

Electric Railway Journal

Consolidation of *Street Railway Journal* and *Electric Railway Review*

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Electrolysis Testing to Be Given Improved Status

ELECTROLYSIS has caused trouble in more ways than one ever since electricity became the motive power for street railways. Much of the controversy on the subject has been due to the limitations which have existed in electrolysis testing, long recognized to be one of the most difficult and perplexing problems, from a technical standpoint, with which the electrical engineer has to deal. Methods of testing heretofore available have not been capable of giving any definite quantitative measure of the rate at which buried pipes and other structures are being corroded by stray current. This fact accounts for many disputes and is also the principal limitation to systematic research work in regard to the relative merits of different methods of mitigation.

In the article on "Earth Current Measurement" appearing in this issue, however, there is described the first successful attempt to make, under practical conditions of field testing, a definite quantitative measurement of the current density discharged from a pipe at any point, this being the factor directly responsible for corrosion. Because the subject is particularly important, because the method described will probably prove the basis of future research work of the American Committee on Electrolysis, and because the results of approaching surveys in certain cities will depend on its use and accuracy, it seems especially worth while to place the analysis of the method before all railway men in sufficient detail and yet sufficiently concise for them to be able to judge the significance of the results.

The method described appears to be one offering promise of great usefulness. If it continues to prove as successful in its practical use as it has in its preliminary applications it should do much to place the art of electrolysis testing on a definite engineering basis.

Municipal Engineers Try Their Hands at Track Specifications

THE American Society for Municipal Improvements is taking an interest in the subject of tracks and track pavements. On another page will be found an abstract of a report on the subject presented at the convention of the society held in Baltimore last week.

This interest should be met more than half way by the American Electric Railway Engineering Association because the street railways and the municipalities have a common interest in the subject. It appears that the municipal engineers are trying to approach the matter in a broad-gaged way and that an opportunity is thus offered for co-operative study of a problem which has so many angles and about which there are so many conflicting opinions.

What is a suitable track construction for paved streets? What are the most suitable pavements for these tracks? Can the various types of track now prevailing be reduced to a few? What pavements are wholly unsuited for use in tracks and should never be

installed when there is track in the street? These are but a few of the questions which arise and about which municipal and street railway engineers have had innumerable discussions. The latter have been mainly on local grounds, depending upon the location and size of the community. But the problems are not local in the main. They have a national importance and should first be studied in respect to fundamental principles applying everywhere. Once agreement is reached on these the local phases may be easily treated. This statement is emphasized by the fact that specifications for street railway track construction were suggested at the Baltimore convention in connection with paving specifications. Incidentally some of the clauses in these specifications will hardly meet the approval of electric railway track engineers as a body.

It is understood that the executive committee of the Engineering Association has taken action designed to secure co-operation with the A. S. M. I. in a joint study of the matter, which is a step in the right direction.

Declare Dividends Even Though Small

IF RESTORATION of credit is the outstanding need of practically every electric railway, would it not be of far-reaching effect in inspiring confidence to declare dividends earned, however small they might be? Many companies last year earned a surplus equal to a rate of 2, 3, or 4 per cent on the allowed valuation. This is of course far short of the permissible and necessary earning of 6, 7 or 8 per cent, and is not conducive to a feeling on the part of directors that they should declare a dividend. At least very few companies have passed on these earnings to their stockholders. To be sure, the surplus earned by some of them was absorbed in accumulated deficits. But looking at the proposition from the standpoint of the man who has held some electric railway stock for a number of years, has watched its market value steadily decline and has not had a dividend for so long that he thinks each time he looks at his certificates he might as well throw them in the wastebasket, it would seem that his feelings in the matter might be considerably brightened by the receipt of even a very small dividend check. It would indicate that the company was not dead—that it was coming back. His contact with others would thereafter be a little more optimistic about electric railway securities. This attitude would spread from such contact with the shareholders and as a result of the public announcement of the dividend and a start would be made in restoring confidence in the financial status of the company.

Too frequently such a dividend is withheld because there is fear of doing anything which local authorities might interpret as an indication of prosperity. This explains the passing of dividends in some instances even where the surplus has been large enough to warrant a full-rate dividend. With that manner of treatment for those who have taken partnerships in the business, there

can be little prospect of any bettering of public opinion toward electric railway junior securities. Even though the surplus earned permitted a dividend of only a fraction of 1 per cent, it would be something, and it is believed this small amount would be very worth while from the viewpoint expressed above. To put such surpluses back into the property may be the cheapest way to get much-needed money now, but that policy will not help greatly toward restoring credit, and to a large extent postpones the day when capital improvements can be made through the sale of other than senior securities.

No Time for Obstructionist Methods

BOTH the *Wall Street Journal* and *Financial America* hope for the best for the plan advanced by the Transit Commission for rehabilitating the railways in New York. Neither paper, however, is very optimistic of the outcome. They see obstacles which to them appear to be insurmountable. Thus the *Wall Street Journal* holds to the theory that "all the existing securities were created legally. They were bought and are held in good faith. No plan can destroy the rights of these holders."

Many securities created legally are bought and held in good faith. That does not make them money earners. Their appraisal as such is pretty accurately fixed by the price which is set for them in the open market. If such be the fact, then the tractions in New York have fallen to pretty low estate under the 5-cent fare as at present imposed. One authority has estimated that securities of the companies in New York, having a market value in 1912 of \$494,145,649, or \$3,336,149 in excess of their face value, have already shrunk to \$176,269,716, or a depreciation in nine years of \$317,375,933. In the light of these figures it would appear that the equities of these holders have already been pretty well discounted even if their legal rights have not been destroyed.

It must be remembered that the commission plan is only a tentative one. The commissioners themselves would probably be the last to proclaim it to be flawless. It is particularly indefinite on the question of the basis of the proposed valuation upon which any security readjustment must be based.

At first hand the task of reconciling all the divergent interests would seem to be insurmountable. As the *Wall Street Journal* says: "There is no legal way of bludgeoning the bondholders into accepting less than the letter of their bond." Even so, there would appear to be no need of it. The situation if allowed to drift unremedied will work itself out eventually in more drastic fashion than could be done by any coercive methods from outside. This fact, the security holders must face.

The basis of all security, after all, is earning power. It is because the earning power of the roads has shrunk so low that the securities of the companies have declined to such an extent that nearly all of them are on the basis of what the holders might be expected to realize if the properties were sold at foreclosure. Bludgeoning did not have to be resorted to in the case of the United Railroads, San Francisco, the security holders of which were willing to accept new evidences of indebtedness and ownership to the extent of \$47,516,000 where such securities had formerly been outstanding to the amount of \$82,190,600, the reduction amounting to \$23,876,000. Bludgeoning has not entered

as a factor in the proposed reorganization of the Pittsburgh Railways, the representatives of the holders of whose securities have signified their willingness to accept a new deal on the basis of \$62,500,000 of new capital as opposed to securities now outstanding amounting to \$156,000,000.

The commission has advanced a plan—the first constructive plan since the tide set in against the companies. If either the *Wall Street Journal* or *Financial America* has anything to offer which it regards as better, the commission will undoubtedly be glad to have it presented for consideration. Obstructionist methods will not get the companies out of the present muddle. They may, however, delay the working out of an equitable plan or may even defeat it. In such event the obstructionists will have even more to answer for than have those to whom the blame now falls for the present intolerable conditions. The policy now of every one interested should be to lend a hand toward a settlement of the problem fair to all so far as it is humanly possible properly to care for the rights of all where there are so many different interests to be considered. The plan advanced by the commission may fail of consummation, but probably not for the reasons either of these papers has advanced. If it does fail all signs would seem to point to a fate worse for the security holders than any which might befall them under any settlement based on the commission's proposal.

Superpower Report Is Timely Contribution

THE Superpower Zone idea, pursued and crystallized by the Geological Survey's Superpower staff, is a logical development of the times. But it needed the impetus given it by the study made by Mr. Murray and his staff to bring home the concrete conception. This has been done in the report just issued and digested elsewhere in this issue. Similar ideas have been put into practice in other places on other scales. The plan in this intensified northeastern seaboard region must be made a reality and this is the problem ahead of the utilities and the railroads. The idea must not die.

There is an impressive note of sincerity and thoroughness of study in the possibilities outlined and recommendations made regarding electrification in the Superpower Zone. Certainly Dr. Cary T. Hutchinson, who is largely responsible for this part of the study and report, is to be commended. There may be some surprise that a group of engineers—principally electrical engineers—should recommend that only 19,000 of the 36,000 miles of track merit electrification, and that certain well known arteries be omitted, even with the low power costs predicted. But as the detailed manner in which the analysis was made is studied the reasons for such recommendations are appreciated. The suggestions of locomotive standardization, of co-operation between the manufacturers, of the constructive ideas electric railway engineers may contribute to trunk line operating problems are all timely and are well considered and presented. In fact, there is a large amount of material which can well be studied and analyzed by both steam and electric railway men.

But the big idea of the superpower system as a whole must be recognized as essential to all the parts. Electrification without power supply is foolish. On the other hand, railroad electrification offers one of the real savings and is one of the main contributing factors to the greater success of any such general undertaking.

Measurement of Earth Currents

Importance and Present Status of Earth Current Measurements—New Instrument and Method Allows More Accurate Determination of Currents Causing Electrolysis in Underground Structures

BY BURTON MCCOLLUM

Electrical Engineer, U. S. Bureau of Standards, Washington, D. C.

IN THE FIELD of electrolysis testing the greatest difficulty that has been encountered up to the present time has been our inability to measure directly the factor responsible for the corrosion, namely, the density of the current flowing from a pipe to earth at any particular point. In consequence of this, it has not been possible, heretofore, to make direct quantitative measurements of the degree of hazard to buried pipes and other structures. Heretofore, tests made to determine electrolysis conditions have com-



NEW EARTH CURRENT METER IN USE IN THE FIELD

prised chiefly two classes of measurements, namely, voltage measurements between various structures and measurement of current flow on pipes and other subsurface structures. The voltage measurements, as a rule, comprise measurements of over-all potential on the railway tracks and measurements of potential difference between various subsurface structures and between such structures and railway tracks. Attempts have also been made to measure potential difference between subsurface structures and the adjacent earth, but, with the possible exception of lead cable sheaths, these have not yielded satisfactory results.

The chief difficulty about securing information regarding electrolysis conditions by means of voltage measurements grows out of the fact that, as stated above, the electrolytic corrosion at any point is determined directly by the intensity of the current discharged from any particular point on the pipe surface. A voltage measurement between a pipe and any other structure constitutes only one factor affecting the current flow, the other factor being the resistance of the path traversed by the current through the earth. Experience has shown that this resistance may vary between extremely wide limits, commonly in the ratio of 10 or 20 to 1 and not infrequently as much as 100 to 1, due to the character of the soil, variations in moisture content and temperature. It will be apparent, therefore, that a mere voltage measurement has no quantitative significance in determining the seriousness of electrolysis conditions in any particular locality. It is not to be inferred from this that such voltage measurements will be of no value as they do have an impor-

tant qualitative significance, and under certain circumstances such measurements can be used to determine relative conditions under different systems of mitigation. They do not, however, permit of any definite quantitative interpretation.

The measurement of potential differences between subsurface structures and the adjoining earth is further complicated by the phenomenon of galvanic potentials which are always superposed on any dynamic voltage that may result from a discharge of current

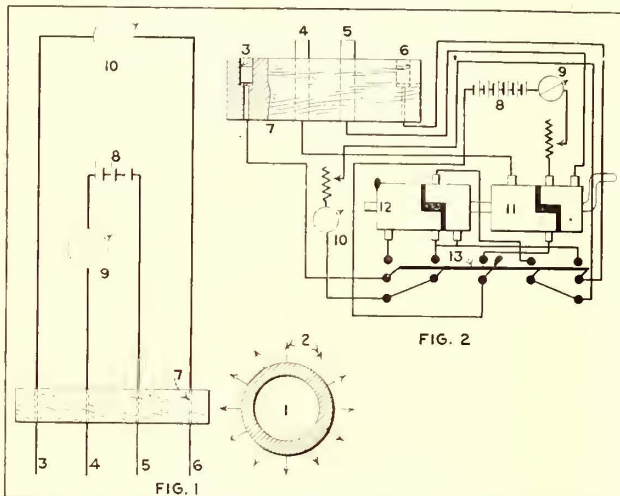
into the earth. These galvanic potentials may often be as large, or much larger, than the dynamic voltage, thus entirely obscuring the quantity which it is sought to measure. On account of these galvanic potentials, it is not possible to determine by any means heretofore available even the polarity of a pipe with respect to earth, since the potential difference due to the galvanic potential often exceeds that due to the stray earth current.

The measurement of current flow on pipes which is very commonly made in connection with electrolysis surveys may also be of value in determining relative conditions under different systems of mitigation, but here again such measurements possess no definite quantitative significance. The amount of corrosion that may be caused by a given current on a pipe depends altogether on the manner and location of its leaving the pipe. That part of the current which may be removed from the pipe through metallic paths will produce no corrosion upon leaving the pipe, only that portion of the current which discharges directly from the pipe surface into the adjoining earth being involved in the corrosive process. Further, even if it is known that all the current on the pipe ultimately leaks directly from the pipe into the earth, the degree of danger depends altogether on the distribution of such current discharge, so that a mere measurement of the current flow on the pipe at any particular point gives no definite information as to the degree of seriousness of the situation. The only way in which definite quantitative information can be secured showing the degree of hazard to a pipe at any point is by measuring the intensity of current discharge from the pipe at the point under consideration.

Up to the present time two methods have been resorted to in rare cases in an attempt to measure the intensity of current discharge in the earth. One of these is by differential current measurement on a pipe; that is, by measuring as accurately as possible the current flow on a pipe at two points some distance apart and taking the difference between the currents at the two points of measurement as the total current discharged from the pipe between these points. The other method is by what is known as the Haber earth current collector, a device for measuring earth current density.

The method of differential current measurement is subject to the very serious limitation that it is extremely difficult to make an accurate measurement of current flow in the pipe, the methods commonly used for this purpose not being accurate enough to give satisfactory results unless the leakage current between the two points of measurement constitutes a very large percentage of the total current on the pipe, which is seldom the case in practice. For this reason, this method has been very little used in the past and has now been practically abandoned.

The Haber earth current collector is a well-known



FIGS. 1 AND 2—DIAGRAMS TO SHOW THE PRINCIPLE AND THE ACTUAL CIRCUIT OF NEW METER WHICH EMBODIES THE IDEA

device designed to be buried in the earth at any particular point at which the current density is to be measured. It is subject to very serious limitations and to very large sources of error, and experience has shown that it cannot be relied upon to give any accurate indication of the normal current density in the earth. Numerous attempts have been made to apply it in the past but it is no longer used in this country.

A NEW METHOD FOR MEASURING EARTH CURRENTS —PRINCIPLE OF THE NEW METHOD

Engineers engaged in electrolysis research have long felt the need of some definite and accurate means of determining both the polarity of pipes with respect to earth and of measuring current density in the earth at any point, especially immediately adjoining subsurface structures which may be in danger of electrolytic corrosion. The object of this paper is to describe a method and instrument the purpose of which is to afford a means for the accurate determination of the polarity of pipes with respect to earth and for the quantitative measurement of current density at any desired point in the earth. This method, if it continues to prove as successful in practice as it has in its prelimi-

nary applications, will enable one to do what it has not been possible to do heretofore, namely, to make direct quantitative measurements of the actual hazard to buried structures at particular locations.

It will readily be seen that if a measurement be made of the resistivity of the earth at any particular point, and if then a measurement be made of the voltage drop between two points, a known distance apart, within this same region in which the resistivity has been measured, these two measurements will permit a calculation of the current density in the earth in the region immediately under investigation. The new method described below involves something of the principle here stated, although in its actual carrying out neither the resistivity of the earth nor the true potential drop between two points is determined.

The principle of the new method of measuring earth currents can best be understood by reference to Fig. 1, which is a diagrammatic illustration of the elements of the apparatus. Let us assume that the pipe (1) of Fig. 1 is discharging current in all directions as indicated by the arrows (2). Four electrodes (3, 4, 5 and 6) may be imbedded in the earth immediately adjoining the pipe, on whatever side the current intensity is to be measured, or placed against the wall of an excavation made near the pipe. An excavation is here assumed tentatively to simplify the explanation of the principle of the method. It will later be shown how the method can be applied without making excavations of any kind. For convenience these several electrodes may be mounted on a single insulating frame (7). Two of these electrodes, for example (3) and (6), may be connected to a suitable voltage indicator (10), which need not read in any particular units.

Suppose, now, a current (I_0) be caused to flow between the terminals 4 and 5 through the earth from the battery (8), which current will be measured by the ammeter (9). It will be evident that this current distributes itself in all directions through the earth and produces a certain voltage drop between the terminals 3 and 6 due to the resistance in the earth immediately surrounding the group of electrodes. This voltage drop between the terminals 3 and 6 will be indicated by the voltmeter (10) and will be proportional to the current flowing between the terminals 4 and 5 and to the resistivity of the surrounding earth. If E_0 is the voltage between the terminals 3 and 6 and if θ_0 is the corresponding deflection of the voltage indicator (10) we have

$$\theta_0 = K E_0 \quad (1)$$

where K is the constant of the voltage indicator (10) which includes the effect due to the resistance of the leads and the electrodes 3 and 6. This is an important consideration and will be discussed later. Further, it will be seen that E_0 is proportional to the current I_0 sent between the electrodes 4 and 5 and to the resistivity r of the surrounding earth, or

$$E_0 = A I_0 r \quad (2)$$

where A is a constant depending upon the geometrical arrangement of the group of electrodes. Substituting the value of E_0 as given by equation (2) in equation (1), we have

$$\theta_0 = K A I_0 r \quad (3)$$

In the above equation it is assumed that the voltage drop across the terminals 3 and 6 is due solely to the current sent through the terminals 4 and 5. In order that this may be true, conditions must be such that no other current flowing through the earth at the time the

measurement is made will in any way affect the apparatus. For the present, we will assume that this is actually the case. It will be explained later how this is readily realized in practice. After taking the above measurement of I_0 and the corresponding θ_0 , the circuit of the battery (8) is opened, after which the voltage drop (E_1) between the voltage terminals 3 and 6 would be due solely to the current (i) which is flowing through the earth, or

$$E_1 = i r L \quad (4)$$

where L is the distance between the terminals 3 and 6, i is the mean current density in the region between the terminals 3 and 6, and r , as above, is the resistivity of the earth.

The corresponding deflection of the instrument (10) is θ_1 and we will have

$$\theta_1 = K E_1 = K i r L \quad (5)$$

Dividing equation (3) by equation (5), we have

$$\frac{\theta_0}{\theta_1} = \frac{K A I_0 r}{K i r L} = \frac{A I_0}{i L} \quad (6)$$

Solving equation (6) for i , we have

$$i = \frac{A I_0 \theta_1}{L \theta_0} \quad (7)$$

As stated above, A is a constant depending upon the geometrical form of the electrode group (3, 4, 5 and 6). This can be determined once for all for a given electrode group by immersing the electrode in a medium such as water through which a current density of known value is sent. Under these circumstances, if we perform the two measurements indicated above and substitute the values in equation (7), i being in this case known, we can once for all calculate the value of A , and as soon as the distance (L) between the two electrodes 3 and 6

is known, the proportional factor $\frac{A}{L}$ becomes known.

Calling this factor R for brevity, we have

$$i = \frac{R I_0 \theta_1}{\theta_0} \quad (8)$$

In equation (8), i is the current per unit area, or the quantity which is to be measured, and R is the known constant.

To obtain the value of i , we have therefore to perform the two operations mentioned above, namely, to send a known current (I_0) through the two electrodes 4 and 5 and at the same time measure the corresponding deflection (θ_0) of the instrument (10), this being done in a manner described below, such that the instrument (10) will not be affected by any earth current other than that which flows from the battery (8) through the terminals 4 and 5. We then disconnect the battery (8) and measure the deflection (θ_1) of the instrument (10) due solely to the earth current (i). These three values (θ_0 , I_0 , and θ_1) are then substituted in equation (8) and the value of i calculated.

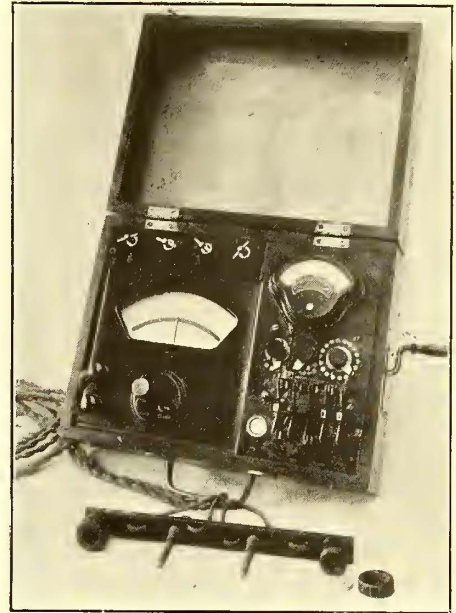
As stated above, the indication of the voltage indicator (10) is a function of the resistance in series with its leads, and therefore of the resistance of the electrodes 3 and 6 and of the earth immediately surrounding them. In practice it is found that this resistance is often very high and quite variable, so that the instrument (10) does not in general give a true value of the voltage impressed in the earth between the two electrodes 3 and 6, and often not even an approximation to the true value. It will be observed, however, from equation (6) that the resistivity (r) of the earth in the region in which the test is being made and the

constant (K) of the voltage indicator (10) disappear from the equation from which the earth current (i) is calculated. It will be seen, therefore, that in making this measurement, neither the resistivity of the earth, nor the true value of the voltage drop between the electrodes 3 and 6 need be known. This constitutes one of the important advantages of the method of procedure hereinabove described.

PRACTICAL EMBODIMENT OF THE PRINCIPLE

As stated above, in carrying out the first of the two operations above described, it is essential that some arrangement be provided whereby the deflection (θ_0) will be due only to the current (I_0) which flows through the terminals 4 and 5 and will not be influenced by any earth current already flowing. This can be accomplished in a very simple manner, by an arrangement shown in Fig. 2, which shows also a complete wiring diagram of the test set.

In this arrangement, two commutators (11 and 12), mounted on the same shaft, are employed. These commutators are so mounted on the shaft that commutation takes place on both at exactly the same instant, and are provided with a crank whereby they may be rotated by hand at a suitable speed. The commutator 11 is interposed between the battery (8) and the test terminals 4 and 5, while the commutator 12 is interposed between the terminals 3 and 6 and the voltage indicator (10). It will be seen that an alternating current flows through the earth from the terminals 4 and 5 and impresses an alternating voltage on the terminals 3 and 6 which are being commutated simultaneously with the current through the leads 4 and 5 and gives rise to a unidirectional voltage on the voltage indicator (10). This instrument being of the direct current type will therefore give a deflection (θ_0) proportional to the current (I_0) sent through the terminals 4 and 5. At the same time, any unidirectional voltage impressed on the terminals 3 and 6 due to an earth current will be commutated so frequently that it will exercise no appreciable effect on the voltage indicator, and hence the reading of the latter will be just the same as if for the time being the earth current to be measured did not exist. After the measurement of the current (I_0) and the deflection (θ_0) is made under these conditions, a double-throw switch (13) is reversed, which, as will be seen from Fig. 2, disconnects the battery (8) from the terminals 4 and 5 and at the same time eliminates the commutator 12 from the circuit between the electrodes



NEW INSTRUMENT FOR THE MEASUREMENT OF EARTH CURRENTS

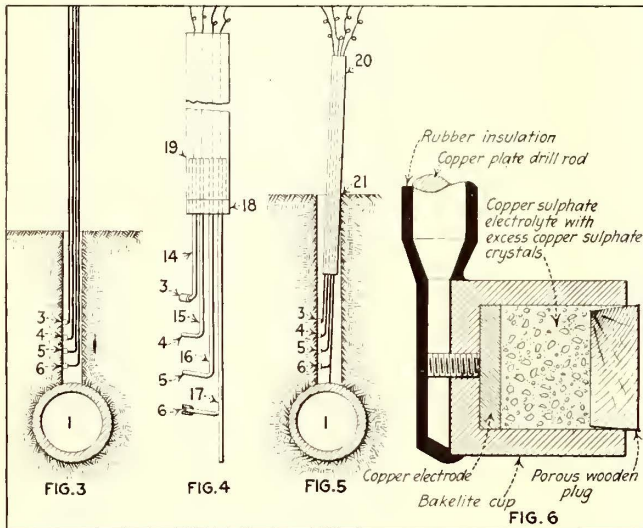
3 and 6 and the voltage indicator (10). In the new position of the switch the voltage between the electrodes 3 and 6 due to the earth current (i) will produce a corresponding deflection in the voltage indicator (10) which is then read as the value θ_1 . These three values (θ_0 , I_0 and θ_1) are then substituted in equation (8) and the value of the earth current (i) is calculated in any desired units, depending upon the value of the constant (R) used.

APPLICATION OF INSTRUMENT TO FIELD TESTING

The electrode group (3, 4, 5 and 6) mounted on the insulating support (7) may be permanently buried in the earth in the region in which it is desired to measure the earth current at any time, or the four electrodes may be placed against the wall of an excavation, so that all four terminals make contact with the earth, while a measurement of current intensity in the earth adjoin-

can be used, however, to explore the current distribution on practically all sides of the pipe, without making any excavations, other than merely driving small holes on either side to the pipe.

In order to use this method of placing four electrodes down in a hole, it is necessary to use a special form of mounting of the electrodes. A very suitable and practicable method is shown in Fig. 4. The electrode (3) is mounted on a flexible rod (14) of some elastic material, such as spring steel, which should be elastic enough to permit it to be displaced about an inch or more, without the rod taking a permanent set. Similarly, electrodes 4, 5 and 6 are connected separately to the elastic rods (15, 16 and 17), these rods being spaced apart sufficiently so that in actual use they do not make contact with each other. These elastic rods are mounted in an insulating bushing (18), which is set in a suitable tube (19), preferably of metal. An extension of the rod (17) is provided, so that the lower electrode will always come automatically to a predetermined distance from the pipe. Wires are brought up through this tube to the surface and the measurements made after the manner shown in Fig. 2. In practical use, the tube (19) carrying the four electrodes (3, 4, 5 and 6) is inserted in the hole leading down to the pipe to the proper depth as shown in Fig. 5, and the top of the rod is pulled sideways in the direction of the arrow (20) using the collar of the hole (21) as a fulcrum, so that the four electrodes (3, 4, 5 and 6) are caused to press independently of each other against the wall of the hole, thus securing reliable contact with the earth. It is necessary that the steel rods on which the four electrodes are mounted be thoroughly insulated and preferably also copper plated in order to eliminate disturbances due to galvanic action.



FIGS. 3 TO 6—DETAILS OF MOUNTING THE FOUR ELECTRODES

ing the wall of the excavation is being made. The constant (R) of the instrument will, however, be different in the two cases, but can be determined once for all for the two types of measurements. In most cases, however, where it is desired to measure the current density discharged from a pipe at any given point, it is unnecessary to make an excavation. For measurements of this kind, a special type of four-terminal electrode has been designed which can be placed down in a hole extending from the surface of the earth to the pipe, as shown in Fig. 3. This hole may be made by means of an auger, or by simply driving a pipe or rod of suitable size into the earth, and then removing the rod from the hole. The four electrodes (3, 4, 5 and 6) are then put down in this hole and the measurement is made in exactly the same manner as described above.

This method of measurement can be used effectively for making rapid determinations of leakage current from the pipe at any point. Numerous experiments have shown that when a pipe is buried at an ordinary depth of several feet, which is relatively large in comparison with the distance between the four electrodes and also the radius of the pipe, the current discharged in a vertical direction upward in the vicinity of the electrodes is substantially the same as that discharged vertically downward or toward either side, so that in general it is not necessary to measure the current density on more than one side of the pipe, and it is most convenient to measure it in a vertical direction upward, as in the manner just indicated. The method

The electrodes (4 and 5) through which the test current is sent from the battery in the first part of the test can be made from any ordinary metal, such as iron and copper. The electrodes 3 and 6, however, should be made on the well-known principle of the non-polarizable electrode developed by Professor Haber, that is, they should comprise a cup having an electrode at the base of copper, the cup being filled with a concentrated solution of copper sulphate. This electrolyte is confined in the cup by a stopper of wood or other porous material. Fig. 6 shows a typical form.

The illustration on page 811 shows a portable test set in which are mounted in compact form the battery (8), the ammeter (9), the voltage indicator (10), the double commutator (11-12), and the double-throw switch (13). The illustration on page 813 shows a portable four-terminal electrode. In this design the handle has a joint in the middle, so that it can be folded during transportation. The cut on page 809 shows the apparatus in use, with one man operating the test set, an assistant holding the rod in test hole over the pipe.

TEST DATA PROVE EFFECTIVENESS OF INSTRUMENT

The number of holes that have to be driven for testing a pipe line depends upon the minuteness with which it is desired to analyze the current distribution on the pipe. Numerous investigations have shown, however, that for ordinary purposes the driving of a hole about every fifty to a hundred feet is sufficient to give a good indication as to the general electrolysis conditions prevailing on the pipe, and in many cases a much larger spacing may be used. In the case of some pipe lines that have been investigated in which holes were driven every ten feet along the line, it was found that the

electrolysis condition of the pipe as deduced from the readings of every fifth or tenth hole was substantially the same as that arrived at from the consideration of the readings taken in every hole. In the case of an experimental installation in Washington, D. C., a dead-end length of 8-in. pipe, about 900 feet in length, was insulated from the main network by means of two insulating joints. A definite leakage current was then impressed upon the pipe and this was measured first by using the earth current meter in a series of holes spaced twelve feet apart along the entire length of pipe. This data was then worked up in several ways. First, the total leakage current was calculated from the measurements in every hole, then by using the data in every other hole, then in every third hole, and so on. The results of these calculations are given herewith:

Every Hole	Every Other Hole	Every Third Hole	Every Fourth Hole	Every Sixth Hole	Every Eighth Hole	Every Tenth Hole
1.12450	1.1188	1.2402	1.26	1.0282	1.1544	1.391

From this table it will be seen that the leakage current as calculated in the several ways does not differ to any large extent from the figures obtained by using the data taken at every hole. It is evident, therefore, that for most purposes an infrequent spacing of the holes would meet the practical requirements. Of course, where large pipe lines of another system cross the line under test, it is desirable to place the holes a little closer together, near the crossing, since the condition of the pipe may change greatly within the distance of 25 to 50 feet at such crossings. Experience has shown that the number of holes required for testing is not such as to make the method expensive to apply wherever pipes of any importance are under investigation.

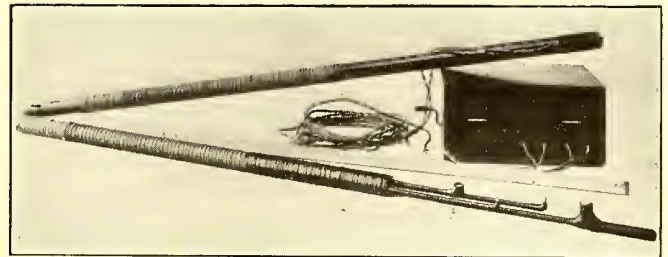
It is well to have clearly in mind just what current is measured by this apparatus. This current is the mean current per unit area, as for instance per square centimeter, or per square inch in the earth in a small region immediately surrounding the center of the four-electrode group. A good approximation will be had by stating that it gives the mean current density throughout the volume of a sphere having a diameter approximately equal to the distance between the two potential electrodes of the four-electrode group. It will thus be seen that by using electrodes of very small size the current density in a very small volume of earth can be studied. By the use of electrodes an inch or an inch and a half apart, the mean current density in a sphere as small as three or four inches in diameter can be definitely determined. For most ordinary purposes, however, it is found desirable to use a two- or three-inch spacing of the electrodes, in which case we secure the mean current density in a volume of perhaps half a cubic foot of earth immediately surrounding the center of the electrode group.

It would be very desirable in many cases, in addition to the average current intensity in the space surrounding the electrodes, to know the distribution of the current at the surface of the pipe, because it is the irregularities in this current distribution which gives rise to the well-known pitting of the pipe. The simple procedure described above does not give information as to whether the current is uniformly distributed at the pipe surface. It is, however, possible by the use of a modified type of electrode, to get considerable information on this point.

In the foregoing discussion it will be observed that equation (3) involves the resistivity (r) of the earth.

If the constant (K) of the voltage indicator (10) is known, the constant (A) being known, the instrument permits a direct calculation of the resistivity of the earth. The constant (K) of the voltage indicator (10) will be known provided the resistance of this circuit is sufficiently high to obscure the effects due to drop of voltage in the electrodes. The test set as made up is provided with a switch whereby a megohm or more of resistance can be inserted in series with the voltage indicator. When this is done, the resistance of the electrodes becomes negligible and the instrument can be used directly as a very rapid and convenient means of measuring earth resistivity. It is the only practicable instrument for making such resistivity measurements of the earth in position without disturbances of any kind and will undoubtedly have a great many applications for this purpose.

At the present time, investigations are under way looking to the comparison of test results obtained by this new method with those obtained by the older methods of voltage surveys, with a view of determining to what extent the data taken in previous years may yield



COMPLETE OUTFIT READY FOR THE FIELD

valuable deductions when interpreted in the light of information revealed by the new method. It is hoped in this way greatly to increase the value of records of tests that have been made in years past. Also it is planned to make very thorough and extensive investigations by the new method in numerous localities, in some of which electrolysis damage is known to be very great, and in other cases in which it is known that pipes have not suffered materially over a period of years. Such investigations when completed will be of considerable value in permitting the drawing of definite and unquestionable conclusions from future tests.

The voltage indicator (10) used in this test set has to be of very special design to have an extremely high current sensitivity. The instrument used gives a full scale deflection for one microampere, and was designed and built especially for this apparatus by the Rawson Electrical Instrument Company of Cambridge, Mass., which company is now manufacturing the complete sets.

This instrument has been in use for some time at the Bureau of Standards, where it has been subjected to careful tests and experimental work, and has been found to be a very convenient, economical, and accurate means of measuring the current intensity discharged from buried pipes. The instrument has also been used in a number of instances in practical electrolysis testing, and has been found very well adapted for use under practical conditions. By the use of this instrument, information can be had showing far more definitely the actual electrolysis conditions prevailing on any particular point than it is possible to secure by any other means heretofore available. The results of tests by this instrument are not subject to the very large factors of uncertainty in interpretation as those obtained by the usual methods of electrolysis testing.

Railway Situation in Berlin

Large Reductions in Operating Expense Made Necessary by Present Conditions Have Been Effected by Consolidation of the Various Street and Suburban Lines in Greater Berlin and by Improving Traffic Conditions

BY EUGENE EICHEL

Consulting Engineer, Berlin, Germany

THROUGH a combination of all the railway systems of greater Berlin the management has been able to introduce large economies. The electric supply and feeder system has been rearranged by shutting down a number of small generating stations and by directing the current supply to the most advantageous feeding point. Expenses for current and feeder copper, for station attendants and for the supplies necessary for maintenance have been diminished. Large savings have also been effected by a rearrangement of the service, which was found desirable from a study of well-kept statistics on the density of traffic and the idle cars during various hours of the day.

The entire network of lines is being scientifically investigated and lines which duplicate service or compete with each other are being scrapped. Various radial lines are being interconnected and the number of stops reduced. Service to the outlying districts of the city is being decreased by introducing fifteen-thirty-minute service during a large part of the day.

An attempt is being made to standardize the equipment as much as possible, but this is very difficult at present. A large number of the smaller systems have tracks constructed to the narrow 1 meter gage, and all are equipped for bow current collection. As a very large part of the system, or that formerly belonging to the Grosse Berliner Strassebahn, is arranged for trolley wheel service, the consolidation has made it necessary to rebuild the smaller lines now provided with bow current collection, because it would be too expensive to change the equipment of the old Grosse Berliner. The bow collector is considered superior to the trolley wheel in Germany and the trolley wire installation is being renewed in such a manner that, with more prosperous times, it can be used for bow collection also.

REPAIR SHOPS ARE CONSOLIDATED

Another large saving is expected from the consolidation and rearrangement of the main repair shops. Old equipment is being scrapped and replaced by up to date machinery and an efficient repair force is being organized. A large number of the men previously used received subsidies for returning to the country and working as farm help. Small farmers are enabled to purchase small plots with government money, which is received in a lump sum, and war invalids are thus induced to live a healthy farm life rather than to increase the large number of city population, which at present groans under the lack of proper accommodations and insufficient and cheap food.

Quite a number of streets are being repaved. Asphalt pavement is relaid in a small number of instances, but the standard pavement used is of granite, at least as far as railway track is concerned. Track repairs are made by means of inserts electrically welded to the old rails. Worn-out joints are sawed and replaced. New rails are installed in but rare cases. These are most generally welded by the Thermit system.

The use of electric rather than air brakes will also produce economies in operation. The air brakes used in Germany have axle compressors, which are very costly to maintain, require a large amount of oil and wear out very rapidly. An idea of the cost of maintaining this equipment may be gained from the fact that the Grosse Berliner could have paid 1 per cent more dividends in 1913 if electric instead of air brakes had been used, and at that time wages, material and oil were very much lower in cost than they are at present. All new cars and as many of the rebuilt cars as possible are being equipped with motors of sufficient capacity so that they can safely be used with electric rheostatic braking.

SAFETY CARS TO BE INTRODUCED

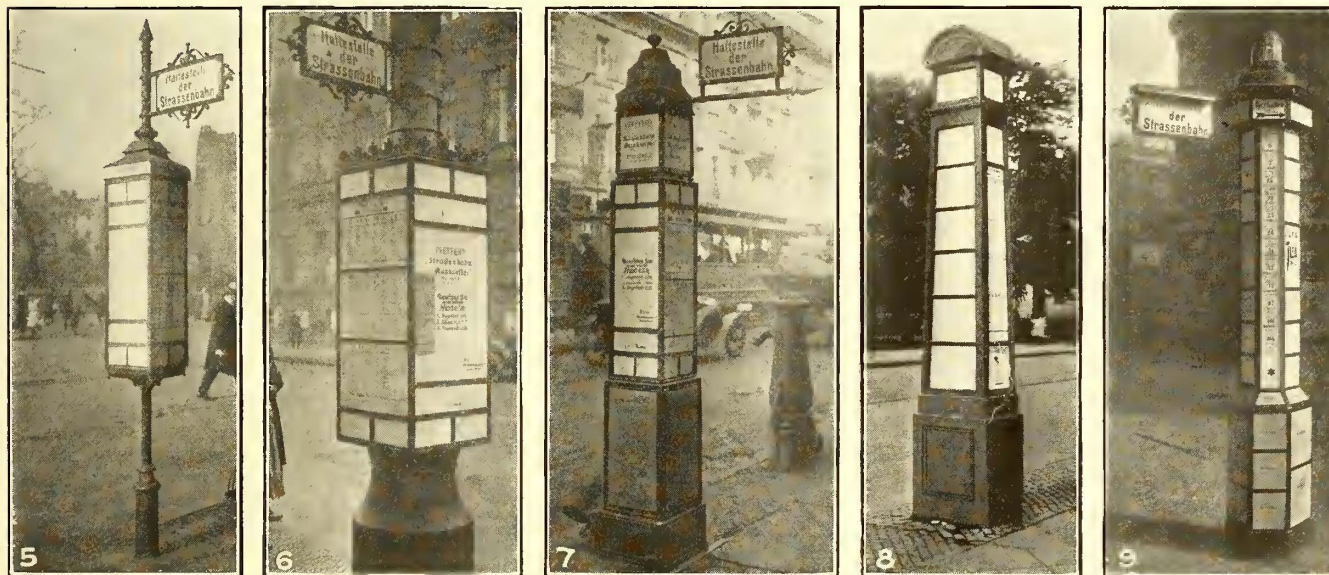
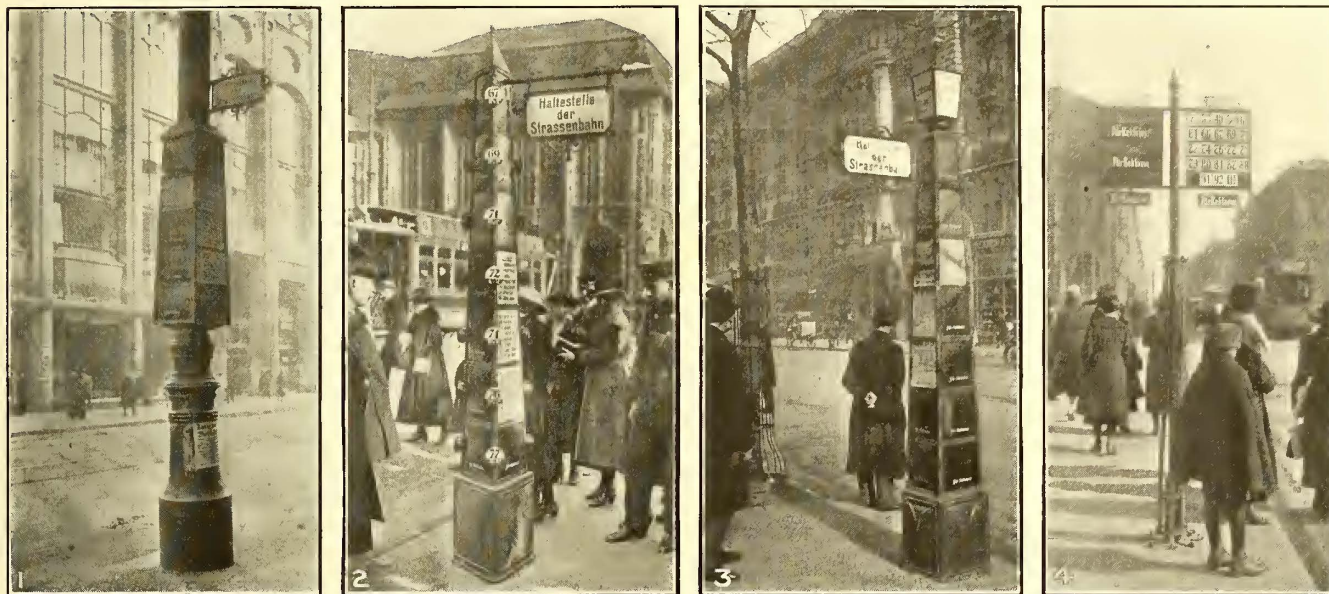
An investigation is now being made of the advantages of introducing one-man safety cars. The intention is to start with ten of these cars operating on lines at the outskirts of the city. The difficulties expected from the introduction of this class of service appear rather large. First, politics will play a considerable part, as the reduction of men from the use of one-man cars is not favored by the Social Democrats, and this party has a large amount to say in the City Hall. Secondly, the public in Berlin is not as patient as the American public, due to the present poor nourishment received and the nervous strain of the war. These effects have made them rather quarrelsome. The third difficulty is that of fare collection. At present there is plenty of dirty and sticky worn and torn paper money in Germany, but no hard cash. Thus the use of a fare box appears to be a rather hard problem to solve. The use of metal tokens might be considered, but tokens in Germany must be manufactured out of cheap material, such as tin, iron, zinc or aluminum. Nice clean German silver coins are too expensive.

In addition to the introduction of safety cars, the use of trackless trolleys on some of the outlying lines is being considered. The present indications are that these will be used as feeders for existing lines and as a substitute for any extensions required.

Some additional means which are being introduced for increasing the income includes an increase in fare to 1 mark, against 10 pfennig previously used. Due to the present depreciated value of the mark, this has a somewhat less buying value than the 10 pfennig of peacetime. A transfer system has also been introduced in an attempt to increase travel. A transfer ticket can be purchased for 1½ marks and can be used on any connecting lines within two hours after its purchase. Of course, the use of a transfer so as to enable the passenger to return directly or indirectly to the starting point is prohibited. Tickets for eight rides are also issued, but no discount is given to the purchaser, as was the former practice. The use of such tickets speeds up operation by the faster collecting of fares and through the decrease in small change difficulties effected.

During the war a rather extensive parcel mail system was introduced for carrying parcels from the depot to the post office and vice versa. This system has now been enlarged and results in a profit of about 1,000,000 marks to the post office and 6,000,000 marks to the street railway. The cars used for this service are

road Commission and by the Prussian Government Railroad. Before the war the electric roads were not allowed to carry freight, as the governing bodies were afraid that their own freight business would be diminished. Previous regulations of the government railroads also prevented the use of advertisements on the



TYPES OF STOP INDICATORS COMBINED WITH ADVERTISING SPACE

No. 1. Trolley pole inclosed by a light angle-iron framework studded with plates, enameled with different colors.
 No. 2. Column of triangular shape, with enameled plates.
 No. 3. Square shape column, with enameled plates.
 No. 4. Ordinary stop pole with sheet-iron plates indicating the numbers of the lines passing. One side is painted white with black letters, while the other has a khaki colored background with black lettering.
 No. 5. Stop pole with light angle-iron framework for supporting glass plates illuminated from inside by storage battery lamps.

No. 6. Type similar to No. 5, but using a trolley pole base.
 No. 7. Square column with the lower part covered by sheet-iron plates and the upper part by glass plates, which can be illuminated from the inside.
 No. 8. Same type as No. 7, but more artistic.
 No. 9. Same type as No. 7, but of a hexagonal shape, which requires little space at the sidewalk and gives more space for views by the passing public. The top is crowned by a glass cupola containing a lamp with a filament of H-shaped aluminum plate which can be dimmed.

antiquated motor cars and open summer cars. Windows and entrances are nailed shut with lattice boards.

An attempt is also being made to start a substantial freight business. Certain classes of business located in central Berlin have large factories in the suburbs. The transportation of raw materials, semi-finished and finished goods is now made principally by autotruck. The electric railways are catering for this business, particularly as a night freight service. The Berlin electric railway is supervised by the Government Rail-

road Commission and by the Prussian Government Railroad. Before the war the electric roads were not allowed to carry freight, as the governing bodies were afraid that their own freight business would be diminished. Previous regulations of the government railroads also prevented the use of advertisements on the exterior of car windows, as it was felt that accidents might result. Now, however, they are less particular and allow advertisements and the city cars have large advertisements on the roofs, dashboards and also sandblasted on windows. This is in addition to the ordinary car advertising cards used inside.

A new source of revenue is also being exploited, which consists of the use of stop indicators. These indicate not only the place where cars stop but also the sign number of the lines passing this place, the

extent of these lines and the time of the first morning and last evening car. A number of different stop indicators have been developed and the increased revenue comes from the use of advertisements at these locations. Advertisers consider the stopping place as an excellent location for their advertisements, as, while waiting for a car, the passenger has time for looking over the various advertising display. Approximately three hundred of these advertising column-stop indicators are now in use. The advertisements are displayed on glass so that they can be lighted in the dark from the inside of the column. In addition to proving an effective means for displaying the advertisement, it also enables passengers to locate the various stops readily, as the illuminated indicators can be seen for a considerable distance.

Before the war there was considerable traffic in gasoline and horse-drawn buses. Due to the high operating cost and the scarcity of rubber for tires, many of these were forced out of business where they were operated by men of small means. The Grosse Berliner purchased a large amount of stock in an omnibus corporation before the war. This is now owned by the city, so that the city now controls this traffic. The intention is to increase this bus service and use it through streets which have no electric railway facilities. A new electrobus concern is also being advocated, if suitable arrangements can be made with the city.

SUBWAYS AND ELEVATED ROADS IN BERLIN ARE EXPENSIVE PROJECTS

The city also owns a block of stock in the Berlin Elevated and Subway Railroad, which has a pre-war concession for a system of feeder lines. The elevated earns a reasonable dividend, but has to return about 3,000,000 marks annually to the city. The cities of Schoenberg and Wilmersdorf built rather expensive subways for developing real estate values. These have been leased to the Berlin Elevated, so that this latter road now has to pay about 4,000,000 marks annually to the city, due to the operating contract. In consequence, the subway service results in a loss of about 1,000,000 marks per year. This, of course, prevents extensions which were planned before the war from being completed. One of these, called the "North-South" Subway of Berlin city, while nearly completed, has an important part still to be built. This runs close to the surface in Friedrich Street and its uncompleted condition is proving a great obstacle to traffic through this street and many requests for a speedy completion are being received. When this is completed it will use 800 volts direct current instead of 1,200 volts, which were previously decided on. This is the same voltage used by the existing Berlin Elevated road and a uniform voltage will facilitate the exchange of rolling stock on the various lines. Another system called the "A.E.G. Subway," on which construction was started before the war, is in very bad condition and it appears commercially impossible to continue the work of construction. The city, however, feels that the building of these various subways should be continued, in order to provide work for a large amount of unskilled labor, as well as to better traffic conditions along the highways where open pits and fences interfere with traffic. Also their completion would increase traffic facilities to a considerable extent. The city attempted to force the corporation to continue this work, but a court decision was rendered to the effect that the corporation could

not be held responsible for contracts entered into before the war. The city and operating corporation are now negotiating in regard to subsidies which it is thought will help the underground corporation to finish the tunnels.

The oldest elevated in Berlin, called the "Berliner Stadt-Ring und Vororbahn," which can be translated as the Berlin city, circular and suburban railway, still uses steam locomotives. This system is operated by the government at a very cheap rate of fare, which is still further decreased by the use of monthly tickets sold at very low rate. As a result, this enterprise has never paid and now costs millions of marks to operate. These losses increase the burden of the population as the deficit of the government railroad must be borne by the taxpayers, and in addition the low fares charged result in a very undesirable competition with the municipal roads. The government and city are now endeavoring to come to a working agreement in regard to fares, transfers and other details, which may include the electrification of this road.

The Chief Commissioner of Berlin Traffic Utilities not only has control over the rapid transit, street railways, buses and cab traffic but also over the municipal traffic utilities, which include the street cleaning and house refuse department and the traffic on the various waterways. These latter are quite important, due to their use for carrying bulk freight, such as coal, brick, lumber and other building material, and also for use in transporting agricultural products, such as fruit, vegetables and the like. An attempt is being made to increase the income of the street railway system through connections with the various harbors by spur tracks. This would facilitate the exchange of goods from and to the harbors and should also result in a saving to shippers.

Valtellina Railway Is Extended*

Famous Three-Phase Railway Now Operates to Monza, a Short Distance from Milan—Road Adopts New Trolley Suspension—Details of New Locomotive—Tests Show Satisfactory Operation*

THE Valtellina Railway may be considered the father of trunk line electrified roads in Europe. The fuel scarcity was always felt in Italy, and this, combined with the abundance of water powers, was no doubt responsible for early and exhaustive tests with electric traction. In the beginning the Italian engineers adopted the three-phase system, because at that time the three-phase induction motor was the only reliable railway motor in existence other than the low-voltage d.c. motor. The system originally installed by Ganz & Company of Budapest has been developed and improved to give the system of today, which represents a very high standard in electrified operation, although rather costly from an installation standpoint. To abandon the three-phase system in favor of a possibly better one would result in a tremendous loss of time, valuable experience and money.

The Valtellina road is not only of great technical and historical interest but also is one of the electrifications that represents an extremely good solution of a difficult traffic problem. The road was built in 1902, and many articles have been published previously describing its equipment. The total length of the road is at present 65.7 miles and is single track throughout. It is the connecting link between Milan and several famous Alpine summer resorts. Its main traffic consists of tourists, freight transportation never being of great importance. The road passes over a very moun-

*Dr. E. Huldshiner contributes to *Elektrotechnische Zeitschrift*, issues of March 26 and June 2, 1921, an article on a recent extension of the Valtellina Railway. From this article the facts herewith are taken.

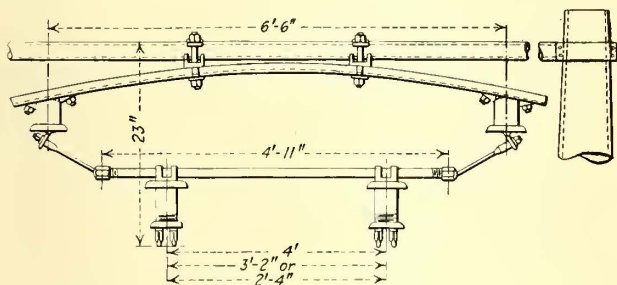
tainous territory; about one-third of the line passes through tunnels, one-half of it is in curves, and there are grades on the system as great as 2.2 per cent. All of the original equipment was furnished by Ganz & Company. Two hydro-electric power stations supply three-phase power at 15 cycles and generate directly at 20,000 volts.

Originally there was only one feeder line parallel to the road, but many interruptions of the service, due to the breakdown of the feeder, forced the road to install a second parallel three-phase feeder consisting of three copper wires, each about 0.4 in. in diameter (160,000 circ.mil), suspended on seamless steel tube masts. Along the tracks are distributed nine transformer stations, each containing one 300-kva. three-phase transformer, which reduce the feeder supply voltage of 20,000 to the trolley voltage of 3,000. These transformers are of a very liberal design and will withstand for short periods 500 per cent overload or 1,500 kva.

ORIGINAL SUSPENSION AND EQUIPMENT

Two No. 0 copper wires suspended 19 ft. 6 in. above the rails constitute the old trolley line. The wires are held in movable insulators made of Ambroin (a material similar to Bakelite). These insulators are held on a steel wire between two porcelain insulators.

The original rolling stock consisted of two locomotives and



STANDARD OVERHEAD CONSTRUCTION FOR THREE-PHASE LINES—
ITALIAN STATE RAILWAY

ten motor cars, but this equipment proved inadequate at the end of the first year of operation, and three new type locomotives were installed of the 1-C-1 type. In 1906 four more Ganz locomotives and three Brown-Boveri locomotives were added. From year to year the traffic grew denser, until in 1914 the normal daily schedule consisted of thirty-nine passenger and forty-nine freight trains.

DETAILS OF THE NEW EXTENSION

The new extension of the line from Lecco to Monza has a length of 23.1 miles, 4.3 miles of which is double track. This extension brings the Valtellina system to within 8.6 miles of Milan. The power for the extension is supplied from an old power house in Robbiate, which was enlarged to its present capacity of 30,000 kva. The feeders are cables made of three copper wires, each about 0.6 sq.in. (360,000 circ.mil) in cross-section. Three new transformer stations, each equipped with a bank of three single-phase transformers rated at 2,250 kva., were erected along this line. To care for emergencies a 430 kva. portable substation was developed and can be dispatched and used at any point on the lines.

The trolley suspension on the new length is somewhat different from and heavier than that on the other portions of the system. It represents the standardized equipment of the Italian State Railway, as shown in the accompanying cut. An interesting detail is the method by which the joints between the porcelain and the hardware are made. To obviate cementing, a layer of hard rubber is deposited on the inner side of the porcelain, upon which is placed an electrolytic layer of copper. This copper layer is then threaded to take the suspension steel bolt. This process is somewhat expensive, but makes a very dependable joint, free from any danger of cracking. The trolley lines are very heavy, each having a cross-section of about 1.5 sq.in. with two wires for each phase, or a total cross-section of 6 sq.in. for each track. In order to carry the great weight of the trolley line and care for the many curves, steel masts have been erected

every 65 ft. Every tenth pole is connected to the rails. The rail bonds are made with the Brown-Boveri metal paste method. Great care was taken to construct the overhead wiring at switch points, which is quite a complicated matter for three-phase systems. The construction is somewhat heavy but has given good satisfaction. On the present terminal station at Lecco there are not less than fifty switch points. Very heavy overhead construction is necessary in stations. For example, there are spans of 108 ft. over nine tracks and also the overhead construction for six tracks, suspended from one pole which is located in the center. Some of these spans appear rather light but seem to give good service.

LATEST TYPE OF LOCOMOTIVES

Three new types of locomotives have been ordered for the extension, which operate, however, over the entire line. Of especial interest is the Westinghouse type 1-C-1, a description of which has not been published previously. The main characteristics of this locomotive are:

Diameter of driver	64 in.
Diameter of pilot wheels	38 in.
Length over all	36 ft. 2 in.
Total weight	161,000 lb.
Weight of mechanical parts	72,732 lb.
Weight of electrical parts	88,160 lb.
Speed at 16½ cycles	23, 31, 46 and 62 m.p.h.
Hour rating	450, 1,670, 2,600 and 2,200 hp.
Maximum tractive effort at periphery of drivers	26,400 lb.
Specific output	32.5 hp. per ton of weight

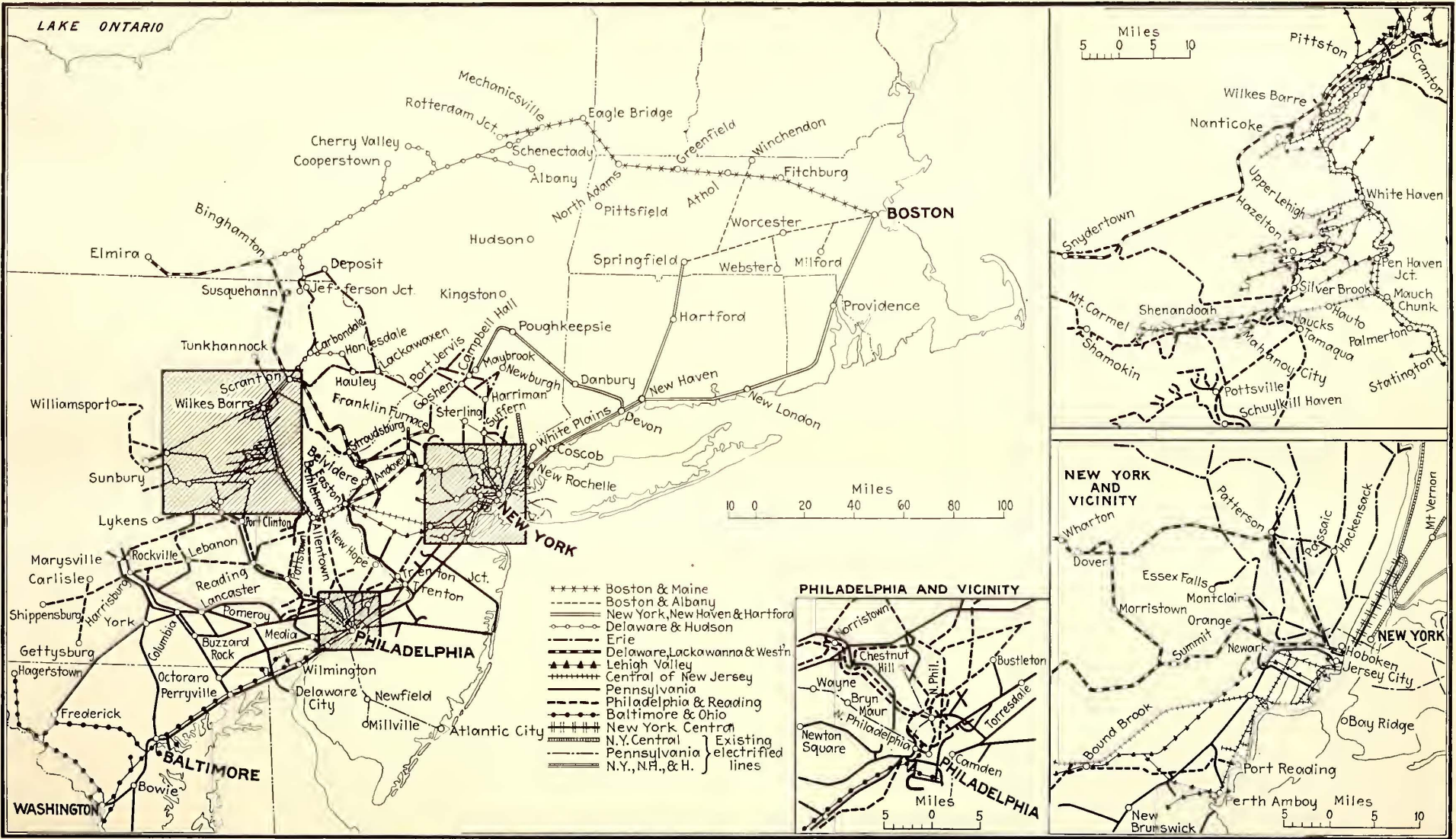
All three driving axles have considerable side play, the center one 1 in., the two outer 0.8 in. The weight of the frame rests upon heavy leaf springs, capable of supporting a weight varying between 45 and 15 tons. Power is transmitted from the two motors to the cab by a triangular rod construction of the Kando system. The motors are not fixed solidly to the frame, but rest upon very heavy spiral springs. Each motor has four bearings, which permits of a very narrow air gap of about 0.078 in. A removable floor construction permits the installation of the motors from above. There are two compressed air operated pantographs on the roof, as is standard for Italian railways. An auto-transformer is used to change the three-phase supply at from 3,000 to 3,300 volts into two-phase supply at from 3,300 to 3,600 volts. The main motors have a maximum hourly rating of 950 kva. each, are asynchronous, give four speeds, and have a wound rotor with four collector rings on one side and three rings on the other side. These rings are located outside of the bearings and beyond the crankshaft which calls for hollow shafts. Four economic speeds can be obtained by operating the two motors either as eight-pole three-phase, or six-pole two-phase, and in each case either in parallel or in cascade. The stators and rotors are wound with twelve coils on each, and every three of these coils form a star connection.

STARTING EQUIPMENT AND TEST RESULTS

The motors are started by means of an electrolytic starter with stationary electrodes. Air pressure causes the liquid to rise or fall. The locomotive has, for this purpose and for the operation of the brakes, two air compressors, taking in 35 cu.ft. of air per minute and compressing it to six atmospheres. Each compressor consists of two pumps and two motors, although one set is sufficient for normal operation.

Tests of a very severe character gave very good results. The temperature rise of the motor copper at a train speed of 46 m.p.h. and with the locomotive pulling 21,000 lb. for one hour was 69.5 deg. C. With a train of 383 tons and up a grade of 1.1 per cent, the locomotive accelerated to 43.5 m.p.h. in 267 seconds. The locomotive shows a consumption of about 35 watt-hours per ton mile. The other locomotives added to the equipment have been previously described and are of the 2-C-2 Brown-Boveri and Oerlikon types. The main dimensions and weights of this type of locomotive are:

Diameter of drivers	64 in.
Diameter of pilot wheels	38 in.
Length over buffers	43 ft. 10 in.
Total weight	202,750 lb.
Weight on drivers	99,100 lb.
Weight of mechanical parts	116,200 lb.
Weight of electrical apparatus	92,550 lb.



Map Showing the Trackage Included in the 19,000 Miles Recommended for Electrification in the Superpower Zone

THE trackage which the United States Geological Survey, through its Superpower Zone report, has recommended for electrification includes only 19,000 of the 33,000 miles of Class 1 railroad trackage and of the 36,000 miles of total trackage. The analysis upon which this recommendation was based was made by operating divisions and not by roads. This has given Dr. Cary T. Hutchinson and his associates a much more detailed view and a greater opportunity to pick out the

actual opportunities for economy by electrification of the steam railroad lines.

The absence of such divisions as the Harmon-Albany division of the New York Central, the Albany-Springfield division of the Boston & Albany and the Weehawken-Albany division of the West Shore Railroad is of course noticeable. But when electrification is shown to save only 6 or 7 per cent on these divisions as compared with 14 per cent as an average for the divisions chosen,

the reasons for the recommendation are appreciated. The recommendations, as inferred from the foregoing, have been based on an analysis of actual operating data, assuming merely the substitution of the electric for the steam locomotive. Certain economies due to the complete revamping of railway operation which would result from actual electrical operation would, of course, modify the recommendations in part and might add some mileage to that indicated above.

Superpower Survey Shows Advantages of System Including Electrification

Report of W. S. Murray and Others for Geological Survey Outlines Savings Possible by Co-ordinating and Supplementing Existing Utilities—Recommends Electrification of 19,000 Miles of Trunk Lines in Zone and Shows Resulting Economies

UNDER the title "A Superpower System for the Region Between Boston and Washington," the United States Geological Survey, Department of the Interior, has just issued the report of its special superpower survey made during the year July 1, 1920, to June 30, 1921. This special report or study was made by a temporary organization within the United States Geological Survey, headed by W. S. Murray and financed by an appropriation of \$125,000 by the government, to which was added \$26,000 contributed by utilities and industries within the Superpower Zone.

One of the outstanding sections of this report has to do with the desirability of electrifying a large portion of the trunk line mileage in the district under observation. As a whole, the superpower scheme comprehends a plan of power production that includes the generation of electricity in steam stations at tidewater and on inland rivers where a sufficient quantity of water for condensing purposes is available, and also the utilization of all hydro-electric power that can be economically obtainable within the zone or within transmission distance of it, the whole to be tied together through an interconnected system of transmission lines.

Reference to *ELECTRIC RAILWAY JOURNAL*, Feb. 28, 1920, page 435, will give a picture of the purpose of the survey as seen at the time of its inception. There is also shown a map giving the preliminary idea of the area to be investigated. Fig. 1, herewith, shows the Superpower Zone which has been included in the final survey. Within this zone is concentrated one-fourth of the population of the United States and within it are operated, most of them independently, 315 electric public utilities, eighteen steam railroads and 96,000 industrial plants.

The general purpose of the study was to show the saving in labor, materials and money that might be effected by the installation of a power system adequate to serve the railroads, municipalities, utilities and the industries in the Superpower Zone. The basic idea of the superpower system is to co-ordinate and supplement existing utilities so as to carry to a higher degree the economies incident to their present operation, but by no means to supplant or even to compete with existing electric public utilities.

While there has been much interest in the legal and financial aspects of putting into operation such a superpower project, these points are not touched on in the report for the reason that it was deemed inopportune, without further consideration, to formulate any conclusions on these important matters. The investigation was an engineering one and the problem set was determining the total amount and location of the power load that would be required for private, municipal, industrial and railroad purposes at a date sufficiently in advance to permit the construction of a system of the highest economy to supply it. The date chosen was 1930, and the allocation of the load and power generating facilities for the six geographical divisions of the

Superpower Zone forms a most interesting part of the report. In determining the amount and location of the load, the electric public utilities, the railroads and the industries within the zone lent their co-operation.

The conclusions reached by Mr. Murray are necessarily largely based on the special studies made by the members of his engineering staff. These studies appear as appendices to the report and are as follows:

Appendix B—"Electric Utilities in Independent Operation in the Superpower Zone in 1919," by L. E. Imlay, T. B. Rutherford and others.

Appendix C—"Proposed Electrification of Heavy-traction Railroads in the Superpower Zone," by C. T. Hutchinson, N. C. McPherson and others. (See abstract below.)

Appendix D—"Industry in the Superpower Zone," by H. W. Butler, H. Goodwin, Jr., and others.

Appendix E—"Performance and Cost of the Superpower System," by Henry Flood, Jr., A. R. Wellwood and others.

Appendix F—"Steam-electric Plants for the Superpower System," by Henry Flood, Jr., and others.

Appendix G—"Hydro-electric Plants for the Superpower System," by L. E. Imlay, L. A. Whitsit, B. J. Peterson and others.

Appendix H—"The Superpower Transmission System," by L. E. Imlay.

Appendix I—"Reliability of Service," by L. E. Imlay and others.

Appendix J—"The Relation of Coal and Coal-Delivery Routes to the Superpower System," by C. E. Leshner, F. G. Tryon and others.

Appendix K—"Use of Process Fuels and Pulverized Coal for Base-load Steam-Electric Plants," by O. P. Hood and others.

Appendix L—"Basic Costs," by the engineering staff.

Appendix M—"Stations and Transmission Lines of Electric Power Companies Engaged in Public Service," by A. H. Horton.

SUMMARY OF CONDITIONS

The market for superpower energy will be furnished by the electric utilities, the industries and the railroads. The estimated requirements for energy supplied through the electric utilities for municipal, private, industrial and railroad purposes in 1930 is 31,000,000,000 kw.-hr. This energy could be supplied by a co-ordinated power system at an annual cost of \$239,000,000 less than by an unco-ordinated system such as is now in use. The total investment in generating and transmission facilities for the superpower system will be \$1,109,564,000, of which \$416,346,000 will represent the value of existing facilities to be incorporated into the system.

A study of the 96,000 manufacturing establishments operating within the Superpower Zone shows that by 1930, through the maximum economical use of purchased electric energy, they can save \$190,000,000 annually above the fixed annual charges against a capital investment of \$185,000,000 to provide the motor equipment necessary to receive and use this power.

The combined capital investment necessary for the electric utilities and the industries as of 1930 therefore amounts to \$1,294,564,000, and this total investment will yield annually above the fixed charges the sum of \$429,000,000 or 33 per cent on the investment.

Within the Superpower Zone there are 36,000 miles of railroad measured as single track—that is, including

each track of main lines, yards and sidings. Of this total about 19,000 miles can be profitably electrified, so as to yield by 1930 an annual saving of \$81,000,000 as compared with the cost of operation by steam. The capital expenditure necessary to electrify the 19,000 miles would be \$570,000,000, and the average return upon the investment would therefore be 14.2 per cent.

The order in which the superpower steam-electric and hydro-electric power plants and transmission systems should be constructed must depend (1) on the present industrial demand for energy that cannot be satisfied because of the difficulties of the local utilities in financing extensions, and (2) on the future demand for energy that will result from the more economical generation of power under the Superpower System. It is believed that the quickest return will be obtained by following in chronologic sequence the order of procedure as follows:

1. The construction of a steam-electric plant near Pitts-
ton, Pa., to supply a part of its energy to the anthracite

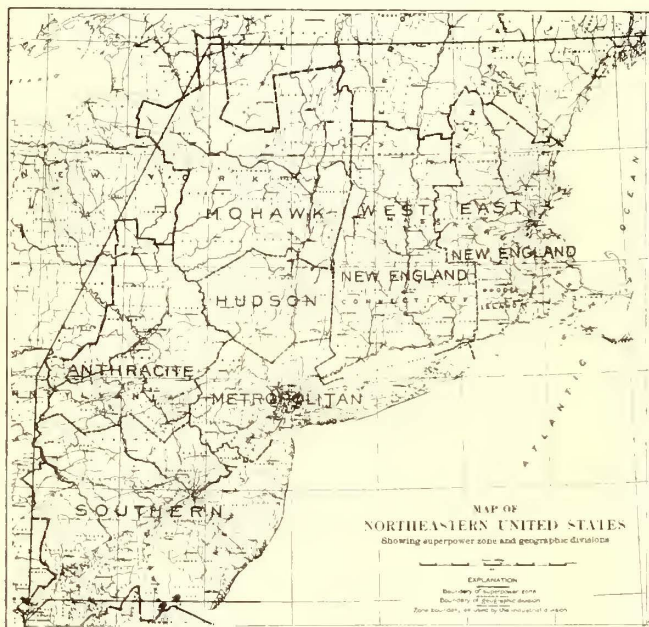


FIG. 1—THE SUPERPOWER ZONE AS VISUALIZED IN THE SUPERPOWER SURVEY REPORT

division of the Superpower Zone and the remainder to the metropolitan division, particularly New Jersey.

2. The construction of a steam-electric plant near Sun-
bury, Pa., to supply a part of its energy to the anthracite
division, a part to the Reading load center, and the remain-
der to Philadelphia.

3. The construction of hydro-electric plants on the Dela-
ware and Susquehanna Rivers to supplement the steam
plants indicated above.

4. The progressive development of the Hudson River
projects to meet the growth of energy requirements at the
Schenectady, Utica, Poughkeepsie and Pittsfield load centers.

5. The construction of a steam-electric plant near Boston
to supply the Boston, Lowell and Newburyport load centers.

6. The construction of a steam-electric plant near New
Haven to supply the New Haven, Bridgeport, Waterbury
and Norwich load centers.

7. The partial construction of the first hydro-electric
plant in the development of the Potomac River as soon as
the power demands of the Baltimore and Washington load
centers require additional plant capacity.

THE SUPERPOWER SYSTEM

The large interconnections in California have held a
spectacular interest, and of course the Superpower Zone
here contemplated is based on a similar principle. But,
unlike the Pacific Coast region, where water power
abounds and industry is relatively small, the Superpower

Zone has relatively small hydro-electric resources and
maximum industrial power requirements. Of a total
energy requirement of 31,000,000,000 kw.-hr. estimated
for 1930, not more than 21 per cent can be supplied from
water power. Fortunately, some of the best coal de-
posits in the country lie near this great industrial ter-
ritory and a joining of hydro-electric power and steam-
electric power should effect maximum capital and
operating economies, at the same time conserving the
rapidly disappearing cheap fuel of the Appalachian coal
fields. Fig. 2 shows how the superpower system should
appear in 1925. The 1930 plan calls for some additional
transmission lines and power plants, the additional
transmission lines reaching principally the relatively
distant large power undertakings, both hydraulic and
steam.

In 1930 the number of power stations required to
supply the entire zone will be only 273. At present
there are 558 electric utility plants and thousands of
isolated plants of all sizes. The principal opportunity
for economy is in having a few plants of large capacity,
it being planned to have base load steam plants ranging
from 60,000 to 300,000 kw. In none of these plants will
there be installed a turbo-generator having a capacity
of less than 30,000 kw.

Aside from the appendix on electrification of heavy
traction railroads, known as appendix C, the other ap-
pendices of interest to electric railways may be sum-
marized in what follows. The appendices are definite
engineering reports largely by experts in the fields to
be covered.

ELECTRIC UTILITIES IN INDEPENDENT OPERATION

In New York, Baltimore and Washington load centers
the predominating agency is 25 cycles; in the remainder
of the zone it is 60 cycles.

The present electric utility load is 10,000,000,000
kw.-hr. (1919), and this is expected to grow to 26,000,-
000,000 kw.-hr. in 1930. By forming a ring around each
large city in the zone and connecting by transformers
to the existing distribution lines greater interchange of
power and therefore decrease in reserve capacity may
be realized.

Under independent operation in 1919 the generating
capacity required was 46 per cent greater than the an-
nual peak load and the resulting annual capacity factor
was 26 per cent. Under the superpower system in 1930,
through joint reserve, the generating capacity required
will be only 9 per cent greater than the annual peak,
and the annual capacity factor will be 45 per cent.

The average unit production cost for the electric utili-
ties in 1919 was 1.93 cents per kilowatt-hour; the cost
of steam electric power was 2.12 cents, and that of
hydro-electric power, 0.94 cents. Based upon the same
capacity factor as applied to electric independent opera-
tion, the superpower system production cost should be
0.99 cents per kilowatt-hour.

INDUSTRY IN THE SUPERPOWER ZONE

Without any invasion of the field of what might be
termed byproduct power, it is estimated that there could
have been effected in 1919 a saving of 13,502,100 tons
of coal—71 per cent of the coal used by the industries
for producing power, or 25 per cent of all the coal used
by the industries. This would have been realized by
shutting down prime movers in industry and purchasing
energy. Of the 96,000 individual establishments in the
zone, 76,000 use power.

A careful study of the power requirements for industrial establishments in the Superpower Zone has been made and has shown that by 1930 an annual saving of \$190,000,000 can be made to the industries themselves above the fixed charges, against an investment of \$185,000,000 for the motor equipment necessary.

PERFORMANCE AND COST OF SUPERPOWER SYSTEM

It is estimated that the new money required for the superpower system up to 1925 is \$453,143,000, and up to 1930, \$693,210,000, thus making it necessary to raise \$90,600,000 annually for the first five years and \$48,000,000 annually for the following five years. If the demand of 1930 were provided for by the independent systems as constructed today, the total sum required would be \$1,856,000,000, or \$85,600,000 a year. There is thus an investment saving of \$163,000,000 during the next ten years. The economic relation established between the joint use of steam and water power may be realized when it is shown that they can be so combined as to yield annually \$69,550,000 on an increased investment of only \$44,838,000.

In this section is shown the economy of using Niagara water power and St. Lawrence water power for generating energy to be transmitted into this district.

This appendix also shows that in 1930 the cost of the power produced by the superpower system *inclusive of fixed charges*, as delivered on the buses of the electric utilities would be 10.6 mills per kilowatt-hour, whereas the cost under independent operation as of 1919, *exclusive of fixed charges*, would be virtually the same.

STEAM-ELECTRIC PLANTS FOR THE SUPERPOWER SYSTEM

It is proposed to retain 79 per cent of the effective capacity of the present steam-electric public utilities in the Superpower Zone, with a rating of 2,677,000 kw. The average power of the steam plants retained is 44,600 kw., and these should produce energy at an average rate of 2.15 lb. of coal per kilowatt-hour. It is calculated that the following operating characteristics for base load steam plants could be realized:

Steam pressure at turbine throttle, 300 lb. per square inch.

Superheat at turbine throttle, 230 deg. Fahr.

Final temperature turbine throttle, 652 deg. Fahr.

Vacuum at turbine exhaust nozzle, 1 in. of mercury, absolute.

The proposed new steam-electric plants have been located so as to obtain the fullest advantage of low freight rates, easy coal delivery routes and ample condensing water. Three of these are to be located on sites in the anthracite region, where sufficient condensing water is available to permit the development of 300,000 kw. each.

HYDRO-ELECTRIC PLANTS FOR THE SUPERPOWER SYSTEM

The principal rivers which can contribute water power to the Superpower Zone are the Potomac, Susquehanna, Delaware, Hudson and Connecticut. It is proposed to utilize power from these rivers in 1930 to the following extent:

	Capacity Kw.	Output (Millions of Kw.-hr.)	Investment	Production Cost (Mills per Kw.-hr.)
Potomac.....	200,000	950	\$22,000,000	3.36
Susquehanna.....	185,000	1,230	28,000,000	3.22
Delaware.....	350,000	1,250	51,500,000	5.05
Hudson.....	150,000	900	38,350,000	5.84
Connecticut.....	165,000	760	29,000,000	5.455

It is proposed to develop these rivers above their primary power capacity for peak-load operation.

The water powers of the Niagara and St. Lawrence Rivers are within transmission distance of the Superpower Zone, but on account of the time required for construction on the St. Lawrence and of the treaty restrictions concerning the use of the water at Niagara Falls the power from these sources has not been considered available in the zone prior to 1930.

It is expected that the total capacity for the production of hydro-electric power by 1930 will be 1,501,500 kw. compared with the present capacity of 451,500 kw., or 30 per cent. This will represent an investment of \$245,977,000.

THE SUPERPOWER TRANSMISSION SYSTEM

Naturally a transmission and distribution system of considerable magnitude is one of the most important elements of the whole scheme. At present there are about 1,200 miles of transmission system at 33,000 volts or higher, and this mileage will become distribution rather than transmission. The principal transmission features of the superpower system will therefore have to do only with transmission of power from new plants to load centers and to the buses of existing electric utility plants.

By 1930 the superpower transmission system should consist of 970 circuit miles of 220,000 volt lines and 4,696 circuit miles of 110,000 volt interconnecting lines. The construction of the transmission system for the St. Lawrence and Niagara developments will add 3,140 circuit miles of 220,000 volt lines. This shows that potentials of not less than 220,000 volts will be selected to transmit power from plants that are at considerable distances from the general interconnected superpower plants, and within the zone a potential of not less than 110,000 volts will be employed for interconnection between power and load centers.

PROPOSED ELECTRIFICATION OF HEAVY TRACTION RAILROADS IN THE SUPERPOWER ZONE

Of particular interest to railway men is that part of the report having to do with railroad electrification in the Superpower Zone. As stated above, some 19,000 miles of the 36,000 miles in the zone could be profitably electrified. The accompanying map shows the lines which comprise this 19,000 miles. In this map the lines to be omitted, some of them important, as well as trackage to be included are noticeable.

This appendix starts out with a discussion of the advantages of unified operation and stresses the extra advantages due to unified operation by electricity. Of this the report says:

These improvements in operation can be made more readily under electric service than under steam, for a change in the power system would bring fresh minds into the service and would consequently liberate the mental operation of the average railroad man from conventional routine. Under electric operation, for instance, the entire traffic between Philadelphia and Washington could readily be carried over the rails of the Pennsylvania System, those of the Baltimore & Ohio being left for future growth. Similarly, electric operation in the vicinity of Boston and New York would leave a margin of track capacity so great that no money need be spent for many years for further extensions of track. This relief of trackage is one of the very notable advantages that would follow unified electric operation of the railroads in this territory. The great expense of any large increase in trackage should of itself force electrification; the total cost twenty years hence will be less if electrification is begun now than the cost of the added track and terminal facilities necessary under steam

operation to provide for the inevitable 100 per cent increase in traffic within that time.

The report then goes on to discuss the specific advantages of electrification in operation and also on account of the characteristics of the electric locomotive as a machine. With most of these arguments, electric railway men are already familiar.

Under the discussion of classes of electric locomotives, it is pointed out that there is no sound reason for such variety as at present exists in the types and weights of steam locomotives. It is pointed out that the United States Railroad Administration formulated certain standard designs and reduced the number of types to about ten. The suggestion with reference to electrical equipment is that this number can be reduced still further, "certainly to as few as six types and possibly to three." The definite proposition is made that:

The entire freight service in the superpower zone can be handled by electric freight locomotives having two articulated two-axle trucks, each carrying two motors geared

load capacity, and all will be able to operate in starting and accelerating at 25 to 30 per cent adhesion.

These suggested sizes and types of locomotives can, of course, be varied greatly without sacrificing the advantage of unified electric operation, but identity of type for the same service throughout the superpower zone is essential.

BASIS OF THE ELECTRIFICATION STUDY

The investigation of the railroads was for the purpose of seeing what saving would be effected by unified electric operation, and to compare this estimated saving with the investment needed to effect it. Merely a substitution of electric for the steam locomotive was assumed, although it was realized that the greatest gain could be obtained only by an entire revamping of the transportation scheme to fit it to the use of the electric locomotive. Such an analysis would have involved a detailed study of each road and of each division, indeed, which was not possible.

Comparisons of cost of investment and operation were based on electrical energy being purchased from the superpower system—no investment in power station and transmission systems being placed on the railroads. Their investment begins with substations segregated for railroad use.

While it was stated that the comparison of cost of investment and operation need take no account of the system of electric traction used, yet as between the 3,000-volt direct-current system and the 11,000-volt (or higher) alternating-current system the estimates were based upon the former. This was done because, with the 60-cycle frequency adopted for generation and transmission, substations with rotating machinery were required for alternating current as well as for direct current, which would remove one of the principal advantages of alternating current over direct current. On this point the report says: "In order, then, to avoid some uncertain element in the estimates of the cost of the alternating-current system it has been decided to base all estimates, both of operation and of construction, on the 3,000-volt direct-current overhead system. Substantially the same results, in money, could, however, be obtained with the alternating-current system, certain gains being offset by certain losses."

It was immediately evident that it would not be adequate to study the roads as units but that a study should be made of the operating divisions of the railroads. The result of this method of studying is graphically shown in the map showing the mileage recommended to be electrified. All of the railroads gave excellent cooperation in the collection of the fundamental data required. Detailed information for each division for each month of the year 1919 and the total for the year was obtained on the following items:

Passenger service, train-miles, total locomotive-miles, car-miles.

Freight service, train-miles, total locomotive-miles. Gross ton-miles moved (including engine and tender) separately for freight and passenger.

Switching service, ton-miles, engine-miles, engine-hours or in such other form as is at hand.

Amount of coal used for each class of service separately, if possible, and total; kind of coal burned.

Average annual maintenance per locomotive-mile, separately for each class, if possible.

Similar data were obtained from those roads having electrically operated divisions and in addition special information of experience in electrical operation was obtained.

The report includes a large number of tables giving detailed information from the various systems. The

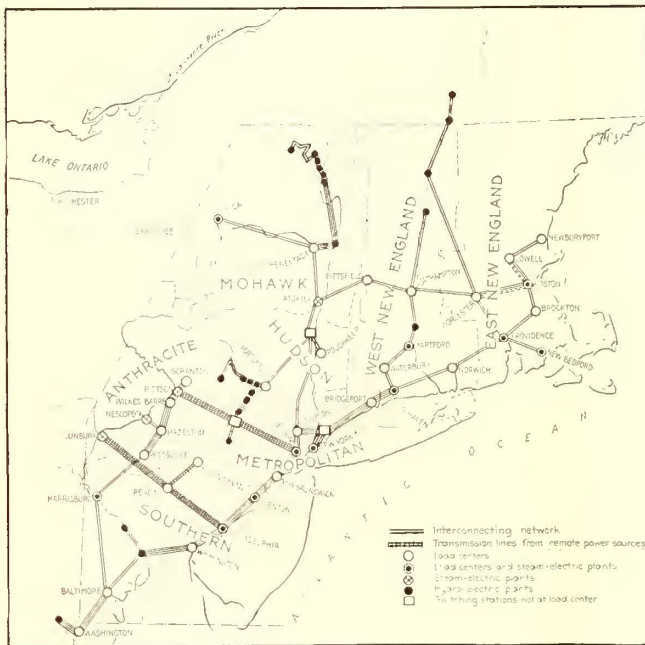


FIG. 2—THE TRANSMISSION SCHEME AND LOCATION OF PLANTS AS CONTEMPLATED BY THE SUPERPOWER REPORT TO EXIST IN 1925

to the axle, the mounting being essentially the same as that in a number of locomotives now in use and similar to the usual street car mounting. There would be two classes of locomotives of this type—a light one carrying 80 tons on drivers and having a continuous drawbar pull of 22,000 lb. at 25 miles an hour, and a heavy one carrying 110 tons on drivers and having a continuous drawbar pull of 30,000 lb. at the same speed. These units can be combined in any reasonable number; the total load on drivers can be made equal to 80, 110, 160, 190, 220 tons, or as much more as may be desired, being limited only by the strength of the draft rigging.

For passenger service a similar arrangement would be used—that is, two articulated, two-axle trucks, with one motor geared to each axle. The motors may be practically the same as those in the freight locomotive, the only difference being a change in gear ratio. The passenger locomotive, however, would have leading and trailing trucks, with either two or four wheels, and the total weight would be redistributed. This passenger locomotive would be of two weights, the light one having 60 tons on drivers and the heavy one 90 tons. These also may be combined, like the freight locomotives.

For the switchers, one size will be adequate, with 70 to 75 tons on drivers, of the same type as the freight locomotive. Substantially the same frame and running gear can be used, with motors of less capacity.

All three types of locomotives will have the usual over-

following summary of the principal data for these roads is of interest:

SUMMARY OF PRINCIPAL DATA FOR CLASS I RAILROADS
WITHIN THE SUPERPOWER ZONE FOR 1919

Road, miles.....	13,396
Main track, miles.....	21,021
Yards and sidings.....	12,233
All tracks, miles.....	33,254
Freight locomotives	4,151
Passenger locomotives	2,669
Switcher locomotives	2,701
All locomotives	9,521
Freight trailing load, thousands of ton-miles.....	95,629,000
Passenger service, train-miles.....	88,026,000
Switcher service, locomotive-miles.....	56,536,000
Coal burned:	
Freight service, short tons.....	9,771,800
Passenger service, short tons.....	5,525,000
Switcher service, short tons.....	3,108,500
All services, short tons.....	18,405,300

The General Electric and the Westinghouse companies prepared estimates on substation equipment, electric locomotives, catenary construction and other electric facilities; and similar data were also asked of the Ohio Brass Company and one or two other companies.

All of these data were analyzed, a study was made of the energy required for electric traction as obtained from roads operating electrically and a second method of determining electrical energy required, by calculating from profile and alinement the various work requirements, was used to give additional evidence. Investigations of switcher service at various yards, even in Chicago, were also made taking records from existing steam operation with reference to energy consumption and total movement.

Other subjects investigated, the results being based on statistics, were: Coal saved, efficiency, equivalent coal, cost of coal, cost of electric energy, cost of maintenance of steam locomotives, cost of maintenance of electric locomotives, the distribution system, maintenance of substations, saving in wages of train crews.

The report then gives summaries of costs of construction of overhead and of purchase of electric locomotives. It analyzes the number of electric locomotives required, studying locomotive mileage and locomotive hours, crew hours, etc., and arrives at the total cost noted above of \$570,000,000. The report includes a table showing the detailed figures for cost of items of construction and equipment involved in the electrification of Chicago terminals, inclusive of power station and transmission systems, as collateral evidence on the relation of certain specified costs to the total cost.

After all this study was made it was concluded that the individual divisions should be examined to see what savings could be realized. Charts of these savings, first including the saving in wages, and second not including the saving in wages, were made and from these graphs it was evident that certain divisions would not prove advantageous for electrification. The group of divisions selected for electrification showed an average saving of 11.4 per cent not including wages and 14.2 per cent including wages. It includes thirty of the forty divisions examined comprised in eleven of the thirteen systems as shown in the accompanying map. It is noticeable that the Hudson division of the New York Central and the Albany division of the Boston and Albany are not included. Special conditions caused specially low operating costs here so that only 6 and 7½ per cent saving, respectively, would be realized.

The figures for each of the divisions examined are given in an interesting summary table, from which the following outstanding figures are of interest: The total net cost of construction, \$570,085,000; the net reduction in annual cost of operation, including crew wages, \$80,880,935, being 14.19 per cent of construction cost; the net reduction excluding crew wages, \$65,065,300, being 11.41 per cent of cost of construction. The percentage of savings ranges from 10.6 per cent for the New York, Susquehanna & Western division of the Erie to 19 per cent for the New Haven-Boston route of the New Haven road.

A very large amount of tabulated matter is given at the end of this section showing in detail various costs of operation and various figures from which judgment can be passed as to the soundness of the conclusion. There is also an interesting graph showing the growth of traffic, both freight and passenger, of tracks and of tractive power for the Class 1 railroads in the Superpower Zone from 1900 to 1919. The report states that "the annual rate of growth has been 5.3 per cent in passenger miles, 4.5 per cent in ton-miles, 0.75 per cent in all tracks, and 6.6 per cent in tractive power of locomotive." Some idea of the future development can be obtained from the slope of these curves.

This section of the report concludes with the following:

The amount of money required for electrification is indicated as being \$570,000,000. This figure is based on costs prevailing in 1919, but at present cost (June, 1921) it would be reduced by 18 per cent, to approximately \$467,000,000 and before this construction can be undertaken there will be further material reductions. Probably five years from now the entire work outlined could be done for not more than \$400,000,000. This is comparatively a moderate sum. Good railroad authorities have stated repeatedly that more than one billion dollars a year is needed by the railroads of the United States for extensions and betterment. The part of this total to be allocated to the Superpower Zone, as determined by the number of locomotives, would be \$150,000,000. The amount required for normal extensions and betterment for three years would therefore be sufficient to electrify the thirty selected divisions of the railroads in this territory, with an annual saving of more than 14 per cent. The most valuable feature of the change, however, is not the amount saved, but the great increase in maximum capacity of existing trackage and the general advantages of electric operation.

These figures indicate that with a return of normal financial conditions all these lines should be electrified before further great expenditures have been incurred to increase in a minor degree the capacity of the existing tracks and yards. Steam operation cannot satisfactorily meet the conditions of the crowded terminal herein described as the Superpower Zone; electric operation can easily do it.

Improving Accident Records

THE Wichita Falls (Tex.) Traction Company has been very successful in forming and building up an organization to improve its accident records. The organization was started in July, 1919, and has been working continuously since that time with increasing effectiveness. At the time of its institution the company's records showed it was averaging one accident for every 750 car-miles, or a little more than two accidents daily with an average mileage of about 1,600. Since that time it has reduced its accident records until they ran an average of 1,500 miles per eighteen-hour day from June 18 to Aug. 6 of this year, making a total mileage of 73,500, without an accident being reported. This is considered an excellent record. The company is organized very thoroughly and every time an accident occurs it is investigated carefully with each and every trainman in an attempt to show how it happened and how it could have been avoided.

Traffic Analysis in New York

The New York Transit Commission Is Conducting an Investigation of Traffic Conditions on the Surface Lines in Contemplation of Recommending a Unified Co-ordinated System

VALUABLE information as to the amount of travel of surface car line passengers in Manhattan has been obtained as the result of trip counts which are still being made among trolley passengers by the New York Transit Commission for the purpose of aiding its investigation as to which of the trolley lines are necessary and should be retained as part of the unified system contemplated under the new plan. These counts have been in progress during the past week on the Eighth, Ninth, Sixth, Fourth and Madison Avenue lines. This week the counts were resumed on the Ninth Avenue line, and when that survey has been completed the counts will be made on the flow of traffic to and from across Eighty-sixth Street. The new transit plan contemplates the dropping or scrapping of little used or unimportant lines and will attempt to determine just what actual use is made of each, whether as a through route or as an intermediate route of the passenger.

The commission expects later, when the work in Manhattan is completed, to extend the count to Brooklyn and the remaining boroughs of the city. Extensive preparations have been made and some preliminary tentative counts were undertaken at various points in connection with mapping out the general scheme. It is proposed to do the work in a very thorough fashion.

Under the present scheme that the commission is using each line is taken up separately and studies are being made in connection with that line by the inspection staff of the commission. Signs were posted in each car several days prior to the beginning of the count by the inspectors. These signs, printed in English, Italian and Hebrew, are informative in character, stating the reason for which the count is being made and urging the co-operation and assistance of the passengers in carrying it out. These posters say that in order to get at the proper routing of cars it is essential for the commission to learn how the lines are used, what the transfer points are of various passengers, etc.

Small cards have been printed which are handed out by the inspectors to each passenger on the car of the line involved during any particular inspection. These cards request the passenger to inform the inspector what line, or lines, he utilizes in order to get from his starting point to his destination; how many cars he uses; the name of the street corner at which he begins his trip; the street corner which is to be his final destination; at what street corner he boarded the car under inspection, and at what street corner he is to leave that car. The passenger is also requested to inform the inspector whether he paid a cash fare on the particular car or whether he presented a 2-cent transfer or a free transfer. City Hall is taken as the center to which or from which all people are considered to be traveling. A blue card is used for all passengers whose destination is in the neighborhood of City Hall, while a pink one is to be filled out by all passengers going away from City Hall.

When the counts are completed the information gathered by the inspectors will be tabulated and indexed so that it can be utilized by the traffic experts of the commission in the preparation of the necessary analyses for the guidance of the commission in working out the details of its plan.

Generally speaking, the commission has obtained an average of about 60 per cent of answers to the questions propounded by the inspectors or tendered to passengers on cars presented by them. Four inspectors are assigned to each car and the counts are made in the workward and homeward rush hours and at mid-day as well. On the longer routes three round trips are made by each squad of inspectors, while on some of the shorter ones as many as six can be made in the same time. This means that on every surface route at least nine round trips are made, so that a very accurate index of the amount and kind of travel is obtained because the counts are made at representative periods in the traffic cycle.

About one hundred inspectors drawn from the various departments of the commission were assigned to this work. In some instances the inspectors have found it possible to achieve a 100 per cent result of information from passengers. This was particularly true of the non-rush hours when the cars were less crowded. During the crowded hours the inspectors found it difficult to reach all the passengers and also found a disposition, particularly among tired passengers in the night rush hours, of not being willing to be bothered.

It was said at the offices of the commission this week that the result of the count so far is regarded as satisfactory and that the information obtained when collated and properly tabulated will be invaluable in working out the problem of the disposition of the surface car lines. It is expected that at least ten days or two weeks more will be required to complete the count in Manhattan. Several squads of men have already begun their count on several of the Brooklyn and Bronx lines.

Water-Power Development Under Federal Act

THE Federal Power Commission under the water-power act of June 10, 1920, has since March 1, 1921, authorized the issuance of thirty licenses involving 1,269,000 hp. and twenty-four preliminary permits involving 1,280,000 hp., a total of 2,549,000 hp., or as much as the aggregate of all applications approved by the several executive parties during the fifteen years preceding June, 1920. As a result, projects aggregating 1,277,000 hp. and an investment of approximately \$100,000,000 are already under construction in New York, Alabama, Wisconsin, Oregon and California.

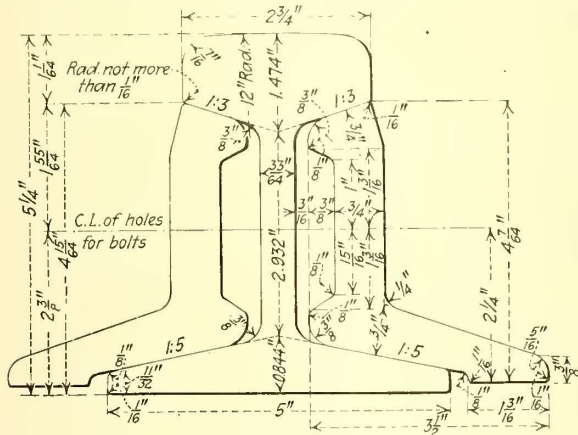
Up to Oct. 8, 1921, there have been filed with the commission 256 applications involving more than 16,000,000 hp., of which about 10,500,000 hp. is primary power and 5,500,000 secondary power. The great majority of these applications contemplate the development and sale of power as public utilities. In 1917 the census report showed an average investment in water-power plant and equipment at that time of \$240 per horsepower. If the average investment required in the projects before the commission is only one-half as much, an expenditure of \$2,000,000,000 will be involved. The collateral expenditures for distribution systems, for customers' installation and in accessory industries will be several times greater. The commission believes that with the removal of the restrictions which have hitherto existed, with improved industrial and financial conditions, with the development of new industries, with railroad electrification, and with the gradual displacement of steam power by water power, it is reasonable to expect in the near future an activity in water-power development hitherto unknown.

Australian Railway Rail

Standard Specifications for Railway Rails and Fishplates
Just Issued—Rails Generally Are Higher for Their Weights than Their American Equivalents

THE Commonwealth Institute of Science and Industry, Melbourne, Australia, has published the new Australian standard specifications for railway rails and fishplates which were adopted this year and have been approved by the Interstate Conference of Railway Commissioners. The specifications include ten drawings giving dimensions of the five standard section rails (T-rails) and fishplates. The rails weigh 60, 70, 80, 90 and 100 lb. per yard. The section of the standard 80-lb. rail and fishplates is reproduced.

The rails generally are higher for their weights than their American equivalents in either A. S. C. E. or



SECTION OF AUSTRALIAN STANDARD 80-LB. RAILWAY RAIL AND FISHPLATES

A. R. A. series. The heads are also wider and of slightly less depth, while the sides of the webs are straight in contrast to the curved sides of the webs in American rails. It is of interest to note the large radius of the fillet connecting the top and sides of the head. It is greater than that found in most American rails. The greater head width is probably for the purpose of securing a larger fishing surface for the tops of the fishplates. A difference in fishing angles will also be noted, particularly under the head, the slope of which is 1:3. It is of interest to note the use of the term "fishplate" in contrast to the American terms, "angle-bar" or "splice-bar," and attention is called to the use of the T-rail in contrast to the British "bull-head" or "double-headed" rail.

In reference to the fishplate designs, it seems that these could have been designed along more progressive lines as they are quite similar to the old A. S. C. E. designs, which are admittedly inadequate. A design similar to the Pennsylvania Railroad standard would cost little if any more and give much greater strength.

The specifications for manufacture in general are

quite similar to current American specifications. Only 5 per cent short lengths are permitted as compared with 10 per cent allowed here. Four kinds of steel are specified, permitting a range in selection by the purchaser. These are basic open hearth, acid bessemer, Sandberg's basic open hearth high silicon and Sandberg's acid bessemer high silicon. The chemical analyses of these are given in the accompanying table.

Single-Phase Express Locomotives for the Swiss Federal Railways

OF THE fifty-three electric locomotives that were ordered by the Swiss Federal Railways from Brown, Boveri & Company, forty-one are of the 1-B+B-1 type and will be used for passenger and express train service. These engines were designed to pull a 300-ton train up a 2.6 per cent grade at a speed of 31 m.p.h., and to accelerate such a train on that grade to the mentioned speed within fifteen minutes. A top speed of 47 m.p.h. should be possible.

To fulfill these conditions an output of 2,000 hp. is required, which is derived from four twelve-pole single-phase motors of 500-hp. continuous and 750-hp. one-quarter-hour rating at 650 r.p.m. Two groups of two motors each drive through a reduction gear of 1:32 two jackshafts, from which horizontal rods transmit the power to the two front and two rear drivers. Each motor has its own 7 1/2-hp. blower mounted directly above it. In the middle of the engine is installed a 1,730-kva. oil-cooled, single-phase auto-transformer, containing eighteen voltage taps for the control of the motors and the train heating. The oil of this main transformer is kept cool by being pumped through a system of cooling tubes located along both sides of the locomotive. The motor-operated tap switch is mounted directly upon the cover of the transformer, resulting in minimum length of connections.

All control apparatus, such as switches, contactors, relays, etc., are actuated by 36-volt d.c. derived from a 1 1/2-kw. motor-generator assisted by a standard car lighting storage battery. Two motor-operated air compressors of 9 kw. each provide air pressure for braking

MAIN DATA OF LOCOMOTIVES

Single-phase current.....	15,000 volt
Frequency.....	16 2/3 ft.
Hourly rating.....	2,400 hp.
Gage.....	Standard
Diameter of drivers.....	60 in.
Diameter of pony wheels.....	37 in.
Length over all.....	54 ft. 2 in.
Weight of mechanical equipment.....	109,760 lb.
Weight of electrical equipment.....	132,160 lb.
Complete weight.....	241,920 lb.

and lowering of the two pantographs. A novel system is provided to apply electric braking on long down grades. For this purpose a 42-kva. braking transformer is connected in series with the main transformer, and it is possible to excite the fields of the four traction motors through this circuit. The armatures of each

CHEMICAL ANALYSES AUSTRALIAN STANDARD RAILS

Elements	Processes			
	Basic Open Hearth*	Acid Bessemer*	Sandberg's Basic Open Hearth High Silicon	Sandberg's Acid Bessemer High Silicon
Carbon.....	0.55—0.68	0.50—0.60	0.50—0.65	0.40—0.55
Silicon.....	Not less than 0.10	Not less than 0.10	0.20—0.40	0.30—0.50
Sulphur.....	Not more than 0.07	Not more than 0.07	Not more than 0.06	Not more than 0.07
Phosphorus.....	Not more than 0.04	Not more than 0.07	Not more than 0.06	Not more than 0.07
Manganese.....	0.60—0.90	0.60—0.90	Not more than 1.00	0.70—1.00

* Carbon varies with weight. That in table is for 80-lb. rail.
Carbons are permitted as high as 0.62—0.75 for 100 lb. O—H Rail.
Carbons are permitted as high as 0.60—0.70 for 100 lb. A—B Rail.

two motors are put in series and discharge their generated current into special braking resistances. As the main transformer is in the field circuit, its eighteen steps permit of a very gradual applying of the braking force.

The valve operating the pantograph lowering device is interlocked with the main oil switch, allowing a lowering only after the switch is opened.

Direct Current for England

Railways Electrification Advisory Committee Submits Its Final Report on the Question of Standardization of System to the Ministry of Transport

THE final report of the Electrification of Railways Advisory Committee on the question of standardization of system was submitted on June 30 to the Ministry of Transport and was made public by the Ministry the end of August. The chairman of the committee is Sir Alexander Kennedy, LL.D., and the members include Sir John A. F. Aspinall, Sir Philip Dawson, Sir John Snell, Sir Henry Thornton, A. R. Cooper and Charles H. Merz. The committee was appointed in March, 1920, to decide "whether any regulation should be made for the purpose of insuring that the future electrification of railways in England should be carried out to the best advantage in regard to the interchange of electric locomotives and rolling stock," and "whether any regulations should be made to limit the drop of potential in an uninsulated return conductor on electrically operated railways."

On the question of system, the committee decided as follows:

1. That, in the case of those railways which have not as yet electrified any lines, as well as those which at present have electrified all or part of their lines on the direct-current system, their electrification, or extended electrification as the case may be, should be carried out on the direct-current system.

2. That the standard pressure of the direct-current system at the substation busbars shall be 1,500 volts, subject to:

(a) The continuance of any existing 600-volt and/or 1,200-volt installations, and, subject to the approval of the Minister of their extension.

(b) The adoption of half the standard voltage—750 volts—in those cases where it can be shown to the satisfaction of the Minister that advantage would arise from the use of this lower pressure.

(c) The adoption of higher pressures—limited to a multiple of the standard pressure—where it can be shown to the satisfaction of the Minister that sufficient advantage would accrue.

3. That both overhead and rail conductor collection should be permitted as long as the position and general design of the conductors and structures are in accordance with recommendations which will be made in a subsequent report. In that report the committee will also suggest the regulations required to insure that locomotives and/or motor coaches shall be able, wherever it may be necessary, to run at two different voltages, *e.g.*, 600/750 and 1,500 and/or with either rail or overhead collection.

4. That the generation of current for direct-current lines should be alternating three-phase at such voltage as may be desirable in each case.

5. That in the case of existing generating stations supplying at any frequency between 25 and 50 cycles it is unnecessary to make any change in frequency, but that it is desirable that where any one such frequency is in general use in a particular electricity district any new power station put down in that district for supplying a railway should adopt the frequency which has been approved by the electricity commissioners or is in general use in that district.

The committee desires to add on this matter that from the evidence which has been put before it, as well as its own experience, it has come to the conclusion that alternating current supplied to substations at a frequency of 50 cycles can be used for railway purposes without any detriment to railway working.

In connection with the recommendation on system, the committee says the London, Brighton & South Coast Railway long ago had installed the single-phase system for its suburban lines and that a change to the direct-current system would involve a large financial expenditure which the railway itself could not be asked to undertake, and which it would be difficult to justify to the public at the present time. The committee recommended, therefore, that the system now in use or planned for lines actually under construction on the Brighton company's suburban lines need not be changed.

The committee considers that a standard position outside the track should be defined within certain limits for the contact surface of the contact rails in relation to the position and level of the running rails and recommends that in respect to new electrically operated lines and extensions to existing lines the following regulations should be issued for securing the interchangeability of running: (1) The contact surface shall be in the horizontal plane; (2) the gage measured between the center of the horizontal contact surface of contact rails and the gage line of the nearest rail of the corresponding track shall be 1 ft. 4 in.; (3) the vertical height of the contact surfaces above the plane of the top table of the running rail shall be for top-contact rails 3 in., for under-contact rails 1½ in.; (4) the vertical height of the contact rail above the plane of the top table of the running rail shall be such as to provide the necessary clearance from the load gages from time to time in use; (5) the under-contact rail where employed shall provide for the engagement of the contact shoe being made from the side nearest to the running rail; (6) above the level of the under-contact surface no part of the contact rail construction shall be at a less distance than 1 ft. 1½ in. from the gage line of the nearest contact rail, and below the level of the under-contact surface at a less distance than 1 ft. 7½ in. from the gage line of the nearest track rail; (7) the vertical distance between the underside of any contact shoe in the three positions and the plane of the top table of the running rail shall not be less than 1½ in.

STANDARDIZED OVERHEAD COLLECTION

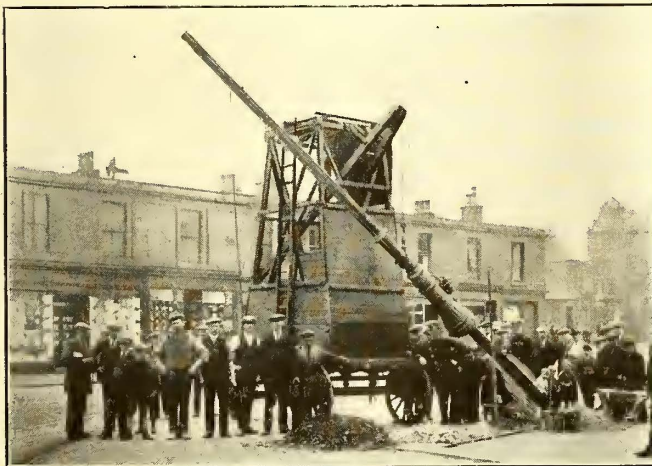
In respect to overhead collection, it is essential for the interchange of electrically operated trains that the position of the overhead live wire and the clearances between the live wire and the fixed and moving structures as well as the width and operating range of the collector gear shall be such that any train may collect current from all electrically equipped railways. The committee therefore recommends that in respect to new lines and new electrical equipment on existing lines the following regulations should be issued for securing interchangeability of running: (1) The standard clearances shall be, between the underside of any overhead live wire or conductor and the maximum load gage likely to be used on the line in the open, 3 ft.; through tunnels and under bridges, 10 in.; between any part of the structure and the near point of any live overhead wire or conductor, 6 in.; between the rail level and overhead conductors at crossings, 18 ft.; at places where there is a likelihood of men in the conduct of their duties having to stand on the top of engines or vehicles, 20 ft.; between any part of the collector gear and any structure, 3 in. (2) The horizontal distance of the contact wire from the plane to the center line of the track and perpendicular to the surface of the track rails shall be within the following limits: At a height of 18

ft. above the level, 1 ft. 3 in.; at a height of 4 in. above the maximum load gage likely to be used on the line, 1 ft. 9 in. (3) The weight and construction of the contact wire and support shall be suitable for the passage of collectors exerting an upward pressure of 25 lb. to 40 lb. (4) The width of the renewable contact surfaces of the collectors at right angles to the track shall not be less than 4 ft. and the extreme width over the horns of the collector shall not exceed 7 ft. 6 in.

The committee concluded that it was unwise to draft any regulations limiting the drop of potential on uninsulated return conductors. It said that the cases of harmful effects due to potential drop in excess of that allowed by the tramway act had been few and unimportant and readily corrected by the railway companies on their own initiative. The only question was the effect of these currents on the instruments in observatories, and the committee felt that regulations should be limited to the portion of electric railways within the vicinity of the observatory.

Edinburgh Corporation Tramways Begin Overhead Construction

ALTHOUGH the motor omnibus has displaced the cable cars in Edinburgh, Scotland, on the majority of routes, additional factors presented their application on the route from Leith to Edinburgh. To allow a continuous trip between the two cities at the least cost, electrification appeared most promising. The photograph reproduced herewith shows the staff of the



SETTING TUBULAR STEEL POLE IN EDINBURGH

Edinburgh Corporation Tramways present at the erecting of the first pole to support the tramway overhead construction since the tramways passed into the hands of the municipality. A special portable derrick furnished means of rapid setting of the tubular steel poles.

The London General Omnibus Company has just completed a motor coach which has many new features. The seats are arranged so that a zigzag gangway runs the entire length of the coach. There is ample room for every passenger. The most striking new feature which the coach displays, however, is the arrangement of the hood, which, when it is not in use, is folded away in front of the driver. It is claimed for this device that, among other advantages, it gives the driver a better view to the rear of the coach, decreases the rear overhang, and prevents damage to the hood when the coach is being reversed.

Letters to the Editors

A Correction in Discussion on Trolley Wire

AMERICAN COPPER PRODUCTS CORPORATION

NEW YORK, Oct. 26, 1921.

To the Editors:

In your issue of Oct. 18, page 633, included with the summary of remarks before the convention of the American Electric Railway Engineering Association, I am quoted as expressing preference for numerous reductions in wire drawing. This is contrary to my opinion in the matter. In substance, my remarks on this subject were that we would agree with the majority that the heavy draws produce wire of at least equal results physically and of more uniform hardness; that is, we get away from the skin hardness by the heavy draws.

I would appreciate it if you would make this correction.

HORACE A. STAPLES.

What Merchandising Means

NEW YORK, Oct. 31, 1921.

To the Editors:

In the efforts to "merchandise" electric railway service, has there been enough thought given to the quality of the goods?

Some people—fewer every day—ride on the street cars because they have to. Merchandising must be directed to winning, or winning back, the others.

In the last analysis, the only way to fight the bus, the private car and the sidewalk is to make the street car service more attractive. If this is not done, no amount of propaganda can save the industry.

To make the service more attractive, the manager must absolutely get the point of view of the passenger. The best way to do this is for the manager to ride his cars and himself study every point of contact of the passenger with the transportation system—the wait on the corner, the stop signs and landing places, the car signs, the steps, the method of fare collection, the cleanliness of seats and windows. The most minute impressions should be studied by the manager, for little things, either good or bad, very often produce general impressions.

No one can talk merchandising and ignore zone fares. There are millions of people in this country walking short distances every day who would ride if the fare for their journey were less. Because a zone-fare system failed in New Jersey is no proof that the principle can never be applied in this country. In some of its many forms it is now in use in many places in this country. The street railway must aim to adapt its service to the needs of the greatest possible number of people.

The subject of civility of employees is hackneyed, but it must be confessed that there is still much to be desired in this line. Shall we throw up our hands or shall we look for new influences and methods in place of old ones which have failed? Some roads have attained a fair degree of success in the matter of courtesy to passengers. On every road there are some men who treat their passengers like human beings. Does this not hold out hope that improvement along this line is not impossible?

J. A. EMERY.

Equipment and Its Maintenance

*Short Descriptions and Details of New Apparatus of Interest
to the Industry. Mechanical and Electrical
Practices of All Departments*

Brake Equipment for Paulista Railway

The Electric Locomotives Are Provided with a Combined Vacuum and Air Pressure Brake Equipment and Arrangements for Regenerative Braking Are Also Made

THE brake equipments for the electric locomotives now going into service on the electrified portion of the Paulista Railway in Brazil have several new features. As the cars to be handled by these locomotives are equipped with the automatic vacuum brake, it was necessary to make provision on the locomotive for controlling this type of brake equipment. As these electric locomotives weigh from 100 to 140 tons, it would take from six to eight vacuum cylinders of 28-in. diameter to give the proper braking force for each locomotive, and as there is quite a list of other apparatus besides brake equipment that must be supplied, it is evident that the vacuum brake could not be utilized on the locomotives themselves, although arrangements had to be made to handle trains of cars so equipped.

The simple straight air locomotive brake equipment could be used for handling the locomotives alone, but to apply it in conjunction with the vacuum train brakes would require the operation of two separate valves by the engine man at the same time, which is objectionable. Moreover, as two separate operating valves could not be mechanically connected so as to operate simultaneously without destroying the independent operation of the locomotive brake, this might prove impractical. The brake as adopted provides for connecting the vacuum and air pressure system, so that a reduction in the air pressure brake pipe would be followed by a locomotive brake application of the same proportionate amount as that realized on the cars and the train. Also, the release of the train brakes automatically causes a corresponding release of the locomotive brakes. Both of these are accomplished without interfering with possible independent release or application of the locomotive brakes at any time.

DETAILS OF BRAKE EQUIPMENT

The brake equipment of these locomotives consists of a motor-driven air compressor of 21 cu.ft. displacement with a 7½-hp. direct-current motor operating on 95 volts. This supplies the compressed air for the locomotive brake system and for the air-operated auxiliaries. The vacuum for the train brake system is obtained by a motor-driven vacuum pump having a displacement at full speed of 150 cu.ft. per minute. This is driven by a 10-hp. direct-current motor operating on 95 volts. The exhaustor operates at full speed only during the release of the vacuum brake. At all other times it operates at half speed to maintain the

vacuum against leakage. On some of the Paulista locomotives the air compressor and vacuum exhaustor will be combined into one unit driven by a single motor. In this case they will both operate continuously at normal speed.

The locomotive brake operating parts are in general the same as are used on all modern steam locomotives. Two brake cylinders are mounted on each truck, one of which operates the brakes on the driving wheels on that side of the truck. Air pressure is admitted to and released from these cylinders by a distributing valve, which is the principal operating device of the Westinghouse Air Brake Company's E.T. locomotive equipment. Two engineer's brake valves are required at each control stand, one of which is called the independent brake valve for operating the locomotive brakes only and the other is called the automatic brake valve for operating both train and locomotive brakes.

TWO TYPES OF BRAKES OPERATE IN HARMONY

The most distinctive features of this new equipment are those provided for causing the locomotive brakes to operate in harmony with the train brakes during the manipulation of the automatic vacuum brake valve. This is accomplished by two new devices called the "application control valve" and the "release control valve," which are connected in both the vacuum and air pressure systems. They consist of diaphragms, springs and valves so arranged as to preserve a certain balance between the vacuum and air pressure. When the vacuum is reduced to apply to train brakes the application control valve causes a corresponding proportionate reduction of air pressure in the pressure brake pipe which connects it to the distributing valve and causes the latter to operate exactly as if it were in an air pressure system. When the vacuum is reinstated to release the train brakes the application control valve admits a sufficient amount of main reservoir air to the pressure brake pipe to cause the distributing valve to assume the release position and to release the locomotive brakes. The release control valve is provided so that in case the vacuum brakes are graduated off in steps, instead of being entirely released at once, the locomotive brake cylinder pressure will be released proportionately in about the same number of steps.

These locomotives are also arranged for regenerative braking and it is considered necessary to prevent the application of the power brakes during the time that the locomotive is regenerating, as both retarding forces acting together would be likely to cause the wheels to slide. This is accomplished by a special cap on the distributing valve, which contains a magnet and valve so arranged that during regeneration the distributing valve will not operate. Immediately upon release of the regeneration the power brakes become active exactly as if the regeneration had not been used.

Turbo-Generator Operated Five Years with But Few Stops

FOR five years a 3,200-kva. turbo-generator has been operating in the power plant of the city of Saskatoon, Canada, without a breakdown. The unit was installed by the Westinghouse company in 1914 and was put into operation Nov. 24 of the same year. Except for a short period in the summer of 1919 it has been continuously available for service.

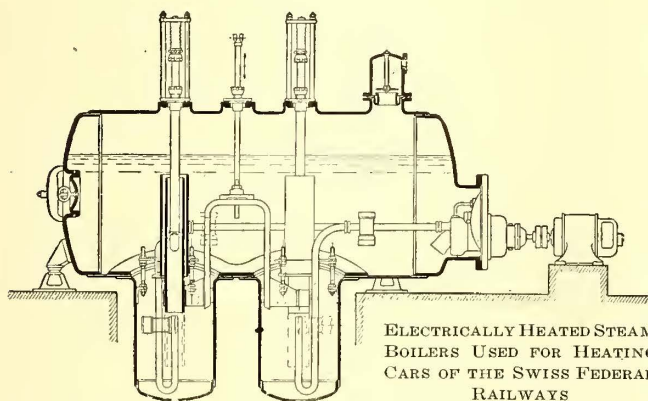
A summary of performances given by city engineers show that the governor operated between extremes of load which varied from 300 to 2,850 kw. in perfect control. The only portion of the entire equipment that was ever removed was the governor pedestal cap for the purpose of renewing a gasket on the gland runner joint. The condenser has proved reliable. On one occasion when ice shut off the water intake seventeen times in an eight-hour run no trouble to the tubes or plates occurred under this unusual strain.

There were two runs of long duration. The first of these took place from Oct. 6, 1916, to April 22, 1917, and the second from June 12, 1917, to March, 1918. In the first run the load factor was 46.3 per cent, while in the second it was 46.6 per cent.

The Electric Steam Boiler

THE APPLICATION of a 15,000-volt, single-phase current directly to the water in a boiler for the purpose of generating steam by electricity was described in the Aug. 6 issue of *ELECTRIC RAILWAY JOURNAL*. Some further details regarding the boiler construction are now available. In the construction of boilers for alternating-current voltages from 1,000 to 15,000 volts, no special heating elements are used. With the lower voltage, one electrode is used, and with the high voltage two electrodes, the water in each case forming the rheostat. The accompanying illustration shows the construction used for the electrically heated boiler in service for heating trains of the Swiss Federal Railways where a single-phase, 15,000-volt current is used.

Extensive tests made on large electro-boilers with



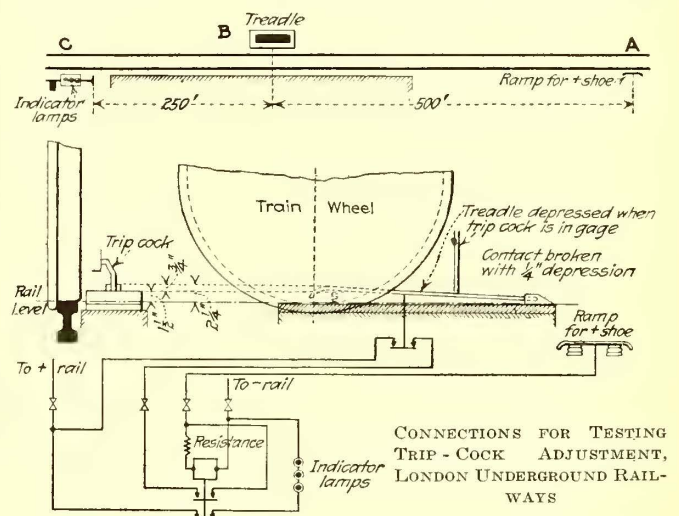
alternating current of 16½ cycles showed that there is no danger from any possible gas generation. The regulation of the current in relation to the steam demand is effected either by controlling the depth of immersion of the electrodes in the water, or by changing the position of an insulated cylinder placed coaxially with the electrodes and thereby increasing or decreasing the length of the path of the current through the water. The latter method has been highly developed by the Brown-

Boveri Company in Switzerland. For the automatic maintenance of a constant steam pressure, the insulating cylinder may be connected to a float. This insulating cylinder may consist of earthenware for low voltage, or porcelain for high voltage. With large output boilers quartz only will resist the action. To provide the necessary cooling of the electrodes, in large output boilers, a water circulating pump is provided.

Trip-Cock Test on London Underground

THE Metropolitan District Railway, London, formerly tested the trip cocks on its trains at the St. James's Park station, but the method used was such as to cause what was practically an emergency stop. Aside from this shaking up of train and passengers, the scheme had the disadvantage that it did not apply to every train and to every trip.

These objections have been overcome by the trip-cock testing devices now installed at the Charing Cross sta-



tion on both tracks, shown in the accompanying diagram. As each passing train operates the device an indication is given at once in case the trip-cock arm is incorrectly adjusted or out of gage horizontally to more than ¼ in. up or down, or vertically within ½ in.

About 750 ft. back of each starting signal there is installed a ramp on the side of the track opposite to that of the positive conductor rail (as distinguished from the negative conductor rail used in London) and having the same relative height and position. About 250 ft. from the starting signal a detector is attached to the end of a tie, set 8 in. from the running rail, also on the side opposite to the positive conductor rail, but about 2¼ in. above rail level. A lamp indicator, showing a purple light, is mounted on the starting signal post or adjacent to the signal.

As the train passes over the ramp the collector shoe energizes the latter by transfer from the collector shoe on the other side, and a relay, which switches on the light in the indicator, is thereby actuated. This relay is held up through a contact on the detector, but as a train with correctly adjusted trip cocks passes the latter the detector is operated to de-energize the relay and extinguish the indicator light. Should the trip cock be out of gage, or otherwise incorrect, the detector will not be operated. The continued illumination of the indicator light will tell the motorman that the trip cock is out of adjustment.

Railway Topics Discussed by A. S. M. I.

Municipal Engineers Meet in Baltimore and Consider Traffic Rules, City Planning, Rapid Transit and Paving—Specifications for Track Construction Proposed

A FOUR-DAY convention of the American Society for Municipal Improvements, the twenty-seventh annual meeting of that organization, was held in Baltimore, Oct. 25-28. A large number of papers and reports were presented, among them a paper on rapid transit systems by Robert Ridgway of New York, printed on another page. Abstracts of a number of other reports or addresses of especial interest to electric railway companies are given below:

TRAFFIC AND TRANSPORTATION

The report of the committee on traffic and transportation was devoted to a consideration of the reduction of street congestion, to jitney traffic and to a recommendation for the establishment, in municipalities having a population of 100,000 or over, of a highway transport division. The duties of this division would be to deal with all matters pertaining to traffic and transportation which affect the economic designs and maintenance of streets and their efficient use by pedestrians and all classes of vehicles. One of the most important functions of such a division would be to make highway transport surveys as preliminary to the design and redesign of streets and the formulation of efficient traffic regulations. On the subject of reduction of street congestion and jitney service, the report says:

"Based on a careful analysis of public passenger transportation, your committee considers that it is highly desirable, from the standpoints of economic public service transportation and the efficient use of municipal streets by traffic, that the society should strongly condemn the development of 'wildcat,' so called, jitney service. Not only is the installation of such service undesirable from the standpoint of the overcrowding of streets with five-passenger public transportation vehicles, but it is obviously unfair to public service corporations, operating under franchises, to be forced to compete with a jitney service, which almost universally is operating on an uneconomic basis. The present overcrowding of some of the principal thoroughfares of the city of Detroit with hundreds of five-passenger jitanes furnishes a striking example of this type of public service transportation development."

In the discussion following this report, Prof. Arthur H. Blanchard of the University of Michigan advocated the principle of compelling jitanes to operate only under municipal franchises by the terms of which they could be forced to render adequate service, as are the street railway companies. Such a method of operation, he announced, is in effect in Detroit, where groups of jitney buses have been formed into companies. He opposed the practice of permitting jitney buses to operate on the same streets as street railway lines, citing the case of one company in Michigan which has been forced to suspend service on account of jitney competition. It was brought out in the discussion, also, that the public may find jitney service agreeable during the warm months of summer, but that

when winter comes the value of an inclosed street railway car is better appreciated.

License fees for motor vehicles operating on city streets, Professor Blanchard believes, are too low. In England, he pointed out, a substantial charge is made for the use of city pavements by buses and trucks. He forecast a wide utilization of motor-truck lines for freight haulage to be installed and operated by the railway companies.

In large cities, where traffic is congested, Professor Blanchard stated the trackless trolley is not an economical means of transport. The concentrated wear caused by these vehicles, he said, is responsible for ruts in pavements.

PUBLIC SERVICE COMMISSIONS AND MUNICIPALITIES

In presenting an abstract of his paper on "The Relations Between Public Service Commissions and Municipalities," Major Ezra B. Whitman, of Norton, Bird & Whitman, consulting engineers, Baltimore, and a member of the Public Service Commission of Maryland, made a plea for the establishment of equitable rates for such utilities as street railway corporations and gas companies, even though this should mean a raising of rates, in order to prevent the companies from going into receiverships. It has been the recent practice in Maryland, in certain cases, to allow a corporation a temporarily increased rate, pending a final decision by the Public Service Commission. Such action is necessary, he pointed out, because changing conditions in the cost of labor and materials take place far more rapidly than it is possible for public service commissions to give their decisions. Often such deliberations take from six months to two years and involve detailed valuations of property. Major Whitman made the point that public service corporations can live only so long as capital is attracted to them, and this means the establishment of rates which will assure a reasonable profit on the investment.

CITY PLANNING

The report of the committee on city planning urged the establishment, in every city of 50,000 inhabitants and upward, of a city planning office with at least one well-trained employee. In the development of a city plan the studies should be made in the following order: (1) Major streets plan, (2) transit plan covering street car lines, (3) transportation plan covering steam and electric railroad locations and terminals, (4) public recreation plan, (5) zoning plan, (6) civic art.

STREET RAILWAY PAVING

This was the first report of a new committee, of which C. E. DeLeuw of Chicago is chairman. It was not presented for adoption. A number of abstracts from letters of city engineers describing street railway track and paving construction in their cities were given, as well as some drawings and statements of these engineers on the various details of construction which have been found successful or unsatisfactory. The report then recites fac-

tors which require study in selection of tracks and pavements therefor. These seem to be taken largely from reports of the committee on way matters of the American Electric Railway Engineering Association for 1914 and 1915. The latter committee is also quoted directly on conclusions presented in 1915 on track pavements.

It also contained a proposed specification for street railway pavements and track construction, submitted for discussion. The specification contains sixteen sections, which bear earmarks of rather hasty preparation. The first ten sections of the specification are reprinted below. These are followed by five sections for stone, brick, wood, asphalt and concrete pavements and a final section on "grade." An objectionable feature of the latter is a proposal that the outer rails of double tracks shall be $\frac{1}{4}$ in. below the inner rail.

PROPOSED SPECIFICATIONS FOR STREET RAILWAY PAVEMENTS AND TRACK CONSTRUCTION

I. *Excavation.* 1. The contractor shall excavate the space to be occupied by the tracks to a depth of — inches below finished grade. Any soft, spongy or otherwise defective material shall be removed from the subgrade, and replaced with sound material.

2. The subgrade, shall be thoroughly rolled with a three-wheel roller weighing not less than 10 tons where practicable. In places inaccessible to the roller compression will be secured by tamping.

II. *Subsoil Drainage.* 3. In all soils except sand, gravel or sandy loam, subsoil drainage shall be provided.

4. This shall be done by laying either 4- or 6-in. tile pipe in a trench surrounded by crushed stone, gravel or cinders. The drain shall be laid under the center of each track or midway between tracks, as may be determined by the character of soil.

5. Provision shall be made for connections leading from the base of rails to the subsoil drains, at frequent intervals.

6. Subsoil drains shall be connected to the sewers by means of vitrified tile pipe of a suitable size.

III. *Foundation.* 7a. Plain Ballasted Construction. The ballast shall be evenly spread in the trench so that, after being thoroughly compacted with a three-wheel roller weighing not less than 10 tons, it shall have a minimum depth of — inches.

8a. Ballast shall consist of clean, hard, durable crushed stone or gravel graded so as to pass a 2-in. screen and be retained on a $\frac{1}{2}$ -in. screen.

7b. Concrete Slab Sub-ballast Construction. Upon the subgrade prepared as above described, shall be laid a portland cement concrete slab — inches in depth. The concrete shall conform to the A. S. M. I. specifications for concrete for pavement foundations.

8b. After the concrete slab has set a layer of ballast shall be laid to a maximum depth of 3 in. Ballast shall consist of clean, hard, durable crushed stone or gravel graded so as to pass a $\frac{3}{4}$ -in. screen and be retained on $\frac{1}{2}$ -in. screen. Ballast shall be well compacted by tamping.

7c. Solid Concrete Construction. Upon the subgrade prepared as above described shall be laid a concrete foundation which shall be constructed integral with the pavement base. The concrete work will follow immediately after the surfacing and lining of the track. The final concrete shall be brought to a height — inches below the top of the rail and shall coincide with the grade established for top surface of pavement base. Concrete below and around ties and rails shall be thoroughly rammed and tamped. If the engineer deems it necessary, cement grout shall be poured so that all voids will be filled. Care shall be taken in tamping under and around the tie and rail so that the surface and line of the track shall not be disturbed. In no case shall the ends of ties be covered by a board while placing the concrete.

8c. The concrete shall conform to the A. S. M. I. specifications for concrete for pavement foundations.

IV. *Rails.* 9. The rails used shall be of a type and weight which shall meet the approval of the engineer. The T-rails shall comply with specifications of the American Society for Testing Materials.

The high T-rails and girder rails shall comply with the specifications of the American Electric Railway Engineering Association.

V. *Rail Joints.* 10. Rail joints shall be modern bolted, riveted or welded joints. The joint selected shall produce the effect of a continuous rail. The type of joint and the method of making shall be approved by the engineer and be subject to his supervision.

VI. *Rail Fastenings.* 11. The rail shall be brought to proper gage and fixed securely to ties by track spikes or screw spikes. Clips shall be used in all cases when crew spikes are used. The type and dimensions of rail fastenings shall be approved by the engineer.

VII. *Tie Plates.* 12. Upon each tie and under each rail shall be placed a tie plate. The size, type, and weight of tie plates and the method of fastening to the ties shall meet with the approval of the engineer.

13. When tie rods are not used, suitable brace tie plates shall be placed as directed by the engineer.

VIII. *Ties.* 14. Wood Ties (untreated). All ties shall be either No. 1 white oak or 90 per cent heart long-leaf yellow pine.

15. All ties must be square edged and sound and sawed out of straight-growing timber. They shall conform to specified dimensions, be out of wind, with sawed ends and straight and parallel faces. Ties shall be free from splits, shakes, loose or decayed knots, or other imperfections which may impair their strength or decrease their durability.

16. The standard dimensions of all ties shall be 6 in. in depth, 8 in. in width and 8 ft. in length. A variation from the standard dimensions of $\frac{3}{4}$ in. in depth and width and 1 in. in length will be permitted, provided that not more than 20 per cent of ties under the standard dimensions will be accepted.

17. Wood Ties (treated). All ties shall be of long-leaf yellow pine, short-leaf yellow pine, loblolly pine, Norway pine, Oregon fir, cypress, white oak or red oak.

18. Ties shall conform to the specifications in paragraphs 15 and 16 as to quality and standard dimensions.

19. The air-seasoning of timber is preferred before steaming, but where sufficient time cannot be allowed for this fresh cut timber will be allowed to be substituted for treatment.

20. The character of the antiseptic solution and the method used shall be subject to the approval of the engineer.

21. The spacing of ties shall be not more than 24 in. center to center.

IX. *Pavement Base.* 22. After the foundation has been constructed, the track laid and brought to proper alignment and grade, the pavement base shall be laid. It shall be of concrete which shall conform to the A. S. M. I. specifications for concrete for pavement foundations. Concrete shall be thoroughly rammed and tamped around ties and rails.

23. Care shall be taken in tamping around the tie and rail so that the surface and line of the track shall not be disturbed. If the engineer deems it necessary, cement grout shall be poured so that all voids shall be filled. In no case shall the ends of the ties be covered by a board while placing the concrete. Care must be taken to have the outside edges of the concrete base conform to the dimensions. The concrete shall extend from the bottom of the ties to a grade above the tops of the ties — inches below the top of the rail.

X. *Rail Filler.* 24. The spaces under the heads of the rails and next to the webs shall be filled ahead of the pavement with portland cement mortar composed of one (1) part portland cement and three (3) parts torpedo sand. At the option of the engineer mastic may be substituted consisting of asphaltic concrete binder.

Right here there comes another serious difficulty. Many states have a law which forbids companies to sell their stock at less than par, but if a company must pay over 7 per cent for the money it raises on its mortgage securities, how is it to sell at par a 6 per cent or 7 per cent preferred stock? The answer is obviously that it cannot, and the very difficult situation that has been thus created has finally made legislators in many states consider seriously a plan which economists have been advocating for over a quarter of a century; that is, the issuance of stock of no stated par value. The advantages of this plan are manifold. The shares, like any other shares, are worth exactly as much as the property behind them is worth, but they bear on their face no misleading statements as to their value. Consequently such stock cannot come under the above legal restriction and the company can set it in any market on the same basis which is then current for other securities of the same intrinsic worth. New York has had a no par value law since 1912. Since that time other states have followed New York's lead, and many states now have such laws on their books while similar measures are pending before the legislatures of several others.

THE LOCAL SALE OF PUBLIC UTILITIES SECURITIES

In this committee's last annual report mention was made of the success which many utility companies were making in the sale of large amounts of their preferred and even their common stocks direct to customers and employees. At that time there were pointed out the manifold advantages of such local distribution of a company's securities. In the first place a new security market of by no means inconsiderable proportions is opened up. It has been estimated that since the plan was first adopted about seven years ago over \$100,000,000 has been added to the capital of public utility companies from this source. Probably a still greater benefit is the good will obtained. The relations of the company with its public and with its employees are greatly improved. The manager of the publicity department of one company which has accomplished much in this connection stated recently:

"Specific instances of improved public relations are many, including a remarkable history of rate increases, the majority of which were obtained without controversy by simply showing the facts. We hear little or nothing of municipal ownership any more at properties where we have home shareholders."

It should, however, be borne in mind that in undertaking the sale of its own securities, a company assumes certain duties and obligations toward the purchasers of those securities. These purchasers, it must be remembered, are mostly people of comparatively small means who are not accustomed to scrutinizing carefully or judging the merits of investment opportunities. To them the utility company has always seemed a financial pillar of strength. In many cases they have considered it, in spite of published figures to the contrary, a veritable gold mine to its owners. To them, the opportunity to buy this stock is an opportunity to share in profits that they have always considered absolutely certain. A careless or unscrupulous company might, in some cases, sell stock that had no real value

Status of Electric Railway Light and Power Securities*

Decided Improvement in Electric Railway Situation Shown During Past Year—
Details Given—Customer Ownership, Valuation and Other Topics
Considered in Report to Investment Bankers

By H. M. ADDINSELL

Chairman of Committee on Public Service Securities,
Investment Bankers' Association

THE past year of general business depression has accentuated the inherent stability of public utility business as a class. The tremendous industrial activity of 1920 greatly increased the demands on the utilities, which were called upon to expand their facilities for service to an unusual degree. But it was an ordered expansion. There was no such peak of production as was the case in the industrial field. On the other hand, when the depression set in there was not the same drastic falling off in gross receipts.

Both periods, of course, brought their problems. After the war interest rates were high. Prime mortgage securities could be sold only at such prices as would yield the investor an income of 7 per cent and more. This, of course, made it rather embarrassing for a company which, faced by large additional demands from its customers, had to raise money for additions and extensions, but had nothing to raise it on except the 5 per cent bonds authorized by the open end mortgage it had drawn up before the war. It was imperative that the extensions and additions be built and built quickly. The commissions demanded it; also it would have been bad business not to satisfy the urgent needs of good customers. In some cases the problem was solved by

issuing 7½ per cent and 8 per cent notes secured by a larger face amount of the 5 per cent bonds.

This, however, was an obvious makeshift and the situation was not really met until the details of the so-called series mortgage had been worked out. This type of mortgage contains all the safeguards to the investor found in the best open end mortgages of the pre-war period, but in addition provides that bonds may be issued in various series bearing such interest rates and due dates as the directors may deem advisable. This makes it possible for the company always to have available against its needs for money for additions and improvement prime securities which will meet the demands of the market in which they are to be sold.

Unfortunately even this does not solve the whole problem. One of the most important of the safeguards to the investor contained in modern mortgages is the provision that bonds may be issued only against a certain proportion of the proposed additions. This proportion is generally 75 per cent or 80 per cent. Thus a large amount of money still remains to be raised from the sale of junior securities. Debenture financing is always expensive and is rarely satisfactory, though it may be used as a temporary expedient in times of emergency. The greater part of this money must, therefore, be raised by the sale of stock.

*Abstracted from the report of the committee, presented at the annual convention of the Investment Bankers' Association of America, New Orleans, La., Oct. 31, 1921.

behind it. This would be a most dangerous practice. Not only would such a company be running the risk of losing the confidence and respect of its local public, but it would be getting back to the same old condition of inflated capitalization which proved so disastrous in the past. It is thus plain that stock which a company expects to market direct should be issued under the same conservative restrictions which would be demanded if the issue was to be made through investment bankers. It should represent actual investment in the property and the price should be in line with the current quotations for securities of a similar class.

COMPETITION FROM TAX EXEMPT SECURITIES

Tax exempt securities have a direct bearing and restraining influence on the marketing of gas and other utility securities and this is a matter which is now receiving considerable attention. Philip H. Gadsden recently appeared before the House ways and means committee on behalf of the three large utility associations and urged that public utilities be placed in a special class for taxation purposes and also opposed the issuance of any further tax exempt securities. It has been estimated that there are \$7,000,000,000 par value of tax exempt securities issued by state, municipal and school governments now outstanding. The continued issuance of tax free bonds of local governments carrying high rates of interest is attracting investors to the detriment of investments offered by private enterprise and agitation for limiting the tax exempt borrowing power of local governments is growing. In public utility circles sentiment is increasing to prohibit the further issuance of tax exempt securities.

WATER POWER DEVELOPMENT AND SUPERPOWER PLANS

One of the most important and interesting developments in the power generating field is the progress that is being made toward the development of water powers on navigable streams, on public lands and on the forest and other reserves. This development has been made possible by the Federal water power bill. The enactment of this law has met with tremendous response from people who seem to be willing to take the responsibility for the development of the potential power made available. Up to June 30, 1921, the commission reported that there had been filed with it applications aggregating 14,675,000 hp. affecting thirty-three states, the District of Columbia and Alaska. This amount is five times greater than the aggregate of all applications with the federal government in the preceding fifteen years. The projects applied for vary in size from less than 100 hp. up to the 3,000,000 hp. scheme of the Southern California Edison Company on the Colorado River. The chief present defect in the act is its failure to provide adequate means for its expeditious administration. In spite of this handicap, the commission has accomplished many things in the first year of its operation.

There is, of course, no possibility of immediate development of all the projects applied for. The market could not absorb the power even if the construction could be financed. But at least there is now available a practical method for a progressive development of water powers, which may be undertaken as rapidly as financial conditions

and market requirements will warrant. After many years of obstruction on the part of so-called conservationists, the country has now adopted a program for the real conservation of our exhaustible fuel supplies by throwing upon the indestructible and self-renewing water powers the production of large amounts of motive power.

SUPERPOWER SYSTEMS

Closely allied with the movement for conservation of fuels by development of new water powers, is the movement for conservation through the more efficient use of facilities already in operation. The United States Geological Survey, under the special direction of Congress, has been engaged for the past year and more in a survey of the power resources of the Atlantic seaboard between Boston and Washington, studying the practicabilities and advantages of a co-ordinated superpower system, and certain preliminary estimates made public last spring point out the enormous coal saving which could have been effected in this zone during 1919 if the facilities which are proposed had been in existence at the time. It may be said that to a certain extent the welding of individual systems into superpower systems is already taking place in many localities. The whole question is one which is of great interest to the investment banker, and one in the solving of which he will undoubtedly play a leading part.

THE ELECTRIC RAILWAY SITUATION

During the past year the electric railway situation has shown decided improvement. The facts have proved the truth of the statement that adequate traction service is indispensable to the comfort, convenience and prosperity of any important community. To most of us this principle is self-evident, but in some cases it has taken an absolute breakdown of the system to bring it home to shortsighted politicians who had been exploiting their local companies for selfish purposes. Other communities have profited by the example of their less fortunate neighbors and have lightened their companies' burdens before the breakdown came. In still other instances the situation has been solved by the interposition of a state commission.

The measures for relief have been various. There have been a few instances in which the city has taken over the roads from the company, usually giving in exchange mortgage bonds on the system. This sort of transaction does not, however, in and of itself, solve the problem; it merely transfers to the city the responsibility for making the system self-supporting in the face of excessive wages, high commodity prices and jitney competition. Undoubtedly some municipal authorities will try to take the easiest way out and make up from the city treasury losses caused by a popularly low fare, but it is highly improbable that the taxpayers will allow such an experiment to be long continued.

The steps taken in various communities have, of course, differed in accordance with the needs of each situation. In the first place, there has been a more or less general raise in fares. A summary compiled early in the year from figures supplied by the American Electric Railway Association showed that the traction companies in over 85 per cent of all cities in this country of over

25,000 population were, at that time, charging fares which ranged from 6 cents to 10 cents. Among the ten largest cities of the country, New York was the only one which still retained the 5-cent fare. Many companies have obtained relief from burdensome paving obligations and other forms of special taxes. In particular, it is becoming generally recognized that unregulated bus competition is not only unfair to the street railways, but is in the long run positively detrimental to the best interests of the public. There is of course, a legitimate field for the buses. Used properly their flexibility makes them most valuable as feeders to bring to the car lines riders from sparsely settled outlying districts that are just opening up. This function they can probably fulfill most efficiently and economically when operated as an integral part of the railway system; at the very least, they should be subjected to the same country as are the other transit facilities in the community. It is most gratifying to note that many states, notably Connecticut, have taken a firm stand in putting all public carriers under the Public Service Commission and requiring all such carriers to secure a certificate of convenience and necessity before beginning or continuing operation.

None of these remedies, however, will cure an over-capitalized company. Such situations must be cleaned up from their very foundation. In these cases, an actual valuation should be made and the capitalization of the company adjusted to a real basis of the property's worth. A new franchise should be obtained embodying such provisions as are necessitated by the needs of the particular situation. Enlightened opinion is coming more and more to favor the so-called service-at-cost franchise which provides machinery for adjusting the rate of fare to insure an income sufficient to provide for all operating expenses, adequate maintenance and depreciation and the interest and dividends which represent the wages paid to capital actually invested in the business. In what is possibly its best form the service-at-cost franchise provides also for a premium on efficient management in the form of a rate of return becoming progressively higher as fares are reduced.

In addition certain factors in the general economic situation have been of material assistance to electric railways. There has been a slight but actual reduction in wages. It is estimated that the average wage index in August, 1921, was 218 as compared with the peak of 232 in September, 1920, and 100 in 1913. To the railways with their large bills for platform labor, this has been a material saving. For example, it is estimated that the recent 10 per cent cut in the wages of the employees of the Interborough Rapid Transit Company means a reduction of \$2,600,000 in that road's operating expenses during the coming year. A particularly encouraging feature of this wage reduction is that, for the most part, it has been effected by individual negotiations on the part of each road and without great friction. This can only mean that the employees are taking an added interest in the welfare of their companies which may prove to be a deciding factor in the avoidance of future labor troubles. Reduction in the cost of materials has not been so general. Particularly in manufactured

articles, such as cars and car equipment, it has almost been negligible, but in some materials which have a very general use, such as copper, the decreases have been marked.

COMMISSION REGULATION

The state regulatory commissions were originally created to place a curb on the utility operators in their supposed exploitation of the public. At that time there was a general feeling, which still persists to a limited extent, that such restriction upon private enterprise would discourage the investment of further capacity in the business and would prevent its proper and necessary development. The critics of regulation, however, seem to have under-rated the spirit of fairness with which the commissions took up their work. Hardly had regulation become an established fact when the war broke out. Within a few years rising wages and commodity prices had so increased operating expenses that many utilities were losing money. The commissions, however, realizing the fundamental necessity of maintaining the utility industry in the best possible condition, were fair in recognizing the necessity for increased rates.

This was not, of course, what the demagogues and politicians had counted on and numerous attempts ensued to arouse popular opposition to the regulatory bodies. In at least two states the gubernatorial elections last fall were fought, and won, on platforms calling for the abolition of the commission. So far as can be learned, however, there is no general public demand for the abolition of state regulatory bodies. In the two cases mentioned above, the campaigns were strongly affected by national consideration. In one of these states the candidate who stood strongly for regulation sent a telegram to the governors of all the other states asking for their opinions in the matter. He received thirty-six replies. The wording of those replies, of course, differed but in their substance all were in fundamental agreement with the statement from Massachusetts, that the commission had proved its usefulness and was here to stay.

PROPER METHOD OF VALUATION STILL UNDETERMINED

There are, to be sure, many problems which have not yet been solved. One of the most important of these is probably the adoption of a uniform and comprehensive scheme for the valuation of utility properties. There is an almost universal tendency to restrict the right of utility companies to earn more than a stated return on the present value of their properties as going concerns. It is thus of the utmost importance to the investment bankers that they be able to form some idea of what valuation will probably be placed by the commission upon a property, in order that they may judge to what extent the securities of the company may be safely issued.

As yet the question remains in a chaotic condition. The various commissions have contributed little helpful thought on the subject, due largely to the limitations of the cases presented to them and the fact that counsel when appearing before them have felt that they must be guided by the peculiar exigencies of each case, and not attempt to present the subject of valuation beyond its relation to the particular case

under consideration. Strictly on its merits, therefore, neither angle of the question has obtained a full presentation. Public utility operators have very varying views on the subject and engineers are more or less hampered by the varying purposes for which they are asked to make valuations. Replacement value seems still to be the best guide the investment banker has as to the value of properties for loan purposes, provided always of course that the properties are reasonably productive, are permitted to earn a fair return on the cost of reproduction, and have been reasonably maintained. This method has its serious drawbacks. By reason of the changes wrought by the war the prices to be used in figuring replacement values have become a new and very difficult problem. At best this method is only what has been aptly termed an "intelligent guess," but it is perhaps the most "intelligent guess" that has so far been arrived at. Perhaps in time the commissions may evolve a new and better system. It is a question of the utmost importance to investment bankers and one which should receive their earnest attention. A sub-committee is studying this question and will report on it shortly.

Many other problems are constantly coming up for solution. With the readjustment of commodity prices has come a temporary lowering of costs of labor and essential materials, but it is as yet by no means certain that this is not a mere temporary condition so far as the

utility business is concerned. It is, therefore, necessary to these utilities that they be allowed to maintain their present rates to cover previous losses in operation and to re-establish a credit for the carrying on of the large construction program which has been deferred for the past four years.

It is gratifying to note the acceptance of these facts by the regulatory bodies, and a far better understanding by them of utility problems. The regulation of utilities is upon a broader and more comprehensive basis with wider recognition of the influence of fair treatment leading to the profitable operation of the utility upon the welfare and development of the community served.

CONCLUSION

It will thus be seen that the public utilities have come satisfactorily through a year of general depression and that during the year progress has been made by the various groups affected by the industry—operators, investors and the public served—toward a more complete realization of the fundamental unity of their interests. In particular the state commissions are arriving at a steadily clearer understanding of utility problems and are rendering valuable assistance toward their solution. All these factors have tended to increase public confidence in the industry and public utility securities are returning to their old favor with investors.

Subways for City Transportation*

When a Rapid Transit System Becomes Necessary—Relative Advantages of Subways and Elevated Railways—Facts About New York System

BY ROBERT RIDGWAY

Chief Engineer Transit Commission, State of New York

RAPID transit systems for cities are comparatively modern institutions and are the result of the phenomenal growths of urban communities during the past seventy-five years. In the smaller cities of a century ago there was nothing in the conditions to require local rapid transit, so, of course, no one gave much, if any, thought to the problems which were to vex the descendants of the more placid folks of those days except the few persons, always found in every community, who are gifted with a far-seeing vision into the future. Merchants and other business men of the small town or village of the past lived within walking distance of their shops and offices. This, of course, was before the days of the automobile. As the community grew in size and the distance between home and office became too great to walk morning and evening tramcars and omnibuses were considered sufficient to take care of the transit needs. The trend to the cities resulted in the wonderful growths indicated by the census figures of the past eight or ten decades and then the question of rapid transit began to be discussed. New York, being the largest of our American cities, naturally felt the urge first, and soon after the ending of the Civil War the agitation began which still continues and which, on account of its importance to the people, has often been made the

political issue of municipal campaigns. It is one of the leading issues at the present time and has been and is being widely discussed from every possible point of view.

Every man is intensely interested in the local transit facilities of his city because they affect his comfort and convenience so intimately and because any of their defects or shortcomings are so apparent to him. He remembers that he had to wait for his subway train and was obliged to stand in discomfort all the way home when he ought to have had a seat. Water supply and sewage, while quite as important to his well being, have a relatively mild interest for him so long as the sewer does not become choked and back up into his cellar and wholesome water flows when the faucet is turned. The water supply structures and the sewers are out of his sight and he does not think of them until they fail to function properly. Few citizens think of what they cost or whether they are well designed and honestly constructed.

If the transit system of a city could be established before the population arrived, the city plan would in many cases be very different from what it now is. Whether better or worse would, of course, depend upon the wisdom and far-sightedness of those who did the planning, but it is impossible to look far into the future or to foresee the advance in the art of construction and the revolutionary changes which take place from time to time in

*Abstract of paper presented at the annual convention of the American Society for Municipal Improvements, Baltimore, Oct. 28, 1921.

the methods of transportation. Who in New York a century ago would have believed that the wide river separating Manhattan Island from Long Island would be bridged and tunneled as it has been since that time or that electric traction would have been developed to the state it has reached today? I am afraid if an attempt had then been made to lay out a rapid transit system to fit our present needs the experts would have made a sad mess of it because they would have had to deal with too many unknown factors. It is not wise to design transportation systems or other utilities for the needs of a time too far ahead. Railway structures and equipment, like battleships, become obsolete, and then, in part at least, are liabilities rather than assets, except the right-of-way, which in nearly every case retains and generally increases in value.

RELATIVE MERITS OF SUBWAYS AND ELEVATED RAILWAYS

Subways have the great advantage of being out of sight. After they are built they permit the streets under which they run to be used to the fullest extent. Operation in them is noiseless to those on or above the street surface, and they do not obstruct light, air or access to property. While it is not as pleasant to travel below the ground as above it, train operation in subways is not affected by weather conditions and when the stations are located at shallow depths they are very convenient of access. Subways have the effect of materially enhancing real estate values in the portions of the city they serve, particularly in the vicinity of stations. The principal argument against them is the cost, which from New York's experience is from four to five times that of a steel elevated railroad of the same capacity.

Prior to the war, New York's subways cost to construct, including track, stations and other appurtenant work and including also the maintenance and underpinning of abutting buildings and the maintenance and restoration or reconstruction of surface and sub-surface utilities, but excluding the furnishing and installation of third rail, signals, lights and other equipment, from \$700,000 per track-mile in an outlying portion of Brooklyn to \$2,500,000 per track-mile in a very congested section of lower Manhattan. Similar costs at pre-war prices for a steel elevated railroad were about \$275,000 per track-mile for a three-track line and about \$235,000 per track-mile for a two-track line. These costs would be much greater at the present time. To put it in another way, a given amount of money for rapid transit construction would build from four to five times as much elevated line as subway. With these facts in mind it would seem that subways, notwithstanding their many advantages, must be confined to the congested portions of a city, using elevated structures or open cuts for the extensions into the less congested and outlying parts. It is a fact that other considerations than financial ones sometimes govern. For instance, an elevated railway could be constructed in the narrow street of the most intensely used business section of a city for a fraction of the cost of a subway, but public opinion might not permit it to be built there and might insist upon having the subway notwithstanding the much higher cost.

Few cities have subways, largely be-

cause they are so costly to build. New York, I believe, has a greater mileage of them than all other cities of the world combined because conditions there are such as to make subways necessary for the large, intensively developed areas.

Compared with subways, elevated railroads are simple to construct and can be built in far less time. In normal times, an elevated structure can be finished ready for track in from eighteen to twenty-four months of the date when work in the field is begun, and the discomfort to the public and interference with traffic on account of the construction confined to a small part of this period. The disturbance of the street surface and of the utilities underlying it is relatively slight. With a section of a subway on the other hand, from three to four years' time is usually required for construction and, except where it is at such depth that the work is done by tunneling methods, it requires generally the entire reconstruction of the street and of the sewers, water and gas mains and other structures beneath it.

An analysis of fifty-seven subway contracts showed the total expenditures on account of them to have been distributed as follows:

Item of Work	Percentage of Cost
Earth excavation.....	25.6
Rock excavation.....	15.9
Concrete.....	14.0
Riveted steel, furnished and erected.....	7.4
Rolled steel, furnished and erected.....	7.2
Steel rods, furnished and erected.....	1.0
Underpinning buildings.....	6.5
Supporting existing railroads.....	2.7
Construction of new sewers.....	3.8
Relocating pipes and ducts in street.....	2.8
Waterproofing, railroad ducts and miscellaneous work.....	13.1
Total.....	100.00

RAPID TRANSIT SYSTEM IN NEW YORK

It is not within the purview of this paper to go into the details of these contracts, which are of such importance to New York City and which have been and are being discussed so much, both favorably and otherwise. It is of interest, however, to know that the cost of constructing the dual system will be, when completed, over \$400,000,000 and of equipping the lines and improving and extending the companies' own lines over \$180,000,000. These costs include the city-owned lines built between 1900 and 1913, but do not include the extensive companies-owned lines constructed prior to 1913. About one-quarter of the construction cost and all of the equipment cost are borne by the two operating companies, and the two systems will include, when completed, approximately 70 miles of subway, 17 miles of railroad in open cut below street grades and on embankment, 126 miles of steel and concrete viaducts and bridges, a total of 213 miles of railroad and 619 miles of single running track. All but 10 miles of this total mileage of railroad is in operation.

The number of passengers carried by the dual system; that is, the rapid transit lines, for the year ended June 30, 1921, amounted to over 1,418,000,000. The average on business days is about 4,172,500 and the maximum for one day was about 4,929,000.* These figures

*This occurred in February, 1920, on the occasion of a snowstorm which partially tied up surface car traffic and thus increased subway traffic.

are exclusive of the passengers carried by the surface lines, the bus lines and the suburban services of the trunk line railroads. The following table indicates the ticket sales at some of the more important subway stations of the congested zone:

ANNUAL TICKET SALES FOR YEAR ENDED JUNE 30, 1921

INTERBOROUGH RAPID TRANSIT COMPANY (Borough of Manhattan)

Portion of original subway on lower Broadway and Fourth Avenue—now part of the new Lexington Avenue Line.

Stations	No. of Tickets Sold
South Ferry Station.....	1,732,200
Bowling Green.....	6,961,700
Wall Street.....	9,435,100
Fulton Street.....	14,803,100
Brooklyn Bridge.....	15,238,000
Fourteenth Street.....	15,862,000
Forty-second Street (Grand Central).....	28,970,900

New Seventh Avenue Line

Wall Street.....	9,584,100
Fulton Street.....	4,190,210
Park Place.....	4,525,800
Chambers Street.....	6,487,500
Fourteenth Street.....	10,093,000
Thirty-fourth Street (Penn. Station).....	23,071,850
Forty-second Street (Times Square).....	29,568,260

Borough of Brooklyn

Borough Hall.....	9,945,100
Atlantic Avenue.....	19,929,720

The intensively developed portion of New York is beyond question a subway district, but the roads are taken out of the ground as the outlying or less congested portions of the city are reached, and the extensions are carried on elevated structures.

The stations are of the local and express types. The local stations are located from 1/4 to 1/2 mile apart and the express stations usually at longer intervals, generally from 1 1/2 to 2 miles apart. The typical local station has side platforms and those of the express stations are usually between the local and express tracks. In the Interborough Subway the platforms of the express stations are about 480 feet long to accommodate their ten-car trains, the cars of which are 51 ft. 2 in. long. The platforms of the original local stations now accommodate six-car trains, while those constructed within the past ten years are designed for the full ten-car trains. The cars of the Municipal Railway Corporation are 66 ft. long and the platforms of their local and express stations are now made 530 ft. long, to accommodate eight-car trains.

Recent Association Bulletins

THE Bureau of Information and Service of the American Electric Railway Association has prepared the reports mentioned below during the past month, and they are now available to member companies upon request: (1) A brief summary of the causes that brought companies into the hands of receivers; (2) a new compilation of cities in which fares have been changed, showing population, cash fare, ticket rate, date of change and number of fare changes granted; (3) a summary of the replies to a questionnaire of the committee on economics of schedules explaining methods of fixing running time; (4) a statement of the policy of public utility commissions in the various states in regard to the issuance of school tickets; (5) month by month statement of electric railway revenues and traffic for the first nine months of 1921 compared with 1920.

Mr. McGraw Discusses Business Revival

At the Annual Meeting in Chicago of Associated Business Papers He Points Out How the Business Press Can Help

THERE are two great classes in the world today—those who look on the world in chaos and see no hope for the future and those to whom the world disaster is but an inspiration for greater effort. I am putting the business papers in the latter class.

"Some one has pointed out that there are people who liken existence to life in a squirrel cage—eternal movement and eternal sameness—but the leader of today is the man looking straight ahead with new thoughts or with new vision of old thoughts. The business publisher as never before must grapple with the great problems before us, with new thought and new vision of world conditions confronting us in order that they may be solved and harnessed for the welfare of humanity."

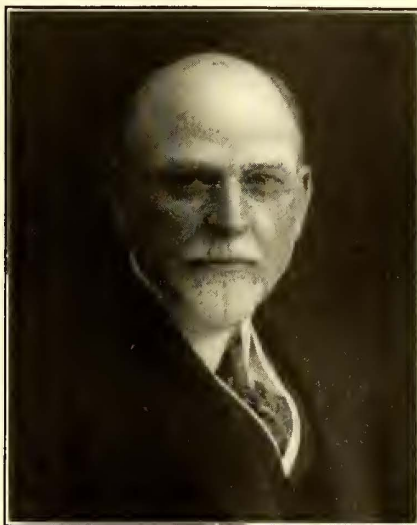
With these words James H. McGraw, president McGraw-Hill Company, Inc., began an address on "What Business Papers Can Do to Speed the Revival of Business" at the annual convention of the Associated Business Papers, Inc., at Chicago on Oct. 24.

Mr. McGraw then outlined briefly the business situation in Europe and America, told how intimate the connection was between the business condition in each and criticized the inaction of Congress on pending legislation for part of the uncertainty in which business men find themselves as regards future development. Continuing, he said, in part:

"Each of the situations referred to has a present-day bearing on American business. What is more, some of them will determine how America is to do business for many years in the future. If American business is to function up to the new position that has come to it during the war, and that necessarily follows from the fact that the center of world finance and of world influence has shifted to our shores, these governing conditions must be interpreted in terms of their influence on every industry. We may become, if we have but the knowledge, the foresight and the energy, what England has long been—the market center of the world. But we can take this position only if we have a race of business men equal to the occasion—a race worthy of a world-wide commercial dynasty.

"How shall American business men get this conception, how shall they rise to this opportunity unless the business press carries the message to them in each issue, strong with knowledge of the situation and its bearing on American business, convincing in the wisdom of the remedies it suggests, invincible in the enthusiasm and courage it displays? It is no job for weaklings, but for the broadest-gaged man that the country commands. It will not be accomplished by editors chained to their desks, nor by mere reporters nor by publishers who are bearish on America's future. It can only be accomplished by broad vision and the gospel of work.

"We must help mobilize American opinion on the stabilization of European currencies. We must not be squeamish in demanding whatever rearrangement of the German reparations may be necessary for the stabilization in Germany—realizing that a stable Germany is essential to a normally functioning economic world. When Russia comes



JAMES H. MCGRAW
President McGraw-Hill Company, Inc.

back, as she must, when the other weakened powers are in a position again to buy in normal quantities, the business press must picture the opportunity and be the apostle of whatever credit structure is necessary to bring these nations again into the world economic family. As to every other factor in the European and the world situation, business papers must rise to the occasion and see to it that American business has a wise and courageous policy.

"Studying the problems that are closer to home, we find many avenues along which business papers can work in speeding the revival of business.

"War breeds extravagance. In spite of the noble ideals which inspired this nation to take up the great conflict across the seas, the inevitable result was the accumulation of innumerable wastes and habits of extravagance. We could not help it, but we must overcome the habits and tendencies which were developed throughout our entire social and industrial fabric by that terrible conflict. As a tangible example of what can be done, Herbert Hoover has focused the attention of industry upon the unnecessary wastes which are sapping the vitality and reducing the productivity of our nation.

"We are appalled when our attention is called to criminal wastes of life through accidents and negligence, the prodigal waste of our natural resources through underdevelopment or political chicanery, the prodigious waste of materials through mismanagement and inefficiency. But of all the wastes which affect our happiness and prosperity, the waste of time and human effort is the greatest and has the most damaging influence. If the business papers collectively and individually can instill into the minds of the thinking men of industry the gospel of intelligent work, we will have performed a tremendous service. Never has there been such an opportunity. Never were our industries more in need of help. Never would they be more grateful for true and full pictures of conditions for wise counsel, and courageous leadership, as a result of unselfish devotion.

"To do all this costs money. Men who can dominate an industry, be they editors or publishers, are not to be held with paltry salaries or poor prospects. Such men are in demand by the aggressive businesses of the country. Not only are the requisite leaders high-priced men, but they must be equipped with competent staffs. A man who is out in the forefront of an industry cannot be burdened by desk detail.

"It is evident then that the business papers need larger incomes. We need them not that our own pockets may be lined with profits but that we may turn back into American business a degree of service which in turn will be a fruitful developer of our industrial and commercial life. This is a time when we should think how much we can give rather than how much we can get. We should give all that we can first, hoping there will be a margin of profit. This is a time for more patriotism, for greater leadership and for less selfishness. The business papers must make the first investment, living up to this thought. With the opportunities that are ours today, the watchword must be: Dividends small; Service large. We must be bulls on American business and not fear to make an investment in the affections and confidence of American business men. If we extend help to American business when it is down, if we help to bring it up, we can safely count upon a full reward when the sun of prosperity shines.

PUBLISHING DIFFICULTIES

"I am fully mindful that while I am urging this wider service, we ourselves are under fire from American business. Prices are falling in many lines and American business demands that we, too, reduce prices, reduce our advertising rates. This demand, we business publishers know, is not justified. Business papers did not profiteer nor did they raise rates during the war in proportion to their increased costs. By rigid economies and reduction of profits they held off their rate increases until their properties went into red ink or the certainty of red ink was just ahead. Then, much belated, our rates were moderately increased, but those increases were small compared with the increases on other products. Meanwhile, the standards of our service to the American business had been constantly raised. The war has forced us all to higher journalistic levels, and today the services which we are rendering our industries are incomparably greater than they were before the war.

"It is to be hoped that our mechanical costs of production will be lowered and we shall receive more per dollar for printers' wages, but, even should those decreases come, the larger margin that would thereby be left between gross revenue and operating expenses is sorely needed right now to bring the business papers to a level equal to the great opportunity for service which I have tried to picture. With all business papers raised to a proper plane, we would return to American industry a hundredfold whatever margin may come to us between gross revenue and the hoped-for reduced operating costs. In other words, the added revenue will not go to dividends but into better service to readers and advertisers."

CO-OPERATION AND A BROADER VISION

Mr. McGraw then pointed out how business publishers could co-operate to a greater extent than they are now

doing so as to give better service. He concluded his address in the following words:

"I will not attempt to recount all of the factors which enter into the problem of adjustment which is before us. But I do want to bring a thought before you, which is given in the words of Thomas Hughes:

Who has the clearest and intensest vision of what is at issue in the great battle of life, and who quits himself in it most manfully, will be the first to acknowledge that for him there has been no approach to victory except by the faithful doing day by day of the work which lay at his own threshold.

"In brief, I bring to you as leaders of thought among thinking men that what this country needs more than anything else is to learn anew the gospel of work. Intelligent work, untiring work, work in its most homely sense. We cannot talk ourselves into prosperity. We cannot argue ourselves into stability, but we can work ourselves out of the valley of depression and up to the heights of plenty. We can do these three things.

"First, everybody get busy at his present task, and make the most of it.

"Second, everybody consider winning

the peace in the same spirit as characterized the winning of the war.

"Third, the business papers, by article, editorial and personal service, show that selfishness has now no more place than in war time. That interest in the welfare of all men, individually and as society, lies at the basis of prosperity.

"In conclusion, let me say, we must consecrate ourselves to giving a full measure of the best service we have within us. As a nation, and as publishers, we must quit our petty quarrels and arguments and devote ourselves to the tasks that lie before us. We had to fight and destroy to win the war. We will have to work and build to win the peace. The first nation that gets hold of the idea that the only salvation comes from work will come out on top and really win the peace.

"The business papers have an opportunity such as has never come to them before, to direct the thinking of industry into sane channels. Let us demonstrate by our own untiring efforts to serve and by our diligence in meeting the problems of the day that we have accepted the gospel of intelligent work as the big step in speeding the revival of business."

ways not members of the association. Discussion hinged on the point that municipal railways cannot become members.

J. H. Pardee then presented the report of the Finance Committee showing an audited statement for the first 11 months ending September 30, 1921, with estimated expenditures for October. This report showed, as of October 31, 1921, a balance sheet of \$28,955, of which \$7,149 is cash. Comparative financial statements for 1920 and 1921 were also given, showing the present operation to be on a more efficient and less expensive basis.

On recommendation of the Finance Committee, the Executive Committee adopted a series of resolutions necessary to put into effect the provisions regarding the handling of moneys and safe-guarding of funds contemplated by the new constitution.

The question of trackless transportation being up as a result of a communication from an outside body, the executive committee decided to ask the Engineering and the T. & T. Associations to appoint committees to co-operate with the American Association committee on trackless transportation to work under the guidance of the latter.

A communication from the Engineering Association, submitted through its president, C. F. Kimball, brought up the question of employing an engineer at Association headquarters to take care of the technical and statistical work of the association in which the Engineering Association is particularly interested and to assume some of the duties which Executive Secretary Welsh has had to relinquish since he took up executive duties. Both this question and Mr. Kimball's reference to the possibility of paying certain expenses of committees in order to get greater committee activity were referred to the Finance Committee for recommendation.

In accordance with the constitutional provision that the executive committee should authorize special committees, if necessary, the committee took action authorizing the following committees: *Education*—co-operation with educational institutions. *Electrolysis*. *Excess profits tax*. *Mail pay*. *Trackless transportation*. *Valuation*.

The committee also authorized a special committee of five with E. F. Wickwire as chairman, to enlist the co-operation of all manufacturers in line with the policy Mr. Wickwire outlined in his speech at Atlantic City. This committee was to act under the general advice of the Public Policy Committee. The committee also authorized the continuance of representation of the American Electric Railway Association on the joint committee of National Utility Associations.

On account of the fact that the fourth Friday in November comes, this year, immediately after Thanksgiving Day, the executive committee decided to hold its November meeting one week later, Friday, December 2, at Indianapolis.

The following members of the executive committee were in attendance at the meeting: R. I. Todd, president; C. D. Emmons, J. N. Shannahan, F. R. Coates, F. E. Webster, L. H. Palmer, R. P. Stevens, W. H. Sawyer, H. G. Bradlee, John G. Barry, C. R. Ellicott, Samuel Curwen, L. E. Gould, George Tontrup, Lucius F. Storrs, W. Caryl Ely, C. L. Henry, J. H. Pardee and the executive secretary, J. W. Welsh.

American Association News

Executive Committee Meets

THE first regular monthly meeting of the executive committee of the American Association was a well attended, busy one at Association Headquarters Friday, October 28. If the first meeting of the committee is typical, the adoption of the monthly meeting plan suggested by President Gadsden will prove of great value to the association on account of the close touch and active management which the executive committee is thus enabled to give to its activities.

Executive Secretary Welsh presented a report concerning the membership of the Association as of October 28, 1921, compared with October 31, 1920. A total loss of two railway companies and 12 manufacturer companies is indicated. Since the meeting of the executive committee on August 5, the following members have been added:

Railway Member: Danbury & Bethel Street Railway Company.

Manufacturer Members: Witherow Steel Company, Copper Clad Steel Company, Loes & Dilworth, United Lead Company, Lowe Brothers Company.

The membership committee will take up with members who have suggested resigning from the association the question of their continuing.

In consideration of the mid-year conference, the executive committee decided it would be advisable to have it in Indianapolis at the home town of the president, Mr. Todd, and a committee of five was authorized to make preliminary arrangements.

The report of the publicity committee was submitted by Mr. Storrs for Mr. Collier, the chairman, who could not be present. This report embodied the principles suggested by Britton I. Budd at the convention, that the executive committee take direct and personal action with reference to the greater use of publicity and the more

extended use of the Advertising Section of the Association throughout the industry. The committee reported that an arrangement had been made between the committee on publicity and the *Aera* advisory committee, now the publications committee, for the conduct of a regular publicity and advertising section in *Aera*, and between the Transportation and Traffic Association and the publicity committee for the carrying out by the advertising section of suggestions made by the safety and merchandising transportation committees. The executive committee approved the report, as well as the suggested form of letter.

On recommendation of the Transportation and Traffic Association, submitted by its president, L. H. Palmer, the executive committee approved the action of the T. & T. Association, with reference to adopting the freight classification prepared by the joint committee of the T. & T. and Accountants Associations. The T. & T. Association had recommended that companies put into effect for the calendar year, 1922, this standard classification, so that sufficient data would be available at the end of the year to furnish a clear idea of the cost of handling freight.

The next question to come before the committee was the application of the new constitution to the status of individual membership of men employed by municipalities in railway work. After much discussion, the interpretation which the reorganization committee and the previous executive committee had intended to be made on the phrase "except that officers and employees of non-member companies shall not be eligible to election as individual members" be retained. This is understood to mean that the term non-member companies should include municipalities or municipal railways, not members of the association, as well as private rail-

News of the Electric Railways

FINANCIAL AND CORPORATE :: TRAFFIC AND TRANSPORTATION
PERSONAL MENTION

Galveston Case Significant

Supreme Court at Washington Will Hear Rate Case in Which Confiscation Is Alleged.

The Supreme Court of the United States on Dec. 5 will hear the appeal in the case of the Galveston (Texas) Electric Company vs. the City of Galveston involving the validity of the ordinance enacted by the city of Galveston abolishing the 6-cent fare and restoring the 5-cent fare on the railway lines in the city. This case has been long in the courts and the company has appealed to the court of last resort for a decision.

This litigation has an interesting history. It began when the Galveston Electric Company announced that fares would be increased from 5 cents to 6 cents, claiming the right under terms of its franchise to charge whatever fare it deemed necessary to meet operating costs and provide a fair return on its investment. The 6-cent fare was maintained for a time until the city could take action to declare the 6-cent not justified and to enact an ordinance restoring the 5-cent fare. The traction company then went into the federal court, claiming the 5-cent fare confiscatory and asking relief therefrom under the Federal statutes. The traction company asked an injunction restraining the city of Galveston from enforcing the 5-cent fare ordinance. Judge J. C. Hutcheson of the United States District Court for the Southern District of Texas at Houston appointed Judge Dannenbaum of Houston as master in chancery to take evidence touching the company's invested capital, operating costs and revenues, and report thereon.

Judge Dannenbaum conducted an extensive investigation in Galveston, and as a result recommended to Judge Hutcheson that the 6-cent fare be allowed, his finding being that this fare was necessary to provide operating expenses, depreciation fund and yield a return of 8 per cent on the fixed valuation of the property.

Judge Hutcheson, however, disagreed with the findings of the master and rendered final decision in the case, holding that a 5-cent fare provided adequate return on a valuation which he placed below that found by the master, and refusing to grant the injunction sought. This was on Feb. 10, last. Attorneys for the company at once set about to take the case to the Supreme Court on appeal, and an order was entered by Judge Hutcheson in his court on May 30 granting right of appeal to the Supreme Court on a writ of error.

The assignment of errors on which the appeal was based set out eight instances in which it is claimed the court erred in ruling favorably for the defendant, the city of Galveston, chiefly in sustaining exceptions to the findings of the master in chancery appointed to place a valuation of the company's property for rate-making purposes.

Both the finding of the master, and

also the approval of the court in regard to establishing of the present valuation by adding 33½ per cent to the pre-war cost of the plaintiff company's property for rate-making purposes, is set out for error.

As another reason assigned for error, it is contended that no actual period of operation was taken in which to test the desirability of the ordinance and fix operating costs. "On the contrary," it is set out, "it was assumed that the revenue for the year ending June 30, 1921, would be twice the revenue for the six months' period ending Dec. 31, 1920, and that operating expenses for the year ending June 30, 1921, would be the same as for the year ending June 30, 1920."

Deferred maintenance, which accrued during the war period, it is contended, was not given proper allowance. The court allowed \$70,000 yearly for maintenance, it is stated, when "the evidence adduced" showed \$104,000 as the normal charge.

It is also assigned for error that the master, having found 4 per cent per annum as the proper allowance for depreciation, applying same to present fair value of depreciable property as found by him, the defendant excepted and the court sustained their exception, "thus excluding from the fair value as found by the master all overheads and various other items included therein, resulting in annual depreciation allowance of \$45,240 in the place of \$66,824.40, allowed by the master."

Certain sums allowed by the master as part of base value for rate-making purposes as proper, for brokerage, to which defendants took exception and the court sustained them, are assigned as error.

The sum of \$200,000 was the amount the master allowed for rate-making purposes for going concern value, it is stated, whereas the defendant's exception to this valuation was sustained by the court, the plaintiff holds, erroneously. Exception was also taken and erroneously sustained, it is claimed, to the amount of income taxes, \$16,254, paid during the year ending June 30, 1920, which the plaintiff holds the master properly allowed as operating expenses.

\$139,750 in Penalties Sought

An action to recover \$139,750 from the International Railway, Buffalo, N. Y., has been started by the city of Buffalo as a test case to determine whether the municipal authorities or the Public Service Commission has jurisdiction over the service rendered by the railway. The suit is brought to recover alleged penalties for failure to operate owl cars on a half-hour schedule on one local line as required under the company's franchise agreement. The railway contends that it complied with an order of the Public Service Commission when it stopped owl service on certain lines and that the city is without authority to restore the owl service.

Fare Adjustment Asked

Public Interests Outweigh Investment and Chartered Rights, Says Connecticut Utility Commission.

The Connecticut Company trustees are being urged to try a 5-cent fare in Bridgeport by Chairman Richard T. Higgins, the other members of the commission concurring. This is the latest move for reduced fares in Connecticut. It has followed closely the development in Norwalk referred to elsewhere in this issue. On Nov. 10 the commission will hold a hearing on the petition of the city of Bridgeport asking for a fare reduction.

Chairman Higgins in a letter to the trustees of the company points out that the city of Bridgeport is the critical point in the State from a street railway transportation standpoint and that unless there is a change in trolley car rates there the commission will be forced to grant additional jitney routes. The trustees take the stand that the lines of the company should be treated as one unit. Salient features of Chairman Higgins' letter are:

1. That the commission has very materially eliminated unfair and destructive jitney competition.
2. That the investment and chartered rights of the company must be subordinate to the paramount interest of the public.
3. That the company should be prepared to adapt itself to changing conditions.
4. That the habit of riding should be promoted by the rendition of cheap and frequent service.
5. That the operating revenues and expenses of each division should be kept separate, thereby permitting an adjustment of rates for each such division.
6. That the methods of transportation must conform to economic conditions.

Chairman Higgins' letter to the trustees expresses the attitude of the commission on the critical condition now existing and confirms the belief that conditions have changed materially since the high rate was made effective; also that the 10-cent rate is more than the traffic can bear.

About the time the letter was written President L. S. Storrs informed the trustees that the company had derived a net income of more than \$1,000,000 in the first few months of the year.

In a reply to the commission Judge Walter C. Noyes, chairman of the company's federal trustees declares that by granting a fare reduction in Bridgeport, the unity of the system would be destroyed. He expresses the hope that next spring the trustees will be in a position to consider a change that will effect the entire system.

Judge Noyes, writing under date Oct. 25, informed the commission that if it ordered a 5-cent fare in Bridgeport the trustees will see to it such order is fairly and fully complied with.

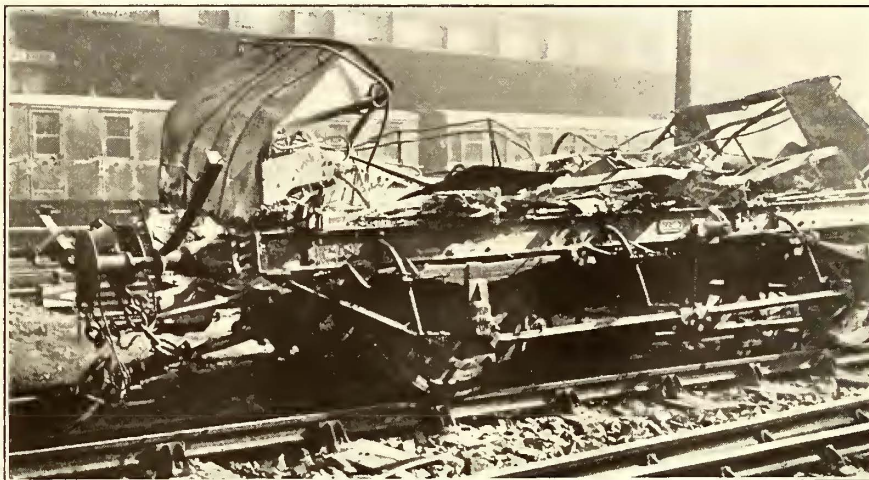
Railway Asks Relief.—The Muskegon Tracton & Lighting Company, Muskegon, Mich., through its directors, has applied to the City Commission for assistance in its financial difficulties. In a letter addressed to the Commission the company reports losses for four months amounting to \$18,772.

Provisions of New Franchise Being Considered

The city of Houston, Tex., is considering provisions of the new franchise which is to be negotiated with the Houston Electric Company. This action is made necessary by the recent rejection by the voters of the city in the referendum election on the franchise which had been submitted by the traction company. City Attorney Sewell Meyer has proposed to the City Council that the company should first be required to establish a flat 6-cent fare in the city or issue books of twenty tickets for \$1. The City Council has taken its recommendation under advisement, but has made no announcement as to whether it would be included in the new franchise provisions. The Mayor and members of the City Council have said that the first consideration in framing the new franchise will be service, and that the company will be bound in such a manner that service must be given.

Paris Subway Wreck Kills Forty

Forty persons were killed and a hundred were injured recently when two suburban trains of the Paris subway



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THE REMAINS OF ONE CAR WHICH FIGURED IN THE PARIS SUBWAY WRECK

system collided in the Batignolles tunnel near the St. Lazare station. Both trains were crowded and the coaches caught fire following the crash. Many were burned to death.

Trackless Trolley Advocated by Street Railway Director

Charles R. Barnes, street railway commissioner at Rochester, N. Y., is an open advocate of the trackless trolley. He has recommended vehicles of this type to the City Council for use by the New York State Railways for cross-town service. At the same time that this proposal was made permission was sought to extend the existing electric railway tracks on Clinton Avenue north from the present terminus at Norton Street to the Ridge Road.

Mr. Barnes stated that both he and President James F. Hamilton of the New York State Railways had decided after investigation that trackless trolleys were most suitable for such cross-town service as Rochester needs. The commissioner of railways emphasized the immediate necessity for such service

and asked for investigation of the plan. His communication was referred to the committee on law. In presenting the matter Mr. Barnes said:

While the president of the railway and I have come to the conclusion that the trackless trolley is the means best suited to supplement the present trolley system in this city, its adoption is such a radical change from prevailing methods of transportation and so important, that I feel before final action is taken that it should be fully discussed and an opportunity given to all interested to express their views on this subject.

Therefore, I would respectfully suggest that this communication be referred to some committee of your honorable body for that purpose.

Municipal Railway Construction Praised

Frederick Boeken, superintendent of the San Francisco (Cal.) Municipal Railway, recently made a tour of inspection of Detroit's municipal street railway lines. Mr. Boeken was passing through Detroit on his way back to San Francisco after having attended the recent convention of electric railway men in Atlantic City.

In view of the way in which Detroit is committed at present to a program of municipal ownership of its railway lines the daily papers there were quick

Differences Being Adjusted

Reconciliation Reached Between Security Holders at New Orleans Helpful Toward Traction Settlement

A quarter page display advertisement published recently in the local papers at New Orleans, La., invited holders of the 4½ per cent bonds of the New Orleans Railway & Light Company, to deposit their bonds with Jan. 1, 1922, and all subsequent coupons attached with any one of four depositaries of the committee.

This announcement followed reports published in the New Orleans papers that an agreement had been reached among the security holders of the several classes. The report could not be confirmed.

R. S. Hecht, chairman of the committee representing the holders of the 4½ per cent bonds of the New Orleans Railway & Light Company, and president of the Hibernia Bank & Trust Company, one of the signers of the advertisement, is represented as having predicted an early settlement of the local railway tangle, though he was unwilling to make public the probable plan of settlement.

G. M. Dahl, representing the eastern interests of the New Orleans Railway & Light Company, while confident that a settlement is not far off, declined to go into details. He indicates, however, that an agreement had been brought about between junior security holders and 4½ per cent bondholders.

The conferences that have been held by Commissioner Maloney, of the Public Utilities Department, with interested parties, have resulted in his plan of settlement being perfected, with the result that it will be submitted to the Council for approval as soon as the time is opportune. Not until the approval of the Council has been obtained, however, will final negotiations be conducted with the company and the security holders. The matter has been delayed by the Mayor's illness.

A movement has been under way for about a month looking to the establishment of bus transportation in New Orleans by popular subscription. The parties back of the undertaking are the Anti-Eight-Cent Car Fare League, supported by the Women's Federation of Clubs and the Central Trades and Labor Council. The organization claims to have 70,000 subscribers to its stock, which is being sold in small denominations on the installment plan.

On Oct. 30 it was stated that the security holders of the company after many protracted meetings with the members of the Commission Council have finally evolved a plan of settlement along the lines of the Maloney plan, which they have asked the Council to adopt. This modified Maloney plan is one that is said to be acceptable to all the security holders at interest, including the fraction that demurred to the preferred position given the holders of the 4½ per cent bonds under the original Maloney plan.

Commissioner of Public Utilities Maloney spent a good part of the afternoon of Oct. 29 in going over the modified plan with City Attorney O'Keefe, with the view of learning the legal right of the city in the proposed agreement and to what lengths the city was committed under the plan. After these representatives of the city have satisfied themselves on the points involved nothing more will remain to be done but

to seek out Mr. Boeken for an expression of opinion as to the lines now being built there and for comment on the progress in municipal operation that has been made in San Francisco. He is quoted by the *Detroit News* in part as follows:

You will probably hear much criticism of the small safety cars—at first. But don't let that disturb you. Both from experience and hearsay I know the one-man cars give excellent service and meet every demand of the public. I saw one of the Peter Witt type of large cars which the local municipal lines will use, and it seems to me that that type of car will be entirely adequate to take care of the heavy traffic on Woodward Avenue and other main thoroughfares.

The track now being built in Detroit is not only entirely adequate to carry the traffic, but, in all my railway experience, I have never seen neater construction. You must have a marvelous organization here to have constructed so much and such good track in so short a time.

Detroit has used what is called the "rigid" type of construction—that is laying the ties and rails in cement. The Detroit United, I am told, still lays its ties on a sand foundation with brick and stone supports. That's old stuff in the railway world. Out in San Francisco we build very much the same as Detroit is building its new lines. Some of the tracks have been down nine years, have given excellent service and are still in good condition.

submit the plan to the Commission Council for its approval. It does not follow, however, that this will mark the end of the matter. The company will have to be reorganized on the lines outlined in the original Maloney plan; the receiver discharged; more money obtained; and the necessary enabling acts passed by the Commission Council.

Those in possession of the facts upon which it is now generally believed a solution of the company's troubles will be reached are unwilling to discuss the details for publication. Nothing will be known definitely until the matter is presented to the Council. It goes without saying, however, that the modified Maloney plan, if approved by the Commissioner of Public Utilities, will be adopted.

The value of the property of the company, for tax assessment purposes for 1921, has been reduced by the Louisiana Tax Commission \$2,510,680 below the assessment of 1920. The loss sustained by the city in this reduced assessment is made up, however, by the amount that applies to the city general fund receivable from the percentage tax on gross receipts for the year. The gross receipts for this year under the present 8-cent fare will be about \$15,000,000 as against \$12,583,560 for 1920. This tax goes direct to the city general fund.

Candidate Curran Another Five-Cent Apostle

Henry H. Curran, coalition candidate for Mayor in New York, made public on Oct. 29 a statement of his position on transit.

In it he came out unequivocally for the retention of the 5-cent fare and for such amendments to the transit commission act passed by the last Legislature as would return to the city complete control of all traction contracts.

Proclaiming himself an advocate of home rule, he declared this campaign was "a fight to the finish to find out whether Hearst rules New York or whether the people of the city still enjoy local self government."

As Mr. Curran sees it the transit problem in New York has come to assume three distinct aspects. They are:

1. The question of home rule.
2. The retention of the 5-cent fare.
3. Improved and extended service.

Mr. Curran said:

I have repeated over and over again my firm conviction that this city is entitled to control its local affairs, free from outside domination.

I opposed the transit law as soon as it was drafted last winter. I said it was wrong and unjust to take from us our control over contracts made by us in good faith and executed by the expenditure of millions of dollars of our own money.

Home rule is right, and I say that right comes ahead of party. Right comes first.

When I am elected Mayor I propose not only to test the constitutionality of the transit law but to fight with all the strength and energy I possess to have it amended. I am going to have a bill drafted and introduced at Albany restoring to our city the control over our transit contracts that this law took away from us.

While the stage has not yet been reached where the different steps and details of the procedure toward securing the ends Mr. Curran has in mind can be worked out, still he has stated specifically his ideas on some of the points as follows:

Before all else, the valuation of the roads must be right. Every drop of water must be squeezed out. If there is no

earning power under the 5-cent fare, that is in the contract, I say there is no marketable value beyond what one man would pay another for such a property.

Also, I am fundamentally and unalterably opposed to the "sliding scale or barometer" fare. I shall oppose any plan that does not render it impossible at any time in the future, or under any circumstances, to exact more than a 5-cent fare, or any plan that alters or modifies the city's present contract right to insist upon a 5-cent fare, with free transfers between all parts of the new system.

\$200,000 Storm Damage

Utility at Tampa Crippled Temporarily, but Not Seriously Injured—Railway Must Meet Repaving Costs

Practically 5 miles of track washed out and one car damaged, along with the loss of the stream of nickels for two days, represent the traction loss of the Tampa (Fla.) Electric Company due to the storm which broke on the morning of Oct. 25 and for forty-eight hours isolated Tampa, doing total damage of \$800,000 to \$1,000,000. In addition to the losses named, the line will also have to pay for the repaving of more than 4 miles between its tracks. Very few of the poles supporting the trolley were washed down, though a score or more throughout the city were blown over. Most of those blown over would, however, probably have had to be replaced before long.

The trouble zone was the Bayshore Boulevard, traversed by the Port Tampa line. There is no seawall along the 5-mile drive and the electric line tracks were on the bayward side of the highway. Very little, if any, of the track was lost, estimates at this date being that all of the rails and practically all of the ties are intact. Practically all of the brick are available, the main cost being relaying.

Manager Hanlon estimates that the entire damage to the electric company, trolley, and lighting systems is about \$200,000.

The trolley damaged was abandoned about half way down the drive when high water flooded the power station cutting off the current. The damage to the power plant will be slight.

The city of Tampa proper was without lights just one night. Fallen wires in all parts of the city delayed the turning on of current to the outlying sections of the city, but within ninety-six hours of the passing of the storm, which raged on Oct. 25 with decreasing vigor after 3 p.m., the entire city and the suburbs were enjoying lights again. The papers, hotels and other downtown places including the Franklin Street whiteway, had lights Wednesday night.

In St. Petersburg early estimates of the damage were excessive. It develops that the entire damage to city property, including a recreation pier, valued at \$20,000, washed away, will only be \$65,000. This is the estimate of R. E. Ludwig, director of public utilities. The principal damage to the trolley lines, which are municipally owned, was the loss of a half mile of track and trolley when the pier went down and part of the approach was washed away. In addition some poles and lines were blown down.

The entire damage in the storm area, spread over a score of counties, and with only a dozen individual losses over \$2,000, will be considerably less than \$5,000,000, more than a third of which total is accounted for by fallen fruit in the citrus groves.

Interurban Ordered to Pay

In a case involving the death of Walter Berg, a joint employee of the Utah Power & Light Company and the Bamberger Electric Railroad the Industrial Commission of Utah has concluded that the Bamberger Electric Railroad is purely an intrastate carrier, and has ordered the railroad, in conjunction with the power company, to pay Mr. Berg's widow compensation as a result of his death.

The case came on for hearing last August, after which the commission ordered compensation paid to Mr. Berg's wife. The Bamberger Electric Railroad petitioned for a rehearing, contending that it was an interstate road and not subject to the orders of the Utah Industrial Commission. This contention was taken under advisement. The commission now finds that the Bamberger Electric road is an employer subject to the provisions of the Utah compensation act.

The findings of the commission are of considerable importance in Utah, since it indicates the stand of the commission that all electric roads operating in the State, with the possible exception of the Utah-Idaho Central, are intrastate roads and are subject to the compensation act. It is probable that the case will be taken to the federal courts by the Bamberger road, owing to the importance of the issues involved.

Three-Wire Electrolysis Mitigation System Working Successfully

The three-wire system as used for the mitigation of electrolysis in Winnipeg and its installation were described in the *ELECTRIC RAILWAY JOURNAL*, for March 26, 1921, since which time the system has been completed and placed in operation. In order to determine whether the railway's contract with the city had been fulfilled, it was agreed that an examination should be made by outside experts. The engineering services of Albert F. Ganz, Inc., were therefore retained jointly by the city, the telephone and the railway interests, and the installation was examined early in October by Prof. L. A. Hazeltine and C. F. Meyerherm of this organization.

After a study of the operating results, conferences were held with the various interests concerned and a joint meeting was held on Oct. 4. At that meeting it was agreed that before the system was finally accepted as being a proper remedy for the mitigation of electrolysis a further six months test should be made. In the meantime, the railway is to keep a careful record of the readings of the voltmeters and is to furnish Mr. Hazeltine and the city authorities with copies of these reports from time to time. After studying these results, a further investigation will be made into the system next spring.

Professor Hazeltine said that the records so far obtained indicated that the system was working satisfactorily and had produced the results contemplated. The principal remaining requirement is to have assurance that these results will be continued permanently.

General Fund Not Available to Meet Costs

A vote of the people is necessary before the general fund may be used for maintenance and operation of the Seattle (Wash.) Municipal Railway. This is the opinion recently expressed by Judge J. T. Ronald of the Superior Court in a decision overruling the demurrer of the city of Seattle to the suit of the fourteen taxpayers to enjoin the city from using money from the general fund in the operation and maintenance of the system.

The suit is one brought by S. B. Asia and thirteen other taxpayers and the demurrer interposed by the city was to an amended complaint in which the plaintiffs sought injunction against the tapping of the general fund by the city. The case was argued on Oct. 14. The city demurred on the grounds that there was a defect of the parties-defendant, and that the facts did not justify a cause of action.

In his decision, Judge Ronald held that the amended complaint of the taxpayers does not attack the legality of the deal or the validity of the bonds, and therefore the Puget Sound Traction Light & Power Company was not a party to the suit. On the point involving the loan of money from the general fund to a special fund the court cited a decision of the Supreme Court in which it was held that such loans could not be made in cases where the special fund had no constant and fixed source of supply. The city may now stand on its complaint and appeal to the Supreme Court or file an answer in the case and allow it to go to trial on its merits.

Elevated Lease Negotiations Broken Off

Mayor Moore, of Philadelphia, Pa., has terminated the negotiations with the Philadelphia Rapid Transit Company over the terms of a lease of the Frankford elevated line and has announced his intention to have the line operated by the city as a separate and independent unit of the city's transportation system.

The apparent hope of the Mayor is that the railway will see what he considers the error of its ways before the completion of the work and accept the idea of the city.

At present the points of junction between the elevated railways built by the city and that built and operated by the railway is separated only by a few feet. As one writer put it, however, the structures might just as well be a mile apart, for the distance is not one of inches, but dollars. As this authority explained, the Philadelphia Rapid Transit was willing to come in and operate the Frankford road, but not at a loss, and though the city administration consented to a lease containing a guaranty against it, the lease went into the discard when Council began amending it. The attitude of the company was that it should be indemnified for any loss in its operation or created by the diversion of traffic from the surface lines.

In commenting editorially on the breaking off of the negotiations, the Philadelphia Ledger said:

The present warring forces in the city administration must get together, recast the high-speed transit program and prepare and put through plans that will be self-supporting, regardless of the effect upon the

Rapid Transit Company. Whether this shall mean the carrying of the terminus of the Frankford line into the center of the city and the linking of it with lines to be built north and south and to the far southwest is the practical problem to be solved. But a point has been reached when a decision should be arrived at that will bring to an end the interminable delays of the last ten years and give to the citizens transportation facilities commensurate with the city's needs.

Wages Cut in Louisville

An agreement was reached on Oct. 29 by employees of the Louisville (Ky.) Railway and the company under which a reduction of 5 cents an hour in the wages paid to trainmen became effective on Nov. 1. Employees represented by the general committee of the Co-operative Welfare Association conferred with the officials of the company in the office of President James P. Barnes and an agreement was quickly reached. The reduction will affect about 1,500 men. It will result in an annual saving of about \$250,000 for the company.

This decision followed a series of conferences and reports relative to a possible 10 to 20 per cent reduction in wages. The men all felt that a reduction was justified, in that the 7-cent fare has failed to improve the financial condition of the company materially, but they were not all agreed on the amount of the cut. The individual differences of opinion were soon all overcome in the suggestion that the cut be made 5 cents an hour.

Under the new schedule motormen and conductors on city lines will receive 36 cents an hour for their first three months, 38 cents the next nine months and 43 cents an hour for the second year and thereafter. Men on the interurban lines are paid 1 cent an hour more. Reductions in wages of other employees will be made on the same basis.

At the conferences with the men and in a formal statement to the public Mr. Barnes took the position that the failure of the 7-cent fare to yield anticipated increases in revenue made it necessary to practice further economies.

Both the Louisville Railway and Louisville & Interurban Railroad are included in the arrangement, as it is one organization, although the interurban lines are operated by a separate corporation.

Defrauders Punished

The fraud has been making himself conspicuous of late on the lines of the Columbus, Delaware & Marion Electric Company, Columbus, Ohio. Two offenders have been arrested and sentenced.

Dewitt Powell, who was employed by the company as a night watchman, after studying the combination of the safe in the ticket office at Columbus, succeeded in stealing several small amounts of money ranging from \$5 to \$59. He was arrested in June and sentenced on Oct. 21 to serve from one to seven years in the Mansfield reformatory.

The second offender against the same property was one Floyd Waln, who camouflaged a broken arm as the result of falling over something in the aisle of an interurban car. He later confessed that his object was to defraud and was given thirty days in the Dayton workhouse and fined \$10 and costs.

A Biography of George Westinghouse to Be Published

Through a committee of the American Society of Mechanical Engineers a biography of George Westinghouse of 330 pages is soon to be published. The author is Col. Henry G. Prout; for many years an associate of Mr. Westinghouse in the Union Switch & Signal Company, and prior to that time editor of the *Railroad Gazette*. Publication of this biography is in charge of a committee of the A.S.M.E., and an opportunity is now being given to members of the four foundation engineering societies to enter subscriptions, which vary in amount according to the kind of binding desired.

The present edition of the biography of Mr. Westinghouse is a limited one. Later it is expected that a popular edition will be issued.



News Notes

Power House to Be Dismantled.—The power house of the Atlantic and Suburban Railway at Pleasantville, N. J., is being dismantled and the machinery is being shipped to a dealer in the south.

Wants Franchise Renewed.—The Coal Belt Electric Company, Herrin, Ill., has applied to the City Council for a renewal of its franchise. The present franchise has four years to run, but the Missouri Pacific Railway, which owns and operates the Coal Belt line, wishes to know definitely if a renewal of the franchise at this time can be expected. The city is asking that the company straighten its line and run out South Park Avenue to the city limits on the south and to pave its right-of-way as conditions to a renewal of the franchise.

Right to Operate Restored.—The Bridgeport and Waterbury auto service has been restored by an order issued from the office of the Public Utilities Commission, which has issued a certificate of convenience to the Bridgeport & Waterbury Passenger Service, Inc., formerly the Bridgeport & Waterbury Taxi Service. The company has resumed its jitney service between Bridgeport and Waterbury, but on a revised running schedule, extending it to 11 o'clock at night. The office of the company has been moved from Water Street to 54 Golden Hill Street, Bridgeport.

"It's Up to Each Employee."—Mayor Charles H. Ellis, of Camden, recently delivered an address on "Relations Between Railway Employees and Officials" before the employees of the Public Service Railway of Camden. The city executive related how he could not take sides in the questions of railway business before the public. He pointed out how the entire company was often condemned for the actions of one conductor or motorman and said that it was up to each employee to aid the company. Martin Schreiber, general manager of the Southern Division, spoke on the organization of an athletic association among the trolley men.

Financial and Corporate

\$1,370,585 Gain in Income

Remarkable Record Made by Eastern Massachusetts for Nine Months—Operating Ratio Down

The Eastern Massachusetts Street Railway, Boston, Mass., in the quarter ended Sept. 30, increased its income by \$242,127 in the face of a reduction in gross receipts of \$665,360. For the nine months ended with September the increase in income available for bond interest and rentals was \$1,405,977 despite a decline in receipts of \$1,707,451, as compared with the corresponding period of 1920.

The ratio of operating expenses and taxes to total revenues has been cut down from 95.5 per cent in the first nine months of 1920 to 78.2 per cent for the same period this year.

Detailed statements for the quarter and nine months ended Sept. 30, compared with the corresponding periods of the previous year, follow:

	1921	1920
Three months ended Sept. 30:		
Operating revenue and income.....	\$2,952,940	\$3,618,300
Operating expenses and taxes.....	2,258,963	3,166,450
Gross income.....	\$693,976	\$451,850
Bond interest and rentals....	399,136	392,319
Net income.....	\$294,840	\$59,530
Nine months ended Sept. 30:		
Operating revenue and income.....	\$8,590,798	\$10,298,249
Operating expenses and taxes.....	6,721,576	9,835,005
Gross income.....	\$1,869,221	\$463,244
Bond interest and rentals....	1,199,762	1,164,370
Net income.....	\$669,459	*\$701,126
*Deficit.		

While gross revenues still show a material contraction as compared with the corresponding period a year ago, this is more than offset by the firm grasp which the trustees have secured on operating expenses. This program of economy is strikingly reflected in the statement of earnings for the nine months ended with September, when a decline of \$1,708,000 in revenues was neutralized by a cut of \$3,100,000 in expenses.

The impression is not altogether correct that prevails in some circles that the company's shrinkage in costs of operation has been brought about entirely by the use of one-man cars and the reduction in wages of the blue-uniformed force. The officials have combed the shop forces thoroughly and it has been found that a substantial saving in the number of employees could be accomplished without measurably lessening the amount of work turned out. The cut in office expenses is exemplified by the fact that the Boston force now consists of about fifty as contrasted with the maximum number of 245, and, in addition, a less expensive suite of offices is occupied than was formerly maintained under the old regime.

Early in October the company opened its new power plant at Quincy Point, which will burn oil for fuel, thus resulting in a material saving. This plant takes care of the entire power requirements of the road south of Boston, and the economies effected thereby should

be reflected in future earnings statements.

It will be a regular policy of the company henceforth to issue quarterly earnings statements. Any additional curtailment of operating expenses which may be effected in the future will be immediately passed on to the public in the shape of lower fares or better service.

Shore Line Doing Better

Another profitable month of operation of the Shore Line Electric Railway, Norwich, Conn., is shown under the management of Receiver Robert W. Perkins, who has just filed his account with the Superior Court. The profit for the month of September was \$3,660. For 1921 the road has shown deficits the first six months, but a profit in operation for July, August and September. The deficits have been \$3,749 in January, \$61,112 in February, \$3,264 in March, \$2,296 in April, \$1,411 in May, \$1,027 in June. The profits have been \$7,439 in July, \$7,441 in August, and \$3,660 in September. The report shows the receipts from passengers during September were \$23,227. The payroll for the month was \$12,340. Power purchased cost \$6,248, and various other items brought the total expenses up to \$26,924, while the total income was \$51,849. The receiver had a cash balance on hand Sept. 1 of \$80,665. His cash balance on Oct. 1 was \$105,590.

International \$248,033 Behind

H. G. Tulley, president of the International Railway, Buffalo, N. Y., has submitted to the board of directors the January-September statement of earnings "in order to supply the information necessary to overcome the thought expressed by the Buffalo City government that the earnings of the company justified the consideration of a lower rate of fare."

For the nine months ended Sept. 30, 1921, the company shows a deficit of \$248,033 against a net income of \$185,147 for the same period of last year. The gross earnings, which were \$7,909,003, were insufficient by \$1,110,565 to provide for maintenance, depreciation, etc. In this period there was a decrease in passenger travel of 17,589,363. Over the entire system 161,244,303 passengers were carried for the nine months of 1921 against 178,833,666 passengers in 1920.

In his statement Mr. Tulley refers to the expenditure of \$2,000,000 in betterment and improvement this year. From January to September, 1920, the wages amounted to \$3,832,037, against \$4,072,926 for the same period this year, despite the fact that two reductions have been put into effect so far this year, one in May and the other in August. These two reductions represented an operating economy of approximately \$458,000 annually.

In answer to the plea of the city of Buffalo to reduce the fare Mr. Tulley maintains that this step is out of the question. The present rate is 7 cents or four tickets for 25 cents.

Part of Road Sold

New Haven-Saybrook Branch of Shore Line May Resume Service Under New Control

Indications are that the portion of the old Shore Line Electric Railway between Flanders and New Haven, Conn., will not be junked after all, for in the Superior Court for New London County on Oct. 29 Robert W. Perkins, receiver of the Shore Line, was authorized to sell the property to the Finance & Reorganization Company, New York.

According to the papers filed with the clerk of the court, \$20,000 in cash is to be paid to the Shore Line receiver as soon as the contract is signed; \$205,000 in cash within forty-five days thereafter, and \$175,000 in first mortgage bonds of the Shore Line Traction Company of an issue not to exceed \$1,000,000. The Finance & Reorganization Company agrees to buy the bonds from the receiver for \$50,000 cash in a year.

The seller agrees to transfer the franchise and other rights west of the Connecticut River to any corporation to be named by the Finance & Reorganization Company which is authorized by law to receive these franchises and to operate a railway thereunder.

Eight passenger cars, two motor freight cars and six flat cars are included in the sale aside from the trackage, etc., which comprises the main line of railway with turnouts and sidings from State and Ferry Streets, New Haven, to Old Saybrook and thence to Chester Cove; from Guilford Green to the end of the Stony Creek line in Branford, and from Ferry Road in Old Saybrook to Flanders Corner at the junction of the line between New London and Niantic in East Lyme.

This is the section of the former Shore Line Railway west of the Connecticut River for which Receiver Perkins once before, about July, 1920, negotiated a sale to Louis I. Levinson, Newburgh, N. Y., who paid \$17,000 cash and then defaulted on the purchase after he had taken up and removed some of the trackage between Deep River and Chester and between Guilford and Stony Creek. Mr. Levinson gave a bond for \$50,000 for the fulfillment of the contract, but under this most recent action the release of this bond is part of the agreement.

I. T. S. Subsidiaries Plan Financing

Five subsidiary companies of the Illinois Traction System, Peoria, Ill., have filed application with the Illinois Commerce Commission for permission to issue additional stocks and bonds. These are:

Bloomington & Normal Railway & Light Company \$69,000 of first general mortgage bonds, \$65,000 of bond-secured gold notes and \$73,000 of preferred stock.

Danville Street Railway \$84,000 of refunding gold bonds.

Urbana-Champaign Railway, Gas & Electric Company \$442,000 of consolidated and refunding mortgage bonds.

Madison County Light & Power Company \$69,000 of first mortgage bonds and \$67,000 of bond-secured gold notes.

Galesburg Railway, Light & Power Company \$400,000 of consolidated and refunding mortgage bonds and \$300,000 bond-secured gold notes.

Eastern Pennsylvania Stockholders Organize

A committee of stockholders of the Eastern Pennsylvania Railways, Pottsville, Pa., in a letter to stockholders asks the deposit of sufficient stock to authorize that body to attempt a financial reorganization of the company. The letter states the company will need funds in the future for improvements and extensions and that the financial structure is such that the securities could not be sold at a reasonable price to obtain these funds.

Outstanding obligations in the hands of the public are as follows:

Underlying bonds	\$434,000
First mortgage bonds	4,446,500
Notes payable (partly secured by bonds)	158,230
Preferred stock	946,820
Common stock	3,917,350

Earnings for the twelve months ended Aug. 31, 1921, are as follows:

Gross	\$2,174,083
Net after rentals, taxes and depreciation	\$542,472
Deductions:	
Interest on prior liens	\$26,350
Interest on bonds and floating debt	231,377
Amortization of debt disc. & exp.	13,788
	\$271,510
Balance	\$270,962

No dividends have been paid on the preferred stock since 1907, and no dividends have ever been paid on the common.

The letter also states that only \$826,000 face amount of bonds are in the company's treasury and that some of these are now deposited as collateral. It further says that on account of general conditions and the large issue of bonds in proportion to past earnings, the price obtainable is and has been very low and that even if a fair price would be obtained there are not sufficient bonds available for a power installation which certainly will be required in the near future.

A committee representing the bondholders was formed in 1919 to look after the interests of holders of first mortgage 5 per cent gold bonds, and, although it is still in existence, no definite action has yet been taken. It is proposed to reorganize the company by a joint action of bondholders and stockholders.

\$3,330,000 of City Street Railway Bonds Sold

A syndicate composed of Kuhn, Loeb & Company, Hallgarten & Company, and Kidder, Peabody & Company, New York, recently submitted the highest bid, 100.27, for \$9,563,000 municipal 5 per cent, 5½ per cent and 5¾ per cent bonds of the city of Detroit. The second best bid was 100.177, submitted by Harris, Forbes & Company and Lee, Higginson & Company. The National City syndicate bid 100.052 and the Guaranty Company and associates bid par and a cover fee of \$8,000.

The bonds were divided as follows: \$5,201,000 of 5½ per cent bonds for general municipal improvements, due 1922 to 1951; \$1,062,000 of 5 per cent bonds for general improvements, due 1922 to 1950, and \$3,300,000 of 5¼ per cent street railway bonds, due in 1940, 1942 and 1943.

The high bid was accepted and the bonds were offered for public subscription during the week ended Oct. 22.

Toronto Purchase Arbitration Dragging

The arbitration hearings have been resumed under which the price will be fixed that the city of Toronto is to pay for the property of the Toronto Railway. At the sessions during the week ended Oct. 29 Fred Hubbard, assistant to R. J. Fleming, former general manager of the Toronto Railway, was on the stand. He merely gave a general outline of the company's activities without any detailed technical information. The hope originally was that the negotiations could be concluded by Jan. 1 so as to permit the liquidation of the Toronto Railway early in the new year, but unless the arbitration is speeded up the prospects are not bright that all the evidence will be in much before that time.

Financial News Notes

Stock Dividend Declared at Detroit.—The Detroit (Mich.) United Railway has declared a stock dividend of 2½ per cent in lieu of the regular cash payment which would ordinarily be declared.

\$4,000,000 Bond Issue Offered.—Drexel & Company, Philadelphia, Pa., recently offered \$4,000,000 of Georgia Railway & Power Company twenty-year 7 per cent general mortgage gold bonds to be dated Nov. 1, 1921, at 97 and interest yielding more than 7¼.

Mr. Schupp Made Permanent Receiver.—Otto Schupp, temporary receiver of the Saginaw-Bay City Railway, Saginaw, Mich., has been made permanent receiver of the company. The creditors of the company will meet on Nov. 25 to consider the form of inquiry into the company's affairs.

Petition in Bankruptcy Filed.—The Liberty Transit Company, which operated in Riverside, N. J., has filed a petition in bankruptcy in the United States District Court at Trenton in which it gives liabilities of \$14,421, and assets of \$11,125. The court has referred the petition for a hearing at Trenton before Samuel D. Oliphant, referee in bankruptcy.

One-Man Cars Purchased with Notes.—The Department of Public Utilities of Massachusetts has approved the petition of Massachusetts Northeastern Street Railway, Haverhill, Mass., that it be allowed to issue \$30,000 of 7 per cent notes maturing serially until October, 1924, the issue to be given with \$10,000 in cash in payment for six new one-man cars.

Railway Guarantees Power Bonds.—Shareholders of the Winnipeg (Man.) Electric Railway have ratified by-laws making possible the guaranteeing of bonds for the new Manitoba Power Company, controlled by the railway. Arrangements were also made for a contract under which the railway will take power from the power company. The development possible under the new plan is 168,000 hp.

Application to Foreclose Planned.—Application to foreclose mortgages of the Syracuse & Suburban Electric Railway, Syracuse, N. Y., amounting to \$550,000 will be made in special term

of the Supreme Court by the Fidelity Trust Company, Philadelphia, and it is expected an order directing the sale of the property within the next two months will be granted. The proceeding is a step in the pre-arranged plans for the reorganization of the company and the property is to be bid in by the bondholders.

Wants to Abandon Line.—The Carolina Power & Light Company, Raleigh, N. C., has sought permission from the City Commissioners to abandon its line on Cabarrus and Bloodworth Streets. The line, known as the Smithfield Street line, runs a distance of eight blocks. Permission for abandonment is sought as a result of decreased patronage and also because of paving expenses which must be met by the company in view of the recent announcement that Bloodworth was to be paved and made a state highway.

Court Suggests Hearing on Suspension.—Judge Evan Evans of the federal district court acted on Oct. 28 to stop the operation of all Fox River valley interurban lines and the Aurora and Elgin city lines of the Aurora, Elgin & Chicago Railroad, which is now in the hands of a receiver. Judge Evans directed that the Illinois Commerce Commission and all persons interested in the street and interurban lines, including officials of municipalities where they are operated, should appear before him Nov. 21 to show why operations of the lines should not be discontinued. The third-rail lines of the Aurora, Elgin & Chicago system, which connect Chicago and Fox River valley cities, are not affected by the order.

Receivership Case Postponed Again.—Federal Judge Julius M. Mayer has granted a further adjournment until Dec. 20 on the order to show cause why a receiver should not be appointed for the Interborough Rapid Transit Company, New York, N. Y. Judge Mayer in commenting on the situation declared it would be a novel thing for a court of equity to proceed in a receivership action when only two-tenths of 1 per cent of the creditors demanded it. J. L. Quackenbush, counsel for the railway, told the court that of the \$38,144,400 of notes owed on Sept. 1 of this year, 92.9 per cent had been deposited for extension by the holders. He declared that at the present there are \$2,710,900 in notes outstanding.

Court May Modify Its Finding.—Objection to the final entry and decree drawn in the settlement of the litigation over the Cincinnati & Dayton Traction Company was made by a group of Cincinnati, Hamilton & Dayton attorneys, who recently appeared before the Court of Appeals at Cincinnati, Ohio. A decision defending the rights of mortgagees and the bondholders was handed down by the court some months ago, together with an order for the appointment of a master commissioner to determine the interest in the power plant, stock and earnings, and an entry upon this was prepared by the court, but was objected to on various grounds. The hearing at which the lawyers from the three cities were present was upon these objections and the points involved and at the conclusion the court decided to re-draft its entry in conformity with some of the suggestions agreed upon. It was practically decided at the session that Attorney Froome Morris, Cincinnati, will be appointed the master commissioner in the case.

Traffic and Transportation

City's Case Disproved

Messrs. Sullivan, Fleming and Duck Show Fallacies of City's Men Seeking Lower Fare in Chicago

Attorneys for the Chicago Surface Lines began on Oct. 25 to present their defense of the 8-cent fare before the Illinois Commerce Commission. The city had closed its case several days previously. It was expected that all evidence would be in by Nov. 5 and a prompt decision is looked for.

The city's case, as previously announced in the ELECTRIC RAILWAY JOURNAL, was based on alleged economies suggested by engineers for the city. Among these suggestions were a proposed operating cost of \$2.40 per car hour and a speeding up of cars through the congested district.

These claims were largely offset by the testimony of J. V. Sullivan, assistant to the president of the surface lines, who presented an exhibit for several companies showing expenses per car hour, including taxes and depreciation. The figures were for the last fiscal year. They follow:

Chicago (surface)	\$3.16
New York Railways	4.05
St. Louis	3.42
Kansas City	3.84
Milwaukee	3.43
Philadelphia	3.27
Boston	5.30
Detroit	3.78
Third Ave. (N. Y.)	3.56
Twin City	3.69
Buffalo	3.84
San Francisco (Municipal)	3.45

It had been stated by one of the city's witnesses that he understood the cost on the municipal system of San Francisco to be \$1.98. Another exhibit of Mr. Sullivan's showed the running time in Chicago, exclusive of layover time, to be 10.64 m.p.h. This time was faster than that of any one of the thirteen other systems mentioned.

Harvey B. Fleming, chief engineer for the companies, also introduced many exhibits to show that the plans offered by the city's witnesses were not practicable. He testified about the proportion of other vehicles using the tracks of the company and showed that cars travel almost twice as fast when using tunnels as when operated over bridges. Engineer Jackson for the city had proposed abandoning the three tunnels and two bridges which now carry one-fourth of the traffic out of the loop district.

John J. Duck, company auditor, presented numerous statements which showed the burdens carried by the companies, these having been left out of the city's calculations for low operating cost. There was considerable discussion about the disposition of the renewal fund of the companies. The commissioners appeared to have in mind that this should not be kept for future depreciation. It was shown that the companies had spent about \$750,000 recently for new cars. This purchase was financed with capital taken from the renewal fund by order of the previous commission. The commission agreed to consider a plan for re-routing submitted by John A. Beeler for the

companies last February. It was claimed that this would allow 11 per cent more track capacity in the congested district.

Mayor Extends Relief—Temporary Jitney Service Approved

Mayor Peters of Boston on Nov. 1 signed the license which had received favorable consideration from the Boston City Council, granting the Norfolk & Bristol Bus Company a right to operate jitneys in Hyde Park. This will insure a 15-cent fare from Hyde Park to Boston, as against the present 20 cents, the jitneys operating over the territory otherwise served by the Eastern Massachusetts Street Railway. In connection with his approval of the license the mayor said:

Before finally determining my approval of the jitney license for the Hyde Park district I conferred with the trustees of the Boston Elevated and the Eastern Massachusetts Street Railway Company and found that they were unwilling to make any compromise which would meet the perplexed situation.

I feel that the people of Hyde Park should have this relief, temporary as it may be, until some time in the future when these street railway companies may come to an agreement.

I therefore approve the license granted the Norfolk & Bristol Bus Company, with the understanding that when an arrangement can be made between the Boston Elevated and the Eastern Massachusetts Street Railway Companies to give the Hyde Park district service at a satisfactory rate I will recommend to the City Council that the jitney license be immediately revoked.

Railway Withdraws Request for Ten-Cent Fare

Judge James E. Goodrich, chief counsel for the Kansas City (Mo.) Railways recently withdrew at Jefferson City the petition of the company to advance the fare to 10 cents. The matter has been pending for more than a year.

The city ordinance prohibiting jitneys from using streets on which street car tracks are located, together with the general good will of the public, enabled the receivers to withdraw the application for the rate hike, according to Francis M. Wilson, one of the receivers.

When the receivers took charge of the property about a year ago they found that testimony already had been presented to the commission on an application to increase the rates.

The request for an increase had been argued and submitted for a final decision. But the receivers, unfamiliar with the conditions of the company and of its necessities, asked the commission to defer rendering its decision until they could determine the actual condition of the company.

Despite the fact that the application for an increased fare has been withdrawn, receivers for the company say the present rate is inadequate to pay operating expenses and a return on the fixed indebtedness of the company.

Despite the passage of the city ordinance regulating the jitney traffic, about 150 jitneys are still operating.

Master Appointed in Jersey

Special Statutory Court Selects Judge Haight to Hear Fare Case Testimony

Associate Justice Pitney of the United States Supreme Court refused on Oct. 26 to issue a stay against the 8-cent fare recently granted to the Public Service Railway for its lines in New Jersey. Justice Pitney, however, did not throw out the petition, but merely declined as an individual member of the court to assume the responsibility for issuing an order. He said:

I prefer that a matter of this gravity should be passed on by the entire court. I do not think it should be acted on by an individual justice.

Justice Pitney suggested, and counsel agreed, that the petition for the stay be addressed to the full bench and that the necessary motion be made before the court on motion day, Nov. 7. Attorney General McCran and L. Edward Herrmann, counsel for the state and the Public Utilities Commission, respectively, said they would immediately take steps to get their application before the full court. In the meanwhile and until the court acts, the 8-cent fare order remains in operation.

At the outset of the hearing Justice Pitney informed counsel that their applications for permission to file an appeal to the highest court was unnecessary; that appeal lay as of right by reason of the petition of appeal allowed and signed at Trenton by Judge Rellstab, one of the members of the Special Statutory Court that allowed the 8-cent fare. The papers could be moved from the court at Trenton to Washington for review, said the justice, by the issuance of a precept.

Mr. McCran for the state and Mr. Herrmann for the commission pivoted their argument for the day on the contention that the special statutory Federal Court had exceeded its jurisdiction in allowing the 8-cent fare and, further, that the action was an invasion of the rights of the state.

Former Federal Judge Thomas H. G. Haight, Jersey City, has been appointed by Federal Judge John Rellstab as special master to take testimony in the application of the Public Service Railway for authority to put into effect a 10-cent fare. Under the provisions of the temporary injunction recently granted by special federal tribunal, restraining the Board of Public Utility Commissioners from interference the railway is now charging an 8-cent fare with an additional cent for each transfer issued. This is an increase of 1 cent over the 7-cent fare established by the Board of Public Utility Commissioners.

Judge Rellstab in his order designating former Judge Haight as special master directs that he proceed immediately with the taking of testimony in the case and that he report his determination at the earliest possible date. The report of Judge Haight will be used as the basis for the establishment of a permanent rate of fare under the provisions of a Congressional statute authorizing a public utility to have recourse to the federal courts in cases where the established rate of fare is so low as to be considered confiscatory.

Judge Haight is recognized as one of the ablest members of the bar in New Jersey. He served as United States District Court Judge and also as United States Circuit Court Judge. He was appointed to both of these posts by former President Wilson.

Low Fares No Incentive

Baltimore Official Says People Ride on the Cars Only When They Have To

"People ride on the cars only when they have to, and no matter how low the fare they cannot be induced to take unnecessary rides." This is the opinion of C. D. Emmons, president of the United Railways & Electric Company, Baltimore, Md. It was expressed by him in discussing the suggestion that the company reduce the fare to 5 cents during the hours when traffic is lightest.

The officials of the company also doubt the efficacy of the suggestion that a freight service be established by the company as a possible means of increasing revenues. On this subject Mr. Emmons said:

The United seriously considered the establishment of a freight and express service and even had a complete survey of the local situation made by an expert from Boston, but in his report he declared that a freight service could not be operated profitably in Baltimore.

Mr. Emmons said that as soon as increased receipts produce a sum larger than the present surplus over operating expenses now allowed the company his company will extend the present city fare zone into the recently annexed territory.

NET EARNINGS RISE THOUGH TRAFFIC DECREASES

The United Railways carried 18,976,056 revenue passengers in September, as compared with 21,187,535 in September, 1920, a decrease of 2,211,479, or 10.4 per cent. Revenue passengers last month were 402,911 fewer than they were in August, though the company's net earnings showed a gain in September over August, less having been spent on maintenance.

The suggestion about the possible establishment of freight service by the company was made by Col. J. L. Wickes, transportation expert of the Public Service Commission. Colonel Wickes said:

This matter came under discussion at the recent meeting of the American Electric Railway Association and was a subject of the paper by J. Rowland Bibbins of Washington, D. C., and is a question which I believe now is occupying considerable of the attention of railways and those interested in transportation elsewhere.

Shreveport Wins Fight for One-Man Cars

The City Council of Shreveport, La., has granted the Shreveport Traction Company permission to use one-man cars on the Union Depot line, but has reserved the right to order discontinuance of the one-man cars and a return to the standard two-man cars at any time the one-man cars may be found to be unsatisfactory. The use of one-man cars in Shreveport was ordered discontinued about a year ago by the city, and court action followed in which the city finally won.

Since that time the railway has been using only two-man cars, but has several times made application to the City Council for permission to operate one-man cars as an experiment in order that the patrons might have an opportunity to compare one-man car service with that afforded by the regular two-man cars. Railway officials assert that the improvement in service made possible by the one-man cars will prove

so satisfactory that the use of one-man cars on all lines in Shreveport will result.

Five-Cent Experiment

Connecticut Commission Seeks to Meet the Public Demand by Ordering Short Test in Norwalk

The Public Utilities Commission of Connecticut has decided to try a 5-cent fare in Norwalk for a ninety-day test period. The order of the commission is the result of the recent petition of the city of Norwalk for reduced fares. With New Britain, Stamford, Bridgeport and Hartford seeking lower fares, the decision is of statewide interest. In its order the commission states that the reduction is an experiment and that it is made with the hope that a reduction in the rate will increase the usefulness of the railway to the public and result in added revenues.

The commission adds:

The test period may show that public patronage is insufficient and that some other rate, more than 5 cents, is the economic rate to install.

The matter came before the commission on petition and was heard on Oct. 19. According to the ruling of the commission, the new or reduced fare will go into effect on or before Nov. 6. The Connecticut Company is directed to supply weekly reports as to the number of passengers carried over the line between Norwalk and South Norwalk, over which territory the reduction in fare is ordered. The revenues and operating expenses of this division are to be kept separate from other divisions.

The order of the commission also says:

It is apparent from all of the evidence submitted from the past record of transportation service in Norwalk that independent jitney service between Norwalk and South Norwalk would ultimately and inevitably cancel and prevent such street railway service, not only upon this line but upon all other lines in the Norwalk division. The Connecticut Company is to supply a reasonably frequent passenger service over the points mentioned at a 5-cent fare, either by street cars or automobile buses, or both.

TRUSTEES WANT ACTION DEFERRED

President Storrs of the Connecticut Company is quoted as declining to comment on the decision. Morgan G. Brainard, Hartford, one of the federal trustees of the company, said that the decision was contrary to the wishes of the trustees, who felt that any change in fares should be statewide in scope.

The Public Utilities Commission has received from the trustees of the Connecticut Company a statement setting forth their attitude in fare reduction in reply to the commission's query for a statement of that position. In their statement, it is understood, the trustees concede that the time is soon approaching when fares must be reduced, but they are firmly of the belief and opinion that fares cannot be reduced until next spring. Operation on the trolley lines of the State in winter is more expensive than in summer and the traffic is lighter, so that the trustees feel and believe the financial conditions do not warrant any general reduction of fares at this time. It is the intention of the trustees, it is understood, that the fare situation will be taken in hand anew next spring and the reduction question settled in accordance with conditions prevailing at that time.

Low Fare Cars Withdrawn

Sanctioning of Jitney Prompts Boston Elevated to Withdraw Five-Cent Line

Another critical stage has developed in the competition between the jitney and the electric railway in Massachusetts. This time the Boston Elevated Railway and the city of Malden are affected. Incidentally the Boston Elevated has declared a policy in cases where competition between the two services takes on the form it has assumed in Malden.

Effective on Nov. 12 the Boston Elevated will withdraw its surface car service from a section in Malden which is being served by jitneys. There has been competition on that particular line for some time, but the railway has consented to operate side by side with the jitney because the jitney was in a sense an outlaw, tolerated but not officially sanctioned by the city. Then on account of many complaints against the jitney the city government passed a jitney ordinance. Mayor Kimball signed the ordinance despite the warning from the railway and accepted a bond from the owner of the jitney line.

Malden was the first city in which the Boston Elevated Railway decided to try the 5-cent fare experiment for purely local rides. The company found it a success. The number of passengers increased about 75 per cent under the 5-cent fare, but on the line in question the jitney is taking away half the traffic from the elevated, and as soon as the jitney became officially recognized by the city through the passing of an ordinance and acceptance of a bond, the trustees of the Boston Elevated declared their policy applicable to Malden and will withdraw the trolley service from the line between Malden Square and Maplewood.

Commission Asked to Reconsider Bus Ruling

Nov. 1 was set as the rehearing date for the case of the Aurora, Elgin & Chicago Railroad, Aurora, Ill., against the Smith Bus Line. The Illinois Commerce Commission recently authorized this bus company to provide a twenty-two mile service, which decision was opposed by the railway. The case was reviewed in the *ELECTRIC RAILWAY JOURNAL*, issue of Oct. 22.

The Smith Bus Line started in operation between Aurora and Batavia on a State Aid road alongside the tracks of the receiver using a street corner opposite the Aurora Terminal of the Aurora, Elgin & Chicago Railway for its Aurora terminus. At Batavia the line opened a waiting station about three blocks from the car line on the opposite site of the river.

It is claimed that the only territory served by the bus line, not served by the railroad would be the three blocks along Wilson Street and at the hearing testimony was offered that there was a demand for such service and a witness testified that such a request had been made but that it had been refused. It is said that the company contends that no council request was made for an extension of tracks in Batavia.

If the order is not set aside the case will be taken to the courts. The order provides that consents of municipalities must be obtained as set forth in Commission General Order No. 68. These consents have not been obtained.

Court Refuses Injunction

Judge Orien S. Cross in the Ottawa Circuit Court recently declined to grant an injunction sought by the city of Holland to prevent the 3 cent a mile increase in the rates of the Michigan Railroad between Holland and Macatawa. The city contended that the new rates were contrary to the franchise agreement.

Judge Cross ruled that the court had no jurisdiction in the matter since the Supreme Court recently held that the Legislature by the enactment of the Glaspie law took the right of fixing fares between villages and towns out of the hands of municipalities.

Men Agree to Operate One-Man Cars—City Prohibits Them

Employees of the Schenectady (N. Y.) Railway on Oct. 22 signed the agreement submitted by the company to operate one-man cars. On Oct. 24 the Common Council of the City of Schenectady passed an ordinance prohibiting the operation of one-man cars in the city limits.

The officials of the Schenectady Railway are going ahead and equipping one-man cars. They have none ready for operation as yet, but propose to ignore the ordinance, believing it will not prevail unless the Public Service Commission should decide in its favor. Officials feel there is little likelihood of its doing this in view of the fact that in Troy it has dismissed the complaint of the city to prohibit the use of one-man cars. The Troy decision is referred to in the following item.

Commission Approves of One-Man Operation

The Public Service Commission has dismissed the complaint of the city of Troy, N. Y., over the operation of one-man cars by the United Traction Company. Mayor Fleming at the request of the Common Council sought to restrain the railway from using this type of car.

In a report to the Commission, C. R. Vanneman, hearing deputy says:

Subsequent to the hearings an unannounced visit was made to Troy. Taking one of the cars operating on the Albia line from regular service we ran it over all sections of Troy in which one-man cars are being operated or may hereafter be operated. Every conceivable test of which we could think was made on all the grades. No unfavorable or erroneous action of any of the devices was observed.

At the hearings mention was made of two accidents in Massachusetts in which the one-man cars were involved. I have communicated with the Department of Public Utilities of Massachusetts respecting these accidents and have been informed that neither was caused by any factor of one-man operation.

After carefully considering the evidence, and having in mind the tests and studies of the operation of the cars which I have made, I am of the opinion that they may be safely operated on any of the streets in the city of Troy on which the lines of the United Traction Company are located providing the recommendations set forth in detail respecting guards over trolley wires, operation over steam railroad crossings, etc., are complied with immediately, and provided further than stringent regulation be laid down respecting the operation of cars by motormen only when they are in position and able to keep proper lookout ahead, and that when for any reason the motormen must for any appreciable time direct his attention away from the track ahead, he must be required to bring his car to a stop.

In dismissing the complaint the commission ordered the railway to provide more safeguards against accidents at

grade crossings, to add to its present equipment for fighting snow and to equip all grade crossings of steam and electric tracks with a metal guard over the trolley wire.

Philadelphia Rapid Transit Wants to Quit Freight Service

The Philadelphia (Pa.) Rapid Transit Company has requested and received the consent of the Public Service Commission to extend until Nov. 30 the time fixed for the discontinuance of the freight service on its line, and the interchange of freight with the Philadelphia & West Chester Traction and the Lehigh Transit Company. The original intention of the company was to discontinue the service on Oct. 30. Shippers who would be affected by the suspension of the service hope that a way may be found out of the difficulty, but the railway is opposed to any extended continuance of the service. The company's stand in the matter has been explained as follows:

For several years prior to the world war, the Philadelphia Rapid Transit Company operated a trolley freight service, which, however, was always limited by reason of the competition of the better-equipped steam railway and express lines, and also because the larger shippers used motor trucks whenever their business developed in such a way as to make it profitable for them to do so.

P. R. T. made its decision to discontinue the freight business because its continuance would necessitate making large capital investment for new freight equipment, relocation of the main receiving station at Front and Market Streets, because of overcongestion, and the immediate establishment of a new freight station in place of the Eleventh and Coloma Streets station, now condemned for a recreation centre.

P. R. T. is chartered solely as a passenger-carrying company, and has urgent need for all available capital to keep pace with its increasing passenger business; and, even if additional capital were obtainable, it would be unwise for P. R. T. to make large investment for freight service, in view of the fact that the State is eliminating toll roads and is engaged in an extensive program of improvement which will result in a constantly increasing amount of light freight being carried on motor trucks, as evidenced by the department stores and other large deliverers of goods now using motor trucks in transporting freight to points reached by this trolley freight service.

Steam railways are by law common carriers of freight and have large investments in equipment and terminals. Some street railways, which have exercised the power of eminent domain have like corporate obligation, but P. R. T. is not of this number.

Further duplication of steam railway investment by street railways for freight service only serves to unnecessarily increase the cost of all service rendered and should, for that reason, be discouraged.

One-Man Cars Upheld

The Commission on Public Utilities in Boston, Mass., recently denied the petition of the Newburyport City Council to forbid the operation of one-man cars by the Massachusetts Northeastern Street Railway.

The ruling follows in part:

The commission has caused an examination of these lines to be made by its inspection department. The operation of one-man cars on the Newburyport end of the line is comparatively recent and is attended with more or less delay on account of this fact, but the conditions on the line present no operating difficulties different from those on many other lines throughout the state upon which one-man cars are in successful operation.

We believe that when the operators and the public have had more experience with this style of operation, the troubles complained of will gradually correct this. If this does not prove to be the case, after a fair trial, the matter can be easily brought again to the commission's attention. The petition is therefore dismissed.

Transportation News Notes

Fares Reduced in Eureka.—By purchasing books of tickets patrons of the Eureka (Cal.) Street Railway can ride for 5 cents in place of the 6-cent cash fare. This reduction in fare comes within one month after the city took over the property. The former company was known as the Humboldt Transit Company.

I. C. C. Jurisdiction to Be Determined.—An investigation was ordered on Sept. 30 by the Interstate Commerce Commission to determine whether or not the Washington Railway & Electric Company, Washington, D. C., over whose depreciation charges the Interstate Commerce Commission has jurisdiction, is a carrier subject to the Interstate Commerce act. The case was assigned for hearing in Washington on Oct. 17.

Mayor Against Bus Service.—Mayor Newton Brainard of Hartford, Conn., will refuse to sign a petition of the Common Council which provides that the Connecticut Company establish before Jan. 1, 1922, a motor bus line running in the south-central part of the city. It is said that the Mayor holds to the opinion that the territory in which the bus line was to run is a congested section of the city and that it is now adequately served by the electric railway.

Railway Answers Complaint.—The West-Penn Railways has filed an answer to the complaint of the city of McKeesport which demands lower fares on the ground that wage reductions have produced increased revenues for the company. In its statement the company gave some figures to show the cost of operation. For the last eleven months the gross receipts of the McKeesport branch of the West Penn Railways were \$465,000, with \$47,000 net income. The company claims an expense of \$500,000 on track and road-way.

Opposition to One-Man Cars Withdrawn.—The committee on railroads and bridges of the Common Council of Milwaukee, Wis., has recommended for indefinite postponement the Dietz resolution seeking discontinuance of the operation by the Milwaukee Electric Railway & Light Company of one-man safety cars in the city. The committee had held several hearings on the subject and had received a report from the City Safety Commission indorsing one-man safety car operation. This report was abstracted in the ELECTRIC RAILWAY JOURNAL of Oct. 1, 1921, page 570.

Hearing Held on Intrastate Rates.—According to John E. Benton, general counsel for the National Association of State Railroad and Public Utility Commissioners, the Interstate Commerce Commission is seeking to impose a "dead uniformity of rates" in the various States. Mr. Benton expressed this view to the Senate on Oct. 29 and reiterated previous arguments to the effect that local conditions were a factor that must be considered in fixing rates. Senator Poindexter joined in Mr. Benton's criticisms of the Commission toward intrastate rates.

Personal Mention

Commission Officer Impressed

General Andrews Returns, Highly
Pleased with Railway Studies
Made in Large Cities

"The thing which impressed me most forcibly and the fact at which I was so agreeably surprised in my recent visit to several of the representative railroads in the East and middle West was that the type of men who are either managers or operators of these properties are keen, wide-awake and intensely devoted to giving the public the best possible service." This was the statement made recently by Brigadier-General Lincoln C. Andrews, executive officer of the New York Transit Commission. General Andrews was accompanied on his trip by C. E. Morgan, assistant general manager of the Brooklyn (N. Y.) City Railroad; William E. Thompson, superintendent of transportation, and John S. McWhirter, superintendent of equipment Third Avenue Railway, N. Y. The properties visited included those in Philadelphia, Cleveland, Kansas City, Chicago and others on the route.

General Andrews, who has charge of the commission's working organization, made this whirlwind trip which, although lasting but two weeks, gave him an opportunity to become acquainted with the operating problems confronting the industry as a whole. It was his belief that wherever any differences between the railway and the public had been satisfactorily settled the managements did not merely let the public attitude remain at a stage of indifference but actively grasped the opportunity and capitalized it to gain the wholehearted confidence and cooperation of the people. This was not a conclusion drawn from a view of the situation existing on one property but was his composite impression. He expressed the view that if some understanding could be reached between the transit companies and the people of New York, all other differences would almost automatically adjust themselves.

General Andrews was keenly interested in the development and the successful installation of safety cars in many cities. According to him the outstanding case of their application to city traffic is Terre Haute, where the lines are operated with safety cars entirely. He considered it remarkable that 65 per cent additional service could be given at a 10 per cent decrease in operating expenses.

Until his appointment by George McAneny, chairman of the commission, General Andrews had always been an army man. He saw service in the World War and after the armistice became assistant provost marshal general of the American Expeditionary Forces. His recent foreign duties were preceded by a long service career. Following his graduation from the United States Military Academy in 1893 he was assigned to the infantry and later to the cavalry, with which he was connected at the time of the Spanish-

American War. In the battle of Santiago he was aide to General Sumner.

General Andrews did not return to the United States from the Philippines until 1903, when he was appointed an instructor of cavalry tactics at West Point. He was later in charge of cavalry instruction at the first Plattsburg Training Camp.

Mr. McGraw Elected President of A. B. P.

James H. McGraw, president of the McGraw-Hill Company, Inc., publishers of the *ELECTRIC RAILWAY JOURNAL*, was elected last week president of the Associated Business Papers, Inc. The meeting of that association was held in Chicago on Oct. 24-26. The main topic of the discussion was the part that the publishers should play in speeding the revival of business. The keynote address was delivered by Mr. McGraw. An abstract of this address will be found on another page.

Among important business matters receiving the attention of the convention was the auditing of publications of free circulation by the Audit Bureau of Circulations. A resolution was passed requesting the "ABC" to discontinue the auditing of such publications since free circulation is contrary to the basic principles of legitimate publishing and circulation statements have the effect of misleading advertisers who have come to associate the "ABC" with ethical standards of publishing.

The new officers elected for the ensuing year in addition to Mr. McGraw were: Vice-president, A. O. Backert, Penton Publishing Company; treasurer, Fritz Frank, Iron Age Publishing Company.

Judge Haight Appointed Special Master in Jersey Fare Case

Former Federal Judge Thomas H. G. Haight, Jersey City, has been appointed by Federal Judge John Rellstab as special master to take testimony on the application of the Public Service Railway for authority to put into effect a 10-cent fare. Judge Haight is recognized as one of the ablest members of the bar in New Jersey. He served as United States District Court Judge and also as United States Circuit Court Judge. He was appointed to both of these posts by former President Wilson.

General Manager of Wheeling Property Resigns

J. D. Whittemore, for several years general manager of the Wheeling (W. Va.) Public Service Company, has left Wheeling for New York to locate. He was the honor guest at a farewell dinner at the Wheeling Country Club recently given by C. P. Billings of the Wheeling Traction Company. Intimate friends and business associates of Mr. Whittemore were present to bid him farewell and extend him their best wishes for his future success.

There were many expressions of regret at Mr. Whittemore's departure.

John J. Coniff acted as toastmaster. Conceiving an imaginary loving cup, Mr. Coniff stated that if all the good wishes that will follow Mr. Whittemore could be placed in it, it would be filled to the brim. Mr. Whittemore responded with an appreciation of the friendships he formed here and by thanking his friends.

W. J. Torrens Appointed Equip- ment Man of Second Avenue

William J. Torrens has been appointed superintendent of equipment of the Second Avenue Railroad Company, New York. Mr. Torrens was formerly with the Metropolitan Street Railway Company, New York, in the old cable days and continued with the above company during the electrification of the cable roads. He remained with the company as foreman until the segregation of the Metropolitan in 1907 and then became master mechanic of the Second Avenue Railroad. In 1910 he resigned to accept a position in Seattle as master mechanic, continuing there until 1919, when he became affiliated with the McKinley system, in direct charge at Ottawa, Ill.

Toronto Street Railway Employees Banquet R. J. Fleming

On Saturday, Oct. 29, the Toronto Railwaymen's Union, Division 113, entertained R. J. Fleming, former general manager of the Toronto Railway, and the members of the Transportation Commission, at a banquet in the Labor Temple, the occasion serving as a formal farewell by the railway employees to their former general manager.

In addition to 900 railway employees there were present Mr. Fleming, Chairman P. W. Ellis, Fred Miller and General Manager H. H. Couzens of the Toronto Transportation Commission, which is now operating the street railway; Works Commissioner R. C. Harris, General Manager Wilson of the Toronto & York Radial Railway, also several other officials of the Toronto Railway who served under Mr. Fleming. President Merson of the Union presided.

K. D. Leavitt is no longer connected with the Oakwood Street Railway, Dayton, Ohio.

E. I. Edgecomb has resigned as claim agent of the Syracuse Northern Electric Railway, Syracuse, N. Y.

A. Gorman has been appointed superintendent of the Corning & Painted Post Street Railway, Corning, N. Y.

M. J. Sullivan has resigned as chief engineer of the Kingston Consolidated Railroad, Kingston, N. Y.

Roy C. Megargel of New York has been elected president of the Southern New York Power & Railway Corporation, Cooperstown, N. Y., to succeed Joseph B. Mayer.

E. E. McWhiney has been appointed assistant secretary of the Doherty Operating Company, New York, and L. W. Wallace has been made an assistant treasurer.

M. M. Freeman has accepted the position as treasurer of the Claremont (N. H.) Railway, succeeding George E. Tenney.

Col. Laird of St. Louis, Mo., has been appointed to the newly created position of first vice-president of the Central Power & Light Company, Walnut Ridge, Ark.

E. Z. Wallawer, formerly vice-president of the Southwest Missouri Railroad, Webb City, Mo., has been promoted to fill the vacant office of president. H. C. Rogers of Carthage, Mo., has been appointed to fill his former position.

John Nichol has succeeded John H. Watkins as vice-president of the Pine Bluff Company, Pine Bluff, Ark. J. L. Longino, secretary and general manager, has also taken over the duties of the treasurer, J. A. Whitlow, who has left the company.

H. B. Fleming has followed W. W. Crawford as vice-president on both the Calumet & South Chicago Railway Company, Chicago, and the Southern Street Railway, Chicago. Mr. Fleming is also vice-president and chief engineer of the Chicago City Railway.

George N. West has been appointed treasurer of the Manchester (N. H.) Street Railway. He has also taken the position as treasurer of the Manchester Light & Power Company, which owns the Manchester Street Railway. He has replaced L. E. Flint, who now has the title of assistant treasurer.

Obituary

Odell W. McConnell, lawyer and head of the street railways of Helena, Mont., died recently at the age of fifty-three.

Harry Hamilton, sixty years old, died in Youngstown, Ohio, on Oct. 8 after a long illness. He was the builder of the Park and Falls Street car line in Youngstown.

Thomas Edward Mullen, chief train dispatcher of the Brooklyn (N. Y.) Rapid Transit Company, died suddenly at Saratoga, N. Y., several weeks ago. He was forty-six years old.

Winthrop G. Bushnell of New Haven Conn., died suddenly of heart disease on Oct. 23. Mr. Bushnell had been prominent in the development of electric railways in Connecticut and at one time was representative of the General Electric Company in that state.

Frederick Heis, roadmaster of the Interborough Rapid Transit Company, New York, died several months ago. Mr. Heis, who was 63 years old at the time of his death, had been an employee of the Interborough and its predecessors for thirty-seven years. He entered the service as trackman in 1884 and through rapid promotion became roadmaster in 1904. Mr. Heis, by years of close application to the track maintenance work of the company, performed under difficulties due to location and frequency of trains, hardly equaled elsewhere, became a most efficient and valued employee.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE
MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES

BUSINESS ANNOUNCEMENTS

A Feeling That Price Liquidation Has Reached Bottom

After personal visits to a number of coal consuming centers, and a telegraphic survey of the situation among wholesalers, George H. Cushing, managing director of the American Wholesale Coal Association, has reached the following conclusions:

The stocks of high priced goods of all kinds have about been worked off. Manufacturers everywhere are buying raw material only after they have orders for the finished product, manufacturing the raw material into a finished product as quickly as possible, and are making shipments almost instantly. Everywhere there is a definite feeling that price liquidation has reached bottom on the present wage scale. Everywhere there is a feeling that business activity is starting to resume and there is an expectation of a price recovery.

Almost uniformly public utilities have on hand a thirty day supply of coal. There was no general belief that the railroad strike would occur. There was a little precautionary buying but not much. In one or two places there were slight price advances. Generally the market was dull.

Proposed Electric Railway Project in India

A large supply of electric energy will be required, according to *Electrical Industries*, in connection with the proposed electrification of the suburban lines of the G. I. P. To insure the supply of electricity it is proposed to interconnect the Andhra Valley, the Tata power and the hydro-electric companies. It will require nearly 17,000,000 kw.-hr. per annum to operate the railway from V. Telminus to Kurla; when extended to Thana, 29,000,000 kw.-hr., and when extended to Kalyan, 36,000,000 kw.-hr.

Bids Asked for Subway Construction

The New York Transit Commission is requesting sealed bids for the construction of Route No. 67, a part of the Queensboro Subway Rapid Transit System, to be received at the office of the Commission, at 49 Lafayette Street, Borough of Manhattan, New York City, until November 9, at 11:30 a.m. Route No. 67 is to be a two-track subsurface railroad extending under East and West Forty-Second Street, Bryant Park and West Forty-First Street, from about the westerly line of Vanderbilt Avenue to about the westerly line of Eighth Avenue, in the Borough of Manhattan. The work to be done will include the care and support of surface, subsurface and overhead structures, the maintenance of traffic and the restoration of street and park surfaces. The method of construction will be partly by tunneling and partly by excavation from the surface. The contractor must within forty-two months

from the delivery of the contract complete the railroad and such other work covered by the contract as may be necessary to put the railroad in condition for operation and must complete all other work covered by the contract within forty-eight months from the delivery of the contract.

Motor Demand Expected

Demand for Railway Motors Still Light Although Heavier Sales Are Anticipated

Demand for railway motors is light, according to leading manufacturers. Electric traction companies are said to be buying new rolling stock only when absolutely necessary. The trend for some time has been so much toward safety cars that the number of motors of larger horsepower bought for the heavier types of cars is now rather small compared with the types used on safety cars. Safety car equipment, principally motors, has reached a state of standardization with the result that delivery conditions are very favorable indeed. One of the largest motor manufacturers in the country is optimistic regarding future business on the ground that the attitude of the public toward electric railways has improved in respect to higher fares and increased transportation facilities. In some cases where fare reductions have been made or where new fare methods have been employed, receipts have been kept up in spite of the industrial depression. Virtually all of the lines are in need of additional equipment, this company states. Heretofore, more cars at the old rates in many cases meant greater loss in operation, however, and the money with which to make extensions has been lacking. Demand, as a result, has not been as great as it would have been if the railways could finance new equipment.

Manufacturing conditions are quite favorable at present. One manufacturer has announced a reduction in wages which took effect on Nov. 1. This cut brings labor costs down to a level so that finished products can be quoted at a figure resembling that of the pre-war times. The shortage of gears and insulating material that prevailed at this time last year is no longer a factor. Producers are anticipating their needs well in advance, keeping a good running stock of material on hand at the factory. A reserve supply of motors is also maintained with each of the car builders, it is claimed, as that reasonable shipments can be made.

At this time there seems to be considerable hope by the leading interests that manufacturing conditions will permit a reduction of prices in the near future. The view that the high level attained by railway motor prices since the war was caused very largely by the exorbitant demands of labor all along the line, from the ore in the ground to the finished product, was certainly justified. Recent months, however, have seen cuts in these contributory industries.

Rolling Stock

Androscoggin & Kennebec Railway, Lewiston, Me., ordered from the Wason Manufacturing Company on Sept. 23 three standard safety cars equipped with G. E. 258 ball-bearing motors and C. P. 25 air compressors.

New York, New Haven & Hartford Railroad, which, as has been previously announced, has ordered three rail motor buses to be operated on some of the short branch lines, has specified that the bodies to be mounted on the rail chassis shall be furnished by the Osgood-Bradley Car Company, Springfield, Mass.

Track and Roadway

Lincoln (Neb.) Traction Company is building two new double-track curves in connection with the rerouting plans which will take effect shortly.

Burlington County Transit Company, Hainesport, N. J., has been requested by the Burlington County Board of Freeholders to change the location of the tracks and place them in the middle of the road on High Street, Burlington.

The Northampton, Easton & Washington Traction Company, Easton, Pa., has completed the removal of the line from the side to the center of the road between Phillipsburg and Post Colden. The work required some time.

New York State Railways, Rochester, N. Y., has sought permission to extend its line on Clinton Avenue north from the present terminus at Norton Street to the Ridge road. The railway also recommends trackless trolleys for cross-town service.

Cincinnati, Ohio.—The contract for constructing the fifth section of the rapid transit loop, Cincinnati (Ohio), has been awarded to the Hickey Bros. Construction Company, Columbus, O., builders of sections 2 and 3. Their bid was \$153,965. The engineer's estimate was \$188,240.

Cincinnati (Ohio) Traction Company, through Walter Draper, vice-president, has announced that it will lay new tracks on Vine Street between McMillan and Mulberry Streets, a distance of one mile. Cars using this thoroughfare will be detoured over a different route while the construction work is in progress.

Toronto, Can. The Transportation Commission of Toronto has approved the plan to extend the Dundas Street line west across Yonge Street to the corner of Dundas Street east and Victoria Street to make a new cross-town car service and relieve congestion. The commission will go ahead with the construction of the connecting link soon as the city provides a right-of-way.

Jacksonville-Pablo Beach, Fla. Stone & Webster have been asked to build the proposed trolley line from Jacksonville to Pablo Beach, a distance of more than twenty miles, and according to reports made to the meeting of the South Jacksonville Commercial Club, the Boston corporation has the plan under advisement. This corporation owns the Jacksonville Traction Company which is now in the hands of a receiver and the South Jacksonville interests. Such a line will serve South Jacksonville, Arlington and smaller towns, besides the colony at Pablo Beach and Atlantic Beach, both prominent winter and summer resorts.

Power Houses, Shops and Buildings

Los Angeles (Cal.) Railway has completed the construction of the Garvanza Automatic substation at Avenue 54 and Buchanan Street. It is to improve power conditions in Eagle Rock Valley, and a part of the northern territory.

Northampton, Easton & Washington Traction Company, Easton, Pa., will build within the next six months a small substation building. The railway will also purchase and install two 300-kw. rotary converters with necessary equipment.

Trenton & Mercer County Traction Corporation, Trenton, N. J., through its presi-

dent, Rankin Johnson, has informed the Trenton City Commission that the company will place its feed wires in conduits along Lincoln Avenue, leading from the power station. The work will cost approximately \$25,000 and will be begun at once.

Professional Note

Stovel & Brinkerhoff is the name under which is announced the partnership of R. W. Stovel and H. A. Brinkerhoff, engineers and contractors. Mr. Brinkerhoff is well known for his work in connection with the construction of the Pennsylvania Station in New York City, of which he was general superintendent of construction in charge of the installation of all mechanical and electrical equipment. Mr. Stovel was the engineer in charge of the Paoli and Chestnut Hill electrifications of the Pennsylvania Railroad and the electrification of the Elkhorn grade of the Norfolk & Western Railway, projects which were executed while he was associated with Gibbs & Hill, from 1914 to 1917. Both men were for many years connected with Westinghouse, Church, Kerr & Company, and both were later associated with Dwight P. Robinson & Company, subsequent to the consolidation of the two companies. Mr. Stovel was graduated from McGill University in 1897 as an electrical engineer and in 1900 he received the degree of master of science from the same university. He served with the Pittsburgh & Lake Erie Railroad from 1898 to 1903 in the design and construction of the Pittsburgh Terminal Station and the McKees Rocks repair shops of that road. From 1903 to 1914 he was associated with Westinghouse, Church, Kerr & Company. He served with the A. E. F. in France as lieutenant colonel and had charge of the mechanical and electrical equipment at all ports used by the United States army in France. Mr. Brinkerhoff was connected with the "C. & C." Electric Company as mechanical draughtsman from 1893 to 1897. In that year he became associated with Westinghouse, Church, Kerr & Company. He continued with that organization until 1920, when the company was consolidated with Dwight P. Robinson & Company, at which time he became the head of the industrial engineering division in the new organization. During the war he was managing engineer in charge of design and construction of United States nitrate plant No. 2 at Muscle Shoals. Both men are members of the American Society of Mechanical Engineers, and Mr. Stovel is a member of the American Institute of Electrical Engineers and the Engineer Reserve Corps, U. S. A. The new firm is prepared to undertake investigations and reports on industrial engineering problems, the purchase and generation of power, the operation and economy of power plants, and the design, construction and equipment of steam and electric power stations, manufacturing plants and railroad shops. Offices have been established at 136 Liberty Street, New York.

and insulating materials, and to this work brings several years of experience in the engineering department of the Company.

George T. Hansen, for ten years district manager of the Allis-Chalmers Manufacturing Company at Salt Lake City, Utah, has resigned to enter private business. E. N. Greenleaf, who has been Mr. Hansen's assistant, will become the new district manager of the Allis-Chalmers Company. Mr. Hansen has devoted his time since Sept. 15 to the practice of mining engineering and to looking after his mining and oil interests.

Electric Tamper & Equipment Company, 1400 West Adams Street, Chicago, under the management of C. Jackson, vice-president and general manager, has taken over the electric tie tamping business of the Kalamazoo Railway Supply Company. This electric tamper was developed by Mr. Jackson for the Kalamazoo Railway Supply Company and introduced into railway service last year. The operation of the device was found to be satisfactory, and a number of equipments have lately been placed in service.

Locke Insulator Manufacturing Company on Oct. 1 moved its New York office from the Woolworth Building to the twenty-first floor of the Equitable Building, 120 Broadway. A month before this change C. H. Wheeler took over charge of the New York territory from Kent Hawley, who returned to the factory at Victor, N. Y., as chief engineer. Mr. Wheeler has been for nineteen years with the General Electric Company. Seven years of this time was spent at Schenectady, and since 1909 he has been in the general office in New York.

D. K. Chadbourne has been appointed manager of the New York office of the Westinghouse Electric International Company. Mr. Chadbourne came to the Westinghouse Company through the George Cutter Company before it was affiliated with the Westinghouse, as he was successively Western district manager and Eastern district manager of the latter company from 1912 to 1920, when he joined the Westinghouse Electric International Company. Before becoming connected with the Cutter interests, he spent six years with the Allis Chalmers Company. Mr. Chadbourne was graduated from the Purdue University in 1906.

Oswald Dale has resigned from the Irvington Varnish & Insulator Company, Irvington, N. J., of which he was vice-president and general manager. He had been with the company for five years. He was previously with the General Electric Company for eleven years, nine years of which were spent in the department of supervision of production and two years in the insulating division. For two years prior to that he had been in charge of the heating-device production of the Cutler-Hammer Manufacturing Company. Mr. Dale has just returned from a nine weeks' trip in England and France, where he has been investigating the market for insulating materials.

New Advertising Literature

The Saugamo Electric Company, Springfield, Ill., has issued bulletin No. 57 (suspending No. 49) on "Switchboard Meters, Alternating-Current, Direct-Current and Ampere-Hour.

Bailey Meter Company, Cleveland, has issued bulletin No. 42, entitled "Bailey Boiler Meters," superseding No. 41, and bulletin No. 160, entitled "Multi-Pointer Gages for Draft and Other Factors.

Spencer Trask & Company, New York, have just issued a folder entitled "Present Opportunities in the Bond Market." Besides containing a discussion on the probable future trend of the bond market, a list of current investment offerings is given.

Whiting Corporation, Harvey, Ill., has issued a new crane catalogue No. 153 which supersedes No. 151. The revised catalogue describes and illustrates the company's standard crane designs and contains several tables of standard clearances.

Chicago Pneumatic Tool Company, New York, has announced the publication of Bulletin No. 710, which describes steam, belt and motor-driven dry vacuum pumps. This is the first bulletin issued on this subject by that company.

Chicago Pneumatic Tool Company, New York, has issued Special Publication No. 674 which will be of particular value to users of pneumatic tools. It gives complete specifications which users of such tools can have as a handy ready reference when ordering these products.

Trade Notes

Griffin Wheel Company, Chicago, has opened sales offices in the Rialto building, San Francisco. W. H. Shedaker, formerly in the Tacoma office for the company, has been placed in charge of the new office.

E. L. Windenburg, who has been appointed office manager of the Cleveland branch of the Cutler-Hammer Manufacturing Company, fills the vacancy made by the sudden death of A. E. Loomis on Aug. 2. Mr. Windenburg has been with the Cleveland office since February, 1919, when he left the aerial service of the United States Navy.

The Motive Power Lubricant Co., 130 N. Wells Street, Chicago, has taken over the lubricant business of the Cassco Bar Metallic Packing Company, which manufactures Cassco lubricated waste and Cassco plain grease. While retaining identical quality, the products of this company will be known in the future as "frictionless lubricated waste," "frictionless grease light" and "frictionless grease heavy."

Belden Manufacturing Company, Chicago, has announced the appointment, which was effective Nov. 1, of C. P. Cushman to be manager of the cable and specialties department. Mr. Cushman will have supervision over that part of the business pertaining to telephone, automobile and appliance cord assemblies, cordage, flexible cable