly large conductor passing above the line of bolt holes and one large and one small wire running through the opening beneath the bolts. This last-named bond has not been on the market long enough to have had a thorough try-out, but it requires less room than a stranded bond with only two branches and should have a longer life than the stranded type which has been squeezed out of its round shape.

With the comparatively short bonds used under the plates there would not be sufficient flexibility if the strands or ribbons ran practically straight from one terminal to the other, and so they are looped or "crimped" or "tucked," as it is variously called, as near the center of the bond as circumstances will allow. These loops add greatly to the life of the bonds, especially when placed in the center, and the resistance to the effects of vibration lessens very materially as the tuck

approaches the end of the conductor. Where only one bond is used to a joint the crimp can be placed at the center, between the two end bolts of the rails, but when two bonds are used they have to be placed as shown in the illustration, with the terminal of one bond, as well as the track bolt, passing between the two branches of the conductor. This makes center tucking impossible and forces the loop to be made close to one of the bond terminals. With bonds having thin ribbons or strands of wire a well-made crimp will increase the life of the bond by almost 100 per cent.

When two bonds are used at a single joint and on opposite sides of the web of the rail it is the general custom to drill the hole for one terminal of each bond between the first and second bolt holes from the end of the rail, and the other holes between the second and third bolt holes from the end of the other rail. The diameters of the single strands of wire bonds vary from 0.04 in. to 0.08 in. The smaller size is much preferable, as experience has shown that they have almost twice the life of those with strands of twice that diameter.

It might be thought that the protected bond that would be considered as best for all round work would be either of the ribbon type or of the type with formed strands, and the ordinary round bond would be last in favor, as the two former can be used in all places that the latter can and in some places where it cannot be used. This, however, is not the fact and the round wire bond is to be preferred for all places where it can be used because it will be found to have a longer life than either of the other two types. Some persons claim that the ribbon bond is even stronger than the wire type for withstanding the effects of movement in a vertical direction, and though they admit that against horizontal vibration the ribbons are not as strong as the wire strands, yet they claim that there is so very little horizontal movement to the rails that the weakness does not show up in practice. The writer has found in actual practice, that the wires last much better than the ribbons and there are places where the use of comparatively short concealed bonds is necessary as ribbon bonds would last but a very short time.

New Colloidal Fuel Developed

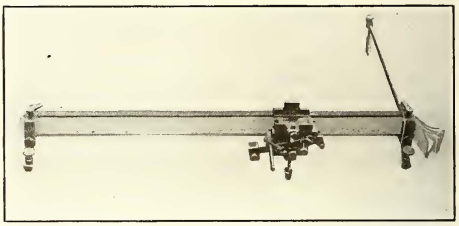
UNDER the auspices of the Submarine Defense Association, which consists of shipping and allied interests, a committee of engineers has been at work for some time developing a fuel which would consist essentially of a mixture of fuel oil and powdered coal. The primary purpose in developing the new fuel was to reduce the consumption of fuel oil.

The association now authorizes the statement that it is possible to suspend permanently in oil 30 per cent to 40 per cent of coal pulverized so that about 95 per cent passes through a 200-mesh screen, the suspension being assisted by a special fixateur. It is now possible to combine in a stable liquid fuel about 45 per cent oil, 20 per cent tar and 35 per cent pulverized coal, thereby replacing more than one-half the oil, securing equal or greater heat values per barrel and saving considerable cost.

As an example of this fuel, the statement is made that "industrial colloidal grade No. 10," devised to use up some poor coal holding 25½ per cent ash, is composed of 61½ per cent of pressure-still oil, wax tailings, petroleum pitch and fixateur, running 18,505 B.t.u. per pound, and 38½ per cent of anthracite rice running 10,900 B.t.u. This grade contains 162,500 B.t.u. per gallon and has 10.2 per cent of ash. The fixated oil itself has 151,750 B.t.u. per gallon. In fuel value, therefore, the colloidal fuel is worth 7½ per cent more per gallon than the oil from which it is made.

Scribing Rail Surfaces to Show Wear

THE instrument shown in the accompanying illustration was developed by the Metal & Thermit Corporation for making records of rail joint wear. To obtain a chart of the running surface of a rail the instrument is placed firmly in position on the part of the running surface of the rail to be scribed, with the supporting foot extending out in the back. A hardened roller running on the surface of the rail



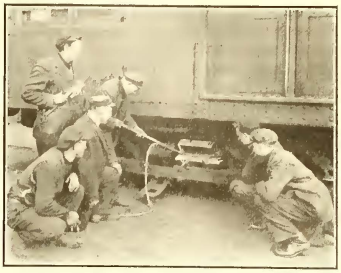
RAIL SURFACE INDICATOR FOR RECORDING WEAR OF RAILS

head imparts motion to a pencil point as the rider moves from one end of the instrument to the other. This transfers very accurately a pencil record onto a strip of paper clamped into the stationary part of the machine. The leverages of the rider are so arranged that a pencil point placed on one side will make an exact duplication of the unevenness of the rail head, whereas if placed on the other side the ordinates of this uneveness will be multiplied by three, thus enabling a more accurate examination of the defects. The scribed records can be carefully marked and filed away for future reference and by comparing them with similar records taken subsequently the rail wear is indicated. The instrument is referred to as a "rail surface indicator" and records made from it year after year and superimposed will quickly indicate any defects which eventually would result in joint trouble or corrugations.

Joint defects such as mentioned above in the case of thermit welds are found to be due in every case to very minor initial defects in the grinding of the rail joint originally, these minor defects being aggravated by the constant hammering of the wheels. An original record of the joint, therefore, made by this machine enables the engineers of the company carefully to watch the joints in the order of their installation and correct any such minor defects in the grinding which may have escaped the operator's notice.

The American Zinc Institute, in its campaign to increase the uses of zinc, is advocating spelter for rail bonding purposes. It is reported that a very important electric railway has recently purchased a large quantity of this metal for the purpose. The institute points out that zinc is a comparatively plentiful and cheap metal, and in many directions is satisfactorily taking the place of more expensive materials.

Some Mysterious Car Ailments



Little but Important Troubles That Tend to Keep Equipment Men Interested in Their Work

CONTRIBUTIONS ARE INVITED FROM THE FIELD

A Peculiar Case of Controller Trouble

THE freight business of a large electric railway property required the use of an additional electric locomotive. This was built in the shops of the company and the equipment used was of an old type made up of spare pieces which the railway already had on hand. To avoid the necessity of purchasing a new four-motor controller two old K-13 controllers were installed and placed back to back. A large rack with the necessary gearing to provide for operating the controllers in unison was mounted on the tops.

After completion a test run was attempted but in shutting off the controller it blew up. The motors were tested and the wiring was checked for wrong connections but all were found correct. Another attempt to run was made, but with more disastrous results as this time the entire cab of the locomotive was badly burned. This led to a further investigation. It had been noticed that in shutting off the controller the arc from the contacts held on instead of being cut off sharply as was to be expected. Further tests showed that the controllers had no blow-out effect due to the magnetism from the coils being opposed so as to neutralize the blow-out effect. The leads to one of the blowout coils were then reversed and no further trouble was experienced.

Train Stalls on Crossover and Ties Up Line

AN ELEVATED TRAIN equipped with multiple-unit battery-type control started to pull out of a yard preparatory to going into service. The head car had just reached the main line while the others were taking the crossover, when the train stalled. This was just at the height of the rush hour, and several other trains were in the yard ready to go into service, while others, heavily loaded with passengers, were tied up on the main line due to the position of the stalled train. The train dispatcher "started hopping around" at a lively rate and called to all employees in sight to try and get the train off the line. A rapid inspection showed all equipment in apparently good working order. An inspector boarded the rear car and found that the equipment would operate all right from the master controller on this car. The train was again pulled back into the yard by operating from the rear end so as to clear the line, and a thorough inspection was given all parts of the equipment.

The trouble was eventually located as an open circuit in the battery "plus" train-line wire between the master controller and the switch group. On opening up the junction box immediately underneath the master controller a loose connection was found. Evidently when last repairs had been made in this junction box, the nuts on the battery plus binding post had not been tightened down securely. These had loosened somewhat and the loose connection resulted.

A Train That Operated Satisfactorily Outbound But Was Very Sluggish on the Return Trip

ON AN IMPORTANT railway system using multiple-unit battery-type control, with train-line jumpers between cars, the motorman of one of the trains reported it as operating O. K. while west bound but as being very slow on the east-bound trip. As the east-bound part of the trip occurred during the rush hour when passenger traffic was very heavy, this resulted in a considerable delay. On arrival of the train at the terminal the electrician, after a very rapid examination, finally located the trouble as a defective jumper between two of the cars. The train was composed of six cars and the defective jumper was between the last two cars on the west-bound trip, but was between the first two cars on the east-bound trip. A further inspection of the defective jumper showed that the multiple wire was open. This caused all cars back of the defective jumper to operate in series only so that on the west-bound trip five of the cars were operating in multiple and one in series, while on the east-bound trip one car was operating in multiple and the other cars in series. This explained the difference in operation in the two directions.

Troubles of this nature have been one of the greatest sources of annoyance to railways using train operation since the introduction of multiple-unit-type control. Such troubles are caused principally by the breaking of the small wires at the terminals in the jumper heads, or in the body of the jumpers where they are subjected to the greatest bending action. Various means have been tried to detect the broken wires, such as connecting all the wires of the jumper in series through a bank of lamps or by subjecting each wire in the jumper to abnormal current, so that in case a wire is partly broken, the high current passing through this would burn it apart. At the same time that these tests are

conducted, the jumper is usually twisted and bent so that the tests may be made as severe as possible. Tests of this nature are usually made monthly and they necessitate considerable handling of the jumpers. The labor involved in collecting these jumpers for test is very expensive.

One road has instituted a method of testing and inspecting each jumper every time the train containing that jumper is in the shop for inspection. The test consists of operating the control equipment on each car of the train, from the master controller on the end car. At the same time an inspector checks each car to make certain that the controller equipment of that car is operating satisfactorily, and at the same time additional inspectors move the cable of each jumper up and down so that by this action a broken connection will be detected by the dropping off of the controllers back of the open circuit. Since the institution of this method of testing, a large number of defective jumpers have been located, and much trouble and inconvenience has been avoided.

A Multiple-Unit Control Equipment That Would Not Notch Up

A VERY serious detention occurred on an elevated line using train operation, with cars equipped with automatic battery-type control. The motorman of the train reported that the control would take one or two notches and then immediately drop off, so that he could scarcely get the train over the line. The cars were taken out of service and inspected for open circuits and dirt on the control contacts, but nothing to account for the erratic operation was found. On taking voltage readings of the batteries, it was discovered that all were weak and one set was badly grounded. As all the batteries in the train were connected in parallel, the grounding of this set had caused the other batteries in the train to attempt to charge it, so that their voltage had also been reduced. This grounding had occurred through the wood battery boxes, due to corroding of the terminals, and to acid-soaked boxes. To prevent a recurrence of the trouble, batteries were removed as rapidly as possible, and the boxes were soaked in concentrated soda solution for twenty-four hours, after which they were painted with an acid-proof paint. Porcelain insulators were also installed underneath the boxes and between them. This gave a better circulation of air, as well as providing an efficient insulation.

A Car That Would Not Leave the Terminal

AFTER changing ends at a terminal, the motorman of a certain car equipped with multiple-unit control found that he could not start it. An electrician was called, and on opening up the switch group and reverser he found the latter thrown for operation in the reverse direction and it would not operate from the master controller on the front end of the car. He at first thought that a poor contact in this master controller might be the cause of the trouble, but all contact fingers were found to be working properly. The electrician then went to the other master controller to see if the equipment would operate from that end and found that the contact drum of this master controller had not returned entirely to the "off" position, so that contact was still being made for the reverser circuit. The reason for the failure of the drum to return properly was found to be a broken return spring. To assist in preventing spring breakages the manufacturer changed the shape somewhat so as to do away with a sharp bend and greater care was given to selecting spring material.

Solving a Hot Axle Bearing Mystery

THE number of hot axle bearings on a large railway system became excessive, expensive and annoying. There were two motors per car of 200 hp. each, and these were mounted on one truck. At first it was thought that improper or insufficient lubrication was the cause of the trouble. The heating of the bearings charred the waste and destroyed all evidence as to the quantity of oil in the bearings at the time the overheating started. On comparison of the records showing the time that the cars had received oil, and the quantities used, it appeared that a sufficient quantity had been added to take care of the service requirements. As no leaks were found in the housings it was evident that the oil could not all have been used up in the short time that the cars were in service between the time that the bearings were inspected and the time that the hot bearings occurred.

In addition to this investigation of lubrication, the bearings were also carefully gaged for clearance, and a microscopic inspection was made of the bearing surface. These tests showed that a pitting action, electrolytic in its nature, had taken place in the bearings, which was evidently caused by the return current from the motor finding an easy path through the bearings to ground. Milli-voltmeter tests were made, which proved that the current passing through the bearings was of a quantity sufficient to heat the babbitt lining and partially melt it. To overcome this trouble a ground lead was installed between the motor frame and the truck bolster to give a low resistance circuit for the current. Since this installation the company has been free from troubles of this nature.

The success derived from the above investigation prompted the officials of the road to conduct similar experimental work in connection with armature bearings. A brush collector was installed on one end of the armature shaft to relieve it from carrying current which might be caused by leakage or grounds. This particular armature has now been in service for about three years without trouble.

There has always been a sort of controversy between the shop men responsible for the maintenance of armatures, and foremen of the electrical repair departments as to the fundamental cause of armatures damaged by rubbing the pole faces. Where hot armature bearings occur and the motors are continued in service for a sufficient length of time, the clearance for the armature is decreased and rubbing occurs. The electrical repair foreman thus draws the conclusion that the damage to the armature results from hot bearings. On the other hand, the repairman usually produces evidence showing that oil in sufficient quantity and at sufficiently frequent intervals has been added to take care of normal conditions, and these men maintain that the grounding or short-circuiting of armature coils was the original cause of the trouble, and that the hot bearings resulted from this, rather than being the cause of the trouble. The test and investigation above referred to were conducted to settle this controversy.

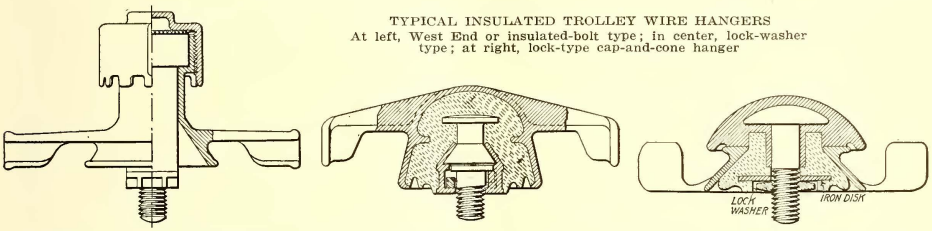
What Makes a Good Trolley Hanger?

The Author Considers the Practical Features Which Experience Shows to Be Necessary in a Durable Insulator

By G. H. Bolus
Designing Engineer The Ohio Brass Company, Mansfield, Ohio

THERE are three general types of insulated trolley hangers in use in the United States for supporting direct-suspended trolley wire. They are the "round top," so called because the top of the hanger is of dome or round shape, the "West End" or insulated-bolt type, and the "cap-and-cone" type. Of the three the West End was the first in use and it still continues to be very popular, although the round-top type may be considered as gaining in popularity as indicated by the sales records of one of the largest manufacturers.

The West End, or insulated-bolt type, is illustrated in an accompanying drawing. It has the advantage that the insulated portion can be renewed without scrapping the malleable body and cap. In some localities where insulation goes to pieces quickly, due to atmospheric conditions, this factor results in preference being given to this type of hanger. For new construction the round-top hanger, in which the insulation is molded into a malleable-iron body and is not renewable, is the more generally used.



TYPICAL INSULATED TROLLEY WIRE HANGERS
At left, West End or insulated-bolt type; in center, lock-washer type; at right, lock-type cap-and-cone hanger

The West End hanger has the further advantage that as the bolt is rotatably mounted in the hanger body it can be screwed tightly in the boss of the trolley ear, thus preventing the stripping of threads both on the stud of the hanger and in the ear boss due to vibration. It is not so well adapted for curve work although it has been used to some extent in this manner. Its chief drawback for curve construction is the very heavy bending moment which is imposed upon the bolt at the point where it emerges from the body of the hanger.

While the insulation in the round-top hanger is not renewable this type of hanger will prove much better on a curve than the West End type. Until a comparatively recent date the principal objection to the round-top hanger was that it could not be lined up with the direction of the trolley and still provide a tight joint between the ear boss and the hanger seat. To overcome this defect several types of hangers have been evolved. The lock-washer type, shown in a second illustration, has met with great success.

The cap-and-cone type hanger is made in the standard and lock-stud types. This type of hanger admits of ready standardization, and the American Electric Railway Association has set standards for dimensions and contour which all manufacturers of overhead with one or two exceptions have adopted. The principal objection to this hanger is the exposure of the insulation to the elements, but many large properties use it with entire satisfaction. Where trouble is experienced with this type hanger backing out of the ear-boss threads, a hanger of the lock type should be used. This is made with a metal bearing and positive lock washer which locks the parts together against accidental disengagement. A third illustration shows the lock-type cap-and-cone hanger.

Mechanical and Dielectric Strengths of Insulators

Electrically all makes of hangers will test about the same. The writer has found that the round-top type will usually flash over from stud to shell at about 13,000 to 14,000 volts effective, and that the mechanical strength is about 4½ to 5 tons vertical load, at which load the stud is pulled from the body of the hanger. The West End type of hangers, except where bakelite insulation is used, will test about the same mechanically and about 9,000 to 10,000 volts effective electrically.

There are several characteristics which an insulation for trolley hangers should possess, namely, heat resistance, non-absorption of moisture, dielectric strength and mechanical strength. By various combinations of gums and fibers the manufacturer can produce stocks running high in one or two of these characteristics, but the aim should be to produce a balanced stock. In other words, a stock should not possess extremely high dielectric strength at the expense of mechanical strength or *vice versa*. The writer has in mind one molded stock which will show an extremely high dielectric strength when dry, but when the hangers have been soaked twenty-four hours in water and wiped dry, and are then tested, the stock is practically valueless.

Most trolley construction for 650 volts direct current employs series insulation; in other words, the hangers are in series with some form of span insulator. This is a step in the right direction because where no secondary insulation is used an arc may hold over from stud to shell, burning up the insulator and tying up traffic.

Rust-Proofing of Stud Is Essential

Overhead trolley hanger bodies are invariably of malleable iron, and some form of rust proofing is employed, ranging from electro galvanizing which is now practically obsolete, to hot dip galvanizing and sherardizing. The writer believes the sherardizing to be the most popular, as this process does not harden the malleable iron as does the hot-dip galvanizing process for instance.

Rust proofing of the stud, or of that portion which is molded in the insulation, should absolutely be insisted

upon because if plain iron studs are used, with the possible exception of Armco iron, oxide of iron is formed. This has a wedging action on the composition insulation and soon causes a separation of the stock from the stud, allowing the entrance of moisture and inviting early failure of the hanger electrically.

The question of petticoats versus a single groove in the insulator is a much discussed one and it is the writer's experience that either type will give satisfaction. The petticoats are added to lengthen the leakage path and in some cases to increase the resistance to side strain, but as there is a large factor of safety possessed by any of the trolley hangers on the market it is questionable whether any form of petticoating is necessary. An argument advanced for the single groove is that it is more easily cleaned than the multi-grooved construction.

Some manufacturers turn the span wire lugs on the arms upward while others turn them downward. With the upturned span lugs the strength of the design lies in the strength of the lugs, while with the down-turned construction the strength lies in the arm and its stiffened rib. The writer's preference is for the latter construction. He has personally installed both types on tight span wire and can see no difference in the ease with which one type is installed as against the other type of construction.

Extra-Heavy Stud Is Unnecessary

All hangers in commercial use today are either $\frac{5}{8}$-in.-11 or $\frac{3}{4}$-in.-10 U. S. standard threading. On some properties where $\frac{3}{4}$-in. studs are used it is believed that this size is absolutely necessary for strength. The writer believes that $\frac{5}{8}$-in. studs will answer all requirements regardless of the type of construction or severity of the service.

There is now a movement under way, fostered by the government, to eliminate $\frac{3}{4}$-in. studs and ears entirely. This is done as a conservation measure and it is the writer's understanding that several of the largest manufacturers will not list $\frac{3}{4}$-in. material in their 1919 catalogs.

The practice of painting the bodies of insulated hangers with black asphaltum or other heavy black paint, applied after the hangers are installed, is a very good one. The paint protects the galvanizing of the hanger and, if well daubed about the span wire where it passes under the hanger lugs, will serve to protect the wire at this point where most span wires rust out from weather conditions.

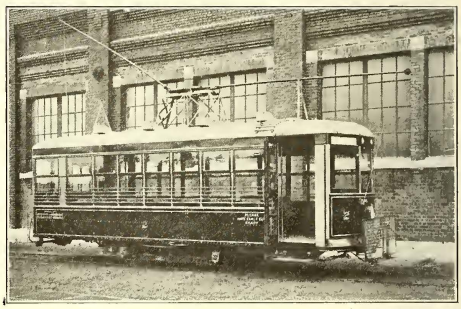
The professional and special section of the United States Employment Service, formerly located at 29 South LaSalle Street, Chicago, has moved to 63 East Adams Street. This section was formerly known as the Division of Engineering but has enlarged its service to include all kinds of professional and technical men and women. Now that the war is over its activities will be directed toward reconstruction and peace needs. No charge will be made for its services. Registration blanks can be secured from the Employment Service, and applicants from Illinois, Indiana, Iowa and surrounding territory should register with the Chicago office of the section.

Light-Weight Air Fender for One-Man Car

By F. P. Maize
Master Mechanic Portland Railway, Light & Power Company, Portland, Ore.

ALL cars provided with air brakes except those with M. C. B. drawheads, running in Portland, must be equipped with an automatic air fender which can be dropped by the motorman, or by a projecting trip in front of the fender which will automatically drop the fender and apply the brakes. As the present fender used by the Portland Railway, Light & Power Company is too heavy for the Birney cars, this company designed a fender eliminating all castings, bolts and threaded pipe, by using instead electric welded pipe and forgings. By so doing the weight of the fender was reduced 50 lb.

The fender as shown in the accompanying picture is composed mostly of pipe. The frame of the apron is made of $\frac{1}{2}$-in. pipe in one piece, bent cold in a form and electrically welded at the joint. Four pieces of $\frac{1}{4}$-in. pipe are welded on the top for holding the screen and bracing the apron. Clips of $\frac{1}{4}$-in. round iron are welded



SAFETY CAR WITH LIGHT-WEIGHT AIR FENDER

on the top for the projecting trip to work through. This eliminates all holes through the frame and makes it stronger and stiffer than the original fender. The joint in the back is made of two pieces of boiler plate electrically welded together. The uprights are made of light boiler tubing, one fastened to the body and the other to the apron. A chain running from the crossbar to an air cylinder under the car pulls the fender to the tracks.

The valve for operating the fender is a three-port slide valve operated by a piston. One port connects to the emergency line, one to the air cylinder and one to atmosphere. Main reservoir pressure is thus provided in the main body of the valve and the piston is held closed by a spiral spring. There is a $\frac{1}{16}$-in. hole in the piston, so that the air pressure can equalize on both sides. On the back of the piston there is a small needle valve, which when opened will reduce the pressure on the back of the piston so that the reservoir pressure will immediately force the piston over, thus connecting the emergency line with the exhaust and main reservoir pressure with the fender cylinder. When the needle valve is closed, the air pressure will build up through the $\frac{1}{16}$-in. opening and the spring will shove the valve

closed, connecting the fender cylinder with the atmosphere and closing the emergency line.

All pipe connections are made to a bracket, so that it is only necessary to loosen two bolts to remove the fender valve. As all parts are electrically welded, the fender, although much lighter, is stronger and more easily repaired than the older type.

Timber Preservation Will Aid In Lowering Maintenance Costs

By R. C. Cram

Assistant Engineer Department of Way and Structures, Brooklyn Rapid Transit System

THERE can no longer be any doubt as to the fact that timber preservation should be considered as one of the most available means of reducing maintenance costs of ties, bridge timbers, poles and crossarms. Electric railways use vast quantities of timber in these forms, and it is a well-known fact that renewals of tie timber alone represent the largest single item of cost in open track maintenance, if the general item of maintenance labor be excepted. With the rapid rise in costs of both timber and labor, it has become almost imperative that all available steps be taken to secure the greatest possible life from the timber.

The most important step in this direction, and the one which produces the greatest results, is that of giving the timber some preservative treatment. But the cost of treatment has also risen, and the most effective method in general, of preserving timber, which is creosoting, has become almost prohibitive because of the high cost due to greatly decreased supply caused by war conditions. This will continue for some time.

There are various methods of treatment, broadly grouped under pressure and non-pressure processes. Of the pressure treatments the best known and most generally used is the "full-cell" pressure treatment with creosote (Bethell process). Second in importance is the Burnett process of pressure treatment, using zinc-chloride. Various modifications of these two pressure processes have been employed, of which those still in considerable use are the Wellhouse or zinc-tannin process; the Card, or zinc-creosote process, and the several modifications of the "saving" or "empty cell" process. The last named includes the Lowry and Rueping processes.

Under the non-pressure method of treatment are the brush, spray, dip and open-tank processes. Each having its own modifications incidental to use and preservative employed. Industrially speaking, the open-tank process merits the most attention, since with variations of temperature and duration of the hot and cold baths almost any kind of preservative treatment desired, may be given with an absorption sufficient for most purposes.

There are various chemicals or preservatives employed in all of the foregoing general processes and creosote and various coal-tar derivatives represent by far the larger group. Under war conditions zinc chloride has come to be used quite extensively. The use of bichloride of mercury (Kyanizing) has been restricted to practically one section of the country for treating spruce lumber. Unfortunately the war has prevented much progress in the use of sodium fluoride solutions which have proved very efficient abroad for a period covering the last two decades. The use of these salts is likely to increase, since tests so far made in this country bear out the promising results obtained abroad in that they are considerably more effective than zinc chloride. Crude oils have been tried as preservatives by the steam roads with very poor results and, at least, one electric railway has definitely proved that such treatments are a failure.

There appears to be some doubt as to the advisability of using zinc chloride on electric railways for tie treatments, because certain tests and statements have indicated that it has a destructive action upon spikes, tie plates and rail bases in tracks carrying electric currents. Signal systems have also been affected to some extent, but in nearly all cases we believe such troubles have been traced to the use of freshly treated ties, and it is reasonable to assume that if a proper seasoning period after treatment were allowed this trouble should be greatly minimized if not entirely eliminated. It is rather unfortunate that these doubts have arisen, since the zinc chloride treatment is comparatively cheap and increases the life of ties from two to three times that of untreated timber. There is little information as to similar action with the so-called double process using zinc chloride and creosote, but it may be assumed that the double process is to be preferred since the use of the creosote oil tends to hold the zinc chloride within the timber, thereby reducing the hygroscopic character of the treated timber. It is possible also that sodium fluoride, which is less hygroscopic, in combination with creosote oil may give a tie treatment with nearly equal preservative qualities as compared with a fuel-cell creosoted tie and at a much lower cost.

The large companies which purchase treated timber in the open market and the few whose requirements are sufficient to warrant the installation of pressure-treating equipments must be considered separately from the majority of companies which purchase timber locally and in comparatively small quantities. For this large class of electric railways, thorough open-tank treatment with any one of a number of desirable preservatives is available. The open-tank method is comparatively low in cost and its use in the past has been principally confined to treating poles, posts and bridge timbers, although quite a number of electric railways have open-tank plants for treating ties.

An extended tie life as well as the increased life of all timber is very desirable and can be obtained by this method without the installation of an expensive plant, at a cost which should be well under any of the pressure methods referred to. It will be well worth while for electric railway managements to investigate the subject thoroughly. Since most electric roads are being forced to use ties made from so-called inferior woods which require treatment if full life is to be obtained and which are usually delivered along their lines, the open tank method can be made available at almost all chief delivery points, thus minimizing handling and transportation charges to far-away treating plants. One of the principal reasons for the comparatively low cost of open tank treatments lies in the reduction or absence of these two items of expense.

How the Public Service Railway Established and Will Collect Its Zone Fare

The Company Proposes to Put a Ticket-Issuing Machine on the Front Platform by Which Each Passenger Will Receive a Check Indicating the Zone in Which He Boards the Car — Then He Pays the Appropriate Fare as He Leaves by the Rear Platform

IN THE ABSTRACT of the proposed zone system of the Public Service Railway published last week the statement was made that the company considers its stand-by and readiness-to-serve cost as 4 cents per passenger and its movement expense as 1 cent a mile. These figures are backed up by detailed figures of the past and anticipated cost of operation.

Elements in Cost of Service

In discussing this question the company points out that the cost of service properly embraces all of the elements of expense required to enable the company properly to perform its natural functions, and these include:

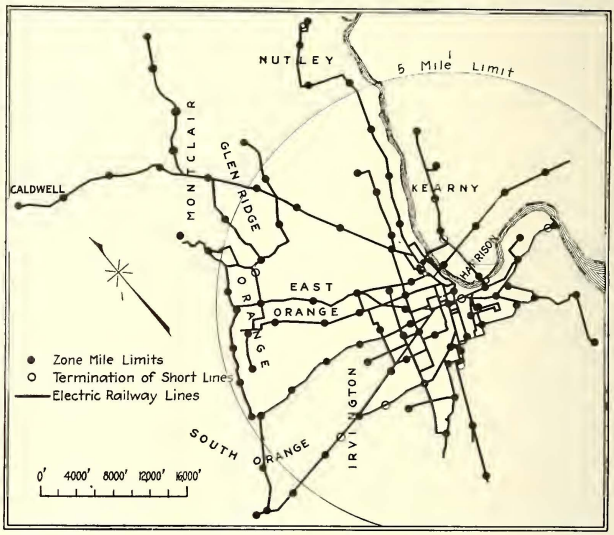
(a) The furnishing of good service to the public;

(b) The maintenance of its property in proper repair and a reasonable allowance for depreciation; and

(c) The securing of a return sufficient to attract capital to the enterprise.

The provision of good service to the public is, of course, the first and primary function of an electric railway and, therefore, the most important of the three factors summarized above as controlling the amount of revenues necessary to meet the cost of service. However, important as the first factor is, the company cannot accomplish this essential purpose unless the other two requirements are also met in a thoroughly satisfactory measure, for in the final analysis the furnishing of good service implies that the company must keep its facilities in a well-maintained condition, and that it must also, by reason of a stable net earning power, be kept in a position at all times to meet reasonable demands involving the investment of new capital.

Entirely aside from the capital requirements to meet increasing traffic demands, there is another very serious factor affecting investment which is not appreciated by the general public. An electric railway company has a peculiarly intimate relation to the development of the territory in which it operates, and because of this it must constantly meet requirements for the investment of new capital if it is to keep pace with the continuous and healthy growth of the communities which it serves. This is particularly true in the case of the Public Service Railway, located in that portion of the State of New Jersey where the industrial development has made marvelous strides in the last few years. This industrial expansion will undoubtedly continue in the future as the great possibilities of this territory are more fully realized, and it is essential that the electric railway should be in a position to meet the demands which have accompanied and which must continue to attend such large developments.



MAP OF ESSEX DIVISION OF PUBLIC SERVICE RAILWAY, SHOWING PROPOSED ZONE-MILE LIMITS

In this widespread civic and industrial growth there must, necessarily, be constantly involved highway and street improvements, which, in locations where electric railway tracks are laid, usually necessitate participation by the railway company. Sometimes these improvements are undertaken by the cities in advance of the expiration of the full life of the track involved and the company is thus required to assume, in addition to such new capital as may be necessary, the replacement of its original investment long before the material has rendered its full and complete usefulness. To the extent, therefore, to which the renewal of such facilities is anticipated, the company is required to shoulder the loss of the value of the unused life and absorb the sum into its operating expenses.

Still another unusual demand which is frequently met is the matter of the relocation of tracks which must be undertaken by the railway company if civic or county improvements are to be carried out as planned

TABLE I—OPERATING EXPENSES—CENTS PER CAR-MILE, PUBLIC SERVICE RAILWAY

	Actual, 1914	Actual, 1915	Actual, 1916	Actual, 1917	Actual, 1918	*Actual Jan. 31, 1919	Estimate 3 Mos. Ending June 30, 1920
Way and structures	2.169	1.959	1.686	2.239	2.477	2.918	2.742
Equipment	1.707	1.650	1.770	2.047	2.989	3.840	3.603
Depreciation	0.924	1.191	1.344	0.316	0.626	1.438	2.000
Power	2.897	2.657	2.753	4.005	4.102	4.179	4.159
Operation of cars	7.678	7.477	7.947	8.372	11.042	13.059	12.960
Traffic	0.005	0.002	0.010	0.002	0.006	.....	0.004
General and miscellaneous	0.912	0.911	0.981	0.944	1.167	1.266	1.223
Undistributed	1.638	1.414	1.569	1.674	2.148	2.430	2.283
Taxes	2.308	2.350	2.314	2.771	2.952	2.960	4.473
Total	20.238	19.611	20.374	22.370	27.509	32.090	33.447

*Operating expenses and taxes actual; depreciation shown on basis of $800,000. per year.

TABLE II—SCALE OF WAGES FOR TRAINMEN, IN CENTS PER HOUR, PUBLIC SERVICE RAILWAY

First year—	In Effect 1-1-12	In Effect 1-1-14	In Effect 7-1-16	In Effect 10-1-17	In Effect 6-1-18	In Effect 6-6-18	Labor Board Award In Effect 6-7-18
First six months	23	23	25	28	30	30	Ist 3 Mos., 41
Second six months	23	24	25	28	30	35	Next 9 mos., 43
Second year	24	25	27	29	31	35	45
Third year	25	26	28	30	32	35	45
Fourth year	25	26	28	30	32	35	45
Fifth year	25	27	29	31	33	35	45
Sixth year	25	27	29	31	33	40	45
Seventh year	25	28	30	32	34	40	45
Eighth year	25	28	30	32	34	40	45
Ninth year	25	29	31	33	35	40	45
Tenth year	25	29	31	33	35	40	45
After ten years	25	30	32	34	36	40	45

by the authorities. This may mean the transfer of the tracks from the side to the center of the roadway or there may be involved in the contemplated improvement a substantial change in grade, or both. In either case, of course, heavy expense which is chargeable against operating cost must be assumed and substantial capital investment is made necessary to cover paving costs and other incidental new work.

That the expense entailed in such work as is referred to above is far from a negligible quantity is evidenced by the fact that over a period of years it has been necessary for the Public Service Railway to reconstruct with the same rail on an average 17 miles of track per annum, such work being undertaken in advance of the time when the track would have required replacement because of actual wear. At the average cost prevailing in 1918, the amount of money expended in the reconstruction of 17 miles of track would be approximately $516,000, which burden the company has assumed annually in this one class of expenditures.

From 1913 to 1917 inclusive, the capital expenditures of the company for track, cars, buildings, etc., amounted to $2,173,888.66 per annum as against an average increase in revenue for the same period of $735,154.13, the ratio of added capital to increased revenue being, therefore, $2.96 for each $1 of added receipts. If the zone-mile system suggested by the company becomes effective, there will be required, in addition to the above normal investment, a capital investment for new registering machines, fare indicators, ticket-issuing devices for the new system of collection, and zone limit signs, as well as moneys for changes in car construction, which involve alterations in the entrance and exit doors and in platform arrangements. The total cash investment which it is estimated will be required to meet the above is approximately $655,000.

Operating Expenses

The company also presented tables of operating expenses, the figures for the last five years on a car-mile basis and the wages paid since Jan. 1, 1912, being shown in Tables I and II. Table III shows the weighted average price of materials purchased in 1918 and prices paid in 1919. In this connection the company points out that in the conduct of the equipment and other departments it is necessary to contract for materials, such as wheels, gears, pinions, rails, etc., well in advance of the time when the articles will be actually used, in order to insure a sufficient and permanent stock and to obtain also the advantage of purchasing in large quantities. Fortunately for this company, many contracts of this character were made in earlier years and covered the war period, and, to that extent, the costs of operation in 1918 were reduced. These contracts have now expired, and the company is forced to pay the higher rates now prevailing. Inasmuch as contracts and orders must anticipate the use of the articles needed for a considerable period, it is obvious that if reductions do occur, immediate advantage cannot be taken of the changes. In other words, the use of the lower-priced goods, if any recession of prices is experienced, would be deferred until the stock purchased at the higher rates has been exhausted. Because of this, there is no justification for anticipating for the immediate future material reductions below the costs which maintained in 1918 and which often involved a lower price under contracts than can now be secured.

The views of a number of expert economists are then published indicating that no early decline in commodity prices is to be expected. Among those quoted were the Federal Reserve Bank and prominent bankers and banks in New York.

From these facts, the company deduces the proper fare to be 5 cents for the first zone and 1 cent for each additional mile zone, as described in the portion of the report abstracted in the last issue of this paper.

Collection Problem Under Zone-Mile System

The great obstacle to the successful operation of a zone system has been the difficulty of collecting and accounting for fares. Several methods have hereto-

TABLE III—COMPARISON OF UNIT COSTS OF MATERIAL 1918 AND 1919

Item	Unit	1918 Weighted Average Price	Prices Prevailing February, 1919
Babbitt metal	lb.	$0.8327	$0.636
Brakeshoes	Net ton	53.66	69.43
Gears GE-67 (69 tooth)	Each	50.00	50.00
Glass, 30-in. x 30-in.	Box	8.31	11.87
Ash lumber, 3-in.	1000 ft.	180.00	160.00
Body color paint	Pound	.265	.28
Pinions, W. H. 101 (16 tooth)	Each	7.92	7.87
Seat rattan	Square foot	.38	.38
Soft steel, 1 in. x 3 in.	100 lb.	4.125	3.97
Black insulating tape	Pound	.3365	.35
Trolley rope	Pound	.608	.76
Trolley wheels	Each	1.05	1.05
Cotton waste	Pound	.13425	.13375
Wool waste	Pound	.2043	.215
Copper wire No. 000—61 strand	1000 ft.	143.24	100.00
Magnet wire—DCC, No. 9	Pound	.3458	.235
Cast-iron wheels—star special 33 in.	100 lb.	1.63	1.63
Steel car wheels—standard	Each	35.00	38.25
Tee rail—section 80/251	Gross ton	70.00	59.30
Girder rail—section 101/486	Gross ton	69.60	76.70
Trilby rail—section 116/434	Gross ton	71 10	76.70
Treated ties—yellow pine	Each	1.73	1.89
Tie rods	Each	.275	.70
Wood paving blocks	Square yard	2.26	2.48
Granite block (Newark specification)	1000	115.00	112.00
Spikes $\frac{9}{16}$ in. x 5½ in.	100 lb.	4.85	4.30
Copper bonds, 36 in.	100	123.42	112.20
Feeder 500,000 circ.mil. W. P.	Pound	.262	.205
Trolley poles—30-ft. steel	Pound	.055	.057
No. 00 trolley wire	Pound	.2682	.18
Charcoal	Net ton	35.00	30.00
Coal, chestnut (for car heating)	Ton	5.90	8.10
Salt	Sack	.87	1.40
Wrapping paper, 36-in.	Pound	.1105	.09
Copy sheets	1000	1.60	1.70
Car records	1000	2 239	2.70

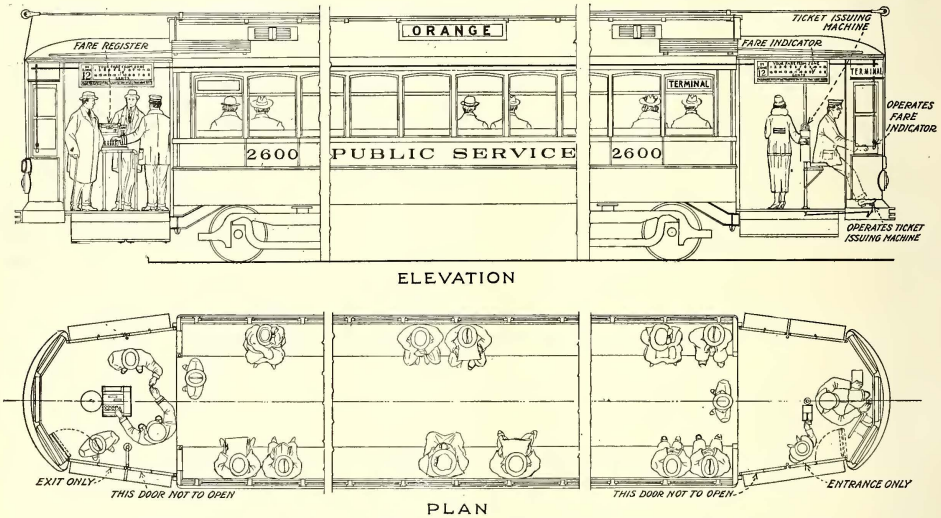
Weighted average increase 1918 over 1917—82.30 per cent
Weighted average decrease 1919 from 1918—2.25 per cent

fore been applied in such work, the report points out. In all cases city fares are collected in the ordinary manner, registration being effected with a fare box, with or without the use of an overhead register, or some other of the many fare collection devices, now generally employed. The fares on suburban lines, in some cases, are collected in the time-honored method, the conductor going through the car and collecting the fare at each zone limit. Where outlying zones of 1 or 2 miles are used and the schedule is rapid the conductor spends practically his entire time in successive trips through the car collecting fares. The practice is annoying to passengers, keeps the conductor off the rear platform the greater part of the time and therefore increases the likelihood of boarding and alighting accidents. Where different units of fare are collected, as for example, 5 cents for a central area and 2 cents per zone in the suburban areas, the methods of registration have involved either the use of two registers, one on which 5-cent fares are registered and the other 2-cent fares; or the use of a 5-cent register for city fares and a duplex ticket for suburban fares. In practice, serious operating difficulties have developed from the use of two registers, dishonest conductors finding it possible to defraud the company by registering 5-cent fares on the 2-cent register or by failing to register all of the 2-cent zone fares collected. This is especially true where, in order to save annoyance to passengers, the entire suburban fare is collected at one time. If a passenger pays 24 cents entitling two companions and himself each to ride through four suburban zones the registration of the fare would require twelve registrations on the 2-cent register. A dishonest conductor will not always register the full number of zone fares.

No company has succeeded in using the duplex ticket to register city fares where the travel is heavy and stops are frequent with a considerable number of persons boarding and alighting at certain points. The registration of fares through the use of duplex tickets is a slow process and has been confined to suburban and interurban lines on which the stops are comparatively infrequent.

The committee on fare zones early reached the conclusion that the successful application of a zone system in thickly built-up city areas was predicated upon the development of a speedier and safer method of fare collection than had heretofore been applied. The successful system of fare collection must be one in which the opportunity for the conductor to overcharge the passenger is reduced to a minimum and in which no loophole is left by which the passenger can defraud the company out of all or part of his fare. It must be a system under which the opportunity for the conductor to misappropriate the fare is also reduced to a minimum.

Careful study was given to the applicability of the European system of collecting fares. The report points out, however, that operating conditions in European cities are quite dissimilar to those which prevail on American urban electric railway properties, such as the Public Service Railway. The European car is small, compared with the cars required to handle the traffic in the large cities of this country. Every electric railway operator who has heretofore considered the zone system has obviously concluded that European collection methods were not applicable to the conditions existing in American cities and the committee on fare zones after deliberate consideration came to the same conclusion.



SIDE ELEVATION AND PLAN SHOWING PROPOSED METHOD OF COLLECTING ZONE FARES

Fare Collection the Key

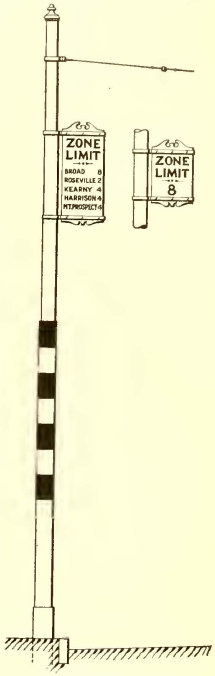
It was early recognized that the success of the entire investigation depended upon the solution of the fare collection problem, and a very large amount of time and study has been devoted to this matter. Unfortunately, no method was at hand which it was felt would meet the requirements, and the problem before the committee on fare zones was therefore one of working out a method that would prove satisfactory under operating conditions

prevailing on this property. The foundation of a successful system of fare collection obviously rested upon devising or adapting instrumentalities of collection and registration which would insure accuracy and honesty on the part of the conductor and protect him against the imputation of dishonesty. The underlying principle of successful registration of zone fares is involved in visible registration of the fare; showing not only that the fare had been collected but the amount paid as well. The plan sometimes heretofore followed of using two or more overhead registers, on one of which the nickel, for example, would be registered while pennies were registered on another, were discarded as cumbersome and impracticable, being wasteful of the time of both passenger and conductor and presenting too great possibilities of dishonesty. The conclusion was reached that the principle of the practicable register for zone fares was embodied in the modern cash register, whose distinguishing characteristic is the ability to register sums of varying amounts by pressing different keys, the amount registered being shown plainly by an indicator visible alike to the passenger paying the fare, the conductor or indeed anyone in the car. The universal application of the cash register to retail business is a

ONE OF THE FARE INDICATORS AT EACH END OF THE CAR

matter of every-day comment. A large percentage of the stores selling merchandise of various kinds have found it advantageous to install cash registers because of the accounting advantages afforded by the machines and more especially because of the effect which such devices have exerted in checking dishonesty or forgetfulness to register sales on the part of clerks. There is no reason why the same safeguards cannot be applied with equal success on the street car as in the retail store. The ordinary individual instinctively looks at the cash register indicator to see the amount which the clerk has rung up. He becomes a volunteer inspector, as it were, for the proprietor, and he is not willing to pay a sum greater than the amount which the clerk has registered on the cash register.

But the cash register in the form in which it has heretofore been manufactured was not suitable for the purpose of fare collections under a zone system. In the first place, the standard keyboard of the cash register and the mechanism which controls is so constructed as to ring up amounts in the following multiples: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 90. Larger machines are built on the same principle; the essential difference being that it is possible to register dollars in addition to the amounts indicated above. It was considered inadvisable to introduce a machine in which any considerable number of fares would have to be registered by pressing two keys. Under the standard keyboard this would be necessary with any fare over ten cents excepting even amounts—20 cents, 30 cents, 40 cents, 50 cents, etc. On long lines such as exist upon the Public Service Railway and on which heavy traffic is carried, a considerable number of fares greater than 10 cents must be registered. In addition, certain protective features later described were considered essential, which were not found in any model of a cash register heretofore placed upon the market. As the manufacturers of these registers were busy with war work, the zone committee on its own account undertook the work of adapting a National cash register of current model to meet the requirements as they were conceived.



PROPOSED METHOD OF INDICATING ZONE LIMIT

Developing a Register

The keyboard was changed so as to register from 1 to 16 inclusive. A zone indicator was added to show both to the passenger and to the conductor the zone in which the machine was then set. A mechanism was attached which locked the machine and prevented its operation except when a key bearing a serial number was inserted in the machine and held therein, and the printing mechanism was so changed as to record on the detail strip (or paper tape) not only the amount rung up on the register, but, in addition, for each amount so registered, the zone indication as it appeared at the time the registration was made, and the number on the key inserted in the register to unlock it. This key number would correspond with the number of the conductor then operating the register. Of course, the adding mechanism had to be materially changed so as to add correctly the new amounts represented by the changed keyboard. A key was also added by which employees' free tickets, transfers and other paper tickets might be registered. When a free ticket is registered a symbol is printed on the detail strip. Where a passenger presents a transfer and pays his zone-mile rate for the journey taken on the transfer, the detail strip shows both the symbol and the amount of money, indicating that the transaction represents a ride on a transfer. A change was also made concerning the totalizers on the register. Three totals are carried; one shows the total number of registrations made, whether cash or ticket; the second shows the number of tickets registered including not only free tickets but transfers; the third shows the total of the cash registration. From the opening and closing numbers of each totalizer the conductor is enabled to make up his day card, which furnishes the basis of his settlement with the receiver in the carhouse.

After the armistice was declared, the National Cash Register Company and the St. Louis Cash Register Company developed model registers for the purposes described. They are illustrated herewith, the St. Louis register being of the first model constructed. These registers can be operated only when the conductor's key has been inserted in the machine and while it remains there. The zone in which the car is operating is conspicuously shown.

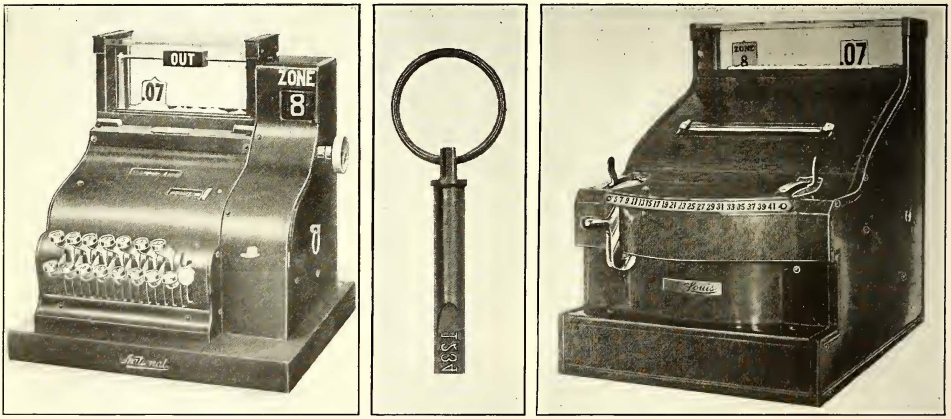
A Machine for Issuing Zone Checks

Another mechanical problem which presented itself for solution involved the perfection of a device for issuing identification checks or tickets, indicating the zone in which the passenger boarded the car. Under the conditions such as prevail in rush-hour traffic it was deemed essential that the issuing of such checks should be accomplished through a mechanical device rather than to require the conductor or motorman to hand them to passengers boarding the car. Attention was naturally directed to the ticket issuing device, now almost universally used in moving picture establishments, familiar to almost everyone in the United States. These machines, it will be remembered, are manipulated by a series of push buttons, each of which regulates the issue of a certain number of tickets. If the button bearing the figure 1, for example, is touched, the machine (which is motor-driven) almost instantaneously throws one ticket through an aperture in the brass plate with which it is covered. If the figure 2 is touched, two tickets emerge. The familiarity of the public with such a method of issue—that is to say, with the issue of tickets in the manner in which these machines present them—was considered to be a feature which should be incorporated in the ticket issuing device. The machines used by moving picture establishments, however, did not contain the other features which were essential. The distinguishing characteristic of these machines is the issue of varying numbers of tickets, all of which were alike. It is true, of course, that some of the machines issue tickets of various denominations, but such machines are merely a combination of the essential features of two or more of the simpler models. The ticket-issuing machine for a zone-mile system, it was decided, should be built so as to accomplish the following results:

1. Issue only one ticket at a time; the ticket being presented to the passenger somewhat after the fashion of the ticket-issuing device described.

2. That while the tickets themselves would be numbered serially and therefore a check would be had on the number issued, the device should register consecutively the number of tickets issued, so that it would be possible to check off the opening and closing number of tickets issued, just as is now customarily done by conductors in taking off the opening and closing number of the totalizer on fare registers.

3. That but one form of ticket should be used. A machine which would contain a roll of tickets for each zone through which the car passed would be unwieldy in size, difficult to operate and confusing to the passenger. If only one form of ticket, however, is to be used, it is obviously necessary to equip the machine with some sort of printing device so that the machine would print in a conspicuous manner, in a space provided on the ticket, the zone number in which the machine was set at the time the ticket was issued.



TWO TYPES OF FARE REGISTERS DEVELOPED FOR USE WITH FARE SYSTEM PROPOSED, ALSO CONDUCTOR'S KEY FOR LOCKING AND UNLOCKING REGISTER

4. The machine should be equipped with some sort of telltale, or device which would indicate in a prominent manner to both the trainman and the passenger the zone in which it was then set, the number of the zone corresponding with the number printed by the machine on the ticket as it was issued to the passenger.

5. The ticket issuing device should be inexpensive, rugged in construction and as nearly "foolproof" as possible.

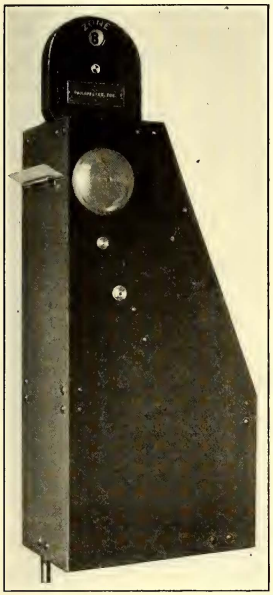
Such a machine has been perfected, and a view is shown, with a picture of the form of ticket issued.

Description of System of Fare Collection

The system which the company proposes to use in the collection of fares after the machines described are received is the pay-leave and it will be conducted as follows:

All passengers board the car at the front door and leave the car by the rear door. Thus a positive movement of passengers through the car will be established

and an even distribution of passengers within the car assured. The ticket-issuing machine, already described, designed to give each passenger an identification slip or ticket, indicating the zone in which the passenger boarded the car, will be located on the front platform and will be operated by the motorman. The fare register will be situated on the rear platform and will be operated by the conductor. At least two fare indicators will be installed in each car; one on each platform, connected by a rod running through the car which will synchronize the two indicators. In other words, when one indicator is changed a corresponding change will be effected on the other. The general appearance of the car as thus equipped is shown in the sketch on page 600.



AT TOP, ZONE TICKET; AT LEFT, TICKET ISSUING MACHINE

The motorman will be charged with the duty of advancing the fare indicator as the car proceeds from zone to zone, and of advancing the ticket-issuing indicator so as to insure the issuing of identification checks bearing the proper zone number. These operations can be done without any trouble, ratchets being provided so that with a simple movement of levers both can be advanced. Pasengers boarding a car will be quick to call the motorman's attention to the fact that he has failed to advance the zone indicator on the ticket-issuing machine if the zone limit has been crossed, for a check or slip bearing the number of the preceding zone increases the passenger's fare. The ticket-issuing machine will be operated by a treadle, thereby reducing to a minimum the amount of work required of the motorman. As there will be no necessity for issuing checks or identification slips except when the car is stopped to allow passengers to board, the motorman's attention will not be diverted from the operation of his car. It is believed that the necessity of issuing identification slips to each passenger boarding the car will tend to reduce accidents arising from premature starting of cars.

In order that both the public and trainmen may know where the zone limits are situated and the number of each zone, the limits of each zone will be marked by appropriate signs attached to poles, the base of the pole being striped to make it stand out conspicuously. The system of marking the zone limits is illustrated in the cut appearing on page 601. The illustration shows two types of marking. The marker on the left of the illustration, attached to a full length pole, is the type which will be used to mark zone limits on trackage used by two or more car lines. The number of the zones on each line appears opposite the name of the line on the zone limit sign. The second type of marker, appearing on the right of the illustration, attached to but a portion of a pole, is the type which will be used to mark zone limits on stretches of track used by only one car line. The number appearing under the words "zone limit" indicates the number of the zone into which the car is about to pass. The company believes that it will require but a few days for patrons to familiarize themselves with the zone numbers in which their homes and places of business are situated. If a journey is taken over an unfamiliar line the zone-limit signs will serve to familiarize passengers with the zone numbers in which their points of origin and destination are located. It is the intention to post conspicuously in the cars on each route the limits and numbers of the several zones so as thoroughly to acquaint passengers with the new arrangement, and to promote public understanding of the system.

The zone identification tickets, an illustration of which appears on this page, are printed in sheets or strips, each ticket being serially numbered. The sheets of tickets are folded and inserted in the bottom of the ticket-issuing machine. Prior to the time that the ticket passes through the machine and is issued by it, the space at the top of the ticket on which appears the large numeral 8 is blank. When the motorman manipulates the machine by pushing the treadle the ticket is fed through a simple printing mechanism which prints in the blank space above referred to a large numeral corresponding to the zone in which the passenger boarded the car; cuts the ticket from the sheet; registers the operation on the totalizer which constitutes a part of the machine, and issues the ticket to the passenger.

When the passenger approaches his destination he goes to the rear of the car and presents his identification check to the conductor. Both the passenger and the conductor have before them a fare indicator, one of which it will be remembered, is located on each platform, the two being connected by a rod passing through the car. The purpose of the fare indicator is to enable both passenger and conductor to ascertain quickly the fare which the passenger should pay. The appearance of the fare indicator is shown in the illustration on page 601.

The large numeral 8 appearing at the left of the indicator shows the zone in which the car is operating. If the passenger about to pay his fare had boarded the car in zone 6 and was alighting in zone 8, he could quickly ascertain the fare by looking for the figure 6 in the first line of figures shown on the indicator and the amount below this figure.

This amount is paid to the conductor who registers it on the cash register. At the same time he collects the passenger's identification check. As all transactions are recorded, an audit is easy. The company will retain its prepayment areas at ferry terminals, with only a slight change in its method of collecting fares.

Conductors will be required to make up trip envelopes at the end of each half trip, inserting therein the passenger identification checks issued and collected during that trip, together with the employees' tickets and transfers which were collected. These envelopes will be sealed and placed in a container, so constructed that they cannot be removed by the conductor. Thus, any holding out of envelopes from one trip to another will be detected because the envelopes will not be found in the container in the order in which the trips were made .

Conductors will be required to note on the face of the trip envelope the direction of the trip, inbound or outbound, the scheduled leaving time, the number of tickets and transfers collected, the number of cash fares registered, and the run number, trip number and conductor's name and badge number. Any attempt on the part of the conductors to mix identification checks collected on different trips will be immediately detected because the serial numbers on identification checks issued on a particular trip will run in consecutive order. Missing numbers should represent the checks issued to passengers who lost them or purposely withheld them from the conductor. In such cases, conductors will be instructed to assume that the passenger has boarded at the end of the line. The total number of identification checks turned in by a conductor on the several trips made by him must agree with the difference between the closing and opening number on the totalizer of the ticket-issuing machine.

The company admits that some slowing down of schedules may occur until the public has become thoroughly familiar with the new system, and the results of the first few days will therefore not be a fair criterion of the possibilities of the new system. But it believes that after the public has become familiar with the system, the location of the zone points and the numbers assigned to the zones between which they customarily travel and the rate of fare applying thereto, and after the conductors have had several days' experience in the new method of fare collection, no slowing down of schedules will occur and that the public will be well satisfied with the new system of fare collection. The opportunity afforded passengers to select their exact fare from their supply of small change while riding to destination will also be a great convenience, especially in winter weather or on rainy days. It is believed that even a larger percentage of persons will have their exact fare ready than is now the case, since it is to the passenger's interest to pay his fare as quickly as possible in order that neither he nor those who follow him may be delayed in leaving the car. There is nothing inherent in the plan, it is thought, which complicates the problem of making change.

Percentage of Increase in Food Prices

According to reports received from retail dealers by the Bureau of Labor Statistics, the retail price of twenty-two of the most essential articles of food, combined, for the United States was 2 per cent higher on Dec. 15, 1918, than on Nov. 15, 1918. Comparing December, 1918, with December, 1917, the increase in the cost of these twenty-two food articles, combined, was 19 per cent. During the five-year period, December, 1913, to December, 1918, the cost of all articles combined shows an increase of 79 per cent.

Car Maintenance Data from Aberdeen

From 8000 to 15,000 Miles Wear Is Obtained from Motor Bearings, and Wheels Wear About ⅛ In. per 5000 Miles

THROUGH the courtesy of William Forbes, general manager, and A. R. Fyfe, works superintendent Aberdeen Corporation Tramways, some interesting comparative statistics are available on equipment life in that city.

Four types of motors are in use: Old-style 25-hp. Westinghouse motors, whose white metal bearings are good for 8000 miles on 32-in. wheels; Westinghouse No. 200 35-hp. special high-speed motors, whose white metal bearings are good for 15,000 miles wear before renewal; Brush No. 1010-G motors, with oil (syphon) lubrication whose bearings are renewed after 12,000 miles wear; British Thomson-Houston No. 200-K 35-hp. interpole motors which first went into service on April 3, 1916, and after two years and ten months of service the tin-lined armature bearings show very little sign of wear. These latest motors are now on eighteen cars. Their lubrication is waste packing and Galena oil. Figuring weekday mileage at 130 miles and Sunday mileage at 100 miles, the first of the GE-200-K equipments has now given most satisfactory service for about 125,000 miles.

Of the motors named above, the first three have gears of 5-in. face and a ratio of 14/68; the GE-200-K gears have a face of 4½ in. and a ratio of 14/67. All gears are lubricated with graphite. Recently the only gears obtainable have been of the split form, although solid gears are preferred. Gears are good for 250,000 miles; pinions for 100,000 miles.

At present all motor coils are bought complete from the motor manufacturers. An impregnating plant will be installed in the new works at an early date. Morganite brushes, used at 5 to 6-lb. tension per brushholder, are standard for all motors.

Recently the wheelbase of the trucks has been lengthened from 6 ft. to 7 ft. to decrease oscillation. These trucks are fitted with the Glasgow Engineering Company's axles of 4-in. diameter, 4¼ in. at gear seat and 3½ in. at the journals. To minimize breakage, the keyway of these axles is no longer square but is undercut about ⅛ in. at the sides to get a rounding effect. These axles are used with steel-tired wheels which are of 32-in. diameter when new and 28½-in. diameter when discarded for retiring. About 35 per cent of the wheels make the full tire life of 75,000 miles without being turned, the remainder being turned once before scrapping. A turned tire averages 65,000 miles. Roughly, the wear of tires is at the rate of ⅛ in. per 5000 miles. The allowance in case of shrinking on tires is $\frac{1}{16}$ in. less 9/1000 in. Axles are pressed into the centers at an average of 32 (long) tons per square inch with an allowance of 6/1000 in. The wheels come from Brown, Bayley's Steel Works, Ltd.

Even in the existing cramped quarters of the car maintenance department several thoroughly modern features are noticeable, such as separate motor drive for most of the machine tools. At an early date the Aberdeen Corporation Tramways hope to secure possession of the building erected for the new works but now occupied for military purposes, and it will then be possible to carry on the upkeep of equipment under more favorable conditions.

Conservative Views of Electrification

At A. I. E. E. Meeting Held in Boston On March 14 Discussion Brought Out Limitations as Well as Virtues of Electrification of Steam Railroads

THE American Institute of Electrical Engineers held its 348th meeting at the Hotel Copley Plaza in Boston, Mass. The morning session was devoted to the subject of "Electrification of Steam Railroads," with an introduction by Calvert Townley and informal statements by several other leaders in this part of the electrical field. Abstracts of Mr. Townley's paper and of some of the contributions to the discussion follow:

Some Possibilities of Steam Railroad Electrification as Affecting Future Policies

BY CALVERT TOWNLEY

Assistant to the President, Westinghouse Electric & Manufacturing Company, New York City

ELECTRICITY now performs every railroad service previously rendered exclusively by steam locomotives, and in every case does it better than it was done before. But in order to use electricity a large investment in equipment and installation must be made and electrification has proceeded slowly because railroad executives were not convinced that the advantages to be gained are always worth the cost.

The progress of electrification has also been impeded, first, before the war by the difficulty in financing due to conditions other then the merits of electrification, and second, since the war began because every one has been too busy to consider any work that could be deferred and because the government's taking over the railroads has created an unsettled situation not conducive to the investment of new capital for future returns. Now, however, there seems to be ground for hoping that these bars to progress will be removed in the not distant future so that electrification can be again studied on its merits. Therefore our consideration of the subject is timely.

The electrification of a railroad is not simply the substitution of one kind of locomotive for another; it is the adoption of a fundamentally different method of train propulsion. It is conservative to say that, within the bounds of ordinary practice, electricity can furnish every train with all the pulling power that can be used. The limitations of the steam locomotive in this respect disappear and ruling grades rule no longer. A strictly limited motive power is replaced by one that is practically unlimited.

ELECTRIFICATION SYSTEMS ARE ESSENTIALLY ALIKE

There are a number of so-called "systems" of electric traction, and heavy emphasis has been laid by the advocates of each upon its points of difference from every other. So much has been said about these differences and so little about the points of similarity as to create an entirely misleading impression. It is a fact that there are more kinds and types of steam locomotives in use many times over than there are electric systems. It is a fact that except for the storage-battery locomotive, which has but a limited field of application, all electric systems have many more common features than differences. It is a fact that they agree on fundamentals and differ in detail only. Their costs may not be the same, their efficiencies may vary but they all do their work and do it successfully and well. The possibility of unlimited electric power is a characteristic not of any one system but of all. It is due to basic differences between steam and electric equipment. A steam locomotive is a complete independent unit which not only generates but also utilizes its power. The electric locomotive generates no power at all. It is only a translating device receiving energy from an outside and a remote source. The electric power house, always having much greater capacity than any one locomotive, can supply ample power for the heaviest train on the steepest grade. The steam locomotive which carries its own power house with it is limited to the capacity of its one boiler. By the multiple-unit principle, as many electric locomotives as may be needed can be coupled together and operated in synchronism by one crew from any cab. Any required tractive effort can thus be exerted without slipping the wheels, without imposing undue strains on the rails or bridges and without increasing the number of engine crews.

ELECTRIFICATION ACCOMPLISHES SEVERAL SPECIFIC THINGS

The business of a railroad is to transport freight and passengers. I put freight first because on the average it produces 73 per cent of the revenue. Unlimited motive power permits longer trains and higher schedule speeds. It cuts the operating cost by hauling more cars with the same or a smaller crew. These new opportunities at one fell swoop banish many of the railroad's time-honored traditions. The traffic possibilities must be studied from a new angle and advantage taken of every facility. It is a new thought to realize that train length is limited not by motive power but by the yard tracks and length of sidings, or that all the trailing tonnage that the drawbars will stand can be hauled. Nor are these new limits fundamental. Sidings can be extended, drawbars can be made stronger, if it pays to do it. In a word electrification opens up tremendous possibilities of increasing the freight capacity of a road and without it being necessary to build additional tracks.

While not as important as freight, passenger traffic likewise comes in for its share in the widened horizon and the vanishing tradition. Unlimited power, of course, is available but the absence of combustion is another basic advantage. Smoke and cinders disappear. Tunnel operation loses its terrors. Unobscured signals permit normal speeds with undiminished safety. Aerial rights over city terminals are now valuable. Multi-unit operation has in fact made suburban traffic. The rapid acceleration made possible by electric traction has directed attention to the equal value of rapid retardation and has quickened the study of braking accordingly; also of modified coach design to bring about the more

efficient loading and discharge of passengers. These combined possibilities secure increased schedule speeds and attract patronage. In passenger as in freight traffic the ability to do something that could not be done before, rather than to do the same thing at a lower cost, is the most valuable attribute of electrification, and again we find a greatly augmented capacity without the need of additional tracks.

SHOULD ALL RAILROADS BE ELECTRIFIED?

It is not my purpose to make an exhaustive comparison of the relative advantages of steam and electric operation. That has been done often and well by others. What I have said about the expanding opportunities for electrified service is by way of illustration to emphasize my plea that the question should always be viewed in its broader aspect and not hampered and restricted within any narrower limitations than properly belong to it.

I am going to assume, then, the broadest possible treatment and to suppose that every electrification project is to have its pros and cons most fully examined. The real and vital question then is, "How far will this lead us?" "To what extent may we expect complete electrification of all our roads?" Parts of a number of them have already been equipped. Many of these are numbered among our prominent roads, successful corporations which have had the advice of the most highly skilled executives and engineers, and which are progressive. Now, every one of these projects has been successful. Every one has justified itself. Nearly every one in its present scope represents an extension of the zone initially electrified, the most convincing evidence possible as to what views the operating companies hold regarding these several projects. Railroad officials are generally glad to give others the benefit of their experience, so it is reasonably safe to say that operating statistics are available covering long enough periods so that the results to be expected from any proposed undertakings may be predicated on established facts and not upon theories. In the light of present-day knowledge, therefore, what answer can we make to the question "Should all railroads be electrified?"

Taken together in 1910 there were in the United States 240,000 miles of railroad main line regardless of the number of tracks. Of this mileage approximately 1250 or one-half of one per cent has been electrified or is today in process. The remaining 99½ per cent comprises, of course, roads performing every variety of service. They range from the back country branch line built by some over enthusiastic promoter and now, perhaps, operated as part of a large system only because operation cannot be avoided and regularly contributing its annual deficit, up to the most important through arteries of travel upon which the commerce and industry of the nation depend. Every sort of community is served; every kind of railroading has its place in this vast aggregation of effort and the variables in the problem are so multitudinous and their nature often so profound as well to daunt the courage of one who seeks to formulate them for incorporation in a general statement. Fortunately or unfortunately, depending on the point of view, it has been my lot to have to deal with this electrification problem from both sides.

I am a thorough believer in the virtues of electrification and an enthusiast about the wonders which it can accomplish, but I also have a keen appreciation of the almost infinite variations in the railroad problem and a very wholesome respect for the dollar. I do not believe that all railroads will ever be electrified. I am not sanguine even that all the tracks of any one really big system will be so equipped in our time. It is a question of economics. Electrification will increase the track capacity. But there are thousands of miles of railroad that have sufficient capacity now, frequently several times over, and where the wildest stretch of imagination fails to picture a future need of this kind. Electrification works wonders in suburban and interurban passenger service. I have ridden for hours across the western prairies without seeing a single town, much less a city where these advantages would count. Electrification effects marked economies in fuel, in maintenance, in labor and otherwise through a long list; but electrification calls for a heavy investment and unless these economies bulk large enough, the interest on such investment will wipe them out and turn the enterprise into a losing venture. I do not believe the cause of electrification is helped by undue optimism on the part of its advocates. Rather should there be an enlightened partisanship, enthusiastic where enthusiasm is justified but tinged with the sober conservatism of the man who has to put his own dollars to work.

There need be no discouragement to the electrical engineer in the views just given, nor to the railroad man who has looked toward the new motive power for salvation. There are so many cases where electricity should be used, where its advantages are clear and conclusive, that once the railroads escape from the financial slough of despond in which they are now wallowing and are again able to get capital for their needs there will not be enough engineers, there will not be enough electric factories in the country to serve them. Every big system has need of electricity somewhere. For some small roads it may mean the difference between solvency and bankruptcy. There can be no rule established. Generalities are sure to be misleading but electrification is now firmly intrenched and successful. It is recognized by railroads generally as an effective agency with great possibilities and one which is particularly valuable for certain specific purposes. Time alone will tell how broad its application is to be but I am confident we can await developments with tranquility assured that the art is in a healthy condition and the progress will be along the right lines.

Discussion of Mr. Townley's Paper

Frank H. Shepard, Westinghouse Electric & Manufacturing Company, said that every "hard-shelled" railroad man will concede that electrification means better service and a better railroad. The broadest vision is necessary in expanding our railroad facilities. New terminals, second tracks, revision of lines, etc., are not always immediately remunerative, hence the long look ahead is necessary. Admittedly the cost of electrification is of the order of the expense required to duplicate the present way and tracks, say $15,000,000,000 for all the roads of the country. The railroad traffic of the country doubles about every twelve years. Electrification will enable double the traffic of a railroad to be handled with virtually the same plant in roadway and tracks. Studies have been made for the application of as high as 18,000 hp. Tests of a single locomotive utilizing 8000 hp. and of a train consuming 15,000 kw. have already been made.

More efficient use of labor results from electrification,

said Mr. Shepard. All steam railroad practice has been built up around the steam locomotive and its limitations. Engine stages of 100 miles or thereabouts are an outcome of these limitations. An electric locomotive engine stage of 500 miles is conceivable. The economies of electrification are greater than are ordinarily pictured.

The Power Trunk Line and Electrification

W. S. Murray, consulting engineer New York City, pointed out that in future a composite railroad-electrical man will be needed to meet electrification requirements properly. The attempt to electrify all the railroads of the country should not be made. It is very significant, however, that electrical operation has succeeded in every branch of railroad service—terminal, freight, passenger and switching.

Referring to the plan of trunk-line power supply lately fostered by Secretary Franklin K. Lane, Mr. Murray pointed out that in 1914 he had become interested as an engineer in the possibilities of centralized motive power supply for the six principal railroads operating into the New York City district on the western side of the Hudson River. Here appeared an excellent opportunity to form a power equipment company to work out a standard equipment for service in this district. This plan gradually evolved into a regional one.

Mr. Murray said that he had given much thought to Secretary Lane's proposed super-power generation, transmission and distribution plan for application in the regional districts between Boston and Washington and was in accord with it. By such an arrangement is offered the opportunity for propelling all trains in the region by electricity, and at the same time supplying all industrial concerns with like power. He said further that at first blush the super-power plan would appear to be a "large order." This is so, but the world is full of big problems and of as big men to solve them. The importance of reducing the fuel consumption per kilowatt-hour can hardly be exaggerated. The amount of wasted coal in this country, especially in the Eastern district, is almost criminal.

Carl Schwartz, electrical engineer New York Central Lines, in a written communication pointed out that the cost of electrification involves many other items in the way of track, terminal and signal system changes which make its economic success more difficult under present conditions. The general standardization of motive power along broad lines is highly desirable, he stated. This can now be done without the exclusion of special systems which have proved their merit.

Fuel Conservation Demands Extensive Electrification

W. B. Potter, chief engineer of electric traction General Electric Company, contributed a written discussion pointing out that electrification necessitates no radical changes in the handling of transportation, but minor changes are usually essential in order to secure the full benefits made possible by the increased power, speed and continuity of service in the individual unit as compared with steam. The objection is sometimes cited that electrification does not provide equal facilities with steam for handling an emergency congestion of traffic. This is not always true, but granting it in some instances, it is an emergency only and should be regarded as such. This condition is more than offset by features of electric railway operation which go far toward removing the possibility of congestion. Thus, the electric locomotive is at its best during the coldest weather, when the steam locomotive is most limited in its capacity.

The investment for electrification is, Mr. Potter said, undoubtedly the most influential factor affecting its advance. With the engineer rests the responsibility for revising and utilizing such equipment as will insure the best economical return to successful service. Electrification operated from hydraulic power offers the only known method of conserving our limited supply of coal and oil. Even when hydraulic power is not available, a saving of more than two-thirds of the fuel and much of the fuel haulage can be obviated by the erection of steam power plants suitably located and furnishing electrical energy from the coal burned in modern practice. An illustration of the coal consumption and the traffic lost incidentally by burning fuel on a small scale in individual units is given by the fact that nearly one-fourth of the coal mined in the United States is used on steam locomotive tenders; that 5 per cent of the ton-mileage moving over our railroads is occupied with hauling this coal again for railway purposes, and that 7 per cent of the ton-mileage is occupied with hauling this coal again in the tenders back of the steam locomotives.

The coal and equivalent oil used on the steam locomotives of the United States in 1914 totaled 140,000,000 tons of coal. The ton-miles moved in the same period, excluding the tonnage of locomotive tenders and 75 per cent of the railway coal was 930,000,000,000 ton-miles. If the same tonnage had been moved electrically, basing figures on an energy consumption of 40 watt-hours per ton-mile, the annual energy consumption would have been 37,200,000,000 kw.-hr. If this energy had been obtained from steam power houses at 2.2 lb. of coal per kilowatt-hour, instead of the 140,000,000 tons actually used there would have been required 40,000,000 tons of coal. This shows a net saving of 100,000,000 tons in one year. A still greater saving would have been accomplished in proportion to the amount of hydroelectric power available.

Less than 5,000,000 Kw. Would Meet Present Requirements

There are frequent misconceptions as to the amount of power involved in railway electrification. The figures just given form a basis for illustrating this rather emphatic point. If the tonnage moved in the United States on steam railroads could have been handled by the expenditure of 37,200,000,000 kw.-hr., this would be equivalent to an average load of 4,250,000 kw. This is not an exorbitant amount compared with the power plants already installed. In 1917 the power station capacity in the United States, including central stations, electric railways and isolated plants was about 20,000,000 kw. Thus there is installed electric power station capacity equivalent to four or five times the power which would be required for operating all the railroads in the United States electrically.

Mr. Potter stated that while he agreed with Mr. Townley that it is very improbable that all the railroads in the United States will ever be electrified, it is at the same time interesting to note what the power demand of these roads would be and the saving of coal that would result from their electrification. The further development of central district stations with either fuel or water as their source of power will afford the most di-

rect means of conserving coal. The existence of such large central stations located at strategic points throughout the country, even if primarily installed for railway use, would of itself further and develop the use of electricity for various industrial purposes, and by so doing would affect the coal consumption more widely than the item of railway coal alone.

Financial Feasibility Is Now the Criterion

George Gibbs, chief engineer Pennsylvania electrification, New York City, also presented a written discussion. He maintained that it is most important to combine the advantages of electric operation with improved railroad practice, and that something beside the purely electrical specialist is needed to solve such problems. In the early days of electrification the chief concern of railroad men was whether electrical apparatus was capable of performing heavy railroad service and electrical engineers were busy weeding out defects and limitations. During this period that much-heated controversy arose among engineers as to the best electrical system for general adaptation. The settlement of this particular question at that time was, to say the least, premature; as has since been demonstrated by the parallel development of systems having great flexibility. Even now, when it has been conclusively proved that electric traction by more than one system is technically feasible, evolution is still in process and the standardization of systems and apparatus, except as regards certain general features, should be relegated to the background in discussing the results following railway electrification.

The question, Mr. Gibbs said, had really now changed from technical to financial feasibility. There are few railroads which in these times face the very heavy expenditures required for electrification except to secure immediate large operating economies either directly or by an increase in the capacity of the road, or in the stimulation of new business, any one of which or all taken together produces sufficient added net increase to at least pay the fixed charges on the new investment. The attention of our government was directed during the war toward the electrification of railways as a possible way of increasing capacity for emergency service; also as a means of fuel conservation. The railroad administration was somewhat at a loss to determine just what it should do in the matter on account of the conflicting views expressed in and out of railroad circles by technical and non-technical advisors. Some way must now be found of attacking the railroad electrification problem with a combined technical and transportation knowledge.

Any general electrification of railway systems in this country is an absurdity economically, by any present electrical system. But on the other hand, there are a number of instances where electric traction is indicated as necessary or advantageous. In some cases the direct savings will be sufficiently attractive to warrant the expenditure, but more often the deciding factor should be the indirect savings produced. The determination of these indirect savings generally involves important alterations in operating methods, facilities, etc., and it is therefore essential that engineers who are called upon to report upon electrification projects should be familiar with transportation methods as well as with the electro-technical side of the problem.

John Murphy, electrical engineer, department of railways, Ottawa, Can., pointed out that only 3 or 4 per cent of the heat energy of the fuel is utilized at the driving wheels of the steam locomotive. He spoke appreciatively of the co-operation of the United States Fuel Administration in supplying coal to Canada during the war period, thereby averting much suffering.

Electric Locomotive Cannot Be Operated on Steam Basis

N. W. Storer, Westinghouse Electric & Manufacturing Company, said that the ultimate results of electrical operation are too broad for present vision; that years of evolution will follow the initial development. "We must thank the steam railroad man for his conservatism," said Mr. Storer. "It is a mistake, however, to operate the electric locomotive on the same basis as the steam outfit. The whole plan of operation must be changed to fit the service possibilities of the electric locomotive." The speaker touched upon the value of proper distribution of traffic throughout the twenty-four hours, and pointed out that where shipments are heavily bunched, as in sending out fruit trains in California, with intervals perhaps of days between successive dispatches, electrification *per se* would not be economically attractive. Again, the cost of providing extra equipment to enable wrecks to be cleared up more quickly than normally is not warranted. The opportunities of the future are very great, and all that need be considered at present are cases where the need for electrical operation is a crying one, as in the case of tunnels, large terminals, etc. Building over city tracks where electrical operation is carried on, is a most desirable procedure. The speaker characterized Mr. Murray's vision of a super-power system as most inspiring and easily within the range of possibilities. He contended that we owe it to future generations to conserve natural resources. The United States spent in four or five days of war enough money to electrify all the terminals in Chicago. "Why then," said he, "should we hesitate to spend money for such a constructive improvement as electrification?"

Major George F. Sever, New York, spoke briefly of the importance of fuel conservation on the Pacific Coast, where coal is an almost unknown quantity. Oil and water are there the chief sources of electrical energy. The railroads are now using about 40,000,000 bbl. of oil yearly and the public utilities of California 1,000,000 bbl. The United States shipping now needs 30,000,000 bbl. yearly, and other users in California consume 40,000,000 bbl. per annum. California produces 110,000,000 bbl. of oil yearly, compared with 350,000,000 bbl. in the entire country. Hydroelectric power development is therefore absolutely necessary in California for both railroad and public utility operation. In 1914 oil cost 40 to 50 cents per barrel; it is now $1.50 at the California wells, and at some other points on the Coast is $1.85. More than $3,500,000 easily can be saved in California yearly by interconnection and hydroelectric supply; the mountain passes are well suited to electrical operation of trains, and the increasing scarcity of oil deserves close consideration. In closing, Major Sever commended the fuel saving work done in New England during the past year, and pointed out that there is at present little if any surplus of water power available for exportation from this section of the country.

Prof. Charles F. Scott, Yale University, then suggested a resolution indorsing Secretary Lane's "superpower" project, and it was unanimously voted that the board of directors prepare and transmit it.

American Association News

The Engineering Association Assigns Subjects to Its Various Committees and Announces New Committee Appointments—The T. & T. Association Also Announces Personnel of Committees—Report from the Bureau of Statistics and Information—Company Section Activity.

Engineering Association Committee Assignments

AS EXPLAINED in the issue of this paper for Jan. 25, page 196, a committee on subjects was authorized by the executive committee of the Engineering Association on Jan. 10 to lay out committee work for the balance of the current association year. The instructions to the committee were that attention should be confined to a few essential topics. Accordingly the following subjects have been assigned:

To the Committee on Buildings and Structures: (1) Further study of the subject of fences, with particular reference to concrete posts and methods of casting them. (2) Design of carhouse inspection pits.

To the Committee on Electrolysis: Co-operation with the association's representative on the American Committee on Electrolysis, continuing a study of the general subject.

To the Committee on Equipment: (1) Co-operation with the National Fire Protection Association in formulating a new code, or a revision of the 600-Volt Code for 1200-volt car wiring. (2) Development of check gages and templates for wheels and truck parts. There are no such standards in existence. The following items are suggested as an outline of the work only, and the committee is asked to go only as far as deemed advisable at present: (a) Gaging points and terms for wheel and track. (b) Wheel mounting and check gage. (c) Brake-beam gage, covering spacing of brakehead. (d) Wheel-flange and tread-contour gage for new wheels. (e) Standard wheel tape. (f) Plane gage for solid steel wheels. (g) Rotundity gage for solid steel wheels. (h) Journal and wedge gages. (3) Standardization of motor parts. It is very desirable that all small parts which go to make up railway motors in the various sizes should be standardized so that they will be interchangeable. This should be possible now in view of the lessons learned during the war and because of similar action already taken by various manufacturers of automobiles and trucks.

To the Committee on Heavy Electric Traction: (1) Revision of diagram of location and clearance of overhead conductors, with the suggestion that the height of the hand-brake staff be indicated and that the height of car running board be dimensioned on the diagram in Cases Nos. 4 and 5. (Engineering Manual Ds-62.). The subject before final action is to have the approval of the committee on power distribution. (2) Revision of dimensions on standard diagram of location and clearance of overhead conductors, to include provisions for pantagraph clearance. (3) Advise committee on power distribution of approval or rejection of specification for catenary overhead trolley construction, to cover high-voltage as well as 600-volt direct-current service.

To the Committee of Power Distribution: (1) Revision of joint specifications for overhead and underground wire and cable crossings with railroad company's right-of-way. The special committee which was appointed to consider this subject is made a subcommittee of the power distribution committee without change in the personnel of the committee. At present the representation on the joint committee consists of the American Railway Association, the American Railway Engineering Association and the American Electric Railway Engineering Association. It is the expectation that other associations will be invited to participate in this work. This activity results from the fact that the present association standards made in 1913 are somewhat obsolete due to the completion of the National Electric Safety Code. (2) Revision of specifications on wires and cables with special reference to stranding of cables and thickness of 600-volt insulation. The special committee on this subject is made a sub-committee of the power distribution committee without change in the personnel of the committee. This subject is taken up at the request of the American Institute of Electrical Engineers and the War Department, in view of the desirability of using standard-size wires in the make-up of large stranded cables. (3) Standard thread for pins and insulators. This special committee is made a sub-committee of the power distribution committee. The work of this committee has been in progress for some time and it is the desire to secure a final report on this subject as early as possible in order that suitable standards may be adopted.

To the Committee on Power Generation: (1) Report on the development of automatic substations. (2) Recommendation of standard form of power contract, for the purchase of railway power. (3) Further consideration of operating performances of railway power stations.

To the Committee on Way Matters: (1) Specifications for special work, with particular reference to steam railroad crossings. (2) Development of a spiral for use in the design of switches, mates and frogs. (3) Report on the development of hand and power tools for track construction. (4) Report on the use of a curved head for girder rails with special reference to wheel and track wear. This is to be considered jointly with the committee on equipment.

Engineering Association Committee Appointments

THE executive committee of the Engineering Association has announced the following list of committee appointments, subject to some revision. In a few cases it is probable that the committees will be expanded somewhat in order that certain subjects may be more completely considered:

Committee on Buildings and Structures: C. S. Kimball, engineer of way and structures Washington Railway & Electric Company, Washington, D. C., chairman. R. C. Bird, Central Traction & Lighting Bureau, New York, N. Y.; G. C. Estill, engineer Cumberland County Power & Light Company, Portland, Me.; H. E. Funk, superintendent of buildings Brooklyn Rapid Transit Company, Brooklyn, N. Y.; James Link, chief engineer Knoxville Railway & Light Company, Knoxville, Tenn.;

F. F. Lowe, architect Boston Elevated Railway, Boston, Mass.; H. G. Throop, engineer of way and structures New York State Railways, Syracuse, N. Y.; H. R. Whitney, special assistant to president Springfield Street Railway, Springfield, Mass.

Committee on Issuance and Distribution of Engineering Manual: Martin Schreiber, chief engineer Public Service Railway, Newark, N. J., chairman; L. P. Crecelius, superintendent of power Cleveland Railway, Cleveland, Ohio.

Committee on Equipment: Daniel Durie, general superintendent West Penn Railways, Connellsville, Pa., chairman; W. G. Gove, superintendent of equipment Brooklyn Rapid Transit Company, Broklyn, N. Y., vice-chairman; W. S. Adams, designing engineer J. G. Brill Company, Philadelphia, Pa.; J. M. Bosenbury, superintendent of motive power Illinois Traction System, Peoria, Ill.; R. H. Dalgleish, electrical engineer Capital Traction Company, Washington, D. C.; H. A. Johnson, superintendent of equipment and shops Metropolitan West Side Elevated Railway, Chicago, Ill.; G. W. Lyndon, president Association of Manufacturers of Chilled Car Wheels, Chicago, Ill.; E. D. Priest, railway engineering department General Electric Company, Schenectady, N. Y.; K. A. Simmon, general engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; N. B. Trist, special representative Carnegie Steel Company, Pittsburgh, Pa.

Committee on Electrolysis: Prof. A. S. Richey, Worcester Polytechnic Institute, Worcester, Mass., chairman; E. B. Katté, chief engineer of electric traction New York Central Railroad, New York, N. Y.; E. J. Blair, electrical engineer Metropolitan West Side Elevated Railway, Chicago, Ill.

Committee on Heavy Electric Traction: C. H. Quinn, chief electrical engineer Norfolk & Western Railway, Roanoke, Va., chairman; A. H. Armstrong, chairman of electrification committee General Electric Company, Schenectady, N. Y.; E. B. Katté, chief engineer of electric traction New York Central Railroad, New York, N. Y.; W. S. Murray, consulting engineer The Connecticut Light & Power Company, Waterbury, Conn.; F. H. Shepard, director of heavy traction Westinghouse Electric & Manufacturing Company, New York, N. Y.; L. S. Wells, superintendent of electricity Huntington Railroad, New York, N. Y.

Committee on Power Distribution: C. L. Cadle, chief engineer New York State Railways, Rochester, N. Y., chairman; C. C. Beck, assistant chief engineer The Ohio Brass Company, Mansfield, Ohio; E. J. Blair, electrical engineer Metropolitan West Side Elevated Railway, Chicago, Ill.; James H. Drew, president Drew Electric & Manufacturing Company, Indianapolis, Ind.; C. R. Harte, construction engineer The Connecticut Company, New Haven, Conn.; J. H. Libbey, electrical engineer Bay State Street Railway, Boston, Mass.; P. M. Lincoln, general engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; A. Schlesinger, superintendent of distribution and substations Terre Haute, Indianapolis & Eastern Traction Company, Indianapolis, Ind.; Francis J. White, The Okonite Company, New York, N. Y.

Committee on Power Generation: A. B. Stitzer, chief engineer Republic Engineers, Inc., New York, N. Y., chairman; C. W. DeForrest, manager electrical department Union Gas & Electric Company, Cincinnati, Ohio; R. W. Eaton, public service engineer, Providence, R. I.; E. F. Gould, consulting engineer Aurora, Elgin & Chicago Railroad, Cleveland, Ohio; C. R. Greenidge, chief engineer J. G. White Management Corporation, New York, N. Y.; G. H. Kelsay, superintendent of power and equipment Cleveland, Southwestern & Columbus Railway, Elyria, Ohio; E. H. Scofield, engineer of power and equipment Minneapolis Street Railway, Minneapolis, Minn.; W. C. Slade, superintendent of power and lines The Rhode Island Company, Providence, R. I.; Howell Van Blarcom, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; E. P. Waller, assistant manager railway department General Electric Company, Schenectady, N. Y.

Joint Committee to Consider Safety Code of United States Bureau of Standards: C. L. Cadle, chief engineer New York State Railways, Rochester, N. Y., chairman; Hugh Hazelton, electrical engineer with L. B. Stillwell & H. S. Putnam, consulting engineers, New York, N. Y.; C. S. Kimball, engineer of maintenance of way Washington Railway & Electric Company, Washington, D. C.

Joint Committee on Standardization of Method for Determining the Cost of Power: L. P. Crecelius, superintendent of power Cleveland Railway, Cleveland, Ohio, chairman; E. H. Scofield, engineer of power and equipment, Minneapolis Street Railway, Minneapolis, Minn.

Committee on Way Matters: C. H. Clark, engineer of maintenance of way Cleveland Railway, Cleveland, Ohio, chairman; A. E. Harvey, superintendent of way and structures Kansas City Railways, Kansas City, Mo.; vice-chairman; William R. Dunham, Jr., engineer of maintenance of way The Connecticut Company, New Haven, Conn.; H. Fort Flowers, president Differential Car Company, New York, N. Y.; W. P. Graves, chief engineer Montreal Tramways, Montreal, Quebec; C. G. Keen, engineer way and structures American Railways, Philadelphia, Pa.; H. H. Ross, chief engineer Toledo Railways & Light Company, Toledo, Ohio; E. M. T. Ryder, engineer of way Third Avenue Railway, New York, N. Y.; N. B. Trist, special representative Carnegie Steel Company, Pittsburgh, Pa.

The personnel of the committee on engineering standards is not yet complete. It is planned to augment the present committee to secure further co-operation with the engineers of manufacturing companies.

T. & T. Committees for 1919

THE minutes of a meeting of the executive committee of the Transportation & Traffic Association, outlining plans for the balance of the year, were given in the issue of this paper for Feb. 1, page 244. The personnel of the committees which will carry out these plans is as follows:

Committee on Code of Traffic Principles: H. B. Flowers, assistant general manager United Railways & Electric Co., Baltimore, Md., chairman; E. J. Burdick, assistant general manager Detroit United Railway, Detroit, Mich.; A. Gaboury, superintendent Montreal Tramways, Montreal, Canada; Paul E. Wilson, assistant to president Cleveland Railway, Cleveland, Ohio; J. H. Stephens, superintendent Washington Railway & Electric Company, Washington, D. C.

Committee on Proper Basis of Compensation to City Companies by Interurban Companies, etc.: R. T. Sullivan, general manager Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, chairman; H. W. Clapp, vice-president East St. Louis & Suburban Rail-

way, Columbus, Ohio; J. F. Collins, general manager Michigan Railway, Jackson, Mich.; A. Swartz, vice-president Toledo & Western Railroad, Toledo, Ohio.

Committee on One-Man Car Operation: C. W. Kellogg, Stone & Webster, Boston, Mass., chairman; S. W. Greenland, general manager Ft. Wayne & Northern Indiana Traction Company, Ft. Wayne, Ind.; J. K. Punderford, vice-president The Connecticut Company, New Haven, Conn. Representing Engineering Association on this committee: J. M. Bosenbury, superintendent of motive power Illinois Traction System, Peoria, Ill.; Clarence Renshaw, railway engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; J. C. Thirlwall, railway engineer General Electric Company, Schenectady, N. Y.

Committee on Collection and Registration of Fares: R. R. Anderson, superintendent of transportation, The Rhode Island Company, Providence, R. I., chairman; T. C. Cherry, vice-president Auburn & Syracuse Electric Railroad, Syracuse, N. Y.; Louis D. Pellissier, president Holyoke Street Railway, Holyoke, Mass.; E. C. Spring, superintendent of transportation Lehigh Valley Transit Company, Allentown, Pa.; C. W. Stocks, general passenger agent, Bay State Street Railway, Boston, Mass.

Bureau of Statistics and Information Needs Co-operation

THE American Association Bureau of Statistics and Information has prepared a report on its recent activities, from which the following abstracts have been made:

Bulletin on Wages and Working Conditions of Trainmen (No. 121). The first edition of this bulletin was issued on March 1, 1919, including replies received to date from 212 companies on Data Sheet No. 185. It contains the most recent information available on the wages of trainmen, including such decisions of the National War Labor Board as apply to above companies. It further contains a very complete summary of working conditions and the general labor situation. It includes the following tables: Wages of motormen and conductors operating two-man cars in passenger service. Wages of operators of "one-man" cars. Wages of motormen, conductors and guards on urban rapid-transit lines. Wages of motormen and conductors operating express and freight cars. Working conditions of trainmen.

The last-named table includes a description of the length, kind (whether straight or swing) and maximum spread of runs; compensation or time allowed trainmen for special work such as over-time, Sundays and holidays, snow plows and sweepers, work cars, reporting for duty, making out accident reports, time taken for meals, etc.; limitations in the making of time-tables, regarding number of parts of runs, method of working meal reliefs, maximum time on cars without relief, payment for intervening time in schedules, length of meal relief, working of maximum number of men in rush hours; ratio of cars operated in rush hours, midday and after supper periods.

Another table relates to the labor situation. It includes data on employment of women, labor turnover, strikes and average annual earnings of trainmen.

The bureau urges all companies that have not as yet sent in data sheets do so at once in order that the second edition of this wage bulletin, which will be issued as soon after April 1 as possible, may include all the companies that have not yet reported.

Income Accounts and Operating Expenses. (Data Sheet No. 186). The principal financial statistics of the electric railway industry are contained in the compilation which is now being made. A report was made at the mid-year meeting, based on replies from 136 companies. These are the same data as requested by the Association War Board and published in Bulletin No. 36. These covered 388 companies and proved effective in the presentation of the electric railway case before the national authorities.

Report forms showing operating expenses in greater detail and conforming to the I. C. C. classification of accounts, have been sent out by the association, which will permit the compilation of these data to be made each month. It is the expectation to show from this information the monthly operating expenses per car-mile, segregated by the operating department and divided into groups representing city operation, interurban operation and combined city and interurban operation. It is believed such information representing the most recent available data will be extremely useful to member companies.

In this connection, President Pardee in his letter to electric railway executives, dated Feb. 13, 1919, states:

> Such information should be continuously available and we trust that we may have your further co-operation in a continuance of these reports from month to month, in order that the association and its various committees which are grappling with the problems now before us, may have at all times full information upon the condition of the industry. Monthly blanks for this purpose are inclosed herewith. Unlike the case of the steam railroads, there is no clearing house of statistics to which electric railways report. The need of a central agency of this kind is pressing. The association is undoubtedly best equipped to perform this work and will perform it if you will furnish us with the date.

Skip-stop Bulletin. A bulletin on skip stops was issued on Feb. 15, 1919, containing the replies of more than 100 companies on Data Sheet No. 183. This bulletin is in the form of a report, showing the advantages and reasons for retention of the skip-stop system. The purpose of this bulletin is to explain to the public at large the general advantages of the skip-stop plan, based upon the actual experience of a number of typical companies throughout the country. Additional copies of this bulletin will be sent to companies upon request.

Increased Rates of Fare. An up-to-date tabulation is maintained of all cities that have received increased rates of fare. These cities are classified in groups based upon the present rate of fare in effect. The tabulation shows the name of the city, the population served, the name of the operating company, the former rate of fare and the date when the present rate of fare became effective. The association has further prepared a statement showing the effect of increased rates of fare on operating revenues in a number of typical cities. This is based upon replies to letters sent out during the last month and represents the situation probably as well as it is possible to present it, in view of the many factors which have interfered with such comparisons, such as the influenza epidemic, the abnormal weather conditions last winter, the effect of war industries, thrift campaigns, etc.

Taxes and Other State, Municipal and Federal Requirements Levied on Electric Railway Companies. Data Sheet No. 182 is now being compiled by the association for the purpose of showing the extent to which

the electric railway industry is subjected to financial burdens as a result of the above requirements. The committee on readjustment, as a result of the resolution adopted at the New York conference on Nov. 1, expects to use this information in its effort to secure a readjustment of the relationship between the electric railway companies and public authorities. Member companies are urged to return the above data sheet filled in, at the earliest possible moment in order that the work of this committee may not be delayed.

Summons Ordered for Waterbury (Conn.) Meeting

THE Waterbury local committee of the Connecticut Company section has issued a notice of the meeting to be held on March 27 in the following unique form:

TO THE HIGH SHERIFF OF ALL COUNTIES:
Greeting:

You are hereby ordered to summon each and every member of the Connecticut Company Section A. E. R. A. to appear at Hotel Elton, Waterbury, Thursday, March 27, 1919, at 6.30 p.m. to sit in judgment on such entertainment and speaking as may thereafter be provided.

Owner Judd of the Elton, in deep sympathy with the defendant committee, has agreed to furnish jurors from afar, attachés in Waterbury and all members of high or low degree, a dinner (price $1.25) that is guaranteed to produce a feeling of instant appreciation and good-will.

SPEAKERS:

WILLIAM B. SANDLAND, *Mayor of Waterbury.*
C. A. TEMPLETON, *president of Board of Aldermen, State Senator.*
FREDERICK S. CHASE, *president Chase interests.*
JOHN H. CASSIDY, *secretary and treasurer, Waterbury & Milldale Tramway Company (Green Line).*
JOHN H. GOSS, *general superintendent, Scovill Manufacturing Company.*
Entertainment furnished in spasms.
Song Leader—ALVIN GILLETTE.
Reception committee on double time.

Therefore fail not under penalty of heavy losses in the things that make life worth living.

Fraternally yours,
WATERBURY GENERAL COMMITTEE.

On March 20 the local committee sent out a 3-page follow-up letter containing well-written descriptions of points of interest along the route from New Haven. Attention was directed also to engineering and transportation features of the route. The letter contained reference to company incidents giving "local color" to the story and sufficient historical detail to render the document of considerable reference value.

The holding of this meeting in Waterbury is part of a general plan to secure the active participation of the company section members located away from New Haven, the headquarters of the company.

Toledo Section Membership Passes 1100 Mark

MORE than 800 members attended the meeting of the Toledo joint section on March 4. At this meeting the announcement was made that 762 new members had been secured in a "drive" launched on Jan. 29. This brings the total membership to 1102, and F. R. Coates, president Toledo Railways & Light Company, announced that valuable prizes would be awarded to the five members bringing in the most new members prior to May 1. The program at the meeting was practically all of an entertainment character.

I. E. R. A. Officers and Committeemen

THE complete list of officers and committees of the Illinois Electric Railways Association for the year 1919 is as follows:

Officers: President, W. C. Sparks; first vice-president, E. M. Walker; second vice-president, W. L. Arnold; secretary-treasurer, R. V. Prather.

Executive Committee: D. E. Parsons, chairman; Frank J. Baker, W. C. Sparks, H. E. Chubbuck, C. F. Handshy, Britton I. Budd, E. C. Faber, E. M. Walker, J. R. Blackhall, W. L. Arnold.

Membership Committee: Frank E. Johnson, chairman; E. H. Noyes, G. T. Seely.

Electrical Engineering Committee: E. S. Gillette, chairman; John Leisenring, Charles H. Jones, G. W. Welsh.

Mechanical Engineering Committee: H. A. Johnson, chairman; J. M. Bosenbury, John Sutherland.

Way Committee: John B. Tinnon, chairman; B. J. Fallon, H. F. Merker.

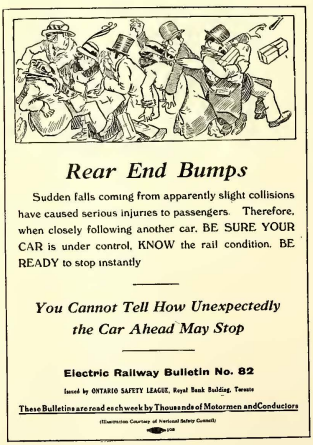
Traffic Committee: C. C. Shockley, chairman; R. Breckenridge, C. F. Speed, E. M. Walker.

Safety Committee: H. B. Adams, chairman; W. H. Heun, Joseph O'Hara, Dr. H. E. Fisher.

Publicity Committee: E. E. Soules, chairman; J. M. Strasser, H. E. Weeks, F. C. Eckman, R. H. Hayward, W. W. Crawford.

Program Committee: H. J. Kenfield, chairman; L. E. Gould, J. W. Busch, A. P. Jenks, W. V. Griffin, Lesley C. Paul.

Ontario Safety League Active



RECENT ONTARIO SAFETY BULLETIN

The fifth annual report of the Ontario Safety League shows that during 1918 the League issued 2500 large cards for posting in street cars, 22,000 bulletins for posting in carhouses and shops and elsewhere, 110,000 cards to motorists, 100,000 letters to parents, 540,000 gummed seals, and other warnings. Through the cooperation of the Ontario Department of Highways a safety card is issued with every automobile license issued by the Province, and the gummed seals are used by merchants and others on outgoing mail. They carry the message, "Be careful. Avoid accidents." The question of how interest can be maintained in the safety movement seems to have been satisfactorily settled by the League, of which J. F. H. Wyse is organizer and engineer.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

New Jersey Strike Settled

Company Will Treat Only with Bodies of Its Employees—Other Matters to Be Arbitrated

Announcement that the joint conference board of the union and officials of the Public Service Railway, Newark, N. J., had accepted the proposed basis of settlement from the federal representatives was made on the afternoon of March 16 by Mr. Ogburn, who is in charge of the railway department of the War Labor Board. Immediately after giving out this information Mr. Ogburn left for Washington, where he reported the situation before the board.

Mr. Ogburn was designated by former President Taft, co-chairman of the War Labor Board, to settle the controversy, if possible, following the appearance before the board on March 14 of representatives of the railway and the union.

Mr. Ogburn arranged for a conference on the morning of March 15 with President Thomas N. McCarter and Edmund W. Wakelee, vice-president of the railway. It was at this conference that Mr. Ogburn and his colleagues submitted the proposed basis of settlement which was accepted by the company. They had previously met the representatives of the employees. In the afternoon the War Labor Board representatives offered the plan to the joint conference board of the men's union, and the board refused to accept the clause in the program submitted by the National War Labor Board's representative which provided that the question of putting into effect of the company's collective bargaining plan be referred to the War Labor Board. The men insisted that the collective bargaining plan be withdrawn, as President McCarter had offered to do on the evening before the strike was called.

On March 16 Mr. Ogburn returned from Washington with a slightly altered draft of the War Labor Board proposition, which the company accepted, and this was put up to representatives of the men on the afternoon of March 16. They promptly accepted it. It was submitted to the union locals on March 17 and approved.

Terms of Agreement

The terms, made public by Mr. Ogburn provide:

That any committee or joint conference board, composed of the employees of the Public Service Railway appointed at a meeting of any division of the Amalgamated Association of Street & Electric Railway Employees of America, shall have the right to deal with the officials of the company concerning any matter or matters in controversy. This does not negative the right of employees to treat with the company directly or through other committees.

It is understood that the company has withdrawn and abandoned its so-called co-operative or collective bargaining plan, recently promulgated.

Any other matters in controversy between the company and its employees may be referred by either party to the National War Labor Board for decision.

It also was provided that all men on strike should return to work upon acceptance of this proposition, and that the workers be reinstated in their old jobs. All matters of wages and conditions of work which were part of the union's demands may be placed before the War Labor Board for decision in the near future.

The principal bone of contention was recognition of the Amalgamated Association, and the withdrawal by the company officials of their collective bargaining plan. The men also asked for ten hours' pay for a nine-hour day.

Thomas N. McCarter, president of the railway, issued a statement declaring that although the agreement provides for recognition of committees of employees the company is supported in its refusal to sign contracts with the Amalgamated Association or any other union of employees.

John L. O'Toole, assistant to President McCarter, when informed that the strikers had interpreted the decision as a recognition of the union, is reported to have said:

We will only treat with bodies of our employees. They can call themselves anything they like.

Mr. Shonts Discusses Port Problem

At a meeting of the Board of Trade & Transportation of New York on Feb. 26 to hear the report of the special committee which made a study of the proposed treaty between New York and New Jersey for joint control and improvement of the waters about New York, Theodore P. Shonts, president of the Interborough Rapid Transit Company, told of the urgent necessity of immediate action to keep clear at this port the channel of the commerce of the world. He declared the problem was one of congestion and advocated the co-ordination of all railroads and spoke in favor of a tunnel under the Hudson River. The situation demanded instant attention, he said, and added that it was not the result of planning, but that it simply grew.

He said that all the New Jersey railroads could be linked up as a solid unit and this done it would afford an economical method for the exchange of freight and would afford one clearing yard for all the boroughs of New York, for New England and for ocean cargoes.

Buffalo Retains Prof. Richey

Will Represent City on Board with James E. Allison to Draw Up New Operating Plan There

Albert S. Richey, Worcester, Mass., professor of electric railway engineering in the Worcester Polytechnic Institute, has been chosen by the City Council of Buffalo, N. Y., as its representative on the board of arbitration which will formulate a plan whereby the International Railway, Buffalo, will be placed under municipal control. Mr. Richey will take the place of Peter Witt, Cleveland, Ohio, who declined to represent the city on the board. The conditions under which Professor Richey accepted this appointment are such that he is not obliged to be the partisan of the city, but can exercise his best judgment on all matters which may come up for decision. The International Railway's representative is James E. Allison, Jr., St. Louis, Mo.

Start on Agreement Soon

During his work in Buffalo, Mr. Richey will be paid at the rate of $150 a day. As soon as the two arbiters agree upon the third member of the board the work of drawing up an agreement between the city and company will be started. The board must also agree upon certain intangible assets of the railway's city lines upon which a fair return will be allowed.

A new phase of the railway tangle in Buffalo developed during the week ended March 15 when a bill was introduced in the State Legislature at Albany giving the municipal authorities permission to enter into an agreement with the International Railway for a service-at-cost plan of operation and guaranteeing the company a fixed return upon its investment. The bill also provides for a compulsory reference of the measure to the voters before it becomes effective, even though it is approved by the Legislature. It is predicted the measure will be defeated. The bill has been approved by the City Council.

The City Council has rescinded its action allowing the International Railway to collect a 6-cent fare with a 1-cent rebate slip pending the determination by the Public Service Commission, Second District, of a just and reasonable rate of fare to be charged in Buffalo. The voters filed petitions and the referendum on the question was to have been held on March 25. The action of the Council rescinding its former action saves the cost of a second referendum, which would be close to $40,000. It was generally conceded the action of the Council would be repealed by the voters.

Ten-Year Grant Suggested

Mayor of Cleveland, Thwarted in Attempt to Extend Tayler Franchise for Year, Makes New Proposal

The Council of Cleveland, Ohio, on March 11 by a vote of twelve to twelve defeated the city administration's proposal for a year's extension of the Tayler grant to the Cleveland Railway pending a vote at the next election on municipal ownership and operation of the railway property.

On March 13 Mayor Davis, in a letter to City Council, proposed that an ordinance be enacted providing for a vote next fall on municipal ownership and operation of the Cleveland Railway property. The Mayor also suggested that Council immediately open negotiations with executives of the railway for a ten-year franchise containing better terms for the car riders than the present grant provides. The Mayor asserted that although, in his opinion, Council made a serious mistake in rejecting the proposed one-year franchise extension, it is imperative that the Tayler grant be extended. He suggested daily sessions of Council, the public and city officials with the railway executives until the railway problem is solved.

In a letter placing his proposal before Council the Mayor said in part:

I feel the present arrangement of private ownership with private operation and public control does not adequately protect the rights of car riders in many essential particulars, and I suggest and insist that the only proper remedy short of municipal ownership is municipal operation and that:

1. A franchise should be drafted and offered to the railway providing for a renewal of the franchise, providing for operation of the lines by the city with the present fixed return to the stockholders by way of rental with proper security given them for the maintenance of the property, and providing therein a separate arrangement by which extensions can be built as required by the needs of the city without the restrictions upon the same, as provided by the present grant.

2. (a) If the present scheme of private ownership and private operation is to be continued, which I deem inadvisable, I suggest and insist that a renewal of the franchise carry with it an incentive for economy of operation by the company, by providing for an increase in the stockholders' return for the period in which the company, by economical management, expends less than its operating allowance and its maintenance, depreciation and renewal allowances, and providing for a decrease in the return to the stockholders when the company over expends its allowances, said allowances to be fixed yearly by a budget system, but otherwise as provided in the present ordinance, thereby making the rate of return to the stockholders depend upon the rate of fare.

(b) If the present general plan is renewed, proper provision should be made in the extension franchise for the making of renewals adequate to promote the growth of the city, by a revision of section thirty of the present ordinance, which at the present time makes it almost impossible for the city to compel extensions in the undeveloped territory.

(c) Provision should also be made in the franchise to do away with the probability of future strikes on the system by providing that the city, in case of disputes between the company and its employees about working conditions, rates of wages, the class and conduct of employees (including grounds of discharge) shall be the final arbitrator, with proper provisions that the company's investment shall not thereby be impaired.

I would ask that each member make it his business to aid these negotiations by presenting the result of his experience and submitting amendments which he deems necessary in the interest of his constituents, to the end that the citizens of Cleveland may secure the best railway service.

On the eve of the negotiations for the renewal of the Tayler grant President Stanley of the Cleveland Railway issued a statement in which he said that while he agreed to the opening negotiations with the city, he was opposed to making any changes that would interfere with rights now held by the company and city. These, he defined, as the security of the company's investment and certainty of dividend, and the city's control of fare and service. According to Mr. Stanley Cleveland has enjoyed the lowest fare and the best service of any of the large American cities under the Tayler grant and this important fact should not be lost sight of in the negotiations.

Among the complaints against the ordinance raised by the city administration is lack of incentive for economy.

In a communication read before the Council on March 17, the Mayor expressed his conviction that Council made a mistake in rejecting his original proposal for a one-year extension of the Tayler grant pending a vote next fall on municipal ownership. He ended with the suggestion that Council should enact his ordinance for a vote next fall and then should proceed to negotiate with railway executives for a ten-year franchise, subject to the right of the electorate to vote at any time on municipal ownership.

A suggestion to meet the complaint of a lack of incentive for economy has come from Fred H. Goff, president of the Cleveland Trust Company, who proposed that the minimum dividend be limited to 6 per cent and that it shall rise as the fare is lowered beyond a certain point, at which the minimum return is to be paid.

Official Acquitted in Brooklyn Accident Trial

After deliberating for four hours and eighteen minutes the jurors in the case of Thomas F. Blewitt, a division superintendent of the Brooklyn (N. Y.) Rapid Transit Company, indicted of manslaughter as a result of the Malbone Street wreck, on Nov. 1, in which more than ninety-five persons were killed and 200 injured, returned a verdict of not guilty in the Supreme Court, at Mineola, Long Island, on March 18. It was charged in the indictment that Blewitt had permitted an inexperienced motorman to take out the train.

The entire day was occupied by both sides in summing up. District Attorney Lewis of Kings severely arraigned the defendant, charging he had assigned men to run trains on the day of the accident who had never acted as motormen before.

A jury will now be drawn to try Anthony D. Lewis, the motorman, whose trial will be called next week. Following the disposal of this case, those of several other indicted officials of the company will probably come up. Lewis ran his train into the walls of a tunnel while acting as a motorman following a strike of the trainmen of the railroad.

Detroit M. O. Vote April 7

Price of $31,500,000 for Detroit United Lines Within City Goes Before Voters at Spring Election

Citizens of Detroit, Mich., will be asked to vote on April 7 whether they approve of the city acquiring the Detroit United Railway system within the 5-cent fare zone at a price of $31,500,000. This was definitely decided at a recent joint meeting of the Street Railway Commission and the Common Council. If approved by the people the city will take possession of the railway system on July 1, 1919. The Common Council informally and in advance approved the financial plans of the Railway Commission for the acquisition of the properties.

COMMISSION OUTLINES PLANS

These plans were outlined in a statement issued by the commission:

The city will pay $15,000,000 in cash to the Detroit United Railway. The balance of the total sum will be made on the partial payment basis.

Interurban, freight and construction cars will continue to be operated by the Detroit United Railway, which is to recompense the city for the use of tracks, etc., on the basis of cost plus 30 per cent.

With the question of the acquisition of the railway system there also will be submitted to the people a proposition to issue public utility bonds to the amount of 2 per cent of the assessed valuation of the city. The sale of these bonds would realize in the neighborhood of $27,000,000. Of this amount, $15,000,000 will be used to make a cash payment to the railway.

The resolution already passed by the Common Council to submit to the voters a bond issue of $10,000,000 for the purpose of piecemeal construction of a municipal system will be withdrawn, and extensions and betterments will be cared for from the proceeds of the one issue of public utility bonds.

Mayor Couzens is quoted as follows:

We are going to submit this price of $31,500,000 to the voters at the next election. If the people want to get control of the lines at once, all right; if not, we are willing to go on with the fight if it is the wish of the people we do so.

It is the best we are able to do at the present time. The present situation is like the smallpox, only worse. The people would be willing to pay $2,000,000 to get rid of the smallpox and have nothing but the fact they were rid of the disease to show for their money.

It is a question now of whether the city is willing to pay an extra $2,000,000 and wipe the Detroit United Railway out as a problem.

The text of the agreement for the sale of the city lines to the municipality was signed by representatives of the city and the company on March 18. As previously stated, an initial payment of $15,000,000 will be made on or about the first day of July and the balance of $16,500,000 on Dec. 31, 1931, with interest at 6 per cent a year from the date of the payment of the $15,000,000. In case the city is unable to make the initial payment of $15,000,000 on July 1 the time is to be extended for not more than ninety days after July 1. After that further extensions are to be secured only by mutual agreement between the railway and the city.

Ex-President Taft on Labor

Explains Basis Upon Which War Labor Board Based Its Action in Making Wage Awards

An unusually interesting speech was made by former President Taft in Atlanta, Ga., recently on the Proposed League of Nations. In the course of his remarks Mr. Taft discussed incidentally the problems of labor, and it is believed that he told for the first time the considerations that governed much of the work of the War Labor Board while he was a member of that body. For this reason the words of the ex-President are of special interest to electric railway representatives and to the employees of such companies. Mr. Taft is quoted in part as follows:

Perhaps you have a right to know why I should speak at a labor meeting. For nine months, as a member of the War Labor Board, I have been forced to study the question of the relations between capital and labor in this country.

The members of the board occupied three weeks in constant discussion, and after a while, to our own great surprise, and I think to the surprise of all twelve of the commission, we agreed and signed the paper.

Now, that paper contained a number of principles. One was that no employer had the right to interfere with the complete right of the laborers to organize into trades unions, to be represented in their dealings with their employers by committees of their own; that no workingmen had a right to interfere with the organizations of employers, and that we approved in the strongest possible way the principle of collective bargaining and of the group system.

And upon that basis we laid down other principles and created machinery by which we took up the differences that might arise between the employers and employees during the war.

The laborers of the world have acquired a greater consciousness of power, and it is for the benefit of the community that the trades unions should be encouraged and recognized and dealt with on the principles of the group system. This will give to the leaders of labor a sense of responsibility and a conservatism that they will not have if employers occupy an attitude of hostility. Unless this is done labor will be driven into hostility and into being reds and radicals, and you will encourage that anarchistic, socialistic spirit that is rife now the world over.

It is essential that the laboring men should acquire a sense of responsibility to society; that the business men who employ should recognize them and deal with them, and come together with them in collective bargaining, so that differences shall be removed.

We have increased wages often and then we have recognized in connection with the increases the necessity especially in public utilities of increasing rates of fare, so that the companies may have the means by which they can pay that rate of wages and other expenses.

That has been done right here in Atlanta and in New Orleans and elsewhere, and the character of the relation is such that if you welcome the organization of labor and put it in a position of responsibility, they ought to feel the obligation to help their employers get what is just for them, because it is not the square thing to get an increase in wages and then ignore the other part of the recommendation of the decree, namely; that the rates of fare also be increased to meet these additional expenses involved in excess costs and higher prices of everything which should be met in some way in order to increase the revenue of the street railway.

New Wage Scale at Wheeling

At a meeting of the Street Railway Men's Local No. 108, embracing the entire Wheeling district, a new wage scale was adopted, as drawn up by the executive board of the organization. The new scale asks for 55, 60 and 65 cents an hour and time and a half for overtime for all motormen and conductors, and a proportionate increase over the old scale for all carhouse men and for women. The present scale is 38, 40 and 45 cents an hour, according to the length of service. It has been stated that the other new working terms are practically the same as the present ones.

The new scale will be submitted to the local railways at once and, if approved, it will become effective on May 1. The union embraces all the Wheeling lines, those in adjacent sections up the Ohio River as far as Steubenville and all lines in the Bellaire, Bridgeport and Martins Ferry section of eastern Ohio. The agreement affects about 500 men and a score or more of women, the latter being employed principally as car cleaners at the carhouses.

Scranton Men Will Ask More

Employees of the Scranton (Pa.) Railway, numbering more than 500 conductors, motormen, track men and barn men, have framed demands for an increase in wages after April 1 of 15 cents an hour. Also, the union is demanding that conductors and motormen shall have every eighth day off and other changes in the present agreement. They request a one-year agreement.

Conductors and motormen are now receiving 41, 43 and 45 cents an hour, this scale having been awarded them by the War Labor Board, following the strike last summer. The demands of the men are for increases to 56, 58 and 60 cents an hour.

The War Labor Board award dates from June 2, 1918, and it provides that "this scale shall prevail during the duration of the war but after Feb. 1, 1919, it may be opened at periodical intervals of six months for the making of adjustments as may be deemed necessary." The present agreement between the union and the company was signed on April 1, 1916, and expires April 1, 1919.

Officers of the union say that they are taking the stand that the war is over and that the War Labor Board award must be superseded after April 1 by a new agreement made between the workers and the company.

Women Again the Issue

Arguments in the appeal from the recommendation of the National War Labor Board that women conductors at Cleveland, Ohio, be discharged to satisfy demands of striking male employees were heard on March 13 by the board. The case was taken under advisement.

Dr. Anna Howard Shaw, honorary president of the National American Woman Suffrage Association; Frank P. Walsh, former joint chairman of the board, and Miss Mary Van Kleeck, director of the women-in-industry service of the labor department, were among those who appeared in behalf of the discharged women workers, while James H. Vahey, attorney for the Amalgamated Association of Street & Electric Railway Employees, opposed the appeal.

Dr. Shaw declared that during the war women in all parts of the country had responded nobly to the nation's call for workers, but now that the acute need for workers had passed, there was a tendency to "get rid of" the women. Dr. Shaw said:

Men employes demand it, and because they are organized, they have power to enforce their demands. The worst of it is that many of the men so employed were never in the military service, but had left to enter "safe" employment.

Mr. Walsh said the board should declare that women were legally entitled to the same rights in industry as men. The women conductors of Cleveland were unjustly discharged, he said, and should be reinstated.

Miss Van Kleeck told the board that women's claim of freedom to choose occupations was the greatest labor issue before the country.

Mr. Vahey argued that the board was not legally empowered to order the re-employment of the women conductors, since its jurisdiction extended only to cases where labor disputes between employees and employers threatened to result in a strike.

B. R. T.'s Labor Policy Stated

Lindley M. Garrison, receiver of the Brooklyn (N. Y.) Rapid Transit Company, has expressed a willingness to recognize the right of the men to organize, but he has made it plain that the company will deal only with its own employees. In the current issue of the *B. R. T. Monthly* Mr. Garrison writes:

No attempt will be made to prevent any employee from joining any organization that he pleases. On the other hand the management of the system will, as heretofore, deal with the committees of its own employees in all matters affecting the relation of its employees to the system.

The purpose in addressing the employees, in view of the recent newspaper publicity given to the most recent ruling of the War Labor Board, is to indicate the position of the system under its present management and to prevent any misunderstanding in respect thereto.

The Amalgamated Association is at present engaged in an effort to organize the trainmen in Brooklyn into a local under its domination.

At a recent labor meeting in Brooklyn a tentative draft was read of the conditions and suggestions that are to be taken up with the company. It calls for a better working understanding and a board of arbitration representing the workers and the company. Section 5 of the temporary preamble calls for an eight-hour day for all conductors, ticket agents and station men, and demands that all work in excess shall be overtime, and shall be paid for at the rate of time and a half. It is also demanded that the company pay all extra men who answer to the rollcall at the rate of $21 a week. The proposed agreement will also stipulate that entries shall not be placed against an employee without the opportunity of a hearing to answer the charge.

The Proper Spirit

The electric railways were in the vanguard of those employers who announced that places were open to all men who entered the service of the government during the war. The instances of the large companies that did this are many. Public recognition in their cases has been freely given. The smaller companies, however, have been no less active in the interest of their men returning from the front. Their work, too, has attracted much attention and been commented on favorably. One of the more recent instances among the smaller companies is that of the Hot Springs (Ark.) Street Railway. Here is what the *New Era* of that city said under "The Proper Spirit" on Feb. 21:

> Of course all corporations are soulless. And this especially applies to public utility corporations. But there is one particular corporation of which we know that seems to have risen to the "Great Idea," and in a manner that would indicate that one corporation is at least part human, and possesses some modicum of soul.
>
> This is our own Hot Springs Public Utility Company. When the big doings started over in Europe many of their men promptly volunteered while others were taken by the selective service plan. No objection was made to their departure—in fact they were encouraged. Neither was any promise made as to holding their jobs for them, but every man that has returned has stepped into his old job.
>
> The street railway has put ten of its men back to work, with all the rights, seniority and increased pay that they would have secured by remaining at home.

The paper named the men at the conclusion of its editorial.

N. E. L. A. Deprecates Advocacy of Municipal Ownership

Public ownership is discussed in the interim report of the public policy committee of the National Electric Light Association. Among the members of the committee are H. G. Bradlee, Walton Clark, H. L. Doherty and Samuel Insull. In referring to the electric railways the committee says:

> Prominence has been given in recent months, and is likely to increase, with regard to the financial condition of the electric railways throughout the country.
>
> In the stress of conditions above outlined, it has been suggested in some quarters that the most practicable and effective solution of the electric railway problem is in municipal ownership since, if the municipalities should acquire the electric railways, the additional revenue required would be forthcoming either through increased fares or indirectly through taxation.
>
> We recognize the extremity of the railway companies and the advantage that such suggestion may offer to some of them individually, but we deem it necessary to say that the opinion of your public policy committee, as hitherto frequently expressed, continues with increasing conviction that municipal ownership of electric lighting, gas and electric railway companies is economically unsound and cannot redound to the mutual benefit of the consumers and the municipality. We think it is only fair publicly to reaffirm our views upon this subject at this time when temptation to the encouragement of municipal ownership by utilities companies themselves seems apparent.

Urges Franchise Forfeiture

Urging that the city of Birmingham, Ala., institute quo warranto proceedings in the courts seeking to have the franchise of the Birmingham Railway, Light & Power Company forfeited to the city, a statement has been issued by the public utilities committee of the Birmingham Civic Association. The statement urged that the city institute the proceedings before properties pass into the hands of a reorganization committee in the course of the present receivership proceedings.

The statement issued by the committee deals with a statement previously issued by Forney Johnston, special attorney for the city, in which he said that he had evidence on which a forfeiture of the franchise could be asked. In his statement Mr. Johnston suggested that satisfactory terms could probably be made by the city with the receiver and a re-organization committee.

The committee of the Civic Association in its statement asks that litigation be started in an effort to revoke the franchise and points out that in the event the franchise is revoked the city will be in a position to dictate terms and arrange, if it is desired, for the purchase of the property.

News Notes

Sioux City Men Want More.—Employees of the Sioux City (Ia.) Traction Company have petitioned the company for an increase of 15 cents an hour effective on May 1. The men are now receiving 30 and 35 cents an hour.

Railway Brotherhood Again Active.—A movement is under way in Terre Haute, Ind., asking organized labor in that city to support a demand of the trainmen of the Terre Haute, Indianapolis & Eastern Traction Company that the company recognize the Order of Railway Conductors and the Brotherhood of Locomotive Engineers as the official unions of traction conductors and motormen.

Labor Department Commends St. Louis Company.—The United States Department of Labor at Washington has commended the United Railways, St. Louis, Mo., for the co-operation of the company in taking back men, with seniority pay, who served during the war in the army, navy and marine corps. The Labor Department was informed of the United Railways co-operation by Frederick B. Dolan, special agent of the department, who forwarded to Washington a card which the railway is displaying in vestibules of 1300 cars.

Municipal Ownership Bill in Missouri.—A series of four bills and two joint and concurrent resolutions submitting constitutional amendments permitting St. Louis, Mo., to own and operate electric railroads and terminals and providing the machinery for condemning property for such purposes have been introduced in the House of Representatives by Representative Davidson of St. Louis. One measure provides that cities of more than 500,000 are "hereby given the power to build and operate street railroads, terminal railroads and railroads of all other descriptions."

Rights Waived to Hasten Purchase.—To facilitate the closing of the deal for the purchase of the railway lines of the Puget Sound Traction, Light & Power Company in Seattle, Wash., by the city all parties to the recent "friendly" action against the city in the State Supreme Court, to test the validity of the deal, have agreed to waive their statutory rights, and consent to an immediate closing of the transaction. The law provides that the plaintiffs have thirty days from the date the Supreme Court upheld the city's right to buy the Seattle railway system to file a motion for rehearing.

St. Louis Men to Ask More.—Motormen and conductors of Division No. 788 of the Amalgamated Association at St. Louis, Mo., have voted unanimously to open their contract with the United Railways on April 1 and demand a new wage scale of 60 cents and 65 cents an hour and the basic eight-hour day. The present wage is 36 cents and 42 cents an hour, based on nine hours for the day's work. This wage was fixed at the conclusion of the strike, in February, 1918, and the contract entered into was for three years, dating from June 1, 1918, with the privilege of reopening the matter for the adjustment of wages and hours.

New Jersey Tunnel Bill Defeated.—The Upper House of the Legislature of New Jersey on March 18 defeated the bill of Senator Edwards of Hudson, providing for a thirty-five-year bond issue of $12,000,000 toward the construction of the proposed vehicular tunnel under the Hudson River from Jersey City to New York and a bridge over the Delaware from Camden to Philadelphia. It is possible the matter will now be taken up by referendum. New York and New Jersey had already made preliminary appropriations. The Public Service Corporation of New Jersey had made extensive studies of the matter on its own account at considerable expense to itself.

No Funds for Paving.—Charles L. Kurtz, president of the Columbus Railway, Power & Light Company, Columbus, Ohio, recently sent a communication to Director of Public Service Bordon in which he stated that it will be impossible for the company to co-operate with the city this spring in paving portions of Broad, Main and Fourth Streets, because of a lack of funds for the purpose. He expressed a willingness to bear a portion of the expense when the company is financially able to do so. The letter called attention to the fact that legislation is pending in the City Council for an increase in the rate of fare and that this may afford sufficient relief for the company to pave its portion of the streets at some fu-

ture time. The city engineer has advised against paving the city's portion of the streets until the company can take care of the remainder.

Another Attempt to Curb Commission.—Measures designed to curtail the jurisdiction of the Public Service Commission of Missouri and to give to the cities control of the public utilities which operate within the municipalities have been reported unfavorably by the House judiciary committee. In December representatives of towns and cities met in Kansas City and agreed to take concerted action to curb the powers of the commission in retaliation for decisions considered by city representatives as inimical to their best interests. Later two bills along these lines were approved by representatives of the municipalities, and delegations from Kansas City and other towns and cities appeared before the judiciary committee urging that the measures be approved. The bills have been reported unfavorably and the matter of curtailing the power of the commission will probably be dropped.

Labor Board Jurisdiction Denied.—The Louisville & Northern Railway & Lighting Company and the Louisville & Southern Indiana Traction Company, New Albany, Ind., through the president, Harry L. Reid, has refused to recognize the jurisdiction of the War Labor Board in settling the wage grievances of employees. This announcement was made when employees of the companies met with representatives of the War Labor Board to present their grievances. Men employees on the lines receive a wage scale ranging from 31½ cents an hour to 36½ cents an hour. The motormen and conductors on the lines running between Louisville and New Albany, and Louisville and Jeffersonville receive from 34 cents to the maximum of 39 cents an hour. The men contended that they were unable to live properly on these wages and requested the War Labor Board to grant them an increase. The exact rate of increase is not set forth.

No Enthusiasm for Local Ownership.—The committee of twelve representative business men and taxpayers headed by W. E. Massey, Ocean City, N. J., appointed some weeks ago to look into the feasibility of raising subscriptions to purchase the Ocean City Electric Railway, made its report at a recent meeting. The committee said it was difficult to interest a sufficient number of property owners to raise the $84,000 necessary, and recommended that the road be operated through the co-operation of the city. The taxpayers at the meeting said that the electric railway must be in operation during the coming season. The committee, the city commissioners and representatives of the bondholders of the railway will hold another meeting when an effort will be made to arrange with the company to operate the road under a guarantee from the city to make up any deficit. It is thought the road will lose not more than $4,000 for the season.

$1,000,000 for Grade Crossing Removal.—The Public Service Commission for the First District of New York has asked the Legislature to make an appropriation of $250,000 to be applied toward the removal of dangerous grade crossings in the Borough of Queens. The twenty-one grade crossings referred to are on the Atlantic Avenue electric division of the Long Island Railroad between East New York and Jamaica. The appropriation of $250,000 by the State will make available $1,000,000 to be applied to this project, as the State's appropriation under the grade crossings law must be met by a like sum from the city and twice as much by the railroad company. With $1,000,000 available the work can be begun and advanced substantially before an additional appropriation will be required.

General Harries Before Supreme War Council.—Brig.-Gen. George H. Harries, commander of the American military force at Berlin, has been at Paris for several days to appear before the Supreme War Council to render a report on the military and economic situation at the German capital and throughout Germany. He has given an account of events in Berlin during the last three months, culminating in the serious street fighting of the last fortnight. When the American party left Berlin, the Government forces under Gustave Noske, the German War Minister, had the upper hand and, in General Harries' opinion, the government will control the situation, particularly if food is sent to aid in holding back the Bolshevik menace from the eastern border. It will be recalled that General Harries, who is a former president of the American Electric Railway Association, was reported some few weeks ago to have had a narrow escape from serious injury during the street fighting in Berlin in which the Spartacides participated.

Franchise Controversy in Bellaire.—The City Council of Bellaire and the Wheeling (W. Va.) Traction Company are engaged in a battle which is attracting considerable attention throughout West Virginia. Some time ago the franchise of the company to operate cars through Bellaire expired, and no agreement on a new franchise having been reached the city decided to charge the company $20 a day for the use of the streets. A bill of upwards of $7,000 has accumulated under the order and an effort is to be made to collect it. Superintendent Billings of the railway has announced that the company intends to ask permission to establish a 10-cent fare between Bellaire and Wheeling, the 5-cent fare limit to be at Stop 9, West Wheeling. The superintendent has also stated that if Bellaire insists on the company paying $300 a mile rental for the use of the city streets by the company, the company would discontinue operating cars in the city rather than establish the precedent of paying the franchise rental.

Programs of Meetings

New England Street Railway Club

The nineteenth annual meeting and dinner of the New England Street Railway Club will be held at the Copley-Plaza Hotel, Boston, Mass., on March 27. The annual meeting will be held at 3 p.m., and the dinner at 6 p.m. The speakers at the dinner will be:

Calvin Coolidge, Governor of Massachusetts.

Andrew J. Peters, Mayor of Boston.

James E. Watson, United States Senator from Indiana.

R. W. Perkins, president of the club, will preside.

The tickets to the dinner will be $5 each. Applications, accompanied by cash, money order or check, should be made promptly to George W. Knowlton, secretary of the club, or to Fred F. Stockwell, chairman of the banquet committee.

Pacific Claim Agents' Association

At a meeting of the executive committee of the Pacific Claim Agents' Association held in Portland, Ore., on March 1, it was decided to hold the next meeting of the association on June 19, 20 and 21 in Oakland, Cal. The following papers are to be discussed:

JUNE 19

"The Psychology of Claims Adjustments," by J. H. Handlon, claim agent of the United Railroads, San Francisco, Cal.

"The Claimant, the Claim Department and the Physician and Surgeon," by F. J. Lonergan, attorney for the Portland Railway, Light & Power Company, Portland, Ore.

"Motor Vehicle Accident Investigation and Adjustment," by S. A. Bishop, claim agent of the Pacific Electric Railway, Los Angeles, Cal., and V. Laursen, solicitor of the British Columbia Electric Railway, Ltd., Vancouver, B. C.

JUNE 20

"The Safety Problem":

(a) "Of the Companies," by Thomas G. Aston, claim agent of the Washington Water Power Company, Spokane, Wash.

(b) "Of the Public," by Sergeant Lewis of Portland Police Traffic Bureau, Portland, Ore.

Written discussion by Charles A. Blackburn, claim agent of the Butte (Mont.) Electric Railway, Butte, Mont.

"Office Kinks in Claim Departments," by Thomas A. Cole, claim agent of the Los Angeles (Cal.) Railway Corporation.

"How to Handle Fraudulent Claims and Actions Having No Merit," by Frank D. Oakley, attorney for the Tacoma Railway & Power Company, Tacoma, Wash.

"Benefits of the Pacific Claim Agents' Association," by B. F. Boynton, claim agent of the Portland Railway, Light & Power Company, Portland, Ore.

The morning session on June 21 will be devoted to an open discussion of claim department problems.

Financial and Corporate

Sufferings of St. Louis

Percentage of Increase in Operating Expenses Five Times That in Passenger Revenue

Although the passenger revenue of the United Railways, St. Louis, Mo., for the calendar year 1918 increased $507,806, or 3.90 per cent, owing to the fare increase on June 1, the current operating expenses rose $1,500,685, or 19.68 per cent. The passenger revenue for the first five months of the year decreased 4.57 per cent, while for the last seven months' period of 6-cent fare it increased 9.82 per cent. The large increases in expenses became effective in June. The amount paid out in wages in 1918 was 42.61 per cent of the gross operating revenue.

The operating expenses for 1918 showed the following increases as compared with 1917:

Way and structures	$66,982	9.50%
Equipment	248,982	24.61%
Power	31,341	2.11%
Conducting transportation	974,230	31.69%
General and miscellaneous	179,149	13.27%
Total	$1,500,685	19.68%

The increase in operating expenses was caused by the increase in wages amounting to 35 per cent, effective March 1, 1918, and an increase in the price of all material used in the operation and maintenance of the property. Operating expenses (including depreciation) increased $1,562,372, or 16.98 per cent.

The interest charges increased $17,641, or 0.69 per cent, and the result for the year suffered a loss from a net income of $642,976 in 1917 to a deficit of $400,299 for 1918.

The loss in earnings during the strike period in February was approximately $185,000. The back wages paid employees amounted to $349,800, which was paid out of the 5-cent fare effective until June 1.

The 6-cent fare, which was in effect during seven months of the year, showed only a 10.32 per cent increase in revenues, while the decrease in the number of passengers was 7.82 per cent. The total number of passengers carried during 1918 was 376,985,727, or 26,314,969 passengers less than the previous year. The passengers in 1918 averaged 8.90 per car-mile as compared with 9.17 per car-mile in 1917. The percentage of passengers using transfers was 53.32 per cent, and the average fare per passenger was 3.59 cents.

COMPARATIVE INCOME STATEMENT OF UNITED RAILWAYS OF ST. LOUIS FOR YEARS ENDED DEC. 31, 1917 AND 1918

	1918 Amount	1918 Per Cent	1917 Amount	1917 Per Cent
Revenue from transportation	$13,551,542	99.4	$13,038,622	99.3
Revenue from other railway operations	88,077	0.6	86,937	0.7
Gross operating revenue	$13,639,619	100.0	$13,125,559	100.0
Current operating expenses	$9,126,514	66.9	$7,625,827	58.1
Depreciation	1,636,754	12.0	1,575,067	12.0
Taxes	852,476	6.3	853,161	6.5
Total	$11,615,744	85.2	$10,054,055	76.6
Income from operation	$2,023,875	14.8	$3,071,504	23.4
Non-operating income	116,698	0.9	94,702	0.7
Gross income	$2,140,573	15.7	$3,166,206	24.1
Interest and miscellaneous charges	2,540,872	18.6	2,523,230	19.2
Net income	$400,299	†2.9	$642,976	4.9

†Deficit

Union Traction Net Falls

Increase in Operating Costs in 1918 Outweighs the Gain in Revenues, Cut by Jitney Competition

The annual report of the Union Traction Company of Indiana, Anderson, Ind., shows a deficit of $98,542 in net income of the company for 1918. This was caused principally by a decrease in business and an increase of 10 per cent in the cost of operation.

The revenue from operation for 1918 was $3,198,820, and the operating expenses $2,236,487. While the operating revenue in 1918 was 4.32 per cent greater than in 1917, the operating expenses were 10.52 per cent greater than in the year previous. The net operating revenue suffered a loss of 7.42 per cent.

For the year 1918, after a deduction of sinking funds, the deficit amounted to $98,542 as compared with a net of $42,142 in 1917. Officials of the company report that the business outlook has improved since Jan. 10.

A total of 16,597,199 passengers were carried on interurban and city lines in 1918, which was 3,086,077 fewer than in 1917. The inroad made by the jitney bus traffic was demonstrated by the fact that the company carried 7,402,744 passengers on its city lines in 1918, as compared with 8,375,460 in 1917.

Detailed financial and statistical statements for the last two calendar years are given in the accompanying statements.

INCOME STATEMENT OF UNION TRACTION COMPANY OF INDIANA FOR YEARS ENDED DEC. 31, 1917 AND 1918

	1918 Amount	1918 Per Cent	1917 Amount	1917 Per Cent
Revenue from transportation:				
Passenger	$2,577,556	80.54	$2,588,176	84.40
Baggage	7,703	00.25	8,966	00.29
Parlor, chair and special car	2,215	00.07	7,787	00.52
Mail	2,744	00.09	1,836	00.05
Express	111,912	03.50	107,330	03.50
Milk	16,190	00.51	15,011	00.48
Freight	404,333	12.65	262,721	08.59
Switching	72	.....	.....	.....
Total	$3,122,725	97.61	$2,991,830	97.56
Revenue from operation other than transportation	76,095	2.39	74,636	02.44
Operating revenues	$3,198,820	100.00	$3,066,466	100.00
Way and structures	$430,992	13.47	$366,641	11.95
Equipment	282,691	08.84	227,902	07.46
Power	570,907	17.85	496,420	16.18
Conducting transportation	592,216	18.51	547,091	17.84
Traffic	8,807	00.28	16,218	00.52
General and miscellaneous	350,874	10.96	369,334	12.04
Total	$2,236,487	69.91	$2,023,609	65.99
Net operating revenue	$962,333	30.09	$1,042,857	34.01
Taxes	138,909	04.34	142,589	04.65
Operating income	$823,424	25.75	$900,268	29.36
Other income	21,627	0.67	16,531	0.54
Gross income	$845,051	26.42	$916,799	29.90
Deductions	943,593	29.50	874,657	28.52
Net income	†$98,542	03.08	$42,142	01.38

†Deficit

COMPARATIVE STATISTICS FOR YEARS ENDED DEC. 31, 1917 AND 1918

	1918	1917
Passengers carried, interurban lines	9,194,455	11,307,816
Passengers carried, city lines	7,402,744	8,375,460
Total passengers carried	16,597,199	19,683,276
Freight handled (tons)	110,613	100,234
Express handled, exclusive of Wells, Fargo & Company Express (tons)	8,821	7,816
Mileage of cars, interurban lines	6,288,345	6,915,933
Mileage of cars, city lines	1,494,056	1,675,822
Total mileage of cars	7,782,401	8,590,755
Coal consumed at all plants (tons)	114,646	120,045
Power generated (a.c.) at all plants (kw.-hr.)	44,786,500	50,397,180
Power generated (d.c.) at all plants (kw.-hr.)	26,094,237	28,591,247

Receiver for New York Railways

Company Operating Many Surface Lines in Manhattan Borough Succumbs Under War-Time Burdens

Job E. Hedges, lawyer, noted after-dinner speaker, and one-time Republican candidate for Governor, was appointed receiver of the New York (N. Y.) Railways on March 20 by United States Judge Mayer. The petition was presented by the American Brake Shoe & Foundry Company, which is a creditor to the amount of $36,806. An answer filed by the railway at the same time that the petition was presented admitted all the allegations made in the complaint. The concurrence of the defendant in the action makes the transfer of the railroad property to the court a friendly proceeding.

Theodore P. Shonts, president of the railway, when asked how the receivership would affect the Interborough Consolidated Corporation and the Interborough Rapid Transit Company, declined to comment except to make it clear that only the New York Railways had been put in the hands of the court.

The New York Railways has been in financial straits for some time. The recent failure of the directors to declare a dividend on Interborough Rapid Transit Company stock aroused interest in the Interborough Consolidated, the holding company which has interest to pay on April 1 on Interborough-Metropolitan bonds. The holding company has depended almost entirely in the past for its income on the dividends paid on the stock of the Interborough Rapid Transit Company.

The allegations contained in the papers filed in court followed the line of statements issued by Mr. Shonts in the last eighteen months. They speak of the threatened disintegration of the property through lack of income to meet pressing obligations, the danger that inefficiency in operation resulting from lack of money and of borrowing capacity will embarrass the public, that a complete cessation of operation may be brought about, and that if many suits for debts were instituted the property might be entirely destroyed. The petition speaks thus of the earnings of the company:

> For the fiscal year ended June 30, 1918, the results from operation of defendant's system were such that the income was $153,633 less than the amount required to pay the interest on the first real estate and refunding mortgage 4 per cent bonds; that for the second six months of 1918, the defendant's income of the period was $738,187 less than the amount sufficient to pay such interest; that on Dec. 31, 1918, defendant's corporate deficit was $2,125,039; that all of the defendant's special and reserve funds have been exhausted and that the defendant has not sufficient credit to obtain the moneys requisite for the operation of its property.

In its answer to the complaint the railways admitted all of the allegations and joined in the prayer for the appointment of a receiver in order to preserve the system "as it has been maintained and operated," and particularly to preserve the "franchises, privileges, and property" and its corporate existence and the real and personal property. The petition makes no mention of any value set upon the property beyond stating the amount of the capital stock.

Mr. Hedges' appointment is temporary. At a hearing to be held on March 31 the appointment will doubtless be made permanent.

The New York *Times* says that Travis H. Whitney, acting chairman of the Public Service Commission, in discussing the receivership said that as the floating debts of the company amounted to $1,600,000 the receivership was inevitable. Asked what the value of the company's plant was he replied that the most recent statement of figures placed it at $65,000,000 in normal times and $85,000,000 at war-time prices. Mr. Whitney was quoted as follows:

> I shall be glad to co-operate in any way possible to insure a continuation of the service so that the public will not be inconvenienced. I hope the receiver will be able to handle the property so as to avoid a separation of the various lines, which would result in additional fares through the abolishment of transfers. The situation has been so serious that there was really no way out but to apply to the courts for relief.

Francis Sisson, vice-president of the Guaranty Trust Company, gave an interview to the *Sun* on March 19 which clarifies some of the questions at issue in connection with the inter-corporate relations of the New York companies and their need for more revenue. He also went over much of the ground covered by him in his address before the American Electric Railway Association at the meeting on March 14.

Oakland Valuation Planned

Following the plan outlined by the advisory board named by the City Council of Oakland, Cal., to take up the matter of the purchase by the city of the properties of the San Francisco-Oakland Terminal Railways, there was filed with the Railroad Commission of California on March 11 by the city attorney of Oakland, a request that the commission place a value upon the properties involved, which consist of the entire holdings of the company as they existed on Sept. 24, 1918, the date of the company's second application for a resettlement franchise. The original application was filed on Feb. 28, 1917. With the present request is filed a stipulation by the railway in which it agrees not to urge in the valuation proceedings the use of higher unit prices resulting from increases in the price of labor and materials occurring between the applications; also an agreement to reimburse the city of Oakland for the expense entailed by the valuation proceedings.

The application involves sixty-nine franchises in Oakland. The earliest franchise was issued in 1883 to the Oakland Railway. The sale will include all franchises held by the company in the city of Oakland except the suburban and interurban railroad franchises which were granted to the San Francisco, Oakland & San Jose Consolidated Railway and are used in connection with the ferry system.

$1,403,585 Is St. Louis Estimate of Year's Loss

A report submitted to the Public Service Commission of Missouri by the United Railways, St. Louis, Mo., for January shows that although fares have increased 20 per cent the passenger revenue increase is only 11.52 per cent for the eight months the 6-cent fare has been in operation. During the same period the number of revenue passengers has decreased 6.51 per cent. The communication of the railway to the commission follows in part:

> Complying with your order of May 15, 1918, we are hereby transmitting our operating report for January, 1919.
>
> We also inclose—
>
> (a) A table of statistics showing that for the eight months during which the 6-cent fare has been collected on city lines, the passenger revenue has increased 11.52 per cent, although the increase in fare was 20 per cent, and during this period the number of revenue passengers on city lines has decreased 6.81 per cent.
>
> (b) An estimate of the results of a year's operation under the 6-cent fare, based on the actual results of the eight months' operation, showing that for the year ending May 31, 1919:
>
> 1. The city lines will show a deficit of $695,285 in earning 6 per cent on a valuation of $52,800,000.
>
> 2. The county lines will show a deficit of $708,300 in earning 6 per cent on a valuation of $7,200,000.
>
> 3. The combined system of city and county lines will show a deficit of $1,404,585 in earning 6 per cent on a valuation of $60,000,000, which was the tentative valuation adopted in your order of May 15, 1918.
>
> We are submitting these figures so that your honorable commission may fully understand the situation.

Six New Directors at Dallas

The annual meeting of the directors of the Dallas (Texas) Railway was held in Dallas during the week ended March 15 for the election of officers and the transaction of other business. According to a statement given out from the office of President J. F. Strickland following the meeting, the poor showing which the company is making in financial returns and how to improve these conditions and increase the earnings were the most important matters considered. It was said that no line of action was determined on.

The program of improvements for 1919 under which $1,250,000 must be spent also was discussed. The company is not yet ready to announce all the new improvements to be made to comply with its franchise provisions for which it is bonded to the city.

Six new directors were elected as follows: La Monte Daniels, Charles F. Weiland, John V. Hughes, W. B. Head, C. E. Calder and G. A. Trumbull. The following directors were re-elected: Fred E. Johnston, J. C. Duke, M. L. Morris, W. R. Ellis, C. W. Hobson, H. A. Olmsted, J. H. McDonough, J. F. Strickland, J. K. Hexter, S. W. King, Jr., R. D. Suddarth, Orville Thorp, M. B. Shannon, W. S. Mosher and F. R. Bissell. Officers were elected as follows: C. W. Hobson, chairman of Board; J. F. Strickland, president; J. C. Duke, W. B. Head, C. E. Calder and Richard Meriwether, vice-presidents; J. B. Walker, secretary and treasurer; C. L. Cox, J. C. Thompson and W. R. Burns, assistants to the secretary and treasurer.

Financial News Notes

Dividend Action Put Off.—No action was taken in regard to the declaration of a dividend by the directors of the Toronto (Ont.) Railway at the meeting on March 11.

Receiver for Philadelphia Railways.—Judge Rogers in the Common Pleas Court No. 2 at Philadelphia, Pa., on March 13 appointed Murdock Kendrick as temporary receiver of the Philadelphia Railways. A further hearing will be held on April 15 to decide whether or not the receivership shall be made permanent.

Buffalo-Lockport Line Sold.—The property of the Buffalo, Lockport & Rochester Railway, Rochester, N. Y., was sold under foreclosure at Rochester on March 12 for $500,000 to W. A. Matson and W. W. Foster, Rochester, representing the bondholders. The plans for the reorganization of the company have been reviewed previously in the ELECTRIC RAILWAY JOURNAL.

Service Resumed in Natchez.—Electric railway service at Natchez, Miss., has been resumed after a suspension on all but one line for three months. It was stated by the Southern Railway & Light Company, owners of the system, that the suspension was made in order that repairs on track and equipment could be made. With the resumption of service the transfer system is eliminated but the old fare of 5 cents is retained.

New Jersey Company Increases Dividend.—The Public Service Corporation of New Jersey, Newark, N. J., has declared a quarterly dividend of 1½ per cent on the common stock, payable on March 31 to stock of record of March 28. The last two quarterly disbursements were of 1 per cent each, while two previous quarterly payments were 2 per cent, making a total of 6 per cent paid during 1918. A monthly dividend of ⅔ of 1 per cent was declared on the new 8 per cent cumulative preferred stock of the company, payable on March 31 to stock of record of March 20. This is at the rate of 8 per cent annually, but it was announced that hereafter payments on the preferred stock would be made quarterly.

Plans to Increase Authorized Stock.—Stockholders of Cities Service Company, New York, N. Y., at the annual meeting of the company in Dover, Del., on April 8 will be asked to approve an increase in the authorized preferred capital stock of the company from $100,000,000 to $150,000,000. It is felt by the directors in view of the great expansion of activities of the company, that provision should be made for its future financial requirements as well as for the conversion of the outstanding senior securities through the approval by the stockholders of a larger authorized amount of preferred stock, even though it is not the intention of the directors to issue any of the new stock in the near future.

Bay State Foreclosure Decree Entered.—Judge Morton in the United States District Court at Boston, Mass., has ordered the entry of a decree for the foreclosure of two refunding mortgages totaling $15,000,000 against the Bay State Street Railway. This is an important step toward the reorganization of the Bay State Street Railway. The Old Colony Trust Company and the American Trust Company petitioned the court. The Boston & Northern Street Railway and the Old Colony Street Railway are subject to the foreclosure order. The decree, when presented, will provide for transfer of the mortgage from the Bay State Street Railway to its successor under the reorganization plan, the Eastern Massachusetts Street Railway. When the reorganization is completed, the Bay State Street Railway will be under public control, similar to the Boston Elevated Railway. The terms of the proposed reorganization were reviewed in the ELECTRIC RAILWAY JOURNAL for March 15.

Holders of Birmingham Notes Act.—A committee which has addressed the holders of the 6 per cent two-year gold notes of the Birmingham Railway, Light & Power Company, Birmingham, Ala., due on April 1, 1919, says it is advised that there are no funds available for the payment of the notes, or interest thereon, due on April 1, 1919, and that in all probability default will be made in the payment of the notes and the interest. The company is already in the hands of a receiver and the committee representing the notes says the appointment of a receiver creates a condition which confers upon the trustee for the note issue the right, upon the written request of 35 per cent in amount of the notes outstanding, to declare the principle of all said notes immediately due and payable. Holders of the notes are being urged to deposit their securities with the Equitable Trust Company, New York, the depositary under the noteholders' protective agreement dated Feb. 15. The chairman of the committee representing the holders of the notes is Thomas J. Walsh, of E. H. Rollins & Sons, New York, N. Y.

Commission Can't Act Pending Dissolution Action.—The Public Service Commission for the Second District of New York has ordered closed on its records the complaint of the residents of Melville, L. I., against the Huntington Railroad over proposed discontinuance of service. Commissioner Fennell, who heard the complaint, said that, since the company is continuing to operate its road pending an action in the Supreme Court for dissolution, no issue is left for determination by the commission. It was stated that the papers in the proceedings for a dissolution are prepared and ready for service. The company, prior to 1910, operated from Huntington Station to Huntington Village and Huntington Harbor, Long Island, 3 miles. It was then extended about 15 miles across Long Island to Amityville. The company showed that from 1910 to 1917 its operating loss was $55,180, and in 1918, $15,764; operating revenue 1910 to 1917 inclusive, $380,423, and expenses including taxes, $435,603; operating expenses 1918, $56,964. The capital stock is $30,000; bonded debt $26,000; accrued interest since 1910 $11,000, and unfunded debt, $600,000.

Buffalo Troubles Multiplying.—The International Traction Company of New Jersey, which owns a large part of the stock of the International Railway, Buffalo, N. Y., faces foreclosure proceedings on April 1 when the ninety days of grace expire on the payment of interest on its $18,000,000 of collateral trust 4 per cent gold bonds. The interest became due on Jan. 1, 1919, and was not paid because the International Railway has not declared a dividend since March, 1918. The interest on the railway's bonds was paid a month ago at the expiration of the ninety days of grace, after $425,000 had been borrowed from New York interests. An addition of 5 per cent was made to the unpaid taxes of the International Railway on March 15. The taxes were due the city on March 1. The bill is approximately $300,000. An additional fee will be charged every month the tax is not paid. The $300,000 due the trainmen as back wages is due in April. The back pay is based on the award of the War Labor Board which gave the men a retroactive wage increase from June 1, 1918, to the time of the strike in October. The company has not sufficient funds with which to pay the men this award.

More People at Greater Cost.—The Dallas (Tex.) Railway carried more people during January, 1919, than in any previous month of its history, according to a report compiled by Grover C. Bland, chief accountant in the office of the Supervisor of Public Utilities. The report shows net earnings at the rate of only 3.63 per cent, however, despite the large number of passengers carried. Under the service-at-cost franchise the company is permitted to make a net return of 7 per cent on the agreed valuation. The report shows total revenues of $175,569 as compared with $120,676 in January a year ago, a gain of $54,892. The net return on the investment during January, 1918, amounted to 2.22 per cent. The operating expenses during January, 1919, amounted to $155,143, while the expenses during January a year ago amounted to $109,104. The report further shows that 3,468,396 revenue passengers and 540,950 transfer passengers (a total of 4,000,346) were carried during January, 1919. It is also shown that the Dallas Railway increased its mileage operation 18 per cent over a year ago. The total car-miles for January, 1919, was 609,049. Expenditures for maintenance and repairs amounted to $30,839 as compared with $12,447 during January, 1918.

Traffic and Transportation

Wants Eight-Cent Fare

Los Angeles Line Plans Open Five-Cent Zone of One and One-Half Miles with Eight Cents Outside

The Pacific Electric Railway, Los Angeles, Cal., suffered a net loss of $1,695,143 during the year 1918. The increase in revenue which will be derived from increased fares now proposed by the company, if granted, will fall far short of making up this deficit for 1918, or the deficit which the company is facing for 1919, but will afford some much needed relief. The company has applied to the State Railroad Commission for authority to establish the following fares within the city of Los Angeles:

An open 5-cent fare zone to extend approximately 1½ miles from the center of the business district with an open 8-cent fare in the remaining territory on all lines where the fare is 5 cents at the present time. It is also proposed to sell a commutation ticket containing twenty rides for $1 or 5 cents per ride. This ticket will be good to any point within the proposed 8-cent zone and will include transfers. It will be sold by conductors as well as by ticket agents but will be limited to ten days from date of sale providing two rides only for any one day during that period. Ticket will be transferable and will be good for the use of any person presenting the same, but only two rides can be used on any one day. The purpose of this ticket is to accommodate the daily rider who will continue by using the same to have the benefit of the 5-cent fare.

In the cities outside of Los Angeles, including Pasadena, South Pasadena, Long Beach, Santa Monica, Venice, Pomona, San Bernardino, Riverside, Redlands, etc., the company has applied to the Railroad Commission for permission to establish an open 7-cent fare with the same 8-cent ride commutation ticket at 5 cents per ride as proposed for Los Angeles.

Permission was granted to the Pacific Electric Railway in September, 1918, to increase and adjust its interurban fares. This was done, but no increase was made in fares within the city of Los Angeles and other outside cities.

It is not proposed by the Pacific Electric Railway to change its present interurban fares except to increase to 7 cents fares which are now 5 cents or 6 cents. This will place the minimum for interurban fares the same as the proposed 7-cent fare in cities outside of Los Angeles.

Six Cents in Cincinnati April 1

The Cincinnati (Ohio) Traction Company made public announcement on March 15 that beginning on April 1 it will charge a 6-cent fare. Under the terms of the revised franchise the company does not have to notify William C. Culkins, street railroad director, of its intention, but must give its patrons public notice by March 15.

The fare was increased to 5½ cents at the beginning of this year under the service-at-cost arrangement.

At present children under ten years may ride on tickets that, in strips, cost 2¾ cents each. There will be a flat rate of 3 cents for children under the revision.

By the terms of the franchise revision grant the company is allowed to raise the cost of fare until it creates a certain reserve or stabilizing fund.

Recently it announced the per capita cost of carrying passengers was more than 6 cents.

Raising of $1,200,000 by the Cincinnati Traction Company through equipment trust certificates at 6 per cent interest, to be paid in ten annual installments, has been approved by Director Culkins. The issue also must be approved by the State Public Utilities Commission. The money will be spent for 150 new double-truck cars.

Indianapolis Case Carried Up

A complaint asking that the Indianapolis Traction & Terminal Company, Indianapolis, Ind., be enjoined from collecting a straight 5-cent fare in the city of Indianapolis, because of its franchise contract providing for the sale of six tickets for 25 cents and twenty-five tickets for $1 was filed in the Superior Court of Marion County on Feb. 26.

The complaint is brought in the name of Edward Barry, a member of the Typographical Union, representing the Central Labor Union which caused the proceedings to be instituted, and also names as defendants the Indianapolis Street Railway and members of the Public Service Commission of Indiana. It is alleged in the complaint that the order of the Public Service Commission issued in October, 1918, authorizing increased rates, gives the railway the right to take property without just compensation, in violation of the terms of the state constitution and also in violation of the constitution of the United States.

It is also alleged that the city officials in Indianapolis have failed to take the proper steps to have the order of the commission set aside and a demand was served upon the city by the organization represented by Mr. Barry.

It is expected that the case finally will be taken to the Supreme Court of Indiana on appeal, regardless of the decision in the Superior Court. No date has been set for a hearing of the complaint.

This action is the result of the refusal of the Public Service Commission of Indiana on Feb. 12 to consider a petition filed by the West Side Improvement Organization and Edward P. Barry asking for a re-hearing in the fare case of the Indianapolis Traction & Terminal Company, as reported in the ELECTRIC RAILWAY JOURNAL for Feb. 22, page 385.

Board Ruling Forecast

Chicago Hears Illinois Commission Will Deny Request of Surface Lines to Charge Seven Cents

Coincident with the announcement on March 17 of the report of the Chicago (Ill.) Surface Lines for the year ended Jan. 31, 1919, showing a decrease in residue receipts of $3,034,776, there was published in the newspapers a statement that the Public Utilities Commission of Illinois would allow no increase in the rate of fare. While this statement regarding the prospective ruling on the fare case is unofficial, it has been hinted in the financial district of Chicago for some time that the commission would refuse to give relief to the surface companies.

The commissioners are said to take the position that the war-time stringencies which caused these companies to ask for an increase are rapidly passing. It is true that the business of the Chicago Surface Lines has been picking up slightly, but the annual report indicates that a considerable gain in revenue will be required to meet the heavy burden of wages and materials. At the present time the surface companies are not earning the 5 per cent interest rate allowed by ordinance on the purchase price.

While the Chicago companies are awaiting an official announcement on the fare petition from the Public Utilities Commission, the Mayor and the Aldermen are busy in the State Legislature in a fight for "home rule." The city wants to regulate traction, telephone, electric light and gas rates and service as it did before the creation of the commission. The City Council recently adopted resolutions to this effect.

Portland Suburban Fares Protested

The Public Service Commission of Oregon recently set March 11 as the date for reopening of the rate case, and rehearing of evidence on rates on all interurban lines, following protest by the city of Portland against the new schedule of passenger rates on interurban lines of the Portland Railway, Light & Power Company. The new rates became effective on Jan. 1, 1919. The principal protest against them came to the Council from the Ardenwald and Errol Heights districts, where patrons declare the 7-cent fare, without transfer privilege, to be discriminatory, because patrons at Lents, a greater distance from the city, have a 6-cent fare, with transfer. Particular protest has been voiced by interurban patrons at the failure to require issuance of transfers with commutations or cash fares on interurban lines. The transfer privilege was removed by the Public Service Commission, on the theory that the interurban system was separate and distinct from the local lines and that transfers should not be interchanged between the two divisions of the railway.

Another Partial Fare Victory

Supreme Court Holds Atlanta Company May Increase Fare to East Point, but Not to College Park

The Georgia Supreme Court on March 15 handed down its decision, in the fare case between the city of Atlanta and the Georgia Railway & Power Company. The company lost its mandamus suit in the Superior Court, at which time it pleaded that the Railroad Commission of Georgia should assume jurisdiction in authorizing an increase in fare. Prior to this suit, the commission recommended to the City Council of Atlanta that the company be permitted to charge a 6-cent fare. The commission held that it did not have jurisdiction to order an increased fare as the city and the company had executed certain franchises previous to 1907 when the State Legislature clothed the commission with power to regulate electric railways and lighting utilities. The salient features of the decision just rendered are as follows:

1. Under the proviso contained under the fifth section of the act approved on Aug. 23, 1907, now embodied in the civil code 2662, the Railroad Commission of this State was without authority to exercise the powers conferred and extended by that act, so as to determine or fix fares upon lines of electric railroads within the limits of any town or city between which and the railroad operating such line there was a valid, subsisting contract at the time of the passage of the act.

(a) There was such a contract between the city of College Park and the Georgia Railway & Power Company, and between that company and the city of Decatur as to one line, running from Decatur to Atlanta.

(b) But, as between the cities of Atlanta and East Point and the Georgia Railway & Power Company there was no such contract.

(c) But there was a contract covering the subject of transfers, which provided that upon the payment of one full fare a transfer should be given and the railroad commission was without jurisdiction to deal with the matter of transfers.

2. A grant of power to a municipal corporation must be strictly construed and such a corporation can exercise no powers except those that are expressly given, or are necessarily implied from expressed grants. Applying this principle to the facts contained in this record the city of Atlanta was without authority to pass an ordinance fixing the rates of fare upon the railway lines constructed within the limits of the municipality, and any attempt by the municipality to pass such ordinances was nugatory.

3. In the absence of a valid, subsisting contract and ordinance on the subject of fares, it was the duty of the Railroad Commission, upon application by the Georgia Railway & Power Company, a street railroad company, to fix and determine the rates of fare upon the line of the street railroad in the city, in accordance with the law defining the powers and duties of the commission.

Mayor Key of Atlanta made the following statement:

I have not been advised by the city attorney yet as to the exact course the proceeding will take from this point on, but the probability is that the case will again be before the Railroad Commission for a hearing on its merits, and that all the facts will be gone into, particularly those facts which have developed since the last hearing before the commission. The case before the commission was for a 6-cent fare. I presume that unless a new case is made the investigation will be confined to that issue.

The consideration heretofore given the case was mainly that of an emergency war matter, this emergency will probably be given more amplitude on the next trial, the commission will have time and opportunity of going definitely into the question of valuation which it did not before.

As a matter of general interest, however, it must be borne in mind that the experience of the country is that increases in fare, however high, are very disappointing as a method of increasing revenue. It is a grievous burden to be borne by those who must use the cars, but does not affect those who do not have to use them.

All of these things are surely and certainly pointing the way to municipal ownership.

P. S. Arkwright, president of the Georgia Railway & Power Company, is of the opinion that although the war is over, labor and material have shown no decrease, and the commission will, therefore, follow its original recommendation with an order for higher fares. The Supreme Court's decision is not quite clear, in that it says the company may increase its fare to the city of East Point, but cannot increase the fare to the city of College Park, which is 1 mile beyond East Point on the same route.

Jersey Zone Hearing March 26

The Public Service Railway, Newark, N. J., which has submitted to the Board of Public Utility Commissioners a plan for a zone system of fare collections on its lines effective on April 1, has asked the board to permit this system to become effective on the date mentioned and to modify its order requiring the company to charge on and after April 1 a fare of 6 cents and an additional charge for transfer where 7 cents and an additional charge for transfer are now charged. The board has placed the application on its calendar for hearing in Newark on March 26.

Contract or No Contract, Rates Must Be Fair

A city is not empowered to make a binding contract with a traction company, or other public utility company, regarding rates, but such rates, regardless of ordinance provisions to the contrary, are at all times subject to a revision on a basis of a fair return to the public service company concerned, according to a decision rendered by Judge Duval West of the United States District Court for the Western District of Texas, sitting at San Antonio. The decision was rendered in a suit brought by the San Antonio Public Service Company against the city of San Antonio to gain authority to increase its fares from 5 cents to 6 cents, as referred to previously in the ELECTRIC RAILWAY JOURNAL.

Judge West held that the franchise ordinance under which the Public Service Company operates its cars does not constitute a binding contract in so far as the 5-cent fare is concerned. The immediate effect of the decision is to bring the railway company's case within the jurisdiction of the United States Courts and to open the way for the trial of the case in that court on its merits. Under Judge West's holding, any public service corporation may go into the courts and on a proper showing secure an annulment of a franchise rate fixed by the city, and obtain a rate sufficient to enable it to receive what the trial court deems a fair return on the corporate investment made by the company.

Ticket System at Portland, Me.

A new fare system substituting tickets for cash was inaugurated on the railway lines of the Cumberland County Power & Light Company in Portland, Me., on March 2, in accordance with recent findings of the Public Utilities Commission of Maine. The entire electric railway system known as the old Portland Railroad has been divided into zones in which the fare is figured at the rate of 2 cents per zone, with a minimum ticket fare of 6 cents and a cash fare of 10 cents. A 4-cent rebate is given to all passengers paying a 10-cent cash fare, redeemable before midnight of the day following at fifteen specified points on the system. The great majority of the company's patrons will use a ticket good for five rides and selling for 30 cents on the cars and at the main office of the railway in Monument Square in the heart of the city of Portland.

For use in paying fares in zones beyond the first three traversed a zone ticket may be used, also selling for 30 cents and covering transportation through fifteen zones. A central transfer area has been established in the heart of the city, so that practically all points within a mile of Monument Square may be reached on a single fare. Various through commutation tickets are also sold. An extended campaign of education was carried on before the new system went into effect, and the public appears to be receiving it most favorably. In a later issue the details of the new schedule will be described, with particulars of the campaign conducted.

New Fare Tariff Statute Interpreted

The Public Service Commission of Washington has construed the new statute passed by the recent session of the Legislature to mean that affirmative action by the commission is required under the regulation statute as amended, before a change in railway rates can become effective. The statute gives the commission power to exceed the 5-cent fare limit on all but municipally owned lines. The commission's view of the statute will abolish the former rule permitting a rate increase to become effective automatically thirty days after filing with the commission if no protests are made. Under the rule now established, hearings will have to be held and orders issued by the commission whether or not formal protest is filed on behalf of the patrons against an increase in rates by the railway.

Transportation News Notes

New Commutation Rates Suspended.—The Public Utilities Commission of Illinois has resuspended until Sept. 8, 1919, proposed advances of commutation fares by the East St. Louis & Suburban Railway, East St. Louis, Ill.

Electors Revoke Fare Increase.—The electors of Saginaw, Mich., have defeated the revocable franchise providing 6-cent fares granted the Saginaw-Bay City Railway last summer, piling up 9000 votes against the increased rate and but 4000 for it.

Worcester Fare Increase Postponed.—The tariff of the Worcester (Mass.) Consolidated Street Railway, which established a 7-cent fare unit on the system, has been suspended until March 31 by the Public Service Commission in an order dated March 7.

In Favor of the Railway.—Judge Martin J. Wade of the Federal Court has ruled against the application of Samuel Seeman, Des Moines, Ia., in his petition to make the receivers for the Des Moines City Railway parties to his suit to force the sale of six tickets for a quarter.

Wants Further Fare Increase.—The Sherbrooke Railway & Power Company, Sherbrooke, Que., is seeking an increase in fare to 7 cents cash or five tickets for 30 cents. Last December the company was authorized to increase fares from 5 cents cash or six tickets for 25 cents to 6 cents cash or five tickets for 25 cents.

Back to Its Peace-Time Basis.—The Illinois Traction System, Peoria, Ill., is at work on its new time-card and is planning better and quicker train service. Two fast trains have been added between Champaign and Springfield and it is said that the company will arrange to restore parlor car and other pre-war service very soon.

Yonkers Abandonment Case Closed.—The Public Service Commission for the Second District of New York heard oral argument at Albany a few days ago on the appeal of the Yonkers (N. Y.) Railroad for permission to abandon certain of its lines. Briefs have already been filed. The commission has reserved decision.

Authority Over Autos.—The Phipps bill recently passed by the Senate at Olympia, Wash., gives the Public Service Commission control over auto stages, and municipal authorities power to regulate city jitneys. The 5 and 10-cent buses are required to operate along routes selected by the city authorities and to continue in operation regularly.

Six Cents for Akron.—The Council of Akron, Ohio, on March 10 reconsidered its action against the 6-cent fare ordinance and passed an amended ordinance granting the fare to Northern Ohio Traction & Light Company. The amendment provides that work shall be begun thirty days after the ordinance takes effect on the extension of the lines as provided for in the ordinance, known as the Myers-Morse-Witwer ordinance.

Fare Advance in Violation of Franchise.—By order of the Public Utilities Commission of Ohio effective on March 3, the Portsmouth Street Railroad & Light Company, Portsmouth, Ohio, cannot charge increased fares on its line from New Boston to Sciotoville and Wheelersburg, as proposed in a new schedule filed with the commission several weeks ago. The commission holds the proposed increase is in violation of the company's franchise rights in New Boston.

Wants Legislature to Oppose Zones.—Assemblyman Rowland, of Camden County, has introduced a resolution in the Legislature of New Jersey asking the House to go on record with a request to the Board of Public Utilities Commissioners that the application of the Public Service Railway to establish the zone system be denied. The resolution has been referred to the judiciary committee. The Assembly will be requested to take action on the resolution later.

Quid pro Quo in Los Angeles.—President Edgerton, of the State Railroad Commission of California, in a recent address said, in effect: "The public in general does not object to paying a reasonable rate providing they get adequate service." To this the Pacific Electric Railway, Los Angeles, Cal., in its own magazine has replied: "Officers and employees of the Pacific Electric Railway, therefore, must bend their energies to perfecting prompt, fast and efficient service."

Spokane Fare Hearing March 31.—A hearing will be held in Spokane, Wash., on March 31 by the State Public Service Commission, on the application of the Spokane & Inland Empire Railroad and the Washington Water Power Company for permission to increase their fares to 7 cents, with 1 cent additional for each transfer. Proposals by city officials that concessions in the way of waivers of franchises and bridge taxes, paving maintenance, etc., be accepted in lieu of fare increases, have been rejected by the railways. The Spokane & Island Empire Railroad is in the hands of a receiver.

Want Eight Cents in Yakima.—N. C. Richards, president of the Yakima Valley Transportation Company, Yakima, Wash., has announced that he will apply immediately to the State Public Service Commission for permission to raise the fare on the company's city lines here from 5 cents to 8 cents, the plan including the sale of five tickets for 35 cents. According to Mr. Richards, the city lines, taking into account taxes and interest charges, showed a loss last year of about $45,000. Including suburban lines, the system, as a whole, had a deficit of $59,000.

Jitneys Resume in Dallas.—Jitneys have resumed operations in Dallas, Tex., following an opinion from the office of the City Attorney that the jitneys could operate unhindered provided they remained outside the zone marked out by the law within which their operations is prohibited by the city ordinance that has been upheld by the state courts. The jitneys are now operating on Ervay Street as far as Young, which marks the southern boundary of the prohibited zone. Since the Ervay cars are being turned at Ervay and Commerce on account of the laying of new rails on Main Street, the jitneys are proving strong competitors.

Increase for Nebraska Interurban.—An order was issued by the State Railway Commission recently to the Omaha, Lincoln & Beatrice Railway, Lincoln, Neb., authorizing the company to increase rates beginning on March 15. The company is authorized to collect 6 cents for each ride between Lincoln and University Place, and Lincoln and Bethany; 5 cents within the Lincoln zone; 5 cents between the University Place zone and the Bethany zone and 5 cents between University Place and Bethany. The road has never paid expenses. It has maintained a 5-cent fare to University Place and Bethany ever since the Lincoln Traction Company got a 6-cent fare, but the commission finds this difference in rates made no appreciable increase in revenues for the interurban.

Fare Case in Binghamton Put Over.—At a hearing before the Public Service Commission for the Second District of New York on March 11 it was decided to postpone for three weeks the argument in regard to the affairs of the Binghamton Railway. It is hoped that in the meantime the appeal taken by the city of Binghamton and town of Union from United States Judge Rays' decision favoring the receiver, to the United States Circuit Court of Appeals, New York City, will be determined by the higher court. The company seeks authority to add 1 cent to the fare. The city alleges a contract exists between city and company, preventing such a raise in the fare. This, the company denies. The appeal was returnable on March 17.

Another Partial Victory at Des Moines.—Both the Des Moines City Railway and the city of Des Moines, Ia., won a partial victory in the hearing before Federal Judge Martin J. Wade at Ottumwa, Ia., when Judge Wade took the service case out of the hands of Polk County District Courts. Judge Wade ruled that so long as the Des Moines City Railway was being operated by receivers the state courts had no jurisdiction and that no more injunctions could be issued by the state courts against reductions in service. On the other hand Judge Wade held that the Des Moines City Railway could not put into effect new schedules covering reductions in service without first making

a showing to him that the service cuts were necessary in order to meet expense.

Steady Improvement in Birmingham.—The number of cars being operated daily by the Birmingham Railway, Light & Power Company, Birmingham, Ala., is showing a steady increase as the railway system gets more nearly on a normal basis. The report made by J. S. Pevear, general manager of the company, to the Public Service Commission of Alabama shows that for the seven years ending on Feb. 28, an average of 208 cars was operated. The maximum number operated during the same period was 211. The report is comparative and shows that for the seven days ending Feb. 15 an average of 182 cars was operated with a maximum of 194. During the period covered by the report there was a gain of four men in the train service, six dispatchers, and one shop employee.

Youngstown Has Deficit Under Service at Cost.—Service at cost for the lines of the Mahoning & Shenango Railway & Light Company in Youngstown, Ohio, shows a deficit of $259 for the first sixteen days of operation, according to the first report of Street Railway Commissioner W. L. Sause, submitted to City Council recently. The service-at-cost ordinance became effective on Jan. 16, and the report is for the period of Jan. 16 to 31 inclusive. The terms of the service-at-cost grant in Youngstown were reviewed in the ELECTRIC RAILWAY JOURNAL for Jan. 11, page 99. The action of the city in passing the ordinance ended a controversy between the company and the city on the subject of service and a more recent dispute between the company and its employees about wages. The initial fare was 5 cents cash and 1 cent for a transfer. The next highest fare is 6 cents cash with nine tickets for 50 cents.

P. R. T. Denies Commission Has Authority.—A demurrer has been filed by counsel for the Philadelphia (Pa.) Rapid Transit Company challenging the jurisdiction of the Public Service Commission over the rate of fare on the ground that the 1907 contract with the city, in which the rate was fixed, antedates the formation of the Commission in 1912. The demurrer sets forth that, "the various rates of fare in use upon the consolidated system have been approved and fixed by contract entered into with the city of Philadelphia on July 1, 1907, and that the rates of fare having been so regularly fixed by agreement before the date upon which the Public Service Company law became effective, are not subject to alteration or adjustment without the consent of both parties." The company in Philadelphia has in use an 8-cent exchange ticket. Complaint against this system was made to the commission on July 16, 1917, by the Northwest Business Men's Association. On account of the demurrer the hearing before the commission has again been put over indefinitely.

Personal Mention

Changes in Birmingham Personnel

Fred V. Underwood has been made assistant general manager of the Birmingham Railway, Light & Power Company, Birmingham, Ala. He took up his duties with the company on March 10, after having resigned his position as superintendent of production with the Alabama Power Company to accept the place. Mr. Underwood is a brother of Senator Oscar Underwood. He was connected with the Birmingham Railway, Light & Power Company for a number of years, but resigned from the company last October to go with the Alabama Power Company.

J. S. Pevear, general manager, will be relieved of some of his duties by the appointment of Mr. Underwood. Mr. Pevear will devote a good deal of his time to the work of rehabilitating the properties of the company. This work has been undertaken by the receiver and is being pushed through as rapidly as possible.

L. L. Newman has been named chief engineer. He will devote practically all his time to maintenance work.

H. E. Cox, formerly an engineer for the Birmingham Steel Products Company, will be Mr. Newman's assistant.

In a statement to the press Mr. Pevear said that in view of the fact that the receiver intended to rehabilitate the property as rapidly as possible Mr. Newman would devote practically his entire time to the work of getting the tracks, ways and structures of the company in shape in the shortest possible time.

Changes in Power Department

R. W. Lamar has been appointed manager of the power department of the Monongahela Valley Traction Company, Fairmont, W. Va., and Francis McQuillan has been appointed assistant manager of the power department.

Both Mr. Lamar and Mr. McQuillan will have headquarters in Fairmont, W. Va.

Captain Lamar has only recently secured his discharge from the United States Army. For the past several months he has been connected with the power section of the War Industries Board where he rendered valuable service to the government and won the commendation of his superior officers. He is a graduate electrical engineer, having secured his education at Washington University, St. Louis, Mo.

The assistant manager of power has been with the Monongahela Valley Traction Company for some time. He held the title of commercial engineer in the power department, so that he will be entirely familiar with his duties in that department.

A reorganization of the power department became necessary because of the enlarged responsibilities of that department with the construction of the Riversville power plant, and also because D. A. Maurer, who has been chief electrical engineer for the company for several years, recently decided to devote his entire time to his private interests. He is the head of the Fairmont Electrical Service Company and also the Mine Service Supply Company, Fairmont.

Personnel of Seattle's Municipal Railway

Thomas F. Murphine, superintendent of Public Utilities, Seattle, Wash., has been appointed to have charge of the electric railway system which the city has purchased from the Puget Sound Traction, Light & Power Company. The property will be taken over by the city early in April. Mr. Murphine is rapidly completing plans for organization of his department. He has accordingly announced that three members of his present staff will be retained. Edward I. O'Brien, assistant superintendent of the utilities department for nine years, will continue in that position. J. J. Wettrick, chief engineer, will become chief engineer of the new railway and will also be superintendent of way and structure. Allen B. Hiatt, chief accountant in the utilities department, will become auditor of the railway system.

Present plans contemplate the operation of the railway system through five general departments—the mechanical, engineering, transportation or operation, correspondence and intelligence. The latter department has been originated by Mr. Murphine, who intends it to represent the public, and to act as a buffer between the people who use the cars and the department. Service complaints or other matters affecting the public will be investigated by this department. The members of it will be responsible only to the superintendent of utilities. The department will also include an educational branch, for the purpose of familiarizing the public with measures that will ultimately result in better service.

The intelligence department will also be required to follow the three contracts which are part of the railway deal. Mr. Murphine believes that with the right man on the job, considerable saving may be effected on the contract for purchase of electric current from the traction company for the operation of the cars. The intelligence department will also be required to keep a lookout for leaks in the use of current. Mr Murphine further believes that the department will be able to make money

for the city on the interurban contracts. The city has agreed to permit the Tacoma and Everett interurban trains, which will continue under the Puget Sound Traction, Light & Power ownership, to operate over the municipal tracks on a mileage basis, taking into consideration the weight and number of cars.

E. Commodore Bowman, general superintendent of the Monongahela Valley Traction Co., will be transferred to Fairmont, W. Va., on April 1. Mr. Bowman has had his offices in Clarksburg for some time.

Frank T. Hamilton, vice-president of the Omaha & Council Bluffs Street Railway, Omaha, Neb., has been elected president of the company to succeed G. W. Wattles, resigned. Mr. Wattles has been made chairman of the board. No succession to the first vice-presidency has yet been announced.

J. N. Tabb, assistant treasurer of the Monongahela Valley Traction Company, Fairmont, W. Va., has resigned and moved to Parkersburg, W. Va., where he will be associated with the Crawford oil interests. Mr. Tabb went to Fairmont as assistant treasurer of the Monongahela Valley Traction Company when the Kanawha Traction & Electric Company's interests were absorbed by the Monongahela Valley Traction company several years ago.

W. V. Neal, former resident of Parkersburg, W. Va., but more recently connected with the Trinidad (Col.) Traction Company, has been appointed assistant general manager of the Monongahela Valley Traction Company with headquarters at Clarksburg, W. Va. For several years Mr. Neal was connected with the Stone & Webster interests at El Paso, Tex. He was also for several years an employee of the United States government and had charge of the construction of numerous government projects in the Philippine Islands.

George M. Alexander, who returned to Fairmont, W. Va., recently after a number of months' service in the ordnance department of the War Department has been elected president of the Monongahela Valley Traction Company. This action followed the resignation of S. L. Watson, chairman of the board of directors, and the advancement of J. O. Watson, until this time president of the company, to the position of chairman of the board. The new president has been identified with the company for a number of years as the head of its legal department. Upon him fell much of the detail involved in the absorption of the Parkersburg lines, the purchase of the Stafford mine and the beginning of the great power plant at Rivesville, which undertaking is now nearing completion.

Edward A. West, formerly chief engineer of the Denver (Col.) Tramway and the Denver & Intermountain Railroad, has been appointed general superintendent of the companies. Mr. West was called to Washington early last year and requested to take charge of passenger transportation and housing matters for the United States Shipping Board, Emergency Fleet Corporation, on the Pacific Coast. The territory covered extended from San Diego, Cal., to Bellingham, Wash., and comprised three shipyard districts, the Southern Pacific District, North Shipping District and Wood Ship Division No. 11. About the first of the year he resigned from the Emergency Fleet Corporation and returned to the Denver Tramway and the Denver & Intermountain Companies as general superintendent.

J. E. Lawless has recently been appointed master mechanic of the El Paso (Tex.) Electric Railway. Mr. Lawless was born in Smithland, Ky., on June

J. E. LAWLESS

3, 1880, and was graduated from the English High School, Hampton, Ky., in 1896. Subsequently he completed the correspondence course in electrical engineering with the International Correspondence Schools. He entered electric railway work in 1898 and has been connected with Stone & Webster for a number of years in different branches of that company's organization. He was formerly master mechanic of the Paducah Traction & Light Company, Paducah, Ky., and later general foreman of the Northern Texas Traction Company, Fort Worth, Tex. He entered upon his duties as master mechanic of the El Paso Electric Railway on Jan. 1 of this year.

J. R. Wilson, traffic manager of the Sacramento Northern Railroad, office at Sacramento, Cal., has tendered his resignation to President G. F. Detrick effective on April 30. Mr. Wilson went to Sacramento nearly five years ago to become traffic manager of the Northern Electric Railway, which, after its reorganization, adopted the name of Sacramento Northern Railroad. Prior to this he was with the Southern Pacific Company general freight office in San Francisco and later commercial agent for the Illinois Central Railroad in that city. Mr. Wilson has made no announcement as to his future connections. The appointment of his successor will be made later.

Guy C. Pierce, Los Angeles, Cal., has been elected vice-president and general manager of the Northwestern Electric Company, Portland, Ore., succeeding Wilbur E. Coman, who, as noted previously in the ELECTRIC RAILWAY JOURNAL, has become connected with the Washington Water Power Company at Spokane. During the greater part of 1909 and 1910 Mr. Pierce represented Eastern capital interested with R. C. Gillis in the development of the Mt. Hood Railway & Power Company's projects at Portland, which later were taken over by the Portland Railway, Light & Power Company. Mr. Pierce became identified with the electrical industry at Sacramento in 1887 and was responsible for a number of the pioneer lighting and power installations in California. In the three years from 1901 he was located at Mexico City in charge of electrical properties and during the two years following he was chief inspector for the Hudson & Manhattan Railroad at New York. From 1906 to 1909 he was identified with the East St. Louis & Suburban Railway, controlled by E. W. Clark & Company, Philadelphia, now interested in the Portland Railway, Light & Power Company. In the four years following his temporary residence in Portland, Mr. Pierce represented Eastern capital in reporting on proposed railway and hydroelectric power projects in states bordering on the Pacific Coast.

Obituary

Charles F. Bachman, East Orange, N. J., master mechanic of the Essex division of the Public Service Railway, died recently after a brief illness from pneumonia. Mr. Bachman was born in Wilkes-Barre, Pa., in 1885. After graduating from the school of mechanical engineering at Cornell University he moved to Elizabeth, N. J. He had been employed by the Public Service Railway for the last eleven years. Mr. Bachman leaves a widow and an infant son.

John J. Gettings, superintendent of the Central division of the Public Service Railway at Elizabeth, N. J., died recently at St. Elizabeth's hospital at that place after a brief illness from pneumonia. He was stricken while at work at the carhouse. Mr. Gettings was born in Brooklyn forty-nine years ago. For a time he was employed by the Brooklyn Rapid Transit Company, and in 1903 became identified with the Public Service Railway. He was stationed at Newark at first. Several years ago he was appointed superintendent of the Central division. Mr. Gettings is survived by a widow.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Lower Prices Required for Successful Export Trade

Better Co-operation as to Consumer Requirements and More Consideration on Deliveries Needed

In outlining the steps which American manufactureres must take to hold their foreign trade, E. M. Herr, president of the Westinghouse Electric & Manufacturing Company and a director in the American Manufacturers' Export Association, declared recently that reductions in high wages accompanied by a reduction of prices were essential.

"The development of export business in electrical machinery, under the present condition of export markets," said Mr. Herr, "would be very rapid and of unusual extent were it not for the high prices which must now be charged for this product. There are some countries which, owing to the ravages of war and the necessity of first remedying the most serious destructive effects of this strife, cannot immediately take up the development of peaceful pursuits. It is in this that electrical machinery finds its legitimate field.

"The most vigorous effort should be made by those engaged in the manufacture of electrical machinery to bring prices to a point approximating those obtained for this material in foreign countries, as with the domestic market slowing down, due to the transition from war to peace conditions, the present time is particularly advantageous for the development of the export field. It is encouraging to note important decreases in the cost of a few of our raw materials and if some yielding of the very high labor costs can also be obtained, we would very soon find an expansion of the export demand for electrical machinery that would more than compensate labor for any sacrifices in hourly rates by the longer hours and more continuous employment which would result.

"In the industrial countries of the world the enormous increase in demand for manufactured products caused by the war has shown the great need for and advantage in the use of electrical machinery, making those countries particularly keen to avail themselves of the economies and advantages of electrical power. This is especially true in countries where fuel is scarce and expensive and where water power is available. Plans are already well matured for the development of larger central electrical power stations in some of the most important industrial countries and extensive projects for the electrification of some of their railroads are well under way. The smaller and less economical steam plants will in this way be displaced by larger and more economical ones and the demand for transmission and current-consuming devices be greatly enlarged.

"The largest electrical manufacturing companies abroad are in Germany and it will be some time before they can operate advantageously. This will give the American companies an unusual opportunity, if promptly seized, of bringing our exports of electrical machinery to an amount and value which is not possible under normal conditions.

"In seeking electrical machinery business in export territory, our agents must make their principals realize that the machinery we sell these people must be designed and built for their requirements and not, as has in the past too often been the case, as we are accustomed to build it. Much effort has been expended in trying to convince the foreign buyer that our styles and construction were best and should be satisfactory to him, instead of making a real effort to ascertain just what he desired and then furnishing it.

Service Must Be Given

"In addition to adapting our goods to export requirements, we must arrange to give service in this trade at least as good as in our domestic market. Too often export shipments have been delayed and foreign customers disappointed on account of the domestic demand becoming suddenly unusually active, when export orders were made to wait while the rush of domestic orders was worked off. This policy is fatal to proper progress in export trade and must be abandoned if real development of the foreign field is to be secured. In fact, just the opposite policy should be pursued and export shipments given preference over domestic, as, because of infrequent transportation service, failure to meet sailing dates results in a very much more serious delay to the customer than the actual delay in production—a condition which does not obtain in domestic business because of better transportation facilities.

"We should never forget in any industrial business that we are selling service as well as product and that however good the quality of one's product, if the material does not come when needed, is not packed properly, or in any other way our service to the customer is unsatisfactory, the transaction fails to tend to tie him to the producer and permits a competitor to obtain a foothold not otherwise possible. These are ordinary principles of business but apply with unusual force when we are dealing with foreign customers.

Maintenance Prices Show Little Change

Copper Products Affected According to Relation of Metal to Labor—Rail Bonds Show Improvement

There has been little price change in general in the maintenance line of electric railway materials for the past six months. Copper products have shown decreases in several instances and some of the track and line equipment has decreased within this time, but these latter changes have been slight compared to those in copper.

Crossarms have just decreased 5 to 7½ per cent on some sizes on all quantities from stock.

Cross-ties of the hewn variety are still selling for $1.20 to $1.60 each, the scarcity of labor in tie-camps generally accounting for the price remaining at this level. Small stocks are kept cut near rights-of-way in many parts of the country.

Friction tape has a constant call in maintenance work, and, regardless of the lower cost of raw cotton, is not being sold at any appreciable reduction. Prices for different manufacturers vary due to the different qualities involved. Labor cost after the raw cotton is delivered is the determining factor.

Varnished cambric has been found off about 2 cents a pound.

Lubricating oil has been reported as holding to the prices of last fall, with an upward rather than a downward tendency.

Rubber-covered wire manufacturers are for the most part using a 20-cent base at this time, and some very satisfactory business has been uncovered.

Bare wire is being quoted on about a 17⅛ cent base. Many fair sized orders for railway maintenance have been reported, and inquiries from the export field have been numerous. Weatherproof wire is quoted from 18⅛ to 20 cent base with rather satisfactory orders of a maintenance character.

T-rails are still holding at from $55 to $65, but it is expected that this price will be reduced following the decisions of the steel manufacturers and the government interests.

Grooved rails continue at a quotation of 4¼ cents per pound, and this price also is expected to be affected.

Railroad spikes are down to 3.65 cents a pound, but screw spikes have not shown any change from the 8 cents which has been holding for some time.

Tie plates and rods, fish plates, angle plates and angle bars fell off one-quarter of a cent from the government price and are at 3 cents a pound. Rail

bolts and nuts, however, are still holding their former price of 4.90 cents a pound.

Car window glass has shown no change in price for some months, and there appears to be no reason to expect any decrease in the immediate future.

Cotton waste is quoted at 8 to 13½ cents per pound, and wool waste at 14 to 17 cents. Some railways use wood waste for journal packing up to 40 cents a pound. On account of the curtailment of the cotton and wool products from which this waste comes, the tendency of the price of each kind is upward.

The continually decreasing price of copper has brought down the price of several kinds of railway materials to a greater or a lesser extent as the amount of copper in the article varies and as the labor item varies. For instance, commutator bars have recently dropped 20 per cent, and such products as armature coils, field coils and strap copper fuses have dropped from 10 to 20 per cent.

Trolley crossings and splicers for trolley wire are still on February discount lists, the crossings at 43 per cent and the copper sleeves at 48 per cent.

Rail bonds have changed for the better a number of times since January 1, and the last quotation leaves them at 25 per cent off list.

Welding rods for use in filling cups and other imperfections in rails are varying from 12 to 18 cents per pound, depending on the quantity ordered, while rods for normal use in railway shops for repair work vary from 10 to 15 cents per pound, depending on the quantity.

Permanent High-Price Level

Prominent Economist Urges Buyers to Face the Facts and Act Accordingly

Goods are on a permanently higher price level and the sooner the business men of the country take this view and adjust themselves to it the sooner will they save themselves and the nation from the misfortune which will come by persisting in the present false hope of lower prices, according to Irving Fisher, professor of political economy of Yale University. This sentiment was the theme of his discourse before the recent conference of governors and mayors at the White House.

"The main reason why business is not going ahead better," declared Prof. Fisher, "is that most people expect prices to drop. It is interesting to observe that many manufacturers think that prices must come down, including the price of labor; but they are ready to demonstrate to you that their prices cannot come down, nor can they pay lower wages. Almost everything they buy somehow costs twice as much as before the war, and their labor is twice as dear. They cannot pay their labor less if labor is to meet the increased cost of living. Now, as a matter of fact, when we investigate almost any individual one of the so-called high prices for industrial products we are likely to find that individually it is not high; that is, it is not high relatively to the rest. Our quarrel is with the general level of prices."

Prof. Fisher then went on to explain the dependence of prices on the circulating medium. Greater circulation of money for the same volume of goods means higher prices. Vast government loans and the large credits have the same effect. The present tendency, however, is not to contract credits, but to enlarge them. In conclusion, therefore, Prof. Fisher states:

"Business men should face the facts. To talk reverently of 1913-14 prices is to speak a dead language today. The buyers of the country, since the armistice, have made an unexampled attack upon prices through their waiting attitude, and yet price recessions have been insignificant. The reason is that we are on a new high-price level, which will be found a stubborn reality. Business men are going to find out that the clever man is not the man who waits, but the one who finds out the new price facts and acts accordingly."

Rolling Stock

Granite City Railway, St. Cloud, Minn., has just placed a contract for six new cars.

Jersey Central Traction Company, Keyport, N. J., is converting four fourteen-bench open cars into a closed type. The company is also rebuilding trucks of fifteen semi-convertible interurban cars. The work is being done through a loan from the United States Bureau of Housing.

Portland Railway, Light & Power Company, Portland, Ore., has recently received and put into operation twenty-five one-man cars purchased by the Emergency Fleet Corporation for the use of the traction company. The purchase was noted in these columns of Aug. 3, 1918.

Cincinnati (Ohio) Traction Company has received permission from the Ohio Public Utilities Commission to issue $1,250,000 equipment trust certificates, the proceeds to be used in the purchase of 105 double-truck closed cars of the pay-within type.

Franchises

Babylon, L. I.—The Babylon Railroad is negotiating with town officials of Babylon for a franchise covering the supply of electric energy for lighting and power purposes to the municipality.

Gary, Ind.—The Board of Public Works of Gary has granted a franchise to the Gary Street Railway to establish a car storage yard and tracks at the southwest corner of Adams Street and Twenty-second Avenue, where the company will expend about $15,000 in laying tracks and making connections with the main line.

Recent Incorporations

Levis (Que.) Tramways.—A bill has been introduced in the Quebec Legislature for the incorporation of the Levis Tramways, as a reorganization of the Levis County Railway. Capital stock, $1,500,000. The petitioners are Senator Raoul Dandurand, S. H. Ewing, J. A. Ewing, Montreal; E. A. Macnutt, Westmount, and J. C. Blouin, who are to be provisional directors. The applicants ask authority to extend the present railway in Levis and in or between any of the various municipalities of the counties of Levis, Bellechasse, Dorchester and Beauce; authority to build branches not exceeding 15 miles in any one case from the main line; also power to enter into agreements for extending the line as far as the Quebec Bridge and over the same and also on the north shore of the River St. Lawrence, and to connect at some point with the line of the Quebec Railway, Light, Heat & Power Company.

Track and Roadway

Birmingham, Ala.—It is reported that Major John R. Fordyce of the United States Engineers, serving with the Mississippi-Warrior Waterways Administration, will survey the territory between Birmingham and the Warrior River and will also prepare estimates of the cost of terminals and of the railway which is contemplated to connect the city with the waterway. This work is to be undertaken immediately. W. D. Nesbitt of Birmingham is chairman of the Warrior River Development Committee.

Gadsden, Ala.—It is reported that plans are being considered for the construction of an interurban line to connect Gadsden, Alabama City, Attalla, Boaz and Albertville. According to the report, the company will establish a distribution system in Gadsden and will furnish electricity to consumers in that city and in Alabama City. It is said that the company will obtain its power from the Alabama Power Company.

British Columbia Electric Railway, Vancouver, B. C.—The construction of a line on the Alma Road from Kerrisdale to Fourth Avenue is contemplated by the British Columbia Electric Railway.

Georgia Railway & Power Company, Atlanta, Ga.—The Georgia Railway & Power Company will rebuild its tracks on Edgewood Avenue between Peachtree and Pryor Streets.

Boston (Mass.) Elevated Railway.—Operation has been begun on the extension of the Boston Elevated Railway from Sullivan Square, Boston, to Everett.

Kansas City, Lawrence & Topeka Railroad, Kansas City, Mo.—The Kansas City, Lawrence & Topeka Railroad will rehabilitate its line at a cost of about $15,000.

Tulsa (Okla.) Street Railway.—Work will be begun at once by the Tulsa Street Railway on the extension of its lines on North Main Street, North Cheyenne Avenue and South Main Street.

Toronto, Ont.—At a recent executive committee meeting of the Hydro-Electric Railway Association at the office of the provincial Hydro-Electric Power Commission at Toronto it was decided to move in the matter of constructing an electrical railway in the district extending westerly from Toronto through Brampton, Guelph, Kitchener, Stratford and St. Marys to London as soon as possible, as desired by the municipalities concerned. A preparatory move will be the urging of the immediate repeal of certain amendments to the hydro-electric railway as requested by the municipalities.

Toronto (Ont.) Electric Railway.—It is reported that the Toronto Electric Railway will construct 3 miles of new track at an estimated cost of $800,000. The cost of the construction of the substructure is estimated at $580,000.

Scranton & Binghamton Railroad, Scranton, Pa.—Reorganization plans for the Scranton & Binghamton Railroad contemplate the merger and consolidation of the Binghamton Railway and the Northern Electric Company with the Scranton & Binghamton Railroad, the construction of a new terminal station at Scranton and the extension of the line from Tiffany Junction to Binghamton. Preliminary surveys have been made of the proposed route for this extension and options taken on much of the necessary right-of-way.

Burkeville (Tex.) Railway.—It is reported that the Burkeville Railway has been organized to construct a line from Burkeville to Wiergate, about 3 miles. Officers: E. F. Montgomery, president; J. F. Woods, first vice-president; K. Jackson, second vice-president; L. C. Wood, treasurer, and J. M. Nation, secretary.

Dallas, Tex.—Plans are being prepared by engineers for the proposed electric railway to be built from Dallas to Wichita Falls. The following publicity committee is working on the project: Wiley Blair, John N. Simpson, T. E. Jackson, E. J. Kiest and Tom Finty. At a recent meeting held at Dallas a resolution was adopted pledging $75,000 to the enterprise, of which two-thirds is to be raised in Dallas and the rest in Wichita Falls. [Feb. 8, '19.]

Richmond & Chesapeake Bay Railway, Richmond, Va.—Plans are under way at Richmond to organize the Richmond-Ashland Railway to purchase and operate the line of the Richmond & Chesapeake Railway from Richmond to Ashland. First mortgage bonds will be issued and opened for public subscription immediately to raise the $200,000 necessary to buy and rehabilitate the line. J. L. Vaughn, president of the Petersburg, Hopewell & City Point Electric Railway, has agreed to direct the operation. The Richmond & Chesapeake Bay Railway ceased operating in December, 1917.

Seattle (Wash.) Municipal Railway.—Arrangements have been made to resume work immediately on the municipal elevated railway in Seattle to the West Side, following assurances that money to complete the project will be provided in not to exceed two weeks from the recent $400,000 bond sale. The connection with the surface lines at Washington Street, and construction of the trestle to connect with the Lake Burien line west of the Spokane Street bridge are required to complete the project.

Wisconsin Public Service Company, Green Bay, Wis.—A committee of business men has been appointed in Luxemburg, Casco, Algoma, New Franken and Kewaunee to meet officials of the Wisconsin Public Service Company and ascertain under what conditions the company will extend their lines from Green Bay through Kewaunee County to these cities and villages.

Power Houses, Shops and Buildings

Hanover Light, Heat & Power Company, Hanover, Pa.—Plans have been prepared by the Hanover Light, Heat & Power Company, which supplies power to the Hanover & McSherrystown Street Railway for the installation of a 1000-kw. turbo-generator and surface condenser with a suitable spray cooling system. Revamping of certain existing distributing lines by raising the voltage to 13,000 volts is also under consideration. A new switchboard is now being installed to meet the requirements of the new plant.

New Advertising Literature

Barrett Company, New York City: Pamphlet on the application of "Carbosota" creosote oil to posts, poles, etc., with suggestions for constructing simple treating plants.

Metal & Thermit Corporation, New York City: Large map calendar, the map showing the railroad time zones in the United States, which went into effect on Jan. 1, 1919.

Bonham Recorder Company, Hamilton, Ohio: Eight-page leaflet on latest type of traffic recorder. It records miles traveled, kind of fare paid, amount of cash fare, total number of passengers, number of cash passengers, month, day, train and division. It also gives the autograph of the conductor who made it. From this printed record the following may be obtained: Travel between stations, density of traffic, revenue per passenger-mile, revenue per car-mile, revenue by trains, revenue by stations, per cent of ticket revenue, per cent of cash revenue.

Trade Notes

J. S. Cullinan has recently been elected president of the Galena Signal Oil Company.

Scovill Manufacturing Company, Waterbury, Conn., has recently filled several orders for metal tokens, paying particular attention to factors that would make counterfeiting impracticable if not completely impossible.

J. F. Mackin, Columbus, Ohio, has recently become connected with the Black & Decker Manufacturing Company of Baltimore, as representative throughout the entire State of Ohio. Mr. Mackin has been connected with the portable electric drill industry for years, his former connection being with the Independent Pneumatic Tool Company.

J. E. Slimp, who has for many years been connected with the sales department of the Ohio Brass Company, has resigned to become associated with H. C. Dodge of Boston, who is at the head of several manufacturing companies in New England. Mr. Slimp will remain with the Ohio Brass Company until approximately April 1.

E. V. Adams succeeds G. K. Heyer as railway sales engineer of the Western Electric Company. He has been a Western Electric man since 1910 when he began in the railway sales department of the Chicago house. He was transferred to St. Louis in 1912 and the following year went to 195 Broadway, New York, where his headquarters will remain.

W. D. Hamer, representative of the Electric Service Supplies Company, Philadelphia, Pa., has been transferred from his former territory in the Middle West to a Southern territory with headquarters in Atlanta, Ga. He has been connected with this company for fourteen years. Prior to 1905 he was employed in the stores and engineering department of the Lehigh Valley Railroad Company. In 1907 with the courtesy and co-operation of the Nashville Railway & Light Company, he proposed and developed what is reported to be the first prepayment car operated in the South. Mr. Hamer is inventor of the Keystone triangle arm.

Pulverized Fuel Equipment Corporation has recently been organized for the purpose of taking over the business of the Locomotive Pulverized Fuel Company and to broaden the activities of the latter to cover the central power station, metallurgical and industrial fields. The head offices are at 30 Church Street, New York City, with a Canadian office in the Transportation Building, Montreal. The officers of the new company will be J. S. Coffin, chairman; J. E. Muhfeld, president; H. F. Ball, vice-president, executive; H. D. Savage, vice-president, in charge of sales; V. Z. Caracristi, vice-president, in charge of engineering, and Samuel G. Allen, secretary-treasurer.