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The Strike Is Over and Radicalism Has Been Routed

WHEN the radical leaders among the New York printers brought on the strike on Oct. 1, they hoped to tie up the printing situation in New York so that no issues could be printed. The Electric Railway Journal felt that it could not give in to the unreasonable demands of the strikers so commenced printing in another city.

This is the seventh issue of the Electric Railway Journal which has been published away from New York. The editorial and mechanical problems of using a printing office some 200 miles away from the main editorial office are not small. We have had to divide our staff, keeping part in one city and part in another. We have also had to use printing facilities not primarily designed for the publication of periodicals. But we have received hearty co-operation from the printing fraternity in the city where we have been doing our work, and without them the undertaking would have been impossible. We have endeavored to maintain throughout these issues published outside of New York the same editorial standards as when work was done in our own office.

We are glad to report that the compositors and pressmen in New York now see the futility of remaining out of work longer. Many of our old men have accepted the terms which had been offered to them before the strike, and they are again at work in our own printing plant. In other words, the strike has collapsed, and radicalism in the industry has been routed.

We are deeply appreciative of the support which our subscribers have extended to us during this fight. Their letters of encouragement and the absence of any complaint about the delayed service have been a great help. Our advertisers have been equally generous with us and have authorized us to repeat their copy as often as was deemed to be expedient, instead of making the usual changes in wording or subject matter.

As our printing office will be congested for some time to come we have a choice between two courses. One is to publish our delayed issues as rapidly as we can, say every five days, until we are even with the calendar. The other is to combine the editorial sections for the next five successive issues so that we can be back on our regular schedule at the earliest possible date. The latter plan, of course, is much more expensive as by it we omit the equivalent of four complete issues of advertising. Nevertheless, we have decided on this course as it will more quickly bring the reader up to date, and we consider it a duty to do this and also to pay the cost of the strike ourselves and not pass it along to the advertiser.

This number, therefore, carries five dates and represents the issues which would normally have been issued on the Saturdays from Nov. 15 to Dec. 13 inclusive. Beginning with the issue of Dec. 20, this paper will be published from New York and will be back on its regular schedule.

January Eight a Busy Day for Railway Executives

THE program for the mid-winter conference of the American Electric Railway Association, to be held in Cleveland on Thursday, Jan. 8, 1920, is beautiful in its simplicity, but the topics to be discussed furnish a wide scope for the expression of thought. Take, for example, the matter of increasing the membership dues in the association. The income must be increased—that point will require no discussion—but how much? The demands on the organization are increasing at a rate which is both alarming and encouraging; alarming because it is causing the small surplus of funds to be rapidly consumed; encouraging because it shows that the association is needed and appreciated. The augmented demand for service comes at a time when the cost of giving it is multiplied by the well-known H. C. L. factor.

For many members, however, the cost of membership has in the past been merely nominal; often a single item of association service has been worth a whole year's fee. In view of these circumstances all members will welcome a statement from the special committee which has been working on the matter, giving expert opinion as to how much income is needed, how much the industry can reasonably be expected to contribute, and how it is proposed to divide the expense among the members in accordance with ability to pay.

The revision of dues is down on the program for settlement first. With this question settled right the conference will be in a mood to consider the technicalities of depreciation and the labor situation.

Cleveland is a very happy choice for the conference this year. Recent conferences have been held on the Atlantic Coast for good and sufficient reasons, but it is only fair to the Western members to make the meeting more accessible to them at this time. There is a certain spirit of hospitality and general friendliness in the Middle West, also, that renders a visit there very attractive at any time. The opportunity to study railway operating conditions in the home

of service-at-cost, of the erstwhile 3-cent fare and of Peter Witt's (formerly) 1-cent car line will also be appreciated by the delegates.

In How Large Sizes Can Turbo-Generator Units Be Built?

A VERY instructive presentation of the elements of modern steam-turbine design was made at the American Institute of Electrical Engineers meeting held in New York City on Nov. 14. The chairman of the meeting explained that the program was planned long ago, before the occurrence of the epidemic of turbine troubles which accompanied the war period. The information given in the papers and the opinion expressed therein and in the subsequent discussion will, therefore, prove doubly reasuring to those who may have feared that limitations in regard to safe size in turbines, and to safe capacity for a given weight, have already been passed. The fact is that the causes of trouble have now been diagnosed and the remedies appear to be simple and easy of application. Compared with the number of machines operating smoothly and continuously for long periods the number of those which have given trouble is small, but the trouble has had wide publicity owing to the popular and technical interest in the steam turbine.

We must remember that the steam turbine and its running mate, the high-speed, high-capacity generator, have imposed new and difficult problems on designers. Here is a combination of high-pressure, high-temperature steam, flowing with tremendous velocity through a very novel bucket-wheel structure, a structure which by the very nature of the principles involved is much more difficult to render mechanically stable than the older types of engine. Moreover, the steam turbine is still young, but owing to its inherent virtues the demand for it in larger and larger sizes has been so insistent that the manufacturers have been kept "on their toes" to supply the demand. This has made difficult the maintenance of the close relation between the science and the art of turbine construction which would have insured even greater efficiency and reliability.

The net result of the very rapid development of the turbine, however, has been that at present the units can be built in any size that is demanded by economic considerations. The turbine is being built in large sizes at an efficiency closely approximating theoretical perfection (that is, within 25 per cent). In other words, the turbine is extracting from the steam almost the total amount of energy available within the ranges of pressure and temperature employed. This transformation is being made in power-plant floor space very small in comparison with what would have been necessary with reciprocating engines. In fact, a reciprocating-engine power plant of a capacity like that of a number of the recent turbine plants would be so huge as to be almost unthinkable.

Mention has already been made of the velocities involved in the modern turbine. To illustrate these, we may cite the 1800-r.p.m. machine considered at the New York meeting, the pitch diameter of the last-stage wheel of which is 88 in. The linear velocity on this diameter is 41,500 ft., or nearly 8 miles, per minute. The upper economic limit of generator rotor speed at present was said, by one of the speakers at the meeting, to be 24,000 ft., or about 4½ miles, per minute. Steam passes through the last stage of a turbine like this at a velocity which challenges the imagination.

The volume of steam which has to be passed through the lowest pressure stage is also of a magnitude to attract attention. For example, a 30,000-kw. turbine with a water rate of say 11½ lb. per kilowatt-hour must, with suitable pressure and superheat, pass 30,000 x 11½ x 585 (cu. ft. per lb.) = 202,000,000 cu. ft. of steam per hour, or 3,360,000 cu. ft. per minute, or 56,000 cu. ft. per second, into a condenser wherein a 29-in. vacuum is maintained. These data are quoted simply to impress upon the mind of the general reader the magnitude of the quantities involved. They are commonplaces, of course, to the engineer. The real point in the whole matter is that the size of turbine can now be selected on the basis of the lowest annual cost per kilowatt-hour, including all factors involved in the cost, with confidence that a high degree of reliability can be counted upon.

Companies Should Know the Value of Their Properties

NO ONE knows what the future legal basis of operation for most of our electric railway properties will be, whether on a service-at-cost franchise, partnership basis with the city, municipal ownership or a continuation of the present form of franchise with commission regulation of service and finances and supervision of fares. It would be only a rash guess for anyone to predict which of these forms of franchise will be most popular with the public which, in the end, will decide this question, or whether some other form of railway control will be preferred. But there is one thing which is certain, and that is that a valuation of the property will have to be made before any permanent basis for future operation can be established.

It seems to us, therefore, that one of the most important things to be done by every company which is not satisfied with its present rate of fare or has a short-term franchise is to get busy and have a valuation made. Otherwise, the need for one may come so quickly that the company will find itself unprepared. Valuations cannot be made in a day or a week, and any hurried valuation will be far more likely to leave out items which properly should be included than to include those which have no place in the appraisal. The latter items can be readily identified and thrown out, but omitted assets are not included because they are forgotten. A hasty valuation, therefore, is much more apt to be too low than too high.

Another question which may be asked is upon what basis should the valuation be made? To this our answer is that it should be made upon all of the present recognized bases for valuations, or at least the data should be located and made available by which a valuation made according to one basis can be corrected or changed to accord with another basis. Thus, a company should not be satisfied simply with a determination of the cost to reproduce new according to present prices but should determine the factor by which this total would have to be multiplied to accord

with the average prices of the last five years. The value of the intangibles should be appraised separately so they can be included or not as occasion may require. Accrued depreciation should be determined whether the management believes it to be a legitimate deduction from the value of the property for rate-making purposes or not, and an attempt should be made to learn from the records of the company the investment in the property and when made. Finally the current records of its company should be in such shape that the valuation can be brought up to date without too great difficulty.

The Romans had a saying, used so frequently that they contracted it to *verb. sap.*, meaning that a word to the wise is sufficient. We shall therefore not expand further on this subject.

The Spigot End Is Cost of Car Maintenance

AT ONE of the informal conferences at the recent convention there was a spirited discussion on the data so far available on the maintenance of automatic one-man cars. One or two of the men present showed a tendency to hold back on the installation of such cars until it had been demonstrated that they would cost little to maintain and last a long while.

This point of view was described long ago by the phrase: To save at the spigot but waste at the bunghole. Surely, a scrap of paper and a bit of lead pencil ought to settle the question as to whether it makes much difference whether the cost of maintaining these cars is or is not as much per ton or per mile as older, less complex cars. The bunghole combination is platform expense, power and accidents; the spigot item is maintenance. For example, in a certain city where the cost of running old cars is 20 cents per car mile, platform expense is 10 to 11 cents, power is 4 cents and accidents, 1.3 to 1.4 cents and maintenance, 2 cents or a total of say 18 cents for three items, leaving about 2 cents for the tax-gatherer and fixed charges. Now on the same property for the one-man car, the first three items total only 7 to 8 cents against 16 cents, because platform expense is 5 cents, power about 2 cents and accidents but 0.4 cent. In other words, the difference in operating costs exclusive of maintenance is 8 cents per car mile. Therefore, there is ample leeway for higher maintenance costs without serious impairment of net.

But what are the facts? The new cars average only 1 cent a mile for upkeep as against 2 cents a mile for cars that may be simpler in apparatus but which are twice as heavy and really too old to be economically maintained. The new cars through their very incorporation of the latest improvements in control, motors, air brakes, etc., are bound to cost less to maintain for their first two or three years at least; but let us remember that in the meantime they are also saving so much power, platform and accident expense and creating so much new traffic that the user of such cars could not only afford to pay more for maintenance but could also afford to put aside enough to pay for and replace the light-weight automatic cars within five years. Some more pencil and paper, please!

What Will the Car of To-morrow Weigh?

THE car of the future is certain to be built to light weight standards and stripped of all excessive material. Some leading equipment engineers have put the weight of the car of the near future at not more than 300 lb. per passenger seat. Others consider that a weight of 400 lb. to 450 lb. per passenger seat will be nearer that actually realized. Whether these figures are high or low it is certain that weight economy is one of the outstanding aims of the farseeing car builder of today.

The problem of reducing operating costs has been forced on the attention of all operating men for several years, and the present financial conditions of the electric railways of this country have emphasized still farther the necessity for economy. Weight reduction offers perhaps the greatest results in this direction. In the cars produced just previous to the year 1917, the weight per seated passenger for double truck cars was from 588 lb. to 694 lb. For single truck cars, the weight per seated passenger was from 474 lb. to 748 lb., and for ultra-light cars built for one-man car operation, the weight per passenger seat was from 345 lb. to 511 lb.

The use of these light cars has shown the officials of electric railways how little power is actually needed to transport passengers and also how much power has been wasted by heavy cars. Thus it pointed the way to the use of light cars of the safety type that are now coming into use so rapidly. The weight of the present standard safety car is about 425 lb. per passenger seat. While this is not as low as some of the ultra-light cars produced, it is a marked improvement over the weight of the single truck cars used just previous to the year 1916. Among railway men responsible for the maintenance of car equipment, there has been some disappointment because the saving in power consumption from the lighter weight has been in a measure offset by increases in maintenance cost. This is unavoidable to some extent, but efforts should not be spared to make the car of the most rugged construction consistent with weight reduction.

Improperly maintained track has always been regarded as one of the principal factors in the deterioration of cars, but in addition to those conditions which originate outside the car, there are many produced in the car structure itself. By avoiding excessive wear and by renewing parts before they have become worn to such a point as to produce excessive vibration in the equipment, the maintenance forces are helping to solve this problem. Manufacturers of equipment have also realized that they can assist in this work by reducing the dynamic forces originating in the car equipment itself. These changes give less pronounced results than those involved in reducing the weight of the car body. Nevertheless, taken altogether, their influence upon the weight of the car cannot fail to be of great importance. The practical accomplishment of the light car has been definitely established and a still further reduction in weight is sure to result without any sacrifice of the features of strength which are considered to be of paramount importance.

What the Brooklyn Report Shows

AT A TIME when the residents of Brooklyn are complaining about the payment of a second fare on the Brooklyn City Railroad system, charged because authorized under an old franchise, the report of Stone & Webster on the Brooklyn Rapid Transit system to Judge Mayer is published and shows to what a serious condition that company has been brought. Here is a property which only two years ago was earning more than $5,000,000 over taxes and fixed charges and its underlying and guaranteed securities were considered suitable for fiduciary investments. Yet from this condition the rapid transit lines alone (based on estimates for 1920) are failing by about $1,302,000 to meet their fixed charges, while the surface lines (for the same period) will not pay even their operating expenses and taxes by $1,114,000. This sudden change from comparative affluence to abject poverty, it should be clearly understood, has not been caused by financial or operating mismanagement. It is due entirely to the change in the purchasing power of the fare charged, that is to say, to conditions brought about by the war and over which the company has had no control.

What will be the result? On this point the report is clear and to the point. Unless there is an increase in fares, the operation of many of the surface lines will eventually have to be discontinued because of their failure to earn operating expenses and taxes. Nothing less than an 8-cent fare, with a charge of 2 cents for transfers, will provide a safe margin for the operation of the surface lines as one system, with reasonable provision for upkeep. Even an 8-cent fare will not yield a fair return upon the actual investment in these lines or upon their reproduction value. As regards the rapid transit lines, without an increased fare they will not be able to earn even fixed charges, and it will take an 8-cent fare to cover the company's preferential and provide a substantial return upon the city investment, including cost of completion.

It is obvious, therefore, that unless the authorities wake up and settle this question promptly and on a permanent basis by giving the companies a living fare, Brooklyn will be bereft of many of its existing surface lines and will be so crippled as to its rapid transit lines that they will be unable to make the extensions which the transportation needs of the borough require.

We believe that there is every reason, from the standpoint of justice, for the grant of a higher fare to the Brooklyn transportation systems, but independent of this reason entirely, the grant should be made as a matter of self-interest by the city. Brooklyn is essentially a city of homes, and for this reason is perhaps more dependent than the average community on good transportation. Anything which prevents the wage earners of the family easily and quickly getting to their places of work will retard the development of Brooklyn. The rapid transit lines cannot reach all parts of the borough, and the bulk of all its local transportation will have to be carried on the surface lines. If some of these are abandoned and the others broken into even smaller fragments than at present, with frequent changes of cars and additional fares at every change, a serious condition will be reached.

If we add to this that the rapid transit lines will be unable financially to carry out any extensions other than those covered by the present contract and must be operated by a receiver in the interests of the bond holders, Brooklyn will prove to be anything but a desirable place as a residence for anyone who lives at a considerable distance from his work.

One-Man Cars Demand Simplest Possible Fare System

ONE of the most gratifying features of more-service operation with one-man cars is the evident willingness of the riding public to facilitate the work of the car operator by taking more pains to have exact change ready. It does not take the passengers long to see that the speed of the getaway is largely up to them—a condition which is less obvious when there is a conductor at the back of the car. It is a fact, however, that odd fares necessarily reduce the proportion of passengers with exact change, thereby slowing down the schedule. A further slowing down is bound to occur if the operator has to handle and register a variety of cut-rate tickets, especially if some of the tickets carry limiting conditions as to hours of use. For these reasons it is extremely desirable that fare collection on one-man cars be reduced to the simplest possible terms.

In some cases, an attractive reduction in the price of tickets and intensive selling of such tickets will do the trick. In other cases, the sale of tickets in quantity might not do because it would be redounding chiefly to the benefit of rush-hour riders who are already being carried at or below cost. In instances of the latter kind, it might be found feasible to sell transportation either through a limited-ride coupon book or an unlimited-ride pass at a price based upon some definite number of rides.

It is not practicable in street railway service to limit such books or passes to the original purchaser, but this is no great disadvantage, as the purchaser could not pass the privilege along unless he failed to ride on it himself. The coupon book is costlier to print and is more cumbersome than the pass since it calls for more work by both passenger and car operator, but if it would give as tangible a check as the presentation of cash, however, it would not prevent the substitution of tickets for cash. The pass is exceedingly simple, calling for no stopping and tearing off of coupons by the holder, while the operator need ring up the presentation only for the sake of the traffic record. It is true that a pass does not give so tangible a check as the coupon book, but this should not prove an insuperable obstacle on one-man cars where all passengers face forward and so exert a moral influence that is impossible when the transactions go on behind their backs. Either class of transportation would carry the boon of eliminating the time-limit transfer which is annoying to the rider and expensive to the operator.

Blessings Brighten as They Take Their Flight

THE voters of Toledo must have felt very well satisfied a few weeks ago when a count of the ballots showed that they had won "a great victory" over the local traction company in approving an ouster ordinance to drive that corporation from the streets. At last those naughty "magnates" would be shown that the will of the people is supreme! Their self-satisfaction must have changed to a feeling something akin to chagrin a few days later when they awoke to find that the corporation officials actually had obeyed the demand of the people and had removed their cars from the streets. They said "traction barons" always were contrary anyhow—they obeyed the law just when the people didn't want them to do so. They should have known that the voters "were only fooling."

Undoubtedly the good people of Toledo were within their rights when they voted to abolish their street car system. Likewise the company management was within its rights in carrying out the expressed wish of the voters. The result of having both parties exercise their prerogatives is that the people of Toledo—voters and non-voters alike—had to walk. Of course the Toledoans had the alternative of paying from 10 to 25 cents for jitney rides, but this was not a suitable salve for their injured feelings.

Persons dependent upon local transportation in other cities ought to feel obliged to Toledo for bringing this lesson home. There has been much bragging about the power of the people to show the street car companies "where they get off." No one will be so bold, perhaps, as to gainsay this power. However, even the all-powerful public will take time for second thought when such developments as the recent event in Toledo show how an exercise of their rights may lead to distress. It sometimes requires a tieup of transportation to reveal the necessity of such facilities for community welfare.

Are We On to Our Jobs?

A LITTLE traffic investigation which we were privileged to make in a Mid-Western city of 60,000 to 70,000 people lately has set us to wondering whether electric railway operators are paying proper attention to the ravages of the commercial motor truck as a passenger carrier.

In this particular city, a number of factories have sprung up on the outskirts, most of them at or within easy walking distance of the terminals, the remainder extending out 2 or 3 miles. Owing to insufficient service on the existing lines and no service at all beyond the tracks, the factories have been obliged to improvise passenger vehicles out of their fleets of motor trucks. Morning and evening a few rough benches are set up and the employees are bumped to and from their jobs. It is true that they pay nothing for this service, but that doesn't mean that they would refuse to patronize comfortable cars if such cars were provided. A natural consequence of this absence of service is that the employees have no incentive to settle on the ample acres nearer the factory, for the good and sufficient reason that no real facilities are available for mid-day shopping and evening pleasure travel. Better service would insure a better-rounded development of this community. For every long-distance rush-hour rider transplanted closer to his work, there would be a family of potential short riders for the off-peak periods.

So far as service over existing track is concerned, investigation disclosed that the remedy would be three-men, two-car trains during the rush hours and one-man cars the rest of the day. With the gradual development of housing nearer the later factories, the train service would eventually become unnecessary, whereas the all-day, one-man car service would become of increasing importance.

As for service to the factories a mile or two beyond the terminals, the immediate answer seemed to be in providing one-man buses as an integral part of the street railway system until the traffic developed would be sufficiently heavy to justify the extension of the tracks. Indeed, in this particular instance, the bus age of operation may be unnecessary if the city waives the paving tax and if the railway finds that it can use light-weight rail for light-weight car service. Then it will be on its job in earnest!

It's the Net per Car-Mile That Counts

IN COMPARING the car-mile earnings of two properties lately, we were amazed to learn that while the 20-cent per mile property was making money the 30-cent per mile property was losing money. Not only that; the property with the heavier gross per car-mile was operating in a town so small that its intake had to be considered excellent, whereas the property with the smaller gross obviously was serving a large community with a poorer riding habit.

The contradiction was resolved by a closer study of power, platform and schedules. The 20-cent property was running the majority of its cars on an energy consumption of about 1.25 kw.-hr. per car-mile instead of 3 kw.-hr. per car-mile because it had light-weight cars; it had a platform expense of 50 cents an hour instead of 90 cents because its cars largely were being operated with one man instead of two; and it was operating on a schedule speed of 10 m.p.h. instead of 8 m.p.h. because its cars were equipped with high-accelerating control, quick-braking apparatus, air-operated doors and other means for shortening standing time. On a car-mile basis the 20-cent property had a platform expense of but 5 cents a mile whereas the other property had a platform expense of 11¼ cents a mile. Thus we see that because of the greater schedule speed of the automatized car, the platform expense was cut more than half, despite the payment of a bonus to the one-man car operator.

For this reason it was possible for the 20-cent property to risk a big increase in service for which it has been amply rewarded by public patronage. Its gross earnings per car-mile are a trifle less than they were before, but its actual margin between income and outgo is far greater than the other property which has gross earnings fully 50 per cent higher. For those who are still skeptical about modern one-man car operation, a little figuring of their margins is in order.

Some Experiences in the Development of Automatic Substations

The Author Tells of Several Schemes Which Were Tried and Abandoned in Bringing the Apparatus of One Manufacturer to a Satisfactory Degree of Reliability

By R. J. WENSLEY

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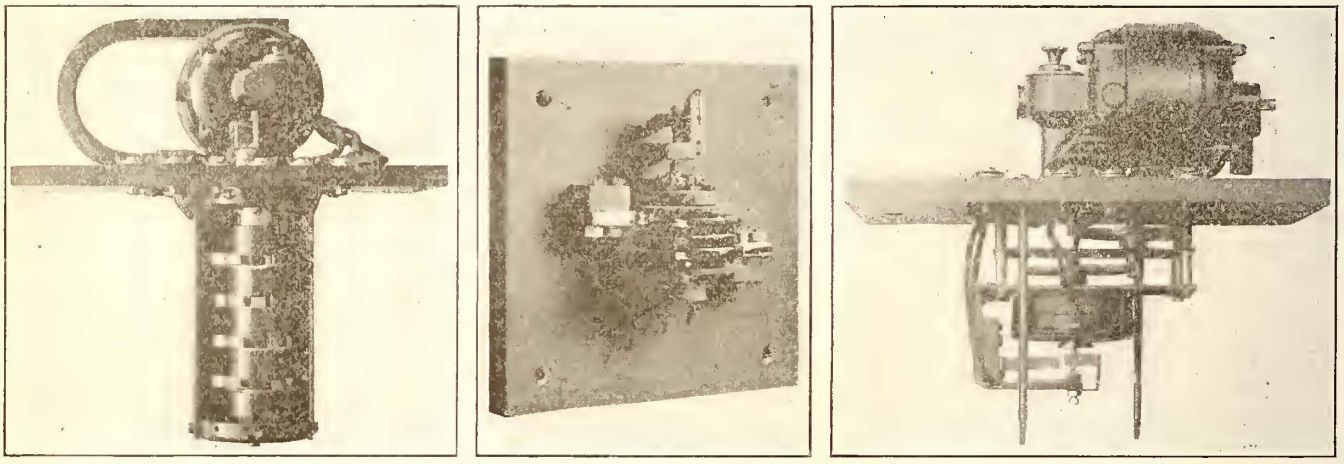
MANY difficulties have been met and vanquished in the development of automatic control for rotating machinery in substations. The requirements of such a control would at first seem to demand attributes so nearly human that the problem might at first glance be considered incapable of solution. On analysis, however, it resolves itself into the anticipation of as many probable conditions of operation that may be met, not so much in the ordinary daily run as in the time of abnormal stress that is sure to come to even the best of systems and machinery.

The average user of apparatus, such as the automatic substation, seldom has the chance to know any of the inside story connected with its development in the factory and with the troubles met in actual operation on systems with which he is not immediately associated. Often there are many interesting developments that considerably modify the original conception of the equipment in its evolution from the first sketches to the perfected machine. This has been quite true in the case of the automatic substation and the purpose of this article is to acquaint those interested with some of the steps in design, as well as some of the troubles and their remedies, from the experience of one manufacturer of this class of equipment.



AT LEFT, POLARIZED MOTOR RELAY AS FINALLY DEVELOPED. IN CENTER, TYPE OF CURRENT RELAY FINALLY ADOPTED FOR AUTOMATIC SUBSTATION. AT RIGHT, MOTOR OPERATED PRIMARY RELAY USED FOR SHUTTING DOWN STATIONS

In the preliminary design, the major problem seemed to be in the development of a satisfactory means to start a synchronous converter from rest as an induction motor, to fix its polarity properly, and accurately to determine the earliest time at which it could safely be connected to the full voltage of its transformers. The converter was the first to be considered because of the great preponderance of its use in railway substations. The motor-generator control, while considered in theory, was not attacked in practice until after the converter problems had been solved.

The first scheme proposed was the use of relays to determine the various times at which connections should be changed to accomplish the starting and loading of the substation. The first equipment constructed for experimental purposes consisted of an assembly of standard switchboard relays, steel-mill-type contactor switches, and a motor-driven drum controller to establish the sequence of operations. The polarity of the converter was corrected by flashing its field from a small generator driven by the drum motor. This equipment was assembled and given an operating test with 300-kw. and 500-kw. converters on both 25 and 60 cycles. This first equipment worked fairly well, but was abandoned in favor of what was considered a more fundamentally sound scheme of switching.

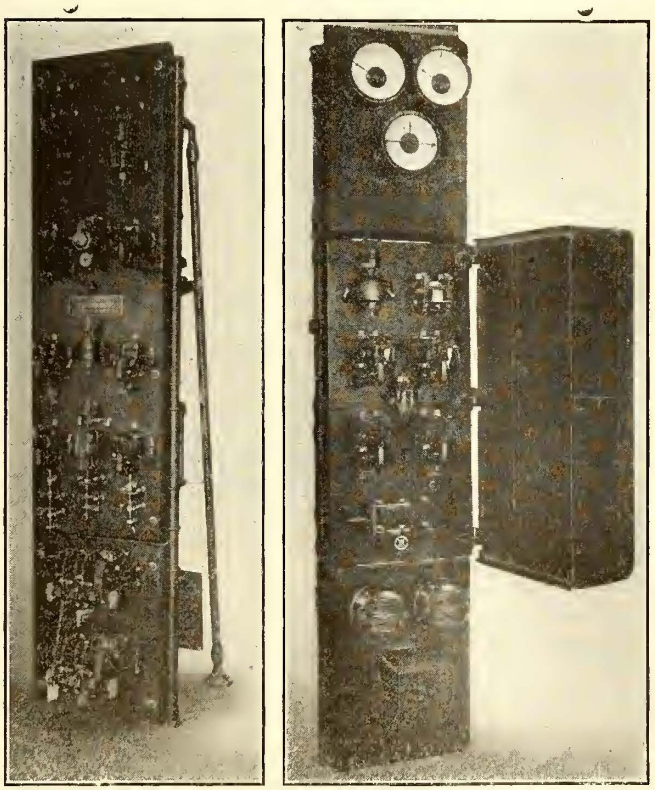
With this first equipment it was necessary that the operations caused by the drum controller should not exceed the rate of acceleration of the converter. This necessitated that the drum speed be set for the longest time that might be required under the worst starting conditions, the result being that under normal conditions the time required for starting would be too long. To prevent this waste of time while starting, the drum could be speeded up to the shortest starting time and some means provided to stop it if it was about to reach the running position before the converter was in synchronism. As the best indication of synchronism in a self-started converter is the presence of unidirectional potential at the direct-current brushes, a polarized relay could be used to "signal" the drum when it was safe to proceed. If this polarized relay could be made definitely to determine the synchronous condition of the machine, then the drum controller would seem superfluous.

The first scheme proposed involved the use of a polarized relay for the purpose of determining synchronism; so it was decided to revert to that method of operation and to omit the drum controller. The abandonment of the drum and its driving motor left the small polarizing generator without a driving means. It could have been direct-connected to the converter shaft and operated all the time the converter was in service, but this was considered objectionable.

In the preliminary development it had been proposed to slip a pole automatically by means of the polarized relay. This method seemed to work out quite well in manual stations and it was therefore adopted as the standard method of polarity fixation. The development of a relay to respond to the change from alternating to direct current at the commutator and to indicate the polarity of the converter at the same time gave some little trouble. The first attempt was the use of a reverse-current relay built like a D'Arsonval movement except with powerful shunt field. This was very highly damped, but the long pulsations of the low-frequency potential at the commutator brushes were sufficient to cause operation of the relay before actual synchronism was reached.

To obtain the longer time element which seemed desirable, it was proposed to put a commutator on the relay movement and operate the contacts through a gear train. Since this was so obviously a direct-current motor, the relay was discarded and an ordinary motor was substituted. This motor was built with a permanent magnet to supply the excitation and a shunt coil to keep the magnet strength up to its maximum. The 10-in. oscillating-fan motor was found to be readily adaptable for the purpose, as its standard gear train was suitable for the application and it had the further advantage of being a well-proved piece of equipment.

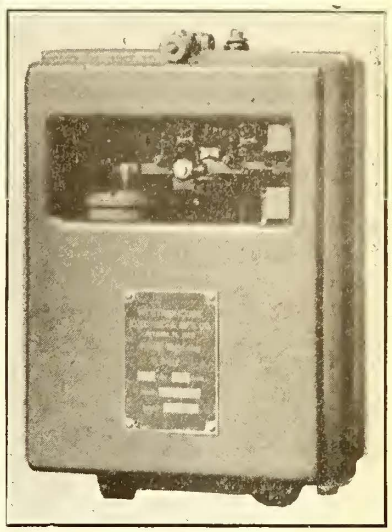
This motor-relay was connected across the converter brushes during starting and soon proved itself exactly suited for the application. During the acceleration of



AT LEFT, SWITCHBOARD FOR ELABORATELY INTERLOCKED CIRCUITS, AFTERWARDS GREATLY SIMPLIFIED. AT RIGHT, PANEL FINALLY DEVELOPED ELIMINATING UNNECESSARY INTERLOCKS

the converter the relay armature would oscillate, rapidly at first, then more slowly as the machine approached synchronism, until finally the armature would be revolving one revolution more or less in either direction just before the point of synchronism was reached. As the converter locked in, the motor armature would revolve continuously in one direction or another depending on the polarity of the converter. This offered just the means desired with which to operate the pole-slipping device.

A contact device was connected to the reducing gearing of the motor relay, with four circuits. Interlocking relays were so connected that if the relay revolved in one direction the starting switch was opened and the running switch closed. If the relay revolved in the opposite direction, a direct-current relay was energized from the converter brushes. This relay in turn operated the field-reversing switches. When the shunt field of a converter is reversed, the direct-current potential dies away rapidly, and the converter hunts slowly backward and forward across the zero line. The field-reversing relay was so calibrated that it dropped out as the potential fell to zero. This allowed the field-reversing switch to return to its correct position and the converter to reverse its polarity. To provide against failure to function properly, provision was made for repeated reversals of field to insure proper polarity. The motor relay, which was left connected to the converter during this operation, would slow down as the potential died away and would start up with the opposite direction of rotation when the converter reversed.



PRIMARY RELAY AS USED WITH INDUCTION REGULATOR

This whole scheme was so entirely simple and satisfactory that it was at once adopted as standard and all future developments centered on the use of the "polarized motor relay," as this device was called. The final form which this relay took is shown in one of the illustrations.

Experience with Induction Regulator was Helpful

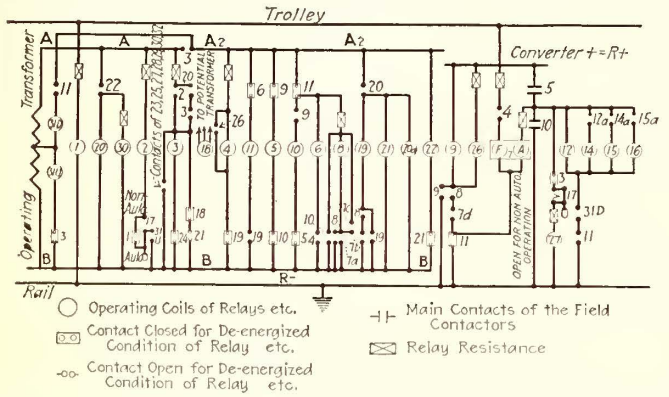
For starting the station as a result of low trolley voltage, a standard piece of apparatus was adopted from the automatic induction regulator. The primary relay for this class of service, as shown in a second illustration, is subjected to very severe service conditions, as it is in almost continuous operation for twenty-four hours a day in its regular service, while the service requirements of the automatic substation would only need its operation five or ten times a day. It was therefore thought to be entirely safe to use this relay. What was overlooked, however, was that in its normal place this relay is operated from a potential transformer and is not subjected to line surges. In the automatic substation this relay was used on the ground side of a limiting resistor but the trolley surges proved too severe for its insulation. As a result three of these relays burnt up in rapid succession on the first equipment placed in actual service. A similar experience with the current relay, which was of the telegraph-relay type, was proof that automatic equipments would have to be constructed with a greater margin of safety than was at first considered to be necessary.

A simple and rugged current relay was adopted as shown in a third illustration. A similar relay with a shunt coil was adopted for the trolley voltage relay. There have been no insulation failures with either of these relays since their adoption.

To provide for shutting down the station when no demand existed, the current relay mentioned herein was used. However, this relay alone would not suffice since it was instantaneous in action and would shut down the station each time the load fell momentarily below its setting. Some form of time element was therefore found to be essential. The use of oil or air dash pots, or of air bellows, was considered impracticable due to their inherent unreliability which is especially great when long-time elements are required. The first form of time relay tried was a solenoid with a heavy moving core, to which a gear train and fan were connected by an over-running clutch. This relay would pick up instantly without driving the gear train but would have to drive the gear.

This relay operated many thousand times but it was of necessity built with rather delicate parts and its maximum time setting was about five minutes. It frequently stuck, due to the excessive mechanical friction as compared to the driving force, the weight of the plunger being considerable.

To secure a greater length of travel, this same principle was adopted, the operation being by means of a small motor which wound up a weight on a drum, the weight in turn



SIMPLE STRAIGHT-LINE DIAGRAM, ELIMINATING "SNEAK" CIRCUITS

1. Under-voltage D.C. relay.
2. Low-voltage delay A.C. relay.
3. A.C. shunt relay.
4. A.C. shunt relay.
5. Field contactor "normal field."
6. A.C. starting contactor.
7a. Armature of polarized motor relay.
7b. Field of polarized motor relay.
8. A.C. shunt relay.
9. D.C. relay for "field reversal."
10. Field contactor "reversed field."
11. A.C. running contactor.
12. D.C. line switch.
13. D.C. series underload relay.
14, 15, 16. D.C. line resistance shunting switches.
12a, 14a, 15a. D.C. accelerating relays.
17. Two-pole D.T. knife switch.
18. Reverse-phase and low-voltage A.C. relay.
19. A.C. shunt relay.
20. Main oil switch in A.C. power line.
20a. Low-voltage release on 20.
21. A.C. dash-pot relay.
22. Control contactor for item 20.
23. A.C. overload relays.
24. Overspeed device on converter.
25. Bearing thermostats.
26. Field reverse limiting relay.
27. Underload delay relay.
28. Grid thermostat (for converter).
29. Replica thermal relay.
30. Lockout relay.
31. Brush-lifting mechanism.
32. D.C. reverse-current relay.

EXPLANATORY NOTES

The polarized motor relay No. 7, consists of a polarized motor driving a rotary-type switch. When during the starting operation the converter voltage builds up with the correct polarity, the switch contacts are made in the order a, b, c, d, etc. When the converter voltage builds up with wrong polarity these contacts are made in the order of d, c, b, a, etc.

If after three trials of reversing the converter polarity, the voltage again builds up reversed, the contacts of relay No. 26 are closed, thus opening the starting contactor.

No. 6 through the opening of No. 4, and a complete new start will then be made.

No. 30 closes its contacts up on the third power impulse produced by the closing of No. 22, unless mechanically reset by the closing of No. 16.

driving a gear train and fan on the downward trip through a ratchet. The motor remained energized while the load relay was in contact, and started to unwind against the time element when the load relay opened. This relay was actually shipped with the first equipment but gave trouble due to excessive friction and to pitting of the motor commutator at the point where the brushes rested in the energized position. In this relay also the ratio of torque to friction was entirely too low.

It was then decided to experiment with a motor-operated time relay in which the motor would run during the timing operation. This was successful and the relay illustrated was developed as a result. The same fan motor was made use of as in the polarized-motor relay. In this case it is used as a straight shunt motor. The gears, which in the fan motor operate the oscillating device, are here used as part of the reduction between the motor and the timing contacts.

The ratio of the fan motor gears is 198 to 1, and two 10 to 1 reductions are added below, making the total ratio 19,800 to 1. The contact arm is driven through a small and simple magnetic clutch, with the coil in series with the motor. The contact arm is driven forward against a light spiral spring, which immediately returns it to rest against a back stop, the position of which may be changed to alter the time setting of the relay. A variation of from three to twenty minutes may be obtained in this way.

The motor and clutch are energized through contacts on the load relay, which contacts are closed when the load falls to a predetermined value. This starts the motor and engages the clutch. If the load remains low, the moving contact arm will finally reach the contacts and press them together, this circuit shutting down the station. If, however, the load relay should pick up at any time prior to the time at which the contacts touch, then the motor will stop, the clutch will disengage and the contact arm will instantly return to its position of rest against the back stop. This prevents any cumulative effect, as the relay must always start from zero position no matter how brief the demand for load on the station may be.

How "Sneak Circuits" were Eliminated

The earlier "circuit diagrams" were quite complicated and abounded in sneak circuits which showed up at most inopportune times. The tendency at first was to add an interlock on one of the relays whenever any circuit trouble was experienced. This resulted in loading the circuits up with multiplied chances for trouble and loading the relays up so that they would hardly operate. At least two equipments were built in this manner, of which an example is shown in one of the illustrations.

A determined effort was made to simplify the circuits and a great number of straight-line diagrams, similar to the one shown, were made up while eliminating the sneak circuits, which are readily visible in this type of diagram. At the same time, most of the objectionable interlocks were removed, the result being the panel illustrated.

This change fortunately was made while the two equipments mentioned were still in the works. These were scrapped and new panel assemblies were made using the simplified diagram.

In the first equipments shipped many aggravating troubles were experienced which were not directly attributable to the automatic control but which caused some unfavorable comment. For instance, the wiremen on the first equipment in their anxiety to do an exceedingly neat job of wiring bent the wire at very sharp right angles, thus breaking the insulation and causing some very nasty breakdowns in service. On the oil circuit-breaker mechanism, a low-voltage tripping device was used of exactly the same design as those used for years in ordinary circuit-breaker practice. This would not stand the unusual shocks to which it was subjected in automatic substation service and a new type of trip had to be adopted.

Some Disconcerting Troubles in Early Machines

The first machine to be operated by this type of automatic control was a 500-kw., 25-cycle, 600-volt non-commutating-pole converter of relatively recent design, having

distributed damper bars for starting. These bars were fastened to the end rings by bolts, and the unusually frequent starting service resulted in the loosening up of the end ring connections until finally the converter would not start. Prior to the time when the entire failure to start was observed, a puzzling circumstance occured which caused much thought and worry before it was understood. The machine, upon coming up with reversed polarity, would go through the sequence of operations in the usual manner until the field switches would reverse. The direct-current voltage should then drop to zero, at which point the field-reversing relay should drop out and normal field should be restored. In this case, the converter would slip partly out of step and then lock with the direct-current voltage only part way down. This was sufficient to hold the field-reversing relay, and the converter would run on the starting tap with field reversed until tripped out by hand. This trouble entirely vanished when the damper winding was repaired.

This repair was accomplished by the use of an oxy-acetylene torch and silver solder, the result closely resembling the electrically brazed joints made in the most modern types of converters. This same trouble with the joints of a cage winding was experienced with the rotor winding of a starting motor used with an old converter, for which automatic control was supplied. This winding was repaired in the same way.

In connection with motor-started converters many peculiar problems were met due to the necessarily different starting methods and to the inherent characteristics of this form of converter. These machines are brought up to speed by the motor and then thrown onto the line through a reactance regardless of the phase relation. The ordinary pole-slipping method does not always work with these machines as the direct-current voltage goes much higher than in the self-starting type. To get some of these machines to reverse, it is necessary temporarily to insert some non-inductive resistance in the circuit so as to loosen the coupling between the converter and the line. The converter will then slip a pole much more readily than when reversed with only reactance in circuit. This is not true of all motor-started converters and experience has shown that each case has to be considered separately.

A Butterfly Caused One Shut Down

The only failure to function properly which has been experienced that was chargeable to insect life was in the station containing the motor-started converter. A butterfly crawled into the arc chute of the running-field contactor and prevented the closing of the field circuit, which in turn prevented the station from coming on the line. In a way the experience was valuable, since it emphasized this hazard and all possible changes were made at once to guard against its repetition. It also suggests the importance of properly screening all ventilating openings as an additional safeguard from this source of trouble. Small-mesh screening is most desirable and its use should be considered in the design of substations. Of course, larger ventilating openings are necessary due to the choking effect of the small-mesh screening.

The only case of trouble that caused any apprehension as to the fundamental scheme of automatic switching, was due to a defective direct-current contactor which failed to open, resulting in material damage from overspeed to the 300 kw., 60-cycle converter it controlled. Inspection and experiment, however, showed that everything was correct and had functioned properly except the contactor. This had failed to open due to improper assembly. Aside from the fact that the automatic switching was entirely vindicated, it was even a greater satisfaction to be able to have this substation in full automatic operation in only a little more than a week after the accident. This was accompished by shipping a new converter form stock half way across the continent by express.

While a number of detail difficulties, as enumerated, have been experienced, the fundamental principle of switching only in accordance with the electrical condition of the machine controlled has proved to be absolutely correct. Experience has further demonstrated that simplicity is very necessary in the apparatus and in the control circuits to make the automatic substation a success.

Gear Manufacturers Discuss Standardization

Recommended Practices Were Adopted for Gears and Pinions for Railway Service and Other Industrial Applications

THE semi-annual meeting of the American Gear Manufacturers' Association was held at Boston, Mass., on Oct. 13 to 16. Recommended practices were prepared and proposed for adoption covering composition gearing, gears and pinions for electric railway service, bevel gearing, limits for holes in gears, and roller-chain and sprocket-wheel standardization.

In the case of composition gearing, standards were offered for adoption covering four classes of gears or pinions, namely, rawhide, fabroil, bakelite and fiber. Charts were prepared and submitted covering the minimum allowance between bottom of teeth and bore, thickness of brass retainers, diameter and number of rivets, and face width of rawhide additional to that of metal mates. This report was accepted in its entirety by the association excepting one section relating to horse-power, action upon which was postponed.

The recommended practice for electric railway gears and pinions as proposed was based upon the specifications of the American Electric Railway Engineering Association, Sections Et 3b, Et 14a, Et 15a, Et 16a and Et 17a.

In addition a further recommendation was submitted as to the proper method of installing railway pinions, as follows:

Putting on Railway Motor Pinions

Many of the pinion failures on electric railway motors are caused by putting the pinions on incorrectly.

Driving a pinion.—It is generally believed that if a pinion is shoved on to the shaft and the nut is tightened, the pinion will run satisfactorily without loosening. Experience has shown that in order to obtain satisfactory operation, pinions should drive their gears through the "press fit" or "shrink fit" on the shaft and not through the key. The key acts merely as a safety device should the pinion accidentally loosen. The desired fit for the pinion can be had by heating or by pressing.

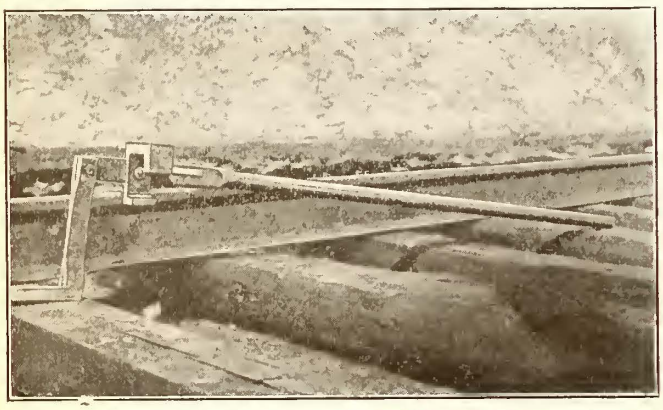
Precautions.—The following points should be observed when putting pinions on railway motor shafts with taper fit: (a) The shaft should be clean and free from burrs or swellings. (b) The pinion bore should be clean and free from burrs. (c) The fit of the pinion bore should be in contact with at least 75 per cent of the surface of the taper fit on the shaft. This can be checked by rubbing Prussian blue, thin red lead and oil, or thin lamp black and oil on the pinion bore and fitting it on the shaft. (d) After the above points have been taken care of the pinions should be put on the shaft cold to make sure that the keyway in the pinion is the proper size for the key mounted on the shaft, and that the pinion does not ride

or bind on the top and sides of the key and will not ride the key when pressed further on.

The keyway on the pinion can be 0.002 in. larger than the key but no smaller. There should be at least $\frac{1}{64}$-in. clearance between the top of the key and the bottom of the keyway in the pinion. The corners of the key should not cut into the fillet of the keyway. To prevent this, the corners of the key should be rounded.

Pinions up to 3-in. bore should be heated in boiling water for thirty minutes, and those with 3-in., or larger bore for sixty minutes. When the pinion has attained the temperature of the boiling water it should be taken out of the water and the bore quickly wiped clean. Before the pinion has had time to cool it should be tapped on the shaft with a 6 or 8-lb. sledge hammer, using a heavy piece of wood or copper between the pinion and the hammer. This sledging is not to get a driving fit, but to make sure that the pinion is "home" and well seated. Three or four taps evenly distributed around the pinion end should be enough. The pinion nut, with lock washer, can then be screwed home tight with a wrench having a purchase or lever arm of 3 or 4 ft.

A suitable pinion-heating arrangement can be easily made, the water being heated by an electric heater, or a gas flame or a steam coil could be used.



TIE LIFTER DEVELOPED BY TRACK FOREMAN OF IOWA COMPANY

To prevent rusting and to insure a clean surface at the fit, washing soda should be added to the water in the proportion of $\frac{1}{4}$ lb. of soda to 5 gal. of water.

By following these directions it is possible to put a pinion on an armature shaft so that it will "stay put" and drive through its fit under the very hardest pulling from the motor.

Action on Committees' Reports

The report abstracted above was accepted in its entirety as recommended practice with provision for furnishing certain additions, such as drawings, etc.

The proposed standards offered for bevel gearing were confined largely to gears up to 20 in. in diameter as distinguished from larger gears. Sections on shafting, length of face and length of bearing were accepted as recommended practice. The section on limit of application and a table giving the proper amount of back-lash was referred back to the committee.

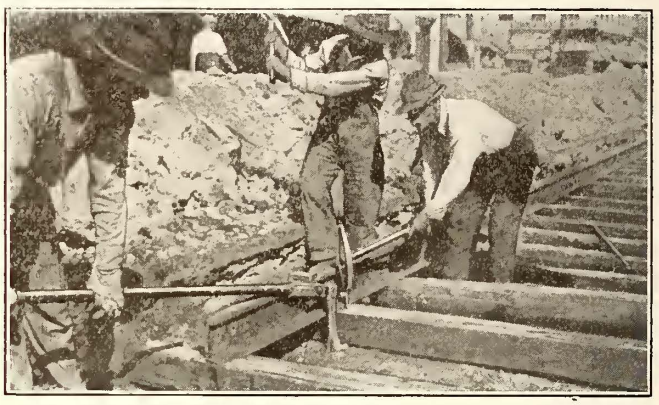
The recommendations of the committee on holes for gears included classes for air craft, printing machinery, automobiles, pumps and hoisting machines and for general jobbing gears. This was accepted as recommended practice.

A report submitted by the roller chain sprocket wheel standardization committee will be printed later by the association and submitted to the membership. No action beyond "Permission to print" was taken at this meeting.

New "Tie Nipper" Reduces Spiking Difficulties

A NEW TOOL which greatly simplifies the operation of spiking ties and makes it no longer necessary to resort to the bar and block to hold the tie up against the rail during spiking has been developed on the property of the Tri-City Railway, Davenport, Iowa. The usual process is not only uncomfortable for the man on the end of the bar, but requires the use of a man and bar on each side of the tie. The new device requires only one man for this purpose and the leverage is such that no jar is felt by the operator. It consists of a lever with a side projection or head to fit over the ball of the rail and act as a fulcrum while a foot at the short end of the lever goes under the tie. The particular function of this device is to clamp rail and tie together firmly while the spiking operation is being performed.

The "nipper" as it is called, consists of four parts, a lever, handle, head and foot. These are put together with pins and cotter-pins for purposes of interchangeability and adjustment to various types and sizes of rail. The foot is a casting and is made in various lengths for any height of rail. For a 7-in. rail the distance from the pivot in the bar to the top side of the horizontal foot is 10 in. The



SPIKING TIE HELD SECURELY IN PLACE BY NEW "TIE NIPPER"

lever or bar to which the foot is attached is $\frac{1}{4}$ in. x 2 in. and a $1\frac{1}{4}$-in. pipe which fits onto the end gives a total length of 6 ft. The head which fits over the rail is also a casting and is made in a sufficient number of types to fit any rail. This head is set 4 in. from the end of the bar.

In operation the foot is first placed under the tie, the head is then placed over the ball of the rail and by means of the handle lever the tie is held firmly against the rail base while being spiked. An actual test made over a given length of track resulted in the accomplishment of the work with the "nipper" in one-third the time necessary when the old method was used. At the time of the test the trackmen did not know a comparison was being made and were not familiar with the new device.

The fact that the handle is quickly detachable makes the tool convenient for the tool box. The total weight is about 26 lb. as equipped for use with a 7-in. T-rail. The device has been patented by its designers, Messrs. Emmons and Johnson of the Davenport track department.

C. W. Rice, chairman of the employment bureau conducted by the engineering societies, reports that during the ten months ending Sept. 30, 1919, the bureau interviewed 17,083 men, registered 4858 men and 1988 positions, and placed in positions approximately 1000 men. The work is to be continued.

Fares Increased in Milwaukee

Commission Estimates Normal Expenditures and Increases Fares to Cover Deficit—Changes in Accounting Methods Ordered to Pave Way for Establishing Fares on an Automatic Cost Basis

THE Wisconsin Railroad Commission on Oct. 30, 1919, handed down a decision of much importance affecting the fares, service and accounting methods in Milwaukee. A brief note regarding this decision appeared on page 808 of the issue of this paper for Oct. 25. From the full report of the decision, now available, the following longer abstract has been prepared.

On July 25 the company filed a petition for a revision of the rates of fare and zone limits within the Milwaukee single-zone area and adjacent suburban zones, claiming a reasonable return was not being received under the previous order. Subsequent to the filing of this application, the question of wages paid in the transportation department was brought before the Board of Conciliation of Wisconsin, in accordance with the State law (Chap. 530 of 1919), and this board filed a schedule for increased wages with the Railroad Commission, which subsequently approved it, although the order required by the above-mentioned law had not been entered. Increases in wages were not confined to the transportation department but other collateral wage increases grew out of this adjustment. The estimated total increase in Milwaukee and suburban areas was $710,000. If the Racine and the interurban companies were included the increase would amount to $829,000.

The state law referred to reads:

> In the event that such dispute shall arise between any public service corporation and its employees of any class, division or grade, and said Board of Conciliation shall investigate and report thereon as herein provided and determine the wages, hours of labor or working conditions to which such employees are reasonably entitled, such determination shall be immediately submitted to the Railroad Commission of Wisconsin, which Railroad Commission shall without delay further investigate the said matter and make and file its determination therein, confirming or modifying the report of said Board within 45 days after receiving the same. If the earnings of such public service business in which such employees are engaged are found to be sufficient to meet the cost of making the determination of said Commission effective without depriving said corporation of a fair return upon the capital employed in such business as determined by the Railroad Commission, said Railroad Commission shall order such public service corporation to make effective the wages, hours of labor and working conditions so determined by it to be fair, equitable and just, otherwise the Commission shall provide for such a revision of the rates, tariffs and charges of such public service business as will enable it to meet such cost and yield a fair rate of return upon the capital employed therein, as determined by the Railroad Commission, which order of the Railroad Commission shall be subject to review in the manner now provided by law, etc.

Estimates for Year 1920 in Single-Fare Area

The commission made a forecast, designed to indicate the amount by which the present fares would fail to yield an adequate return upon the fair value of the Milwaukee city and suburban railway property. Determining this the commission indicated the specific fare increases considered necessary to provide the additional revenue requirements. The commission used as a base the figures for three months ending July 31, 1919, due consideration being given to seasonal variations and to increases in the cost of labor and material.

The operating revenue for the three months ending July 31, 1919, were taken as being representative of any quarter, and the yearly revenue estimated therefrom. This was estimated to be $6,340,986.

In estimating the operating expenses for a normal year the various items were considered separately and not necessarily in the same manner. In carrying out this idea the commission made an audit of expenses for three months ending July 31, 1919, and considered first the expenses if based on the price levels of July 31, 1919, and added thereto wage increases effective Aug. 1, 1919, or which were expected in the near future.

An audit examination, the commission stated, in many cases has secondary value as the questions involved relate not only to the character of expenditures which may be properly considered maintenance, but also to the amount of maintenance which may properly be considered normal for any one year. The most reliable index was the average annual expenditure for actual maintenance work over a period of years, if due regard was given to changes in the cost of labor and materials. Unfortunately, the accounts of the Milwaukee company are not so kept as to show charges which should have been made to property and plant account or depreciation reserves, and therefore any allowance for maintenance based on such averages would unnecessarily be higher, inasmuch as expenditures that should have been capitalized are included.

Estimates of Expenses for 1920

Estimates for way and structures and equipment accounts were worked out on two bases, namely:

The first basis used the average maintenance figures per car-mile over a period of years reduced to a level of pre-war costs, and to this cost the estimated increase of present-day costs over the pre-war costs was applied. This figure was then adjusted to show the effect of wage increases already allowed or anticipated within the period for which the estimate was made. On the second basis the estimated increase in the cost of labor and materials for 1919 over 1916 applied to adjusted figures for the calendar year 1916, so as to make the estimate on July, 1919, price levels. To this figure were added the wage increases either already allowed or anticipated within the period for which the estimate was made.

To make allowances for the charges which the commission claimed should have been capitalized or cared for by the depreciation reserves, an amount equal to the difference between these two bases was deducted from the figures under the estimate based on the figures for the first half of 1919 adjusted to the calendar year 1916. To this difference was added the same allowance for increase in wages effective during the period of the estimate.

Investigation of way and structure accounts showed that December, 1916, price levels were approximately the average for the period July 1, 1908, to June 30, 1917, and the cost for the last half of 1918 averaged 47.97 per cent higher. In July, 1919, labor showed a 64.39 per cent increase and materials 48.77 per cent increase over December, 1916, while the composite figure indicated a 56.25 per cent increase.

Investigation of equipment accounts showed that figures for the year ending June 30, 1918, must be reduced 29.39 per cent to be on a 1916 cost basis and that for the last

half of 1918 eosts had to be redueed 58.7 per eent. Labor in July, 1919, inereased 105.26 per eent over Deeember, 1916, and materials 60.76 per eent, while the composite figure showed an increase of 79.87 per eent.

Expenses for traffic, eost of power, eonducting transportation, general expenses and undistributed expenses were figured by the eommission for the three months ending July 31, 1919, stated on an annual basis. An allowanee for depreeiation and a 7½ per eent return was allowed in the eost of power. To the other items increases in wages anticipated during the coming year were added. To determine the amount for depreciation the eommission took the value as of Dee. 31, 1918, of the city property, exclusive of power plant, with additions sinee made. This gave a valuation in the single-fare area of July 31, 1919, of $15,645,534.

At the allowable rate per annum, 2.82 per cent, less the eompany's eharge to the railway reserve for the quarter ended July 31, 1919, the annual amount for the depreeiation reserve was estimated to be $400,766.72.

The taxes for the quarter were increased four times to meet the year's estimate. The eommission noted that with any inereasc in net incomc, taxes would likewise be in-

TABLE I—ESTIMATE FOR EXPENSES, WAY AND STRUCTURES AND EQUIPMENT

	Way and Structures Account	Equipment Account
On basis of twelve and one-half years average:		
Miles of single track operated	180.4	.....
Operation—1916 prices, per mile	$199.68—$36,022	.....
1919 prices increased by	52.25%—$56,285	.....
Maintenance: Car miles operated, seven months ending July 31, 1919	9,767,978	.....
Car miles estimated for year Dec. 31, 1919	14,745,105	.....
1916 prices, per car-mile at	1.15c.—$192,569	1.68c.—$281,318
1919 prices, increased by	56.25%—$300,889	79.87%—$506,006
Total costs for 1919—labor and material	$357,174	$506,006
On basis of 1916 adjusted figures:		
Actual expenditures, 7 months ending, July 31, 1919	$273,774	$1,400,000
Estimate for year, based on average for 1916-7-8 of	52.34%—$523,068	51.32%—$721,643
Wage increases July 1 and 16, 1919	$11,982	$46,361
Estimate for year on 1919 prices	$535,050	$768,044
Amount that should have been capitalized or charged to deferred maintenance	$177,876	$262,038
Net maintenance	$357,174	$506,006
Wage increases to be added:		
Granted since August 1, 1919	58,678	.....
Anticipated during period	26,438	52,917
Estimated wage increases on basis of	66.76%—$56,823	65.88%—$34,862
1920 estimate allowed	$413,997	$540,868

ereased due to the federal income tax law. The non-operating revenue was estimated to be $22,178.64. In Tables I, II and III is given in detail in tabular form the basis of the eommission's estimates—together with a summary to show the estimated revenue needed in the city area.

Milwaukee Suburban Railway

In considering the rates of fare in the suburban zones the eommission believed weight must be given not only to the theoretieal eost of rendering serviee in that area, but also to the eonneetion of that area with the flat-fare eity area. Rush-hour or tripper serviee is largely eonfined to the flat-fare area, but the eost of sueh as is operated into the suburban zones is apportioned by the eompany on the ear-hour basis. The eommission did not agree that this method was entirely correct but did say that if a suburban rider is to enjoy the advantages seeured through the attainment of a better load faetor on suburban ears during the off-peak hours of the day and if he is to enjoy the same transfer privileges that a eity rider enjoys, he must also expeet to bear at least some portion of the eost of the expensive tripper service.

The commission further stated that it did not believe that the suburban area at the present rates of fares was self-

TABLE II—ESTIMATES FOR EXPENSES—TOTAL WITH DEPRECIATION AND TAXES

Item	Three Months Ending July 31, 1919	On Annual Basis	Wage Increase Anticipated	Total
Traffic	$1,941	$7,764	None	$7,764
Cost of power	207,559	830,236	None	830,236
Conducting transportation	583,043	2,340,173	487,078	2,827,251
General expenses	43,537	174,147	10,364	184,511
Undistributed expenses	68,627	274,509	5,770	280,279
Total	$906,707	$3,626,829	$503,212	$4,130,041
Way and structures and equipment from Table I.	....	....	....	954,865
Depreciation at 2.82 per cent of valuation	110,301			
Less company's charge	10,109			
Actual	100,192	400,767	....	400,767
Taxes	54,190	216,763	....	216,763
Total operating expenses and taxes				$5,702,436

supporting; for it would be entirely possible to zone the system in sueh a way that eertain zones eould never be self-supporting, just as it is undoubtedly true that eertain eity lines yield a mueh smaller return than do eertain other lines operating within the single-fare area. These faets lead to the eonelusion that a rate within a eertain zone or on a eertain line is not neeessarily too low merely because it is insufficient to make that area or that line, considered by itself, yield a fair rate of return. The question of proper rates of fare for the suburban area therefore, is one that eannot be deeided alone on the narrow grounds of the theoretieal eost of serviee. The suburban area of any eity railway system always represents the thinly settled portion served, and if the needs of a growing community are to be adequately served, it is inevitable that extensions must be made before the population in those areas has reaehed a density that will make the extensions when built immediately profitable, if only the revenues earned within the suburban zone are considered. To adopt a policy of making these extensions only when and as they become immediately profitable, would inevitably cause the business and social interests of the eommunity to suffer.

The present relations existing between the city of Milwaukee and the suburban munieipalities in respeet to their street railway transportation requirements are such that some portion of the shortage in revenue now resulting from the operations of the Milwaukee suburban railway may properly be borne by the eity railway and any increase in fares in the flat-fare area automatieally results in an inerease to the suburban rider, as a very large pereentage of rides originating in the suburban area terminate within the flat-fare area.

Figures presented for the suburban area are purely an estimate inasmueh as the eompany does not keep on its book separate aeeounts covering the expenses of the suburban railway area.

Estimates of Revenue and Expenses

The eompany's figure of $302,939 for operating revenue for the year ended July 31, 1919, was accepted by the eommission.

The eharaeter of the way and structure maintenanee work in the suburban area made it impossible to follow

TABLE III—SUMMARY OF ESTIMATED REVENUES AND EXPENSES—CITY AREA ONLY

Operating revenue	$6,340,986	
Operating expenses	5,702,436	
Operating income		$638,550
Non-operating revenue		22,179
Gross income		$660,729
Value of Milwaukee city property exclusive of power plant	$15,645,534	
Add for materials and supplies	500,000	
Total valuation	$16,145,534	
Estimate revenue needed to earn 7½ per cent and pay operating expenses, without making allowance for increased taxes and high recession rate		$1,210,915
Deficit to be made up in suburban area		$550,186

the plan used in the city area. Lacking any definite basis for determining expenses in the suburban area the company's figures for the seven months ended July 31, 1919, were accepted and raised to an annual basis, to which increases in wages actually made or anticipated were added.

The commission did not make any elaborate reinvestigation of the early fare question and only considered the period since its order of Aug. 23, 1912. Taking the period of Aug. 23, 1912, to date as a whole, the commission states, the company has not earned excessive earnings over a reasonable return. If it had previous to that time, whatever earnings there were were under lawful rates and were the property of the company, which it was entitled to use in any lawful manner. To be sure this question of early earnings has a bearing on questions of going value, etc., but to order now the company to forego a reasonable return for a fixed period to absorb past calculated excess earnings would not only in the opinion of the commission be a violation of the Constitution of the United States but would be establishing a principle against public policy and against the interests of the riding public in the city of Milwaukee. It could only result in crippling the company financially,

TABLE IV—SUMMARY OF EXPENSES SUBURBAN AREA

		Other Figures on Annual Basis	Total Expenses Stated on Annual Basis
Ways and Structures:			
Actual expenses for seven months to July 31, 1919	$67,148	none	$72,144
Equipment:			
Car-miles for seven months to July 31, 1919	614,585	1,053,574	.....
At 1916 prices per car-mile	1.68c.	$17,700	.....
At 1919 prices—increase of	79.87%	31,837	.....
Wage increase anticipated	.....	1,794	33,361
Power:			
Car-miles three months to July 31, 1919.	275,186	.....	.....
Cost on per car-mile basis	4.56c.	1,053,574	48,043
Transportation expenses:			
Basis $1.52222 per car-hour	.....	.....	145,127
General and Undistributed Accounts:			
In city this item was 10.06 per cent of other accounts above	.....	.....	30,074
Taxes:			
Computed on ratio of valuation	.....	.....	16,498
Depreciation:			
Calculated on 2.82 per cent property value.	.....	.....	37,244
Total	.....	.....	$382,761

TABLE V.—ESTIMATE OF REVENUE REQUIREMENTS—SUBURBAN SERVICE

Operating revenues		$302,939
Operating expenses, taxes and depreciation		382,761
Net deficit		$79,822
Valuation of suburban railway as of July 31, 1916	$1,320,698	
Adding allowance for materials and supplies used in April 4, 1919, decision	42,500	
7½ per cent return on valuation of	$1,363,198	102,240
Additional revenue requirements		$182,062

making it impossible to carry out not only the very provisions of this order for giving adequate service, but would be very likely to interfere with other improvements found necessary for serving the public in the future.

System of Fares

The commission found that the most difficult question was in raising the increased revenue as the basis of fares cannot be placed strictly upon the income account by zones. This would be unfair to the outer zones and give to some extent the single-fare area an advantage of density of traffic and lower costs than would obtain were it not for the contributing traffic from the outer zone areas. No traffic study has been presented upon which an ultimate conclusion as to actual costs can be based, if the contributed density of traffic in the inner zone is considered. Economic and social considerations must also be considered as well as established business and riding habits, and residential congestion in the single-fare area ought not to be furthered by a system of fares that would discourage the outward growth of the city. However, the additional cost for a long haul should not be overlooked, and it is believed that some system of fares, not now in effect, can if properly treated give recognition to the increased cost of hauls into suburban areas, take into account the decreased cost in the single-fare area through traffic originating in the outer zones and give consideration to economic and social conditions. The commission believed it unwise to introduce another zone within the single-fare area, inasmuch as the present area is not large, the outer limit being only 3½ to 4 miles from the Public Service Building. To do so would introduce serious problems in handling fare collections and would greatly influence the trend of traffic throughout all the areas under consideration.

A 6-cent flat fare in the single-fare area would probably produce the necessary revenue and would also for some time at least discourage riding, especially the short haul, and any cash fare using multiple coins is likely adversely to affect the time of loading. It is impossible to avoid multiple coin fares, but a 6-cent cash fare without reduced rate tickets does not recognize the principle that frequent riders are entitled to special consideration and should have some advantage over the occasional riders.

Hence, 7-cent cash fare in the central area and 3-cent zone fares were allowed with tickets in the single-fare area sold in lots of six for 35 cents and eighteen for $1, in order to give the most frequent riders the lowest fare. The commission says it sought to put in ticket rates on a basis which it estimates will produce the necessary revenue. The commission believes that two classes of tickets should be sold so that those who make the largest investment would receive the greatest discount. Inability to forecast the riding on various tickets led the commission not to make this part of the order final. A further study of the revenues accruing under this order is to be made and within a reasonable time the final order regarding ticket rates applicable to the single zone area will be entered.

Riding since Jan. 1, 1919, has increased a great deal and has resulted in far more favorable conditions than existed in October and November, 1918. The commission believes that increased traffic is to be looked for and that additional cars will increase riding and revenues. The careful following of the accounting procedure fixed by the commission should make it possible readily to adjust the ticket rates, especially those at the minimum rate from time to time so as to meet fluctuations in the cost of service.

Metal tickets, the commission acknowledged, were more convenient for the company to handle, but if sold to the car riders in large quantities are an inconvenience. While tokens may possibly prove satisfactory for the first fares established, paper tickets will be more convenient for those riding at the minimum rate of fare.

Between the Cudahy depot and the Bay View district the commission, although against overlapping fare zones as a principle, did establish this plan during rush hours on special cars or trains. Any questions of difficulty in fare collection, it was believed, could be obviated by not running cars south further than Mitchell Street.

The commission also suggested a commutation ticket to South Milwaukee and left it to the company to suggest a rate.

Treatment of Reserves

Something should be said, the commission continues, in favor of a requirement that depreciation reserves shall be represented by depreciation reserve funds, but the commission does not believe any good public policy would be served by a segregation of such funds, at a moderate rate of interest, to be used only to replace property retired from service, but the public interest requires such funds to be used for corporate purposes, especially for extensions and additions to property. The funds in effect can be restored as capital issues are made. No matter how the

funds are used the commission is of the opinion that they should draw not less than 3½ per cent interest, which should be credited to the reserves, inasmuch as depreciation is figured on a corresponding sinking fund basis.

The commission also believes that a further development of traffic can be secured in the non-rush periods, and that economies can be brought about by short routing.

Additional Car Equipment

In the June 1, 1918, decision the commission retained jurisdiction as to the service. The commission held that the primary duty of a public utility was to render adequate service. Adequate service was as much a corollary to fair rates of return as was the right to demand a fair rate of return for adequate service rendered. More equipment was necessary, it now claimed. The commission engineer reported eighty-three cars needed to fulfill the requirements of the standards of service. It was estimated that 100 more cars having a seating capacity of 5000 seats will be needed by November, 1920.

Double Transfers

The commission claims that it has brought up the need of extending the use of double transfers repeatedly. The June, 1918, order also referred to this, and the company was expected to submit a proposal for the commission to consider. The company was given until Nov. 24, 1919, to install a transfer system allowing passengers to reach their destination without payment of a double fare. The commission finds that the extension of the double transfers is necessary for this purpose and allowed the company to submit a statement showing the restrictions which it thought necessary to prevent abuse. The commission, retained jurisdiction, to pass not only upon these matters, but on all those growing out of the extension of the use of the transfers and for the purpose of requiring changes from time to time, as may be necessary, to bring about a more general transfer system throughout the city of Milwaukee.

Order of the Commission

In conclusion, the commission ordered the company to install a new accounting procedure, effective Jan. 1, 1920, to conform to the accounting practices set forth in the previous audits prepared for the commission by its audit staff.

In the single-fare area an allowance of 20 per cent of the operating revenue was made to cover way and structures and equipment maintenance and depreciation, exclusive of power property. The charge for depreciation is to be the excess over and above the monthly expenditures for maintenance, plus an allowance of 2.82 per cent on the valuation of the power plant property devoted to the city area.

The commission states it has given no consideration to the ratio between maintenance expenses and depreciation allowances to operating revenue, but inasmuch as the current price levels are likely to prevail during 1920, it believes the allowance made is reasonable and fair. Nothing in the order, however, should be construed as committing the commission to a permanent policy of basing allowances on percentages of operating revenue or to the percentage used, for as a general matter the depreciation reserve should be based upon the cost of the property against which the reserve is established.

Commencing on Jan. 1, 1920, the company is also ordered to make a monthly charge to interest and a credit to not only its depreciation reserve but to all active reserves, partially or wholly built up through charges to operating expenses, amounting to 3½ per cent interest on the several balances at the beginning of each month. The interest charge is treated as a deduction from gross income.

The company is also obliged to separate the depreciation reserve as between the single-fare and suburban areas, as well as to keep the monthly charges to operating expenses and interest separate as between the reserves, while losses on property retired from service are charged to the proper reserve.

Beginning Jan. 1, 1920, no additional charges are allowed to the reserves for "legal expenses" or "promotion of business." All such expenditures shall be charged directly to operating expenses, except as the company can continue its present practice of charging a part of legal expenses to capital expenditure.

The cost of stock handling, now carried in a separate account, is to be charged after Jan. 1, 1920, to a "materials and supplies disbursement reserve," and a percentage added to materials issued to cover the cost of handling and storage plus losses due to breakage and spoilage after deducting therefrom the interest credits to this reserve.

Until such time as a scientific computation of relief and pension requirements can be made, based upon an actuarial study of pensions accrued yearly, all charges shall be made on the basis outlined in the commission's audit for the three months ended July 31, 1919.

All interest credited to reserves or charged to interest paid, under deductions from income, is segregated from interest paid on funded and floating indebtedness and entered in a lump on the income account under a new caption "interest on reserve capital."

Changes are also made in method of computing and distributing taxes. The commission ordered that all State, city and capital stock taxes be apportioned monthly among the several operating utilities and the power division on the basis of the fair value of the property as of Jan. 1, 1920, until the completion of the property ledger. Federal income taxes are also to be apportioned monthly upon the basis of the distribution of the net income of the preceding calendar year among the several operating utilities.

The company must go back to the forms of monthly reports made prior to the consolidation of last February and again make two separate railway monthly reports—one report covering the operations of the Milwaukee city railway and the other the operations of the suburban, interurban and Racine railways. The same is required of the electric utility, and to preserve the continuity of records the company must prepare corresponding reports covering the results of operations from Feb. 1, 1919, to date.

The November, 1919, and subsequent reports must show condensed statements of income accounts and the power costs computed in the manner specified and apportioned to the several utilities for the month.

Transfers on a transfer are also ordered in the central area, effective Nov. 24, 1919, subject to limitations from time to time, approved by the commission. The company is also instructed to take immediate steps to procure 100 additional cars having a seating capacity of 5000; plans for such cars to be submitted by Dec. 1, 1919, and to be in service not later than Nov. 1, 1920.

The report of the Wisconsin Board of Conciliation (created under Chap. 530, Laws of 1919), filed with the Railroad Commission, was approved and the railway company ordered to make effective the wages, hours of labor, working conditions determined therein as being fair, equitable and just, and in compliance with Chap. 530 of the Laws of 1919, the rates of fare were ordered changed to cover the increased cost of operation.

Effective Nov. 2, 1919, the rates charged are: For any ride within the Milwaukee single-fare area, including transfers, a cash fare of 7-cents, and two tentative ticket rates, namely—six for 35 cents or eighteen for $1. Both classes of tickets are sold on the cars. The eighteen tickets for $1, which are in a convenient book or folder form are also sold

at the stations where the electric bills of the company are paid.

In the suburban area the fare was fixed at 3 cents per zone, with a 6-cent minimum. In all other respects the July 2, 1918, decision covering fares on the suburban lines remains in effect.

During the morning and evening rush hours the same fares as prevail in the central area are to be effective on special cars or trains between Cudahy depot and Mitchell Street. The company under the terms of the order is also required to submit prior to Nov. 15, 1919, a scheme for the issuance of commutation tickets between South Milwaukee and the single-fare area.

The commission attached to its order an addendum concerning the advisability of establishing an automatic cost basis of fares within the single-fare and suburban area of the city of Milwaukee.

Regarding this the commission said that it was inclined to believe that with the accounting practices established, no great difficulty would be met in providing by order for a more or less automatic adjustment of fares. The working out of this order and the results of some experience will undoubtedly be helpful in working out a basis for a possible order. This suggestion was made in the hope that it might lead to a larger consideration of the subject and its possible benefit, and with a distinct assurance that if it shall appear to those interested to be feasible, the commission will be glad to work along lines of making it effectual.

Municipal Ownership Conference

Meeting Continues Three Days in Chicago with Three Sessions Each Day—Resolution Indorses the Desirability of Public Operation of Utilities—Papers on San Francisco and Seattle Systems

A THREE-DAY conference was held, Nov. 15-17, at the Congress Hotel, Chicago, by the Public Ownership League of America. Some fifty other organizations were invited to participate in the conference. Among them were the local public ownership leagues in Chicago; Duluth, Mich.; St. Joseph, Mo.; Columbus, Ohio; Dubuque, Ia.; Paducah, Ky.; Fort Wayne, Ind.; and in the states of Kentucky and California; as well as several railway labor organizations. Altogether, forty-three papers were scheduled for the conference. Three sessions were held each day of the meeting, namely on Saturday, Sunday and Monday.

Four papers among those scheduled related primarily to electric railways. One of these was the address of the president, Albert M. Todd, who compared the results of municipal ownership in Great Britain with private ownership of utilities in the United States, to the disadvantage of the latter.

Delos F. Wilcox presented an address on "The Present Street Car Crisis in America and the Way Out," the way out being municipal ownership, which Dr. Wilcox said American cities have been very slow to adopt. Chicago, for instance, voted for immediate municipal ownership thirteen years ago, but has not got it yet. Detroit and Toledo have also been talking about it for a long time, but Toledo has not even got private operation now. Dr. Wilcox thought that the experience of the people in Toledo would teach them to stop pussyfooting. Referring to the progress of the municipal operation idea he said: ".The result of the Railroad Administration and the campaign that has been carried on against public ownership, using the Railroad Administration as an illustration of the so-called or so-claimed inconveniences of public ownership, have made the business interests of the community as a whole more reactionary with respect to public ownership than they were before the war, while the underlying elements, the elements that are silent in ordinary times, are more radical." He suggested that the Seattle plan of purchase might be useful in other cities in working out the financial problem.

Mayor Thompson of Chicago was scheduled to present an address on "The People's Plan for Ownership and Operation of the Chicago Street Railway System." In his absence he was represented by Frank T. Ayers, who said that the Mayor's plan was for the railway lines to be operated by a street railway commission of five, elected by popular vote.

Abstracts of the papers on the San Francisco municipal system by M. M. O'Shaughnessy, city engineer of San Francisco, and on the Seattle municipal lines, by Thomas F. Murphine, superintendent of public utilities of Seattle, are published in abstract on pages 896 to 898 of this issue of the JOURNAL.

Before the close of the meeting the conference adopted a resolution in favor of public ownership of urban utility and transportation service, as follows:

RESOLUTION ADOPTED

Whereas, Adequate urban utility services (water, gas and electric supplies, transportation, etc.), are necessities of modern cities and are in their essentials service monopolies for any given city or metropolitan district, and which, as such, are eminently proper functions for governments to undertake and supply at low cost, and

Whereas, It has been the general practice to delegate these important service functions to private interests by charter and franchise grants with an almost universal resulting inadequacy and high cost of service, financial exploitation and the final break-down of the "System," also in view of the recent general demands made by the utilities companies for higher rates and the street railways and rapid transit interests for higher fares (which they have generally secured, regardless of contract obligations, even without proof of the justice or equity of their demands), usually to insure returns on fictitious values, overcapitalization, improvident financing and bad management, and

Whereas, The experience of over sixty years has shown that franchise trading for utility service undertakings and street railway and rapid transit grants and the selfish activity of these private interests for profit, have been the most active and potent factors in bribery, political corruption and prostitution of municipal governments in the country, and

Whereas, The cities of other lands, notably Great Britain and Germany, have found it expedient and to their best interests to eliminate private profit-making concerns, and to take over their urban utility and transportation service as municipal enterprises (the majority of American cities already own their water supply and some of the Pacific coast cities, San Francisco and Seattle, have undertaken public ownership of city transportation service), as the only definite and satisfactory solution of the municipal utility service problem, now therefore be it

Resolved, That we, the members of the Public Ownership League of America, in conference assembled, express our belief and devotion to the principle and practice of public ownership, and operation of the water, gas and electric service and urban transportation and marketing facilities of our cities, and that we pledge ourselves to work in every practicable way to bring this about; that we urge this upon all citizens in the interest of public welfare, political honesty and civic righteousness, the desirability, or rather the necessity, of taking over these func-

tions at the earli t possible date, and, eventually, all other essential services that are monopolies in their nature or scope, under public ownership.

Street Railway Situation in San Francisco*

Beginnings of the Municipal Line Described—City Now Has $6,750,000 Invested—Company is Also Affected by High Cost

By M. M. O'SHAUGHNESSY
Engineer of San Francisco City

SINCE the beginning of street railway transportation San Francisco has been well to the front. It was here that the first cable car in the United States was operated, because of the fact that San Francisco is built on steep hills, making it almost impossible for the city to expand unless power-operated vehicles were employed, the grades being in some cases as steep as 21.3 per cent. Following the natural tendency to keep to the forefront in urban transportation matters, San Francisco also was the first in the United States to take up municipal ownership by the construction and operation of electric street railway lines.

The present mileage within the city consists of 360 single track miles of railway. Of this, 25 miles are operated by cable and 335 miles by electricity. The electric lines are all standard 4-ft. 8½-in. gage, the cable lines 3-ft. 6-in. gage. The 360 miles of road are operated by two companies and the municipality. The California Street Cable Railroad operates a little more than 10 miles of single track, using thirty-eight cars. The United Railroads operates approximately 286 miles of single track, and owns about 700 electric passenger cars. The municipality operates close to 64 miles of single-track line, owning and operating 195 electric passenger cars.

San Francisco has always been noted for the large number of passengers carried per car-mile operated. This is due to the fact that the street grades are so steep in places as to be unpleasant for walking. The natural arrangement of the city is also conducive to riding, as all of the business portion is located at the northeast corner of the peninsula upon which San Francisco is built. This means that all of the population going into the business district or leaving San Francisco for the eastern side of San Francisco Bay must go to one side of the city. This makes the average length of travel much greater than would be the case if the business district were at the geographic center.

GENESIS OF MUNICIPAL RAILWAY

Prior to the fire which destroyed a large part of San Francisco in April, 1906, plans had been prepared and funds secured for the acquisition by the city of the Geary Street, Park & Ocean Railway. All thought of taking up this work was banished by the disaster, the money which had been appropriated for the railway work being used for the reconstruction and rehabilitation of streets and buildings. The Geary Street Railway's franchise had expired in 1903 and the company had been operating on a temporary month-to-month permit, paying into the city's treasury 5 per cent of the gross revenue. On Dec. 30, 1909, at a bond election, a proposition was passed calling for the expenditure of more than $2,000,000 for the construction of a little over 15 miles of single track overhead trolley electric railway over the old route of the Geary Street Railway, with extensions to the ocean on the west and the ferry on the east. This work was in part completed and placed in operation on Dec. 28, 1912; the remaining portion being placed in service on June 24, 1913. This railway was very successful from the outset, bringing in almost $500,000 in gross receipts the first year of its operation, with a passenger car revenue amounting to 34.19 cents per mile.

At the time this road was finished the city was compelled to plan for the traffic of the Panama-Pacific International Exposition. This exposition was to be held in a portion of the city which was not adequately served by street railways. The privately-owned roads declined to make the necessary extensions to serve the exposition. Plans were then made for greatly enlarging the Municipal Railway system and in August, 1913, a bond issue to the amount of $3,500,000 was voted by the people for the primary purpose of serving the exposition needs. This bond issue was to construct some 25 miles of additional single track and to purchase 7.8 miles of single track of the existing Presidio & Ferries system and the work was carried out prior to the opening of the exposition.

In 1916 the matter of constructing a line on Market Street was again taken up. A great deal of opposition from the existing private corporation against building parallel outer tracks was encountered, resulting in the matter being carried to the Supreme Court of the United States. The city, however, after winning all of its contentions was able on June 1, 1918, to commence the operation of its cars along the full length of Market Street over new tracks built outside of those belonging to the United Railroads.

At the present time the city has approximately $6,750,000 invested in its railway system, $1,000,000 of which came from earnings. During the past year it operated more than 7,200,000 car-miles with net passenger receipts of nearly $2,500,000, the revenue per car mile being a little more than 33⅓ cents. Almost 60,000,000 passengers were carried.

NET EARNINGS AFFECTED BY HIGHER COSTS

When the road was first placed in operation the conductors and motormen were paid on the basis of $3 per day of eight hours. This was later increased to $4, then to $4.50, and beginning with July of this year the wage is $5 for eight hours time. The wages paid by the United Railroads are lower, running from 46 to 52 cents per hour, but the men may work more than eight hours per day and every day in the month if they desire. Thus the average monthly pay of a man employed by the private corporation is greater than that of a man employed by the municipality where they are limited to eight hours per day and six days per week.

As indicated before, the passenger car revenue per car-mile in 1912 amounted to over 34 cents. For the past fiscal year this same revenue was but 33⅓ cents. During the same period the operating expenses have increased from 15.9 cents to more than 26 cents per car-mile. There has been no increase in the rate of fare, while the average length of ride per passenger has been very materially increased. Increased expenses of operation have been met out of net earnings. Beginning with July 1, 1919, when the last increase in wages was made, there will be no net income out of which to meet increasing costs or extensions with a continuation of the 5-cent fare. Heretofore it has been the custom to set aside 18 per cent of the gross passenger receipts to cover depreciation and to provide a fund out of which to pay damage claims. These funds are the only place it seems possible to secure the necessary money to meet the expenses. The percentage which has been set aside was very carefully determined at the time that we commenced operating the road. Other roads operating similar system are allocating to depreciation reserve about the same percentage of their passenger receipts. In order

* Abstract of paper presented at meeting of Public Ownership League of America, Chicago, Nov. 15-17, 1919.

to meet the July payroll a small amount has been borrowed from this fund, although as yet no definite action has been taken by the Board of Supervisors of San Francisco as to the final policy which will be pursued.

The privately-owned railway lines have not agitated for an increased rate of fare although the reports given out by the companies indicate that the companies did not meet their operating expenses and fixed charges during the past year, and they have not for a number of years paid dividends.

Because of a number of causes it is very undesirable upon the part of the corporations to increase their rate of fare. This is partially due to the competitive nature of the Municipal Railway and the privately-owned roads, and also because their franchises stipulate that the fare shall not exceed 5 cents. It is equally true that it is very undesirable for the city to raise the rate on the Municipal Railway, as it would immediately justify any claims the privately-owned lines might make for a similar fare, at the same time causing unfavorable comment from the opponents of muncipal ownership.

Within the past two weeks * the transbay ferry lines have increased their cash fare rate to Oakland, Berkeley, and Alameda, from 11 cents to 15 cents, and the commutation rate from $3.30 to $4.00. The whole matter of street railway operation is being watched with considerable interest by all parties, but at the present time there is no surface indication of any change in street railway fares or operating methods. Taken on the whole, San Francisco, having 1 mile of single track for each 1600 inhabitants, is very well provided with railway service of a high class.

While not wishing to advocate the increase of street railway fares at this time, it is my opinion that the traveling public can only expect to get what it pays for and that in any community served with street railways it is much more desirable that the returns to the corporation or to the municipality be sufficiently high to insure first-class service rather than to retain a low fare and allow the service to deteriorate.

Seattle Municipal Lines †

More Service Given Than Under Private Operation—Control of Jitneys Important—City Has More Tracks Than Any Other Municipal Railway

BY THOMAS F. MURPHINE
Superintendent of Public Utilities

ON APRIL 1 of this year the city of Seattle by the purchase of the street railway properties of the Puget Sound Traction, Light & Power Company came into possession of approximately 206 miles of street railway track and overhead system, 540 street cars, eighty pieces of real estate and a variety of buildings, carhouses and shops, freight sheds, machinery, tools and equipment, and a stock of supplies.

Certain portions of this property were appraised by various engineers and real estate experts. The street cars were valued at $2,500,000; the commercial real estate at $540,000; the buildings, carhouses, shops and freight sheds at $528,980; the machinery, tools and equipment at $500,000; and the stock of supplies at $350,000. The railway track and overhead system was not physically appraised at this time, but from former appraisals made by engineers of the Public Service Commission of the State of Washington and by comparison with the cost of construction of like track by the City of Seattle and the City of San Francisco, a value of $11,683,966 was placed on them by this department.

The total purchase price by the city of the street railway properties was $15,000,000 in utility bonds, payable in annual installments of $833,000 beginning March 1, 1922, with interest on the total amount of 5 per cent per annum, payable semi-annually.

REASONS FOR PURCHASE

The immediate causes that led up to the purchase by the City of Seattle of the railway properties of the private company were:

1. The service given by the company was totally inadequate.
2. The company was demanding an increase in fares of from 1 cent to 2 cents.
3. The company was further demanding to be relieved from all franchise obligations.
4. The employees of the private company were not being paid a living wage.

The city officials of Seattle maintained that with the relief from franchise obligations adequate service could be given and the fare kept at 5 cents.

The city has now operated its railway system for the first quarter of the year 1919 and a brief résumé of operating receipts and expenses for the first quarter with the comparison of the corresponding quarter of last year will be interesting. Our experience for the first three months, however, ought not to be taken as a basis for calculating future operations.

CHANGES SINCE MUNICIPAL OWNERSHIP

The operating economies proposed by the Department of Public Utilities have not, as yet, been put into effect for the reason that the physical connections between certain of the lines have not been completed; the skip-stop system has been installed on only four lines; downtown traffic is more congested than ever, the new traffic code having just been passed by the City Council; the campaign for the saving of power has been installed on only a few lines; and the thorough co-operation of the employees with the city has not, as yet, been fully effected.

However, under practically unchanged conditions the city immediately increased its service so that for the first quarter of its ownership it operated 4,146,850 car-miles as against 3,386,311 car-miles for the corresponding quarter of last year, showing that there has been an increase in service of 760,539, or a little more than three-quarters of a million car-miles, carrying a total of 33,015,082 passengers as against 28,394,008 total passengers for the corresponding quarter of last year.

The total revenue for the first quarter of this year was $1,229,039 as against $1,135,122 for the corresponding quarter of last year, and the total operating expense for the first quarter of this year was $1,052,727, leaving a profit over operating expense of $246,312. From this there has been set aside the sum of $198,781 to pay the interest on all outstanding obligations. Also, there has been set aside $20,000 more than has been paid out for accident claims, and approximately a like amount of $20,000 more than has been paid out for industrial insurance, leaving a net profit for the first quarter of $6,808.

The wages of trainmen and other employees were increased practically 20 per cent. The following schedule of wages paid motormen and conductors under city operation as compared with wages paid by the Puget Sound Traction, Light & Power Company show the increase that was paid to trainmen beginning April 1, 1919:

* The paper is dated Aug. 27, 1919.
† Abstract of paper presented at meeting of Public Ownership League of America, Chicago, Nov. 15-17, 1919.

	Company scale	City Scale
First six months of service	46 cents	53½ cents
Second six months	48 cents	56¼ cents
Over one year	50 cents	59⅜ cents

It will be noted that no amount has been set aside for depreciation, for the reason, which this department deems sufficient, that there has been expended during this quarter for maintenance of way and equipment the sum of $230,540 as against $131,796 during the same period in 1918. Approximately $100,000 more has been spent by the city in maintaining the track, overhead system and street cars for this quarter than was spent by the company for the corresponding quarter of last year.

The Traction Company set aside approximately $25,000 per month to take care of depreciation and allowed the property to depreciate. We believe that spending this depreciation fund now on the tracks and equipment (at least until the same are restored to a normal condition) is wiser than allowing the fund to accumulate, because we are appreciating the value of the property instead of allowing it to depreciate.

We expect to show in the near future, upon the completion of certain work now under way, with the complete installation of the skip-stop system and with certain reroutings, a large gain per month over the first quarter—at least enough to take care of the further increase of wages to employees to meet the increased cost of living.

It must be remembered, however, at this time, that the railway is still maintaining the largest franchise obligation, from a financial standpoint, that the private company agreed to maintain, *i. e.*, the care and maintenance of that portion of the street covered by the railway tracks. This, the department feels, is not a proper railway expense under city ownership and it is not being charged against the railway in San Francisco and other cities which own and operate street railway properties.

Means of Relief Discussed

The rise in wages and prices of material caused by the war affected all lines of business, but none more than the street railway business. Nothing is more certain in this field that the fact that the business can no longer bear the charges and burdens that it has borne in the past. This is evidenced by the number of street railway companies that have gone into the hands of receivers in all parts of this country; by the miles of track that have been actually abandoned and taken up, and by the applications for relief from franchise obligations that have been made almost universally to the appropriate authorities.

It is now generally admitted that it is impossible to pay out of a 5-cent fare all the things that have been paid out of it in previous years. About four standard methods have been tried or urged upon the street railways to meet the change in conditions, viz: (1), increase in fare; (2), relief from franchise obligations; (3), economies in operation; (4), public ownership.

No one of them alone will suffice. There must be a combination of at least three of them. The fourth method (public ownership) is not, taken alone, sufficient. It must be accompanied by Nos. 2 and 3.

The increase of fare has been tried almost universally and, while an increased fare brings increased revenue, it does not do so in proportion to the increase in fare, showing that a large percentage of the people, under an increased fare do not use street cars. The short-haul patron walks and the longer-haul patron rides only when necessity compels him to do so. This affects not only the railway but the manufacturer and the business man as well and is not compatible with the idea of service.

Relief from all franchise obligations is imperative, and under public ownership and management there can be no just reason advanced why any portion of the nickel fare should be taken to pay other than legitimate railway expenses. In fact, if the city owes a duty in the way of transportation, and everyone admits that transportation is a vital element in urban life, then the street car patron should be placed on an equality with patrons of other conveyances. At present, the car rider's nickel or fare has to maintain not only the car track but, to a large extent, the track of the competitors of the car in the field of transportation.

If the automobile can render service equal to the electric railway car, at a less cost, the sooner any city is convinced of that fact and acts upon it the better. But before any city can intelligently choose between rival systems of transportation it must first place them on an equal competitive basis, removing handicaps and equalizing burdens.

There is no indication now that automobiles can fill the place occupied by the street railways. They can perhaps take the cream of the business away from the street railways, and where the railway systems are privately owned might drive them into bankruptcy. Under city operation, unregulated jitney competition, while it cannot bankrupt the city, can make its street railways unprofitable and result in placing a burden upon the taxpayers that they would not have if the the street car and the jitney were placed on an equal basis.

More Mileage than Any Other Municipal Road

Seattle has been spoken of as having the largest publicly-owned street railway system in the world. This is only true in regard to mileage of tracks. The City of Seattle is now operating approximately 230 equivalent single-track-miles of street railway. The City of Glasgow, Scotland, operates less than 200 equivalent single-track-miles of street railway, while the City of San Francisco operates approximately 60 equivalent single-track-miles of street railway. The City of Glasgow, however, serves a population three times as large as Seattle and carries annually four times the number of passengers that the street railways of Seattle carry, while the City of San Francisco, with approximately one-quarter the mileage, carries one-half as many passengers.

Procedure in Formulating Safety Codes

THE United States Bureau of Standards has sent out a preliminary report on the subject of best methods of procedure in formulating industrial safety codes. Plans for future precedure were submitted some months ago to a large number associations, federal bureaus, state utility commissions and others, with the request that preferences be indicated. The result of the balloting has been that majority of those voting prefer the following plan: The preparation of safety codes and other standards by appropriate sponsor bodies, but under the auspices and procedure of the American Engineering Standards Committee as enlarged under a revised constitution. Of a total vote of eighty-five organizations, fifty-six indicated a willingness to join the American Engineering Standards Committee.

To consider this matter further, the Bureau has called a conference scheduled to be held in Washington on or about Dec. 8.

It is intended at that time to consider the procedure which should be followed in further work on safety codes and the co-operation that can be secured among the engineering societies, government department and other agencies that are actively concerned with safety work. Formal invitations to attend this conference were to be issued at about the date when the forms closed for this issue of the ELECTRIC RAILWAY JOURNAL.

Soldered Bonds for Track Bonding

The Use of Soldered Type Bonds Is Decreasing But There Are Many Places Where Their Use Is Found Most Convenient

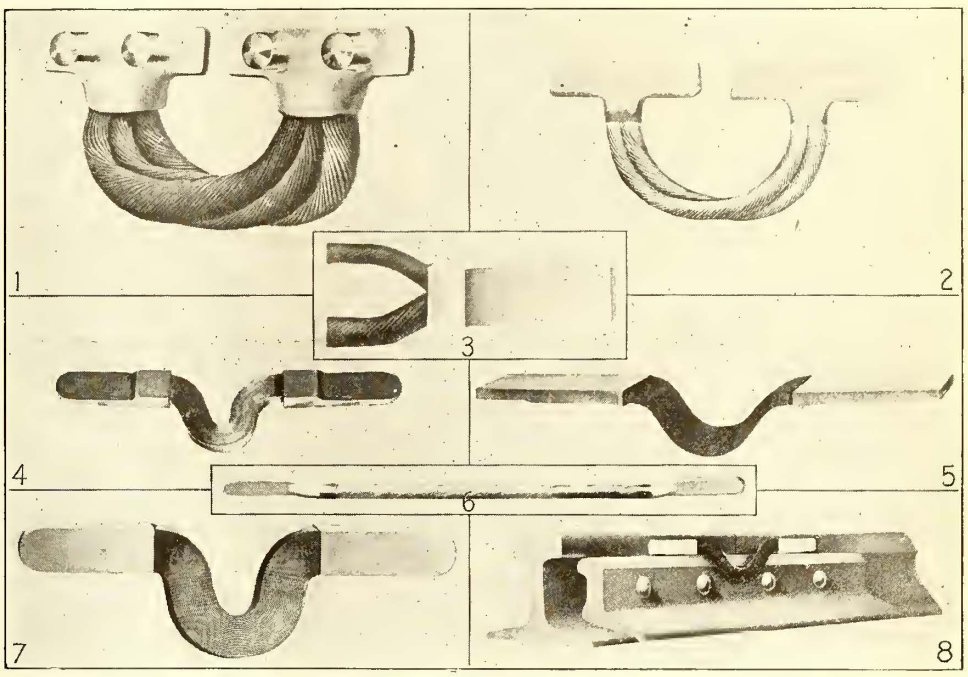
By G. H. McKELWAY
Engineer of Distribution, Brooklyn Rapid Transit System

THE use of solder for attaching the terminals of bonds to the rails was much more common a few years ago than it is now, although it is still much used, but generally in rather special cases. About 1905 or 1906 the practice became quite universal and at that time many engineers predicted that the soldered bond would become the standard American type and would eventually supersede the other types. It was claimed that the large contact surfaces permitted a low current density and a low contact resistance; that there was not the opportunity for moisture to work in between two soldered surfaces and so to deteriorate the contact, as there is in the case of the joint between an expanded terminal bond and the rail; that the bond, if well installed in the first case, should maintain its excellence of contact indefinitely, and lastly, that the condition of the contact could always be ascertained by either measuring the electrical resistance or by attempting to pull the bond from the rail.

Other points in favor of the soldered bond were: that in most cases a shorter bond could be used than with any of the expanded terminal bonds then on the market, thus making a saving in first cost; that short bonds could be applied to the head of the rail and would be of so little value that it would not pay to steal them; that no holes would be drilled in the rail and so it would not be weakened by the installation of the bonds, and that no elaborate testing instrument would be necessary in making periodic tests to see whether or not the bond contacts were deteriorating, as the inspector need merely see that the terminals had not loosened from the rail and occasionally kick one to assure himself that the contact was still in good condition.

Soldered bonds are made in several forms and are applied to all parts of the rails, although the head is the place most frequently used. Two of the accompanying illustrations show bonds adapted for use on the head of the rail. Both consist of two soldered terminals connected by a short loop of copper wire or ribbon. In one case the loop is arranged to hang down vertically and in the other to stand out horizontally. Of the two types the former is more frequently used and is justly the more popular as it presents less surface to the blows of anything hanging from the cars which might strike the bonds and tear them off. It is not often that the brake rigging or other portions of the car equipment get down low enough to harm the bonds, but it takes only one such occurrence to do wholesale damage to the bonds on long sections of track before the trouble is noticed and rectified. In order to avoid such damage the terminals of some bonds are made thinner at the top than at the bottom so as to cause the blows to glance off instead of striking them squarely.

Although in most cases the type of bond with the vertical loop is the one that should be chosen, yet the horizontal type must be used with rail joints of the Weber type which project out too far to permit of the vertical loop being bent across them.



TYPES OF SOLDERED BONDS

1—Soldered stud rail bond. 2—Tapered terminal bond for outer face of ball of rail. 3—Soldered terminal bond with two conductors of different size. 4—Bond with flat ribbon conductor. 5—Bond for underside of rail flange. 6—For bonding around splice bar. 7—Bond with thin copper strips for conductor. 8—Application of soldered bond to head of rail.

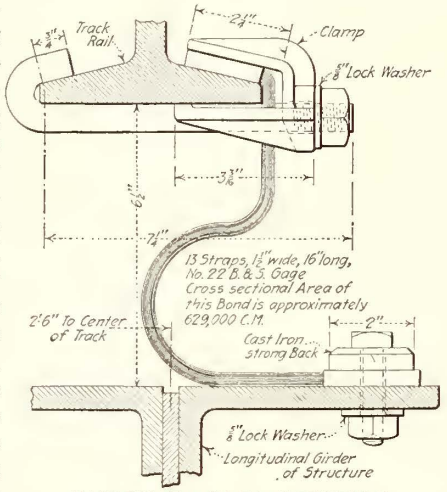
Of the two forms made with the vertical loop it will be found that the bonds made with wire conductors, if the size of the strands has been properly chosen, will generally outlast those having the terminals connected by ribbons, as the ribbons are much more sensitive to vibration and are therefore more easily broken.

There are two methods of inserting the wires into the terminals. In one they enter horizontally and in the other case vertically. The latter is to be preferred, as the bend in the wires at the entrance to the terminal which is necessary to bring them in horizontally, slightly weakens them.

The same type of bond that is attached to the head of the rail and projects out horizontally from it is also suitable for use on the base of the rail. Where the rails are held together with fish plates without shoulders, which cover up the base of the rail, these bonds can be installed on the top of the base, the loop projecting up. The terminals can be installed between the fish plate and the

edge of the base. Such plates, however, are but seldom used now so that if these bonds are used as foot bonds they must be installed on the bottom surface of the base. This position makes possible the use of much broader bonds than when they are installed elsewhere but the bonds are hidden in the ballast and cannot be renewed or repaired without going to much trouble and expense. The result is that when such a bond fails another one is installed at another location on the rail instead of trying to do anything with the old one.

When installing such bonds on new rail the best way is to invert the rail and attach the bonds to long lengths of the rail, then set the latter up in place and spike it. Soldered foot bonds have given good service on third-rails but are hardly practicable for running rails, not only because of the difficulty of installing and repairing them but because they are liable to be damaged when the ballast is tamped around them or by the creeping of the rail. The terminals of other soldered terminal bonds are attached to the web of the rail and the conductors are run either under or around the joint plates in the same manner as is done with compressed terminal bonds, the only difference in the two types of bonds being in the form and manner of attachment of the terminals.



BONDING TRACK TO STRUCTURE

A number of years ago one of the electrified steam roads made quite a thorough test of short copper bonds, one end of which was soldered to the web of the rail and the other to the joint plate. It was thought that a saving in first cost would be shown with this form of bond as it required so little copper. However, two bonds were needed for each joint, one at each end of the plate, and the labor cost of applying the two bonds far exceeded the saving in the cost of copper. In addition, the short bonds soon failed owing to the relative movement between the joint plates and the rail.

All of the bonds so far described are attached to the rail in the same manner, that is, by sweating them on. The rails at the points where the bond terminals are to be applied are first cleaned and polished, preferably with an emery wheel, although filing or chipping will do. These points of the rail are heated with blow torches until they assume a violet or blue color which indicates a temperature of about 500 or 550 deg. Fahrenheit. Occasionally, the rail ends can be cleaned with a sand blast, which makes a first-class job, but it is very seldom that such equipment is available for use. After heating, the locations for the terminals are tinned by first brushing them with acid or other soldering flux and then by rubbing on a stick of solder. This is repeated until the points are well tinned and then the bonds are put in place and clamped there with "C" clamps. More heat is then applied from the torches and wire solder is run in behind and around the edges of the terminal. Probably the best work is done when the bond terminals are clamped only tightly enough to insure their staying in place and then are brought up as tightly as possible after the solder has a chance to penetrate between the terminal and the rail. As the bond terminals are heavily tinned this will seem to be an unnecessary refinement to many, but it is a safer practice than that of setting the clamp up to its maximum tightness at first. Some of the terminals are knurled so that they will become imbedded slightly in the solder, and the chipping of the rail leads to similar results on the other side of the film of solder. One make of bond terminal is surrounded with wire mesh which serves not only to hold the copper ribbons together but also to act as a bond between the rail and the terminal by having its wires securely surrounded by the solder.

In order to be able to remove the clamp almost as soon as the soldering is completed, it has been the practice with some bonders to cool off the bonds with water, but the sudden shrinkage thus set up is liable to make the rail and the terminal pull apart and thus weaken the connection between them. It is safer to have plenty of clamps so that the work can go on and at the same time the bonds can cool slowly.

There are other soldered bonds which do not belong in the same class and which in fact do not belong to any single class as they are installed by first expanding the terminals in holes drilled in the rail and then by soldering them in place The first of these bonds were brought out several years ago and were never widely used, although some companies made them standard and used them in large numbers. They were similar to ordinary compressed bonds except that the terminals were tinned. After being compressed into the rail the solder on the terminals was melted by heat generated by the ignition of a small charge of thermit placed around the end of the terminal.

In another type, designed to be used on and in the webs of the rails, two small terminals project out from the regular flat soldered terminal. These studs, which are also tinned, are compressed into holes drilled into the rail and soldered there, the heat being supplied from blow torches.

Still another type is practically a twin terminal bond for installation on the head of the rail, the terminals of this bond too being tinned. The studs of this bond are driven into holes in the rail head by the blows of a hammer and then the solder on the stud is melted by heat from a torch.

One class of work where soldered bonds have been used on a large proportion of the work is in the bonding of elevated structures or steel bridges so as to protect their members against electrolysis or to add the conductance of the steel in the structure to that in the rail. These bonds are nearly always made of flat copper laminations with the ends of the strips soldered together and also surrounded by a strip of copper soldered around the other strips. The places where the bonds are to be placed are first cleaned and then the bonds are soldered to them in the same manner as to track rails. The vibration of the bridges or other structures is very hard on the soldered connections so that sometimes the soldered contact is not relied on solely but is reinforced by either a clamp or a bolt. This reinforcement not only holds the surfaces closely together and reduces their movements relative to each other, thereby preserving the soldered connection, but, if the latter is broken, the mechanical connection prevents the bond from falling to the ground below and becoming lost. On the other hand, many men dislike the use of the bolted or clamped contact for the reason that there is no way of proving that the bonders have made a good job of the soldering as the bonds will stay in place even if no solder has been applied to their terminals.

Where both the rails and steel structure are bonded it is the custom to install "equalizer" bonds between them so that the current density will be approximately the same in both. These bonds are generally of the soldered

type, either with or without the bolt or clamp, and run from the base of the rail to the steel structure. These bonds are frequently installed only on every third length of rail as that is often enough even when heavy currents are taken by the trains. Where connections between the rail and the structure are made on sharp curves where the rail is worn rapidly away by the grinding of the car wheels, and so must be renewed at frequent intervals, it is much simpler to sweat the bond terminals off of the old rail and on to the new one than to renew expanded terminal bonds every time that the rails are changed.

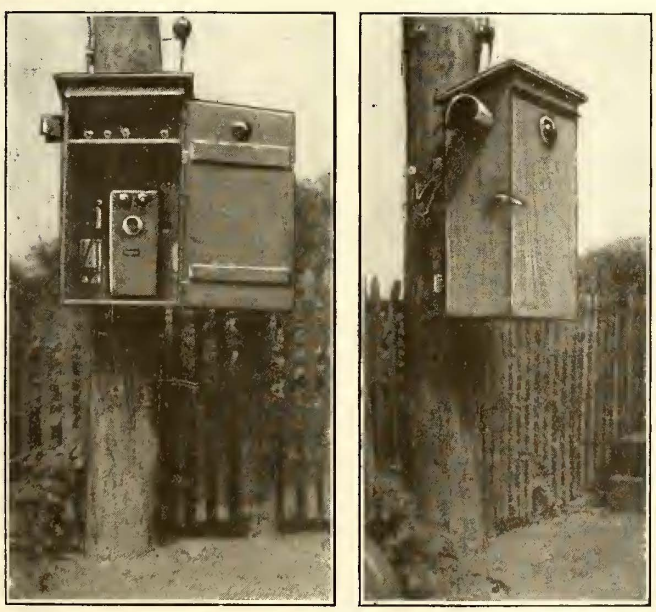
Manganese or other very hard rails are still often bonded with soldered bonds, but, with the exception of structure or equalizer bonds, the "plain soldered" bond has generally given away to some other type. It should be understood, however, that the "plain soldered" bond just referred to does not include the type where the bond is installed by expansion of the terminal as well as by soldering it to the rail.

Combined Signal and Telephone Box

For Communicating With Car Crew While en Route Dispatcher Causes Signal to Be Displayed in Box Which Contains Telephone

By Harry Restofski
West Penn Railways, Connellsville, Pa.

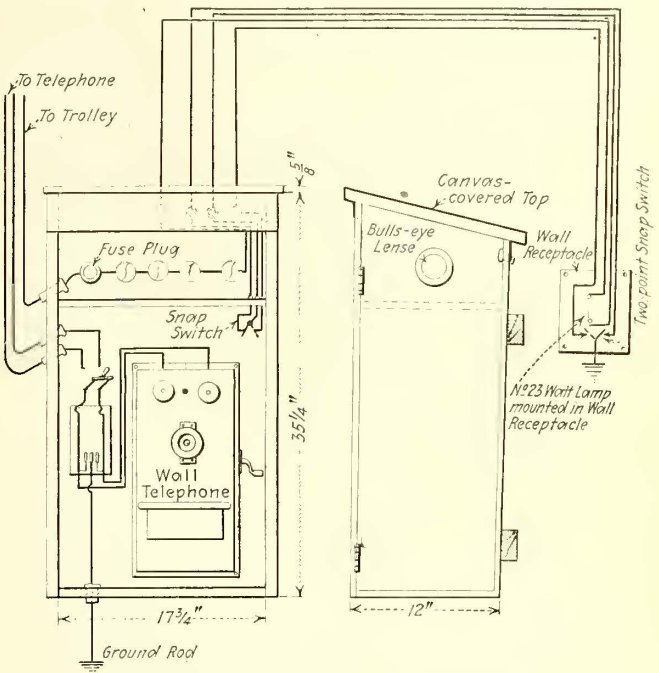
IT FREQUENTLY is necessary for the Uniontown dispatcher of the West Penn Railways to communicate with a car crew while it is en route to the terminal of that line. As this terminal is near one of the car shops in the outskirts of the city, it has been customary for the dispatcher to call the car shop and ask a man to notify the conductor



INTERIOR AND EXTERIOR VIEWS OF COMBINED TELEPHONE AND SIGNAL BOX

to call up the dispatcher from the shop telephone as soon as he arrived. It frequently was inconvenient for a man to leave his work in the shop to perform this duty and it also caused a loss of time not only on the part of the shop men but of the crew as well. In order to meet this situation, R. S. Cooper, head of the signal department, designed the combined signal box and miniature telephone booth with its circuits as shown in the accompanying illustration.

The box is built of wood and is located on a pole adjacent to the track in front of the car shop. It is provided with two compartments. In the upper one is a bank of four lamps, protected by a fuse plug, energized from the trolley wire. This lamp circuit is controlled by two two-point



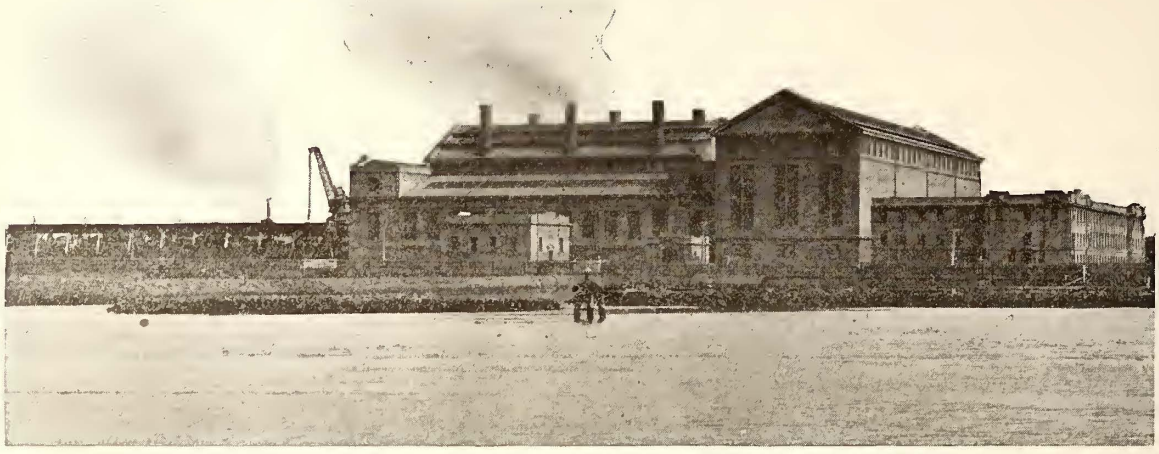
TELEPHONE AND SIGNAL CIRCUIT FOR SIGNAL BOX

switches, one located in the box and the other adjacent to the telephone in the earhouse. At each side and in front of this compartment red bull's-eye lenses are installed.

In the lower compartment of the box a wall telephone with protecting equipment is installed as well as a telephone switch and a two-point switch in the light circuit.

When the dispatcher desires to communicate with the crew he calls up the shop by telephone. The shop man who answers this call snaps his two-point switch and thus closes the circuit to the lamps in the signal box. A pilot light located just above the two-point switch in the carhouse, and connected with the lamps in the signal box, burns when the signal lights are lighted and thus provides an indication as to satisfactory operation. When the lamps are burning the bull's-eye lenses show red, and the signal crew is thus notified to stop and call up the dispatcher. The box is located at the end of a block so that a stop to operate the signals must always be made at this point. When the crew arrives the conductor connects his telephone, calls the dispatcher and when through turns out the lights by means of the two-point switch and disconnects the telephone from the line.

The Engineering Council, which represents the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society for Testing Materials, has been elected to membership in the Chamber of Commerce of the United States. The council has appointed to represent it in the national chamber H. W. Buck, of Viele, Blackwell & Buck, consulting engineers, New York City, and as alternate I. E. Moultrop, of the Edison Electric Illuminating Company of Boston.

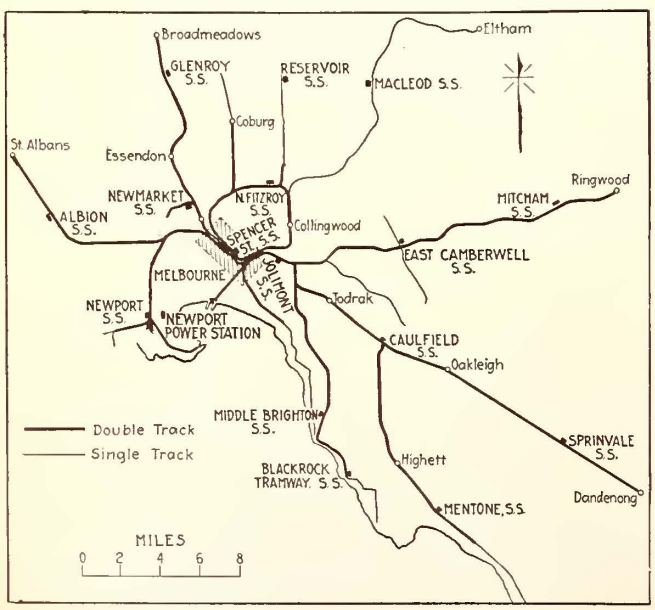


GENERAL VIEW OF NEWPORT POWER STATION OF THE MELBOURNE SUBURBAN RAILWAYS

Melbourne Suburban Railways Electrified—I

Australians Employ 1500-Volt Direct-Current System with Overhead Trolley—Some Interesting Features of the Power House, Distribution System, Substations, Tracks and Rolling Stock Are Described

THE Suburban Railways System of Melbourne, Victoria, comprising approximately 350 single-track miles, including sidings, has been electrified during the last few years. The electrified lines comprise about 155 miles of track route, of which 110 miles is double tracked and the remainder is single, triple, four tracked and six tracked. The project was first taken under consideration in 1908 and the firm of Merz & McLellan, consulting engineers, London, engaged by the Minister of Railways of the Province of Victoria to make a report on the proposed electrification of the system. After a very comprehensive report had been made by the engineers the subject was dropped for a time because the prospective financial results did not justify the proceedings at that time. But it was revived a few years later under the premiership of Hon. W. A. Watt, and after close investigation the Parliament decided to proceed with the conversion to electric traction of the whole suburban railways system. The basis of this decision was the use of the 1500-volt direct-current system, using overhead contact wires. A series of articles published this year in the Australian paper, *The Commonwealth Engineer,* which were written by E. P. Grove, representative of the consulting engineers, give a very full account of the installation and from them this article is abstracted.



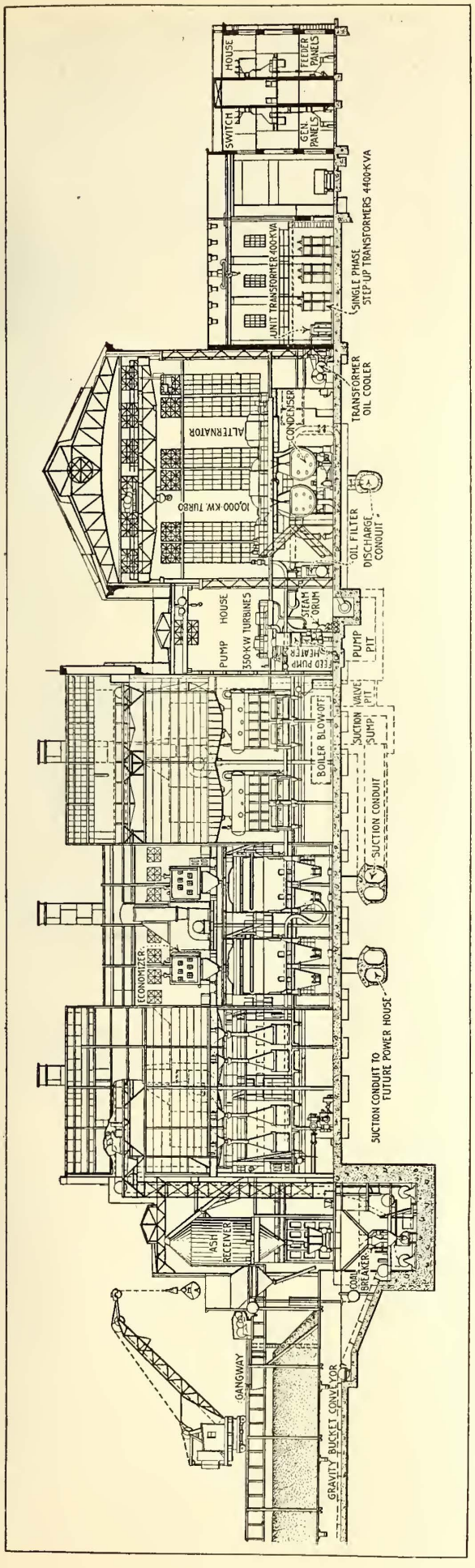
SUBURBAN RAILWAY SYSTEM OF MELBOURNE

New Power House Construction

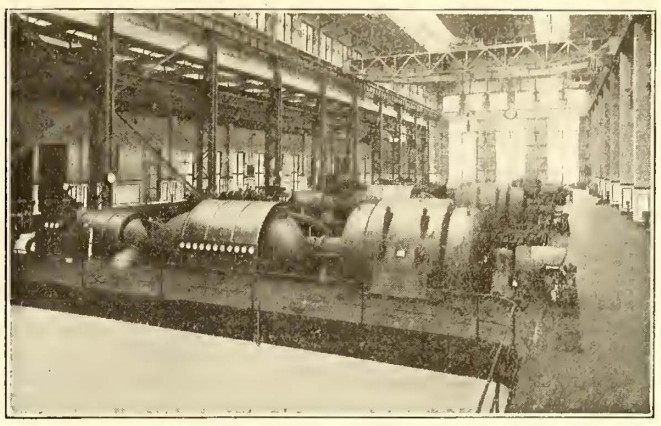
One of the major parts of the electrification plan was the construction of a 60,000-kw. generating station. It was located on the River Yarra, where an ample supply of condensing water was afforded, the name of the near-by town of Newport being adopted to name the power plant. The location of this site with respect to the general suburban railway system may be seen in the accompanying map.

Differing from America's practice which tends strongly toward fewer units of large capacity rather than a larger number of units of smaller capacity, this Australian station is laid out to accommodate six steam turbine generating units of only 10,000 kw. normal rated capacity. These generators have a maximum continuous output of 12,500 kw. at 0.95 power factor with a temperature rise not exceeding 45 deg. C. on an intake air temperature of 25 deg. C. These units generate 25-cycle three-phase energy at 3300 volts pressure, which is stepped up to 20,000 volts. At this voltage, it is transmitted to the several substations.

Each of the two boiler houses which are laid out at right angles to the turbine room is equipped with twelve boilers of Babcock and Wilcox water-tube marine type. The twenty-four boilers are arranged on either side of a central firing aisle and grouped in pairs, and the gases from each pair are handled by one fan and one chimney, both of which are placed immediately over the corresponding boilers. But each boiler is equipped with its own return tube superheater and Green economizer. Pockets are provided below the economizers for collecting soot and flue dirt which is extracted by a suction system which is also employed for handling the ashes.



LONGITUDINAL SECTION THROUGH NEWPORT POWER STATION

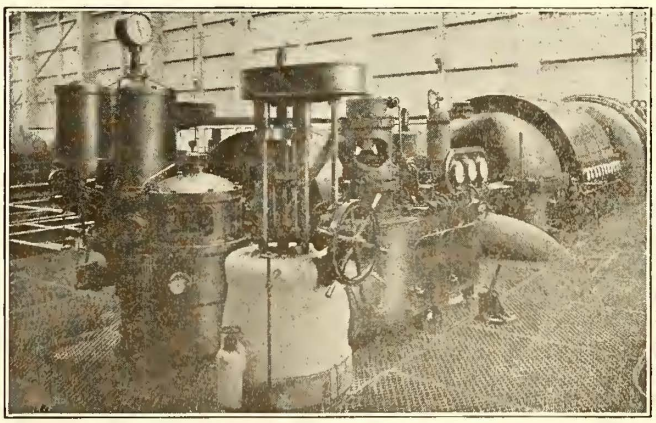


TURBINE ROOM IN NEWPORT POWER STATION

One of the more interesting features of the plant is the equipment for handling ash and coal. Coal is delivered to the plant in 15-ton bottom dump cars, which deliver their loads into four 50-ton track receiving hoppers, two opposite the end of each boiler room. The sidetracking is so arranged that after dumping their loads the cars can be returned to the main line by travel in a continuous direction without switching back. At present a steam locomotive is used for shifting cars in this service, but it is ultimately planned to electrify the sidings at the power plant and employ two electric locomotives.

From the receiving hoppers, the coal passes down through crushers, from whence it is discharged into bucket conveyors, three in number, of which the two outside ones carry the fuel to the two rows of overhead bunkers above each firing aisle. These overhead bunkers supply a capacity of 1500 tons for each boiler house, and the coal is discharged from them by gravity chutes direct into the boiler receiving hoppers.

A 10,000-ton coal storage area is also provided opposite each boiler house. For delivering coal to these storage areas, it is received in the same track hoppers mentioned before, from which the central bucket conveyor carries it up to a structure extending over the storage area from which it is dumped as required. This same conveyor continues to the end of the structure and passes down into a tunnel underneath the structure and returning at this level to the room underneath the main track receiving hopper. Coal can thus be taken from the storage pile underneath the structure by means of chutes which discharge by gravity onto this bucket conveyor and carried back to the power plant where it is dumped on the two conveyors leading up to the overhead bunkers. Or, as a duplicate system, the coal from the storage area may be picked up by a traveling crane and grab bucket which is mounted on the structure

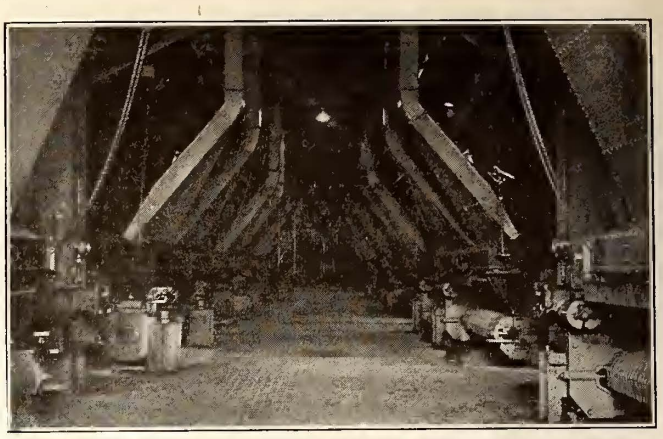


STEAM END OF ONE OF THE 10,000-KW. TANDEM TURBO-GENERATOR UNITS

over the storage area, and discharged into an auxiliary hopper which in turn discharges into the main receiving hoppers. One of these traveling jib cranes and bucket conveyor systems is provided for each boiler room.

The ashes from each boiler fall from the stoker into a bunker in the basement, capable of storing an accumulation over some twelve hours of working at full load. A portable crusher for breaking up clinkers is operated on a narrow gage track below the ash bunkers and discharges into a pipe through which the ashes are conveyed by air suction to elevated ash receivers outside and at the end of the boiler houses. From here they are discharged by gravity into cars on the main coal siding.

The six steam turbines, of which four are installed at present, are of the Parsons pure reaction type with a single-flow high-pressure cylinder and double-flow low-pressure cylinder, and they operate at a speed of 1500 r.p.m. Two auxiliary turbines of 350-kw. capacity each, delivering 25-cycle three-phase current at 440 volts, are used mainly for starting up the condensing plant auxiliaries prior to getting the main turbines under way. When the latter are in operation, the 440-volt supply for all station auxiliaries is taken from main transformers or from a separate unit transformer provided for each main turbine generator unit.



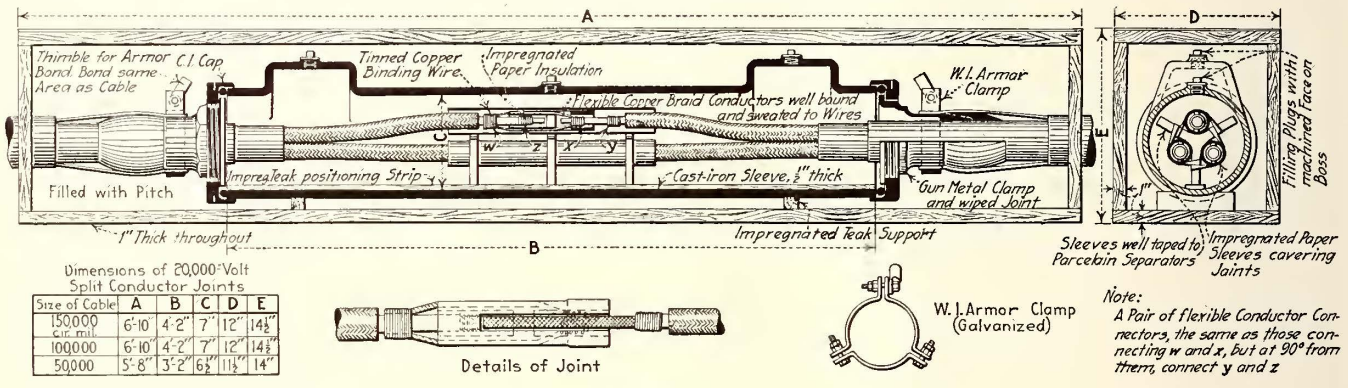
FIRING AISLE OF THE NEWPORT STATION BOILER ROOM

Distribution System

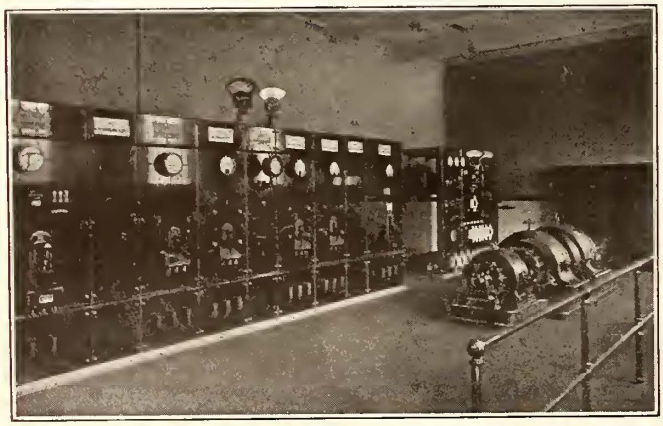
From the Newport power house thirteen 20,000-volt supply lines radiate to the fifteen railway substations. All of these lines are of the split-conductor type of paper-insulated, lead-covered and wire-armored cable, having a protective serving of heavily compounded Hessian tapes between the lead and the armoring and again outside the armoring. They were furnished by the British Insulated & Helsby Cables, Ltd., of Prescot, England.

These cables are laid mainly in trenches in the streets owing to the very limited space available along the right-of-way. The trench averages 4 ft. deep, and the cables are laid at a distance between centers of 21 in. and are covered by red gum boards 9 in. wide and 1½ in. thick, laid about 4 in. above the cable. Joints in the cable are made in cast-iron boxes fitted with covers to provide for filling them with compound so that air pockets will be eliminated.

All of these supply lines to the various substations except that to the Albion substation are laid underground their entire length. Only the first mile of the line to the Albion substation is underground, and from this point, the two cables supplying this substation are connected to two over-head transmission lines carried on high steel masts of construction similar to those carrying the contact wires on electrified tracks. These masts will be so arranged that by the introduction of steel bridges between them, the track can be electrified and doubled if necessary.



METHOD OF SPLICING 20,000-VOLT SPLIT CONDUCTOR CABLE

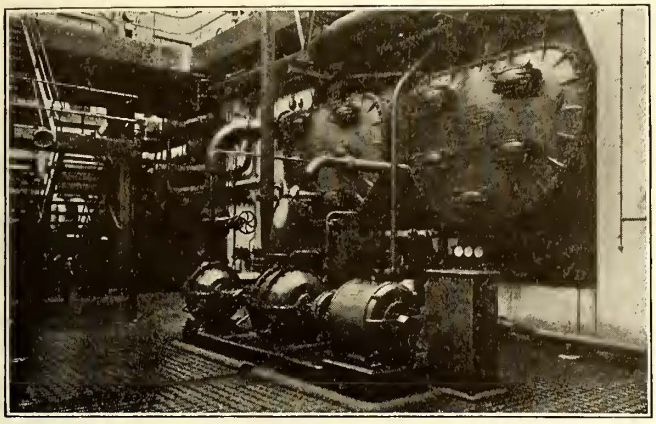


FEEDER CONTROL SWITCHBOARD AND LIGHTING AND BATTERY CHARGING MOTOR-GENERATOR SET WITH DIRECT-COUPLED BOOSTER

Substation Construction and Equipment

The thirteen railway substations are variously equipped, some of them with temporary installations on account of the difficulty which was experienced in securing the specified machines. The installation in the various substations comprises from two to four 22,000/1500-volt rotary converters of 1500, 2250 or 3000-kw. capacity, and one substation has two 350-kw., 600-volt rotaries. Some of these were manufactured by the Siemens Brothers Dynamo Works, Ltd., of Stafford, England, and some by the General Electric Company, Schenectady.

The substation buildings are constructed of brick and stucco, with flat concrete roofs covered with malthoid. Each building comprises two or more rotary converter bays with an unloading bay, and, in the case of the central substations, a bay set apart for signaling equipment. An annex forms the switchhouse and operating gallery. Each rotary converter is installed in a separate compartment and during the starting up and operation of any particular rotary, the



TWIN CONDENSERS WITH AIR AND WATER EXTRACTION PUMPS

chamber is screened off and the locking gear on the entrance gate is interconnected with the 20,000-volt oil switch controlling the supply to the rotary converter transformers, and with the operating levers controlling the 1500-volt d.c. switch gear.

The switch house is three stories high. The ground floor is used for the installation of the cable terminal boxes, grounding switches, and potential transformers. The second floor is used for the oil-switch cells and current transformers, and the third floor for busbar chambers.

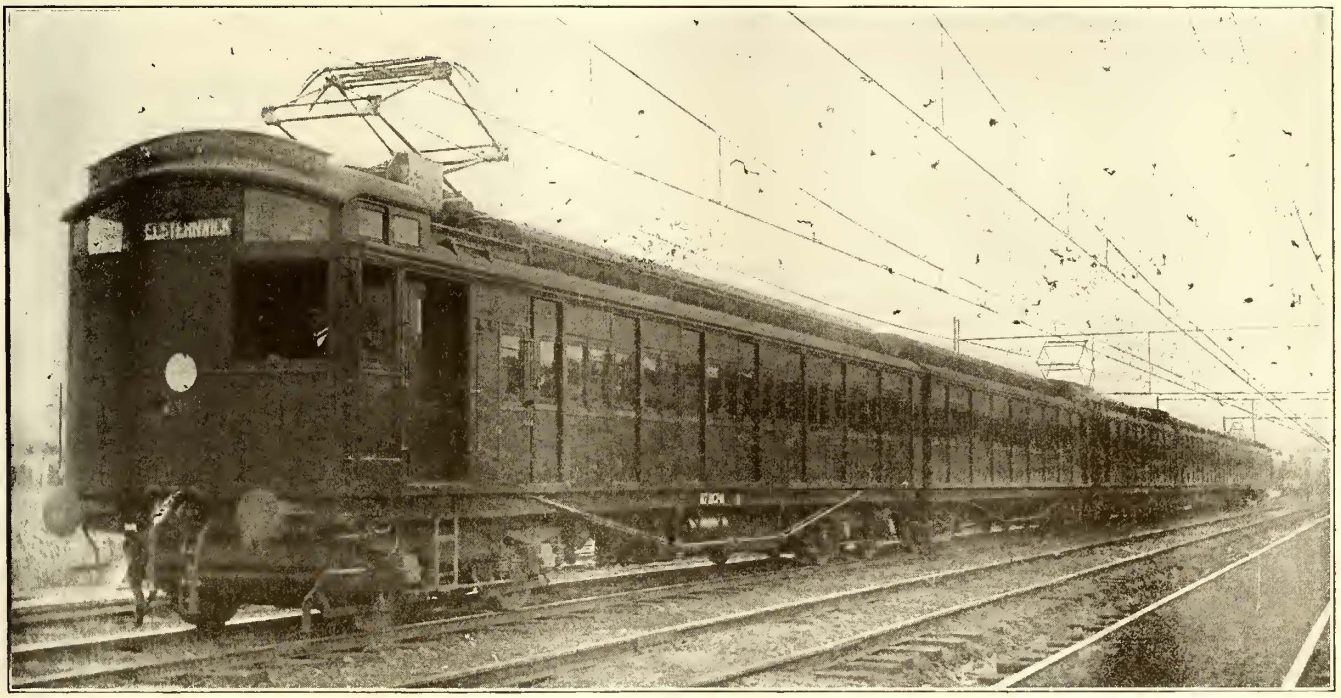
The operating gallery is also provided for on the second floor, and the 20,000-volt oil switches, 1500-volt d.c. switch gear and the 2200-volt signal supply switching are controlled from this point. The 15,000-volt d.c. positive busbar and switch gear is located underneath the operating gallery, and the negative and equalizer busbars are placed in the basement below the rotary converters.

The signaling bays are equipped with 65-kw. motor-generator sets for providing a supply of 2200-volt single-phase current from the 440-volt side of the three-phase auxiliary transformers to the signaling circuit. These motor-generators consist of a three-phase induction motor connected by slip coupling to a 2200-volt single-phase 25-cycle generator having the exciter on the same shaft. The generator shaft is also solid coupled to a 110-volt d.c. motor, so that if the a.c. supply fails the signal current will be maintained from storage batteries which are of 500-amp.-hr. capacity.

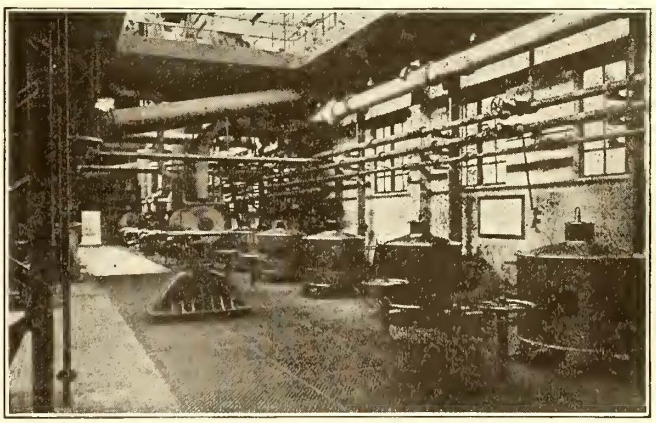
THE PERMANENT WAY

Normal permanent way construction consist of 100-lb. "T"-section rails double spiked to untreated ties of hard red gum, ironbark or boxwood, dimensioned 9 ft. x 10 in. x 5 in. and spaced 2 ft. 10 in. centers at intermediate ties and 8 ft. 8 in. centers at joints. The approximate depth of bluestone ballast is 15 in., of which 10 in. is under the ties. The track gage is 5 ft. 3 in. Tracks are centered 11 ft. 8 in. apart with provision for increase of this dimension. Minimum structure clearance above the platform level on tangent track is 7 ft. from the center of the track. This dimension is increased to 8 ft. on curves of 800-ft. radius. The minimum curve is on the Flinders Street (Melbourne) viaduct and this has a radius of 600 ft.

The line between Sandringham and Broadmeadows, which may be taken as typical of the system, contains a maximum grade of 2 per cent. Between North Melbourne and Broadmeadows, a distance of approximately 9 miles, the average grade is 0.85 per cent. The maximum permissible speed on this section is 52 m.p.h., with restrictions on



STANDARD SIX-CAR TRAIN WITH THREE MOTOR CARS



CIRCULATING PUMP ROOM WITH VERTICAL SHAFT MOTORS MOUNTED AT THE FLOOR LEVEL

curves to suit a maximum track super elevation of 3 in. and restrictions at junction work to suit train operations. Practically all curves have a 150-ft. easement approach.

Rolling Stock Equipment

Electric locomotives are not used in connection with the electrification of the Melbourne suburban railways, but instead multiple-unit control motor cars. The practice followed is to operate the normal six-car train with a make-up consisting of a motor car with its controlled end outward at each end of the train, and with a third motor car placed about the center of the train. Thus about one-half of the cars have been equipped with motors, while a number of the trailers are equipped with control apparatus at one end. The balance of the cars are equipped with the necessary cables for multiple-unit control through any train, but without control apparatus.

The rolling stock for the electrical operation has been provided by equipping the old steam road coaches with new trucks and motors, and no new rolling stock has been purchased. Approximately 45 per cent of the electric rolling stock will consist of compartment cars with swing doors, the remainder being a combination type having sliding doors and cross-seats, with a corridor running the length of the passenger portion of the cars. The majority of the latter type of cars are partitioned off into sections to form smoking and non-smoking compartments. These cars seat from seventy to eight-four people.

The rolling stock equipment comprises 359 motor cars, fifty-six trailers equipped with control apparatus and 287 non-control trailers making a total of 702 cars equipped for electrical operation. Each motor car is equipped with four GE-237 motors rated at 140 hp. and normally a 750-volt machine. The two motors mounted on one truck are permanently connected in series and operate as one unit, either in series or in parallel with the two motors of the second truck. Among other equipment placed on the motor cars are the pantograph, dynamotor control apparatus and air compressor for Westinghouse brakes.

The weight of the motor cars completely equipped is from 105,000 to 107,000 lb., depending on the type of car, and the weight of the trailers equipped with the control apparatus is from 58,000 to 62,000 lb. The weight of the trailers not equipped with controllers is from 57,000 to 61,000 lb.

The car bodies are of combination construction, having a steel underframe and bulkhead and the remainder of the body framing of Australian wood or teak. Steel is also used for the exterior and interior panels, and for the headlining. Electric lights have been installed in all cars by modifying the existing Pintsch gas fittings, two of which which are provided in each compartment with total of 80 cp.

The motor trucks used are equipped with four 42-in. wheels, and arranged for inside suspension of the motors. The axles are 6 in. in diameter, and the journals are 9 in. x 5 in. The brakes are of the clasp type acting on both sides of the wheel.

A second installment of this article dealing with the overhead construction which embodies many unusual and unique features will appear in a later issue of ELECTRIC RAILWAY JOURNAL.

In testimony of the effectiveness of the efforts work of its employees interested in the safety campaign, the Ford Motor Company states that with a 26-per cent increase in number of employees between October, 1916, and May, 1919, there has been an 80-per cent decrease in lost-time accidents. For the year ending July 31, 1919, the plant had only one accidental death, a remarkable record for an average of 50,000 employees.

Removing Track with a Small Force of Laborers

By A. G. Drury
Cincinnati, Ohio

A PUBLIC utility having failed to agree with the municipality in regard to the renewal of a franchise which had expired, permitting operation over two streets, was required by the city to remove its tracks from these streets. There was about 3000 ft. of double track on each street, making a total of 12,000 ft. of single track.

The line on one of these streets paralleled a line one square distant on which the company had a franchise, with the result that in this case the two lines owned by the same company were essentially competing against each other. The company was glad to be relieved of this operation with attendant cost of upkeep, renewals and repairs, to say nothing of the repaving of parts of the street.

On the other street, the situation was different. Certain parts of the line were more than a quarter of a mile from the nearest car line, which meant some loss of patronage. However, the tracks had to come up.

The removal of the tracks on the first street was accomplished in the regular method. The joints of the rails were removed and the single lengths of rail were loaded on a flat car by sliding them by hand up an incline of short skids on to the car.

By the time the company was ready to take up the rails on the second street a distinct shortage of labor had developed, and that which remained was not so efficient as the former gang. In fact, the company did not have enough men to load the rail in the old way, making even what might be termed poor progress.

The track on this street was of 70-lb. rail in 30-ft. lengths. The conductor on the car which hauled the flat car devised a way for loading the rail which worked out very well in this case.

The storage yard to which the scrap rail was hauled was on another line beyond the south end of the street under discussion. The gang therefore began at the north end of the street and would free first the right hand rail, then the left, from the ties and street in strips of seven rail lengths—that is with about 210 ft. of rail jointed together, the joint between the seventh and eighth rail being broken. The rail was freed from the ties and street by ordinary hand jacks, being placed in holes dug about 20 ft. apart under the rail and forcing it up, the wood ties being knocked from the rail with sledge hammers, and cross-rods of iron being cut.

When a 210-ft. strip of each rail was thus freed from the street, the south end of the strip was fastened to the flat car by means of a chain, and the car would then drag it back on to the untouched part of the street. There it would be separated into its 30-ft. lengths by removing the intervening joints.

To load it on to the flat car, the men would lift the end of the rail on to the end of the flat car which would then be started in the direction of the rail, *i. e.,* north, thus forcing the rail to slide up on the car. Two men on the car and the remainder in the street would control the direction of the rail so that it would not slide off the car.

When two such strips, or fourteen rail lengths were thus loaded, the car would haul them to the storage yard where three men would unload them by sliding them off on skids, the piling up of the rail being left for another time.

When the cost of the job was figured up, this method showed only a slight saving in cost of removing track over the old method, but it did demonstrate that track could be removed with a much smaller gang of men than was usually employed for the work, which was a very important consideration at that time.

Correspondence on Washington Testimony

Letters from Messrs. Stotesbury, Mitten and Joyce with a Memorandum from Mr. Warner, Relating to Testimony Before the Federal Electric Railways Commission, Are Published

THE following correspondence is published with the permission of the Philadelphia Rapid Transit Company and the North American Company.

LETTER FROM MR. STOTESBURY

Chestnut and Fifth Streets
Philadelphia, Nov. 7, 1919.

T. E. MITTEN, President,
Philadelphia Rapid Transit Company,
Dear Mr. Mitten:—

The "Memorandum Re Philadelphia Rapid Transit Company" which I sent you some days ago cannot be considered as being anonymous because it was presented to one of my business associates by Mr. R. L. Warner of the North American Company, 30 Broad Street, New York City.

I shall be glad if you will make such answer to the North American memorandum as will set our friends straight in the matter.

Yours very truly,
E. T. STOTESBURY.

The memorandum above referred to reads as follows:

"(1) The American Electric Railway Association has presented before the Federal Electric Railways Commission, appointed by President Wilson, the universal need of increased revenues for electric railways, if these are to continue in operation. The testimony presented by a large number of bankers and operators two months ago were given considerable publicity throughout the country and the need of relief was generally conceded in editorial comment.

"(2) There has been a decided change in the situation during the last two months, due to statements emanating from Philadelphia quoting Mr. T. E. Mitten as entirely satisfied with a 5-cent fare in that city. These statements were generally seized upon by the radical press throughout the country as condemning the electric railway case through the testimony of one of its own operators.

"(3) So widespread has been discussion on this subject, that Mr. Mitten was summoned to appear before the Federal Electric Railways Commission two weeks ago and explain the reason for such satisfaction with a 5-cent fare in Philadelphia. Mr. Mitten did not appear in person but sent a special assistant to testify in his behalf. The general conclusion adduced from this testimony was not only that the 5-cent fare was satisfactory to Mr. Mitten, but that the results achieved by the Philadelphia Rapid Transit Company were due entirely to good management and could be duplicated in almost any other city in the country. These further statements designed to convict the entire industry of gross inefficiency in handling its business, were likewise given widespread publicity throughout the country.

"(4) Sentiment disclosed at the convention last week of the American Electric Railway Association was one of universal condemnation of the harmful publicity put forth from Philadelphia, resulting in several instances in failure of negotiations with public authorities for relief and the suggested retirement of the railway executives because of the resulting crisis. All the results of months of effort in public education have been largely minimized.

"(5) The only reason that can be assigned to Mr. Mitten's action, is that local conditions require his present stand; the facts as adduced from the reports of the Philadelphia Rapid Transit Company did not disclose that this company is more advantageously situated than many others. Maintenance and reserve for renewals are being sacrificed to pay dividends. The Philadelphia Company set up 15 per cent of its operating revenues for these purposes in 1918. It spent practically all of this amount for maintenance and its maintenance expenses per mile of track and per car were less than the corresponding figures in Cleveland, St. Louis and Milwaukee, where we know that maintenance and renewals were not at normal due to the conditions produced by the war. A number of the state commissions have specified as reasonable 10 per cent of the operating revenues for depreciation reserve in addition to the amounts expended for maintenance. Some traction company mortgages require that at least 20 per cent of operating revenues be used or set aside for maintenance and depreciation and engineering testimony generally is to the effect that this amount is the minimum if the property is to be maintained. The rising cost of wages and materials with stationary fares, has made 20 per cent inadequate. It is estimated that an average rate of fare of 6¼ cents would be necessary for the Philadelphia Rapid Transit Company to provide for maintenance and depreciation in accordance with accepted standards and pay 5 per cent dividends on its capital stock.

"(6) An erroneous impression of the prosperity of the Philadelphia Rapid Transit Company is obtained from the statement that it has paid a 5 per cent dividend on its capital stock. The common stock of the company amounts to only $30,000,000 and represents a very small portion of the total investment devoted to city transportation service. Philadelphia in addition to its 5-cent fare secures an additional charge of 3 cents for some of its transfers; the revenue from this source alone was nearly equal to the dividend paid last year.

"(7) Traffic conditions in Philadelphia are unusual; it is one of the few cities whose riding population increased during the war. The relative location of its industrial and residence districts enables cars to be loaded in both directions and its standards of loading are very far below the standards prescribed by public authorities for other cities. These traffic conditions, methods of accounting, and a large proportion of new cars, rather than superior management are responsible for the fact that the company has remained out of the receiver's hands.

"(8) The value for rate making purposes of the property of Philadelphia Rapid Transit Company is probably not less than $120,000,000. Its gross operating revenues for the calendar year 1918 amounted to about $31,000,000. Against this value and this gross, the Mitten management charged to depreciation account only $320,000. This is only 0.27 per cent of value and 1.03 per cent of gross operating revenues. For example, these figures are to be compared with those of United Railways Company of St. Louis. With a value approximately $60,000,000 and gross operating revenues about $13,600,000, maintenance charge was approximately 15 per cent of gross operating revenues, amounting to say, $2,040,000, and in addition thereto, charges to depreciation account amounts to $1,360,000, that is to say, 2¼ per cent of value and 10 per cent of gross operating revenues.

"(9) Had the Mitten management been equally conservative in regard to Philadelphia Rapid Transit Company, its charges to depreciation should have been over $3,000,000, this would have not only wiped out his so-called 5 per cent dividend on $30,000,000 stock, but would have resulted in a deficit of about $1,200,000 after paying interest charges. Upon the basis of sound bookkeeping the Philadelphia Rapid Transit Company is not paying dividends earned but paying dividends in liquidation. The accrued liability for future replacements is not less than $18,000,000. The liability shown on the balance sheet as of December 31, 1918, was about $1,150,000.

"(10) In conclusion

"(a) The allegations that a 5-cent fare in Philadelphia is remunerative have delayed fare adjustments in many other cities and subjected invested capital to further jeopardy;

"(b) Philadelphia requires fare increases as do all other cities and the public is being fooled into believing that increases are not contemplated;

"(c) The property cannot be kept in a proper condition of repair and the corporation cannot be made solvent on the present rate of fare;

"(d) The accrued liability for future replacements is not less than $18,000,000 or about $17,000,000 more than is recorded on the books of account.

LETTER FROM MR. MITTEN

Philadelphia Rapid Transit Company

Philadelphia, Nov. 10, 1919.

MR. E. T. STOTESBURY, Chairman, Board of Directors,
Philadelphia Rapid Transit Company.

The writer of the "Memorandum Re Philadelphia Rapid Transit Company" is evidently unfamiliar with both facts and figures so far as Philadelphia is concerned. The treatise is misleading and bristles with untruth and misrepresentation.

It was only after the Federal Electric Railways Commission had been in session two months and Chairman Elmquist became more insistent because of the fact that Philadelphia, in marked contrast to the experience of other street railway companies, had succeeded in continuing the 5-cent fare despite advancing costs, that I agreed to present

PHILADELPHIA'S ANSWER TO THE TRACTION QUESTION

Philadelphia's Plan is not offered as a cure-all for other cities. Every situation has its own peculiar difficulties to overcome, but in the light of this experience, it is plain duty to decry the thought that there is any cure for the present trouble excepting that which lies in honest dealing, efficient management, effective workers.

There are striking examples of that which follows dependence upon increased fares alone.

Efficiency in management and effectiveness in men must prevail, else other means of transportation will follow higher fares, street cars will be supplanted, and the industry destroyed.

Philadelphia's results under this management are contained in the report for the eight years ended Dec. 31, 1918. This report and the books from which it was derived were both subjected to the scrutiny of separate sets of able accountants representing the City of Philadelphia and the Public Service Commission of Pennsylvania. $31,337,807.04 representing 15 per cent of gross earnings was, by agreement with the city, set aside for maintenance and renewals. This fact speaks for itself and cannot be now confused by figure-juggling separate items of expenditure or appropriation.

More than 15 per cent of our greatly increased earnings are now being set aside. This represents about $10,000 per mile of used track per annum, which is in our opinion here adequate, and is far in excess of the average set aside by other street railway companies. In this connection it must be borne in mind that gross earnings here approximate $60,000 per mile per annum and that while our heavier track and better designed cars represent a greater capital investment, their effective life is much above the average.

The physical condition—cash reserves, and earned but undistributed surplus of P. R. T., will today compare favorably with any similar system.

Transit matters at St. Louis and Milwaukee are not in such condition as to warrant the assumption that the North American Company has yet produced a Moses to lead the industry out of its wilderness.

The North American "slide-rule" method of computation, which can be made seemingly to override facts and show an undue depreciation of property, will fail to impress Philadelphians who are familiar with the greatly improved condition of P. R. T. since the incoming of this management in 1910. The production capacity of the entire transportation system has been so greatly developed, and so substantial a proportion of physical improvement has been here paid from earnings, that the fixed charges, which in 1910 required 45 per cent, are now satisfied with but 28 per cent of the gross earnings.

Representing accomplishment and present sound condition:

The basic 5-cent fare has been retained. The average rate of 4.13 cents has been reduced to 3.98 cents—a saving to passengers of $7,941,983.73 in the period.

Wages increased 151 per cent—average day's pay now $5.51. Passengers carried per trainman increased 121 per cent. The riding habit has been increased 50 per cent. Accidents have been cut in half; the money saved from this item alone totalized $5,392,054.51.

Earned net income $8,079,698.23, of which but $3,597,578.50 was declared in dividends to P. R. T. stockholders—the remaining $4,482,119.73 remained undistributed in surplus account.

Increased effectiveness of men and management makes for economical expenditure and has, therefore, much to do with the results here secured, and also with the adequacy of the funds.

T. E. MITTEN, President.

NOTE: C. J. Joyce ably presented Philadelphia's answer at the Washington hearings. The contents of his accompanying report are significant.

LETTER OF MR. JOYCE

Philadelphia Rapid Transit Company

Philadelphia, Oct. 13, 1919.

MR. T. E. MITTEN, President.
Philadelphia Rapid Transit Company.

Report on Washington hearing of Federal Electric Railways Commission at which I acted as your representative follows:

The need of Philadelphia's testimony is shown by reference to the statement before the Federal Electric Railways Commission Aug. 15 by the Chairman of the Public Service Commission of Pennsylvania, Hon. Wm. D. B. Ainey:

Let me express in no unfriendly spirit of criticism my astonishment at the incertitude and confusion with respect to remedies which appear in the testimony of the railways and allied interests which have been presented to you.

In the Philadelphia testimony the 5-cent fare was in no instance advocated as universally sufficient. Following your instructions to accentuate the fact that Philadelphia's plan is not offered as a cure-all for other cities, I was careful to make this fact clear in my response to all questions bearing on the subject, and that I succeeded in so convincing my audience is evidenced by the following, taken from the report of the hearings contained in the issue of the Electric Railway Journal, under date October 11, 1919:

In his testimony the witness (your representative) emphasized the idea that the inference should not be drawn that the measures and practices adopted and followed in Philadelphia would have worked equally favorable results elsewhere.

The argument and brief of the Amalgamated Association of Street & Electric Railway Employes of America demanding union domination was forcefully presented, and was undisputed in the evidence prior to the introduction of Philadelphia's answer.

The spokesman for the Amalgamated Association attempted to show that the efficiency of trainmen has increased out of all proportion to the increase in wages, and their testimony and statements to that effect stand upon the records of the Commission entirely unanswered, save only for the evidence presented by the Philadelphia Rapid Transit Company which shows that in Detroit, the home of the Amalgamated Association, where the employees are fully organized, there was in 1919 an increase in wages of 113 per cent over 1910, while the production of the trainmen has increased only 30 per cent, and in Cleveland where the employees are also fully organized there was, during this period, an increase in wages of 110 per cent and an increase in the production of the trainmen of only 27 per cent. Philadelphia during the same period, by co-operative effort, increased wages 151 per cent co-incidentally increasing the production of trainmen 120 per cent.

Although a considerable portion of the time of the Commission was devoted to hearing testimony on so-called "service-at-cost" plans, all of which involved the valuation of the properties of the utilities, the fact remains that the only positive and constructive suggestion for the basis of such valuation, upon which the commission could, in its report, base a recommendation to the state and municipal authorities, was that which is contained in the statement presented by the Philadelphia Rapid Transit Company.

C. J. JOYCE,
Special Representative.

N. S. C. Forms Engineering Section

THE National Safety Council is organizing an engineering section for the purpose of bringing together the civil, mechanical, electrical, mining and chemical engineers in the council's membership, so that they may contribute more effectively toward the solution of the purely engineering problems so frequently encountered in safety work. Membership qualifications are parallel to those of the great national engineering societies, except that for the present associate membership is open to engineers having three years experience.

The functions of the engineering section are stated to be:

1. To help to meet the technical demands of the various industrial sections and furnish them technical information as desired.
2. To perform technical services for the council, on request of the executive committee, such as the development of standards or participation therein; the solution, by inquiry or through research, of special engineering problems arising in safety work; and helpful co-operation with the American Engineering Standards Committee, the national engineering societies, the Bureau of Standards, the casualty department of Underwriters' Laboratories, etc.
3. To conduct one or more meetings as a part of the Annual Safety Congress, at which engineering problems shall be discussed.
4. To conduct, if considered desirable, one or more additional sectional meetings during the year, or in different localities.
5. To carry on such other activities as will, in the opinion of the executive committee of the National Safety Council, promote the safety movement and the best interests of the council.

The electric railway to Hakone, Japan, a prominent pleasure resort, began operation on June 1. By means of this line the heart of the mountain district is brought within four hours from Tokyo.

Italian Car Design Experience

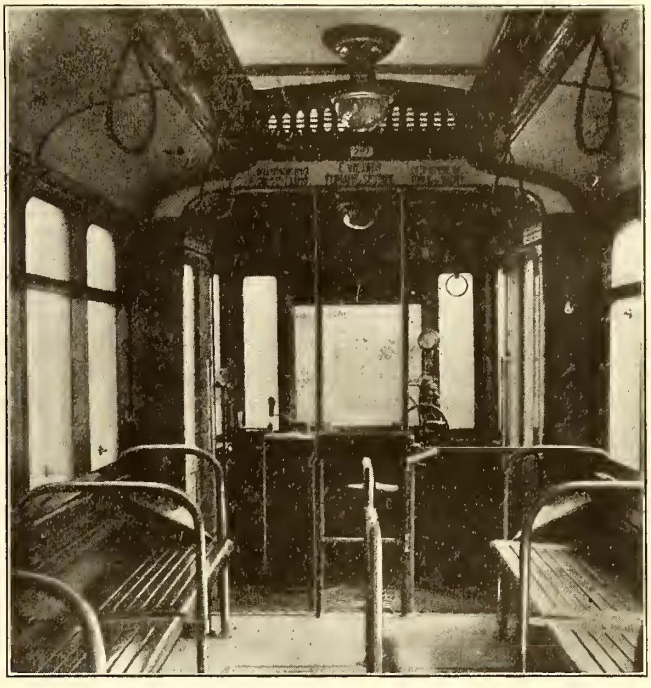
"All Standee" Car Is Unpopular—Convertible Standing and Sitting Car Substituted—American Prepayment Plan Successful in Rome

A SHORT item in the Aug. 3, 1918, issue of ELECTRIC RAILWAY JOURNAL related the plan of the Roman Tramway & Omnibus Company of Rome, Italy, to try out seatless cars for a period of six months. Information is now at hand covering the experience with these cars, and it indicates that they have met with much criticism on the part of the traveling public, even to the point that it has left these cars severely alone.

The development has progressed from this standing only car to a new convertible arrangement, whereby longitudinal seats are folded up or down during the rush hours to make seatless cars. The idea behind this plan was that while rush hour passengers were glad to hang on to the car anywhere, and would readily assent to the necessity to hang on the straps or special supports provided in the cars, it did not seem fair to compel non-rush hour passengers to stand. The convertible car, it is reported, has already practically demonstrated its adaptability to varying traffic conditions. The Roman Tramway & Omnibus Company has been operating two-car trains consisting of one seatless car, and one provided with the regular cross seat arrangement. With this combination, it has been very noticeable that the "sitter" cars are always crowded, even on the platforms where no seats are provided, while the "all standee" cars are left empty up to the last minute of the peak. This does not happen in the convertible cars because the passengers know that the conductor will pull the seats out again, as soon as this is possible, and permit the passengers to travel comfortably. A similarly successful experience with the convertible arrangement has been had by the Milan Municipal Tramways.

LOOP PREPAYMENT CARS

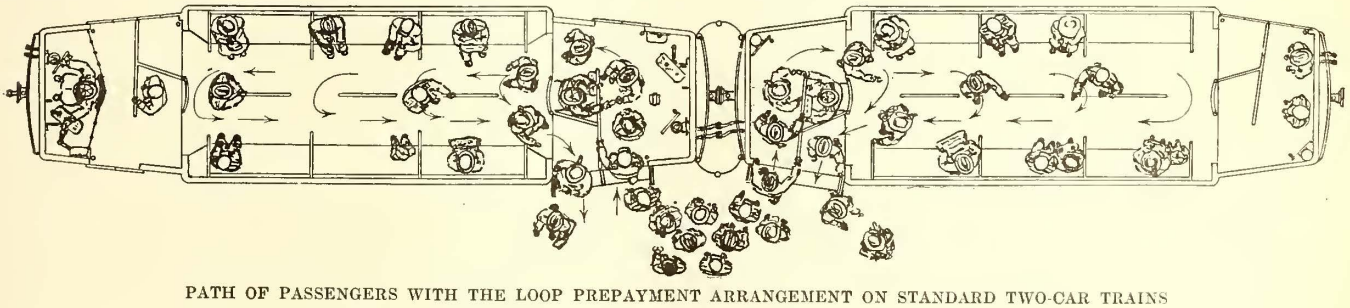
After much suffering from over crowding, numerous accidents to passengers riding on the couplers, buffers, steps and fenders of the cars, and the consequent loss of fares, the Municipal Corporation Tramways of Rome decided about the first of this year to install a prepayment plan of fare collection in conjunction with closed vestibules and folding steps. None of the prepayment plans of the United States or Canada was thought to be readily adaptable either to the design of existing cars, or to the riding habits of the Roman public. Also, the almost universal use of trailers had a bearing on this consideration. So it was decided that both entrance and exit should be made on the same platform, as it had been found that the enter-at-rear, leave-at-front scheme which had been advocated and recommended by the management of both traction systems of the city for a number of years, had met with but scant respect from the riders. They always seemed desirous of leaving by the same door through which they had entered the car.



FOLDING SEATS, STANCHIONS AND RAILS IN LOOP PREPAYMENT MOTOR CAR

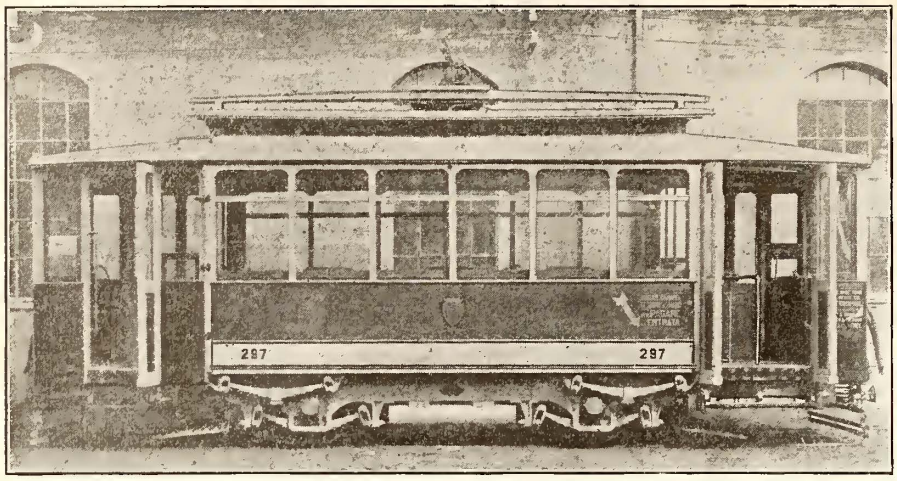
Based on these various considerations the "loop prepayment" plan was originated. This is illustrated in the accompanying drawing. Passengers enter at the dash side of the platform at the rear end of the motor car and front end of the trailer and leave by the corner post side of the same platform. This plan is claimed to eliminate any confusion, as the stream of entering passengers divides itself between the near entrances of the two cars while the outgoing passengers leave at both sides of the entering stream without meeting or mingling with it. Moreover, the motor car conductor is enabled to supervise all loading and unloading operations of the train, even though the signal inter-locks should fail.

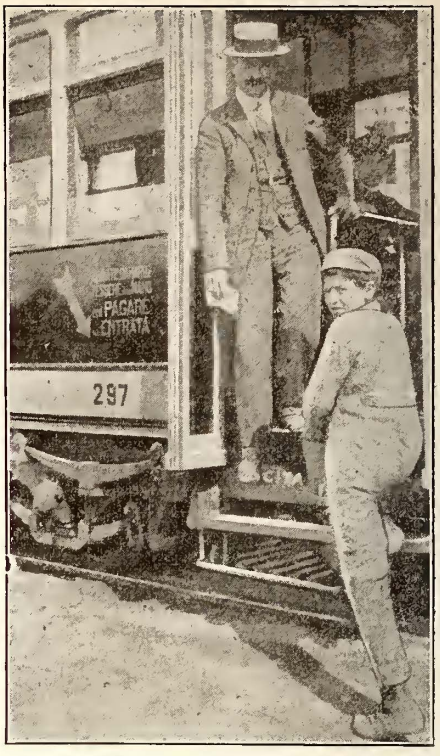
To carry out this plan, the vestibules of the cars were converted into payment platforms by the removal of the bulkheads. Inside the car body, the crosswise seats were removed, and folding longitudinal seats substituted, so that the cars may be converted during the rush hours into the standing only type. With the seats in service, there are seats for 18 passengers and standing room for from 20 to 25. With the seats folded down each car can accommodate as many as 70 riders. These figures apply both to the motor cars and to the trailers.



PATH OF PASSENGERS WITH THE LOOP PREPAYMENT ARRANGEMENT ON STANDARD TWO-CAR TRAINS

Each platform of the motor car is equipped with double doorways on one side and a single doorway on the opposite side. The double doorway is used at the rear of the car for the main ingress and egress of passengers. The single





ABOVE, LOOP PREPAYMENT MOTOR CAR SHOWING FOLDING DOORS AND STEPS AT THE FRONT AND REAR. AT RIGHT, ENTRANCE AND EXIT AT THE DOUBLE DOORWAY, AND POSITION OF CONDUCTOR ON THE PLATFORM

doorway is used at the front end of the car to permit the motorman to leave and enter the car without the necessity to go through it. This door is also conveniently used by the traffic inspectors, ticket takers and other employees. The trailer platforms are equipped with double doors on one side only. All doors are manually operated, the double doors by the conductors and the single doors by the motorman.

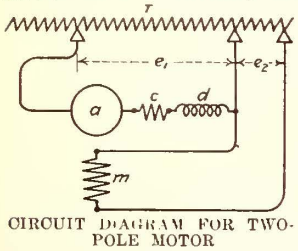
BIRNEY CARS NOW UNDER CONSIDERATION

The latest development in the Italian situation is the consideration looking toward the use of one-man safety cars. Data on the Birney cars are now being sought in this country by the Milan Municipal Tramways, and meantime a car is being converted along the lines of the American safety car as a step in blazing the way for the finished product.

Regenerative Braking with Single-Phase Commutator Motors

Tests Carried Out with One of Four Trial Locomotives Ordered by Swiss Federal Railways for St. Gotthard Line

IN THE ARTICLE describing the single-phase locomotives for the Swiss Federal Railways published in the issue of the ELECTRIC RAILWAY JOURNAL for June 14, 1919, page 1141, mention was made of the requirements of the railway authorities that these locomotives be provided with electric braking of some improved form so that power could be returned to the line. A test of this electric braking feature was carried on June 27, 1919, with the second of the four trial locomotives, which was built by the Oerlikon Company in conjunction with the Winterthur Locomotive & Machine Works. This locomotive has been in regular service since the beginning of last May on the newly electrified Berne-Thun section.



CIRCUIT DIAGRAM FOR TWO-POLE MOTOR

Trials were first made with the locomotives alone on the steep gradient between Kandersteg and Frutigen. Additional tests were later made with a train weighing 345 tons (2000 lb.) traveling at different speeds up to approximately 43½ m.p.h. These tests were conducted without the use of any mechanical brakes or brake resistances. The preliminary tests have proved entirely satisfactory, and the regulation at all speeds is reported to have proved very reliable.

The essential connections for regenerative braking used on this locomotive are shown in the accompanying diagram, which represents the circuit of a two-pole motor or generator with a rotor, *a*, and field windings, *m*. The various possible compensating or auxiliary-pole windings are represented by *c*. The armature is connected in series with a choking coil, *d*, of suitable dimensions, and connected with adjustable pressure steps, e_1, to a current transformer, *t*. Pole windings are connected to another suitably chosen pressure step, e_2, on the same tranformer. The machine acts in conjunction with the reactance as a motor or generator, from rest up to high speeds, with a constant torque at the given pressures e_1 and e_2 and a power which increases proportionately with the speed. For a given terminal pressure, the current is said to rise from the lower limit value while stationary more quickly than the speed, and the power factor approaches unity.

In an article in the *Electrician,* London, for Dec. 20, 1918, Dr. H. Behn-Eschenburg gave a brief theoretical discussion of the principles of the control and makes some general statements regarding the arrangement and operation of the equipment. He states that as far as the properties of the motor are concerned, the new arrangement does not appear to offer any advantage, as the weight is generally greater for the same capacity and the power factor lower than in an ordinary series motor. The weight and cost of the choking coil, as well as the losses within it, are also additional. The advantage of the arrangement, however, lies in its simplicity, as only the choking coil is needed in addition to the usual apparatus for the control of the motors.

A note in a recent issue of *Engineering,* London, states that the Shanghai (China) Tramways has decided to build its own street cars. The company has acquired an acre of land, on which it will erect a new factory building and install the required machinery. The company proposes to begin its building operations with the construction of fifteen cars for use on rails and seven cars for railless operation.

Economics and Equity in Valuation

A Discussion of Eight Forces Which Interlock with the Process of Fair Valuation, with Brief Reference to Points of Application and Practical Working Methods

BY CHARLES B. COOKE, JR.

Of Kelly, Cooke & Company, Engineers, Philadelphia, and assistant manager Transportation and Housing Division, U. S. S. B. Emergency Fleet Corporation in Charge of Street Railway Operations.

GENERAL principles to be regarded in the valuation of street railway properties have been extensively and ably discussed, particularly during the past few years, in which the broad question has come to a head under stress of the receding investment status of street railways generally. The important factors, of which due and equitable account must be taken in the development of "fair values," of both physical and intangible property, are generally well appreciated in informed quarters and have recently been summarized in the comprehensive report of the committee on valuation, appointed by the American Electric Railway Association.

On account of the vital importance of the complex problem presented by determination of "fair value," which is a term more easily used than understood in its fundamental aspects, it is desirable at this time to give some additional emphasis to the play of what may be termed the economic levers operating between "value" and the general policy of the regulatory power with respect to limitation of public utility earnings. There are, without question, very direct controlling forces or factors of absolute natural jurisdiction at work in the premises, which may not be disregarded. The following commentary indicates broadly the nature of these:

1. *Origin of Limited Earnings Idea:* The idea of limited earnings has its origin in consideration of the public service business as a natural monopoly and as therefore enjoying a species of public protection for which the company should pay by a restriction of its earning power. Inasmuch as the benefits from monopoly are distributed to the public in the form of better and economically cheaper service, and to the company in the form of such profits as it may earn up to a given amount, without compensating guarantee as to minimum profits, the equity of such a proposition is open to serious question. It is evident that the major protection afforded by the monopoly principle is that received by the public in safeguarding itself from the disjointed service and inevitable higher levels of service charges which would obtain under competitive conditions. In the nature of the case, there can be no limitation of benefits to the public, and these do actually increase from year to year as the service monopoly expands its facilities. The equity here is unbalanced and must in time tend to create an unhealthful condition for the utility, the effect of which will be borne finally by its public either in the shape of higher fares, or the more costly alternative of deficient service.

2. *Differential between Value and Investment:* Commercial and economic definitions of value are multitudinous and, of necessity, relative in character. Viewed as a general proposition, it would appear that definition or measurement of value of capital after investment in public utility must be such as will co-ordinate with definition or measurement of its value after investment in industrial or other enterprises, in order that there may be no hurtful discrimination between competitive fields of investment. Any mature consideration of "value" of a public service property and of the underlying economic forces governing flow of capital into selected applications must lead logically to the conclusion that cash capital devoted to public service represents but one element of its value after investment. Value may obviously be either greater or less than investment. In the case of a well managed property giving adequate service, it cannot be otherwise than greater. In a property giving poor service, value for rate fixing purposes will be equal to or less than investment if the inadequacy arise from bad management, but it will be greater if the poor service is a result of low earnings due to deficient rates.

Pretentions that original cash cost of existing physical property constitutes the only value on which earnings should be allowed emanate from a form of special pleading which would encourage the belief that a dollar invested to carry a man to work earns, and should receive, different treatment than accorded the dollar invested to put clothes on his back or food in his stomach. Man-made laws may authorize labelling the value and limiting the earnings of that dollar in the one case and not in the others, but none have yet been conceived that can control where the dollar chooses to work.

3. *Natural vs. Artificial Limitation of Earnings:* It would appear that the same economic law which governs the supply of other human needs and receipts therefrom will operate even more positively as an automatic governor of utility earnings. The law of diminishing returns will set in more surely following a rise in utility rates, regardless of whether such rise is justified, than it will following increases in commodity prices. Thus, the public utility is subject to the two-fold burden of an artificial and a natural limitation of earning power. The artificial limitation is, in the last analysis, needless, as it attempts to do something which would come about utimately through natural causes, unassisted by fallible human dictation. And in the process of its operation, the artificial limitation works injury to the enterprise affected by automatically causing its withdrawal from attractively profitable classes of investment projects and limiting the grade of its product. The artificial regulatory power may only act with certainty and popular approval in depressing earnings. It cannot, with any similar certainty, elevate earning power by merely authorizing tariff increases, for in this domain the superior law of natural regulation will function, and from this the public service company cannot escape.

Human intelligence has not yet progressed to a point where it may embark safely on a policy which looks toward guiding or confining laws of natural economic forces governing capital distribution so that these will operate to produce certain specific results in a given field of application, without compensating effect therein and in other fields. The imponderable elements here encountered are too elusive and the whole structure of economic law is too complex and fluid in character to permit of manipulation of individual parts, with the assurance that the local effect obtained does not produce, in some degree, damage to the rest of the structure.

4. *Effect of Limited Earnings, Value Adjustment and Risk on Supply and Cost of Capital:* Limitation of earn-

ings may be dictated by all conceivable economic reasons, logical and sound from every academic standpoint, but if the man with money to invest does not like it and diverts his capital to other channels, then that policy applied to the public utility must be fundamentally defective, and it must only be a question of time before injurious effects accumulating from deficient capital resources are felt by both company and public.

Business risk in public utility operations cannot be regulated out of the mind of the investor. The risk is really there (witness railway conditions today), and private capital has the initiative to take it, but naturally and only if there be acceptable compensation in prospect. Capital has always refused to be bound by the judgment of a third party in the matter of what constitutes acceptable compensation for placing itself at risk. It is a poor rule that does not work both ways. Clearly, those who are responsible for an economically unsound utility enterprise should pocket its losses, but it is equally clear that responsibility for well conceived projects is entitled to rewards such as it may earn through increased use of facilities provided and effected through good management and service.

If, because it cannot be justified in a manner acceptable to the regulatory power, property value for rate fixing purposes be depressed, consciously or unconsciously, below a critical point, to an extent which prejudices its interests in the mind of the prospective or actual investor therein, the logical result will be a rise in cost of capital for that property or depreciation of its securities until a compensating balance is reached from the investor's viewpoint. He is the court of last appeal. This follows, not so much from the numerical amount of the value depression, as from the psychological effect on the investor, produced by the exercise of what he considers an arbitrary power which may finally affect his interest.

5. *Value of Property to Community:* Any consideration of fair value of the public service property must necessarily give due weight to value from the standpoint of its service to the community. In the commercial sales transaction, the price of the thing sold is governed largely by the question of its value to the purchaser, and if that value is not large enough to justify manufacture by those who are willing to assume its risk, the enterprise is not economically or commercially sound. The same principle holds good as to the sale of service by the public utility and should be accordingly recognized. If that service be adequate, the value of the property which provides it should be considered at least as not subject to the chance of depression to an extent which may work injury upon it.

It follows logically from this and for other sound reasons that depreciation which has set in on physical property is not a factor to be applied in fixing value for rate making. Value of the property and of its service to the public is not affected by the fact that the rail head may be worn half way through its useful life, so long as the wearing does not affect service. The public is, however, vitally concerned in guaranteeing itself the renewal of that rail at the appointed time and in seeing the company maintained in funds sufficient to provide therefor, and for proper maintenance in the meanwhile.

6. *Other Regulation:* The policy of supervision, or regulation by public bodies, of principles to be regarded in new and reorganizing financial operations is sound and well conceived, in that it tends to prevent recurrence of unsound practices marking the developmental period of some properties. Likewise, and for similar reason, the practice to be followed in capital, expense and revenue accounting is properly subject to guide and action of the regulatory power. Sound procedure in this domain must necessarily be one of the pillars maintaining the future value of the property to the community it serves.

Supervision and control of service and service facilities as to character and their adequacy to the demand is obviously essential and desirable, in view of its vital bearing on public and community interest. Regulation of financial and accounting practice is justified in that service, the vital thing, is thus insured and safeguarded and "value" thereby protected. Service is not so insured or safeguarded by the policy of regulated earnings, and hence value of the service property remains unprotected and is subject to depreciation through the very application of this policy.

7. *Selection of Price Levels:* One of the most difficult questions connected with the development of unit costs concerns the selection of the scale or level of basic material prices and labor rates, upon which to build up the structure of unit and total values. In the past periods of normal price fluctuations, it was common practice to base figures on prices representing three and five year averages, this being considered as a fair measure of the then probable future price levels. This was essentially sound, as findings for rate adjustments applying during a future period must necessarily be based upon probable firm value of property during that period. Under pre-war conditions of moderate variations, plus or minus from normal levels, past average prices could be safely considered as an index of the level of future prices.

Well appreciated conditions brought about by the war have, however, upset the logic and workableness of this basis for establishing fair values for the future period. This question may not now be considered apart from the high levels of operating labor and material costs. These are the reflection of economic and industrial conditions for which no precedent exists as to fundamental cause and future effects arising therefrom. In the nature of the case, it is difficult to avoid the conclusion that, with base labor costs on a high level in all industries producing equipment and maintenance materials and other supplies used by street railways and with their own operating wage scales similarly elevated, there can be no marked recession in existing levels of total operating costs and charges exacted by capital, for many years to come. For decades the trend of wages to labor has been upward. Under normal conditions the change upward has been a slow and graduated process. Under normal conditions, a general decrease in wage levels would be an even slower matter. Under what we term abnormal conditions today, which may represent the normal of the future, any material decrease in wages throughout the whole industrial fabric may be expected to be so slow as to be imperceptible. And when the necessity for national and world wide stimulation of production in all directions is contemplated, the prospect of further elevation of cost levels operating progressively throughout the allied fields of production, whether of materials or service, is not at all unreasonable.

The value of capital, and the required return thereto, measured by the same money standards as measure the value of materials and human labor, must necessarily co-ordinate in some degree with the variations of the latter value as expressed in the medium of exchange. The two things interlock and must move up or down together. There may be some lag in movement of one following movement of the other, but it will finally occur in the same direction and continue until equilibrium is established.

Fair consideration of the foregoing leads to the conviction that present day prices furnish the best, as well as a conservative basis for measurement of physical values which will typify, reflect and recognize conditions of operating and capital costs during the future period. The fact that this basis will, in many cases, produce value figures in excess of known cost is immaterial to the deeper question involved of maintaining correct and stable relations between the economic factors governing the premises.

8. *Valuation Policy:* Experience has shown that regulatory bodies and their technical representatives passing upon valuation matters are usually fair minded, particularly where the material presented to them in support of a given case shows evidence of a consistent purpose to base figures throughout on facts and real conditions, so far as these may be subject to numerical translation. It is unfortunately the case that some valuation proceedings and preparation of data therefor have been based largely upon the trading principle, so that it has become more or less a fixed idea in the mind of the public representative that any figures presented in behalf of the public utility are excessive and subject to substantial reduction. Public authorities in the premises, for political or other reasons, are sometimes governed in their findings by a desire to show a " raison d'etre " for themselves, and consider it advisable, on general principles, to find values lower than facts, properly presented, would justify. This vicious condition or atmosphere, the outgrowth of past political and corporate practices, undoubtedly affects many valuation cases and retards equitable settlement thereof.

It is to be hoped that the present distressing situation of the street railway industry will bring about closer cooperation between companies and regulatory bodies on moot questions of valuation, and a clear appreciation by both that nothing ultimately is to be gained either by corporate or public interests by departure from ascertainable facts and practical principles of equity. It is important, too, that regulatory bodies should realize the ultimate wisdom of a liberal policy in deciding questions of valuation on which reasonable doubt exists. Better by far to err on the side of a too liberal valuation than the opposite and so strengthen rather than weaken the position of the utility. The per capita cost to the public of liberal valuation policies is nothing compared to the cost of the reverse. The inherent nature of the problem is such that the company is frequently unable to produce unassailable proof of certain items of value, evidence of which, while sound and logical, may be largely circumstantial. The general public has much to gain and little to lose by a country-wide policy of liberality in utility valuation cases, and much to lose and little to gain by any policy which may be construed as oppressive. Practical and not academic considerations should govern here.

Working Methods of Valuation

It is a matter of major importance that, with general principles of valuation developed and established along sound and logical lines, attention be turned to the equally, and possibly more, vital matter of making practical use of them. In other words, systematic methods should be developed for attacking the problem presented, not only by the necessity of an inclusive inventory and specifications of items of property and investment value, but also the development and application of unit values upon a basis that can withstand critical analysis.

The valuation problem should be approached and carried consistently through to a conclusion with the constant object in view of developing reasonable and defensible supporting detail for every figure appearing in the final valuation report. This applies to tangible as well as intangible items of value. Where certain of these are believed to exist but are not susceptible of logical supporting argument and connecting figures, they should be presented frankly in their proper classification. The attempt to support such items with bolstered up argument rarely, if ever, produces anything but unpleasant suspicions which adversely affect other departments of tangible and intangible valuation in which the company is well fortified.

Unit labor and material costs, forming the basis of total physical values, should be built up step by step in a way that will show the elements of all direct and semi-direct charges against the particular class of property or work to which they apply, and by a method which will show clearly upon investigation how such elements have been derived. Careful attention to these details is of the utmost importance as proof to the examining body of the integrity, fairness, and logic of the developed unit cost structure.

The development of unit figures should rest primarily upon the consideration that practically all classes of railway construction work may be resolved by analysis into a sequence of divisions and sub-divisions of constructive processes. These generally do not conform with standard construction accounting procedure, so that a logical development of unit costs must go further than simply analyzing construction accounts.

For example, in building up substantiating detail for unit and total values of tangent track work, the following plan of inventory and valuation, systematically carried out, provides maximum assurance of credit for all discoverable items of property and support for their valuation:

I—*Classification of Tangent Track by Types:*

(a) Survey of all tangent track to determine where changes occur in:
  1 Rail section and weight
  2 Joints
  3 Bonding
  4 Ties
  5 Trench depth
  6 Ballast
  7 Paving

(b) Definition of track lengths by classes of construction, A, B, C, etc., this being considered to change wherever a change occurs in any one of the main items above listed. Summary of construction classifications by types, lengths and street locations.

II—*Development of Unit Costs Applying to I-(b) Per Unit Length:*

(a) Material items occurring in various classifications, A, B, C, etc.
  1 Rail, by sections and specifications
  2 Joints by types and sizes
  3 Bonds by types and sizes
  4 Spikes
  5 Ties by sizes and specifications
  6 Ballast by specifications
  7 Paving by occurring classes

(b) Track labor
  1 Segregation of construction into natural sub-divisions and sequence of processes
    a—Clearing
    b—Excavation—rough
    c—Excavation—to line and grade
    d—Ballast—first course placing and levelling
    e—Ties—rough placing
    f—Ties—spacing
    g—Rail—rough placing
    h—Joints—temporary bolting
    i—Rail—gage and spiking
    j—Bonding—attachment of bonds
    k—Joints—final bolting
    l—Ballast—tamping, placing second course, first track surfacing, and back fill
    m—Operation over track
    n—Second track surfacing (where required)
    o—Paving
    p—Teaming and hauling for above, classified by operations
    q—Storage of materials—Unloading
      Labor
      Hauling to central storage
      Handling in central storage
      Hauling to sub-storage
    r—Transportation of men on and off job
    s—Miscellaneous labor—
      Watchmen
      Water boys
      Time clerks
    t—Supervision on job

Each one of the above defined processes represents a time and labor consuming operation and constitutes an element of total labor costs. Based on actual time studies and experience in other similar construction, supplemented with consultations with the intelligent types of track bosses, very close estimates of unit man-hour costs, by classes of labor, for detail operations and combinations thereof may be developed, to which their wage rates may be applied. It has been found that total labor costs per mile, established step by step in this way, check out very closely with actual performance, as disclosed by analyses of particular jobs. Cost figures so established are evidently not open to serious question.

III—*Incidentals:*

No matter how carefully and painstakingingly the inventory of property is taken, it is well known that a large number of items, small in themselves, but representing an important amount in the aggregate, will, in the nature of the case, be overlooked. An analysis of the details of construction vouchers covering almost any class of work will always disclose numbers of items of which the most imaginative estimate would fail to take account. These represent an absolutely legitimate element of valuation, for which due allowance must necessarily be made in the form of a percentage addition, most conveniently made to basic unit costs. The amount of such addition may be properly determined by analysis of incidental details from construction vouchers applying to the particular class of work concerned, which gives a fair and defensible basis for this. As the "incidental" item varies from 2 per cent to as high as 8 per cent and 10 per cent, depending upon the class of property or work, careful attention to the development of supporting figures for the percentages used is advisable.

IV—*Contingencies:*

A few years' first hand experience with construction jobs in the field is the best possible school to develop appreciation of the importance and necessity of liberal allowance for unforeseen contingencies encountered in the usual operation. The character and cost of exceptional or extraordinary contingencies actually met in a given situation can generally be established through analysis of job records and consultation with engineers and foremen handling different types of construction on the company's system. Much valuable historical information relative to invisible physical investment may be collected in this way, and forms an excellent groundwork for developing a fair allowance for this item, representative of practical conditions met in a given situation.

GENERAL

The principles outlined in the foregoing may be likewise applied to other classes of street railway property, with such modifications as may be necessary to recognize differences in construction processes inherent thereto and subject to numerical cost measurement. This applies with particular force to the inventory of special track, analysis of typical layouts, etc., as well as to distribution systems in which property values are constituted in large numbers of similar or identical items of equipment.

The basic thought in the whole inventory question should center about the importance of taking and listing quantities in such a way as will permit of the application of unit costs determinable from analysis of natural sequences of construction processes. In other words, the material items should be taken and grouped in a way that will permit of attachment of ascertainable labor costs connected therewith and ultimate charging into the classification of accounts used by the company. There cannot be too much emphasis laid on the necessity of "system" in scientific inventory. Lack of it will surely and inevitably result in confusion, inaccuracy and defective accounting for existing values which are then easily opened to question. Working papers and figures should be laid out and arranged to provide for ready checking of statements and figures appearing in the valuation report for the convenience and intelligent consideration of the examining body.

In the valuation of large street railway properties it is often either desirable or essential for many obvious reasons to work out allocations of values to various companies, or groups thereof, constituted in the underlying corporate structure.

This involves an analysis, in some cases very complicated, of the corporate history of the property as it exists, the corporate processes through which it has been developed and of the terms and conditions of leases, mortgages, operating agreements and similar instruments through which such corporate processes were consummated.

Electrolysis Amelioration at Kansas City

AN ELECTROLYSIS Committee has been formed at Kansas City with S. H. Grauten, electrical engineer Kansas City Railways, as chairman. The committee includes also a representative from the Bell and Home telephone companies, the Western Union and Postal telegraph companies, the water company, gas company and electric light company. Meetings are held monthly.

The committee was organized for the purpose of studying electrolysis conditions which might affect all the utilities having underground structures. The first step was to adopt a unified system of drainage for all companies owning underground cables.

Aside from the work of the committee, the railway company has made considerable progress in rehabilitating its feeder system, having already installed an insulated return system on two substations. It is expected that a similar work will be completed on a third station during the present year.

At one substation located in the Kaw River bottoms an elevated structure extends for about ½ mile west and 1 mile east. This is a double-track structure with four guard rails, making available eight rails laid on ties and well insulated from the structure. It was arranged for these rails to act as insulated return feeders and thus about 40,000 lb. of return cable was salvaged. Owing to the fact that this cable had been well grounded by part of it lying in the bottom of the Kaw River, electrolysis conditions were much improved by its removal.

New Officers of New York Railroad Club

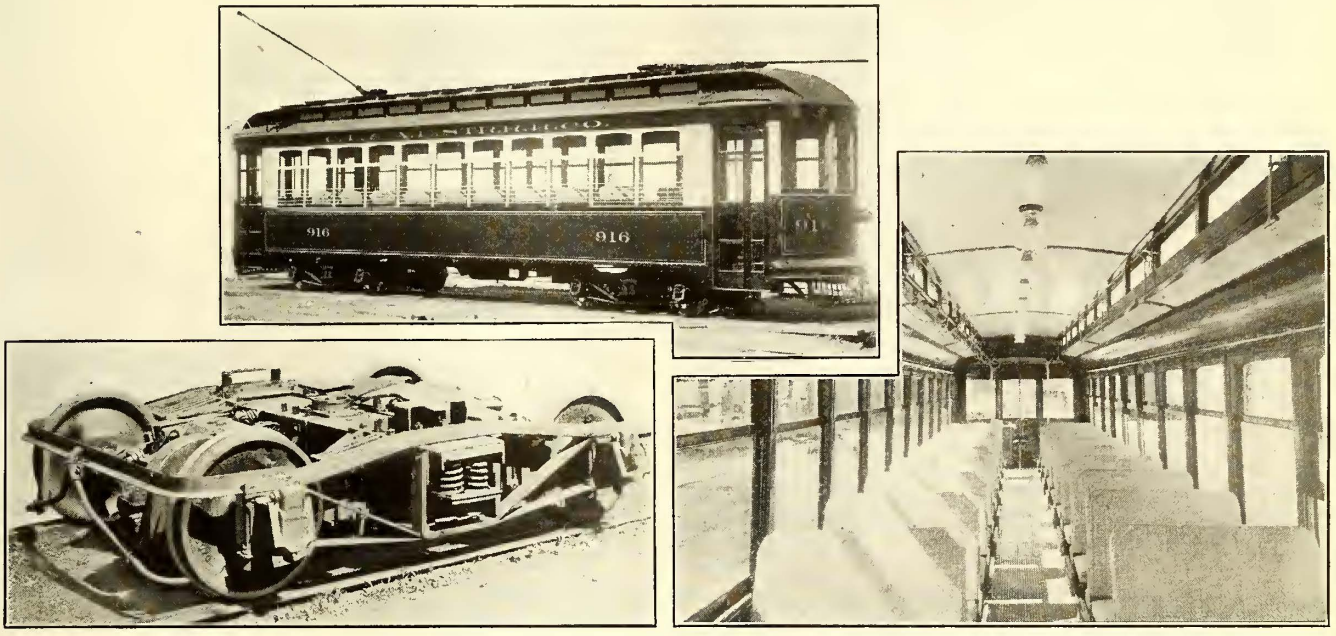
THE following officers of the New York Railroad Club assumed their duties on Nov. 21, the meeting held on that date being the first one under the new administration: President H. C. Manchester, superintendent of motive power and equipment, D. L. & W. Railroad, Scranton, Pa.; first vice-president, J. A. Droege, general superintendent New Haven Railroad; second vice-president, J. S. Doyle, superintendent of car equipment Interborough Rapid Transit Company; third vice-president, F. T. Dickerson, assistant to the president C. R. R. of N. J.; treasurer, D. W. Pye, president Tuco Products Company; executive member, J. J. Dempsey, vice-president Seamans Oil Company; member of finance committee; C. C. Castle, vice-president National Railway Appliance Company.

Cutting Down Operating Expenses on a Small Interurban Road

The Cincinnati, Lawrenceburg & Aurora Electric Street Railroad Has Made Large Annual Savings by Eliminating Useless Material, Reducing Labor Cost and Speeding Up Cars

By C. T. DEHORE
Railway and Lighting Department, General Electric Company, Cincinnati, Ohio.

THE Cincinnati, Lawrenceburg & Aurora Electric Street Railroad had been for several years in a receivership, when in 1917 operating expenses commenced the rapid upward trend that has proved so disastrous to the entire industry. Under this condition, the operators faced the alternative of abandoning operation or of materially reducing operating expenses. They decided on the latter course and as a result of their efforts power costs were, during the past year, cut more than 50 per cent; maintenance charges approximately 44 per cent, and platform costs 20 per cent. The return for the first year was about 50 per cent on the net investment in new equipment. The result was achieved by the use of modern, light-weight cars and equipment, the purchase of power from a large central station plant and its distribution through automatic substations, and the elimination of some unnecessary stops by locating part of the road on a private right-of-way instead of in city streets.



EXTERIOR, INTERIOR AND TRUCK OF LIGHTWEIGHT INTERURBAN CAR FOR CINCINNATI, LAWRENCEBURG & AURORA ELECTRIC STREET RAILWAY

The Cincinnati, Lawrenceburg & Aurora Electric Street Railroad is an interurban line 32.6 miles long, running west from the outskirts of Cincinnati (Anderson's Ferry) to Lawrenceburg and Aurora, Ind., a distance of 24.9 miles, with a branch line to Harrison, Ohio, 7.7 miles long.

A half-hourly service is given between Cincinnati and Valley Junction; and every other car branches off at the junction giving hourly service to both Aurora and Harrison.

No freight business is handled on the road because at present the eastern terminus is approximately 6 miles from the business center of Cincinnati and there is no way of getting freight up town. The city lines are wide gage, whereas the C. L. & A. gage is standard. Passengers are transferred at the eastern terminus (Anderson's Ferry) to the Cincinnati Traction Company's cars, which transport them up town.

As passenger earnings of the company had remained practically stationary for seven or eight years and in the fall of 1917 there was the prevalent increase in cost of labor and material, the management decided to invite suggestions from the General Electric Company's engineers as to ways in which expenses could be reduced. These engineers inspected the road, analyzed operating costs and checked up the equipment in use. They made certain recommendations for the reconstruction of the road, which the management put into effect. The details of these and the results are explained below:

Car Weight Cut 50 Per Cent

In 1917 the rolling stock consisted of eight 44-passenger cars, equipped with four motors on 33-in. wheels, geared for about 35 m.p.h. free running speed and weighing from 50,000 to 52,000 lb. when officials of the Cincinnati Car Company were consulted, they offered to build a car of equal seating capacity, on trucks with 24-in. wheels, suitable for interurban service, which, with four low-wheel motors, would weigh not to exceed 25,000 lb. The substitution of this type of car for the existing equipment would obviously cut the power consumption in two, and effect

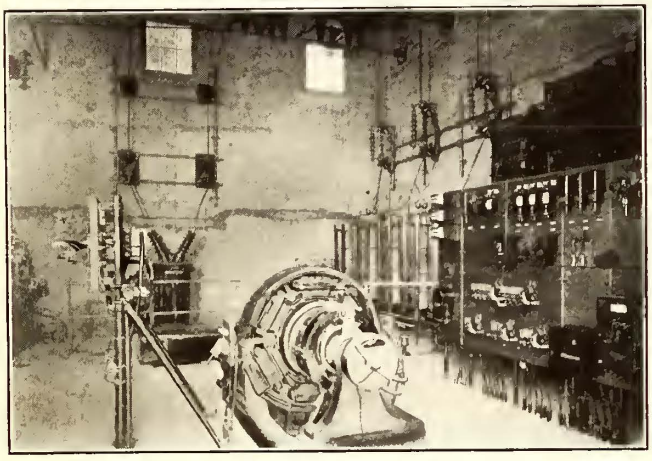
material economies in track and equipment maintenance. Seven of these cars were purchased, the use of the old cars being discontinued and the latter were offered for sale.

The cars are a radical departure from those usually found on interurban roads, and as far as we know are the lightest cars in this class of service. The car floor is flush with the platform, and the open bulkhead design is used.

The cars are of composite wood and steel construction with monitor roof and inclosed platforms. They are constructed with the wide body corner posts, or piers of steel, and window posts, letter-board and roof of wood.

The adoption of the open-bulkhead design of car, with flush platform, low wheels and light-weight trucks and electrical equipment, has resulted in a 44-passenger car having a free running speed of 35 m.p.h., weighing but 25,000 lb. complete.

The energy consumption of this car is 1.7 kw.-hr. per car-mile, including line, transformer and converter losses, and the cost of power per kilowatt-hour is 1.2 cents, making the power cost per car-mile about 2 cents.



FERNBANK AUTOMATIC SUBSTATION OF THE C. L. & A. LOOKING TOWARD DIRECT CURRENT END OF ROTARY CONVERTER

A comparison of the weights of the old cars with the new is given in Table I.

The electrical equipment consists of four GE-258 motors, K-12 double-end control, General Electric straight air brakes with emergency feature and conductor valves,

TABLE I—COMPARISON OF OLD AND NEW CAR WEIGHTS

	Old Cars Pounds	New Cars Pounds
Body, including conduit, piping and equipment hangers.	22,700	13,500
Electrical equipment	14,400	4,750
Air brake equipment	1,400	850
2-arch bar type trucks	13,500	6,000
Total weight	52,000	25,100

TABLE II—DATA REGARDING THE NEW CARS

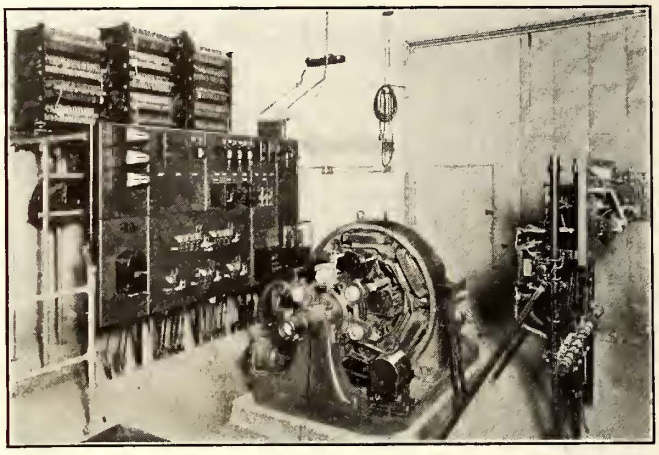
Seating capacity	44
Length over all	40 ft. 6 in.
Height—rail to top of trolley base	11 ft. 3 in.
Extreme width	8 ft. 3 in.
Height—rail to step	16 in.
Height—step to platform floor	12 in.
Width of aisle	22 in.
Width of seat	38 in.
Length of platforms	4 ft. 7 in.
Width of door openings	30 in.
Trucks	Cincinnati Car Company arch bar type.
Truck centers	20 ft. 6 in.
Wheel base	5 ft. 8 in.
Size of wheel	24 in.
Material of wheel	Steel
Type of motors	4-GE-258-C 25-hp.
Control	Double-end K-12
Lighting	11 GE combination shade holders and fixtures—Holophane shades down center of car.
Heaters	16 Consolidated No. 199-0 foot rest heaters with Gold thermostatic control.
Fare collection devices	Ohmer fare registers.
Entrance and exit	Rear entrance—front exit.

using a CP-25, 10-ft. compressor. The electrical equipment and air brakes combined weigh about 6000 lb.

AUTOMATIC SUBSTATIONS PERMIT SALVAGING OF COPPER

In 1917 this company was producing its own power in a 600-volt direct-current steam plant at North Bend, 9.9 miles from the eastern terminus of the road, and 15 miles from Aurora. Due to the extremely long stub-end "feeds" approximately 42 miles of 400,000-circ. mil copper feeder and 22 miles of No. 0000 feeder had been put up.

A proposition was secured from the Union Gas & Electric Company in Cincinnati, covering the furnishing of 3-phase, 60-cycle current at 33,000 volts. The power company built the transmission line to the substations, and it was found that power could be purchased at a somewhat lower figure than it was costing to manufacture it, particularly in view of the extreme high cost of fuel. A contract was therefore entered into with the Union Gas & Electric Company. The power contract specifies a maximum demand rate of $1.50 per kilowatt per month, based on fifteen-minute readings on four consecutive days in the month,



INTERIOR OF FERNBANK AUTOMATIC SUBSTATION LOOKING TOWARD ALTERNATING CURRENT END OF ROTARY CONVERTER

with a sliding-scale rate for actual energy consumed, depending upon the amount used. Power is delivered at the substations on the high-tension side and measured by printometers with watt-hour meters.

This contract enabled the company to secure the full benefit of the reduction in energy consumed, and it also enabled them to dispose of their old boilers, engines and generators.

An order was also placed with the General Electric Company for two 200-kw. automatically operated substations. These were designed to receive 33,000-volt, 3-phase, 60-cycle power, and deliever 600-volt, direct-current power. Substation No. 1 was located at a point approximately 6 miles from the eastern terminus, and substation No. 2 was located at a point approximately 8 miles from Aurora.

Both substations are entirely automatic in their operation and both are equipped with time clocks, shutting them down at a predetermined hour around midnight. The clock cuts in again at a predetermined hour early in the morning and starts the substation. A control wire is run from substation No. 1 to the car shops at North Bend, so that the substation can be started up at any time between the midnight and starting time in the morning should occasion demand.

The substation buildings are of concrete blocks, the exterior and interior appearances being as shown in the accompanying illustration. The equipment has all of the standard protective devices developed by the manufacturer, such as those for speed limit and overload protection, ther-

mostats on bearings and resistors, etc. The high-tension lightning arrester is of the new oxide-film type, requiring absolutely no attention. The direct-current arrester is of the standard aluminum cell type.

The use of automatic substations was decided upon to eliminate substation attendance, to reduce feeder copper to the lowest point and to improve the trolley voltage.

With the old 600-volt direct-current generator system, the extremely long stub-end "feeds" and the heavy ears approximately 42 miles of 400,000-circ.mil copper feeder and 22 miles of No. 0000 feeder was required. Under the new plan 400,000-circ.mil feeder is used between the two substations, approximately 9 miles. A No. 0000 feeder is used from each substation to the end of the line and a No. 0000 feeder extends down the Harrison branch, making a total of 21.7 miles. The 33 miles of 400,000-circ.mil feeder no longer required has been taken down and salvaged.

Local Public Was Reasonable

The first 6 miles from Anderson's Ferry is within the city limits of Cincinnati and the line was double-track, with girder rail through the streets of the suburbs. The franchise had only a few years to run, and the operating officials had been of the opinion for some time that it would be good policy to remove the tracks for 3 miles through the villages of Delhi, Sayler Park and Fernbank, and to re-lay them on private right-of-way adjoining the Big Four Railroad, which is only 200 ft. distant from the old line through the streets. There were considerations favoring this move: (1) The old track was in poor condition and would require rehabilitation shortly in any case. (2) Should the city decide to improve this street with brick, it would mean paving charges which the company could not afford. (3) Several curves and grades could be eliminated, a number of stops could be abandoned, and a faster schedule could be maintained.

Negotiations were entered into immediately for a new franchise, with the privilege of making the suggested changes in track. The Big Four Railroad was also approached with a view to securing the desired right-of-way. The franchise was granted in December, 1917, and the use of the right-of-way was also secured at a nominal rental. Three miles of double track in the villages mentioned was abandoned, and one track of the 3 miles of double track between Anderson's Ferry and Delhi was also abandoned and taken up. The second track between Anderson's Ferry and Delhi is off the main thoroughfare, so that no change was thought desirable in this piece of track.

Work on the new roadbed was started in the spring of 1918. This has gravel ballast with only one or two curves and no grades. The number of stopping places for the first 6 miles was cut from thirty-five to eighteen. Due to the light weight of the new rolling stock the ties were spaced on 2-ft. 6-in centers instead of the usual standard 2-ft. centers.

Increasing the Schedule Speed of Cars

The schedule in 1917 called for six cars to give a half-hourly service to Valley Junction, and hourly service to Aurora and Harrison.

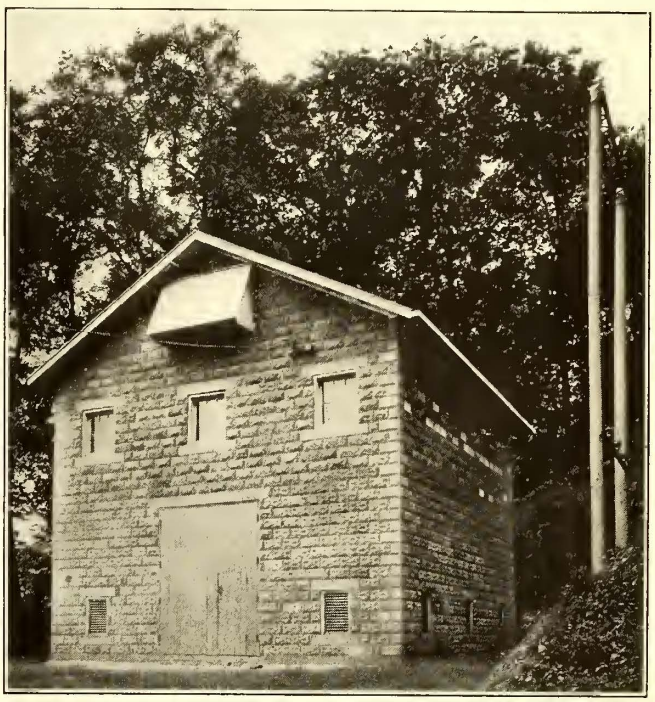
A layover of five minutes was allowed for each car at Anderson's Ferry, with ten- to fifteen-minutes layover at Aurora and Harrison. By reducing these layovers to approximately three minutes at each end of the line, and utilizing the possiblities of the new right-of-way and elimination of stops, the running time was reduced, and it is now possible with the new cars to maintain the same schedule with five cars instead of six, and no difficulty is experienced in keeping the cars on time. This one feature alone reduced the operating expenses per year approximately $7,500.

With the light cars and the new right-of-way if has been found possible to reduce the annual maintenance cost of track and roadway approximately $2,713. The actual costs of operation and date covering the old system as compared with the new are given in Table III.

TABLE III—COMPARATIVE OPERATING DATA—THEN AND NOW

	Old System July, 1917, to June, 1918	New System July, 1919, to June, 1919	Decrease or Increase
Car-miles	533,556	556,389	22,833 Inc.
Car-hours	37,778	37,436	342 dec.
Kilowatt-hours per car-mile	3.56 d. c.	1.7 a. c.	1.86 dec.
Platform wages at 90 cents per car-hour	$34,000	$33,692	308 dec.
Power cost	36,423	17,539	18,884 dec.
Maintenance of cars and equipment.	7,421	4,150	3,271 dec.
Maintenance of track and roadway.	15,073	12,359	2,714 dec.
	$92,917	$67,740	$25,177 dec.

Reduction in operating costs $25,177.



EXTERIOR OF FERNBANK (OHIO) SUBSTATION

Full benefits from the increased schedule speed, resulting in running the service with five cars instead of six, are not shown in the above figures, due to the fact that this schedule was not put into effect until January, 1919. During the next twelve months it is expected that the item of car-hours and platform wages will decrease about 20 per cent as compared with the old system, bringing the total savings up to about $30,000 per year.

Power cost will also show a reduction, due to the fact that the 1918-1919 figures cover the use of a portable hand-operated substation, requiring two attendants and involving a rental charge. This station will be released in September, 1919, so that these items of cost will be entirely eliminated.

From the above it will be noted that the company has made 22,833 more car-miles with 342 fewer car-hours, with a reduction in all items of expense. In addition, it has done approximately 25 per cent more business as measured by receipts and number of passengers carried.

The patrons of the road are very much delighted with the new cars and the reduction in schedule. These light cars with 24-in. wheels ride considerably better than the old-type cars with 33-in. wheels, and the cars are constructed so that there are no obstructions to the passengers' view. As the road follows the Ohio River quite closely, this fea-

ture is appreciated by the passengers. The center-lighting scheme with intensive Holophane reflectors is also a cause of considerable favorable comment, as compared with the cluster-type lighting which was installed in the old cars.

LOOKING BACK OVER THE PAST YEAR

The cars have now been operating for a year with no unusual troubles either electrical or mechanical, and with a very low maintenance cost; track repairs have also been considerably reduced since their installation. The reconstruction of the road is now complete, and at the present time there is not a mile of bad track in the system. The substation equipment and rolling stock are in excellent condition, and the substations require the attention of one man only a few hours each week. As this man looks after the substation in connection with his other duties at a slight increase in salary, the labor cost is practically nothing.

The rates of fare on this road are exceptionally low and up to the present time have not been raised. If the company can secure a reasonable increase in rates to offset some of the exceptional high prices of labor and material, it is believed that the receivership can be lifted and the road made to pay fixed charges and possibly a small return on its capital stock.

Due to the fact that the road is partly in Indiana and partly in Ohio, with franchises in several municipalities, considerable delay has been experienced in getting action on the fare question.

In conclusion, I wish to express my admiration for the spirit of the officials of the C. L. & A., who have had the foresight and courage to go to the limit to save this road from abandonment. Had they continued under the old plan of operation, the road would have been unable to meet operating expenses, to say nothing of interest, and as the receiver is not allowed to borrow for operation there would have been no recourse but to scrap the road. As it is, the road has been kept intact, the physical property is in excellent shape, and the prospect of raising the receivership during the coming winter is good.

N. Y. R. R. Club's Annual Electrical Night

New York Central Engineers Summarize Recent Progress in Heavy Electric Traction and Arc Welding

AMONG the papers read at the "Annual Electrical Night" meeting of the New York Railroad Club, held in that city on Nov. 21, the principal papers of electric railway interest were the following: "Electrification of Steam Roads in 1919," by Edwin B. Katté, chief engineer of electric traction New York Central Railroad, and "Recent Progress in Arc Welding," by H. A. Currie, assistant electrical engineer New York Central Railroad. Abstracts of these papers follow:

FOUR MODERN ELECTRIC LOCOMOTIVES

First in importance in electrification work Mr. Katté placed the electrical extension of the Chicago, Milwaukee & St. Paul Railway from Othello to Seattle, a distance of 127 miles over the Cascade Range. This is practically complete and is in partial operation, full service being delayed pending the delivery of the passenger locomotives. This is a 3000-volt direct-current system, with the double overhead working conductor, exactly the same as the construction used on the existing and very successful 440 miles now on its third year of operation on the Rocky Mountain and Missoula divisions.

Two new types of passenger locomotives are now ready for services on these divisions. They are designed to operate a 950-ton train at 65 m. p. h. on level track and to average 25 m. p. h. over 18 miles of average 2.2 per cent grade and 20 miles of average 2 per cent grade.

The Westinghouse Electric & Manufacturing Company will supply 255-ton locomotives, the drive being through gears and quills by six twin motors of 700-hp. capacity each. The General Electric Company will supply five locomotives, each weighing 265 tons, and equipped with twelve bi-polar gearless motors, of 270-hp. capacity each. One locomotive of each type has been completed and tested, while the balance of each order is well under way. Soon after the new year all fifteen of these locomotives will be in service.

Another type of passenger locomotive is the one of the New Haven Railroad, designed to haul 900-ton trains in express service between New Haven and the Pennsylvania Terminal in New York City by way of the New York Connecting Railroad, over the famous Hell Gate Bridge. These operate on either alternating current at 11,000 volts under a suspended contact wire, or on direct current at 600 volts from the third-rail. Each locomotive weighs 180 tons, of which 115 tons is on the drivers. The motor equipment consists of six twin motors of 170-hp. normal rating each. The drive is through gears and quills. The total one-hour rating of the motors is 2000 hp. and at this rating the tractive effort is 21,000 lb. The motor armatures are permanently connected in four groups of three in series. Several of these locomotives are now in successful operation.

A description of recent electric locomotives, however brief, would be incomplete without recalling that the engineers of the Pennsylvania Railroad and the Westinghouse Company have developed and tested an electric freight locomotive, weighing 250 tons, for service over mountain grades. This locomotive, known as No. 3931, was tried out in June, 1917, and after the usual test-track trial was put in regular freight service between Philadelphia and Paoli, where to date it has traveled about 5000 miles.

The electric equipment of this locomotive is designed to operate on 11,000-volt single phase current, taken from an overhead contact wire. At each end of the locomotive there are two motors, each driving a jackshaft, the power being transmitted through springs and side rods to a set of three driving axles. The combined one-hour rating of the motors is 4800 hp. and at this rating the tractive effort is 87,200 lb., the maximum speed being 20.6 m.p.h. These facts have been furnished by William F. Keisle, Jr., mechanical engineer of the Pennsylvania Railroad.

But not only in this country have things been happening electrically on steam railroads during the past year, but also in other countries, notably Australia. The electrification of the Metropolitan Railway system of Melbourne was put in service last May. In 1908, C. H. Merz, the distinguished English authority on electric railroading, first reported favorably on the electrification of the Melbourne suburban section of the Victoria Railway System. Proposals were received in 1912 based upon the single-phase, 11,000-volt alternating-current system and upon the 1500-volt direct-current system. Under both methods the propulsion cur-

rent was to be collected from overhead catenary contact wires, supported by steel masts or bridges. It was reported that the single-phase scheme would have cost 23 per cent more than the direct current, and it was estimated that it would cost 21.7 per cent more in annual operation. High-voltage direct current was, therefore, adopted. The delay in completing this work is attributed to war conditions.

Mr. Katté then gave some details of the Melbourne electrification which need not be repeated as they will be found fully covered in articles in this paper, one of which appears elsewhere in this issue.

Recent Progress in Arc Welding

Following Mr. Katté, Mr. Currie gave the results of the experience of the New York Central Railroad with arc welding in repair work. He prefaced his remarks by calling attention to the fact that one phase of welding that has had but little attention is the fundamentally important one of preparation, to which he wished to direct special attention in his paper.

The facilities in the New York Central shops for electric welding consist of both direct-current and alternating-current units of various makes. Depending on local requirements they are either portable or in a fixed location. All of the alternating-current equipment is of the transformer type. All types have given satisfactory service.

The welding equipment comprises the single-operator type of machine, suitably located throughout the buildings and so connected by bus lines that machines can be electrically connected to any outlet throughout the shop. This arrangement gives all of the advantages of multiple-operator machines with none of the disadvantages.

The saving in the locomotive shops since electric welding was installed can hardly be calculated and the additional mileage that is obtained from locomotives is remarkable. This is mainly due to the following: (1) Greater permanency of repairs; (2) shorter periods in the shop, giving additional use of equipment; (3) existing shop facilities can take care of larger numbers of locomotives than originally expected, thus relieving shop congestion; (4) the use of worn and broken parts, which without electric welding would be thrown into the scrap pile; (5) the time required to make repairs is much less and the repairs require fewer men, and (6) a smaller quantity of spare parts need be carried in stock.

Mr. Currie then gave a number of examples of actual processes in welding, stating, for example, that in the work of repairing wheels great success had resulted from welding. Flat spots had been built up without removing the wheels from the locomotives, thus effecting a great saving in time and money. Building up sharp flanges has also been very successful. Many axles are being reclaimed by building up the worn parts. These are tender and truck axles which are worn on the journals, wheel fits and collars. The saving is about $25 per tender axle and $20 per truck axle. There is also a large saving in welding broken parts of shop tools and machinery.

Mr. Currie called attention to the importance of careful training of operators for arc welding. Success here depends solely on the men who do the work. They must be instructed in the use of the arc; the type, size and composition of the electrodes for various classes of work, and the characteristics of the various machines which they will be called upon to use. A properly equipped school for teaching these matters would be a valuable adjunct. Manufacturers of equipment have recognized the importance of proper instruction and have equipped schools where men are taught the welding art free of charge.

Another important matter is intelligent supervision. The duties of an inspector might be summarized as follows: (1) To see that the work is properly prepared for the operator; (2) to insure the good condition of machines and wiring; (3) to advise as to the proper selection of electrodes; (4) to inspect the weld in process of application and when finished, and (5) to act as adviser and medium of interchange of welding practice among shops.

Bare electrodes should be used almost exclusively even for alternating-current welds. Whenever a new lot of electrodes is received, it is good practice to make up test-piece samples so that they may be subjected to careful test and analysis. In railway practice the sizes of electrodes and uses to which they are put are as follows: (1) Flue welding, $\frac{1}{8}$ in.; (2) repair work, broken frames, cylinders, etc., $\frac{5}{8}$ in.; (3) building up wearing surfaces, $\frac{7}{32}$ in.

Mr. Currie concluded by suggesting the following rules for guidance in welding procedure:

1. *Preparation.* The work should be arranged or set up so that the electrodes may be held perpendicular to the plane of welding. When this cannot be accomplished the electrodes must be bent so that the arc will be drawn from the point and not the side of the electrodes. The surfaces to be welded must be thoroughly cleaned and free from grease and grit.

2. *Electrode.* The proper electrode and current volume must be selected for the work to be done.

3. *The arc* should be maintained as constant as possible.

4. *The prepared surface* should for nearly all work be evenly welded over and then the new surfaces welded together.

5. *Shields or helmets* of suitable type must be used with proper color values for the lenses.

In the work described by Mr. Currie a good operator will deposit an average of 1½ lb. of electrode per hour. The limits are from 1 to 2 lb.

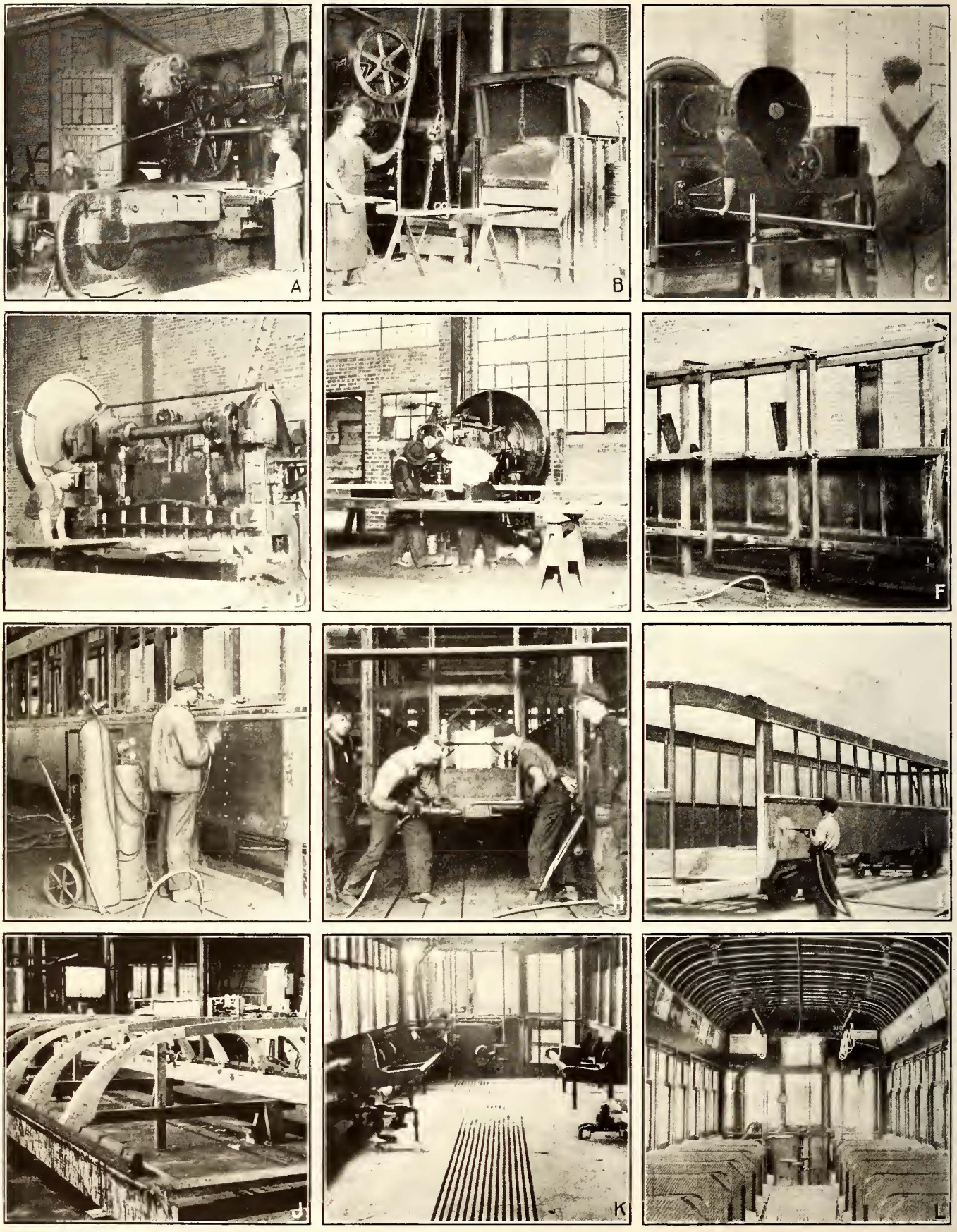
Limiting the Load on Richmond Safety Cars

IN RICHMOND with only eighteen safety cars in operation at the present time, the management has already reached the conclusion that the service which these cars render to the public will be enhanced by observation of a limited load rule. It has adopted the practice of placing a car-full sign in the front window when the number of passengers on the car reaches fifty. With a seating capacity of thirty-two, this gives a standing load of eighteen passengers—certainly a large enough load according to the comment of Mr. Buchanan, the general manager. The contention is that when a car becomes loaded beyond this point, its operation is unduly handicapped. The ingress and egress of passengers is so obstructed that the standing time of the cars is annoyingly prolonged, the passengers become impatient at the delay and condemn the cars, and the operator meets with difficulty in collecting all the fares.

The car-full sign on the Richmond cars has been mounted on a frame inside the car within easy reach of the operator and pivoted about a horizontal axis so that it may be reversed without the slightest delay or effort. On one side the sign reads, "Car Full," and on the other, "Please Have Exact Fare Ready." Thus far there has been no complaint on account of the practice which this sign signifies.

Ivy L. Lee Extends Organization

Ivy L. Lee's organization is now constituted of the following men: J. W. Lee, Jr., W. W. Harris, Daniel T. Pierce, Thomas J. Ross, Jr., Charles W. Towne, Edward N. Lewis, Thomas E. Orr and William L. Dempsey, with H. W. Dengler, Jr., as office manager. The experience represented by this organization includes extended daily newspaper work, technical journalism, political reporting, legislative reporting, advertising management, and other publicity work of many kinds.



Some Steps in the Fabrication of Cars in Detroit United Shops

A—The big bulldozer handles most of the bending work. B—Bolster members are heated in oil-burning furnace before bending. C—Profile shear for cutting angles, channels and bars. D—All large plates for side sheathing are cut in the gate shear. E—Practically all holes in construction of new cars are punched. F—The sides of the car are first assembled on a vertical template. G—The oxy-acetylene apparatus is used in welding joints. H—There is plenty of riveting to be done. I—The sand blasting is done as the car passes on to the carpenter shop. J—The roof is also built on a template. K—The car is now ready for the paint shop. L—Interior of completed car looking toward the front.

Shop Methods Used in Building Cars

Detroit United Railway Is Engaged in an Elaborate Car-Building Enterprise—Templates Used in Constructing Standardized Interchangeable Unit Parts

IN THE EXTENSIVE car building program upon which the Detroit United Railway has entered it is planned to turn out some six or seven cars per month for an indefinite period and by shop methods which differ materially from those usually employed by electric railway companies. This was briefly referred to in a description of the details of design and construction of these cars in an article in the issue of this paper for Nov. 8, page 863. The several parts of the car are built as units upon templates and later assembled; this method having been devised with the idea of standardization and quantity production. Much of the labor is paid for on a piece-work basis.

New Equipment Installed in Blacksmith Shop

To facilitate the work in the blacksmith shop several pieces of new equipment have been installed. Among these is a Williams & White No. 28 reversible bulldozer, which is used for most of the bending work. This includes the floor supports, made with special dies and formed cold; the top members of the bolsters, also bent cold; and the bottom members which are first heated in a new Ferguson oil-burning furnace, and such other members as the vestibule support angles, belt rails and sash rests.

Other new equipment includes a Buffalo Forge Company profile shear designed to cut a soft steel bar 3 in. in diameter or the equivalent; a No. 6 plate-bending machine and a No. 8 gate shear, made by Bertsch & Company, the shear being powerful enough to cut a plate ⅜ in. thick and 78 in. wide, and a No. 2 Hilles & Jones power punch capable of punching a hole 1 in. in diameter through metal 1 in. thick. In the construction of the new cars practically all holes are punched rather than drilled. Many other new machines essential to present-day steel car building have also been installed.

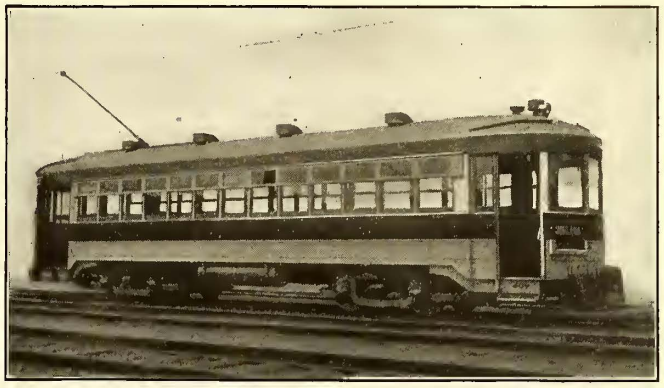
All Work Assembled by Units on Templates

As the steel parts come from the blacksmith shop the two sides of the car are assembled on a vertical template. All parts of this template are adjustable so that if cars of a different design than those now being built are desired they can be constructed on the same template.

The first step in assembling a side is to bolt all vertical T-iron posts to the form. The belt rails and sash rests are then assembled and later the sheet-steel sheathing is bolted in place with its splice plates. The letterboards are then applied and the side sills bolted in position. An angle iron is used at the top of the letterboard as a support for the roof. Next, all parts are riveted together, all joints in sash and letterboard are acetylene-welded and each post is welded at the top and bottom respectively to the letterboard and sash rest.

When both sides have been thus far assembled they are moved along the track and assembled on the body bolsters. After the floor members have been assembled the car is again moved along the track and the vestibules are assembled. All welding is then ground down and the car is sand blasted en route to the carpenter shop and given two priming coats of paint.

The roof is built in three units, the main roof and the front and rear vestibule hoods. Two longitudinal roof angles are first laid out on forms in the carpenter shop and the steel carlines are riveted in place so that one will come over each T-iron post. A pair of wooden carlines is bolted onto each steel carline and two single intermediate wooden carlines are placed between adjacent steel and wood combinations. All holes having been previously punched in the roof angles with corresponding holes in the roof support angles of the car frame, the poplar roofing is applied and covered with canvas duck and the roof, now complete, is assembled on the body framing of the car.



STEEL MOTOR CAR BUILT IN DETROIT RAILWAY SHOPS

The next step is the assembling of all interior wood work including flooring, post furring and lining. All wiring is done in the carpenter shop, the motor wires and resistance being placed in conduit. All equipment, also, except the transverse seats is installed in the carpenter shop. When the woodwork is complete the bodies are placed on trucks and the leads are connected.

Procedure in the Paint Shop

From the carpenter shop the car proceeds on its own power to the paint shop where the ceiling receives, in order, a priming coat, a putty coat, sanding, a coat of surfacer and two coats of oil enamel. The interior woodwork receives two coats of shellac, is then lettered and finally receives two coats of flat varnish. The base panels are next primed and given two coats of enamel. The floor is then painted and trimming and bronzing is done.

The outside of the car receives first a putty coat, then a sanding and finally a coat of surfacer. Next the roof is painted and finally the car is given a glaze and two coats of enamel and is striped. The fenders, air tanks, etc., are painted black. After all painting is completed the seats, windows and doors are installed.

The French government is putting into operation a plan for co-ordinating the work of the railroads of the country and for providing collaboration of representatives from the different classes of railway workers with the heads of departments and directors in the management of the roads. This will "head up" in the "Committee of Exploitation" comprising representatives from the administrative and operating departments of the lines, representatives of the government and representatives of the employees. A technical committee will supervise the rolling stock, with membership made up of the chief engineers of the lines, manufacturers of road material and representatives of the employees.

Present Status of Engineering Association Standards

Adoption of A. S. M. E. Boiler Code Has Effected Saving in Manufacturing Cost and Improvement in Safety and Operating Methods

By J. W. Welsh

A GENERAL survey of the work of the power generation committee for the past ten years discloses a great amount of research and investigation on the part of members of this committee.

Its earliest activities have been connected with the boiler house. It is here that the greatest economies in operation have been possible. In the boiler room, however, the problems relate mainly to operating methods and economies as compared with other departments of the electric railway wherein there is a greater use of materials in new construction and maintenance. Notwithstanding this, however, those elements in boiler-house practice which have permitted standardization have received the closest attention and as a result the association has in the Manual the "Boiler Code," the "Specifications for Boiler Tubes," and the "Specifications for the Purchase of Fuel."

Probably the most important and valuable recommendation of this committee has been the adoption of the "Boiler Code" of the American Society of Mechanical Engineers. The preparation of this code has been the work of engineers and experts on this subject, from all parts of the United States. It has resulted in a unification in the construction and manufacture of boilers throughout the country, replacing a condition in which each state had its own requirement. As a result there has been a considerable saving in the cost of manufacture and a tremendous advancement in safety and operating methods.

The "Specifications for Lap Welded and Seamless Boiler Tubes" were developed in the same way as the "Boiler Code" and relate to the chemical and physical properties of steel used in the manufacture of tubes and the methods of installing them in boilers.

In the adoption of a "Specification and Form of Contract for the Purchase of Coal," the association has made an independent contribution as this represents the work of the committee unassisted by outside organizations. These specifications have not been adopted as "standard" but only as "miscellaneous methods and practices," as they serve largely to fix the variable commercial value of coal as its constituent elements change. They should be, however, of material assistance in the preparation of contracts for the purchase of coal.

The researches of the committee during this period of evolution, covering the economics of boiler plants and the improvements in types of equipment for the generation and conversion of electrical energy, have not been so well adapted to standardization. This is well illustrated by the character of the papers that have been presented.

The increase in size of the steam turbine and its substitution for the reciprocating engine and the introduction of centrifugal types of auxiliary apparatus received its greatest development during this period. The commercialization of hitherto laboratory types of measuring devices in the boiler room has permitted the substitution of scientific methods for rule of thumb.

On the other hand, the tremendous growth and complexity of modern power systems have developed great improvements in methods for the control of electrical energy. The possibility of concentrating great quantities of power through the interconnected mesh work of transmission systems has necessitated great advances in suitable control equipment. This is illustrated in the modern switchboard with its gigantic switching equipment, selective relays and other protective devices capable of interrupting instantly the whole power supply of a large city.

The most notable recent development in power equipment undoubtedly has been the automatic substation. The success of this type of laborless apparatus has opened up a new field in the operation of all forms of power equipment, from the power station to the electric car. The recent advances in the cost of labor makes this improvement particularly advantageous at the present time.

The report of this year's committee on power generation represents a well-rounded view of the whole power situation. While it has made no definite recommendations for standards, yet it includes material of permanent value.

The recommendation of a "Standard Form of Contract for the Purchase of Power," meets a very present need in the increasing tendency of railways to take advantage of the economy and diversity of a central power system.

The paper on "Further Consideration of Operating Performances of Railway Power Station" is of special interest, exhibiting the great improvement in operating economy permissible with modern equipment and presents an interesting study of the effect of various factors (such as the form of load curve, size of unit, quality of fuel, etc.) in determining the switchboard cost of power.

The paper on "Automatic Substations" is a review of the experience of those companies where this form of equipment has been adopted. It contains data covering both construction and operating costs together with a statement of operating performances, and is well illustrated.

Modern Steam-Turbine Plants Show High Degree of Efficiency

IN A PAPER read before the American Boiler Manufacturers' Association at Buffalo, N. Y., Dr. D. S. Jacobus pointed out among other things the importance of the relation of furnace and stoker in the matter of design. With a given boiler arrangement, tube spacing, etc., he said, it usually follows that, to secure a high heat transfer, the draft resistence will be greater than with the same amount of surface provided with baffles that will give a lower rate of heat transfer. If the arrangement of heating surface and baffles is such as to lead to too high a draft resistance, the capacity developed by the boiler with a given draft may be lower than desired. If the arrangement is such as to give a low draft resistance, the efficiency may be less than it should be. In providing a proper design, one of these features must be balanced against the other and an arrangement provided which will give the best all-round results.

The addition of an economizer will increase the economy, say 5 to 10 per cent. Now that the price of fuel is increasing, a greater number of economizers are being installed.

For large plants the efficiency obtainable with a modern steam boiler and steam-turbine installation is greater than could be secured through gasifying the coal in producers and using gas engines. A large steam-turbine plant of the best modern design will generate a kilowatt-hour with a heat consumption, based on the heat in the fuel, of 17,000 B.t.u. This is a round figure for plants of the best modern construction with a load factor of, say, 60 per cent and steam pressures of from 250 to 300 lb. By increasing the steam pressure and raising the superheat, the figure can no doubt be reduced to the neighborhood of 15,000 B.t.u. per kilowatt-hour.* There is no likelihood of the gas engine displacing the steam turbine for large power-generating station work for some time to come.

* As 1 Kw.-hr. is equivalent to 3412 B.t.u., the thermal efficiency (ratio of output to heat in coal) is 3412 divided by 15,000, or 22.7 per cent.—Eds.

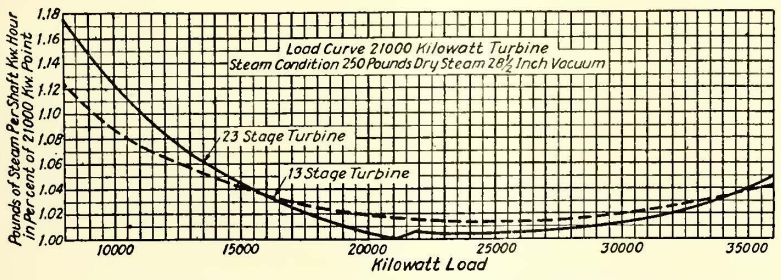
Limitations in Steam-Turbine Design

At the A. I. E. E. Meeting Held in New York City on Nov. 14, the Discussion Brought Out the Relation of Speed, Size, Temperature Rise and Other Factors Which Affect Capacity and Proportions

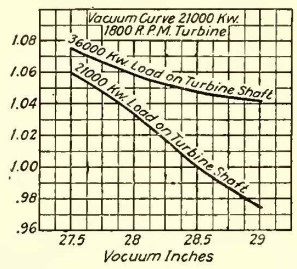
THREE papers on steam-turbine and turbo-generator design were read at a meeting of the American Institute of Electrical Engineers held in New York on Nov. 14. The titles and authors of these were: "Present Limits of Speed and Power of Single-Shaft Curtis Steam Turbines," by Eskil Berg, General Electric Company, Schenectady, N. Y.; "Present Limits of Speed and Power of Single-Shaft Steam Turbines," by J. F. Johnson, Westinghouse Electric & Manufacturing Company, East Pittsburgh. Pa., and "Present Limits of Speed and Output of Single-Shaft Turbo-Generators," by F. D. Newbury, Westinghouse Electric & Manufacturing Company.

Operating Characteristics of Large Turbines

Mr. Berg gave data regarding two typical large turbines, one built for 1800 r.p.m. and the other for 3600 r.p.m. and both of the single-flow type. The 1800-r.p.m. machine has twenty-three stages, the pitch diameter of the first stage



STEAM CONSUMPTION OF 21,000-KW. TURBINE, EXPRESSED IN PERCENTAGE OF CONSUMPTION AT RATED LOAD



RELATION OF VACUUM TO CAPACITY FOR 21,000-KW. TURBINE, EXPRESSED IN TERMS OF PERCENTAGE OF RATED LOAD

wheel being 35 in. and that of the last wheel 88 in. The curves reproduced show the best efficiency at 21,000 kw., although with the sacrifice of 5 per cent in efficiency an output of 36,000 kw. can be secured, live steam being by-passed to the eighth stage shell above 21,000 kw., thus accounting for the break in the curve. The curve in dash-line is for a similar turbine in which the first eleven stages are replaced by one two-bucket stage.

A second graph shows the effect of vacuum in the twenty-three-stage turbine. Still others show the efficiency of the machine in the last stage, the percentage of energy in the steam which is turned into mechanical energy in this stage, the percentage of energy in the loss of the exhaust and various losses in the machine. As the overload increases the per cent of the energy transformed in the last stage increases, with reduction in efficiency both of the last stage itself and of the turbine as a whole.

The final diagram reproduced gives a load curve of a 3600-r.p.m. turbine, having five stages, one two-bucket wheel in the first stage, and single-bucket wheels in the other four stages. The first wheel has a pitch diameter of 35½ in. and the remaining four wheels one of 54 in. This turbine is designed for a maximum load of 6250 kw.

From the data given in the paper, Mr. Berg concluded that for a given speed there is one particular size of turbine which can be designed to be most economical as to steam consumption, weight, space and price per kilowatt. Even if a size smaller than this is required, it would in many cases pay to install the larger unit even though it would have to run at reduced load for some time.

In some of the first large machines of the type discussed, serious trouble has developed through the formation of cracks in the forged wheels. The cracks have started at holes in the wheels provided either for balancing steam pressures on the two sides of the wheels or for the attachment of balance weights. Much evidence has been accumulated to show that the trouble with the wheels has not resulted from stresses in excess of those which had previously been found to be practicable, but was caused by fluttering and vibrations of the wheels due to the lightness and thinness of their construction.

To overcome such troubles as have developed it is simply necessary to make the wheels stiffer and to put in holes in parts near the hub where a suitable reinforcement of thickness can be provided which stiffens the wheels and reduces the stresses near the holes.

Experience has shown that in the absence of a tendency to form fatigue cracks through vibration, over-speed in such turbine wheels involves relatively little danger as compared with other types of high-speed machinery.

Fluttering or vibration of the web of the wheel not only causes fatigue cracks in the wheels themselves, but also causes loosening and breakage of buckets. A cure for these difficulties is to use stiffer wheels and stiffer buckets, so that the whole structure is incapable of vibration of any amplitude through such forces and periods as arise from the conditions of operation.

With High-Vacuum Turbines the Limit of Power Is Determined Largely by the Area Through the Last Stage

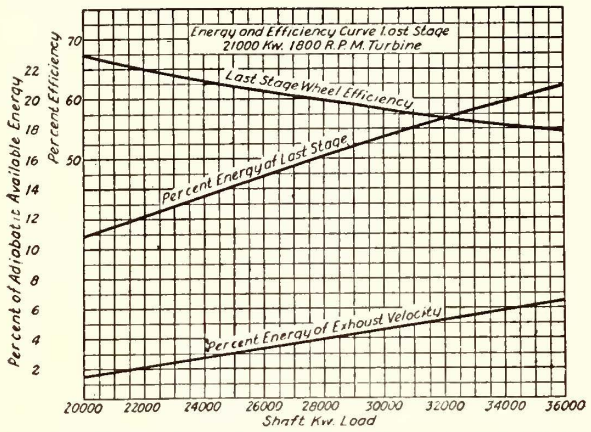
In his paper Mr. Johnson divided the limitations in the size of turbines into three classes—theoretical, physical and economic. That the limiting feature is the area obtainable in the last stage can be seen from the fact that whereas a pound of steam when entering the first stage has a volume of less than 2½ cu. ft., when passing through the last stage it has a volume of approximately 395 cu. ft. when expanded to 28½ in. vacuum, and 585 cu. ft. when expanded to 29 in.

Under theoretical limits Mr. Johnson stated that for a given diameter and blade height, the capacity will be limited by chosen maximum values of steam speed through the blades, in order to keep the leaving losses, or available energy in the steam discharged through the condenser, within permissible limits. Throughout the entire turbine, with the exception of the last few stages, steam speeds only about 25 per cent in excess of the corresponding blade speeds are employed in order to secure maximum efficiency.

In the last stages the steam speed may be twice the blade speed.

When the height of a row of blades is fixed, the area of the steam space is dependent upon the angle formed between the center line of the row of blades and the outlet portion of the blade. The smaller this angle is, the smaller will be the area and *vice versa;* on the other hand, the smaller the angle the higher the efficiency, because of the lower absolute velocity left in the steam discharged to the condenser.

Chief among the physical factors limiting turbine capacity are the physical characteristics of the materials employed and the chosen limits to which these materials may safely be stressed. Conservatism demands adherence to the lower-strength, less-sensitive materials, rather than



CHARACTERISTIC CURVES OF LAST STAGE OF 21,000-KW. TURBINE

special alloy steels; and such materials may, with suitable forms of construction, be safely stressed under the maximum stress condition to within a few thousand pounds of their true elastic limits. The steel regularly used by the Westinghouse company for turbine rotors shows these characteristics with standard 2-in. specimens: Tensile strength 65,000 to 75,000 lb. per square inch; true elastic limit 22,000 to 25,000 lb.; elongation 15 to 18 per cent, and reduction of area 20 to 25 per cent. The material is obtained ordinarily in the form of castings, although occasionally forgings are used.

There exist two interesting relations between the stress at the base of the blade, the steam passage area through the blade and the rotative speed. They are these: (1) For any given rotative speed and blade angle, the steam capacity or steam area through the blades is directly proportional to the stress at the base of the blade, regardless of diameter and blade height selected. (2) For any given stress the area through the blade will vary inversely as the square of the speed.

Increased capacity without decrease of rotative speed or increase of stresses may be obtained by employing multiple, low-pressure stages. This expedient possesses the merit of permitting high-vacuum turbines to be built at speeds and capacities up to approximately the present limits of generator construction, without exceeding moderate diameters, blade lengths and stresses.

An important limit of size and capacity now being approached is that imposed by transportation facilities. For example, the low-pressure rotors of the 30,000-kw. Interborough Rapid Transit turbine had to be shipped with the last-stage blade-carrying element removed. Ways may be devised for partial dismantling of rotor elements, as in this case, although diameter will be one of the limiting factors. This cannot be reduced beyond the point of omission of blading.

While the physical dimensions and capacities of turbines are being constantly increased, it is essential that the reliability factor be not decreased. The employment of special materials and higher stresses does not usually permit increased capacity or efficiency without a corresponding increase in weight and cost unless reliability be compromised.

Some Economic Limitations

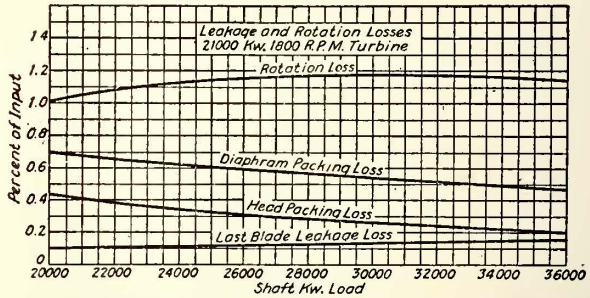
As yet turbines of large capacity are not required in sufficient quantity to warrant equipping and operating shops for their exclusive manufacture. They must, therefore, be produced largely by the same processes and equipment as are used for smaller turbines. As sizes become larger, a greater proportion of special equipment and processes becomes necessary, resulting in increased rates of cost, unless accompanied by very material increase in quantity of production. Under present conditions this economic limited capacity agrees closely with the physical limits of 1500-r.p.m. units.

In the larger low-speed structures, the physical proportions become such that, using ordinary steel and cast iron to which we are limited by the metallurgical art, the distortions due to temperature changes and elastic properties of the material are such that increased clearances and bracings have to be employed. Further development of the allied arts and increased demands for larger units will tend to reduce the influence of this limitation factor. Another factor tending to limit capacity of single units is the loss resulting from suspension of service for inspection or repairs.

In order to avoid the undesirable characteristics referred to, a number of turbine units of capacities varying from 30,000 to 60,000 kw. have been built in which the turbines have been divided into two or three separate compounded elements, each having its own generator and each capable of operating alone on high-pressure steam in emergencies. It is believed that units of this type will continue to be employed for the larger capacities because of the advantages not obtainable in single cylinder types which justify their somewhat greater cost.

Generator Output Is Determined Broadly by Rotor or Stator Dimensions

From the electrical end of the turbo-generator units, according to Mr. Newbury, the maximum output at any speed is obtained when slot space is provided for the maxi-



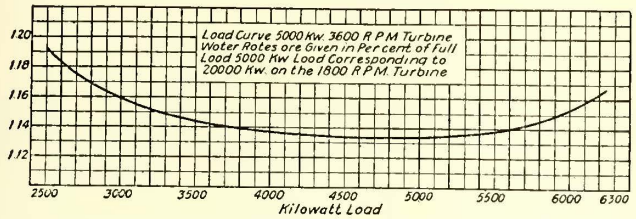
OVERLOAD LOSSES IN 21,000-KW. TURBINE, EXPRESSED AS PERCENTAGE OF INPUT

mum possible ampere-turns (in either stator or rotor) and core cross-section is provided for the maximum possible flux. These conditions require the most effective rotor diameters (or stator bore) and the maximum rotor and stator core length. All factors that limit rotor diameter (or stator bore) or core length have a possible bearing on limiting output.

For maximum output the rotor should have maximum space for winding, and maximum tooth and core section for flux. Obviously these requirements are antagonistic

and the actual design is a balance between slot area and polar area.

Again, as the diameter is increased (with a given speed) there is more room for both winding and flux, but with increase in diameter each pound of copper exerts an increasing centrifugal force and the ratio of slot area to tooth cross-section must be decreased in order to keep within desired stresses. Beyond a certain peripheral velocity, ampere-turns must be decreased in spite of the increase in available space, and the most effective diameter has been



CHARACTERISTIC CURVE OF 5000-KW. 3600-R. P. M. TURBINE SHOWING WATER RATE AS A PERCENTAGE OF THAT AT A LOAD OF 20,000 KW. ON THE 1800-R. P. M. TURBINE

passed. It is seen, therefore, that in order to obtain maximum output at a given speed the rotor proportion must be chosen properly to balance mechanical stresses, rotor ampere-turns and flux.

Voltage regulation has ceased to be a limit to the output of electric generators due to the use of voltage regulators. Permissible regulations are roughly 25 per cent, at 100 per cent power factor, and 40 per cent, at 80 per cent power factor. Obviously such regulations could not be tolerated if regulation were a factor in operation.

Turbo-generators are designed for a maximum speed 20 per cent above the running speed. At this over-speed the tooth stresses should be approximately one-fourth the ultimate strength of the carbon steel and the coil-retaining-ring stress should be approximately one-third the ultimate strength. This results in working stresses, in both cases, of approximately one-half the yield point. It is important that the material be ductile. Carbon steel, with proper working can readily be obtained with 22 per cent elongation and 25 per cent reduction in area, and the alloyed steel should have 22 per cent elongation and 50 per cent reduction. These figures refer to standard 2-in. test pieces under tension.

American design practice has established 400 ft. per second as an upper limit of peripheral speed for maximum ampere-turns in output, for rotational speeds to 1500 r.p.m. and higher.

In the paper Mr. Newbury went on to discuss the factors of ventilation, rotor deflection, winding temperatures and transportation facilities as limitations in generator design. Under the first head he said that designers are already finding it necessary to devise more complicated systems of ventilation in order to take care of 3600 and 1800-r.p.m. ratings now in prospect. As to rotor deflection, obviously as the rotor length is increased, the journal and bearing sizes must be increased in order to keep the shaft stress and the critical speed within desired limits, and the limit may be imposed by bearing losses and temperatures. As to winding temperatures, values higher than 150 deg. result in relatively little gain in rotor ampere-turns on account of the rapid increase in the resistence of the windings. For example, a doubling in temperature rise and rotor loss may result in a gain of only 25 per cent in output. Very high temperatures also introduce danger of trouble from "creeping" of the windings caused by linear expansion. Finally, as to transportation facilities, the same consideration holds as in the case of the turbines. The limiting capacities given for speeds below 1500 r.p.m. can only be obtained by exceeding present transportation facilities if present design types are adhered to.

In conclusion, Mr. Newbury said that he had not intended to express an opinion as to the wisdom of installing very large single-shaft units. Whether it is desirable or even wise to install very large units—above 50,000 kw.—will depend very largely on the growth and size of the generating stations. As stations become larger there will undoubterly be a demand for units of 50,000 to 100,000-kw. capacity. If single-shaft generators are justified from the turbine standpoint, there is no question but that such generators can be conservatively designed and constructed.

Discussion Brings Out Effects of Vibration

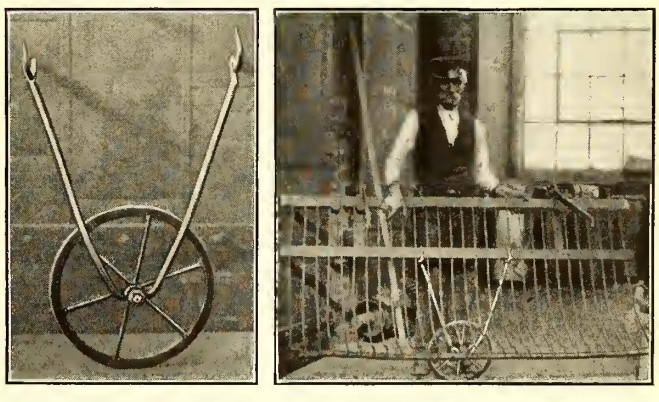
The three papers abstracted above were read together and discussed as a whole. One fact which was dealt upon considerably was the effect of vibration in producing fatigue in the highly-stressed members in turbine and generator construction. In the turbine the disk wheels, of comparatively thin construction, are subject to vibration, particularly at certain speeds, and there was some question as to the effect of continued vibration on the mechanical properties of the steel.

The retaining rings used to resist the effect of centrifugal force on the end windings of the generator rotors also came in for attention. There was some feeling that the high stresses permitted at present might in time cause deterioration of these rings. However, the discussion as a whole brought out the fact that the effect of vibration can be controlled, and that, if materials are used with reasonable factors of safety, there is no reason why turbines and generators cannot be designed to be entirely reliable.

Handy Shop Carriage for Fenders

A FENDER is an awkward thing for one man to handle even with the ordinary small two-wheel truck. A single-wheel carriage which enables one man to transport a fender about the shop through narrow openings and without any lifting has been constructed in the shops of the Tri-City Railway, Davenport, Iowa.

The frame of the carriage consists of a single $\frac{5}{8}$-in rod bent to the shape, indicated in the photographs. The ends form two supporting hooks and the center is flattened and



AT LEFT, SIMPLE CARRIAGE FOR TRUCKING FENDERS ABOUT SHOP. AT RIGHT, THE FENDER, WHICH IS SUPPORTED BY AND RESTS ON THE CARRIAGE FRAME, IS MOVED LENGTHWISE

drilled to admit the axle. The latter is attached rigidly to the frame by means of a shoulder and nut. The wheel was constructed entirely with the acetylene welder from sections of steel bar and a piece of steel tube for a hub.

The hooks are placed under the fender as indicated and when the wheel is in a vertical position the fender rests on the carriage frame. The carriage when not in motion also acts as a support to hold the fender upright.

Facts Regarding Motor-omnibus Service *

The Author Advocates the Giving of Bus Service as Auxiliary to Municipal Tramways Although Its Field of Profitable Operation is Limited

By A. R. FEARNLEY
General Manager Sheffield Corporation Tramways and Motors

ON MANY occasions recently when the question of road passenger transport has been under discussion the opportunity has been taken of suggesting that extensions of electric tramways should not be made, but that any further transport facilities required on the roads should be provided by motor omnibuses. This opinion, of course, comes from those who have had no experience in handling passenger transport work by the electric tramcar.

I propose to look at the question from the point-of-view of the municipality engaged in passenger-transport work, and to show as a result of the experience gained while working motor-bus services as auxiliary to a large tramway system, during the past seven years, how and to what extent motor-omnibuses can best be utilized.

Under present conditions it is comparatively easy for any municipality to obtain powers from Parliament to work motor-omnibuses within its own district, and despite the opposition which is generally met with from railway and motor-bus companies, county councils, and urban district councils, it can also obtain powers to work omnibuses in the districts adjoining its boundaries.

In 1907 the Sheffield Corporation obtained a clause which reads as follows: "The Corporation may provide and run motor-omnibuses within the city, and also in connection with its tramways in certain districts adjoining the city on the following routes." Then follows a description of the routes outside the city boundary on which the Corporation is authorized to run motor-omnibuses, and as will be seen from the accompanying map most of the main roads leading into the city are now provided with bus services; on those which are not so provided powers have been already obtained, and in a short time services will be in operation.

Another clause provides that the Corporation shall make payment to the road authority of ¾ cent † per bus-mile run by its motor-omnibuses; also that the Corporation shall not be required to make any payment in excess of the sum of ¾ cent per bus-mile in respect of any road which has not been constructed or reconstructed so as to be adapted for mechanical traffic.

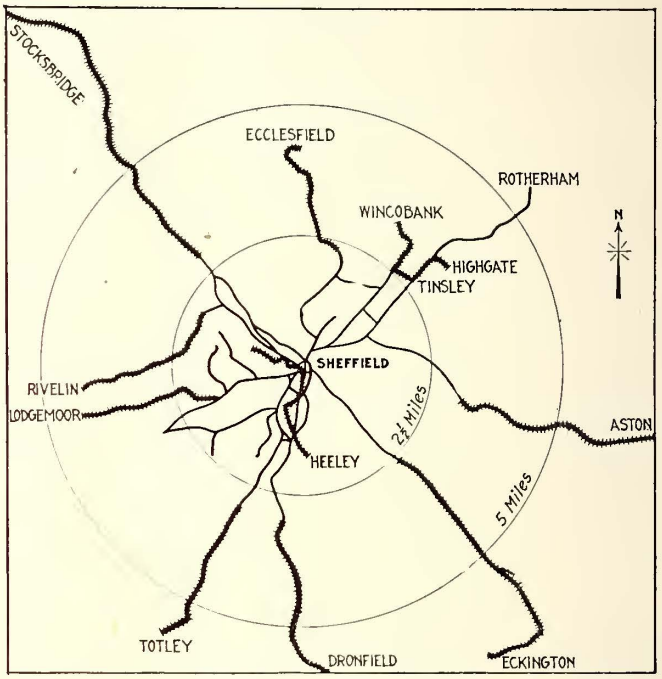
Further clauses provide that the Corporation shall not be required to make any payment in respect of the cost of raising the standard of any road to meet the requirements of mechanical traffic, and that if a grant from the imperial exchequer is made in respect of any roads towards the cost of maintenance the amount to be paid by the Corporation shall be proportionately reduced.

These clauses remain operative for at least five years from March 31, 1919, and were settled by agreement with the West Riding County Council and the Derbyshire County Council so recently as the summer of 1918, after they had had five years' experience in the running of the motor-bus services over their roads.

Another clause in which the Sheffield Corporation appears to have been more fortunate than many other undertakings is in the fare clause. Our clause in regard to this matter reads as follows: "The Corporation may demand and take such reasonable fares and charges for the conveyance of passengers and parcels in or on their motor omnibuses as they may think fit."

With the parliamentary authority above referred to, the Sheffield Corporation commenced in 1913 to run motor-omnibus services on a number of routes within the city and as extensions of its tramway routes outside the city and has continued since that date as opportunity offered to extend such system, until it has now services covering 37 miles of road, of which 15 miles is within the city boundary, and 22 miles outside the city on County Council roads. Altogether about forty motor-omnibuses are employed. At least six additional routes are contemplated, a number of which are to be put into operation as soon as a further supply of suitable omnibuses can be obtained.

The results of the first three years operation were excellent but, of course, war conditions, especially during the last two years, made the working of the services very difficult. At times, owing to inability to obtain spare parts and carry out repairs, it was almost impossible.



OUTLINE MAP OF TRAMWAY AND MOTOR-BUS LINES IN SHEFFIELD
Heavy lines show bus routes

The expenses for the last two years are as follows:

AVERAGE EXPENDITURE PER BUS-MILE

	1915 Cents	1918 Cents	1919 Cents
Traffic expenses	6.02	9.86	14.17
General expenses	0.74	0.76	1.06
Repairs account	3.83	8.82	9.05
Road maintenance account	0.11	0.29	0.40
Power expenses (gasoline)	3.37	8.31	11.10
Total working expenses	14.07	28.04	35.78

Although on country roads the single-deck bus is the more satisfactory type of vehicle, the preference in the district for the double-deck bus is so pronounced that we have tried as far as possible to meet this requirement, 75 per cent being of the latter type.

On the city routes this class of service undoubtedly provides a great public convenience for short-distance cross-town traffic through streets and districts which cannot be served by cars.

The traffic which has been developed on roads branching off from tramway routes is enormous, and has astonished its most sanguine advocates. The use of buses as extensions to existing tramway routes has also proved very satisfactory. In addition to paying their way, they have

* Abstract of paper read at meeting of Municipal Tramways Associations, of Great Britain. For more complete abstracts see *Electrical Review*, London, *Tramway & Railway World* and other British periodicals. This abstract amplifies the brief note printed in the issue of this paper for Nov. 8.

† Amounts in American money have been obtained by assuming a value of 2 cents for 1d.

brought a great amount of traffic to the tramways. What this means in the summer months may be gathered from the motor-bus traffic return for the last completed week, ended Aug. 17, 1919, as follows:

Receipts, $10,327.10 (fare 3 cents per mile)
Passengers carried, 159,371
Miles run, 20,768 (lost mileage, 59 miles)
Receipts per bus-mile, 50.2 cents
Receipts per bus-mile up to date this year are 47.1 cents

The traffic on bus routes is greater in summer than in winter, the ratio of difference being much greater than on the tramways. There is no doubt that the general effect on the outlying districts is in every way beneficial.

The motor-omnibus, so far as it has been developed up to date, is:

1. An excellent vehicle in acting as feeder of and in connecting up tramway routes and services.
2. An unsuitable vehicle for dealing satisfactorily with heavy town traffic.
3. Quite inadequate for dealing with peak loads.
4. Financially impossible for workmen's traffic at reduced fares.
5. In regard to average speed maintained throughout the day it has no advantage over the electric tramcar.

The maximum seating capacity that we have so far been able to provide is thirty-seven against the maximum of seventy-six on the latest type of tramcar. The new type of bus, of which one has just been put on the streets by the London General Omnibus Company, seats forty-six passengers.

The great difficulty from the passengers' point of view is that only twenty-two passengers on the new type of bus are provided with cover or a comfortable seat under inclement weather conditions which prevail during eight months in the year, whereas the whole of the seventy-six passengers on the tramcar referred to are under cover and traveling under reasonably comfortable conditions whatever the weather conditions may be.

There are very few tramcars running today in the busy manufacturing centers or thickly-populated districts without covers, experiences having shown that for the greater portion of the year the top-deck seat on the open-top car is of little use and the vehicle without top cover becomes practically a single-deck tramcar.

For dealing with the peak loads the Sheffield type of bus with its maximum of thirty-seven seats would be of very little use; for the Tinsley district in Sheffield, each evening we have to provide a service of eighty-two cars per hour, in which time we carry 5576 passengers at an average fare of less than 1 cent per mile. To carry these passengers the number of buses would have to be double the number of cars provided, and in wet or winter weather this would be totally inadequate for the purpose. Given this necessary increase in the number of vehicles, serious loss would result if the same fares as are now charged on the tramways were maintained.

The 3½-ton maximum weight allowed for the London bus is of no use for the provinces. Actual experience has shown us that a body of the London type after two years on roads such as are met with in the Midlands and North County is in such a condition that very heavy repairs are required, and in fact it then becomes a question whether such type of body is worth repairing for work under such conditions. The makers themselves have confirmed this opinion, and today decline to build a body of that type for use in the provinces.

The minimum weight of a double-deck omnibus for roads such as are found in our district is 4½ tons, and the difference in weight of vehicle per passenger carried in the provinces is, therefore, very little in favor of the motor-omnibus, as compared with the tramcar.

COMPARATIVE FIGURES FROM THE 1918-1919 SHEFFIELD ACCOUNTS

	Per Car-Mile, Cents	Per Bus-Mile, Cents	Bus Expenses Are
Working expenses.	24.77	35.79	44.5 per cent more than tramways
Service of debt (capital)	3.37	1.85	45.3 per cent less than tramways
Total expenses.	28.15	37.63	33.7 per cent more than tramways

	Tram-Ways, per Passenger, Cents	Omni-Buses, per Passenger, Cents	Bus Expenses Are
Working expenses.	1.43	4.27	198 per cent more than tramways
Service of debt (capital)	0.19	0.22	12.3 per cent more than tramways
Total expenses.	1.63	4.49	176 per cent more than tramways

	Tramways per Seat per Car-Mile, Cents	Omnibuses per Seat per Bus-Mile, Cents	Bus Expenses Are
Working expenses.	0.46	1.06	131.3 per cent more than tramways
Service of debt (capital)	0.06	0.05	129 per cent less than tramways *
Total expenses.	0.52	1.11	114.1 per cent more than tramways

	Per Car-Mile, Cents	Per Bus-Mile, Cents	Bus Receipts Are
Traffic receipts ...	33.13	40.91	23.5 per cent more than tramways
Traffic receipts per seat provided ...	0.61	.122	98 per cent more than tramways
Average fare charged per mile.	1.30	3.0	130 per cent more than tramways

* This is an important figure and one which is often entirely overlooked by the motor-bus advocates. The impression usually left is that the difference in capital expenditure is much greater.

Appended are some figures for the year ended March 25, 1919, showing:

1. That the revenue expense of running the motor-bus is 44.5 per cent more than the tramcar. After giving the motor-omnibus the benefit of its comparatively lower capital expenditure it still costs 33.7 per cent more than the tramcar to work per mile.
2. The revenue expenses per passenger carried on the motor-omnibus are 198 per cent more than on the tramcar. The total expenses per passenger carried are 176 per cent more on the bus than on the tramcar.
3. Per seat provided, the omnibus revenue expenses are 131.3 per cent higher than the tramcar revenue expenses. The total expenses per seat provided are 114.1 per cent higher on the bus than on the tramcar.

The average speed of the buses is 9.97 m.p.h., and that of the tramcars 8.65 m.p.h., that is, 15.26 per cent in favor of the bus. Bearing in mind, however, that 75 per cent of such bus mileage as is here referred to is run on urban and rural roads, it will be seen that under similar conditions the speed of the tramcar in the provinces is easily equal to the speed of the bus, so that in this respect there is nothing to choose between the two vehicles.

What is very necessary at present to assist the motor-omnibus undertakings in carrying out their work is a plentiful supply of fuel at a reasonable price; that is not a price a cent or two below the monopoly price of the "petrol ring," which is not the way to encourage the use of either benzol or any other home-produced motor fuel.

In conclusion, I would like to suggest that it is the duty of every tramway-owning municipality to undertake this work.

New Executive Members City Representatives' Association

In the report of the organization of the American Association of City Representatives of Electric Railways at Atlantic City, reported in the issue of this paper for Oct. 11, the statement was made that the executive committee was not filled and that two other members of the committee would be named later. W. C. Culkins, secretary of the association, now announces that these places have been filled by the election of Fielder Sanders, Cleveland, and Lynn D. Milam, Dallas.

Straightforward Publicity Does Bring Results

Experience in Massachusetts and in Several Canadian Cities Is Cited to Show that the Public Wants Facts on the Traction Situation

BY ERNEST B. FREDERICKS
Street Railway Publicity Expert, Ottawa, Ont.

DURING the past five years electric railway companies in many cities have taken the public into their confidence to an extent that would have made the industry stand aghast before the era of co-operation began. In the final analysis the new order of things pays. In places where the companies have been in constant touch with their patrons it is noticeable that a much better relationship exists and a much better understanding of operating conditions is had by the public. From this we can deduce the conclusion that the closer the bond between the car riders and the company, the stronger the position of the latter will be when an issue, vital to the industry, is before the people.

LAST YEAR'S MASSACHUSETTS PUBLICITY CAMPAIGN WAS UNIQUE

Concrete examples of what can be accomplished by well-organized publicity campaigns are not difficult to find. In Massachusetts last year there was conducted what will probably stand for some time as a record performance along these lines. It was undoubtedly the most pretentious and extensive campaign of its kind ever waged in behalf of a definite group of public utilities, because it took in the entire State and covered every road operating therein, whereas in most cases a campaign is limited to one city or county, or to the territory served by one company.

At the time the campaign was started practically every electric railway in the State was in financial distress. Service was breaking down, the public was dissatisfied, governing bodies were non-committal as to what they would do, the Public Service Commission had gone as far as it felt it could, the Legislature was "looking into the matter," investigations were pyramided one on top of the other without getting anywhere, and meanwhile the industry was getting to the end of its rope. Everybody admitted that something ought to be done, but no one had anything tangible to offer except the public-ownership advocates who, while not knowing exactly how the State would get out of the mess if it took over the roads, believed that it might be well to "let George do it."

Realizing that quick action was necessary if the business was to be saved, the security holders to the number of more than 15,000 banded together to devise some means of bringing order out of chaos. It looked like a hopeless task but they went at it. An association was formed to conduct a campaign of education, one of the chief objects of which was to try to get the people to unlearn some of the things that they had been taught about the street railways of Massachusetts. This was a man-size job, because for years many papers throughout the State had charged the roads with committing every crime possible in the railway business as well as a number invented as a background to the general arraignment.

To begin with, the association adopted a definite plan for the relief of the roads and came out strongly for a service-at-cost plan adapted to the different needs of the companies and the cities which they served. It was realized that one general bill would not take care of all the roads so three different service-at-cost measures were advocated, one for the Boston Elevated, one for the former Bay State system and one general bill for the other roads in the State. A jitney regulation measure was also advocated as well as one providing for the carrying of freight.

A press bureau was organized as a branch of the association's work, and every paper in the State was provided with articles of a semi-editorial character dealing with the railway situation and offering the service-at-cost idea as the logical solution of the problem. The papers used the material liberally, many of them asking for special articles in addition to the regular stories. As up to that time there had been no organized effort to get all the facts before the people, the papers and the public were in a receptive mood for the material sent out. The newspaper campaign was supplemented by another phase of publicity work that proved of inestimable value. This consisted of sending capable speakers throughout the State to address chambers of commerce, boards of trade and other organizations, on the street railway question. The advantages of service at cost were dwelt upon and as a result of this part of the campaign the plan advocated by the association was indorsed by practically every organization before which it was presented.

Other meetings were called in various sections of the State to the members of the Legislature representing those sections which were invited and the service-at-cost idea was explained to them. Meanwhile hundreds of thousands of booklets were issued, explaining the situation and showing how the service-at-cost plan appeared to be the best available method of solving the problem. These booklets were distributed by banks to their depositors and the remainder were sent direct to thousands of people known to be interested in public utilities. The banks and insurance companies were very helpful allies because under the laws of Massachusetts such companies are permitted to hold street railway securities, and hundreds of thousands of dollars of bank funds are so invested.

MASSACHUSETTS PLAN SPREADS

Coincident with this campaign a legislative committee was at work drafting various relief measures and the association was consulted frequently before the final drafts of the bills previously mentioned were offered for passage. When these measures were first reported to the Legislature there was a promise of formidable opposition, but the work of the association had been well considered and designed to head off such opposition. The members of the Legislature began to receive letters and petitions from their constituents urging the passage of the service-at-cost legislation. Various public-ownership bills made their appearance, but they received such scant support that they were withdrawn. When the final vote was taken the service-at-cost legislation went through both branches of the Legislature with only a handful of negative votes. There is no doubt that the publicity campaign had a great deal to do with the final result because it acquainted the people of the States with the exact situation and, what is equally important, it offered some definite plan for relief.

Encouraged by the result of the intensive campaign in Massachusetts other places that had been awaiting the

outcome in conservative New England undertook similar campaigns. Montreal was one of the first to follow the Massachusetts lead and, with the service-at-cost plan as a groundwork, a well-planned campaign was conducted which ultimately resulted in the adoption of the very admirable plan now in force in that city.

St. Johns, N. B., then took a hand at the same work and began to tell the people why the local public utilities needed relief and pointed out the special advantages of service at cost. The situation here was a little complicated because the campaign had to cover heat, light, power and transportation. A variety of literature was issued, dealing with the subject from a number of viewpoints and, in a straight-from-the-shoulder series of talks, pointing out just what would have to be done. This literature was sent out directly to the customers of the different utilities and before long everybody in the city knew about all there was to know of the situation. The result was the appointment of a special commission to investigate the case and when the commission made its report it recommended the service-at-cost plan.

The most recent instance of what well-directed publicity can accomplish was shown in the case of Sherbrooke, Quebec, where the citizens voted by a large majority to do away with the existing contract with the street railway company and substitute a new agreement providing for a substantial increase in fares and making other concessions to the company. The report of this case was contained in a recent issue of the ELECTRIC RAILWAY JOURNAL. The secret of the success of the new agreement was the nature of the publicity campaign that preceded the vote of the people. In Sherbrooke, as in many other places, there was a strong public-ownership sentiment and, when the new agreement was first discussed, it was freely predicted that the measure would be beaten and that the city would vote to take over the road. The publicity work not only proved the impracticability of public ownership at this time but convinced the people that the best way out of the difficulty was to pass the proposed new agreement.

TORONTO IS STILL OBDURATE

In Toronto a campaign of education was launched about a year ago, encountering a political atmosphere that not only antagonized service at cost but opposed any plan that contemplated relief for the street railway. Certain factions had become obsessed with the idea that public ownership was the only remedy for all public utility ills. Whether this was done as a matter of political expediency or was inspired by public-spirited motives has never been clearly determined. In any event the situation was an impossible one so far as the company was concerned and, while the Ontario Railway Board was in sympathy with the principles of service at cost, the city authorities would consider no plan that involved any kind of relief for the company.

An extensive campaign to tell the people the truth was launched, and a straw ballot showed that the majority of the thinking class were willing to pay a straight 5-cent fare for the kind of service they wanted. When the conciliation board, appointed to arbitrate the wage differences between the employees and the company, handed down a decision favorable to the men it embodied a recommendation that the company be allowed to increase its fares to meet the increased operating costs. The city government "smacked its lips" over the wage award but branded the recommendation as "mischievous," and this despite the fact that it had been shown that the company could not make both ends meet by selling six rides for 25 cents. It was another case where a city "out-Shylocked" Shakespeare's famous character, for Toronto not only insists upon the company carrying out its contract but actually demands more cars and extended service. Fortunately, there are few cities that have put such a strangle hold on their street railways.

The inconsistency of Toronto's attitude toward the company is reflected in the open discussion that is being carried on relative to the fares that the city should charge when it takes over the road in 1921. This in itself is an acknowledgment that the present fares are insufficient and doubtless the city has learned from its limited experience in operating street cars what it means to run this kind of a business. The city has been operating about 10 miles of a civic road for a short time and has managed to pile up a deficit of more than $1,000,000. The loss this year will be around $300,000. A lot of people in Toronto are wondering what the city will do when it takes over the 130 miles of road operated by the Toronto Railway.

LEAVEN OF PUBLICITY IS WORKING AT MANY POINTS

In Vancouver, Winnipeg, Ottawa and other places in Canada publicity campaigns are now under way telling the people about the real conditions in the electric railway industry and how they can be remedied. It is safe to say that the people of Canada are better informed on street railway matters today than they ever were before. That they are taking a real interest in the welfare of the roads is attested by the treatment the companies are getting in most cities. With few exceptions the fare in Canada is less than 5 cents, most of the roads selling six tickets for 25 cents. Many of the companies that are in need of relief would be satisfied with a straight 5-cent fare. Some of the others, and among the latter municipally-operated roads, are not so sure that 5 cents is enough and the day of the 6-cent fare seems not far distant in a number of important cities in the Dominion.

Just what the lasting qualities are of a properly directed publicity campaign is shown in the case of Montreal, where the fare has recently been increased to 7 cents, the second increase since the adoption of the present plan. So well informed had the public been kept that practically no opposition was made to the latest increase. The riding public, being in constant touch with the trend of affairs, has accepted the higher fare as a necessity. The result is that Montreal has one of the best services on the continent, and with a continuance of the present spirit of co-operation manifested by the public the city will doubtless always enjoy good service because the company will be able to keep abreast of the demands made upon it. There is no doubt but that intelligent publicity has made it possible to bring about this condition in Montreal. This case also shows the contrast between a city that will not treat the situation with an open mind, as in the case of Toronto, and a city that decides the question on its merits. One has only to compare the service and equipment in the two cities to find the answer.

In Minneapolis, where a service-at-cost plan is under consideration, a very effective publicity campaign has been under way for some months and it is certain that the public is well informed about what is in prospect. With any kind of reasonable consideration when the plan is voted on by the citizens the service-at-cost plan should be approved by a substantial majority.

Richmond, Va., has been conducting an up-to-the-minute publicity campaign which certainly helped to overcome the opposition that for a long time held up the relief that the road needed and ultimately secured.

The above are but a few of the instances where carefully-planned publicity work has been instrumental in leading the public away from false prophets and showing up the sophistry that has characterized much of the discussion about electric railway matters in the past. Without desiring to discourage any of the efforts that are being made to

educate the public about conditions in the street railway industry I shall conclude by observing that there is a marked tendency, in the case of some literature issued by street railways, to indulge in a vein of flippancy that is hardly to be commended. There is a great deal that the public should learn about the street railway business and scarcely a day passes that does not produce its quota of live news relative to the industry. There is ample material for a lot of straight talk about subjects that are of very serious import to the business and I can find no better advice than to fall back on the old but always forceful command " Do it now "—*and put a punch in it.*

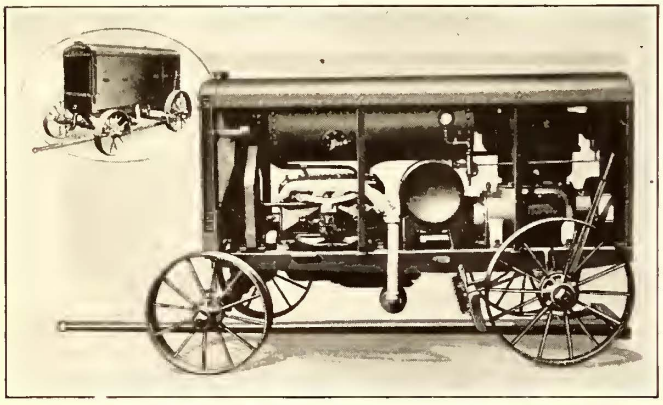
New Portable Air Compressor

ONE thing that has interfered with the use of pneumatic labor saving devices is the trouble and expense of installing an air power plant on a short-time job. Despite the advantages incident to the use of air-operated tools, it is difficult to justify the cost for transporting a stationary machine, the building of a shelter, the setting up of a steam boiler and the laying of a pipe line for only temporary use. To this must be added the cost of tearing down the plant when the job is completed. The portable type of air compressor reduced difficulties somewhat and portable outfits of many varieties have been developed in the last few years.

The Ingersoll-Rand Company has recently introduced a light-weight gasoline engine-driven unit, built in two sizes, to be known as the Imperial Type 14 portable compressor.

These are all-steel outfits and the power plant of each consists of a duplex, vertical compressor, driven at high speed, by a four cylinder, four cycle, tractor type gasoline motor. The outfit, being designed especially for portable use, has unnecessary weight eliminated. The larger machines, of 210 cu. ft. capacity, weigh only 6000 lb. and the 118 cu. ft. unit 400 lb.

The compressors have cylinders cast *en bloc,* with cylinder heads, valve chambers and water jackets integral. Both intake and discharge valves are of plate type and are



PORTABLE COMPRESSOR 210 CU.FT. CAPACITY

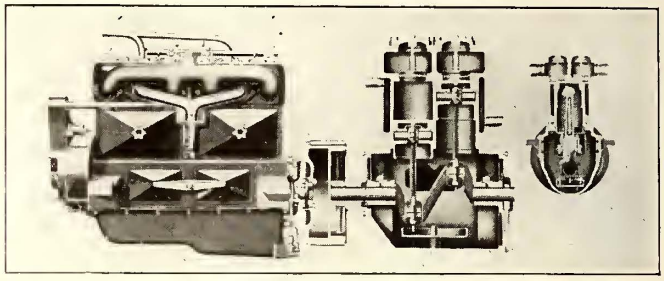
located directly over the cylinder bore. Crankshafts and connecting rods are drop forgings. Air pistons are fitted with three-piece piston rings and, in addition, with an oil wiper ring. This latter returns all surplus oil from the cylinder walls to the crankcase, and is claimed to obviate the difficulty caused by having the air carry an excess of oil into the receiver.

All bearings are die castings of anti-friction metal. Hand holes in the crankcase permit convenient access for adjusting main bearings and those of the crankpins. All parts are lubricated by splash from an oil reservoir in the crankcase.

The compressors are provided with inlet unloading devices which automatically close the compressor intake when the receiver pressure rises above a predetermined limit, and permit the machine to again take up it load when the pressure has fallen a definite amount.

The gasoline driving motors are of long-stroke type, and operate at medium speed. They are equipped with high-tension magneto ignition with automatic governors to maintain constant speed under all working conditions and to prevent overspeeding when idling. A splash oiling system lubricates all moving parts. A starting crank is located at the front of the machine beneath the radiator.

Both compressor and driving motor are water cooled by a circulating system, with centrifugal pump, large radiator and blast fan. The radiators are made up of removable sections, a construction which allows the removal and repair



SECTION OF IMPERIAL PORTABLE COMPRESSOR

of a damaged section without taking down the entire radiator or interrupting the use of the compressor.

Each of these units is equipped complete with receiver, safety valve, drain valves, pressure gage and service valves to which the air hose lines may be attached. When the fuel tank has been filled, lubricating oil provided and the cooling system supplied with water, the units are ready for work.

The mounting of the machines provides a swiveled front axle which moves freely in both horizontal and vertical planes. This, with the rigidly attached rear axle, gives three-point suspension, and permits the outfit to pass over inequalities of the ground without any racking effect or misalignment of the power plant.

The two sizes differ in respect to the location of the air receiver and in minor details of design.

Non-Slip Shoe for Ladder

IN the September issue of the *Railway Mechanical Engineer,* A. G. Johnson describes a safety-non-slip shoe for use on ladders. This shoe is made of a hardwood block and it is fastened to the base of the ladder by means of two steel plates. A pad of rubber is glued and then nailed to the underside of each hardwood block, to prevent the ladder from slipping while in use on a hard or smooth surface. These shoes have been in use in the shop of the Duluth & Iron Range Railroad (a steam road) for a number of years and they have given satisfaetory service.

A boiler inspector who recently investigated the causes of a disastrous boiler explosion reported that enough evidence was established to assure the inspector that the cause of the accident was imbrittlement of the plate of the boiler by the action of some alkaline or caustic ingredient in the feed water. This feed water was taken from an artesian well. On analysis it was found that it contained a large quantity of alkaline substance. The inspector advised that users of boiler feed water drawn from artesian wells have the water analyzed by competent chemists who can determine whether it is of such a nature as to cause imbrittlement.

Equipment Standards of the A. E. R. E. A.

Conditions that Have Lead to Standardization by the Master Car Builders as Compared with Those Existing in the American Electric Railway Association—Conclusions as to Standard Articles

BY T. A. CHANCE

THE decision expressed in the report of the standards committee presented at the 1919 convention at Atlantic City, to the effect that a determined effort should be made by the association to apply some of the principles of constructive salesmanship to the dissemination and more general use of its standards, makes an analysis of the present status of these standards desirable. A contemplation of the car equipment standards naturally turns one's thoughts to the results that have been accomplished by the Master Car Builders' Association. It may be helpful in studying the electric railway standard situation to compare the individual standards of the two associations.

AIMS OF THE MASTER CAR BUILDERS

In the M. C. B. Proceedings for 1918 an interesting account is given of the formation and objects of the Association, in which it is stated that the organization was founded in 1867 and that:

The objects of the association are the advancement of knowledge concerning the construction, maintenance and service of railroad cars and the parts thereof, by investigation through committees and discussions in convention; to provide an organization through which the members and the companies they represent may agree upon such joint action as may be required to bring about uniformity and interchangeability in the parts of the railroad cars, to improve their construction and to adjust the mutual interests growing out of their interchange and repair; but the action of the association shall have only a recommendatory character, and shall not be binding upon any of its members or the companies represented in it.

The foregoing has been quoted at length to show that the action of the M. C. B. association is not binding. Notwithstanding this fact the M. C. B. Proceedings go on to state:

The question of uniformity in the construction of cars, whereby the parts of cars used by one railroad may be used in repairs of the cars of any other road has been constantly before the (M. C. B.) association. As an indication of what has been accomplished in this direction, the following comparison of parts necessary to be kept on hand for repairs at the date of reorganization (1882) and the present time is a test:

	1882	1918
Axles, different kinds	56	5
Journal boxes, different kinds	58	5
Couplers, different kinds	26	2
Brakeshoes, different kinds	20	1
Brake heads, different kinds	27	1

It may be asked how such a result was obtained without compulsion, and the answer lies in the fact that the cars owned by one steam railroad may travel for a long time on some other road and must receive repairs in the shops of the latter. "To take hold of this condition this (M. C. B.) association has formulated and maintains rules for the truckage of traffic in so far as they relate to the physical condition of the car, so that the traffic itself may not be delayed." Among the efforts of the M. C. B. association through these interchange rules is "the compulsory use by car owners of detail standards of construction as brought about through the operation of the rules, so that when the association feels that certain standards of construction are necessary for the safe operation of cars, they will not be permitted to be interchanged without the use of said standards." Provision is further made that in the event of a car being offered to another road for interchange which contains a non-M. C. B. part covered in the rules of interchange, the second road is to replace the part with the M. C. B. standard and bill the parent road for the cost thereof. This gives a compelling reason for the real standardization of parts which have been considered of sufficient importance to be required by the rules of interchange.

A like reason does not exist among electric railways at the present time, as with few exceptions they operate independently, not interchanging with steam railroads or amongst themselves. We must look elsewhere therefore for a justification of the existence of the A. E. R. E. A. standards and for telling arguments for their increased use. This refers of course to the detail construction standards and not to the standard specifications for materials, which will be treated later.

The "acid tests," therefore, of the A. E. R. E. A. standards are the following: (1) Will they provide better and more durable articles than those now in use? (2) Are these articles cheaper than the present ones? (3) Can the standard article be used on present equipment without prohibitive alteration to adjoining parts?

With these queries in mind let us compare the individual A. E. R. E. A. equipment standards with those of the M. C. B. association.

STANDARD DESIGN OF BRAKE SHOES, BRAKE SHOE HEADS AND KEYS

(Engineering Manual, Section Eb 1a)

The M. C. B. freight-car trucks are of sufficient wheelbase, and have wheels of the same character throughout, thus permitting the use of the standard parts without difficulty. Many electric passenger car trucks are of extremely short wheelbase, maximum-traction variety, which gives but very cramped space for the brake shoe and head. The A. E. R. E. A. standard does not, however, specify any particular design of head at the hanger attachment and the general design is sound and one which can be used on most existing trucks. The tendency of the brake-shoe manufacturers, however, is to urge the use of as thick a shoe as possible, and inasmuch as interchange is not a controlling factor, these roads which can do so might be justified in using a shoe of different thickness. It would therefore seem that the A. E. R. E. A. standard design should provide for a variable thickness. The use of the shoe, of course, involves the use of the A. E. R. E. A. standard wheel flange and tread.

The advantages of the use of the standard shoe are that a shoe which will wear evenly is provided and the manufacturer's patterns and steel backs necessary to be kept in stock are reduced in number.

AUTOMATIC COUPLERS FOR INTERURBAN CARS AND RADIAL DRAFT RIGGING

(Section Ec 2b)

This standard is of a "special" character covering those cases where interurban cars interchange with steam railroad cars. It provides for a coupler of the well-known M. C. B. type, with radial attachment.

LOCATION OF END CONNECTIONS ON INTERURBAN CARS ENGAGED IN THE INTERCHANGE OF CARS

(Section Ec 4a)

This standard while desirable is not of compelling interest inasmuch as the interchange is, in general, of local character and easily adjusted by agreement between the interchanging roads.

TAPER FOR BORE OF PINIONS

(Section Ec 10a)

This is a matter strictly in the hands of the pinion manufacturers, as regards new motors and I believe that the recommendation is generally compiled with. For old motors it can be adapted as armature shafts are changed, and this course should be pursued in so far as possible, as it permits the manufacturer to ship from stock, assuring quick delivery and lessened price.

JOURNAL BOXES

(Section Et 1a)

These boxes are designed for the M. C. B. type of journal with collar, which has been adopted as the standard axle of the association. The use of this style axle is by no means universal among electric railways and there are many roads which prefer a properly designed collarless journal with check plate. The great number of short-radius curves of the electric railways with consequent heavy end thrust on the somewhat limited bearing surface presented by the axle collar causes rapid wear and many roads therefore still prefer the check plate type, and in some instances have changed from the collared axle to the collarless type.

For those roads which wish an M. C. B. journal, the boxes are of good design and might well be adopted. This would permit manufacturers to reduce the number of patterns now found necessary and would enable them to make quick delivery and to figure prices closely. It will be noted that the M. C. B. practice is followed of not specifying the type of lid or its attachments, leaving the manufacturer free to design the ribbing and other features of the box in accordance with his best judgment and experience. It therefore appears that the design should be adopted wherever a collar M. C. B. journal is used, but provision should also be made by the association for a check-plate type of box.

JOURNALS AND JOURNAL BEARING KEYS

(Section Et 2a)

The heading given in the Engineering Manual is somewhat misleading, the matter referring rather to journal brasses than the journals themselves. These are copies of the M. C. B. standard brasses, and as such can be used satisfactorily with the type of journal box above described and the M. C. B. type of collar and axle. The actual details shown no longer agrees with the M. C. B. standard, as certain changes have recently been made in the latter and the A. E. R. E. A. standards should be used.

These brasses have the defect mentioned above in discussion of the journal boxes, namely insufficient bearing to resist the end thrust. Furthermore, where the braking power has been pushed up to the limits recommended by the air-brake manufacturers there is a tendency for the brass to ride up around the journal. Some roads have therefore found it desirable to change the shape of the brass. All in all there would not seem to be enough unanimity to warrant the continuation of the journal box and its contained parts as association standards. The fact that the M. C. B. Association has adopted standards for a certain part does not of necessity prove that that part is susceptible of standardization on electric railways.

AXLES

(Section Et 3a)

As above stated these axles are designed with the M. C. B. collar-type journal and the arguments against its use are already given. Until a substantial agreement is reached as to the relative merits of the two types of bearing, the axle designs should not be included as association standards. All portions of the axle other than the journal collars are as truly matters for standardization, and designers of new equipment and those having trouble with their old designs should use the standards shown.

The commercial advantage of the standard axle is that the manufacturer may reduce his stock of forms and dies and will be familiar with the shipping weight of the axle thus facilitating close figuring in the price quoted. Further advantages are the standards which its use permits in the boring of wheels, motor bearings and gears.

TREAD AND FLANGE OF WHEEL

(Section Et 4a)

No subject has been given more thought and study than that of the wheel flange and tread, and the association standard now presents the agreed best practice. Its use enables way engineers to adopt standard rail sections which simplify the foundry work of the chilled wheel manufacturers. It provides a satisfactory contour and should be adopted generally, and I believe is being very widely used.

ROLLED STEEL WHEELS

(Section Et 7a)

This recommended design covers a part which it is extremely desirable should be made standard, and it is to be considered a matter for congratulation that the equipment committee this year in its report recommended a standard and that the standards committee has approved its recommendation. The resulting tonnage of steel and chilled iron wheels is great and it would greatly facilitate a prompt delivery and reduce manufacturing costs if the association standard wheels are adopted.

CONCLUSION AS TO STANDARD ARTICLES

Reviewing the foregoing notes one may list the equipment standards which appear worthy of general use thus: Brakeshoes, heads and keys (Eb 1a); automatic coupler for interurban cars (Ec 2b); location of end connections on interurban cars (Ec 4a); taper for bore of pinions (Ec 10a); tread and flange of wheel (Et 4a); rolled steel wheels (Et 7a).

These standards which do not seem to have the unanimous support of the association and which therefore should be altered or eliminated are: journal boxes (Et 1a); journal boxes and keys (Et 2a); axles (Et 3a).

The revision of the National Electrical Safety Code, which is being made preparatory to the publication of a new edition, has been nearly completed by the United States Bureau of Standards. Among other items, the rules involving the construction of electric power lines are now governing all outdoor construction will be submitted for under consideration, and soon a revised draft of the rules general criticism. This has been somewhat delayed by a survey of such construction, covering the entire country, which has been carried out in co-operation with the committee of the N. E. L. A.

An Effective Home-Made Grade Indicator

An Extemporized Device Which Was Prepared for Use in Wartime Work Permitted Grades to Be Measured Rapidly

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

IN COLLECTING the data regarding electric lines which the American Electric Railway Association furnished the War College, the Connecticut Company found it necessary hastily to determine grades on a considerable mileage of tracks which had been built by predecessor companies, for which plans and profiles were incomplete or in many cases entirely lacking.

The base sheets for the work had been enlarged from the United States Topographic Survey sheets, which are on a scale from 1/62,500 to 1/20,000. It was necessary to locate the beginning and the end of each grade of 3 per cent or over, and to determine its magnitude.

J. B. Whittemore, engineer Shore Line Electric Railway, solved the problem for his track by hanging a carpenter's level in a car window so it could swing in the plane of the glass, marking on the latter a circle 2 ft. in diameter having for its center the pivot on which the level turned, and dividing the circumference, for about 2 in. above and below a horizontal line into hundredths of a foot. By keeping the bubble of the level central, the rate of the grade on which the car was standing or operating could be once read on the scale, one per cent being represented by a division approximately $\frac{1}{8}$ in. long.

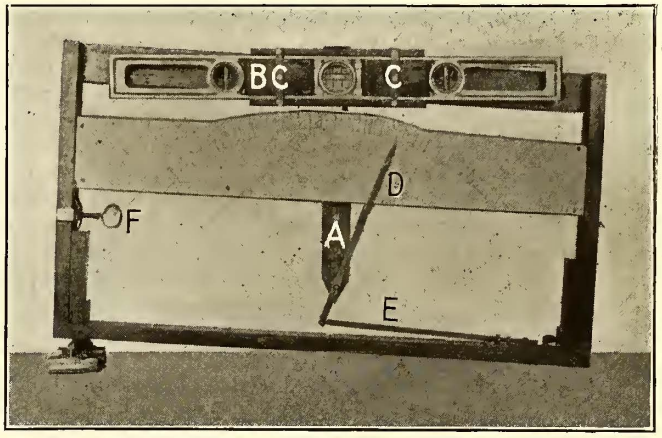
With care the grade could be determined with Mr. Whittemore's device within one half of 1 per cent. The Connecticut Company, however, felt that more rapid and more accurate results would be had by the use of a larger scale, and that as the work was to extend over several divisions it was desirable to have the "gradienter" so it could readily be fixed in any car.

The illustration shows the device as developed. To one end of the steel bar *A*, 2 in. wide, $\frac{1}{8}$ in. thick and 10 in. long, were fastened two wood arms between which the carpenter's level *B* just fitted and was held in place by the straps *CC*, while a screw on the center line and midway between the blocks served as a pivot. The brass needle *D* was pivoted to the lower end of *A* and to the swinging arm *E*, the result of the leverages being that a movement of 0.01 ft. at the end of the level which was just 2 ft. long moved the end of the needle about 1 in., the exact relation varying somewhat in different parts of the scale since the point of the needle does not follow a true circle.

An adjusting screw and nuts from an old skate served to connect the swinging arm to the frame and to allow adjustment, and the scale was graduated by first setting the level parallel to the base, by careful measuring at each end and adjusting the needle to the center of the scale at the same time. The needle was then moved until the end of the level had traveled 0.01 ft., then 0.02, and so up to 0.15, the position of the needle point being marked each time. These points were then checked by moving back by the same steps, while the one half of 1 per cent points were measured directly on the scale, halfway between the points secured by trial.

In service the frame is held in a car window by the clamp *F*, which wedges it into the frame, and the needle is brought to the center mark with the level bubble central when the car is on track which is known to be level. This adjustment is necessary, particularly with older cars, since due to unequal spring strengths the window sills are not always parallel to the track. One man then keeps the bubble central, by moving the needle, while the observer notes the readings desired—in our case 3 per cent or over—and the points at which the changes occur.

The results made with the device were checked on the return trip, and in the very few instances of disagreement a second test was made. For the war maps, where 1 in. on the sheet represented 1667 actual feet, the grade-ends could probably be located as accurately as they could be plotted, under regular run conditions. However, having in mind the assistance (?) which would be given the men by curious passengers the users of the device deemed it wiser to run a "special." This gave opportunity to locate the grade points more accurately, and to tie them definitely to known reference points such as bridges, roads, curves or the like. When, as often happened, the grade point



GRADE INDICATOR DEVELOPED BY CONNECTICUT COMPANY FOR USE IN EMERGENCY WAR WORK

was some distance away the special could, with due regard to the regular schedule, of course, be held long enough to tape or pace the required interval.

The device proved very satisfactory for the purpose intended. Clamped and adjusted in an automobile or wagon it would serve equally well to determine highway or street grades; with a longer and more sensitive bubble tube the grade could be read to smaller percentage fractions, but of course in such cases particular care would have to be taken to prevent any play in the lever connections. In the arrangement shown machine screws were used in holes just large enough to allow free motion without backlash. These would doubtless soon wear loose if used to any great extent, and for a permanent or more accurate form a spring to hold the pivot against the other parts should be added. However, the simpler form will serve for many purposes, and with the thought that it may help others it is here described.

Vestibuling of Cars Still Going On in Baltimore

THE work of vestibuling 560 double-truck semi-convertible cars by the United Railways & Electric Company of Baltimore, which was started in 1915, is still being carried on. This remodeling of vestibules and the standardizing of other parts were described in the ELECTRIC RAILWAY JOURNAL of Aug. 19, 1916, page 302. Much better progress would have been made but for the war, during which the remodeling was suspended on account of the scarcity of material and the shortage of labor. To date 330 cars have been finished, about 60 per cent of the total number to be done. The cost of reconstructing each car now is practically double that of the first cars, due to the great increases in cost of labor and materials which have taken place since the remodeling process started.

Helical Gearing for Railway Motors

Helical Gearing in Railway Motor Construction Was Introduced in Order to Lessen Motor Troubles Caused by Vibration

By W. H. PHILLIPS
Metallurgist R. D. Nuttall Company, Pittsburgh, Pa.

THE spur gear has been standard for years in electric railway motor construction. While it was known that it had certain inherent defects, still the importance of these imperfections was not given much thought and it was assumed that they were of minor importance. With the increasing demand for cheaper operation, manufacturing engineers spent considerable time in trying to improve this field of gearing, and the spur gear, with its vibration, was carefully studied.

For equipment used in the heavier type of traction service, the flexible gear was introduced. This was originally developed by the Westinghouse Electric & Manufacturing Company and has greatly increased the life of this class of railway equipment, and has produced substantial savings in maintenance costs. The life of the gearing has also been materially increased. The flexible gear design, however, is of too expensive a type to warrant its extensive use in city service. So far all attempts to develop a low-price flexible gear that would meet all requirements have been unsuccessful.

Vibration Causes Spur-Gear Trouble

The fundamental cause of most of the spur-gear trouble is vibration, and the reason for the successful operation of flexible gearing is its ability to absorb this vibration. The deterioration of the various parts of a railway equipment is directly proportional to vibration. Therefore, if this is eliminated to any extent the life of the equipment is lengthened and noise is reduced.

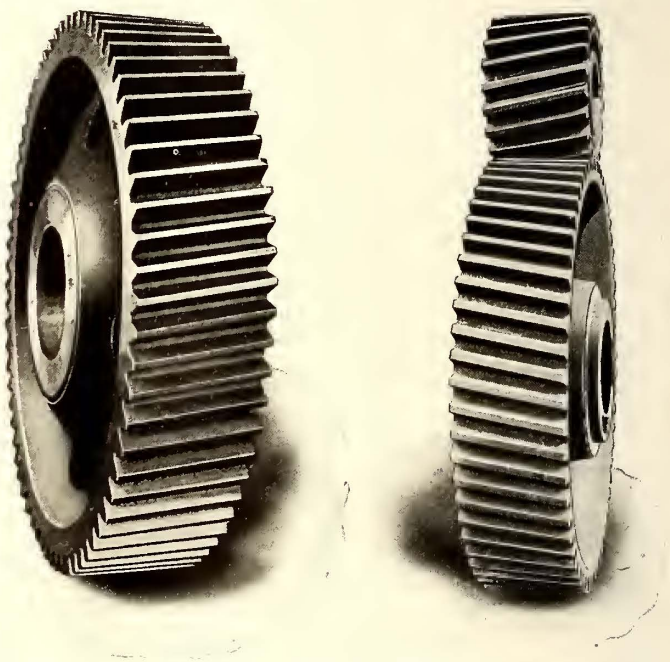
The helical gear goes back a step farther than the flexible gear, and instead of absorbing the vibration eliminates it. In order to see clearly just how this is done it is necessary to study the cycle performed by a spur-gear tooth in passing through mesh with a pinion tooth, or, in other words, the relation between spur gearing and vibration. A motor in ordinary city service, with a gear ratio of 15 to 69, will have one tooth of the pinion in contact with one gear tooth alone, approximately 35 per cent of the time. During the remainder of the travel of this tooth through the arc of action, there will be two teeth of the pinion in contact with two teeth of the gear. A gear tooth, according to the "Lewis" formula, is loaded as a cantilever beam.

Due to the modulus of elasticity or stretch of the steel within its elastic limit, and which stretch is constant for all steels, whether heat-treated or untreated, this tooth will deflect slightly, as will also the tooth of the gear with which it is in contact. When a pinion tooth first makes contact with a gear tooth, the distance between this pinion tooth and the pinion tooth leading it into mesh is less than the normal pitch by an amount equal to the deflection of the leading tooth. At the same time, the distance between the contacting gear tooth and the gear tooth leading it into mesh is greater than the normal pitch by an amount equal to the deflection of the leading gear tooth; that is, the two deflections noted are added together to produce relative displacement of the contacting gear and pinion teeth, bringing them into contact sooner than this should occur.

It is therefore evident that this premature contact causes impact and vibration in the so-called "stepping-over action" of the spur gears. There are many conditions that accentuate this vibration, such as misalignment, load fluctuation, wear of teeth, bearing wear, etc.

Every effort has been made to produce material that will resist wear in gearing. The lubrication and proper design of bearings has been studied, and much time and thought have been expended on gear lubricants, some going as far as to mix sawdust in the grease in an endeavor to effect improvement. While much improvement has resulted from these endeavors, still, as the gears grow older, vibration gradually becomes greater, until the gearing has often to be scrapped before it is worn out.

The helical gear accomplishes the results desired by the practical elimination of tooth deflection. If the spur-tooth impact could be divided into an indefinitely large number of infinitely small impacts, the spur-tooth impact would disappear. Consider a spur pinion tooth made up of layers of tin, with each layer advanced slightly ahead of the next one. The impact of each small step as it somes into contact



AT LEFT, HELICAL GEAR DESIGNED FOR RAILWAY MOTORS. AT RIGHT, HELICAL GEAR AND PINION AFTER NEARLY 300,000 CAR-MILES SERVICE

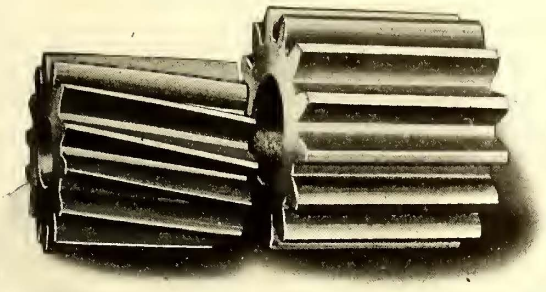
is infinitely small. If now, in order to simplify the construction, we cut the tooth on a slight helix angle, we obtain the tooth meshing with no steps, and therefore a very smooth action. The teeth feed into mesh like a worm gearing. The tooth picks up its load at one end. The contact falls gradually across the face, and before it leaves the other end a second tooth has taken up its share of the load. It can be seen that while there may be slight tooth deflections at the end as it comes into contact, the action is so smooth that no vibration results. Obviously, the elimination of vibration and impact results in the elimination of noise and actual service has shown that a car equipped with helical gears is practically noiseless. While noiseless gearing is undoubtedly desirable, what may be considered as of much more importance in these days of economy is the effect of the elimination of vibration on the other parts of the equipment.

End Thrust of Helical Gearing

As the teeth of helical gearing are cut on a slight helix angle, there is bound to be a slight resultant end thrust. In considering the problem of taking care of this end thrust the capacities of the armature and axle collars on most of the modern railway motors have been studied. Tests have

shown that the end thrust is under 25 lb. per square inch on these bearings, or well within the ability of the bearings to retain an oil film with the motor running in one direction. This load is on the bearings, with the oil film between restraining lateral movement. With spur-gear operation, due to track irregularities and the lack of restraint of lateral motion, the lurching back and forth causes these bearings to slap together, driving the oil from the surfaces. One or two revolutions in this position will be liable to cut the bearing slightly. Actual service tests extending over a period of five years of heavy interurban service show that the wear on the bearings in which helical gears are used is no greater; and probably is less than in the bearings in which spur gears are used.

Experience with herringbone, or double helical gears, as they are ordinarily installed in heavy industrial service, shows that they are incapable of sustaining end thrust and that where end thrust exists serious wear of the gear teeth results. End thrust in this case is of necessity carried on the gear teeth. With helical gears, however, the tooth angle is selected so that end play of the armature is accompanied by screwing of the pinion tooth past the gear tooth with only a frictional resistance, and a very small direct force



COMPARISON OF HELICAL WITH SPUR TYPE PINION

component. Experience has proved conclusively that the end play which is permissible with spur gearing is also permissible with helical gearing, as far as the good of the gear itself is concerned.

The effect of helical gear operation upon the rest of the equipment provides a very interesting study. The deductions which I include are based upon actual experience and are from the opinions of competent operating men. It was formerly considered imperative that there be oscillating motion between the brushes and the commutator of a motor or generator, whether this be accomplished by oscillating devices such as are found on large stationary apparatus or end play of the armature. The use of ball bearings on railway motors has exploded this idea, and there is a strong tendency now to omit the oscillators in stationary apparatus. The commutation on motors equipped with helical gearings is remarkably good, and as one well-known operating man said, with it an old non-interpole motor operates almost as well as a motor of the most modern type. Again, in the case of the armature bearing, it was thought that the end play aided in distributing the oil films and helped the lubrication. With helical gearing it is found that the life of the armature and axle bearings is increased due to the uniform bearing pressures. Obviously, the brushholders and brushes will give much greater life when vibration is eliminated.

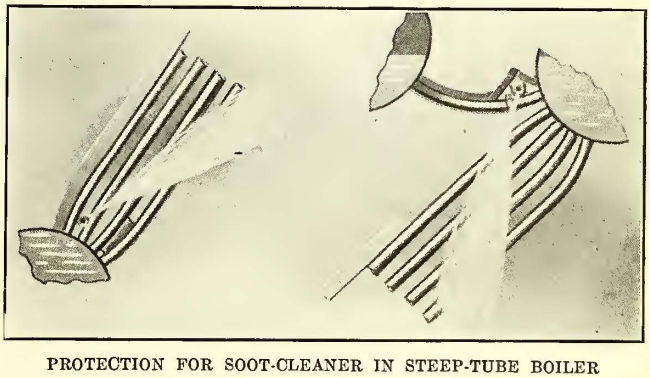
The causes to which open circuits in the various motor windings are traceable are very obscure, and only very extensive operation and a careful analysis of service data will justify any definite conclusion. Results to date, however, indicate a material reduction in open circuits coincident with the use of helical gear. Vibration, especially in aggravated conditions, has a detrimental effect upon insulation, and the elimination of vibration will obviously lengthen its life. The cause of loose punchings has in many cases been traced directly to spur-gear vibration. In the examination of motors with loose punchings the worst condition has been found to exist at the gear end, the trouble becoming progressively less toward the commutator end. Modern motor design has overcome most if not all of this trouble, but the detrimental effect of spur-gear vibration is well illustrated by this former condition. The loosening of all parts, such as axle caps, gear pans, etc., as caused by vibration, will serve to show that by a reduction of this vibration less trouble of this nature should be expected.

This does not mean that the helical gear is a cure-all, and that proper inspection and maintenance can be eliminated. It does mean, however, that it will be possible to lengthen periods between inspection and overhauling on cars equipped with helical gearing. Motors with helical gears have now been in use nearly five years, under widely different operating conditions. The oldest installation has made nearly 300,000 miles on both pinions and gears with little appreciable wear. Since the Nuttall Company formally introduced helical gearing last June, nearly fifty railway companies have made installation of this gearing on a large scale or have made trial applications.

Dead Gas Pockets for Protecting Soot-Cleaner Elements

IN CONNECTION with its research and development work the engineers of the Vulcan Soot Cleaner Company, Du Bois, Pa., has furnished information regarding the protection of soot-cleaner elements by means of so-called "dead gas pockets."

In order fully to protect the soot-cleaner elements in steep-tube boilers, they place a patented deflecting baffle tile, or row of firebrick forming a pocket in which the element is operated, at the bottom of the first pass, as shown in an accompanying illustration. This pocket eliminates the direct scrubbing action of the hot gases. Space is allowed at the bottom of this baffle through which soot and ash will drop during the cleaning process. At the top of the first pass is another dead gas pocket, also patented, in which the second soot-cleaner element is located. This second element rests upon the circulating tubes to the front drum. Contact with the comparatively cool tubes

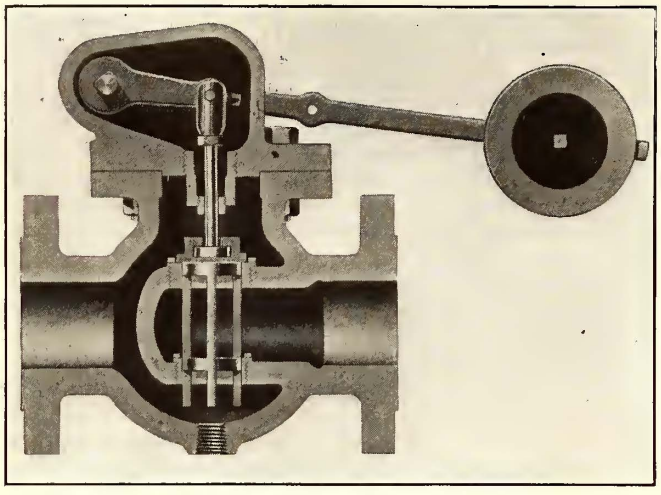


PROTECTION FOR SOOT-CLEANER IN STEEP-TUBE BOILER

assists greatly in maintaining the element at a safe temperature.

By arching the baffle tile over the circulating tubes as shown, the hot gases, in their natural flow do not come into direct contact with the element.

In boilers of this type where tubes are arranged in squares, perpendicular nozzles are used. The nozzle makes a right angle with the axis of the element, hence the jet is directed between the tubes and cleans the entire bank of tubes.



CONTROL VALVE WITH HORIZONTAL SHAFT IN PLACE OF RECIPROCATING STUFFING BOXES

New Regulator for Feed Water

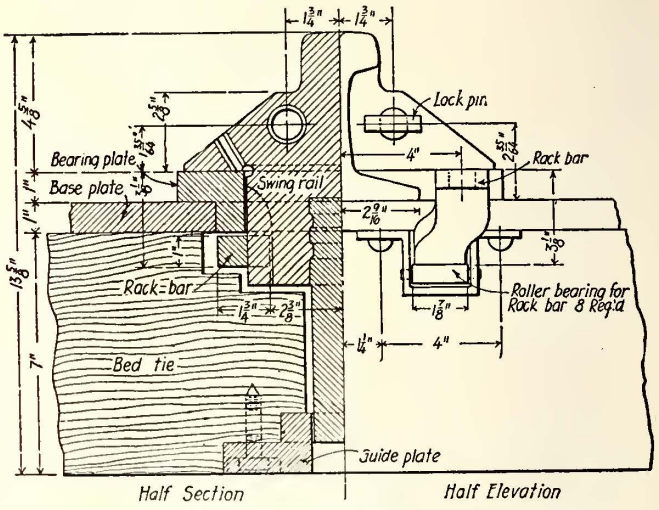
IN 1912, the Northern Equipment Company, Erie, Pa., brought out and patented the continuous feed principle of boiler-feed control. This is that water should be fed proportionally to and variably with the load. It involves a variable water level temporarily inversely proportional to the load for gradual increases or decreases in load—with a temporarily decreased feed on a sudden increase in the load and a temporarily increased feed on a sudden decrease in the load.

In the design of the new Copes control valve shown herewith, which the company uses as part of its feed system, the reciprocating stuffing boxes previously used have been abandoned, and in their place there is a horizontal shaft which rotates very slightly, performing the same function as the old reciprocating rod. The frictional resistance has been reduced as much as 6 to 16 lbs. The valve is of the balanced piston type. The weight on the valve lever exerts a constant closing force of 50 lb. on the valve piston. The valve cap or bonnet can be unbolted and removed with fittings attached without removing the valve body from the pipe line.

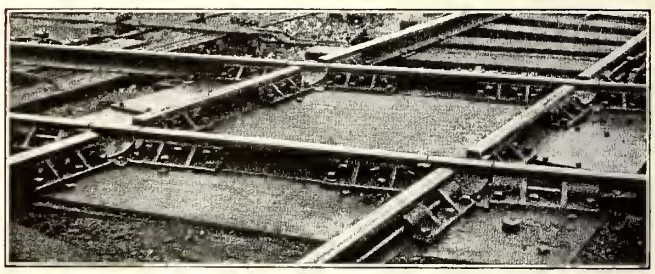
The assembled regulator complete is shown in a second illustration. It consists principally of a heavy expansion tube. This is known as the "thermostat." It is a straight piece of heavy metallic tubing $1\frac{1}{8}$ in. in outside diameter. The top of the thermostat is connected with the steam space of the boiler and the bottom with the water space; hence there is a water level in the thermostat corresponding with the water level in the boiler. It is this water level in the thermostat that determines the rate of feed. The tube lengthens and shortens with drop and rise of water level, the lengthening and shortening being caused by change in temperature of the tube as the water rises and falls. This expansion or contraction of the tube is amplified by means of the link work, and through the link work operates the control valve.

New Type of Continuous-Rail Crossing

THE pounding out of railroad crossing frogs and the resulting effect of the vibration on the car equipment as it passes over these crossings are items of exceptional interest to those responsible for railway maintenance. With an idea of reducing these factors the Alexander Railroad Crossing & Equipment Company, Chicago, Ill., is now placing on the market a new type of continuous-rail crossing. This consists of a single steel plate, 1 in. in thickness, on which is mounted a swing rail at the point where the crossing rails intersect. Each swing rail consists of a casting of manganese steel 10 in. in diameter, the top being molded in the form of a rail head, while the bottom part is molded

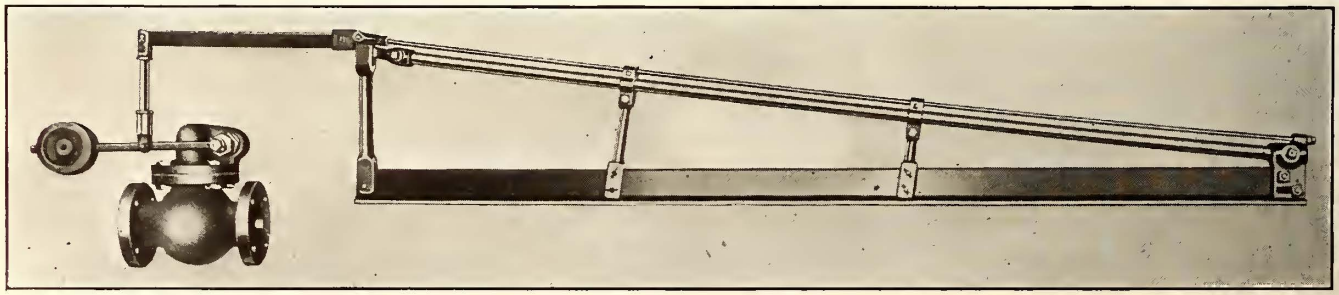


DETAILS OF CONSTRUCTION OF SWING RAIL AND SUPPORTS



CONTINUOUS-RAIL CROSSING OPERATED FROM INTERLOCKING TOWER

in the form of a pinion. The device is worked by a rack bar, operating upon this pinion. The swing rail works upon a flanged bearing plate, which in turn rests upon the base plate. The swing rails are connected up with the interlocking for the crossing and are operated from an adjacent signal tower. As a precaution against any accidental misadjustment or failure of the parts to work, the usual interlocking devices are operated in connection with the swing rails. The positive locks are worked simultaneously from one lever in the tower.



BOILER FEED REGULATOR COMPLETE

Novel Annunciators for Fire Sprinkler System

As a Safeguard Against Mistakes in Locating Sprinklers When They Operated, a Duplicate Annunciator with Bells Was Found Necessary

THE three-story carhouse of the Brooklyn Rapid Transit Company for the Bay Ridge section occupies the entire block bounded by Fifty-eight and Fifty-ninth streets and Second and Third Avenues, Brooklyn. This has housing facilities for 635 cars and there are times when the house is filled completely. Extreme precautions against fire are necessary at all times.

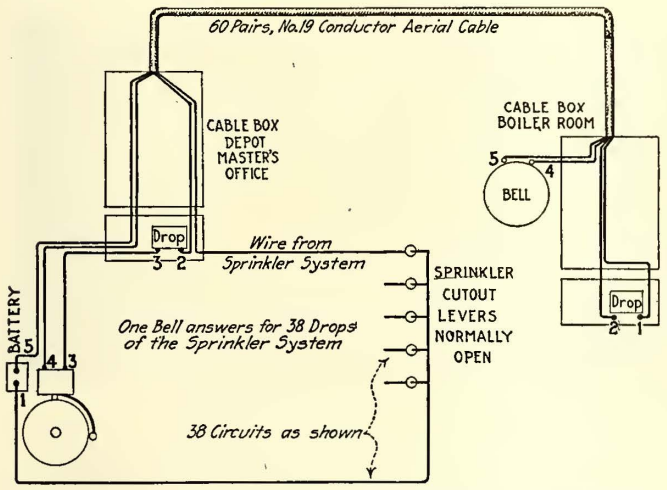


DIAGRAM OF ADDITIONAL ANNUNCIATOR FOR B. R. T. SPRINKLER SYSTEM

Some years ago this carhouse was equipped with a very complete sprinkler system, the installation being made by the General Fire Extinguisher Company. An annunciator of fifty-two drops, with the usual bells was set up in the main office of the depot master at Fifty-eighth Street and Third Avenue. Later it was decided to equip the quarters of the engineer located at the corner of Fifty-eighth Street and Second Avenue with a duplicate annunciator and bells to work in conjunction with the equipment in the depot master's office. The object of this was to avoid the possibility of mistakes in telephoning the location when sprinklers opened.

The additional annunciator in the engineer's office differs from the one originally installed, which is of the standard type, in that each drop has an incoming and an outgoing binding post instead of having the outgoing posts of each drop connected to a common return. A sixty-pair cable, consisting of No. 19 B. & S. conductors, is used to connect the two annunciators, and this cable is terminated in a cable box directly above each annunciator. The wires are brought to separate binding posts and each circuit is labeled. All sprinkler contacts are normally open.

The accompanying diagram shows a representative circuit; the principle of operation of the other thirty-seven being the same. When the circuit is closed at the sprinkler, one lead runs directly to one side of the battery while the other can be traced as follows: Sprinkler to the annunciator drop in the engineer's room, to the drop in the depot master's office, to the bell in the same office, to the bell in the boiler room and then back to the other side of the battery. When the sprinkler contacts close, due to fire or otherwise, the annunciator drops at both locations will register, and also the bells at each location will ring continuously. In the engineer's office there is a 5-in. 11-ohm bell and in the depot master's office there is a 7-in. 10-ohm vibrating bell.

The resistance of the additional annunciator which was installed in the engineer's room measures about 14 ohms. The system formerly required one set of dry batteries, consisting of seven cells in series, but to overcome the additional resistance, due to the additional annunciator, there was added four sets of dry batteries in series, each set having five batteries in parallel.

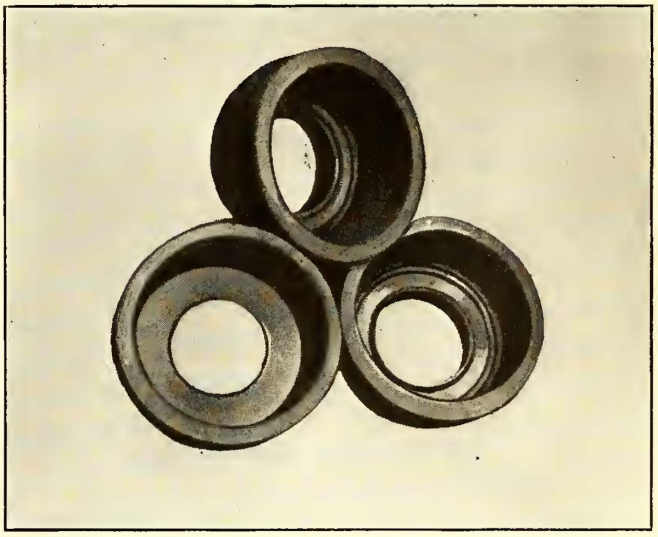
The installation of this additional equipment was done by the electric line department of the company, which department has charge of the maintenance and contruction of its extensive fire alarm system.

Reclaiming Worn Armature Dust Collars

DUST collars on the gear end of the motor armature axle are subject to severe wear on the inside surface and also to some wear around the axle. On the Tri-city Railway, Davenport, Iowa, it was formerly the practice to scrap these collars when they became excessively worn and to purchase new ones for about $2.50 each. At the present time the worn collars are being reclaimed at a cost of about $1 each.

When the collar is badly worn on the inside surface and is also loose on the axle, the first step in reclamation is to heat the collar up to a red heat and then cool it in moderately cool water. The collar is not completely immersed but is held on a rod so that only the outer rim is immersed in the water and then the collar is slowly revolved by means of a pair of tongs. By this method the part of the collar surrounding the axle can be shrunk about 0.01 in. in diamcter.

The second step is to smooth up the worn surface by taking out a cut on the lathe and then to rivet in place



THREE STAGES IN DUST COLLAR RECLAMATION

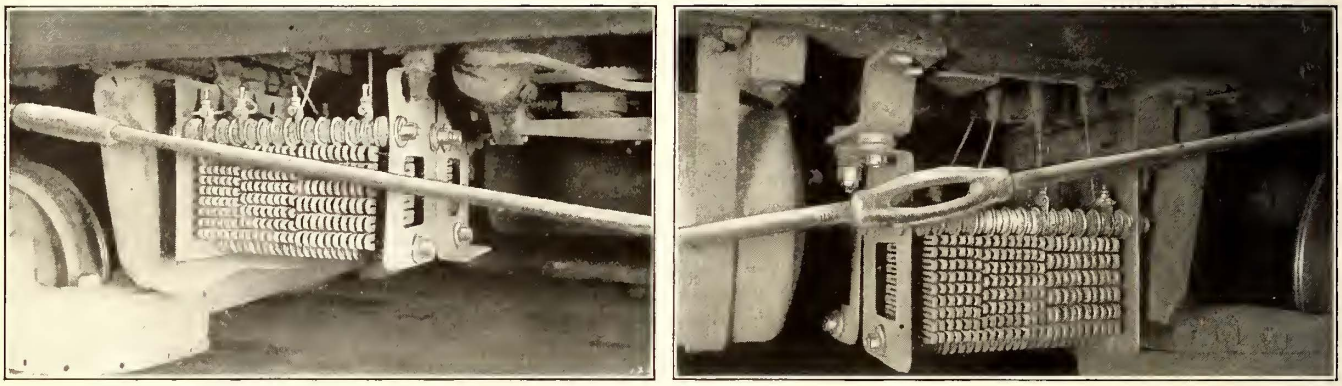
Collar at right shows badly-worn surface as taken from armature axle. Collar above in same condition but has been shrunk. Collar at left has new wearing surface and is ready for reinstallation

on this wearing surface a $\frac{3}{8}$-in ring. The rings are cut from the end of an old axle. This surface is again turned down until the proper thickness is secured and the axle opening is then drilled out to exact diameter. Some collars that need new wearing surfaces do not need to be shrunk, in which case the cost of reclaiming is proportionately reduced.

Engineering Council is urging the appointment on the new Industrial Conference of two or more engineers familiar with industrial problems.

Lowering Grid Resistors to Provide Increased Ventilation

ON THE double-truck closed cars of the Brooklyn Rapid Transit Company, the grid resistors are installed in a location between the end of the main reservoir and the truck. In order to prevent wheel wash from short circuiting the different grids, it has been necessary to install a shield between the end of the resistor frame and the truck. When this type of resistor was first installed on these cars, there were no air brakes and consequently no main reservoirs to interfere with the circulation of the air. The installation of the air-brake equipment placed the grid resistors in a sort of pocket and trouble from overheating resulted in numerous cases. In order to provide increased ventilation for the resistors the company is now lowering them a distance of 4 in. The same insulators and method of supporting are used, but a flat iron support is bolted to the car members with an offset, so that the supporting face provides for the necessary lowering of the grid frame. The accompanying illustrations show the grid resistors before and after the change has been made.



GRID RESISTORS BEFORE AND AFTER LOWERING

Causes of Brakeshoe Wear

IN A COMPANY publication * a question was recently asked regarding brakeshoe wear. This question was: "Will brakeshoes wear away faster when operated with a high braking pressure which requires but half the distance to make a stop or with half this pressure and twice the braking distance?" As an example, suppose a 400-lb. brakeshoe pressure will stop a car in 1000 ft., will the shoes wear faster with this operation, or when an 800-lb. brakeshoe pressure is used to make a stop in 500 ft.? In answer to this question, M. F. Skouden, superintendent of motive power Union Traction Company of Indiana, stated that the wear of brakeshoes is determined by the resulting temperature rise. If the coefficient of friction becomes great enough from rapid rise of temperature the surfaces will, in his opinion, wear much faster. He concludes, therefore, that with high brakeshoe pressure there would be a more rapid rise in temperature and a more rapid grinding away of the brakeshoes.

This question was referred by the ELECTRIC RAILWAY JOURNAL to a prominent engineer connected with a brakeshoe manufacturing concern. He stated that the wear is faster at higher temperatures, but that the temperature obtained depends more on the character of the service than upon the brakeshoe pressure and length of stop. A brakeshoe consists of quite a large volume of metal. This can absorb heat only at a certain definite rate, and under certain conditions it might be possible to stop a car with a high brakeshoe pressure before a temperature would be reached which would cause excessive wearing away of the shoes. On the other hand, in freight service, where it is necessary to make long applications of the brakes when descending grades or reducing speed, this is usually accomplished with a comparatively light brakeshoe pressure; but the period of application is so long that very high brakeshoe temperatures are reached and the resulting wear is necessarily very rapid. To illustrate this principle, this engineer refered to a man pouring water from a pail into a barrel through the bunghole. If a stream slightly smaller than the diameter of the hole is used the water can be poured in without waste, but if an attempt was made to force the flow much of the water will be spilled.

In this connection there is another point which should be taken into consideration, namely, that the brakeshoes make contact only in spots and, of course, the smaller the areas of these spots the quicker will heating take place. If the metal of the brakeshoe adjacent to these spots of contact cannot conduct the heat away at a sufficiently high rate, the spots will reach excessive temperatures and will wear away rapidly. It thus appears that an accurate and complete answer to the question can be arrived at only from tests.

It is suggested that anyone having data on this subject available could do the industry good service by sending them, in brief form, to this paper for publication.

* *Safety*, published monthly by Union Traction Company of Indiana.

Gas vs. Gasoline for Motor Vehicles

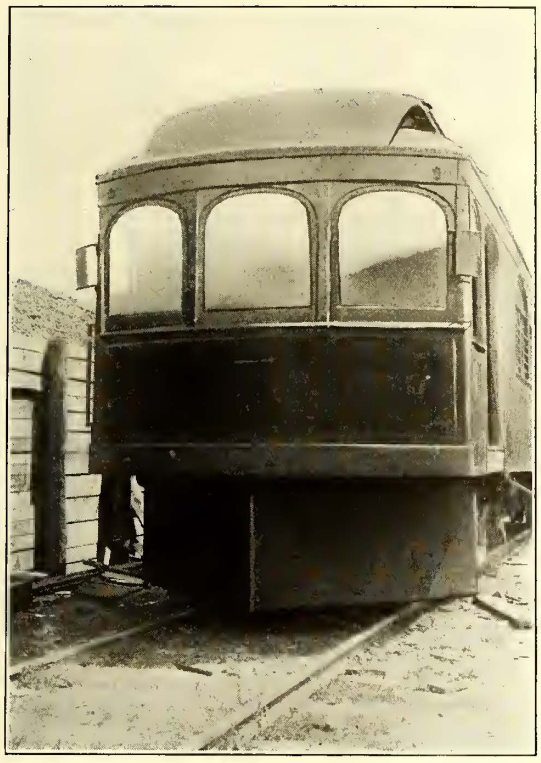
A REPORT of the inter-departmental committee on the employment of gas as a source of power in motor vehicles is discussed in London *Engineering* for Aug. 15. It is stated that gas performed a very useful function in the war, but since then has apparently dropped out of use due possibly to the decrease in the coal supply. This report gives an example of the use of gas by the Griscom Street Tramways, which estimated that for every 1000 miles run on gas a saving of nearly $3.75 was made as compared with gasoline. A large part of the gas used had not been debenzolized, and about 240 cu. ft. of gas was to be equivalent to a gallon of gasoline.

The possibility of using steel cylinders for the flexible containers previously used gives an entirely new aspect to this question. The committee recommends that gas be stored at high pressure in steel cylinders and favors a semi-rigid container consisting of an inner member or tube in the form of a rubber container and an outer casing of woven steel wire. This class of container is approximately one-third the weight of a steel container for a given volume of gas, and as it stretches on being charged, it gives ample warning of over-charging. A working pressure of 45 atmospheres is recommended.

Steel Pilots for All-Year Service

Interurban Company Equips All Motor Cars With Solid Pilots for Protection of Motors and for Service as Snow Plows

THE Winona Interurban Railway, Warsaw, Ind., has equipped all of its interurban motor cars with steel pilots for all-year service. Wood-slat pilots were formerly used, but these were constantly in need of repair. The steel pilots not only protect the motors at all time but also serve as snow plows in the winter.



MOTOR CAR EQUIPPED WITH STEEL PILOT

The construction of the plows is clearly shown in the accompanying illustrations. No. 10 gage steel is used and the horizontal reinforcing angles are 3 in. x 3 in. top and bottom. The angle at the point of the plow is also 3 in. x 3 in. and this is bolted to the bumper, suspending the front of the plow therefrom. The frame at the rear, which is bolted to and supports the rear of the plow from the forward longitudinal sill, is made up of 1½-in. x ½-in. strap iron vertical and cross bracing and 2-in. x 2-in. horizontal angles. As additional bracing against shock a 3-in. x 3-in. angle extends from the lower forward point of the pilot to the forward longitudinal car sill which is a 5-in. x 3½-in. angle. All work is bolted together, no riveting or welding being employed.

Using Electric Lights to Replace Oil Tail-Lights

IN ORDER to eliminate the troublesome oil tail-light the Harrisburg Railway has equipped one of its suburban cars with two small battery lamps. These are red lights, such as are usually used for tail-lights of automobiles, and the current is supplied from a 40-amp. storage battery. In order to keep the battery charged it is floated across the line through one of the car-lighting circuits, which has five 23-watt Mazda lamps. So far no trouble of any kind has been experienced, although the car has been in operation over a year. The battery has given no trouble, and the only maintenance necessary so far has been to add distilled water to the cells. The accompanying diagram shows the method of connecting the tail-light and the method of keeping the battery charged.

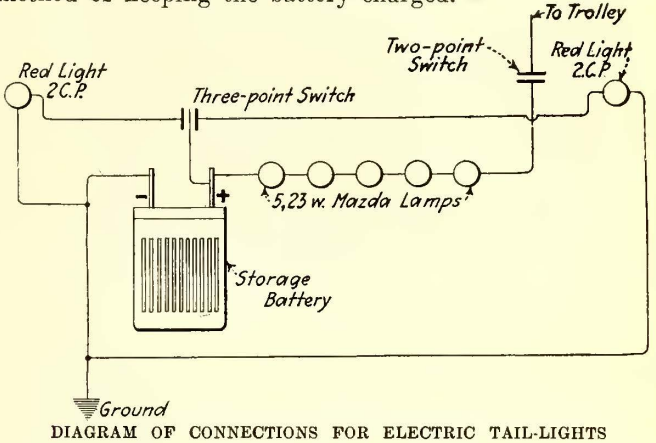
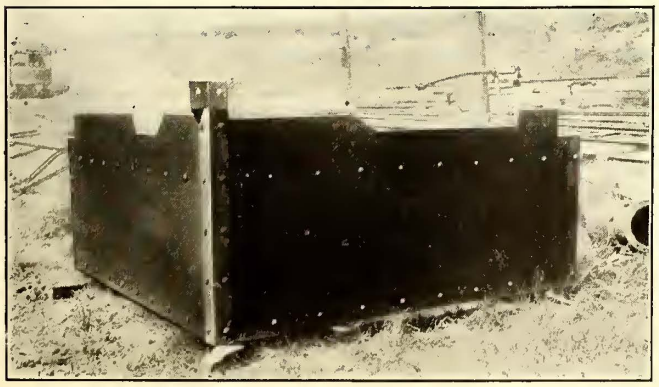
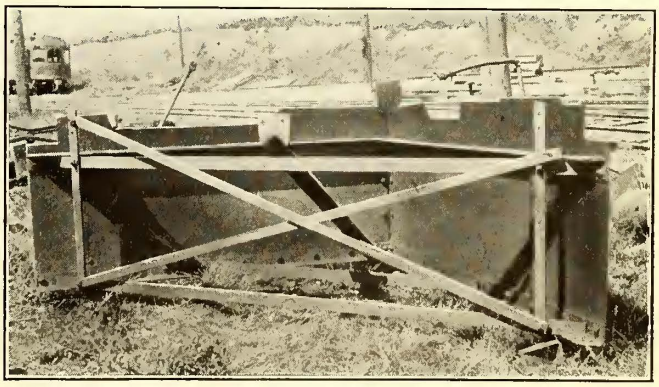


DIAGRAM OF CONNECTIONS FOR ELECTRIC TAIL-LIGHTS

[NOTE—There seems to be an opinion among railway men that there is a certain hazard in the use of electric tail-lights. The New York Municipal Railway has used electric lights for head, tail and marker lights on its subway cars for the past four years, but supplements these by hanging an oil lantern at the rear of each train. The idea is that there is an element of danger in the use of electric lamps for tail-lights as they might become extinguished and lead to serious accident. A double-filament lamp of a type commonly used in electric signal installations is used on these cars, which reduces the hazard from broken filaments. Other installations have used two lamps in parallel, one of which has a high resistance in series, so that ordinarily this lamp is not lighted, but in case the other lamp becomes open-circuited, this lamp lights up.—EDS.]



TOP OF STEEL PLATE IS CUT TO FIT UP CLOSE TO CAR FLOOR

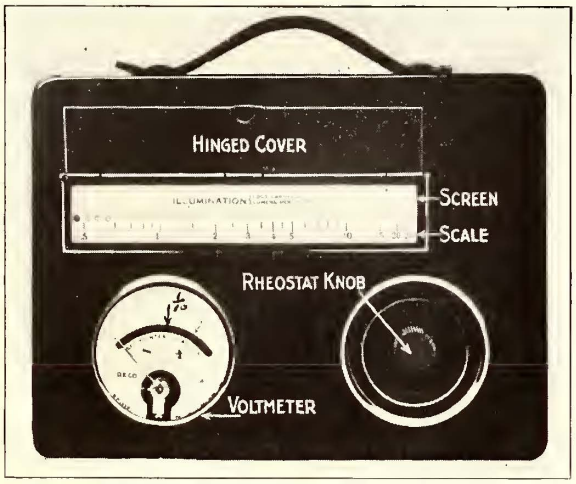


PILOT IS STURDILY CONSTRUCTED AND BRACED AGAINST SHOCK

Portable Foot-Candle Meter

Illumination Intensity of the Light at Any Point Can Be Read at a Glance

IN ITS EXHIBITS at the recent convention of the American Electric Railway Association at Atlantic City the General Electric Company showed a new portable foot-candle meter for general photometric use. This was developed to meet the demand of electric railways for a light, compact, non-complicated instrument which would measure the illumination intensities commonly found. No special skill is required to operate the instrument, and as it is light and compact it can be carried anywhere and read-



PORTABLE FOOT CANDLE METER

ings can be taken in the same manner as with a large photometer and with sufficient accuracy to be of real practical value.

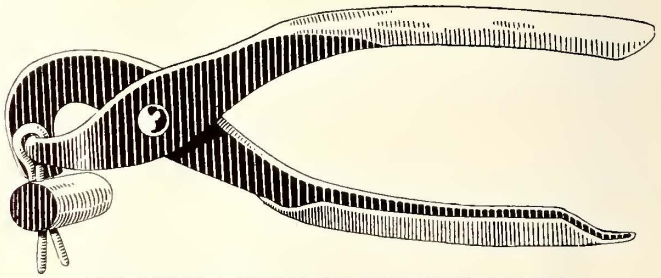
The basic principle on which the foot-candle meter operates is the same as that employed in the photometer. The screen on which the reading is taken consists of a piece of a clear glass on which are two thicknesses of paper. One contains round holes fairly opaque, and the other spots which are highly translucent. This screen forms one side of the light box which is so constructed that the screen is illuminated from within to a much higher intensity at the right end than at the left. The exposed side of the screen is very nearly uniformly lighted and the round spots appear brighter than the surrounding screen at the right end and darker at the left, as shown in the accompanying illustration. At the point where the spots change from brighter than the background to darker, the illumination on both sides of the screen is approximately the same. The illumination intensity thus indicated may be read without any difficulty whatever.

SCREEN OF METER INDICATING A LIGHT INTENSITY OF 5.5 FOOT-CANDLES

As the light supplied to the screen from within comes from a small electric light it is obviously important that, after the foot-candle meter has been calibrated, the light supply be kept constant. To effect this a rheostat or adjustable resistance is connected in series with the lamp and the battery. This permits the voltage applied to the lamp to be maintained at a constant value. A small voltmeter, which is a part of the instrument, shows the voltage supplied to the lamp. An arrow is placed on the voltmeter scale and as long as the voltmeter needle is directly over the arrow the lamp is operating at the correct voltage to supply the proper illumination to the photometric screen. There is another mark on the voltmeter scale, labeled 1/10, which is so located as to make the scale read ten times the illumination measured. This is useful for measuring low values of illumination which are not reached by the direct-reading scale.

Convenient Tool for Extracting Cotter Pins

THE removing of cotter pins is often a difficult job to the shopman, particularly when these are so located as not to be readily accessible. The tools most used for removing cotter pins are hammer and cold chisel, but there are many locations where a hammer cannot be used and the use of the cold chisel frequently damages the cotter pin to such an extent that it is worthless for further use.



EXTRACTING A COTTER PIN WITH SPECIAL PLIERS

The accompanying illustration shows a tool for removing cotter pins which has been given publicity by the *Scientific American*. The device is of the same size as an ordinary pair of pliers. One tong of the pliers engages the pin while the other uses all of the leverage exerted against the member through which the pin is inserted. As this leverage is four times as great as the actual force used the pin comes out quickly and easily.

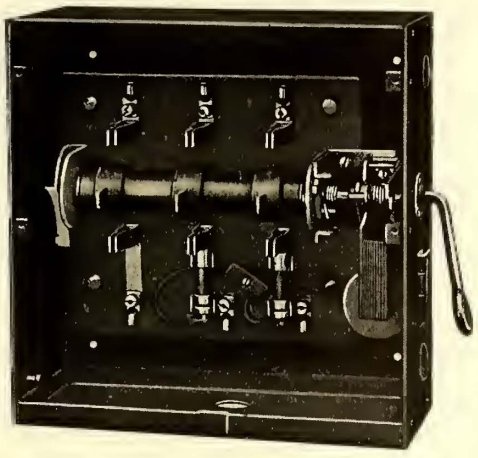
New Portable Utility Light

A NEW TYPE of night lamp for localized lighting has recently been placed on the market by the Western Electric Company. It is known as the "Portable Utility Light," and is for use at close range where the lamp is to be located at distances not greater than 125 ft. from the object or surface to be illuminated. With the light operating on a 100-ft. throw, a 100-ft. spread is obtained at an angle of 60 deg. The hammered glass reflector is spring suspended in a one-piece cast-iron housing. The housing is closed by a wire glass front which is at the bottom and secured by a hand latch. The lighting unit is 19¼ in. high and weighs approximately 30 lb. The base is 9 in. in diameter. The unit can also be mounted on either vertical or flat surfaces, such as walls, poles or roofs, by means of a heavy universal joint which fastens the housing to the base. In railway work this light can be used for lighting transfer tables, coaling stations, inspection pits, loading platforms, cranes, drawbridges, loading operations, shop yards, material yards, coal yards, erecting shops, machine shops, conveyors and all kinds of emergency work.

PORTABLE UTILITY LAMP

New Safety Motor Starting Switch

A NEW type of motor starting switch has just been placed on the market by the Westinghouse Electric & Manufacturing Company. It is designed for use with single-phase or polyphase alternating-current motors of from 1 to 10 hp., 250 and 500 volts, and connects these motors directly to the line without the use of the auto-transformers or resistance commonly used. The mechanism is inclosed in a steel box but the protective devices are easily accessible on opening a door in the cover. As a special precaution the box is arranged so that this door cannot be opened except with the switch in its open position, nor can the switch be closed with the door open.



INTERIOR OF SAFETY STARTING SWITCH

No-voltage protection to the motor is provided by a magnetic release which opens the switch automatically on a failure of voltage. Overload protection is provided by means of relays resembling cartridge fuses in appearance, each of which contains a contact connected in series with the release magnet. The entire mechanism is mounted on a slate base and can be removed as a unit without disturbing the box or the conduits.

Improvement in Pole-Pulling Jacks

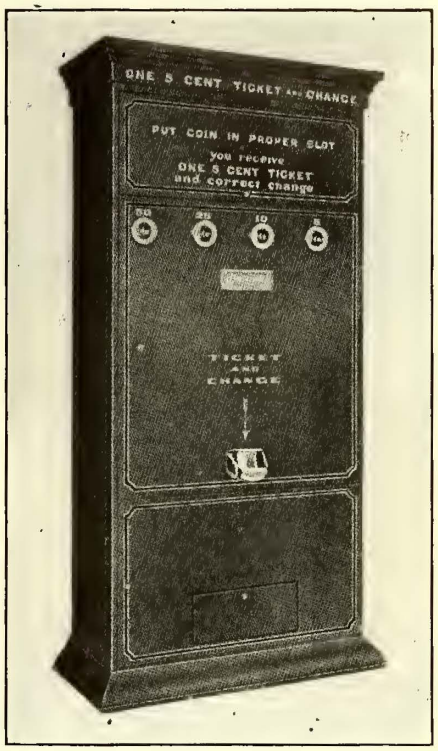
Templeton, Kenly & Company, Ltd., Chicago, Ill., manufacturers of the Simplex car and track jacks, have recently improved their pole-pulling jacks by making the lowering mechanism a gradually controlled one instead of the tripping arrangement formerly used. The method of control is now the same for lowering and raising. The accompanying illustration shows the method of using this jack to pull a pole.

USING A JACK TO RAISE A POLE

The National Safety Council has issued a complete bulletin catalog, consisting principally of small reproductions of its posters. More than 1000 illustrations are shown. There are 135 posters in the electric railway section alone.

Automatic Ticket-Selling Machine

AT THE RECENT electrical show held in New York City, the National Sales Machine Company, New York City, exhibited one of its new model ticket-selling machines. Where it is desired to sell tickets of a single denomination automatically, the machines are arranged to receive coins of any denomination up to and including 50 cents. To obtain a ticket, the coin is put in its proper slot and a ticket together with the correct change is delivered. Defective coins are returned to the delivery tray.



AUTOMATIC ELECTRIC TICKET-SELLING MACHINE

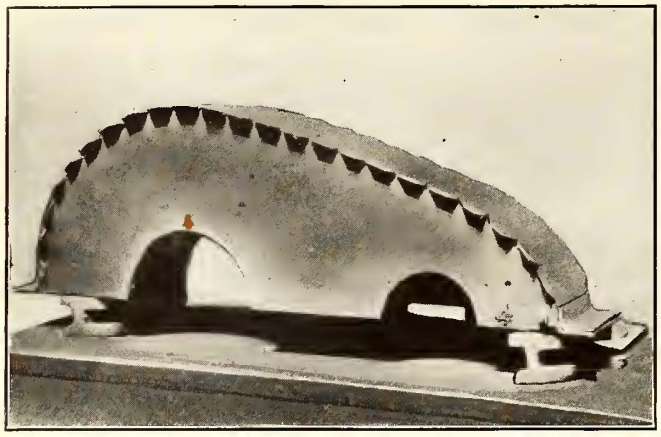
For uses in which it is desirable to have a printed record made on the ticket, suitable provision is made in the machine, so that the date, time, or additional information, such as point of issue, number of zone, etc., will be printed on the ticket as it is issued.

A feature of the machine is the coin detector arranged to reject spurious coins, worn coins or slugs whenever they are offered for payment in the machine. The slot will receive the coin, but the coin detector refuses to accept it in payment, and it is promptly returned to the reject slot. The coin detector takes account of all the particular governmental markings on the various coins by means of a series of points which bear on both sides of the coin as it is received. Any pieces of metal not bearing the required markings will be automatically rejected. These machines are operated by small electric motors and the current necessary for operation may be supplied from any lighting fixture that is convenient.

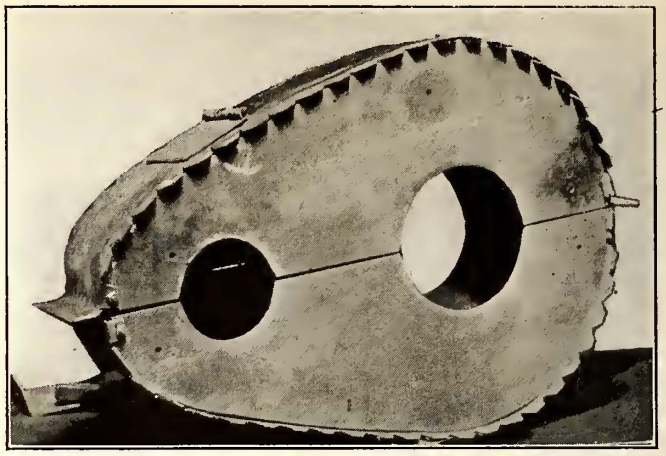
Preventing Punch-Press Accidents

In a recent bulletin of the National Safety Council reference was made to some accidents which occurred on small punch presses in spite of the fact that they were equipped with approved safeguards. Vibration of the building or the falling of a heavy object would cause the presses to repeat while the guard was up. Investigation showed that the trouble was the result of a slight burr on the dog or latch of the press. Acting on these results, the management of the factory instituted a regular weekly inspection of all power presses. Any dogs or latches giving indication of the presence of a burr were immediately polished. This did away with accidents.

While undoubtedly this is a special case the principle of applying systematic inspection methods with regard to machine tools of all kinds is to be commended. An inspector becomes expert in detecting incipient causes of trouble which might possibly escape the notice of the regular operator.



HALF OF GEAR CASE ASSEMBLED WITH ANGLE REINFORCING PLATES IN PLACE



BOTH HALVES OF GEAR CASE ASSEMBLED AND READY FOR WELDING

Gear Cases Electrically Welded

THE Winona Interurban Railway, Warsaw, Ind., is making its own gear cases, using $\frac{3}{16}$-in. sheet steel and an electric welder. No rivets or bolts are employed in the furnished product.

The side pieces are cut out in the usual form. The strips which hold the two sides together are, however, more complicated in design. Each is made from a strip 52 in. long and $8\frac{1}{2}$ in. wide. Along each side of this strip, $\frac{13}{16}$ in. from the edge and beginning $4\frac{1}{4}$ in. from one end, twenty-three holes each $\frac{1}{8}$ in. in diameter are drilled 2 in. apart. With each of these holes as a vertex a V-segment is cut out with a hand chisel.

The parts are assembled as shown in the accompanying illustrations and temporarily held together by four bolts in each half. With a block inserted to give firm support, the fingers are bent over and welded to the sides with an Erico welder. The ends are bent up in line with the center axis of the case and an angle-plate reinforcing is welded at each end. A complete gear case can be welded up in about two hours.

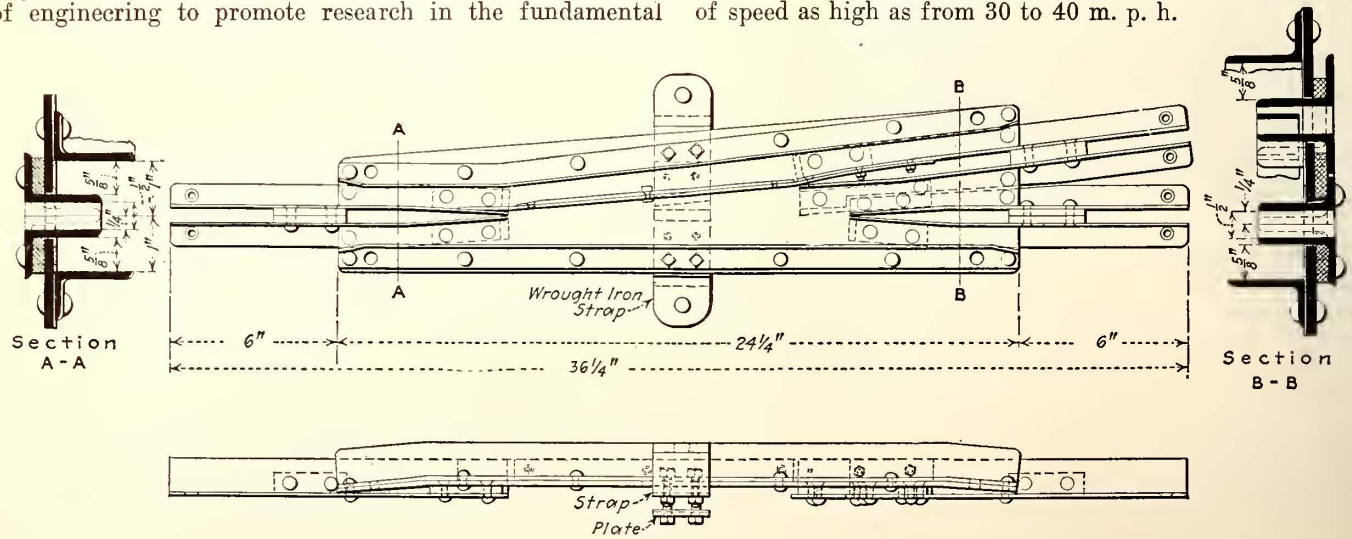
More than twenty cases have been constructed in this manner and those now in use are giving excellent service. These cases are made up at odd times.

The one-hundredth anniversary of the death of James Watt, the inventor of the steam engine, was fittingly celebrated in Great Britain, particularly at Birmingham, England, a few weeks after the centenary date, Aug. 19. By way of a memorial it is proposed to endow a professorship of engineering to promote research in the fundamental principles underlying the production of power and the study of the conservation of the national sources of energy, to erect a memorial building and to publish a memorial volume.

Home-Made High-Speed Trolley Frogs

IN CONNECTION with the article on page 566 of the ELECTRIC RAILWAY JOURNAL for Sept. 20, 1919, showing method of making spring switches from the standard trolley frogs, M. B. Rosevear, superintendent of distribution Public Service Railway, Newark, N. J., has called attention to the method which has been in use on his property for some years and which apparently accomplishes the same results in a simpler and less expensive manner. This consists in fastening a flat steel spring to the side of the runway underneath the casting so as to form a guide for the trolley wheel. The flat spring can be fastened by drilling and tapping four holes. This method was described in the issue of this paper for Oct. 7, 1911, page 591. A modification in the material used for the spring has recently been made. Formerly phosphor bronze springs were used, but now the railway has adopted steel springs because they last longer and give better results.

The accompanying illustration shows the assembly for a special high-speed trolley frog which is also being made in the shops of the Public Service Railway. This consists of a heavy rolled-steel plate to which angle irons are riveted for guides and runways. To insure that the trolley wheel will follow the proper wire, a reinforced flat spring is used. Cars operate successfully under this frog at rates of speed as high as from 30 to 40 m. p. h.



SPECIAL HIGH-SPEED TROLLEY FROG

Letter to the Editors

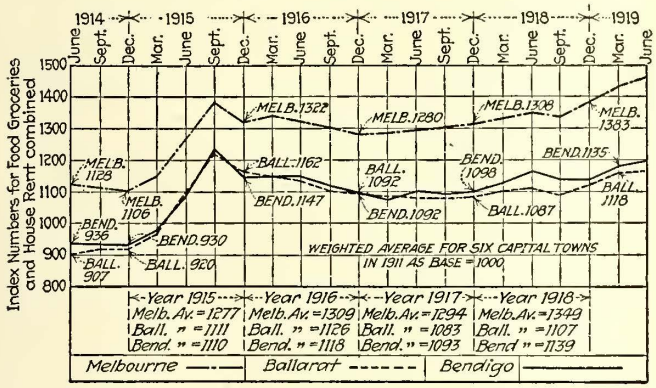
The Principle of Differential Wages in Awards

THE ELECTRIC SUPPLY COMPANY OF VICTORIA, LTD.
BALLARAT, AUSTRALIA, Aug. 25, 1919.

To the Editors:

I see from various issues of your valuable journal that the question of differential wages has been exercising many of your undertakings during the recent general demand for increased wages. The officials of the Kansas City Railways made a strong defence in this direction before the National War Labor Board. It may be of interest, therefore, to your readers to have some particulars of how this matter is dealt with in Australia.

Coming from the old country some eight years ago, where differential wages dependent upon the local conditions and cost of living are generally recognized between the unions and the employers, I was much surprised to find that here wages were being awarded by the various industrial courts on a fixed standard with only one exception, which was



COST OF FOOD, GROCERIES AND HOUSE RENT COMBINED IN MELBOURNE, BALLARAT AND BENDIGO, THE WEIGHTED AVERAGE OF SIX CAPITAL TOWNS IN 1911 TAKEN AS 1000.

the following: If a state as a whole had higher cost of living than another, then differential wages would be found in federal awards.

For instance, in West Australia the cost of living was notoriously higher than in Victoria, and the former would in consequence have wages awarded from 10 per cent to 15 per cent higher. There was, however, no attempt to differentiate between one town or district in a state, yet in the capital cities the cost of living is much higher and this fact should receive consideration in wage awards.

As the undertakings which I control are in inland towns away from the capital cities, this principle has been of great importance to us. I have been the pioneer of this principle of differential wages in both the Federal Arbitration Court and in the various state awards, and it has become an accepted principle in all arbitration court awards and in many state awards for the last six or seven years.

I append copy of a curve dealing with food, groceries, (forty-six commodities) and house rent combined, which I prepared prior to the war and have kept up to date since. This shows the fluctuations in the cost of living between Melbourne and the towns of Ballarat and Bendigo, in which we operate electric light, power and tramway undertakings. Food, groceries and rent represent approximately 60 per cent of a worker's expenditure. The commonwealth statistician makes no similar inquiry into the balance of expenditure. Much evidence in regard to this balance has frequently been brought before the courts, and they assume that this is subject to approximately the same increase as the 60 per cent. On this basis Melbourne's cost of living for the June quarter of this year has increased 35.5 per cent over pre-war times, the Federal Arbitration Court now awarding a basic wage of 66s. a week of forty-eight hours. The cost of living figures for Ballarat and Bendigo are now 19.8 per cent and 17.7 per cent respectively lower than Melbourne.

The high peak shown in September, 1915, is due to the effects of the war combined with drought. The cost of living for our country towns then came very much nearer Melbourne's, owing to many of our food costs increasing above the Melbourne standard. This was because many local supplies were cut off by the drought and had to be imported from other states. As Ballarat is 75 miles, and Bendigo 100 miles from Melbourne, extra freight charges above Melbourne had to be met. Food and groceries are now, as normally, a little cheaper in both of our towns than in Melbourne, but the main difference is due to house rents.

The differentiation in wages allowed to our towns, compared, with Melbourne, varies in Federal awards from 6s. to 10s.6d. per week per man less.

P. J. PRINGLE,
Chief Engineer and General Manager.

Association News

Work of Committee of One Hundred Summarized

L. S. STORRS, chairman of the sub-committee on information and service of the committee of one hundred, has issued a summary of the work of the committee and has sent to all electric railways reprints of the progress reports presented at the Atlantic City convention.

Mr. Storrs says in substance that the committee:

1. Brought together about fifty leading railway executives, manufacturers, engineers, bankers and economists who presented the case for the electric railway industry to the members of the Federal Electric Railways Commission in a series of hearings held in Washington and extending for a period of more than two weeks.

2a. Organized a bureau of information and service which prepared daily abstracts of the testimony submitted and mailed 60,000 copies the same night to companies, public authorities, organizations and associations in every part of the United States.

2b. Prepared daily news stories of the hearings for the press with the result that the Associated Press carried from 800 to 2000 words daily in 1100 newspapers; the United Press from 400 to 800 words in 750 papers; the International News Service from 500 to 2500 words in 300 papers; and innumerable special stories were sent out by 300 special correspondents located at Washington.

2c. Prepared special pamphlets, bulletins, reports and window card advertisements for electric railway companies.

An expert compilation of the aggregate space obtained in the newspapers as proved by clippings actually returned to the Washington office, shows that $1,000,000 worth of publicity was given to the railways, measured on the basis of actual advertising rates.

3. The committee's counsel is now preparing a brief covering the case of the railways, which will probably be completed and made public about Dec. 1.

4. As soon as the Federal Electric Railways Commission issues its report at least 50,000 copies will be distributed. Simultaneously the printing of the entire testimony and the report will be undertaken.

5. The work of the committee of one hundred has already resulted in demonstrating that the problem of the electric railways is a national one, that the situation of the railway com-

panies is a matter of importance to every individual, and that a readjustment of relations between the companies and the public is essential to the public interest. A broad foundation has been laid for the companies to complete a similar campaign locally whenever their interests require it at any time within the next decade.

On Nov. 24, Bentley W. Warren, counsel for the Committee of One Hundred, in his presentation of case of the electric railways before the Federal Electric Railways Commission, filed his argument and brief on the testimony submitted. The brief occupies 153 printed pages, and its cover shows that Edwin Gruhl, A. S. Hills, and Harlow C. Clark assisted in its preparation.

Besides a short foreword and introductory statement, the document is divided into five parts. The first of these is entitled "Argument and Brief." This is followed by a statement of the historical development of the street railway industry, occupying thirty-eight pages. The next chapter is a brief one on "Present Condition of the Industry." This is followed by a longer chapter on the causes of the present condition, and this by the final chapter entitled "Fundamentals Underlying the Solution of the Problem." There is an appendix giving the identification of the witnesses.

Safety Car Motion Picture

SECRETARY Burritt of the Association in a letter to member companies under date of Nov. 17, 1919, advised that a number of reels of the motion picture depicting the operation of the safety car, which aroused so much interest at the recent Atlantic City convention, had been made for the use of electric railway companies. Under arrangements with the Universal Film Company a copy of the film has been placed in the Film Exchange maintained by that company in Atlanta, Boston, Chicago, Dallas, New York City, Omaha, Philadelphia, St. Louis, San Francisco, and Seattle, Wash., and can be secured upon application. Companies contemplating the installation of safety cars will find it helpful to have this film shown in local motion picture houses, prior to actual installation of the cars. Arrangements can also be made with the exchange to show the picture to special parties of public officials without extra expense except for the operator's time.

Mr. Dunham Elected President at New Haven

THE thirty-second and annual meeting of the Connecticut Company section was held at New Haven on Nov. 24 with ninty-nine members and guests in attendance. Dinner was served at the Hotel Garde, and after dinner the program was opened by Congressman John Q. Tilson, who congratulated the officers and employees of the company for so successfully preserving intact the transportation system through the war period. President L. S. Storrs then thanked all employees for their interest and efforts in inaugurating the zone system, and he called attention to the importance of all employees putting greater thought into the improvement of public service.

The next speaker was H. C. Eddy, senior traffic inspector New Jersey Board of Public Utilities Commissioners, who gave a historical lecture on the development of electric transportation equipment, illustrated with lantern slides. A model of the original Vandepoele motor, the first used in this country for transporting freight, was shown, and F. L. Beardsley, superintendent of the company's New Britain division, who had operated the original motor in 1888, demonstrated its construction.

The following officers for the coming year were then elected: President, W. R. Dunham, Jr.; vice-president, J. W. Colton; secretary (re-elected), C. K. Savery; treasurer, G. H. Crosson; director for three years, F. A. Hewitt.

Resolution for Consideration at Cleveland

SUPPLEMENTING the preliminary note regarding the program of the mid-winter conference which is to be held at Cleveland in Jan. 8, 1919, the following text of the resolution to be introduced and supported by Williston Fish, vice-president West Penn Railways, is given:

Resolved, That the American Electric Railway Association recommend to its member companies that they provide in their accounting practice for the creation of adequate reserves to insure the replacement or abandonment of major items of property in advance of their actual replacement or abandonment; that such reserve shall, if possible, be provided for in cost-of-service franchises; and further that this subject be referred to an appropriate joint committee of the American Electric Railway Accounting Association and American Electric Railway Engineering Association, to formulate report on the preferable means of creating such replacement reserve and the variations in the amount thereof that will occur in railway properties of different characteristics; and be it further

Resolved, That a summary of such report be presented to the American Electric Railway Association at its annual convention in 1920.

An analysis of the records of the American Electric Railway Association giving an up-to-date list of companies now operating or about to operate one-man cars shows a total of 2409 cars, of which 6 per cent are safety cars.

Railroad Association Adopts Overhead Crossing Specifications Revision

AT ITS MEETING held in Chicago the American Railroad Association adopted, on Nov. 19, a report of its general committee of Section 2—Engineering, on behalf of the electrical division.

The report consisted of three parts: (1) On regulations of the electrical division; (2) a list of officers of the electrical division, and (3) railroad specification for electric light, power supply and trolley lines crossing steam and electric railways; originally adopted May 15, 1912 and previously amended Nov. 18, 1914.

The electric division includes those connected in official or supervisory capacities with the application of electricity to railroad service. Affiliated members may be appointed by the committee of direction. The committee of direction consists of nine representatives of members within the division, including the chairman and vice-chairman of the division, to be selected by the general committee of Section 2—Engineering. The committee of direction conducts the business of the division, authorizes orders, defines duties, and fixes the number of and appoints the members of certain special committees as may be necessary to investigate and report their findings and recommendations upon any subject to be considered by them. The following committees are provided for: (1) On electricity; (2) on overhead and third-rail working conductors, and (3) on crossings of power and other service wires.

The officers of the electrical division are George Gibbs of Gibbs & Hill, New York City, chairman; Edwin B. Katté, chief engineer of electric traction New York Central Railroad, New York City, vice-chairman; committee of direction, Messrs. Gibbs, Katté, A. S. Baldwin, vice-president Illinois Central Railroad; C. L. Bardo, general manager New York, New Haven & Hartford Railroad; H. B. Earling, general manager lines west, Chicago, Milwaukee & St. Paul Railroad; J. E. Crawford, chief engineer Norfolk & Western Railroad; J. H. Davis, electrical engineer Baltimore & Ohio Railroad. There are still two vacancies to be filled in the committee of direction.

The overhead crossing specifications report was the same as that presented at the Atlantic City convention, report No. 304 A, referred to in the convention report supplement of this paper, issued on Oct. 11, page 71.

Bulletin News Page

Summary of the Principal Happenings of the Industry of Current Interest Since the Last Issue of This Paper Was Published

PRINTED DECEMBER 4, 1919

"Dan" Pierce has joined Ivy L. Lee in general publicity work.

The Brooklyn (N. Y.) City Railroad has withdrawn its extra fare charge on the Flatbush Avenue Line pending a determination of its rights by the courts.

Fares in San Diego, Cal., have been ordered readjusted and the zone system prescribed.

Bankers who have reviewed the affairs of the Brooklyn Rapid Transit Company see the system's only financial hope in an increase in fare.

The net operating revenue of the Virginia Railway & Power Company, Richmond, Va., declined $252,570 for the year ended June 30, 1919, over the previous year.

The *Wall Street Journal* says that much new financing by public utilities is in prospect.

Bankers point out that obligations of the Baltimore railway are much more onerous than those of the Philadelphia Rapid Transit Company.

An interesting comparison of conditions under municipal ownership and under private operation is contained in the award of the arbitrators at Portland, Ore., advancing wages on the private lines there.

The Massachusetts Institute of Technology suggests a new alignment between big business and the institute, profitable alike to both.

The city of Lawrence, Mass., required to choose between jitneys and the trolleys, has eliminated the jitneys.

The Columbia Railway, Gas & Electric Company, Columbia, S. C., has offered to sell its railway lines to the city.

William E. Rolston, formerly superintendent of power and equipment of the Chicago, Lake Shore & South Bend Railway, Michigan City, Ind., has been appointed superintendent of power of the Kansas City (Mo.) Railways.

A decision by the United States Supreme Court is interpreted to mean that the Public Service Commission of Missouri has authority to fix rates regardless of franchise provisions limiting fares to 5 cents.

The State Supreme Court of New York has ruled that because of provisions in the company's franchise which limit the rate of fare, the Public Service Commission has no authority to increase fares on the Binghamton Railway.

The Railroad Commission of California says a 5-cent fare is sufficient for the Los Angeles Railway Corporation and that there is no need for a charge for transfers. The engineers who conducted the investigation believe that economies and improvements are possible. One-man cars are recommended. Relief for the company from paving is another reform suggested.

The Public Service Railway, Newark, N. J., has been authorized to abandon the zone plan as modified recently by the Board of Public Utility Commissioners and to return to a flat 7-cent charge with 1 cent for each transfer.

The Public Service Commission of New York has approved the reorganization plan for the Buffalo (N. Y.) Southern Railway.

The shareholders of the Cities Service Company, New York, N. Y., have approved the creation of an authorized issue of $100,000,000 of second preferred stock.

The report of the engineers retained by security holders of the Interborough Rapid Transit Company, New York, N. Y., to inquire into that company's affairs confirms the need of the company for additional revenue if the company is to be saved from receivership.

The reorganization plan for Oakland, Antioch & Eastern Railway, Oakland, Cal., is to be modified.

The property of the Southern Traction Company, East St. Louis, Ill., may again be offered for sale at foreclosure, as the purchaser is in technical default in making the purchase payments.

Traction securities in New York shrunk in value more than $106,000,000 during the period from Jan. 2 to Nov. 10.

A special session of the Legislature of Michigan is urged for the purpose of considering the question of bonding the city of Detroit so that subways may be built at public expense.

A substitute is offered by E. R. Morse, transit commissioner of Pittsburgh, Pa., for the city's proposal of a $6,000,000 downtown subway loop.

The director of city transit of Philadelphia takes issue with the proposal of President Mitten of the Philadelphia Rapid Transit Company over Mr. Mitten's plan for relief for the company.

The Public Service Commissioner for Greater New York is expected to reiterate his suggestion for consolidation of the lines in New York as a step in the solution of the railway problem in that city.

Arbitrators have decided in favor of a maximum wage increase of 10 cents for the employees of the Des Moines (Ia.) City Railway.

The court has stepped into the street railway controversy at Toledo, where service has been abandoned, and has proposed terms for a temporary settlement, with other suggestions looking toward permanent relief. In the opinion of the court Toledo has made itself a joke to all the rest of the country.

Railway operators are contributing to a discussion on fare being conducted by the Chicago *Daily News*. Among the railway men who have participated are President Mitten of the Philadelphia Rapid Transit Company, President Brooks of the Detroit United Railway and L. A. Busby, president of the Chicago Surface Lines.

The Portland Railway, Light & Power Company, Portland, Ore., as the result of a wage award increase, has asked the Public Service Commission to determine upon a fare charge that will permit the company to meet its obligations.

The Shore Line Electric Railway in Connecticut has asked the court to determine the right of the company to discontinue service that is unprofitable. The property is in the hands of a receiver.

St. Louis has taken to the token.

The recent daily average of passengers carried on the surface and rapid transit lines in Greater New York has been 6,400,000. The fares per capita have increased to 370. The cold figures of the Public Service Commission covering passenger traffic in New York last year deserve careful reading.

All lines of the Terre Haute division of the Terre Haute, Indianapolis & Eastern Traction Company except one have been equipped with safety cars.

The Chicago (Ill.) Surface Lines has been ordered to sell ten tickets for 65 cents and books of fifty tickets for $3. The Public Service Commission, however, has refused to order the discontinuance of the 7-cent cash fare.

A dispute has arisen over the interpretation of the terms of the loan of the War Finance Corporation to the New Orleans Railway & Light Company.

A bill of foreclosure has been filed against the Aurora, Elgin & Chicago Railroad, Wheaton, Ill.

A receiver has been named for the Northampton, Easton & Washington Traction Company, Easton, Pa.

The operator of New York's municipal busses sees a great future in these vehicles as operated by himself.

The merit system has been applied to the employees of the Seattle (Wash.) Municipal Railway by Superintendent Murphine.

The manager of the Brooklyn City Railroad, recently separated from the Brooklyn Rapid Transit Company, sees a deficit of $400,000 before him for the year ended Aug. 31, 1920, with no allowance for Federal taxes, payment of rentals or interest on securities outstanding.

The wages of trainmen in Portland, Ore., have been advanced 6 cents an hour under arbitration.

News of the Electric Railways

Principal Happenings Up to Closing of Forms for This Issue, on Dec. 1. Issue Printed Dec. 13, 1919

FINANCIAL AND CORPORATE . TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Railway Ready to Sell

South Carolina Company, Insisting on Its Rights, Offers to Dispose of Its Property to the City

Edwin W. Robertson, president of the Columbia Railway, Gas & Electric Company, Columbia, S. C., on Nov. 8 transmitted a letter to the City Council in which, speaking for the directors, he offered to sell the railway to the city.

Business Run at Loss

It is pointed out that the business is being operated at a loss, the deficit from Jan. 1 to Nov. 1 being $134,886. Mr. Robertson emphasizes that the present system cannot be maintained indefinitely with its sources of revenue so sharply reduced. In his letter Mr. Robertson says:

For some time now this company has been operating its railway at a decided loss, as shown by the figures in statements hereto attached, and any additional burdens placed upon the company at this time will react to the discomfort and inconvenience of our citizens.

Municipal ownership and operation of city railway lines have been before the people of many municipalities and the advantage claimed for such ownership and management has been so thoroughly discussed that I will not attempt to advise you along these lines. If Council deems it to the best interest of the citizens of Columbia that the railway lines should be owned and operated by the city government, in the full faith and belief that the same can be operated as well and more economically, I am authorized to offer to sell the railway lines and equipment belonging to this company to the city of Columbia on a fair valuation basis as of the date of this letter. There is one large item I readily see can be saved under municipal ownership which is now a heavy burden on this company, to-wit: taxes. This year taxes will amount to practically $92,000.

In the past we have been able to give to the citizens of Columbia what we have every reason to believe is one of the best electric railway services in the country, and we have been enabled to do this because of profits made from other departments of the company which were not expended in dividends to the stockholders, but used to improve and better the service in every respect. The recent decisions of the Public Service Commission have taken away our means to continue this course, and I cannot say at this writing how much longer the company will be able to maintain the present service. Certainly if additional paving burdens are forced upon us there is no other alternative save reduction in the number of cars operated.

The losses as set forth from the books by Mr. Robertson range from $10,809 for February, the lowest for the year, up to $16,757 for September, the highest. The total receipts were $369,459 against operating expenses amounting to $504,346, or a net loss of $134,886. This does not include interest on bonds and taxes.

At its meeting on Nov. 11 the City Council took no definite action on the proposal of the company to sell the railway to the municipality, but passed a resolution the sense of which was that Council would expect the company to pave the car tracks on Divine Street as requested in another resolution passed at a recent meeting. The matter of buying the railway will be discussed later.

City Insists on Paving

When the letter of Mr. Robertson was presented to the Council Councilman Coleman stated the he considered the part relative to the paving of the car tracks along Divine Street in Shandon separate from the proposal to sell the railway to the city and he thought that Council should insist on its previous resolution that the paving work be done. He contended that the paving was being damaged by the tracks not being paved. A resolution was then put and carried calling upon the company to proceed with the paving as referred to in the previous resolution, which brought forth Mr. Robertson's letter.

As to the matter of buying the railway it was proposed that Council hold a special meeting and if it considered the plan feasible to have a committee meet with a committee of the directors of the railway, to discuss the matter and also to look into the advisability of purchasing the entire interests of the company in case an offer on a fair basis be made.

It is understood that the company will persist in its refusal to pave the track on its own right-of-way. This right-of-way was purchased or received as a gratuity from a land development company. The land on which the tracks are laid now happens to be in the streets as extended to meet the requirements of the growth of the city.

Ten-Cent Wage Increase in Des Moines

The employees of the Des Moines (Ia.) City Railway will get a maximum wage increase of 10 cents according to the decision of the arbitrators. C. W. Reese, representing the public, and Fred Sargent, representing the company, have signed the agreement making it effective at once, but Ben J. Wiley, the representative of the employees on the arbitration board, refused to sign the agreement. He stated, however, that the terms would be accepted by the men.

The rates of pay which have been determined upon for the men by the board are: 51 cents an hour for the first three months of service, 54 cents for the next nine months, and 57 cents after one year. The men demanded a maximum of 65 cents. The same three arbitrators some months ago agreed upon 50, 55 and 60 cents contingent upon the passage of a 6-cent fare, but this was turned down at a special election. Judge Martin J. Wade, of the Federal Court, then ordered the 47-cent scale re-established.

The new agreement is retroactive to March 1, 1919, and continues until the present contract between the men and the company expires on March 1, 1920. As the company has paid a portion of the time on the basis of the 60-cent scale a credit will be due according to the recent decision of the arbitration board.

Improvement Program for St. Louis

The annual report of Charles S. Butts, engineer for the department of public utilities of St. Louis, Mo., outlines improvements which the United Railways can make for the benefit of the city. Mr. Butts' improvement program calls for the expenditure of $2,000,000. He recommends the construction of a car line from Meramec Street through Carondelet Park to the southern limits of the city. The report urges the extension of several other lines to outlying parts of St. Louis.

Consolidation as a Way Out

New York Commissioner, It Is Said, Will Again Urge Merger as a Means to Traction Settlement

The talk of a merger of the traction lines in New York has again been revived. The rumors come to New York via Mount Clemons, Mich, where Lewis Nixon, public service commissioner, has been spending a vacation. Report has it that the data and findings in connection with the various inquiries into and the engineering reports on the New York City companies have all been transmitted to Mr. Nixon and that he has been devoting no small part of his time to the consideration of what had best be done.

Several Conferences Recently

For all this there would appear to be some foundation in fact. Mr. Nixon has conferred several times with the representatives of the various railways and early in the present proceedings urged that all negotiations be conducted in the spirit of give and take. He has said previously that he was inclined to favor service-at-cost, indeterminate grants in place of the present perpetual franchises, the valuation of the properties in the interest of the city, the right of the city to purchase the lines, the abolition of holding companies and the termination of the present leases.

If rumor is to be believed then Mr. Nixon has modified his views to the extent of considering it advisable to bring about consolidations of the lines in the boroughs of Manhattan and the Bronx as a unit and those of Brooklyn and Queens as a unit, with the ultimate goal a final consolidation of all the companies rather than the first objective as reported some time ago.

From all the conferences looking toward a readjustment of affairs the present city administration, headed by Mayor Hylan, has stood aloof. Thus the effort to have the Mayor participate has failed. In fact one of the developments in connection with the inquiry by the commission into the transit situation was a passage at arms between the Mayor and the commissioner. In political circles the tilt between the Mayor and the commissioner has been construed as a rupture between the Mayor and the Governor, by whom Mr. Nixon was appointed. Whatever the significance of these moves from a political standpoint may be, there can be no mistaking the uncompromising attitude of the city administration toward the local railways.

Security Readjustment of Problem

As for Commissioner Nixon it is said that upon his return he will have ready for submission to the officials and legal representatives of the companies a complete plan for the merger. All this would have to be presaged upon the ability of those in charge to reconcile the holders of the various security issues involved to the changes in the nature of their holdings which would necessarily have to follow.

Plan Suggested for Temporary Toledo Resumption

City Sought Mandatory Order—Court Suggested Friendly Temporary Adjustment—Company Willing to Resume on Assurance of Protection

The Toledo, Ohio, abandonment case has reached the courts. Shortly after the cessation of service by the Toledo Railways & Light Company following the vote by the people upholding the ouster ordinance Mayor Schreiber hinted at a legal way to require the company to resume operations. It appears now that the Mayor had in mind a law passed recently, for he applied to Judge Killits of the District Court for the Northern District of Ohio, Western Division, for relief.

Court Suggests Temporary Settlement

The case came before the court on Nov. 28. Judge Killits said he was ready to order the cars back to the streets immediately upon the formal order of Mayor Schreiber now in court, but he expressed the belief that the order of the Mayor lacked the sanction of the City Council. To this Mayor Schreiber declared he would call Council in special session. In his suggestion for operation of the cars immediately Judge Killits proposed to appoint a commission, composed of six or ten members, equally divided between adherents of municipal ownership and those favoring the Tayler service-at-cost plan.

Under this plan, he said the cars could be operated at once as he would suggest appointing Frank Coates, president of the Toledo Railways & Light Company, operating head of the traction system, while the city officials and traction owners consider details of the franchise drafts they now are working upon.

The plan proposed by Judge Killitts has been summarized as follows:

1. Provides for resumption of car service at once, on temporary basis, if H. L. Doherty, Mayor Schreiber and Council accept court's suggestions for temporary and permanent settlement.
2. Requires Council first to pass emergency resolution, ratifying Mayor Schrieber's application for mandatory order for resumption of car service under Miller law.
3. Judge Killits then to begin operation of railway for sixty-day period, preserving company organization intact, and appointing President Frank R. Coates operating officer. Court to determine fare, schedules, re-routing.
4. For permanent settlement, Mayor and Council must agree to accept assistance of a commission, to be appointed by Killits and approved by Mayor and Council.
5. Commission to consist of either six or ten members, divided equally between municipal ownership and Tayler plan advocates.
6. Commission, Mayor and Council to work out ordinances providing for both plans to be submitted to popular vote.
7. Acceptance of court's proposal by either party not to be deemed final until order is framed and submitted designating exactly how cars sball be operated temporarily.
8. If both city and company refuse to accept court's suggested order, Judge Killits may abandon further attempt to help.
9. Court reserves judgment as to what will be done further if one party accepts and other refuses to accept suggested plan.
10. Judge Killits expresses opinion court has power to order resumption of transportation, under Miller law, but says this or any other order would be subject to appeal and indefinite delay.

Court Explains Situation

The remarks of the court on the general situation were very significant. Judge Killitts said in part:

It will occur to everybody that the city loses in prestige and promise every day the cars stay out; that citizens in private and business life are suffering financially and, what is more important, the health of our people will be seriously impaired with the bitter season at hand.

The controversy which has afflicted Toledo for fifteen-years ought to have a quick end. It has disastrously hampered the city's growth and has embittered its people, arraying them in opposing classes and breeding heated dissensions among them. Some of the situations it has produced all of us would like to forget. Wherever you go, you find that we have the reputation of a quarrelsome, divided people. The local papers might fill pages of editorial comment ridiculing Toledo for its present plight, which newspapers from the Atlantic to the Pacific have recently printed. Plainly, we have made ourselves a joke to all the rest of the country. We have put upon ourselves an intolerable burden, and a great many people think that a very great sacrifice might well be borne if thereby Toledo could throw it off for all time.

But, after all, very little sacrifice is necessary to put our city on the map again as a community of sensible, enterprising people. We would at one step go more than half way out of the mire if everyone of us would meet the matter coolly and as a fresh proposition, with open minds, and a fair regard for the feelings, views and interests of each other, and, above all, with a fixed determination to do the very best for the city, in short, if we would act just as citizens of a democracy should act, to get the best result out of the principle of democracy.

What can the court do to help? God knows this court will do all it can, and it will not stick for propriety or conventionality. In the first place, the court can make no order in the pending case which is not subject to review by a higher court, and it would only make things worse if the court should enter an order which a higher court might set aside. This court is bound to a best effort to get an order which it feels a higher court would sustain, and then enforce it. This order must protect rights which the parties enjoy, otherwise it will not stand. It must be so written that it will give the least possible excuse for appeal. We have in mind a discretion abiding in this court the exercise of which cannot be reversed unless it is seen on the face of the record that the discretion has been unwisely used, and we think we know how to use it without encountering reversal. An order in this line does not involve the Miller law in any way whatever, but to issue it would not directly involve the running of cars. It would, however, create a situation which would probably bring about the result in the end. We also believe that the court has the power to issue an order based upon the Miller law, directly going to the resumption of transportation, leaving only to the court's discretion the terms and conditions of that order.

In both cases, however, as we have said, an appeal could not be prevented, and the order might not go into effect until this court was sustained by a higher court.

So far as giving immediate transportation through this court is concerned, two factors are considered:

First, how far is the court willing to use its discretion?

Second, what is the disposition of the company respecting obedience to the court's order without appeal?

Now this court, deeply impressed as we are with the necessity for quick resumption of service, will not use its discretion to that end except upon conditions which will, first, protect the company in every legal right it possesses, giving it every safeguard it should have, so that it would have the least possible chance for success in a higher court, and which will, secondly, encourage the company to refrain from testing the order in a higher court. We must impose conditions, also, which will work to as speedy a final adjustment of the street car question as can be consistent with safe action.

The court then outlined at some length the plan for settlement which has been summarized previously, stating first of all that the Council must pass an emergency resolution ratifying the act of the Mayor in making application to the court. In conclusion the court said:

These suggestions are submitted to the parties with the sincere hope and with much confidence that they will appeal to their good judgment and public spirit, and that they will so far meet with the approval of both sides that the parties will cordially unite in mutual agreements within the limits of these conditions which will reduce to the minimum the courts work therein.

A meeting of the company officials and city officers with Judge Killitts followed almost immediately and the company asked more time to consider the proposals of the court for a settlement by temporary restoration of service as suggested by the court. No time was set for another conference and the meeting of the Council called for Saturday to pass the emergency resolution ratifying the appeal of the Mayor to the Court was postponed.

At the conference the company did not refuse to accept the court's proposal. It merely presented these conditions upon which it might bring the cars back:

1. A temporary ordinance granting the right to operate cars and protect the company.
2. A high enough temporary fare for service to make a permanent settlement at lower fares attractive to the people.
3. Elimination of bus competition during the interval of temporary service.

Mayor Quotes New Law

The Mayor bases his case against the company on the so-called Miller law. This measure was passed by the Legislature on April 15, 1919, and was approved on May 16. It enlarged the powers and duties of the Public Utility Commission with reference to the abandonment of service facilities of railroad and public utilities, and provided that no political sub-division of the State shall require to be abandoned, and no public utility (including interurban and street railway service) shall abandon the operation of any such public utility until reasonable notice is given to the Public Utilities Commission so that body may inquire into the propriety of such cessation.

In appealing to the court for a mandatory order compelling the company to restore service under the old conditions, the city contends that at "no time has any application been made to the Public Utilities Commission for leave to abandon service or remove such cars and no order permitting such abandonment has ever been allowed by such Public Utility Commission, nor has such leave ever been granted by this court or any other court, either as to city or interurban cars."

The court entertained the city's plea to the extent of notifying the city and the company to appear before him on Nov. 21. After a short hearing Judge Killits put the case over a few days. This was done on the plea of Thomas H. Tracy, counsel for the company, who said he desired time to consult with Henry L. Doherty of Henry L. Doherty & Company, operating managers of the local company. Mr. Tracy said that counsel for the company believed the Miller law was not applicable to city street railway systems.

History Reviewed Briefly

It should, perhaps, be explained that since January, 1914, the company has been operating under a day-to-day franchise, the city having the right to oust the company on twenty-four hours notice and the company having the same right to abandon operation. The court in April, 1918, ordered a straight 5-cent fare and a charge of 1 cent for each transfer. In May, 1919, wages were referred to War Labor Board. Increases were granted, and in June the fare was increased to 6 cents with 2 cents for a transfer. Mayor Schreiber retaliated with an ouster ordinance. This was passed by the Council, but its application was postponed by a initiative petition putting the matter to the people at the polls. In the meantime the company submitted a service-at-cost plan, but this was shelved. At the election the voters upheld the ouster measure and as soon as the official count had been returned the company withdrew its cars across the border into Michigan. One of the things Mr. Doherty wants is a decisive vote for municipal ownership or an expression of opinion favorable to the company being granted a workable franchise under private ownership.

Meanwhile the work is being kept up of securing names to the petition looking toward the filing of a request for an initiated franchise ordinance which would place the issue squarely before the public.

Lawrence Service Restored

Railway Withdraws Service Compelling City to Decide Definitely Between the Trolley and the Jitney

A notable struggle over jitneys in Lawrence, Mass., was brought to a climax on Nov. 26 when the public trustees in charge of the Eastern Massachusetts Street Railway withdrew electric railway service after the City Council had failed to enforce an order for the revocation of all jitney licenses. The expressed attitude of the trustees was this:

> A street railway and jitneys can not both live in the same community. These rival transportation mediums operating against each other are an economic waste. The people should choose between the two. If the people want jitneys they should abolish the street railway, but if they want the street railway they should abolish the jitneys.

The public trustees, appointed by Governor Coolidge to take charge of the railway under the Public Control Act, providing for service-at-cost, have had numerous clashes with city and town officials over the jitney problem, and in every instance thus far the verdict of the people has been in favor of the railway, and jitney competition has been eliminated.

Immediately service had been withdrawn there was such public clamor that the city officials, after ineffectually appealing to the Governor to compel the trustees to restore railway service, found it necessary to confer with the public trustees and submit to terms which covered all of the points made in the original ultimatum served upon Mayor John J. Hurley and the other members of the Lawrence City Council on Nov. 11.

Ordinance Passed Restricting Jitneys

After their conference with the public trustees in Boston, on Nov. 26, the Mayor and City Council returned to Lawrence and at a midnight session passed an ordinance which provides that jitneys cannot operate on any street or part of a street where the street railway is now in operation and that motor buses cannot operate upon any other street until public necessity for the same has been shown and the street railway refuses to take care of the transportation thereon.

The one trolleyless day in a drizzling rain during which the people in the outlying districts were left practically stranded and the retail merchants reported business almost at a standstill, apparently convinced the City Council that the city without trolley cars was unthinkable.

As the result of the unrestrained jitney traffic in streets already served by the Bay State in Lawrence the public trustees discovered in the segregation of the Lawrence District accounts that the monthly loss in earnings was $25,000. Although jitney regulations had been adopted by the Lawrence City Council, the Department of Public Safety paid little or no attention to their enforcement.

These facts were brought sharply to the attention of the Chamber of Commerce and a service committee composed of five representative citizens was appointed, which throughout all the dealing between the public trustees and the City Council stood stanchly by the public trustees in favor of giving the railway the right to operate without having to contend with the unfair and wasteful jitney competition.

George E. Ricks, secretary of the Lawrence Chamber of Commerce, and James H. Bride, a wholesale plumber and steam fitter, gave their services in conducting a campaign of education which aided the public trustees materially in effectively presenting their case to the people of Lawrence.

Manufacturers, retail merchants and newspaper publishers also got into the line and one newspaper conducted a referendum of its own which showed conclusively that there is an overwhelming public sentiment in favor of the street cars. This newspaper, *The Telegram*, printed on its first page for several days a ballot and invited its readers to express their choice as between street cars and jitneys. About 95 per cent of the replies expressed preference for street cars.

Reduced Fare Plan Suggested

When the railway service was restored on Nov. 28, the reserve cars were operating on all of the local lines, and Howard F. Fritch, assistant general manager, immediately took up with the citizens' service committee the matter of lower fares which the public trustees promised in the event of the elimination of the jitney traffic. It is proposed to put into effect in Lawrence on Dec. 7 a sixteen-ride $1 punch ticket with no transfer privilege.

Since the passage of the ordinance by the City Council at its special session a marked change has come over the Police Department, which is now enthusiastically co-operating with the public trustees and strictly enforcing the order of the City Council revoking the jitney licenses. The new city ordinance will not become effective until Dec. 6 under the provisions of the Lawrence City Charter, but the existing regulations under which the jitney licenses were revoked will remain in force until the new ordinance becomes operative.

In the city of Brockton jitney competition has been completely removed without the public trustees being obliged to resort to the cessation of service. When Patrick F. Sheehan, manager of the division there, announced the proposed discontinuance because of unfair jitney competition, neighborhood meetings were held and the people expressed themselves so strongly in favor of the continuance of railway service that the Board of Aldermen voted five to one for the revocation of all jitney licenses under the existing ordinance and Mayor William L. Gleason having served notice that it was his intention to make the Police Station the destination of every jitney driver who operated after the revocation became effective, there has been little or no irritation from that source since. Brockton has also been given a sixteen-ride $1 punch ticket without transfers.

Jitneys Eliminated in Other Cities

Lowell, Fall River and Taunton are the other Bay State System cities where there is no jitney competition and all three are enjoying reduced ticket rates which appear to be working out satisfactorily.

Optimistic About New York Busses

Application was made to the Board of Estimates of New York City on Nov. 21 by Grover A. Whelan, commissioner of plants and structures, for authority to continue the operation of the various bus lines in the city until July 1 next and to charge the bus owners $2 a day for each bus. This money, Mr. Whalen suggested, could constitute a fund to meet the expenses of supervision. The present authorization under which Mr. Whalen is permitting the busses to operate expired on Dec. 1.

In his report on the busses, Mr. Whalen said that 114 of them were in operation on Nov. 14, and that they carried 75,000 passengers daily. He thought that if the city would undertake the operation of a unified system of city-owned busses great success would attend the venture. He submitted figures showing that 100 busses, seating twenty-seven passengers each, would cost $550,000, and that garage equipment and spare parts would cost an additional $20,000.

His figures for operation and maintenance, including garages, the employment of 180 chauffeurs at $1,800 a year each, starters, checkers, etc., total $635,000. Then Mr. Whalen's report says that it is proposed to operate ninety-two busses on the nine routes, which have bus service at the present time, eight busses being held for emergency service.

He estimates the profits of operation at $376.80 a day. Then his report reads:

> These nine routes total a length of only 25 miles, and on account of their length are bound to be profitable sources of revenue, and the service of these 100 busses will give, I confidently expect, in one year after city operation is commenced, a much greater income than is quoted here.

Endowment on Business Basis

Massachusetts Institute of Technology Proposes a New Relation With Industry Big With Possibilities

Big possibilities for the future of Americen engineering schools are inherent in a plant which the Massachusetts Institute of Technology is now developing. This plan not only puts contributions to the endowment fund upon the sound business basis of quid pro quo, but affords an opportunity to many industries of contributing without charging the appropriations to bequests and charities.

The Institute, it may be recalled, is seeking $8,000,000 in endowment funds—or rather, $4,000,000 from the public in order to secure a like amount already promised by the "mysterious Mr. Smith," the income from the fund to be used to pay more nearly adequate salaries to the members of its teaching staff.

In the quest for this amount, "Tech" has decided to place before the great industrial corporations a plan by which they will agree to pay an annual fee to the institute in return for certain specified services and privileges. The Institute, on its part, permits the corporation to have the use of its library, the opportunity to consult its professors, and the first chance at hiring Technology men.

Fears that the proposal may conflict with the work of the consulting engineer are answered by the obvious fact that the problems submitted to the institute would be beyond the scope of the private engineering firm to handle and by the further fact that the consulting experts of the country are already swamped with the unending questions submitted to them for solution.

Under its new constitution, the State of Massachusetts is compelled to withdraw the aid formerly given to Technology. The per capita income from the student body is insufficient to meet the actual cost of instruction, and the tuition fee cannot be further increased without working a hardship on many students. Hence the turning to industry and the plan for a closer and more helpful relationship than has ever before been obtained.

Wage Advance Granted in Portland, Ore.

Arbitrators Compare Portland Railway With Seattle Municipal Line and Recommend Relief

By a unanimous decision of the board of arbitration considering a scale of wages for the trainmen and other classified railway employees of the Portland Railway, Light & Power Company, Portland, Ore., a schedule was signed on Nov. 14 for the period from Oct. 1, 1919, to April 30, 1920, subject to reopening at intervals of six months commencing May 1, 1920.

Sixty-Two Cent Maximum Established

Wages of platform men are raised from a maximum of 56 cents an hour to a maximum of 62 cents an hour and those of other classified employees to a scale corresponding with that figure.

The arbitrators were Otto Hartwig, appointed to represent the employees; F. C. Knapp, appointed to represent the company, by whom Ira F. Powers was selected as the third member and designated as chairman of the board of arbitration.

In concluding the task the members of the board expressed their gratification that most cordial relations exist between the employees and officials of the corporation, and commended the spirit in which the parties to the controversy had presented their testimony.

The schedule showing the present wages and scale of the award for platform men, applying alike to conductors and motormen, is as follows:

	Present rate per hour	Award
First three months	$0.52	$0.58
Next nine months	.54	.60
After one year	.56	.62
One-man car operators, 6 cents an hour above scale.		
Extra men, a month	$90	$100

In the schedule for classified employees, including blacksmiths, carpenters, machinists, painters, employees in the truck, air and other departments and in the carhouses, including laborers, there is a general advance in wages of from 3 to 4 and 5 cents an hour over the former agreement. This also applies to the interurban track force, bridge and building force, interurban station agents and employees and tellers at the carhouses.

Seattle Lines Helped

During the negotiations reference was made time and again to conditions that prevail on the Seattle (Wash.) Municipal Railway. On this point the arbitrators say:

This board has not raised the Portland rate to the full level of the Seattle rate because of the following considerations:

(a) The financial condition of the Portland company as compared with the municipal fund in Seattle which is available for transportation expense.

(b) An effort has been made to adjust the rates fixed by this award in accordance with the award of the War Labor Board of August, 1919, taking account of the increase in the cost of living since that time.

(c) The cost of living is somewhat less in Portland than in Seattle.

Full data were presented to the board showing the present financial condition of the Portland Railway, Light & Power Company.

For the purpose merely of suggesting possible solutions, it may not be out of place to incorporate in this report certain comparative data applying to Seattle and Portland which the parties brought before this board.

The Seattle Municipal Railway department is relieved from the following items which are borne directly by the Portland company:

General taxes, franchise fees, legal department and accounting expense (assumed in Seattle by other city departments), bridge tolls, paving (assumed in Seattle by street department).

The aggregate of these expenses in Portland amounts approximately to $600,000 per annum.

It further appears that Seattle is charging no depreciation on its railway system, while the Portland company is subject to a depreciation charge of $366,000 a year.

Furthermore, it appears that Seattle is now paying from the general fund to the railway department approximately $50,000 a year for carrying city employees. In Portland firemen and policemen are carried free.

In effect the increases in the cost of operating the Seattle system are thus assumed by the taxpayers, and unless the Portland public desires to undertake the necessary investment incident to acquiring the railway property and the consequent obligations of operation, some adjustment of revenue or expense would appear to be the only alternative.

Another very interesting feature of the Portland finding is the reference by the board to means of relief for the local company. On this point the board said:

This board does not conceive that it is its proper function to do more in this regard than to list the possibilities of increasing revenue and decreasing expenditures, all without recommendation, but in order that the public may consider the necessary effect of this award and give consideration to ways and means of insuring a continuance of service.

Possibilities of Increasing Revenue

1. Increased fares.
2. Charge for transfers.
3. Limiting length of ride for one fare.
4. Payment of fare by city for firemen and policemen.

Possibilities of Reducing Expenditures

1. Relief from bridge tolls.
2. Relief from franchise fees.
3. Reduction of taxes.
4. Relief from paving obligations.
5. Reduction of service.

It has appeared to this board that the prosperity of the people of Portland would be seriously affected by the insolvency and bankruptcy of a utility which plays such an important part in our industrial and commercial activity, and that the board would fail in its duty to the public if it should withhold a clear and comprehensive statement of the facts brought out at its hearings, which, with their obvious results, are of such importance to the public generally.

Merit System in Seattle

No Political Nepotism on Seattle Municipal Railway Under Civil Service Direction

A new system of merit marking for conductors and motormen on the Seattle (Wash.) Municipal Railway has been started by T. F. Murphine, superintendent of public utilities. It is known as the "Discipline-by-Record" plan. Under the new system, the top notch pay of $5.25 a day goes only to the men who rate 0.85 or better in the city's merit ledger. Those whose marks lower their standing a certain per cent go into the second grade and are paid only $5. Lower ratings calling for $4.75, and if the rating falls below 0.70, it means that the employee is in line to quit the service automatically.

Basis of Merit Marks

The merit markings are based on personal appearance of the trainmen, courtesy to passengers, efforts to insure safety, and suggestions for improvement of service. There are thirty-five causes for demerit marks and eight causes for merits.

Mr. Murphine states that the trial of the system so far made shows that the application of the merit plan has improved the service of the company to a remarkable extent. Each man's record is posted daily, and he is accorded the right to protest against any demerit, if he has an acceptable excuse.

The railway men are under the rule of the city civil service commission, which requires each department head to report every sixty days on a percentage basis the relative efficiency of his employees. It was this fact that led to the installation of the merit rating system for the railway men.

The "Psychological" vs. the "Mathematical"

Many Differences Exist Between Operating Terms and Conditions in Baltimore and Philadelphia

The Philadelphia correspondent of the Baltimore *Sun*, in a recent communication, contrasts the method of the Philadelphia Rapid Transit Company and the United Railways & Electric Company, Baltimore, in an endeavor to increase its receipts to meet increased operating expenses, and exemplifies as follows:

The difference in the methods of the two companies in securing the additional money they need might be described as the psychological *versus* the mathematical method. The Baltimore company, finding itself short of sufficient money to maintain and operate the property, pay its fixed charges, and get a sufficient balance to surplus for credit purposes, put a lot of experts on its books, figured how much it would require and then asked the Public Service Commission to establish a fare that would yield the amount required. That was the mathematical method.

The Philadelphia Company, in a similar financial situation, put some experts in another line to studying the situation and evolved the salesmanship plan—the plan of selling more units of the thing it produces, which are street-car rides; of filling the empty seats in the cars at non-rusb hour periods, of inducing the man who otherwise would walk to ride by convincing him that by riding instead of walking he would be helping to maintain the 5-cent fare and thus do his city as well as himself a good turn. That is the psychological method.

In commenting on this statement Nelson, Cook & Company, Baltimore, bankers, said in part:

In other words, the Baltimore company appealed to the Public Service Commission for an increased fare while the Philadelphia company appealed to the public to ride oftener and thus prevent the necessity for an increased fare.

The fact that the Philadelphia company is still charging 5 cents and paying dividends, while tbe United Railways is charging 6⅔ cents and not paying dividends, has been illustrated as a reason whv the Public Service Commission should not authorize an increased fare. On its face this is a reasonable argument, but most unreasonable when it is explained that conditions regulating and controlling the two systems are absolutely dissimilar.

The Philadelphia Rapid Transit Company is enjoying the benefit of the "skip-stop" policy, once in force at Baltimore and repealed at the protesting request of the public. This privilege is estimated to be worth $1,000,000 per annum to the Philadelphia company. This company charges 3 cents for transfers at 580 points and gives free transfers at 320 points. The revenue from transfers is estimated at $1,500,000. The Philadelphia company pays, under a contract made with the city, $550,000 per annum "in lieu and satisfaction of all liability on the part of the company and its subsidiary companies for the paving, repaving, and repair of the streets occupied bv their surface lines, the obligation of the companies with respect to the removal of snow therefrom, and all license fees, and shall be in lieu of the right of the city to impose upon the company similar obligations and charges." The only other tax required is the usual tax on real estate. The Philadelphia company charges full fare for children over four years of age. It would appear that the total obligation of the Philadelphia company to the city of Philadelphia is less tban 6 per cent of its gross receipts.

Now contrast this condition at Philadelphia with what the United Railways is obligated to the city of Baltimore and its people. In addition to carrying children in arms free, the United Railways is compelled to charge only 4 cents for children under twelve years of age; it is required to pay a speoial tax (Park Tax) of 9 per cent of gross receipts within certain limits. In addition the company is compelled to pay all other corporation taxes, trackage, real estate, etc., and also a license tax on each car. It is compelled to pave and repave all streets occupied between the tracks and 2 ft. outside of the tracks, and is required to give free transfers, to clear the tracks of snow, and, in summer, to water the streets occupied.

The grand total of public charges last year was $1,344,406 or more than 26 per cent of the net receipts after operating expenses. The park tax alone was last year $755,467.

Tbe United Railways pays $1,344,000 in taxes and other municipal obligations, against the Philadelphia company's $550,000—a difference in favor of the latter company of $794,000. This is equivalent to 2¼ per cent annual dividend on the capital stock of the Philadelphia company. Now add to this estimate savings of $1,000,000 to the Philadelphia Company from skip-stops and $1,500,000 revenue from 3-cent transfers and we find that the United Railways is handicapped about $3,294,000 in its competition with the Philadelphia Rapid Transit Company in its efforts to make both ends meet.

This is what we call the psychology of mathematics.

Mr. Mitten's Transit Plan Attacked

Improvement Program Pending Before Philadelphia Council Opposed by Mr. Twining—Counter Proposals Made

Plans recently advanced by Thomas E. Mitten, president of the Philadelphia (Pa.) Rapid Transit Company, for improving electric railway service in Philadelphia, have encountered opposition from William S. Twining, director of city transit, who has recommended to the City Council that Mr. Mitten's suggestions be rejected. Mr. Twining in a report submitted to the joint councilmanic committees on finance and street railways on Nov. 14, alleged that Mr. Mitten's program, if carried out, would subordinate the interests of the city to those of the company.

Ordinances Introduced in Council

Mr. Mitten's program was embodied in a series of ordinances recently introduced in the City Council and now pending before that body, as announced previously in the ELECTRIC RAILWAY JOURNAL. The plan calls for the release of the company from the annual payment of $785,000 for street paving, in return for which the company agrees to abolish the 3-cent charge for exchange tickets, except in certain sections of the city, where the transfer privilege would be done away with. It includes a form of lease for the Frankford elevated line under which the company proposes to operate the road, now nearing completion, for a term of years beginning on July 4, 1920, at a nominal rental payment $1 a year. It also provides for track improvements in the section adjacent to the City Hall.

Soon after the ordinances were introduced Director Twining requested President Mitten to answer a series of twenty-seven questions intended to throw light on the company's policy. Mr. Mitten in his reply characterized the questions as lacking in constructive value. After answering the series of questions categorically, Mr. Mitten said:

> Co-operation between city and company is now more than ever essential to insure the best possible use of existing facilities. This management now respectfully submits that its record of the last eight years justifies the confidence of the people.
>
> Constructive action should now displace carping criticism. The street car system should be developed to its greatest capacity, which is possible only of accomplishment after eliminating the 3-cent exchange.
>
> The need of the car rider for increased transit is urgent, and the way should forthwitb be opened to early use of the Frankford "L."

Mr. Twining promised to expand his criticism of the company's plans. His report to the councilmanic committees followed.

City Transit Commission Proposal

In this report the director of the city transit, alleging that the company, even since its formation in 1902, had been "seeking the pocket of gold at the end of the rainbow," charged that Mr. Mitten's plan was designed to give the company a maximum of income with a minimum of expense and obligation. He further declared that in seeking to be relieved from paving charges, the company was seeking a direct contribution from the city in order to retain the 5-cent fare.

The transit director set forward a counter proposal for the operation of the Frankford "L" by which the city would lease the line to the company at an annual rental of $600,000. The lease would run until 1957. Anticipating that the company might reject this proposition, he declared municipal operation to be the only alternative. Mr. Twining's counter-plan follows:

> The company shall agree to lease the completed section of the Frankford Elevated Railway from Front and Arch to Bridge Street, for a period running until 1957, at a fixed annual rental of $600,000, and to give the same privileges as are accorded the company's lines in West Philadelphia. The company to agree to operate all extensions and other lines of the city's system upon terms to be settled by arbitration before the Public Service Commission. The city to furnish all funds necessary for the initial equipment of the Frankford Elevated ready for operation, the company to furnish all funds needed for additional equipment during the period of the lease; the city's rental to be considered as a part of the company's fixed charges and all matters pertaining to the service and fare to be regulated by the Public Service Commission, either directly or through a local board, as provided in the former agreement.
>
> I regard this proposal as embodying the limit to which the city is justified in going. Under this proposal the operation of the city's lines will be secured on a unified basis and both the city and company will be protected by the State body legally designated for that purpose. It is an offer by the city to submit the terms for operating the remainder of the city's system to the arbitration of the Public Service Commission, and it is difficult to see what valid objections the company can raise to this proposal, or to see what other method can be adopted for harmonizing the conflicting viewpoints of the city and the company.
>
> It is also difficult to see how the Public Service Commission can refuse to act in this matter, in view of its having final responsibility in all these matters.

President Mitten, after studying the report, addressed a letter to Director Twining in which he declared that the latter's plan failed to solve the problem. Mr. Mitten said in part:

> Municipal transit plans undertaken six years ago bave failed to date to produce transportation for a single passenger. Discussion of the dead past does not produce transportation for Philadelphia now.
>
> Director Twining makes such criticism of tbat which has been done by the Stotesbury-Mitten management to increase and improve transit. This management recognizes tbat facilities are still inadequate, and with that knowledge has submitted certain definite proposals to Councils. Tbe director condemns these proposals, recommends that they be put aside without further consideration and urges that the whole transit problem, past, present and future, be turned over to the Public Service Commission.
>
> The following are vital objections to Director Twining's conclusions:
>
> 1. P. R. T. Operation. The director's proposal for a lease running to 1957 ties the hands of the incoming city administration. P. R. T.'s proposal, revocable on six months' notice, avoids this. P. R. T. cannot guarantee $600,000 rental for Frankford "L" with a 5-cent fare, when on the City Transit Department's own showing the Frankford "L" cost will be 7½ cents per passenger.
>
> 2. Municipal Operation. The director's proposal for municipal operation, after unnecessary expenditure on the makesbift Sansom Street terminal, sacrifices the greatest public advantage of the P. R. T. proposal, i. e., through operation of the Frankford "L" and Market Street lines, including free transfer with surface lines.
>
> The director's whole report promises nothing for the future, except continued discussion. It is exactly this policy that has resulted in no accomplishment in the past six years. The city needs more transit now. The company alone offers a plan to meet this need.

Contending that there was little likelihood of the enactment of the proposed legislation during the life of the present Council, Mr. Mitten on Nov. 20 wrote to the joint councilmanic committees asking permission to withdraw the pending ordinances. He plans to ask for the passage of the measures when the incoming Council meets in January.

Recommends Loop Plan Be Abandoned

City Transit Commissioner of Pittsburgh Opposes City Administration—He Also Recommends Municipal Ownership

Abandonment of the entire system of transit operation involved in the $6,000,000 downtown subway loop approved by the voters of Pittsburgh, Pa., in the bond election of last July, is demanded by E. K. Morse, transit commissioner of Pittsburgh, in the annual report of the City Transit Commission submitted on Nov. 18 to the Mayor and the Council. Mr. Morse declares that municipal ownership and the operation of the cars at a straight 5-cent fare inside the city (the fare is now 7½ cents by ticket and 10 cents cash) would so far increase the car-riding habit as to insure revenues enough to operate the electric railway system. Failure to solve the traction problem, he said, has driven people from Pittsburgh. The report contains a chart showing that population of Pittsburgh has increased only 13.2 per cent in nine years, the smallest percentage of gain by any of the ten leading cities of the country.

The subway loop plan, so directly opposed by Mr. Morse in his report, was fostered by the city administration, and was retained in the bond issue by the administration. The commissioner insists the subway loop leaves unsolved the real problem—"rapid transit, which must be provided, or Pittsburgh cannot compete with Detroit, Cleveland and Cincinnati, all of which are providing rapid transit and rapidly outstripping Pittsburgh in population." The present report says:

> The transit commissioner made his views against a subway loop very plain in the 1917 report, and has not had occasion to change them. The views expressed then were written after most careful consideration of surveys, data taken by the commission, plans and estimates. It was shown conclusively that a subway loop would not provide rapid transit; that the city of Pittsburgh could not operate a subway loop; that the Pittsburgh Railways was the only company that could operate such a loop; that no additional revenue would be derived by its operation and for that reason the company could not be expected and should not be allowed to pay to the city any rental whatsoever for its use; that the building of the loopings back of the surface lines and passageways, such as Washington Street and other streets in Boston, had become such a financial burden to the company that it was then threatened with bankruptcy.
>
> To begin with, $6,000,000 will not build tbe proposed subway loop. It will not accommodate one-half the present number of street cars now entering the central business district; will not provide for future growth; will not take care of a single car from the Northside, and will not reduce the running time to or from the city in any direction. Those favorable to the subway loop argued that it was the beginning of rapid transit; that the subway loop would be used by rapid transit cars, and that it would relieve the downtown congestion. Notbing could be more misleading. Nothing would be, if ever built, more disappointing. Nothing could be more wasteful of the city's borrowing power than an expenditure of this kind and magnitude. . . . No city in the United States contemplated a subway loop such as tbat presented to the voters of Pittsburgh on July 8, a subway that each and every car entering it is planned to travel 8,400 ft. before passing back into the subway approach that it entered.

As a substitute for this, the transit commissioner urges that the city expend the $6,000,000 it has voted, by building the first phase of the rapid transit plan submitted in a previous report by the transit commissioner. That, he said, would make a beginning of real rapid transit. In touching upon municipal ownership, he said:

> In the recent investigation of tbe traction problem of Cleveland, Ohio, made by Barclay Parsons & Klapp, they give the riding habit as more than 325. If the same riding habit was obtained in the metropolitan district of Pittsburgh, the passenger revenue at 5 cents for the Pittsburgh Railways would amount to $19,500,000 annually, more than enough to meet all expenses of the service company, and leave a balance. . . . . If the street car system were under the control of the city, were it municipally owned and were service at 5 cents everywhere within the city limits and 10 cents beyond, the riding habit would

very soon be equal to that of Cleveland. As an investment, as a financial proposition, the street car service of Pittshurgh should take in more money than Cleveland and yield a greater net profit on the investment. The time has come when the city should enjoy the benefits of municipal ownership.

COMMISSIONER'S RECOMMENDATIONS

Mr. Morse's recommendations are submitted thus:

1. Start Rapid Transit: It will hring ahout the following solutions:
(a) The housing problem.
(h) Municipal ownership.
(c) "Service-at-cost" plan.
(d) Riding hahit.
(e) Relieve congestion.
(f) Therehy protect Pittshurgh's supremacy.
2. Remove the Pennsylvania Railroad tracks from the Point and the Duquesne way. (These are elevated freight tracks running along the wharf of the Allegheny River, encircling a portion of the business section.)
3. Reclaim and improve the wharf.
4. Ahandon the suhway loop plan and
(a) Use the $6,000,000 in constructing the Grant Street and Diamond Street units of rapid transit,
(h) Use these units for surface cars, until
(c) The rapid transit lines recommended in the report of 1917 are completed.

A Manager's Problem

Plea for Brooklyn City Railroad Made Before Local Chamber of Commerce by Company Executive

H. Hobart Porter, general manager of the Brooklyn (N. Y.) City Railroad, recently separated from the rest of the Brooklyn Rapid Transit System, addressed the Flatbush Chamber of Commerce on Nov. 15. Mr. Porter discussed more particularly the conditions confronting his own company, but he made it perfectly plain that many of the problems which have come up for settlement in Brooklyn are common to the industry as a whole. He went over the ground covering the total of receiverships of electric railways throughout the county, advances in prices and increases in the cost of doing business and cited the case of Toledo which through its arbitrary action is now entirely without railway service.

A $400,000 DEFICIT

In referring more particularly to the electric railway situation in the borough of Brooklyn, Mr. Porter said:

The companies composing the Brooklyn Rapid Transit System suffered from these conditions as well as from certain problems of their own, with the result that the receiver of the company was ordered hy Judge Mayer to cancel all leases, and contracts hetween it and the Brooklyn City Railroad, and to return the latter property to its original owners.

The receiver, in his petition to the court, estimated that on the hasis of the present cost of materials wages, and rates of fare, the gross earnings of the Brooklyn Heights Railroad for the year ended Aug. 31, 1920, had it continued to operate, would have heen as follows:

Gross earnings	$10,180,000
Operating expenses	10,043,000
Net operating revenue	$137,000
Taxes	537,000
Net operating deficit	$400,000

The operating expenses ahove mentioned include no payments for rentals, nor Federal income tax imposed on the Brooklyn City Railroad, nor for any interest upon any securities whatsoever.

Under these circumstances, it could hardly he claimed hy any fair and reasonahle property holder, husiness man or association that the company is not entitled to some measure of relief. Certainly the investors who own this property, admittedly of great value, may reasonahly expect a return upon their investment.

The Brooklyn City Railroad is largely owned and controlled hy residents of Brooklyn. Of its 1472 stockholders, 742 are women, 208 are trustees, administrators, executors, guardians, life insurance companies, charitahle institutions and colleges, and 522 are other corporations and individuals.

The records of the company show that it received 100 cents on the dollar in cash for every share of stock issued. Under the direction of hoards of directors, which have always heen composed of prominent and representative Brooklyn citizens, this cash was invested in the company's property.

Detroit Council Persistent

Despite the Mayor, It Wants Agreement With D. U. R. Embodying Best Tayler Plan Features

Although its action is almost certain to be vetoed by Mayor Couzens, the City Council of Detroit, Mich., at the meeting on Nov. 11 adopted a resolution embodying a majority report authorizing the nonexistent Street Railway Commission to begin negotiations with the Detroit United Railway for an agreement along the lines of the Tayler grant as applied in the city of Cleveland.

The majority report, signed by five members of the Council, stated that the committee of the whole had considered the report and recommendations of the Board of Street Railway Commissioners relative to the acquirement by the city of control, operation and extension of a railway system that will make possible the betterment of transportation facilities now so inadequate and unsatisfactory. In reviewing the commissioner's report it was stated that the same had included recommendations that the city begin now to build and own its subways and other rapid transit structures, and that an agreement including the best features of the Tayler service-at-cost plan be entered into with the local railway. Municipal control of operation of the enlarged system provided for in this agreement which is to be negotiated by the Street Railway Commission and to contain a purchase clause at a fixed valuation is also recommended. The purchase right is to be exercisable by the city at its own option at the end of any five-year period.

WANTS VOTE BY PEOPLE

The commission also recommended that the members be authorized to proceed on this basis and that the people be given an opportunity to vote upon this plan and at the same time upon any amendments to the city charter which the city's legal advisers may find necessary in order to make this plan legally possible. Inasmuch as the commission's recommendations merely ask that the members be authorized to negotiate with the company, and any agreement they may make would have to meet the full approval of the Common Council before submission of the matter to the people, the recommendations were concurred in by the signers of the majority report.

The resolution authorizing the Board of Commissioners to present a plan of settlement to the Common Council after negotiations with the railway in accordance with the commission's former report and recommendations was offered by Councilman Nagel. The resolution also requests the commissioners to include in any agreement which they may make, a provision that the city will build all trackage and extensions and replace all worn-out tracks and foundations so that the city shall eventually own all tracks.

A defeated minority report stated that its signers did not agree with the commissioners in their statement that the people had twiced voted adversely upon an immediate and outright proposition to purchase the railway system. It further maintained that each previous proposition carried with it a franchise in some form.

A resolution was accepted and ordered laid on the table requesting that the governor of Michigan cause a special session of the Legislature to be convened during the present year for the purpose of a consideration of the question of bonding the city so that subways may be built at public expense.

News Notes

Offer to Supply Bus Service.—The Fifth Avenue Coach Company, New York, N. Y., which is controlled by the Interborough Rapid Transit Company, has issued an illustrated booklet which contains the announcement that the company is ready to supply all the motor bus service the city needs. It also said the company has applications before the city authorities for permits to place new lines in immediate operation. The officers of the company know the requirements of the city from their experience in operating buses on Fifth Avenue.

Purchase Vote Arranged.—Representatives of nine border municipalities, Windsor, Walkerville, Ford City, Sandwich, Ojibway, Sandwich East township, Sandwich West township, Anderson township, Tecumseh and Amherstburg, Ont., have decided to have the ratepayers vote on Dec. 6 on the question of authorizing the Hydro-Electric Power Commission of Ontario to purchase the Sandwich & Amherstburg Railway for $2,039,000. The development of the plans for this purchase were reviewed at considerable length in the ELECTRIC RAILWAY JOURNAL for Nov. 8, page 873.

Bonner Freight Container System Urged.—Col. Joseph C. Bonner has filed with the Federal Electric Railways Commission a brief urging the investigation of the Bonner "through container" system for transporting freight on electric railways. This system, it is claimed, is much cheaper than by auto truck. Col. Bonner stated in his brief that one of the large railways expected to test the system, and that several hundred "through container" units and the complementary accessory rail cars and auto truck carriers are planned as the operating unit. If, through the Federal Commission, the roads can again be put on their feet, the brief urges that there will be an opportunity of developing this economic method of transporting freight, for the benefit of the transportation companies and the public. The Bonner system has been described previously in the ELECTRIC RAILWAY JOURNAL.

New Wage Contract in Charleston.—The Charleston Consolidated Railway & Lighting Company, Charleston, S. C., has signed a new wage agreement with its men, organized as a division of the Amalgamated Association. The old rates of pay were 36, 38 and 40 cents an hour. The new rates are 46 cents an hour for the first three months, 48 cents for the next nine months and 50 cents thereafter. There is a provision for time and one-half for overtime and five legal holidays, plus fourteen days vacation with full pay each year. The only provision from the absolutely closed shop is that the company reserves the right to use outside men if at any time the union fails to supply enough men. There has never been a strike in Charleston on the railway system, which has been organized since 1907, and the scale of wages under the agreement with the union in Charleston has been steadily less than in the neighboring non-union towns until the present time.

Financial and Corporate

$430,713 Deficit

Permitted Return at Dallas Under Service-at-Cost Has Fallen Behind This Amount in Two Years

The Dallas (Tex.) Railway operating under a service-at-cost franchises, for the twelve months ended Sept. 30, 1919, earned 4.61 per cent net on the agreed valuations, as against an authorized return of 7 per cent, according to the report of Grover C. Bland, chief accountant in the office of the supervisor of public utilities. The agreed valuation of the properties of the company on Sept. 30, 1919, was $8,560,429. This includes the valuation fixed at the time the franchise was granted, plus additions and betterments made since then.

EARNINGS AND EXPENSES COMPARED

A comparison of the earnings and expenses of the company for the first and second years of operation is shown as follows:

Gross earnings	$564,511	Inc.
Operating expenses and maintenance and accident charges	498,091	Inc.
Net earnings	66,420	Inc.
Interurban Terminal net earnings	5,350	Inc.
Non-operating income	1,639	Dec.
Total net earnings	$70,132	Inc.
Authorized return—7 per cent on property value	31,885	Inc.
Deficit in authorized return	$38,247	Dec.

The total net earnings for the two years were equivalent to a rate of return of 4.30 per cent per annum on the property value, as against a permitted return of 7 per cent, resulting in a deficit of $430,713 in the authorized (or permitted) return for the period.

The railway gross earnings for the second year increased over the first year by an amount of $564,511, or 34.68 per cent, due to elimination of jitney competition and a general increase in traffic. There was jitney competition during nine months of the first year of the street railway's operation under the new franchise, the abolition of the jitneys becoming effective on July 1, 1918.

The railway operating expenses and maintenance and accident charges for the second year show an increase of $498,091, or 22.99 per cent.

The principal increases were in the items of maintenance expenditures and conducting transportation. The increase in maintenance was due to higher costs of labor and material, and to the fact that somewhat more maintenance work was done during the second year. The increase in conducting transportation was caused by higher wages to employees in the transportation department.

OPERATING RATIO HIGH

The total appropriations to the accident reserve for the two years (6 per cent of the railway gross receipts, as provided by the franchise) amounted to $229,161, and the expenditures therefrom were $186,501, leaving a balance of $42,652 in accident reserve as at Sept. 30, 1919. There were no balances in the surplus reserve or repair, maintenance and depreciation reserve of the company as at this date.

The operating expense ratio was 84.03 per cent for the year ended Sept. 30, 1918, and 86.11 per cent for the year ended Sept. 30, 1919, as compared with an average operating expense ratio of 73.80 per cent for the five years immediately preceding the beginning of operation under the new franchise on Oct. 1, 1917.

RECORD OF PASSENGER TRAFFIC

During the twelve months ended Sept. 30, 1919, the railway carried 43,352,996 revenue passengers, 396,837 free passengers and 7,337,952 free transfer passengers, a total of 51,087,785 passengers. The transportation revenue per revenue passenger was 4.79 cents, and per revenue and free transfer passenger 4.09 cents.

The net earnings from operation of the interurban terminal building and facilities for the year ended Sept. 30, 1919, increased $5,350, or 11.59 per cent over the first year. The total net earnings for the two years amounted to $97,644, equivalent to a rate of approximately 3½ per cent per annum on the investment in the interurban terminal property.

$106,000,000 Security Shrinkage

Receiver Reduces to Dollars and Cents Loss in Railway Security Values in New York in Ten Months

Job E. Hedges, receiver of the New York (N. Y.) Railways, addressed the New York Credit Men on Nov. 13. For the most part his remarks had to do with the problems confronting the electric railways in New York City. He said that the great difficulty with the problem was that for a year and a half public opinion had not been adequately expressed. He wanted to know why the credit men, men of faith and credit, had been civically silent so long.

MR. HEDGES GIVES DETAILS

One of the matters with which Mr. Hedges had recently concerned himself was that of the shrinkage in security values of the railway attributable to the present unsettled condition with respect to some definite program of relief for the railways. On this point he said:

> I took pains to-day to secure figures on tbe loss of traction values consequent upon a refusal of tbe Mayor to recognize facts as part of tbe problem. I found tbe following shrinkage in values by virtue of the non-expression of the thinking people of this city: Interborough 5 per cent and 7 per cent notes, $36,000,000; Interborough collateral bonds, $12,000,000; Manbattan Railway stocks and bonds, $26,700,000; New York Railway two issues of bonds, $3,371,000; Brooklyn Rapid Transit bonds and notes, $28,471,000.
>
> Facts are dangerous to fool with if you have never had an intimate acquaintance with them. When one accepts another's theory for facts, his mind is likely to be confused in logical sequence. This sbrinkage in value has come about in order that a foolish theory may be imposed by unthinking men on thinking men who are mentally dormant.
>
> It is my aim that government functions sball not be fogged by the impotency of men charged witb creating public opinion.
>
> I recently suggested in a lawful manner by letter to a superior officer what I tbought his lawful duties were, and my letter was sent to the District Attorney witb the suggestion that I be indicted for trying to have an effect on his official mind.

Mr. Hedges explained that the shrinkages to which he referred were from Jan. 2 to Nov. 10.

Affairs Again Tangled

The Purchase Payments Not Made for Southern Traction and Security Holders Seeking Redress

Further legal complications are threatened in the already badly tangled affairs of the Southern Traction Company, East St. Louis, Ill., in an appeal of a group of stockholders against the ruling made in the United States Court that holders of stock issued during the period the company was in the hands of receivers shall not participate in the money realized at the recent sale of the property.

PROMOTER BEHIND IN PAYMENT

Furthermore H. D. Mepham, the original promoter of the road, on whose bid of $400,000 the property was knocked down three months ago, has failed to make the two payments due in October of $30,000 each and the final payment of the purchase price on Nov. 1. It is expected that an application for a resale of the property will be made in United States Court at East St. Louis.

The appeal from the decision of Judge English which barred the holders of certain securities of the company has been filed in the United States Court of Appeals at Chicago. Corporations and individuals who delivered goods to the road and rendered other services and whose claims aggregate $31,500 have joined in the appeal to the court. Among others who are expected to join in this appeal is Assistant Attorney General William E. Trautman, who holds abut $50,000 in accumulated claims.

When the road was knocked down to Mr. Mephan he paid $30,000 "earnest money." If he fails to make good on his final payments, which are now overdue, this sum will be held to pay the expenses of the two sales. Mr. Mephan has paid $75,000 in all, which may go by default if he does not fulfill his contract.

BEFORE THE COURTS SINCE 1914

The affairs of the Southern Traction Company have been in the courts since 1914, when the company became involved after more than $1,500,000 had been spent in construction work. Former United States Senator William Lorimer, Chicago, who was the head of the Lorimer-Gallagher Construction Company, which built the road for the most part from East St. Louis to a point just beyond Belleville, lost much money in the enterprise before he suffered financial eclipse in the failure of the LaSalle Street Trust & Savings Bank, Chicago, of which he was president.

Interest in financial circles now centers in the possible resale order. In the first sale Mr. Mephan outbid Judge E. C. Kramer, who was acting for a group of St. Louis financiers. This group, it is expected, will bid again for the road if it is offered for resale.

Fate of Eastern Massachusetts Branches Decided

The Randolph-South Braintree Street Railway, a branch of the Eastern Massachusetts Street Railway, Boston, Mass., will be discontinued after Nov. 21.

The proposed abandonment of the Danvers-Putnamville line of the Eastern Massachusetts Street Railway has been postponed. By a vote of about two to one the citizens abolished jitney licenses. The Eastern Massachusetts Street Railway has reduced the fare on the Danvers-Salem line to nine tickets for $1.

$5,000,000 Subway Deficit in New York

Engineers Report that Based Upon Present Prices Lines Will Fall $8,800,000 Short by June 30, 1920, on Five-Cent Fare

The report and analysis of the Interborough Rapid Transit Company, New York, N. Y., which the engineering firm of Day & Zimmermann, Inc., has been making for the committee for the Interborough Rapid Transit Company first and refunding mortgage 5 per cent bonds and the three-year secured convertible 7 per cent notes have been completed, and the secretary of the committee, William Ewing, sent out copies of the report to all bondholders on Nov. 22.

J. P. Morgan is chairman of the committee. As explained previously in the ELECTRIC RAILWAY JOURNAL it was deemed advisable to organize a committee in the interest of the security holders mentioned, but no deposits have been requested.

The engineering firm was engaged in February to make the examination. It completed its efforts in June, before the award of the 25 per cent wage increase to Interborough employees. The engineers then revised the report to incorporate in the analysis the effect of the increased wages.

ADVICE TO SECURITY HOLDERS

The committee, in its letter to holders of bonds and notes, said that "although it is impossible for the committee to predict with certainty the future trend of operating costs or the position the city will finally take with regard to increased fares, it is of the opinion that investments in both bonds and notes will ultimately be protected, and, therefore, recommends that the holders refrain from sacrificing such securities."

The report has been summarized as follows:

The corporate history of the Interborough is unusually free from those complexities which have resulted from circumstances incident to the growth of most transportation properties serving large communities. All the subways in operation have been constructed new since 1900, and the disbursement of the proceeds from the sale of the 5 per cent bonds and 7 per cent notes (approximately $200,000,000), and the investment by the city (approximately $159,000,000), has at all times been subject to the supervision of public authorities and is a matter of public record.

The report shows the physical property is in good condition throughout, and well maintained in spite of the difficulties which the management has encountered through and subsequent to the war, and that the results of its operations with an unparalleled record of safety could not have been achieved but for the highly efficient organization which the company has created and maintained throughout the period of its activities.

The operating ratio increased from 45.6 per cent in 1916 to 67.9 per cent in 1919, equivalent to approximately $10,000,000. Of this amount $6,000,000 is accounted for directly by the increase in wages and $3,000,000 by the increased cost of coal and other supplies. These figures do not include the increase in wages of Aug. 17, 1919, equivalent to approximately $5,000,000 annually.

The report shows that if 1916 unit costs had remained in effect, the Interborough Company would have passed successfully through the remaining period of construction as estimated when the contract with the Gaynor administration was negotiated.

During the year ended June 30, 1918, the company was experiencing the increasing costs generally prevailing owing to conditions growing out of the war, but it was not until the following year that these increases became serious. In the early part of the fiscal year 1919, a wage increase (separate from and prior to the 25 per cent increase made in August, 1919), was granted amounting to approximately $3,000,000 annually.

The effect of this increase, together with increased costs of materials and supplies, notwithstanding the fact that gross earnings for the year ended June 30, 1919, increased $2,700,000 over the year 1918, resulted in a decrease in net earnings, after the payment of operating expenses and taxes, from $18,219,000 to $14,447,000, a loss of nearly $4,000,00.

Also, during this year the interest and sinking fund on the 5 per cent bonds and 7 per cent notes chargeable to income amounted to $9,215,000, an increase of almost $4,500,000, the result of the opening of the Seventh Avenue and Lexington Avenue subways and other extensions. The deficit in this year, of $3,810,000, was the direct result of the foregoing conditions.

The report includes estimates for the future up to and through the year ending June 30, 1924, all of which estimates are based on the continuance of the 5-cent fare and present costs of materials and supplies. The report indicates that even with the 5-cent fare, provided unit operating costs prior to the last wage increase had remained the same through the next five years, the company could have earned in the year 1924 its fixed charges for that year, excluding, however, any return on the $100,000,000 invested by the city under Contract 3.

The wage increase of Aug. 17, 1919, has changed the situation completely. This increase adds approximately $5,000,000 annually to the operating expenses. Through the five-year period ending June 30, 1924, it is estimated that the accumulated deficit, as the result of the conditions mentioned above, would amount to about $40,000,000.

The report shows that on Oct. 31 of this year the cash position of the company will be such that approximately $5,000,000 will have to be provided from some source other than operating income that the company may meet the rentals and fixed charges payable on Jan. 1. For the fiscal year ending June 30, 1920, it is estimated, based on present prices of wages, materials and supplies, and the continuance of the 5-cent fare, that the company will fall short of meeting its fixed charges (including rentals) by approximately $8,800,000.

It must be borne in mind in connection with the foregoing estimates that present unprecedented costs have been made the basis of estimates, and while it is impossible to forecast the future it is obvious that any decrease in operating expenses would be reflected directly in an equivalent increase in the sum available for interest and sinking fund on the outstanding 5 per cent bonds and 7 per cent notes.

Increase in Philadelphia Net

The Philadelphia (Pa.) Rapid Transit Company on Nov. 17 made public the following statement of earnings:

October	1919	1918
Operating revenue	$3,165,552	$2,411,985
Operation and taxes	2,140,411	1,794,717
Operating income	$1,025,141	$617,267
Non-operating income	45,216	50,202
Gross income	$1,070,357	$667,470
Fixed charges	813,550	806,395
Net income	$256,806	*$138,925

* Deficit.

Ten Months Ended October	1919	1918
Operating revenue	$29,160,983	$25,535,542
Operation and taxes	20,029,040	16,883,766
Operating income	$9,131,942	$8,651,775
Non-operating income	441,311	520,480
Gross income	$9,573,254	$9,172,255
Fixed charges	8,109,495	8,017,458
Net income	$1,463,758	$1,154,797

Reorganization Plan Changed

Changes in the plans of the reorganization committee having in charge the financial affairs of the Oakland & Antioch Railway, Oakland, Cal., are indicated in a supplemental petition filed with the Railroad Commission on behalf of the San Francisco & Sacramento Railroad, the new corporation formed to take over the Oakland & Antioch lines. The new plans provide that the rate of interest on the bonds to be issued by the new corporation is not to exceed 7 per cent, and that the bonds to be issued in accordance with the reorganization scheme are to mature in five years instead of twenty, as was originally contemplated. The total authorized bond issue will be $3,000,000 par value, of which not to exceed $2,100,000 will be issued forthwith. The remainder of the bonds are to remain in the treasury and are to be issued only for the purpose of acquiring new properties or for defraying costs of additions, extensions or betterments, the bond sale to be made only upon approval of the commission.

Of the $2,100,000 of bonds to be issued forthwith the bondholders of the Oakland & Antioch Railway, Oakland, Antioch & Eastern Railway and San Ramon Valley Railroad, as provided in the original plan, are to receive $1,300,000. The balance of $800,000 is to be sold at a figure to net the company not less than $720,000, nor more than $732,000. The proceeds from the sale of the bonds are to be utilized to pay off prior liens, non-assenting bondholders, to provide working capital for the company, to meet reorganization expenses and to pay costs of extensions, additions and betterments.

Receivers for Interstate Road

William L. Doyle, Easton, Pa., has been named receiver of the Northampton, Easton & Washington Traction Company, Easton, Pa., in a suit for foreclosure brought by the Bankers' Trust Company, Easton. There will be a hearing to show cause why the receiver should not be continued permanently.

The mortgage against the railway under which the bank acts as trustee amounts to $536,000. The traction company, it is alleged, executed a mortgage with the trust company covering all its personal property and real estate to secure a bond issue on May 1, 1910. The railway is charged with failing to pay $13,400 interest due on Nov. 1, 1919.

The inability of the railway to meet its obligations was brought about by operating and financial difficulties. A short time ago the employees of the company went on strike for an increase in wages. The company said it could not grant the increase because of having lost $20,000 per month on the operation of the 18 miles of road. The company then ceased operations. Officials say that the road will probably be dismantled.

Mr. Doyle, the receiver, is treasurer of the railway.

Intervening Petition in St. Louis Suit

An intervening petition has been filed in the United States District Court in behalf of George E. Vail in the suit of John W. Seaman against the United Railways, St. Louis, Mo. The petitioner charges among other things that by means of a voting trust the legal control of the company was bartered away from the majority of the stockholders. It further alleges that company officials by use of company funds, sought to influence legislation.

The petition reviews the consolidation of the fourteen companies operating in St. Louis in 1898 by the St. Louis Transit Company, which afterward became the United Railways. It is alleged that these companies had an investment of $5,000,000 or less and that on this actual value $15,000,000 of bonds were issued, for which no adequate consideration was secured, and $25,000,000 of stock, on which the stockholders still owe $20,000,000.

The petition demands an accounting by the directors of the company and its officials, the return to the company's treasury of 250,000 shares of common stock and 163,832 shares of preferred. It also asks that the outstanding bonds be declared to have been issued fraudulently.

Judge Dyer has referred the intervening petition to Henry Lamm, master in chancery, who has been hearing evidence in the United Railways case.

Charles W. Bates, attorney for the receiver, said he was not acquainted with Mr. Vail or the contents of the suit. He would make no comment.

Melbourne Lines Prosperous

Although Operating Costs Have Increased Materially the Cable Lines of Australia City Do Well

The Tramway Board of Melbourne, Australia, in its third annual report covering cable and horse tramway operation for the year ended June 30, 1919, states that notwithstanding the heavy loss of traffic due to the influenza epidemic of some months ago and more recently to the industrial unrest the passenger revenue showed an increase over the previous year of nearly 7.5 per cent. The increase, however, was more than absorbed in the greater cost of operation due to higher costs of fuel, supplies and a wage increase which was retroactive to Mar. 1, 1919. The operating ratio increased from 56.6 in 1918 to 61.21 in 1919. The system operates 44.3 miles of double-track line and serves a population which is estimated at 450,000.

OPERATIONS COMPARED WITH PREVIOUS YEAR

		+ Inc. — Dec. 1918
Passenger revenue	£944,269	+ £42,795
Non-operating revenue	1,530	
Total revenue	£945,799	
Maintenance expenses	£53,226	
Power expenses	118,650	
Transportation expenses	344,066	
General expenses	38,323	
Total operating expenses	£554,265	
Net operating revenue	+391,534	
Taxes and car licenses	27,691	
Reserves, etc.	135,000	
Surplus	£228,843	
Traffic statistics:		
Tram miles	13,149,637	+316,208
Tram hours (estimated)	1,460,000	
Schedule speed in m. p. h.	9	
Revenue passengers carried	118,302,781	+4,268,624
Special concession tickets	102,864	
Free tickets to 1914 returned soldiers, sailors, and nurses on furlough	248,340	
Number of employees June 30	2,400	+125
Cars owned	547	—2
Dummies owned	539	+24
Av. Max. No. trains operated daily	429	
Scale of fares	1d., 1½d., 2d., 3d.	
Average distance in miles for a penny fare	1.628	

Pursuant to the provisions of the Melbourne & Metropolitan Tramways act of 1918 the surplus of revenue over expenditure between Jan. 8 and June 30, 1919, (£250,000) was credited to the Melbourne and Metropolitan Municipal loans redemption fund in addition to £250,000 which was transferred from the "tramway fund." Amounts of £100,000 have also been respectively credited to the renewals and reconstruction reserve funds.

The electric lighting of the cable cars from storage batteries, which was delayed by the non-delivery of equipment for the charging stations, is now being pushed to completion. It is said that the installation is much appreciated by the traveling public and it is believed that the expenditure should be amply justified by the results obtained.

A new agreement with the Australian Tramway Employee's Association supplementing the one that expired on Dec. 2, last, was entered into after extended negotiations and subsequently filed at the court of conciliation and arbitration. This agreement, which runs until May 1, 1922, provided increased wages averaging one shilling per day, additional annual holiday leave, extra payment for "spread of hours" and holiday work. On Peace Celebration Day double time is granted to all workers.

A summary of revenues and expenses arranged to agree with the I. C. C. classification system is presented herewith.

Cities Service Earnings Increase

Earnings of Cities Service Company, New York, N. Y., for October, 1919, show a fair increase over the preceding month, indicating that the improvement in earnings noted in the September statement is still continuing.

Gross earnings of the company for October, 1919, were larger by $37,756 than for September, while the amount available for payment of dividends on the preferred stock for the month increased $40,451. The balance available for reserves, dividends on the common stock and surplus for October showed a gain of $38,987 over the preceding month, and an increase of $195,820 over the balance for August, 1919.

In conformity with the policy announced in May, 1916, the directors at their November meeting increased the rate of stock dividends being paid on the common stock from 12 per cent to 15 per cent annually by declaring a monthly dividend of 1¼ per cent on the common stock, payable in common stock at par on Feb. 1, 1920, to stock of record Jan. 15, 1920. The board also declared the regular monthly dividends, payable in cash, of one-half of 1 per cent on the preferred stock and one-half of 1 per cent on common stock, both payable on Feb. 1, 1920, to stock of record Jan. 15, 1920.

In 1916 and 1917 the Cities Service Company paid 6 per cent in stock dividends on the common stock, in 1918 9 per cent was paid on the common stock in stock dividends, and the present rate of payment of these dividends is 12 per cent.

The directors at the meeting also approved the issue and sale of the $3,000,000, par value, preference B shares recently offered to stockholders of Cities Service Company, which offering was heavily over subscribed, and declared the initial monthly dividend on the 6 per cent cumulative preference B shares of one-half of 1 per cent payable on Jan. 1, 1920, to shares of record Dec. 15, 1919.

Public Utility Security Outlook

Despite adverse conditions affecting public utilities arising from war prices and fixed rates and fares, these corporations, says the *Wall Street Journal*, have been able to do considerable financing recently by means of stock issues sold to the public. The total amount of stock sold by public utilities corporations so far in 1919 is $53,601,490. This compares with $614,858,600 preferred and $514,948,500 common stock sold by industrial corporations.

Many utility corporations, particularly traction and gas companies, says the same authority, are in need of money for expansion purposes, but owing to their curtailed earning power wherever they have been obliged to operate under rates and fares which prevailed before the war, financing cannot be successfully promoted at present time. The situation, however, is slowly but surely improving and through courts and public utility commissions many of the companies have been authorized to increase rates and fares to meet higher operating costs.

With improvement in the general situation it is expected that much new financing will be done by public utilities and their securities which have always as a class been regarded highly in peace times, will eventually work back to their former position.

Virginia Railway Net Declines

With 30 Per Cent Increase in Expenses the Net Revenue, Even with 12 Per Cent Increase, Declines

The annual report for the year ended June 30, 1919, of the Virginia Railway & Power Company, which operates electric railway, gas and electric utilities in Richmond, Portsmouth and Norfolk shows that the railway contributed 55.2 per cent of the total earnings, at an expense of 60 per cent, although the operating ratio of the railway alone was only 69.5 per cent.

In addition to the current charges for way and equipment maintenance, which increased 4. 95 per cent over the previous year, the company set aside an amount equal to 6 per cent of the gross revenue for depreciation, thus continuing the policy established eight years ago. Only one cash dividend of 3 per cent was paid on the preferred stock, due to the necessity for conserving cash resources for making extensions and improvements.

To provide in part for additional facilities required on account of government activities two loans were secured, one of $500,000 from the U. S. Shipping Board, which was used in the installation of additional power house equipment, and the other from the U. S. Housing Corporation of $300,000, for the purchase of fifty cars. Both of these loans are to be repaid in equal annual installments beginning one year after the declaration of peace.

The results of the year's railway operations compared with those of the preceding year were as follows:

	June 30, 1919	— Dec. + Inc.
Revenues:		
Passenger	$4,569,524	+ $500,982
Freight	41,707	— 17,343
Mail	1,069	— 124
Non-operating	35,610	+ 5,800
Total railway revenue	$4,647,910	+ $489,315
Operating expenses:		
Way and structures	$482,798	+ $180,985
Equipment	349,871	+ 115,588
Traffic	6,619	— 1,296
Transportation	1,922,004	+ 427,055
General	431,030	+ 19,543
Total operating expenses	$3,222,322	+ $741,875
Net operating revenue (Ry.)	$1,425,588	— $252,570
Taxes and licenses	$354,969	+ $57,859
Statistics of operation:		
Revenue passengers	91,556,392	+8,910,643
Transfer and free passengers	18,189,760	+1,035,566
Total passengers	109,746,152	+9,946,209
Car miles run	13,693,501	— 515,229
Car-hours operated	1,638,725	— 30,890
Kw.-hr. used	48,022,532	—2,183,223

At the end of the fiscal year the company operated 177.7 miles of route having a total of 255.09 miles of single track, of which 15.22 were sidings. Three hundred and thirty-one double-truck and 228 single-truck passenger cars were owned, the majority being of the semi-convertible type. In addition forty-nine service cars of various types belonged to the company. During the year thirty-five new single-truck "safety cars" with equipment and one interurban car were purchased and six single-truck open cars were converted into double-truck trailers, all of which are included in the above totals.

No main track extensions were constructed during the year in Richmond and vicinity although several sidings were extended and rearranged with a net increase in single-track equivalent of 0.241 miles. In the Norfolk and Portsmouth division 2.583 miles of single track equivalent were constructed, 2.384 miles abandoned and removed and 5.583 miles of standard gage were changed to widegage. In addition to that made necessary by the rebuilding of tracks 38,038 yards of new paving was laid.

Merger Proposed

Plan Advance for Raising Money and Consolidated Suburban Lines at Cincinnati

B. H. Kroger, head of the Cincinnati, Milford & Lebanon Traction Company, Cincinnati, Ohio, according to the Cincinnati *Enquirer*, has confirmed reports that he has been considering a proposition to merge that traction line with the Cincinnati & Columbus Traction Company. The merger hinges upon one development —the ability of the citizens of Hillsboro, Ohio, acting in conjunction with Cincinnati business men, to raise $425,000.

On Oct. 25, acting upon permission granted by the Ohio Public Utilities Commission, the Cincinnati & Columbus Traction Company abandoned service between Hillsboro and Owensville, but continued to operate that part of the line between Owensville and Norwood. It is understood that if the merger is accomplished the connection at East Norwood will be abandoned and passengers will be brought to Cincinnate via Madisonville. In confirming the report Mr. Kroger is reported to have said:

Citizens of Hillsboro submitted the merger proposal to me a few weeks ago. They were told that it would be necessary for them to raise $425,000 to bring about the rehabilitation of the Cincinnati & Columbus line and the installation of new light cars. This proposition was presented to the public utilities committees of the Chamber of Commerce and the Business Men's Club. The local committees were asked to see about raising $300,000 in Cincinnati and $125,000 in Hillsboro, with which to purchase the property of the Cincinnati & Columbus Traction Company.

Under the plan the Cincinnati, Milford and Blanchester road would give as security $425,000 first mortgage bonds of the Cincinnati & Columbus Traction Company and $400,000 first mortgage bonds of the Cincinnati, Milford & Blanchester Company.

If the merger is effected both the present power plants of the two lines would be abandoned and the current supplied by the Union Gas & Electric Company.

Shore Line Abandonment Before Superior Court

The Shore Line Electric Railway, Norwich, Conn., was recently ordered by the Public Utilities Commission to install and to supply at least hourly service daily in each direction between New Haven and Saybrook Junction. The inadequacy of transportation service between New Haven and Saybrook Junction was brought to the attention of the commission Oct. 15 in a petition from residents of Clinton, Madison, and Guilford.

In its finding the commission states that the Shore Line Electric Railway has never been excused or relieved from operating either by the commission or by the court and that no facts have been presented to the commission warranting a suspension of the service. The commission assumes that the temporary receiver is authorized by the court to operate the company's lines, "but has not the arbitrary power of operating only such lines as he may select and to refuse to render service on the other lines."

In commenting upon the order of the commission to restore at least hourly service in each direction between New Haven and Saybrook Junction, Receiver Robert W. Perkins of the Shore Line Electric Railway said:

I suppose it is up to me now to satisfy the Public Utilities Commission that this section of the Shore Line cannot be operated without material loss to the company. Under the receivership the court has directed that there shall be no operation of divisions of the road except at a profit.

The order to the Shore Line did not become operative until Nov. 24.

Meanwhile an application was filed by Mr. Perkins with the clerk of the Superior Court of the New London County, asking for an order discontinuing service on the lines operated by the Shore Line Electric Railway between New Haven and Saybrook Junction. He stated that when the company ceased operating its lines on July 16 it had been operating with continual and large financial loss for sometime. He further says that the cost of operating these lines has not materially decreased since that date, and that a large financial loss would entail should any effort be put forth by the receiver to operate the line at this time. He has petitioned the court to pass an order authorizing the discontinuance of service on this line and each of its aforementioned branches. The court fixed upon Dec. 2 as the date for a hearing at Norwich, Conn.

Various United Railway Details

A report filed during the week ended Nov. 15 by Rolla Wells, receiver for the United Railways, St. Louis, Mo., in the United States District Court for last September shows that the cash on hand at the end of the month had been reduced by $349,086 over the amount on hand at the end of the previous month.

The balance on Aug. 31 was $1,010,543. Receipts during September were $4,423,509. Disbursements totaled $4,772,596. The balance on Sept. 30 was $661,456. The receipts included $2,254,000 from the sale of receiver's certificates, negotiated to replace a matured bond issue, $1,344,609 from conductors and $17,050 from employees as payments on Liberty Bonds. The disbursements include $2,521,484 for operating expenses, prior to the appointment of the receiver April 12, last, and $314,145 for operating expenses during September.

Special Master Lamm, who is inquiring into the affairs of the company subject to the court's sanction, has approved the application of the receiver to pay $667,550 bond interest due Jan. 1 and $83,165 bond interest due Feb. 1. He has also approved the expenditure of $621,910 for reconstructing about 25 miles of track; $2,427 for the construction of a snow sweeper, and $1,095 for the construction of fire escapes in the general office building of the company.

Judge Dyer denied the application of Attorney Ephrim Caplan, representing certain stockholders of the company, to have special counsel appointed to represent the company at a hearing before the Public Service Commission on Nov. 28, in regard to the increase in price of electric power under contracts with the Union Electric Light & Power Company. Judge Dyer told Attorney Caplan the hearing would be open and that he had no doubt the commission would be glad to receive any information that might be offered.

Foreclosure Bill Filed Against Aurora-Elgin

A bill of foreclosure against the Aurora, Elgin & Chicago Railroad Company, Wheaton, Ill., of which Joseph K. Choate was recently appointed receiver, has been filed in Judge Evans' court at Chicago by the Northern Trust Company, trustee for the holders of the underlying bonds of the company. Under the new order of the court Mr. Choate has been reappointed receiver. The same personnel of officials remains. No statement has as yet been made regarding the date of the sale of the property.

Poor Outlook for Brooklyn

Bankers Who Represent Security Holders See Little Hope for Some Time to Come Under Present Conditions

Kuhn, Loeb & Company and Kidder, Peabody & Company, New York, N. Y., comprising the protective committee for Brooklyn Rapid Transit 5 per cent and 7 per cent notes and New York Municipal Railway Corporation 5 per cent bonds, the Central Union Trust Company having resigned from the committee because of possible conflict with its duties as trustee of the first refunding mortgage, has sent out to bond and noteholders a report outlining the situation as represented by the report of Stone & Webster and Price, Waterhouse & Company, who were employed to investigate the properties and accounts of the system. The circular says in part:

As a result of greatly increased costs due to the war, the city's delay in completing the new rapid transit lines and other causes, it became necessary to provide a large additional sum to meet the system's obligations under the city contracts, including both equipping the new lines and completing the addition to the power plant, which had been commenced to provide power for the new rapid transit lines. This money was provided by the issue and sale of $18,000,000 of the B. R. T. receiver's 6 per cent two year certificates. The proceeds of $5,000,000 of these certificates have been retained by the B. R. T. receiver mainly for power development, the proceeds of the remaining $13,000,000 being advanced for use by the rapid transit company's receiver under the city contracts. Against this advance the rapid transit companies' receiver has issued $13,000,000 of receiver's certificates secured by a lien upon all the properties of those companies prior to the subway bonds and junior to the underlying bonds, these certificates being in turn pledged to secure the B. R. T. receiver's certificates.

Stone & Webster advise that, assuming that there will be no further important advance in wages or cost of materials, the proceeds of these certificates, with such part of the income as is available for the purpose under the decree, will be sufficient to meet the terms of the contract with the city and that, provided the city does its part with reasonable promptness, all of the rapid transit lines provided for in the city contracts should be equipped and in full operation before the maturity of the certificates.

As a result of the investigation of Stone & Webster it became apparent that the surface lines of the system would be unable to earn their fixed charges, despite the 2-cent charge for transfers, recently allowed by the Public Service Commission, and they now report that with the increased scale of wages and disregarding the effect of the disintegration which has occurred these companies cannot earn during the current fiscal year, and probably for some time thereafter will be unable to earn even operating expenses and taxes.

A receiver for the surface lines was appointed by the United States District Court in July and defaults in payment of the interest on practically all the mortgages resting upon those lines have occurred. Following default in the payment of rental to Brooklyn City Railway that company has taken possession of its lines, comprising about 40 per cent of the surface mileage of the system, which had been operated by a subsidiary of the B. R. T. Company under lease. The result has been a general breaking up of the system of surface lines formerly controlled by the B. R. T. Company. How far this will affect the earnings of the lines is still problematical.

The activities of the receiver of the B. R. T. Company proper are now, in general, confined to completing the additional power generating facilities and furnishing power and doing repair and maintenance work for both the rapid transit and surface lines. Under a contract negotiated by the receiver he will also furnish power for the future operation of the Brooklyn city lines. Stone & Webster report that while this part of the system is earning and will probably continue to earn interest on the B. R. T. Company's investment therein there will be no substantial surplus over such interest.

As appears from the reports of Stone & Webster, with the wages and other operating costs now in force and a 5-cent fare, the earnings of the rapid transit lines remaining after the payment of interest upon the receiver's certificates and the $22,967,000 of underlying elevated bonds, will fall considerably short of the interest upon the $60,000,000 of B. R. T. notes and subway bonds. As already stated, without an increased fare no substantial contribution toward your interest can be expected from the surface lines or from the properties of the B. R. T. Company proper.

There have now been deposited with the committee about $30,000,000 of the three-year notes, which, together with the $16,544,700 of that issue held by the War Finance Corporation constitute over 80 per cent of the entire amount outstanding. The committee also represents the majority of the subway bonds outstanding.

War Finance Loan at New Orleans Unpaid

The future course of the War Finance Corporation with respect to the loan which it made some time ago to the New Orleans Railway & Light Company, New Orleans, La., will depend upon the tenor of the inquiry now being conducted by the corporation into the affairs of the railway. This has been made plain by A. W. McLean, managing director of the War Finance Corporation. The loan was for $1,000,000. It fell due on June 1, but was not paid. Up to the present time the interest has been paid, also $215,000 on account of the principal. The receiver of the New Orleans company is understood to have agreed, subject to the approval of the court, to pay an additional $50,000 on account of the principal by Dec. 15 and a further sum of $75,000 by Jan. 10, 1920. Mr. McLean is quoted as follows:

Repeated negotiations have been carried on by the office of the War Finance Corporation with the receivers and other parties interested for the purpose of obtaining larger payments on the loan from the revenue derived from the increased fare ordinance adopted by the city, which expressly provided that the net increase in revenues arising from the increased fare should be devoted exclusively to paying the debt due the War Finance Corporation. The receiver claims that the return from the net fare ordinance was very small, while the officers of the War Finance Corporation claim that they have not received the total amount accruing from this source.

At a conference held on Oct. 31 between the receiver and parties interested in the company's obligations and also the War Finance Corporation, it was understood that the War Finance Corporation should send public utility experts to make a full examination of the records, books and properties of the railway company and report to the War Finance Corporation in order to enable it to determine what additional amounts are due it from the increased fare. After the War Finance Corporation receives the report of its experts it will decide upon its future course of procedure.

$100,000,000 of Second Preferred Authorized

At the special meeting of the security holders of Cities Service Company held on Nov. 17, at Dover, Del., the stockholders approved the creation of an authorized issue of $100,000,000 of second preferred stock, of which $40,000,000 will be of $10 par, and will be known as preference B stock, and $60,000,000 will be of $100 par, and will be known as preference BB stock. The stockholders also approved the amendment to the charter of the company which provides that the company shall have the right to redeem all or any part of the present preferred stock at 112, and that all or any part of the second prefererd stock may be redeemed at 106. The third amendment to the charter of the company in respect to investments from the proceeds of securities junior to the present preferred stock, was approved.

Of the new preference B stock of $10 par, only $3,000,000 will be issued at present, this amount having already been offered to stockholders of Cities Service Company for their subscription at $7.50 a share. The board of directors of the Cities Service Company in offering this small amount of preference B stock did so with the idea of making this stock known to the investing public, establishing a market for it, and learning whether it would be as popular among investors as were the bankers' shares. The offering of 300,000 shares of this stock was largely over-subscribed, and subscriptions were received from more than 3500 persons, thus indicating an even more widespread demand for this stock than there was for the initial issue of bankers' shares, which were distributed to slightly more than 1000 holders of record on their initial offering, although since that time the number of stockholders of record of Cities Service Company bankers' shares has grown to almost 5000.

No Dividend Action Planned

With reference to a report in circulation that the Ohio Traction Company, Cincinnati, Ohio, would in the near future issue interest-bearing scrip for the accumulated back dividends on the preferred stock of that company W. Kesley Schoepf, president of the company is reported to have said:

My attention has been called to this report regarding the possibility of the issuance by the Ohio Traction Company of scrip to pay the accumulated back dividends. No consideration has been given to such a procedure, nor is it in contemplation. The report has probably grown out of statements, although unofficially made, that the present rate of fare would prove sufficient to meet the requirements under the revised ordinance under which the Cincinnati Traction Company is operating.

This may be true in so far as the current requirements are concerned, but there is an accumulation of quite a large deficit that must be taken care of in some way. Whether, with this deficit out of the way, the 7-cent fare is sufficient will be determined by the results of operation in the months of October and November, and even if this should prove to be true, the company has not developed any plans along the line reported.

Financial News Notes

Lake Shore Earnings Improve.—The Lake Shore Electric Railway, Cleveland, Ohio, reports gross earnings of $232,645 for September, 1919, compared with $216,052 for the same month of 1918 and a surplus of $35,831 for September, 1919, as compared with $29,593 for the same month of 1918. For the nine months from Jan. 1, 1919, to Sept. 30, 1919, the same company reports gross earnings of $1,940,762 as compared with $1,638,730 for the similar period of 1918 and a surplus of $225,409 for the nine months of 1919 as compared with a surplus of $145,937 for the similar period in 1918, or a gain of $79,471.

Municipalities Arrange to Run Road.—At a conference held in Attleboro, Mass., on Nov. 12, an agreement was reached whereby the operation of the Norton, Attleboro & Taunton Street Railway will be conducted by the towns of Attleboro, Mansfield and Norton and the city of Taunton. Each municipality will choose three men to form a council of twelve which will comprise the board of management. Until this board is named the operation will be conducted by the present management. The purchase price which will be raised by the municipalities is $120,000. The outstanding debts amount to $53,413. There are no court claims against the road.

Olean Company Without Resources.—The Western New York & Pennsylvania Traction Company, Olean, N. Y., has no financial resources, claims President Wilson R. Page. The claim was made in an examination of the company in supplementary proceedings to execution of a judgment against the company. Patrick S. Collins was referee. The judgment was obtained by Thomas A. Flynn against the company for $750 for injuries received in a wreck in Vandalia in December, 1917. The object of the examination was to learn whether the company has any property that can be reached to satisfy the judgment. The railway was tied up several weeks by a strike. The course that the labor troubles took were reviewed previously in the ELECTRIC RAILWAY JOURNAL.

Reorganization Plan Approved.—The Public Service Commission for the Second District of New York has approved the plan for and authorized the reorganization of the Buffalo Southern Railway, Buffalo, N. Y., under a petition by Robert B. Austin, William J. Wheeler and Edward L. Frost representing the bondholders' committee. The reorganization plan provides for a new company, the Erie County Traction Company, Inc., taking over the property and franchises of the Buffalo Southern Company. The new company proposes to issue $450,000 in capital stock and $100,000 in bonds. Application will be made by the new company to the commission for approval of operation and for authority to issue stock and mortgage bonds. The system of the Buffalo Southern Railway consists of 25 miles of road extending out of Buffalo.

$1,750,000 of Notes Offered.—William A. Read & Company and Tucker, Anthony & Company, New York, N. Y., are offering for subscription at 98¼ and interest to net about 6.75 per cent $1,750,000 of collateral trust 6 per cent convertible gold notes of the Manchester Traction, Light & Power Company, Manchester, N. H. The notes are dated Nov. 1, 1919, and are due Nov. 1, 1922. The notes are issued to refund $1,500,000 of two-year 6 per cent notes due on Jan. 1, 1920, and for other corporate purposes and are the direct obligation of the Manchester Traction, Light & Power Company, specifically secured by deposit with the trustee of $2,059,000 of first refunding mortgage 5 per cent bonds due in 1952. The bankers announce that they will take the 6 per cent notes of the company maturing on Jan. 1, 1920, in exchange at 100 and interest.

$4,500,000 of Notes Offered.—The Illinois Trust & Savings Bank, Chicago, Ill.; the Continental & Commercial Trust & Savings Bank, Chicago, Ill.; Montgomery & Company, New York, N. Y.; Bonbright & Company, New York, N. Y., and H. M. Byllesby & Company, Chicago, Ill., are offering for subscription at 99 and interest, to yield 7.5 per cent, $4,500,000 of 7 per cent convertible sinking fund secured notes of the Standard Gas & Electric Company dated Nov. 15, 1919, and due Nov. 15, 1921. Pledged as collateral security for the notes will be $2,280,000 par value, of bonds and notes,$1,160,000, par value, preferred stock, and $1,150,000, par value, common stock of Standard Gas & Electric's public utility properties, together with $1,000,000, par value, 7 per cent preferred stock and 110,000 common shares of no par value of Shaffer Oil & Refining Company represented by voting trust certificates. The common stock of the latter company so pledged as collateral represents a majority interest in that issue. The company places the value on the collateral of over $9,000,000, or twice the amount of the note issue. The notes are convertible at the option of the holder into either preferred or common stock of the Standard Gas & Electric Company at the rate of $100 principal amount of notes for $100 par value of preferred or common stock with adjustment of accrued interest and accrued dividend. The notes are in the denomination of $1,000 and $500.

Traffic and Transportation

Missouri Commission Enjoined

Federal Court Holds Joplin & Pittsburg Rate Confiscatory and Suggests One of 2.5 Cents a Mile

Federal Judges Stone, Van Valkenburgh and Wade, sitting at Kansas City, Mo., on Nov. 11 issued an injunction restraining the Public Service Commission of Missouri from enforcing a passenger rate of 2.12 cents a mile on the Missouri lines of the Joplin & Pittsburg Railway, Pittsburg, Kan. The company has been authorized to collect 2.5 cents a mile on condition that coupon slips be issued to passengers. The difference between that rate and the 2.12-cent rate will be impounded pending submission to the higher courts.

Commission May Be Enjoined

The court's order establishes the principle that a State commission may be enjoined from enforcing increased rates because the increase granted is inadequate. The court held that the 2.12-cent rate was confiscatory. While it is stated specifically that it had no power to fix a rate, the court said it could indicate a maximum rate, by which the company might be guided pending the fixing of a remunerative rate by the State commission. The court set the minimum remunerative rate at 2.5 cents a mile.

The Joplin & Pittsburg Railway operates 104 miles of interurban electric lines in Kansas and Missouri. In May, 1919, the Public Utilities Commission of Kansas established a rate of 2.5 cents per mile, an increase of 0.5 cent above the former Kansas rate. About the same time the Interstate Commerce Commission allowed an interstate rate of 2.6 cents. The company applied to the Missouri commission for relief on its Missouri lines and was granted a rate of 2.12 cents, as compared with the previous rate of 1.93 cents.

The company, contending that this increase was insufficient, then applied for the 2.5-cent rate. The application was denied. The company then turned to the Federal Court, and sought an injunction against the enforcement of the commission's order on the ground that the 2.12-cent rate was confiscatory, in that it failed to provide adequate revenue.

Court Upholds Company

The court upheld the company's contention that the rate was confiscatory. In the ordinary course of events the issuance of the injunction would have re-established the former rate of 1.93 cents. But, since the court held that the 2.12-cent rate was confiscatory, it followed that the 1.93-cent rate fell under the injunction, being declared confiscatory also. This opened the way for the installation of the 2.5-cent rate at the direction of the court.

The court took the position that rates cannot fairly be established on the basis of pre-war costs, since present costs are not definitely known to be only temporary. In making its order the Missouri Commission had used a five-year average of costs before the war. While the court's findings with reference to the basis on which costs should be figured in arriving at equitable rates, are worded in such a way as to avoid criticism of the methods of state commissions, it intimates that the display of figures based on costs of several years ago, does not reflect present costs. On this the court said:

> It would manifestly be out of place here to disapprove the methods and standards adopted by the commission and its experts, but it may be pointed out that it appears upon the face of the report that great, if not undue, emphasis was laid upon the original cost of the property thus somewhat arbitrarily assigned to intrastate passenger traffic at a period greatly antedating that with which this investigation must deal; nor can we say that the present period of high prices is so temporary or abnormal that it may, practically, be disregarded in arriving at the value of complainant's properties. No one can say what degree of depression may ultimately come, but it is reasonably certain that the cost of the properties now under consideration will never again approximate figures prevailing in the years before the world war.

The company has installed the rate indicated by the court as the minimum under which it can operate remuneratively and is proceeding to take up with the State Public Service Commission the question of adjustment of its findings.

Jersey Abolishes Zone Plan

Modified Zone System Had Been in Effect Only Since Nov. 15—Under It Company Faced Bankruptcy

The State Board of Public Utility Commissioners of New Jersey on Nov. 29 announced that it would permit the Public Service Railway to abandon the present zone system of collecting fares and restore the old 7-cent flat rate, with one cent for a transfer. The change will become effective on Dec. 7. The board will file its report on Dec. 2. Commissioner Wright of the board dissented from the opinion.

The company asked the change on the ground that if the present system of 5 cents for the first zone and 1 cent for each additional zone was continued, the company would be forced into bankruptcy. Two previous applications for the abolishing of the zone fare system were refused by the Utility Board.

The announcement of Nov. 29 was made following a hearing on the company's application for the abolition of the system, before the Public Utility Commission. President Thomas N. McCarter of the railway company, declared at the hearing that the employees had given perfect cooperation, but that the public had failed.

Mr. McCarter explained why, when the 7-cent fare was in force, he had told the commission that the company would go into bankruptcy unless it was changed while he now declared that the company faces bankruptcy unless the flat 7-cent fare was restored, by saying that at first the results under the 7-cent fare were unsatisfactory owing to the influenza epidemic, but during the last month of the 7-cent rate the receipts increased and the company now believes the receipts would be heavier.

The so-called "five-and-one" plan of rates as proposed by the New Jersey Commission was put into effect on the lines of the Public Service Railway on Sunday Nov. 15. These rates provided that the fare for an initial ride on any car should be 5 cents, which entitled the passenger to a ride of two zones or less, with 1 cent for each additional zone. A charge of 1 cent was made for each transfer. These rates superseded those which became effective on Sept. 14.

Binghamton Increase Barred

Decision of State Supreme Court Holds New York Commisson Has No Power to Grant Higher Rate

Justice Charles E. Nichols of the New York State Supreme Court has handed down an order restraining the Public Service Commission for the Second District from granting an increase in fares to the Binghamton Railway. The decision affects the company's Binghamton and Union lines. Justice Nichols has ruled that, because of provisions in the company's franchise which limit the rate of fare to 5 cents, the commission has no power to grant an increase.

Case Reviewed

The Binghamton Railway has been endeavoring to secure higher fares for more than a year. The City Council refused to pass an ordinance suspending for the duration of the war and two years thereafter, the franchise provision limiting the fares. Receiver Phelps then petitioned the Federal District Court for the Northern District of New York, alleging that there was no contract in existence between the company and the city of Binghamton or the town of Union, limiting the rate of fare which might be charged by the company. Attorneys for the town of Union and the city of Binghamton appeared before Judge Ray on the hearing held on this petition and objected to the jurisdiction of the court to determine this question.

The United States District Court overruled the objections and instructed the receiver to apply to the Public Service Commission for an increased rate of fare, sustaining the contention of the town of Union and the city of Binghamton, however, that the court had no power to increase the rate of fare. Upon this finding, the receiver applied to the Public Service Commission.

The city of Binghamton and the town of Union immediately appealed from the decision of the United States District Court to the Circuit Court of Appeals for the Second Circuit. The Circuit Court of Appeals sustained the contention of the city and the town that the District Court had no authority to fix the rate of fare and furthermore that the United States District Court could not decide that there was no contract limiting the rate of fare and that such a decision was beyond its power.

Receiver Appeals to Commission

Attorneys for the receiver, then made application to the Public Service Commission to increase the fare, asking it to decide whether or not there was a contract between the company and the city of Binghamton and the town of Union which limited the rate of fare, which question the Circuit Court of Appeals had held could not be decided by the United States District Court. Last August, the attorney for the town of Union, and John Marcy, corporation counsel for the city of Binghamton, then made application to the Supreme Court, Albany County, presided over by Justice Nichols, for a writ of prohibition, preventing the Public Service Commission from proceeding with the hearing, basing their application on the contention that the Public Service Commission had no power to increase the rate which was fixed by contract. This decision has been fully sustained by the decision of Justice Nichols, just handed down.

Chicago Rate Reduced

Surface Lines Ordered to Sell Ten Tickets at Six-and-One-Half Cent Rate—Seven-Cent Cash Fares Stand

The Public Utilities Commission of Illinois in a decision rendered on Nov. 25 ordered the Chicago Surface Lines to sell ten tickets for 65 cents and 50-ticket books for $3. The ticket-rates as established by the commission are 6.5 cents and 6 cents respectively. The commission refused to order the discontinuance of the 7-cent cash fare.

Reductions Went Into Effect Dec. 1

The reduced fares became effective on Dec. 1 and will continue until May 1, 1920. The commission retains jurisdiction in the case, however, and reserves the right to make such changes as circumstances may warrant. Meanwhile the hearings on valuation were continued, and it was expected that the evidence on which a permanent rate is to be based would not be complete for more than a month.

The city authorities maintained their hostile attitude after the findings of the commission had been announced. They said the fight would not end until the 5-cent fare had been restored. They hope to achieve this result through injunction proceedings which have been pending in the courts for several weeks.

In addition to establishing the new fare schedule, the commission in its findings declared that present facilities of the surface companies are inadequate, and it directed them to purchase 200 additional cars of the type in use and to have these in operation if possible within five months. One hundred additional cars are to be purchased and added to the equipment annually. The commission also announced its intention to make further orders affecting service within a few weeks.

The commission declared that the surface lines are entitled to earn operating expenses, depreciation and a reasonable return on the investment. While the valuation proceedings are still pending, the commissioners hold that it is not reasonably possible to place upon the properties a valuation of less than $123,000,000, which was the amount fixed tentatively last April when certain items of the capital account were eliminated. The companies are in their opinion entitled to earn a return of 7 per cent upon this valuation of $123,000,000. They,therefore, find that the requirements for all these allowances are about $46,000,000. They estimate that a 5-cent fare would yield $37,700,000; a 6-cent fare, $45,000,000; and a 7-cent fare, $52,500,000.

Statement of Commission's Estimates

They decided that an average rate of 6¼ cents would meet the requirements. From experience in other large cities where a considerable differential was established between cash and ticket rates it was estimated that the use of tickets would range from 65 to 93 per cent, and for this reason the several rates named above were fixed as apparently equitable.

In arriving at their total of allowances for operation, renewals and return on investment, the commissioners adopted the following from various estimates quoted in the evidence:

For maintenance	$ 6,300,000
For power	3,200,000
For conducting transportation	19,500,000
For damages, general and miscellaneous	3,200,000
For taxes	2,050,000
For renewals	3,000,000
For return on investment	8,600,000

Regarding the allowance for return on investment the decision said:

> This sum of $8,600,000, of course, is not to be taken as an allowance for return upon the fair value of those properties actually used in the public service made after full valuation. It is the amount which the companies are entitled to earn in order that it may not appear that they have been compelled to observe a confiscatory rate. In the orders which have been heretofore made, and in this order, the indication of this amount is without prejudice to the valuation proceedings. It is made upon the theory that beyond all doubt the companies are entitled to a return upon the lowest valuation that can reasonably be placed upon their properties, and that to allow them less would result in confiscation.

Commission's Reasons Reviewed

In detailing the reasons for its decision the board said:

> With a 5-cent fare these companies will earn at the rate of about $37,700,000 a year, or more than $8,000,000 less than they are entitled to earn, in any aspect of this case. On the basis of a 6-cent fare the companies will earn at the annual rate of $45,000,000. On the basis of a 7-cent fare the companies will earn at the annual rate of about $52,500,000.
>
> It is plain, therefore, that adherence to the principles upon which the orders of April 25, 1919, and Aug. 6, 1919, were made [the first denied the companies permission to raise fares to 7 cents; the second sanctioned the increase after their employees had gone on strike and obtained pay increases of $8,750,000 annually] leads to an allowance to these companies of a return which will be represented by an average rate of approximately 6¼ cents per passenger.
>
> In prescribing a plan which will produce this result, it is fair and equitable that consideration should be given to the regular patrons of these companies, who make daily use of transportation over the lines in connection with their regular business.
>
> After carefully considering the evidence in the record as to the effect of ticket arrangements which have been established in various cities, we have reached the conclusion that the results above stated can be accomplished without injustice to the companies, by the establishment of a 7-cent cash fare, and by making provision for the sale of tickets, at places convenient to the regular patrons of the companies, at the rate of ten tickets for 65 cents, and for bearer ticket books of fifty tickets for $3.
>
> In formulating the plan consideration has been given to the fact that experience in other large cities shows that where there is a substantial differential in favor of purchasers of tickets, a very high percentage of passengers use the tickets instead of paying cash fares.
>
> These percentages range from 65 per cent to 93 per cent, and it is doubtful whether, under the plans herein provided, the companies will receive an average fare of more than 6¼ cents.

Plans to Abandon Bridge Service

The New York & Queens County Railway, Long Island City, N. Y., will cease operation of all cars across the Queensboro Bridge at midnight on Dec. 15. W. O. Wood, president of the company, has so informed Alfred M. Barrett, Deputy Public Service Commissioner. Mr. Wood states that his company is now preparing a new tariff schedule, which he will ask the commission to put into effect.

According to Mr. Wood, on June 12, 1919, he notified the Board of Estimate & Apportionment of New York City that his company would not exercise its right to renew the old contract for operation over the bridge. The terms of this contract are too onerous for present day operation, Mr. Wood declares. At the same time, he notified the Board of Estimate that his company was ready to negotiate for another agreement to operate across the structure.

The city of New York owns the tracks on the Queensboro Bridge, and the rails have only been leased from the city by the railroad. The New York & Queens County Railway has been operating for the past ten years over this structure through an agreement with the city of New York. This agreement expires on Dec. 16.

The Public Service Commission has appealed to Borough President Connolly to take action in the Queens transit matter and consult with the other members of the Board of Estimate & Apportionment to find if possible a way out of the muddle. President Connolly will follow the suggestion and expects to have conferences with representatives of the railway and with members of the board.

Seeks Fare Increase in Portland

According to officials of the Portland Railway, Light & Power Company, Portland, Ore., the recent wage increase to its employees, referred to elsewhere in this issue, will necessitate the raising of fares in Portland. The new wage scale, it is stated by Franklin T. Griffith, president of the company, will absorb practically all of the earnings of the concern, which under the previous rate scale, are said to be less than 3 per cent of the actual value of the railway properties. The matter is now before the Public Service Commission, but final hearing will probably be deferred until the middle of December. The application filed with the commission by the company does not ask authority to increase the fares to any fixed amount, but requests the regulative body to decide what the rate shall be.

Traffic Solution Sought at Pittsburgh

An organization known as the Citizens' Committee on City Plan of Pittsburgh, formed some time ago by a group of men who head some of the largest financial and commercial concerns in Pittsburgh, Pa., has announced that it will undertake, at once, an investigation of the entire matter of traffic in that city, with a view to rearranging traffic channels and electric railway lines and extending the facilities for vehicular travel. The scheme calls for a "major street plan," which will be an effort to co-ordinate thoroughfares, railroads and railroad terminals, traction lines and their terminals, and other public utilities. One of the intentions of the committee is to make the public realize the direct connection between traction facilities and the growth of various sections of the city.

More Safety Cars for Terre Haute

On the Terre Haute division of the Terre Haute, Indianapolis & Eastern Traction Company, all lines except one have now been equipped with safety cars of which there are thirty-eight in regular operation. Eight safety cars were added on Nov. 18 and eight on Nov. 23. The Terre Haute lines have had thirty safety cars in service for some time. These have proved so satisfactory and have met with such favor from the public that there was no difficulty in installing the additional cars. No special advertising was necessary. On one line the headway has been reduced from ten minutes to eight minutes and on the other from ten minutes to seven minutes. This has been accomplished by the installation of only two additional cars on the two lines. The Terre Haute division is now operating approximately 6000 car miles daily with safety cars.

Course Outlined for Los Angeles

Railroad Commission Advises One-Man Cars, Discontinuance of Paving and Prohibition of Parking in Downtown District During Day Time

A 5-cent fare is sufficient for Los Angeles, and there is no need for a charge for transfers, says the report of the engineers of the Railroad Commission filed Nov. 12 with the city authorities of Los Angeles. Supporting this contention the commission's engineers tell how the Los Angeles Railway Corporation can save $1,500,000 a year by better methods of operation. In this connection they recommend that one-man safety cars should be operated on most of the company's lines. The purchase of 400 of these cars at a cost of $2,800,000 is advised. It is estimated that these cars will save $625,000 per annum and will pay for themselves in about four years.

Rerouting Recommended

Recommending a complete rerouting scheme, abandonment of certain lines and services; special regulation devised to prevent street traffic congestion, such as parking of autos and street turnings of machines, the engineer's report urges a change in the method of management of the company and recommends "that the company use better methods in dealing with employees and with the public."

In connection with the company's treatment of employees the report recommends the establishment of a pension insurance plan, saying: "The financial condition of the company, in the economies which we believe are possible under our recommendations are effected, will permit of the institution of a pension insurance plan." The commission declares the determination of a just return for labor is just as much a matter of public concern as is the determination of just return for capital.

The report contains the further declaration that unless the recommendation of the Railroad Commission engineers are carried out it will be necessary to increase fares.

The report is a document of about 400 pages and contains the result of an exhaustive investigation carried on during the last nine months of all phases and branches of the Los Angeles Railway Corporation's operations. That portion of the investigation covering street railway service and the traffic congestion problems in the city streets was made by the Railroad Commission engineers jointly with H. Z. Osborne, Jr., chief engineer of the Board of Public Utilities of the city of Los Angeles.

Fare Increase Not Justified

The report of the commission's engineers is signed by Chief Engineer Richard Sachse. On the matter of fares the report says:

> An increase in fares for the Los Angeles street railway system is not justified and not necessary under present conditions. Conditions can be created under which it will be possible with the estimate of minimum savings to reduce operating expenses by $620,000 per annum, and simultaneously increase the depreciation allowance by $180,000 per annum, equal to a total saving of $800,000 a year. The showing under the maximum of estimated savings will result in a reduction of $1,105,000 per annum with a simultaneous increase of the depreciation allowance of $390,000 per annum, equal to a total saving of $1,495,000 per annum. This showing is made without taking into consideration any other large savings that may be effected by economies in paving construction and maintenance and other savings that can be brought about through a modification of franchise conditions and through other possible economies. The savings estimated will enable the company to meet all of its interest requirements and sinking fund obligations and will in each case leave a very substantial surplus.

Acceptance by the city and the railway of an "indeterminate resettlement franchise" is recommended. It is pointed out that this type of franchise should determine the condition under which the city may acquire the railway properties, the methods of determining value of property, disposition of revenues and provisions governing service and extensions.

Regarding street paving and its cost, the report says:

> It is unjust and not to the best interest of the city that this total paving expense should be paid for in fare by the car riders. In the early history of street railway operation the paving clauses were inserted in the franchises in an effort to have the company share some portion of the street railway profits with the municipality. No objections could be offered to such procedure if the old conditions still existed. They no longer exist, however. The speculative element has been entirely eliminated from street railway operation in the last years and it is now no longer a question of excessive profits, but rather one of finding the necessary revenue and funds to pay the operating expenses, depreciation and a moderate return on actual value of actual investment. The fact is that the paving between the rails and outside the rails is not used or worn out through the use of the electric street railway, as was the case with the horse cars. It is worn out—and to a greater degree than paving on other streets—by the use of other traffic. It can be demonstrated that the street railway patron in many instances is not only forced to pay the cost of paving which does not contribute to his benefit, but is forced to pay for paving that contributes to his detriment. This is true because of delays to street railway traffic in all paved streets that is caused by other traffic. Under present conditions the car rider pays from 40 to 50 per cent of the cost of paving on all streets on which there are tracks, the property owners on these streets both receiving the increase in property values, due to the proximity of transportation, and bearing lesser cost of paving the streets than the owners of property on streets not occupied by car tracks.

The engineers say that the problem of the relations between the company and its employees, including matters of wages and living conditions, is in some respects the most urgent and important matter before the company. On this point they say:

> When we find that during the past six years an average of 40 per cent of the entire number of platform men is changed annually, it is apparent at once that the problem of obtaining and keeping permanent and capable men requires the most serious consideration. The methods now being used by several utilities in the United States and notably in Philadelphia, in our opinion, lead in the right direction and are worthy of the most careful investigation and study by the owners and responsible officials of this property. It is possible, we believe, with methods of absolute frankness and absolute fair dealing to create a real and lasting partnership between all of the employees of this company and the owners of the property. The practical working out of a definite program should be left to the management and the employees of the company, but the commission and the city should insist upon such a program being formulated and lend every effort to carry it into effect.
>
> In the last analysis the determination of the just compensation for the services of the employees of an essential public utility is just as much a matter of public concern as is the determination of just compensation for capital (with a fixing of a fair return), and for property (in condemnation proceedings, for instance). Rates, as a matter of cost, must be so adjusted so as to enable the utility to pay this just compensation. And if the entire transaction and the entire determination of the question is carried on with broad publicity, and if the people of the community are, at all stages, kept reliably informed of what is being done, there is no doubt that the overwhelming majority of the community would be in fullest accord with such a procedure and would be ready to pay this first cost of the desired service.

One of the most important recommendations, in the report, is the prohibition of the parking of automobiles in the most congested part of the downtown district between the hours of 8 a. m. and 6 p. m., except on Sundays and legal holidays. Other traffic recommendations prohibit all left-hand turning of automobiles in this district at all times. These two recommendations, in the opinion of the commission's engineers, will relieve the great traffic congestion in the business district and will make it unnecessary to issue traffic regulations to force street car riding in one direction only, as has been urged by a number of people.

The report goes into the details of the company's organization and management and the engineers believe that great economies and improvements are possible and should be adopted. It is declared that the present operations of the company have outgrown the system or organization and that a modern one should be adopted with centralized authority definitely placed.

Missouri Commission Upheld

United States Supreme Court Upholds Fixing of Rates Regardless of Franchise Provisions

The United States Supreme Court in a ruling handed down on Nov. 10 dismissed the appeal of the city of Kansas City, Mo., from a decision of the Supreme Court of the State upholding the right of the State Public Service Commission to raise the fare in Kansas City. The court's action means, in effect, that the Missouri Public Service Commission has authority to fix rates regardless of franchise provisions limiting fares to 5 cents.

The franchise of the Kansas City Railways limits the fare to be charged by the company to 5 cents. In February, 1918, the company filed a petition with the State Public Service Commission, requesting the commission to inquire into the question of rates to be charged by the company, and to make an order fixing such reasonable increase in rates as the facts warranted. The city of Kansas City filed an answer objecting to the jurisdiction of the commission, upon various grounds, and among the defenses set up the claim that the franchise ordinance passed in July, 1914, constituted a contract between the city and the company.

Commission Fixed Fares

The commission overruled as to its jurisdiction, and after hearing the evidence, made an order fixing the rate of fare to be charged by the company at 6 cents for passengers more than 12 years old. The city then brought the case up for review before the Circuit Court of Cole County, Mo., and the order of the commission was reversed and set aside. The Kansas City Railways and the Public Service Commission of Missouri then appealed to the Supreme Court of Missouri. The Supreme Court reversed the judgment and order of the Circuit Court and affirmed the judgment of the Public Service Commission.

The city thereupon brought the case to the Supreme Court of the United States upon writ of error. Upon application of the company the Supreme Court dismissed the case, in effect upholding the decision of the Supreme Court of Missouri and ruling that the commission had jurisdiction in spite of the franchise.

Meanwhile the commission, acting on the plea of the company that a 6-cent fare was insufficient, in August of this year authorized the installation of 8-cent fares on the Kansas City lines. The commission ordered that the higher rate should become effective on Sept. 1. The company delayed putting the 8-cent rate in effect until it had secured a sufficient number of tokens, which, the commission ordered, should be sold at 7 cents each.

104,430,015 More Passengers

This Is Record of New York's Transit Lines for Year Despite 17,000,000 Passenger Loss During Epidemic

The Public Service Commission for the First District of New York on Nov. 24 made public its annual summary of passengers carried for the year ended June 30, 1919, on the transit lines of the greater city. The growth in traffic in the year recently closed was almost unprecedented in spite of the ravages of the influenza epidemic during the autumn months of 1918.

INCREASE FOR SEVEN MONTHS 122,500,000

This epidemic caused a falling off in October alone of more than 12,000,000 fares and for the period of July to November, inclusive, of 1918 of 17,000,000 fares. Based on the number of fares collected the figures show that during the year 2,079,942,604 passengers rode on the lines, an increase of 104,430,015 over 1918.

In December the conditions changed for the better, normal conditions for the year were resumed, and the number of fares increased 8,500,000 during the month. Each month after December showed increasing traffic, as follows:

December	8,500,000
January	15,700,000
February	13,200,000
March	15,800,000
April	20,600,000
May	23,100,000
June	25,600,000
Total	122,500,000

The report shows that the total increase of approximately 104,500,000 was divided between the various lines as follows: Rapid transit lines, 98,751,618; surface lines, 5,679,197. On the basis of percentages the total increase was 5.29 per cent, all of which went to the rapid transit lines except 0.65 per cent which went to the surface lines.

Details contained in the report disclose the fact that the largest percentage of gain was by the elevated lines of the Brooklyn Rapid Transit System, where the growth was nearly 20 per cent, which represented a total traffic of 308,879,791, or an increase of 50,712,478 over that of 1918. The heaviest traffic on any single system was on the subway lines of the Interborough Rapid Transit Company, where the grand total of passengers was 461,147,058, which represented a gain of 10.23 per cent, of 42,889,050 more than were carried in 1918.

There was a decrease of 1.27 per cent on the Interborough elevated lines, representing a loss of 4,472,059. These elevated lines carried a total of 348,188,600 passengers during the year. Figures of the business done by the Hudson & Manhattan Company disclosed a gain for the year of 12.70 per cent, or an increase of 9,701,817 passengers in a total of 36,050,815.

RECORD FOR THREE YEARS

Figures on traffic on the surface lines, divided among the boroughs, show that in Manhattan the total traffic was 370,085,099 passengers; a loss of 1,051,290, or 0.28 per cent less than in 1918; in Bronx there was a gain of 1.11 per cent in a total of 80,806,261; in Brooklyn there was a gain of about one-half of 1 per cent in a total of 362,103,192; in Queens the gain was 7.54 in a total of 3,275,369, while in Richmond the gain was 4.38 per cent and the total was 15,958,213.

A comparison of traffic for the last three fiscal years follows:

ELEVATED AND SUBWAY

	1918	1919
Interborough Subway	418,337,666	461,147,058
Interborough Elevated	352,660,669	348,188,609
B. R. T. Elevated and Subway	258,167,313	308,879,791
Hudson & Manhattan Tubes	76,548,998	86,050,813
Total	1,105,514,646	1,204,266,264

STREET SURFACE LINES

Manhattan	371,136,389	370,085,099
Brooklyn	360,207,555	362,103,192
The Bronx	79,917,071	80,806,261
Queens (B. R. T.)	43,448,206	46,723,575
Richmond	15,287,922	15,958,213
Total by borougbs.	869,997,143	875,676,340
Grand total all lines.	1,975,511,789	2,079,942,604

The report says that the traffic problem in the city is exemplified by the fact that since 1903, a period of sixteen years, the traffic on all of the transportation lines has more than doubled, and that the billion mark was first passed in 1903. To illustrate the point the following table is submitted:

Year Ended June 30	Number of Passengers	Annual Increase
1903	1,000,767,483	61,717,519
1904	1,065,984,910	65,217,427
1905	1,130,982,696	64,997,486
1906	1,251,841,173	120,858,479
1907	1,315,381,388	63,340,213
1908	1,358,000,407	42,619,049
1909	1,402,417,642	44,417,235
1910	1,531,262,914	128,845,272
1911	1,603,001,397	72,638,483
1912	1,680,913,935	70,012,530
1913	1,709,876,508	88,962,573
1914	1,813,204,356	43,327,840
1915	1,807,632,726	*5,571,630
1916	1,898,735,615	91,102,889
1917	1,918,812,226	20,076,611
1918	1,975,482,316	56,640,087
1919	2,079,942,694	104,430,815

5,700,000 RIDE DAILY

It appears from the figures that the average traffic each day during the last fiscal year was 5,700,000, which about equals the population of the city. Toward the end of the year the daily averages of rides increased to 6,400,000. The fares per capita collected in 1860 were 43, and in 1919 the number had increased to 370 which shows, according to a comment in the report, that the habit of riding is growing steadily more popular. Then the report says:

> The increase of 104,430,815 passengers brought approximately $5,220,000 additional revenue to the railroad companies, which with revenue other than that gained by operation of the lines, yielded a total revenue for the year of $110,191,682, or $6,690,919 more than in 1918. Operating expenses increased greatly, however, the total of these increases being $15,267,181, which caused a deficit in net income of $8,085,819.
>
> The average cost of transporting each passenger (no allowance being made for taxes, interest, or dividends) was 3.446 cents in 1919, as against 2.293 cents in 1918, and 2.638 cents in 1916.

It is pointed out that because of the opening of the new subway lines the total increase in the length of track was 64 miles, and the number of passenger cars in service grew from 12,775 to 13,035.

Wants Columbus Service Improved

The City Council of Columbus, Ohio, has passed a resolution calling upon the Columbus Railway & Light Company to furnish service more nearly adequate to the traffic requirements of the city. C. L. Kurts, president of the company, in a letter addressed to Milton W. Westlake, the president of the Council, stated on Nov. 17 that the company could not improve the service at the present rate of fare. Mr. Kurts declared that the company had been forced to curtail the service to meet the wage increases and back pay awarded to the employees last year.

Views on Fare Question

Chicago "Daily News" Prints Series of Articles—Railway Operators Among the Contributors

Under the title of "How can Chicago get back the 5-cent fare?" the Chicago *Daily News* has been printing a series of articles on the fare question for several weeks past. The discussion was started with an interview with Thomas E. Mitten, president of the Philadelphia Rapid Transit Company, amplifying the statements he had previously issued concerning the 5-cent fare in Philadelphia. Another of the series contained the statement of L. A. Busby, president of the Chicago Surface Lines, which was printed in the issue of the ELECTRIC RAILWAY JOURNAL for Oct. 25, 1919.

AN ALDERMAN SUGGESTS RELIEF

Another view of the fare situation in Chicago was given by Alderman Henry L. Capitain of the Chicago Local Transportation Committee. In brief Alderman Capitain's opinion was that Chicago could get back its 5-cent fare only by assuming burdens it now lays upon the company. Upholding this view, he said:

> One method for securing a 5-cent fare would be for the city to make up arbitrarily any deficit from some other sources than car fares. The only other source that occurs to my mind would be general taxation. How much do the 5-cent fare advocates think the general public would relish seeing their taxes spent to make good deficits yawning between the receipts and expenses of running the street cars because the nickel isn't big enough to pay all the cost? The most practical plan would be to combine all our local transportation facilities and add to these combined systems whatever subways may appear necessary. The combination of the "L," underground and surface lines would do away with competition and enable large savings to be achieved in the cost of operation.

Mayor Thompson furnished one of the series of articles, devoting the space to a condemnation of the present management, an appeal for retention of the present fare ordinance and an explanation of his plan for municipal ownership for the city of Chicago which has previously been described.

THREE ARTICLES ON DETROIT

The Detroit situation was covered in three separate articles, one being an interview with Mayor Couzens, another with President Brooks of the Detroit United Railway, and another a review of present conditions in that city. Mayor Couzens referred to the deficiencies of the service on the lines of the Detroit United Railway in Detroit and insisted the only remedy lay in municipal ownership. He said:

> I am viciously opposed to any higher street car fare than 5 cents. I do not intend to be radical or to violate property rights. But neither do I propose, if it is humanly possible to prevent it, that a public utility which has taken away millions from the people of this city during fat years shall now come back on the public to make good at the first sign of increased costs or the possibility of losing money.

DETROIT PRESIDENT SAYS LIMIT HAS BEEN REACHED

President Brooks of the Detroit company was quoted as saying:

> It is utterly impossible to give up-to-date street car service for a nickel. In Detroit we are not getting by with a 5-cent fare by a whole lot. We can't go ahead much longer without reaching some settlement. By insisting upon a nickel as the maximum street car fare the people of the city of Detroit will soon find out that they have eaten their cake and the bakeshop is closed.

Mr. Brooks admitted that it was impossible to maintain the properties in good condition. He said that the average dividend of the Detroit United Railway since 1901 has been less than 4 per cent. The company there operates 538 miles of line, with more than 1800 cars.

Relief for San Diego

California Commission Orders Two-Zone System With Five-Cent Fare in Each Zone—One-Man Cars Urged

The Railroad Commission of California on Nov. 14 issued an order authorizing the San Diego Electric Railway to adopt a zone system under which the city of San Diego is to be divided into two zones, an outer and an inner, with a 5-cent fare in each. The commission stated in the order that the adoption of a zone system afforded the only solution of the electric railway problem in San Diego.

City and Suburban Fares Readjusted

The zone system provides that the fare, including transfers between any points within each zone is to be 5 cents and the single rate, through two zones, 10 cents. Ticket books, four tickets to a book, good in both zones, at 7½ cents a ride are provided for, also monthly sixty-ride ticket books, good in both zones, at 6½ cents per ride. All other fares in outlying territory, including the cities of Coronado, National City, Chula Vista, East San Diego and Point Loma are readjusted.

The inner zone has a radius of approximately 1 mile, measured from the intersection of B Street and Broadway. The outer zone extends from the end of the inner zone to the ends of the various car lines and to the limits of National City.

The commission, in ordering the adoption of this plan, for the first time in its existence abandoned the one-fare principle in fixing the fare within the limits of a municipality. Commissioner Devlin, who wrote the order, stated that although he was of the opinion that the zone system could not be adopted indiscriminately, he considered the arguments of the commission's engineers in support of its adoption in San Diego, to be sound.

The commission recommend strongly that one-man cars be put in operation in San Diego. The commission refused to authorize the company to discontinue a number of lines in San Diego, in East San Diego and in Point Loma, holding that the proposed system of operation will produce sufficient revenue to justify their continuance. The commission did, however, authorize abandonment of service on the Fifth Street car line in Coronado and orders changes on certain lines in San Diego.

The city of San Diego is urged by the commission to change its paving requirements and to relieve the car riders from the burden of having to pay for some of the most expensive paving in the city. Appointment of a paving committee consisting of the engineers of the city and the company, who shall meet at certain times and decide what paving expenditures shall be incurred, is recommended by the commission, the decision to be made by the commission in the event of failure to agree.

Depreciation Fund $18,000 a Month

The commission also ordered the company to set aside a depreciation fund of $18,000 a month.

The commission estimates that under the proposed zone system of fares there will be a decrease in passengers in the next year of 335,000 (about 2 per cent) and that there will be a decrease in earnings of about $10,000. The commission is of the opinion, however, that with conditions changed to meet the requirements of its order and proposed plan of operation, there will be a profit of $110,000 as against a loss of approximately $23,316 probable under the present method.

The company's case has been before the commission for many months. The company stated in 1918 that it was losing money, but refused to ask for a definite increase in fares until its condition had been thoroughly investigated by the commission. Richard Sachse, chief engineer of the commission, after a thorough investigation of the company's fares reported that the company was in need of more revenue and urged the adoption of the two-zone system.

In the valuation of the properties of the San Diego Electric Railway, the commission gives a figure of $4,726,693 as the reproduction cost less depreciation. The books of the company claimed $5,068,119 as the investment. Commissioner Devlin declares, in giving consideration to both figures, that it is impossible to base rates for this company on the value of the plant. He said:

> It does not seem to me that establishment of rate base is practical interest in this proceeding. I make this statement because it is evident to me that a fair return on a proper rate base figure is not here a controlling factor. It will become clear that conditions in San Diego and in the territory served by this street railway system are such that rates which theoretically and on paper might produce a fair return on a fair rate base cannot, as a practical matter be put into effect. If the fare exceeds a certain maximum, traffic will automatically decline to such an extent that the cure will be worse than the disease, and the result would be, in my opinion, the end of this transportation system.

Tokens Popular in St. Louis

The United Railways of St. Louis on Nov. 1 last put into effect an 8-cent cash fare, with two tokens for 15 cents, seven tokens for 50 cents, and fifty tokens or tickets for $3.50. The tokens sold at the rate of two for 15 cents are of bronze, and slightly larger than a cent. These are sold by the conductors only. The tokens sold at the rate of seven for 50 cents and fifty for $3.50 are slightly smaller than a dime and are sold only by agencies.

On the day when these fares became effective, the cash fares equalled 27.91 per cent of the total, while that of all classes of tokens combined equalled 72.09 per cent. On Nov. 15 cash fares had been reduced to 6 per cent with all classes of tokens combined equalling 94 per cent. It is believed that cash fares will be further reduced to at least 5 per cent, as the decrease has been steady since Nov. 1.

Tokens and tickets are at present sold by about 800 agents throughout the city. The principal agencies sellers are the department stores and banks, one store selling as much as $1,400 of tokens a day. No compensation is given the agents for selling the tokens with the exception that they sometimes break the packages of tokens sold fifty for $3.50 and sell them in small lots of seven for 50 cents. This is done more for the convenience of patrons of the stores than for any profit which is received.

The company has 4,080,000 tokens in circulation and could use many more if they could be obtained. To fill the demand, emergency paper tickets have been issued in books of fifty which are sold for $3.50 each. As Johnson fare boxes are used on the cars, these tickets together with children's tickets are at present being rung up on an overhead register. Enough tokens of the seven-for-50-cents and fifty-for-$3.50-variety have been ordered to bring the total of tokens up to 6,000,000, and it is believed that it may be necessary further to increase the order so as to place 10,000,000 tokens in circulation.

Safety Cars Considered

Atlanta Company Alive to Their Advantages, But Must Meet Local Traffic Requirements

Safety cars have not as yet been used in The Gate City of the South, but this does not mean that the management of the Georgia Railway & Power Company, Atlanta, is not keenly alert to the possibilities they offer. Two things have deterred the purchase of cars of the safety type. The first is that all lines in Atlanta pass through the downtown section and the riding is very heavy on all of them.

There are no cross-town lines, or lines having light traffic or well distributed loading, where an initial installation of safety cars might be made under conditions which would give the public and operators a fair chance to become accustomed to the radical change. In other words, the initial installation must of necessity be tried out under the severe conditions encountered in passing through the very congested downtown streets. This fact has caused the officials of the company to proceed cautiously until fully convinced that all other factors entering into the operation of these cars could be properly met.

The second and more complex consideration which has delayed the use of the light-weight cars is the negro problem. Georgia is reputed to have more negroes than any other State, in proportion to the total population, and Atlanta has an aboundant share of them. Forty to 45 per cent of the population is black.

The problem has been found so serious that the use of pay-as-you-enter cars is a source of much trouble, and the intermingling of the two races in entering and leaving these cars is less than it is with the safety car.

Hence the officials have about reached the conclusion that if they do try out the one-man cars, the first cars at least will have to be built with doors at both sides of both platforms so that the cars will be suitable for two-man operation if they prove incapable of coping with the two races.

Opposed to Extension of Parking Time

A special committee of the retail merchants' bureau of the Merchants & Manufacturers' Association, Baltimore, Md., proposes to ask the City Council for an extension of the time allowed for parking automobiles in the afternoon from 4.30 to 5.30 o'clock.

In answer to the argument of the merchants' bureau that customers who come in automobiles to shop at 3.30 p. m. generally need at least two hours in which to make all their purchases properly, C. D. Emmons, president of the United Railways & Electric Company, states that they could as easily commence at an earlier hour. He says that the thousands of people who are finishing a day's work at that hour and are anxious to get home to the evening meal are the ones who have the right of way.

The company made complaint on Nov. 25 that the parking law was not being enforced as it should be, to which Marshal Carter replied that, while there may be some lack of vigilance on the part of the police, the ordinance is being generally enforced.

When the City Council committee on police and jails hears the merchants' proposition officials of the railway will oppose the proposed amendment.

Extra Fare Charge Abandoned

Brooklyn Hoodlums Make It Desirable for Company to Suspend Extra Fare Pending Court Ruling

The Brooklyn (N. Y.) City Railroad, formerly included in the system of the Brooklyn Rapid Transit Company, decided on Nov. 25 to collect only a single fare on its Flatbush Avenue line until the Supreme Court has passed upon the right of the company to collect two fares. The extra fare change was put into effect following the segregation of the old Brooklyn City lines from those of the rest of the Brooklyn Rapid Transit System following the default by the latter in the payment of rental charges. The second-fare point as at first established was recently moved farther out from the city, but a great deal of trouble attended the collection of the second fare.

COMPANY AND COMMISSION CLASH

The two fare scheme was abandoned just before the heavy traffic of evening set in and after a conference between Col. William N. Dykman, counsel for the road, and District Attorney Lewis. It came after two days of disorder on cars and constant fighting between passengers and the company's inspectors at Foster and Flatbush Avenues, the point where the two fare rule was being enforced.

The company in trying to collect two fares ignored an order of the Public Service Commission and obtained an order of certiorari requiring a review of the Public Service Commission's order by the Supreme Court. District Attorney Lewis appealed to by Flatbush residents promised he would begin prosecutions against officials of the road.

He discovered, however, that the Public Service Commission had not made personal service of its order on the railroad directors and took the view that he could do nothing until proper service was made. At noon on Nov. 25 the Public Service Commission made personal service on eight of the directors and Mr. Lewis at once called up Colonel Dykman and informed him that he would institute proceedings immediately if the order was not obeyed.

Colonel Dykman asked him to wait long enough for the directors to hold a meeting. The meeting was called within a couple of hours and at its adjournment orders were issued to employees of the Flatbush Avenue line directing them to carry passengers for a single fare.

It is said that about fifty passengers were forcibly ejected from cars during the day and that seventeen inspectors were arrested on charges of assault preferred by passengers.

The company was seeking a speedy ruling from the court on the points at law involved in the controversy and was prepared to issue rebate slips to protesting passengers.

Chicago's October Earnings

Figures on earnings, expenses and traffic of the Chicago (Ill.) Surface Lines for the month of October as filed with the commission by the railway companies show the following comparisons:

	Oct. 1919	Oct. 1918	Oct. 1917
Revenue passengers ..	64,022,273	55,548,262	60,367,237
Transfer passengers ..	46,562,648	40,267,932	43,765,971
Free passengers	2,767,869	2,245,543	2,546,705
Total passengers ..	113,352,790	98,061,737	106,679,913
Gross earnings.	$4,519,329	$2,821,389	$3,067,492
Total expenses.	3,440,036	2,341,882	2,020,170

Attorney General Brundage also filed with the commission an analysis of these figures. It was expected the commissioners would use his conclusions as a guide in fixing the new fare schedules. It was pointed out that the loss of traffic due to the influenza epidemic in 1918 should be considered in connection with the present favorable showing.

Transportation News Notes

Whitman Jitneys Under Ban.—The voters of the town of Whitman, Mass., have passed an ordinance imposing a fine of $20 upon the operation of a jitney bus within the town limits. A petition for the licensing of jitneys in Whitman has been rejected.

Seven Cents on Fitchburg Line.—The Fitchburg & Leominster Street Railway, Fitchburg, Mass., has been authorized by the State Public Service Commission to increase its fare from 7 cents to 10 cents and to advance its rate on strip tickets from 6¼ cents to 8⅓ cents.

Six Cents in Trinidad.—The Trinidad Electric Transmission, Railway & Gas Company, Trinidad, Col., has installed 6-cent fares on its lines under authority recently granted by the Public Utilities Commission of Colorado. Children's fares now cost 3 cents.

Jitneys Barred in Brockton.—The Board of Aldermen of Brockton, Mass., voted on Nov. 17 to revoke all jitney licenses within the city. The order was scheduled to take effect on Nov. 22 at midnight. Seven jitney lines and several bus routes are affected by the action of the board.

Seven Cents in Burlington.—Under authority of the State Public Service Commission, 7-cent fares went into effect on the lines of the Burlington (Vt.) Traction Company on Nov. 12. The company has applied to the commission for an increase in interurban fares between Essex Junction and Winooski.

Six Cents in Pueblo.—A straight 6-cent fare became effective on the lines of the Arkansas Valley Railway, Light & Power Company, Pueblo, Col., on Nov. 11. The higher fare was installed following an agreement between company officials and the Pueblo city authorities. The company had previously applied to the State Public Utilities Commission for authority to charge 7-cent fares in Pueblo.

Seven Cents in McAlester.—The Pittsburgh County Railway, which operates the electric railway at McAlester, Okla., has been authorized by the Oklahoma Corporation Commission to charge a 7-cent fare with a 5-cent rate for children. The company has filed a protest with the commission against the zone system established on its interurban lines.

Eight Cents in Morgantown.—The South Morgantown Traction Company, Morgantown, W. Va., has received permission from the State Public Service Commission to raise its fare from 5 cents to 8 cents. The company, which is now in the hands of a receiver, had applied for the increase after it had been forced to discontinue service owing to lack of funds.

Higher Rates Asked on Interstate Line.—The Ohio Valley Electric Railway, Huntington, W. Va., has filed with the Interstate Commerce Commission an application for an additional 5-cent zone on its line between Huntington and Ashland, Ky. Under the proposed schedule the fare between the two cities would be raised to 25 cents.

Would Penalize Cash Fares.—The Terre Haute, Indianapolis & Eastern Traction Company, Indianapolis, Ind., has petitioned the Public Service Commission of Indiana for authority to collect a 5-cent penalty when a passenger pays a cash fare of 50 cents or less on board a train or one of 10 cents when the fare is more than 50 cents. The company proposes to refund the penalty at the nearest ticket office.

Traffic Districts for Dallas.—Owing to the constantly increasing volume of traffic on its lines, the Dallas (Tex.) Railway has divided its system into five operating districts, each district embracing a portion of the city of Dallas. Each district will be in charge of a supervisor of traffic, to whom a staff of inspectors will report. The five district supervisors will be under the immediate direction of C. A. Swanson, superintendent of transportation of the company.

Eight Cents Cash in Nashua.—On Nov. 1, 1919, the Nashua (N. H.) Street Railway increased the cash fare from 7 to 8 cents. Checks good for one fare are sold in quantities for 7 cents. In connection with this change the road has put into service the one-man type of car for the outlying districts. A new policy has been devised wherein the power will be obtained from the Manchester (N. H.) Traction Company instead of from the Lowell Power Company, as for many years.

Inter-company Transfers Abolished.—The Washington Railway & Electric Company, Washington, D. C., has discontinued the sale of 2-cent inter-company transfers on its suburban lines. The company formerly issued transfers on commutation tickets which entitled the holder to a ride on the lines of the Capital Traction Company in the city of Washington. Commuters from Maryland will now be required to pay an additional fare of 7 cents if they transfer onto the lines of the latter company.

Must Resume Service at Ballston.—The Public Service Commission for the Second District has directed the Kayderose Railroad Corporation, Ballston, N. Y., to restore service by operating a combined passenger and baggage car for two round trips daily. The company announced on Oct. 2 that, because of the shutting down of paper mills along its route as the result of a strike, its revenue had declined to $800 a month, while its operating expenses amounted to $2,500 a month. The cutting off of the service followed.

Interstate Fares Raised.—The Rhode Island Company, Providence, R. I., has received permission from the Interstate Commerce Commission to establish on its interstate lines the 6-cent zone fare granted some time ago by the State Public Utilities Commission on the company's Rhode Island lines. The order affects passengers on the Danielson and Taunton lines, which enter Connecticut and Massachusetts respectively. The company has been collecting 6 cents for each zone travelled on these lines and issuing refund slips.

Personal Mention

Mr. Pierce Joins Ivy L. Lee

Will Engage in General Publicity Work After Many Years of Newspaper and Corporation Experience

Daniel T. Pierce, who was executive assistant to the president, Philadelphia (Pa.) Rapid Transit Company, from 1906 to 1909, and has been a frequent contributor to this paper, has joined the organization of Ivy L. Lee. Mr. Pierce was graduated from the Columbian University Law School in 1894, and then became editor of *Public Opinion*. After a period of seven years with this paper, he became correspondent of various western papers, and in 1904 became associated with Mr. Lee.

In 1906, at the request of Charles O. Kruger, then president of the Philadelphia Rapid Transit Company, Mr. Pierce joined the forces of that company as assistant to the president and was associated with the company during the strikes of that period. He left the Philadelphia Rapid Transit Company in 1909 to join the McGraw Publishing Company, devoting his time to editorial work on the *Engineering Record*, *Electrical World*, and ELECTRIC RAILWAY JOURNAL.

In 1910 he returned to Philadelphia to become executive assistant with the General Asphalt Company, and remained with that concern until the outbreak of the war. He then acted for a short time as director of the information department of the American International Shipbuilding Corporation, but at the request of the Red Cross officials went to Paris to manage their publicity in Europe, as director of the department of public information of the American Red Cross. He remained in Paris during all of the latter part of the war, returning to this country last spring. Some of his observations on the effect of the war on French tramways were given in an article written by him which appeared in the issue of this paper for June 7, 1919.

Colonel Dillon Joins M. I. T. Staff

Col. T. H. Dillon, Engineer Corps, U. S. A., has resigned to accept an appointment as professor of electrical engineering at the Massachusetts Institute of Technology, Boston, Mass., where he will specialize in the problems of electric railways, steam railroad electrification and power transmission. Colonel Dillon is a graduate of West Point, class of 1904, and of the Engineer School of Application, United States Army, class of 1907. His pre-war experience embraced a varied career in engineering work in Cuba, the Philippines, the Pacific Northwest and the Panama Canal Zone. He was electrical engineer of the Panama Canal and superintendent of the Gatun Locks.

In 1918 he went to France as colonel of the 37th Engineers, a noted electrical and mechanical regiment, and in France served as Deputy Chief Engineer of the First Army of the A. E. F. during the St. Mihiel, the Aisne-Marne and Argonne-Meuse campaigns, in charge of electrical and mechanical work, water supply, army shops and engineers' supplies. At the conclusion of hostilities he was made deputy to General McKinstry, who was chief of the board of damages in Allied countries and had charge of estimates for the American Peace Commissioners of personal and property damages due to enemy aggression.

New Post for Mr. Rolston

Former Superintendent of Indiana Interurban Appointed Superintendent of Power at Kansas City

William E. Rolston, formerly superintendent of power and equipment of the Chicago, Lake Shore & South Bend Railway, Michigan City, Ind., was appointed on Nov. 12 superintendent of power of the Kansas City (Mo.) Railways. T. W. Hogate will continue to act as power engineer of the company until Jan. 1, 1920, serving in a consulting capacity. No change will be made in the power plant organization, members of which will report to Mr. Rolston.

WILLIAM E. ROLSTON

Mr. Rolston was graduated from the Armour Institute of Technology in 1898. Three years later he joined the Dayton & Troy Electric Railway. During his connection with the company, which lasted five years, he served first as chief engineer of power plants and later as superintendent. In 1906 he became superintendent of power and shops of the Canton-Akron Railway, Akron, Ohio, now included in the system of the North Ohio Traction & Light Company.

In the following year he was appointed superintendent of power and shops of the Cleveland, Southwestern & Columbus Railway, continuing to act in this capacity until 1911, when he became general superintendent of the Des Moines (Iowa) Railway. Later in the same year he was named superintendent of the Interurban Railway, Des Moines, in addition to his connection with the Des Moines City Railway. In 1912 he resigned from these companies to accept the position of superintendent of power and equipment of the Chicago, Lake Shore & South Bend Railway, continuing in this capacity until his appointment at Kansas City.

J. F. Winn has been appointed auditor of the Ottumwa Railway & Light Company, Ottumwa, Iowa, succeeding J. Canfield, whose appointment to be auditor of the Union Heat, Light & Power Company has been announced previously this paper.

E. C. Macken has succeeded C. C. as train master of the Columbus ware & Marion Electric Company, bus, Ohio. Mr. Moyer's appoint superintendent of the company elsewhere in this issue of the RAILWAY JOURNAL.

Harold Bates, who has been in the construction engineering ment of the Connecticut Co Haven, Conn., with Charles more than ten years, has with the Winchester Re Company, where he will with the sales engineer At first his work will be ture, with particular ref ing marketing methods of this company.

Arthur W. Thomps Philadelphia Compa holding company of ways, was presente monial from the e more & Ohio Rail formerly vice-pre was in the form one of the finest country. It is e covers are of l bossed in gold lining. In th is the name

C. C. Mo intendent Marion F Ohio, succ Mr. Moy nected seventee tion in ware, becom interu poin he in car in s b

Russell W. Stovel has been appoint a consulting engineer of Westinghous Church, Kerr & Company, Inc., New Yo engineers, and, as a member of that o ganization, will devote his entire time t the company's electrical and mechanical work. Mr. Stovel recently returned from France, where as Lieutenant-Colonel of Engineers, he served as chief of the Term inal Facilities Division of the Army Transport Service. He has had an un usually comprehensive experience in the electrical and mechanical problems con nected with central power station and steam railroad electrification work. He was graduated from McGill University in 1897 with the degree of Electrical Engineer. He had direct charge of the Chestnut Hill electrification of the Pennsylvania Railroad, the Elkhorn Grade electrification of the Norfolk & Western Railroad and the electrification of the New York Connecting Railway linking up the lines operating into New York with those from New England.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER
SALESMAN AND PURCHASING AGENT
ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Storm Reports Increase Sales of Sleet Cutters

Medium Sized Stocks Now on Hand Are Expected to Vanish With First Rush of Orders

Prospects of a coming cold snap are rapidly increasing the sales on sleet cutters according to the latest information received from manufacturers.

The Weather Bureau at Washington reports strong north west winds along the middle and north coasts with light local snows from the lake region and upper Ohio valley eastward, and this, it is believed, will be sufficient warning to the railways to prepare for snow and sleet.

Small Stocks on Hand

Stocks are only moderate and it is expected will be cleaned out by the first big rush of orders. Manufacturers are now engaged in adding to their stocks as rapidly as labor will permit, although up to this time, they were reluctant to do so, in order to keep their forces working on other products which were bringing a ready sale.

Sales of sleet cutters up to the present time have been fair, but not up to the mark of last year. According to one manufacturer, the railways would rather take a chance of operating throughout an entire winter hoping that nothing worse than a mild season would be encountered than expend a fairly small sum in anticipation of a condition they may not be called upon to face. Once the bad weather sets in, however, they are not slow to place comfortably sized orders, as has been evidenced recently, although it is claimed that they are willing to gamble up to the last minute.

Deliveries can be made from stock on medium sized orders. On large orders, partial shipments will be made on receipt of order and the remainder at a later date depending largely on shop conditions and orders on hand.

Hand-Brake Prices to Go Up

Good Deliveries if Ordered From Stock Otherwise Two to Three Months Is Required

Sales of hand brakes for the first six months of 1919 were almost double the sales for the corresponding period of 1918, according to reports received. Recent sales, however, show a decided falling off. This, however, is not unusual as a large volume of orders during the last quarter of any year is not expected.

Buying Is Irregular

The buying has been and still is irregular. A large car order will be given and later a hand-brake order will be placed. Again, numerous orders result from cars which are being rebuilt. There have been some large individual orders placed during the year, but not nearly so many as there should have been.

A price increase is looked for before the end of the present year. This is due to the increases granted foundry men and iron workers, which have been noted from time to time in these columns. Materials also are higher, but the companies are endeavoring to take up as much of the increases as they can absorb. Labor in addition to forcing up prices has also slowed up deliveries. At the present time deliveries can be made on standard equipment from stock. However, it is only from stock that any reasonable delivery can be made. One well-known manufacturer advises that on any type of brakes which are not carried in stock no quotation under three months will be given.

Payment by the railways has been slow of late although previously this condition was more satisfactory. Some of the roads are meeting their bills promptly while others are taking ninety days or longer.

At this time it is not known just what the price increase may amount to, but from present indications it is assured that a rising market will be effective for sometime.

Good Deliveries on Tie Tamping Tools

Fall Orders May Deplete Stocks—Every Effort Being Made to Increase Production

Hand tamping tools have advanced 10 per cent effective from Nov. 1. Production has increased during the past month in spite of difficulties in obtaining steel and coal, but must continue to increase if present stocks are to be built up. The supply on hand is decreasing at a lively rate and with normal sales, will last eight to ten weeks.

Mechanical Tamper Sales Light

Up to Oct. 15, several tool making plants were tied up with strikes which caused a curtailment in production and a delay of three to four weeks in shipments of orders. These plants are now making considerable headway toward completing orders accepted before the strike although deliveries, which were a week to ten days behind, are back two to four weeks. At the present it is doubtful whether manufacturers will be able to get enough stock ahead to fill spring requirements. If any further trouble develops, railway companies, which have not been forehanded in placing orders for their needs, probably will be seriously inconvenienced.

Owning to uncertainty as to the future status of the steam railroads and the decreased earnings of electric railways, orders have been unusually light for pneumatic tie tampers for the past few months. This has given the manufacturer an opportunity to catch up on orders, and deliveries can now be made in five to six weeks on complete sets, including the tampers and necessary tools. The tamping tools can be furnished out of stock.

The feature of recent sales of mechanical tampers has been the increasing number of outfits purchased by electric railways for tearing out asphalt and concrete paving, for drilling bond holes in rails, and for other uses supplementing the original purpose for which the outfit was designed.

Coal Shortage May Force Shut Downs in West

Bituminous Coal Production During Strike 29 Per Cent of Normal—Men Reject Operators' Proposals

Shut downs may occur in the Middle West during December unless conditions which are rapidly reaching a critical stage there are relieved within the next two to three weeks. Conditions in the east are slightly better although all surplus stocks are vanishing rapidly. Everywhere schedules are being reduced and many outlying localities are reported to be operating only from 50 to 70 per cent of their cars.

At one of the largest coal receiving companies in the Greater New York district, it has been learned that shipments of coal to tidewater were reduced 50 per cent during the week of Nov. 22-29, to permit all coal mined during a portion of this period to be shipped to the West and North. This may temporarily relieve some railways and public utility companies, but on the whole the amount shipped will scarcely be a drop in a bucket as every one is now in the market and it is a question of having the government fuel administrators distribute what little coal there is available.

Railroads Confiscate Coal

Railroads over which coal is being carried have in some instances started confiscating car after car for their own use. Three different companies within the past two weeks are reported as having lost as high as thirty cars of coal and in one instance sixty cars were taken.

Reports from the conference in Washington, D. C., where representatives of the coal miners and coal operators have been called before committees, are to the effect that coal operators claimed to have granted all that they possibly could in the increase of 15 cents a ton which would represent a 23.2 per cent increase to pick miners and a 35.1 per cent increase to machine workers. The miners, however, rejected this offer without making any counter proposal.

Production at Low Point

Production of bituminous coal, for the week ended Nov. 8, during which the strike was in progress, according to latest reports from the Geological Survey, is estimated at 3,477,000 tons, or approximately 29 per cent of the average for the four weeks ended Oct. 25, in which production was at the highest rate attained this year.

Production for the week of Nov. 8 was the lowest recorded in recent years, for no strike has ever before affected all union mines at the same time. The daily average output in the week, of 580,000 tons, was 54 per cent greater than on Saturday, Nov. 1, the first day of the strike.

For the second week of the strike production was 33 per cent of normal as compared with 29.4 per cent during the first week. From reports received since Nov. 15, it is believed the tonnage being mined is just about the same as was recorded during the first two weeks and that the final reports will show production not more than 35 per cent of normal for this period.

Deliveries on Track Brooms in Less Than a Week

Stocks in Good Shape and Fair Sales Being Made—Winter Season Creates Big Demand

Wire brooms and brushes in reasonable quantities can be delivered within two to three days of receipt of order. On rattan brushes, about a week is required, one company making up brushes to order in that length of time.

Up to the present time, sales have only been fair, probably due to the mild weather which has been prevalent over the country. As the first quarter approaches, sales usually take an upward spurt and hence good sales are expected within the next four to six weeks.

Production for the past month has been above normal although there was little done previously. Labor troubles have affected manufacturing to some extent, but all demands can be met out of surplus stocks which are sufficient to last a number of weeks with normal sales.

Prices have advanced slightly, but this evidently has not been a check to the buying, which although rather light so far, has been regular.

Bond Tester Sales Increase

Prices Now Lower Than Those In Effect at the Time Armistice Was Signed —Four Weeks for Deliveries

Sales of bond testers declined somewhat during the war, but business is now picking up again and seems to be rapidly nearing pre-war demand.

No attempt is made by manufacturers to carry a stock of bond testers except by branch offices and agents whose samples often are used to take care of urgent orders, since factory deliveries in virtually all instances can be made in four weeks. This, as a rule, is satisfactory to purchasers.

Bonds are usually tested during spring, summer and fall, but now there is an increasing tendency to test bonds during the winter months, due to recent mild winters and the realization that bonds must be maintained in the best possible condition to keep down operating costs. This tendency to test bonds during winter months has resulted in orders for bond testers.

Prices have not increased recently; in fact, prices were reduced shortly after the armistice was signed and these are still in effect.

Window Glass Scarce

Acute Shortage of Stocks Has Developed —Labor Troubles Keep Down Production—Long Deliveries Rule

Purchasing agents who failed to place orders for window glass requirements are now faced by long delivery quotations, if they are possible to obtain any at all, and by prospects of an increase in prices dependent upon the action of glass blowers and glass wokers who have been holding up production in some sections. Stocks are badly depleted especially those of heavy glass of which there is little or none to be had. The greatest demand is for heavy glass of the 39-oz. size or what is commonly called 3/16 in. Recently two car builders placed inquiries for large amounts but were unable to get any glass of this size. Heavy demands also have been made for the 34-oz. and for the 29-oz. variety. Delivery of from eight to twelve weeks on a limited supply of the lighter grades are being quoted by one large jobber.

Prices are firm. Quotations as of Nov. 18 are as follows: On car window glass, first three brackets, A and B quality, New York, there is a discount of 77 per cent; on car window glass, of double strength, AA quality, New York, 79 per cent off and on car window glass, double strength, BB quality, New York, the discount is 81 per cent from jobbers lists based on the official list of March 1, 1913.

Mr. Lincoln Joins Lincoln Electric Company

Paul M. Lincoln, for many years commercial engineer of the Westinghouse Electric & Manufacturing Company, has resigned from that organization, effective November 1, to take active charge for the Lincoln Electric Company, Cleveland, Ohio, of its motor application engineering.

Mr. Lincoln is a prominent figure in electrical engineering circles, having designed and installed the first hydro-electric power plant at Niagara Falls and subsequently directed its operation for a period of six years. He also developed the first high-tension voltage transmission line and is to-day one of the best known authorities on this subject. Among many other inventions, he perfected a synchronizer especially adapted by the Lincoln Electric Company for paralleling large electric alternators. For this he has received different medals and awards. Mr. Lincoln was president of the A. I. E. E. in 1914.

Scrap Iron and Steel Advancing

Short Lengths of Steel Rails in Fair Demand—Scrap Dealers Holding Out for Higher Prices

Within the past four weeks there has been a very appreciable stiffening in the scrap iron and steel market, with but little demand, except for cast iron, accompanying the advance in price. Scrap dealers who have been watching the pig iron market are reluctant to sell their holdings at present prices, but are waiting for a further advance.

A firm conviction that the steel strike is now virtually over but that, nevertheless, a lessening in production must inevitably result has been responsible for the renewed firmness in scrap. Besides, a number of gondola cars have been released to the dealers, offering an opportunity to move accumulated stocks.

Reports from Cincinnati are to the effect that short lengths of steel rails are being purchased in fair-sized tonnages. $22.50 to $23 per gross ton was quoted on Nov. 11 for steel rails for melting in this market. This price has held and in numerous instances $24 has been paid in the Chicago and Pittsburgh districts for heavy steel scrap.

Malleable scrap is becoming very scarce, it is reported, under a heavy demand.

Since Nov. 11, several scrap products have increased considerably. According to Pittsburgh quotations of Nov. 18, rerolling rails have advanced $1, at $29 to $30; heavy steel scrap $1, at $22 to $23; while railroad malleable is up $2 to $3 at $22 to $23. Old iron car wheels at $25 to $26 and steel car axles at $28 to $29 have not been affected by price increases.

No changes are recorded in any of the above quotations for Nov. 25, with the exception of those for car wheels, which in the Chicago and Philadelphia markets are up $2, although the price in Pittsburgh remains the same as last week.

Heavy Culvert Sales Predicted for Fourth Quarter

Producers Have Difficulty in Getting Steel —Deliveries Good Except in a Few Localities—Price Advance Likely

Recent sales of iron culvert show a very great improvement and although the Fall and Winter months are really the off-season, reports from a number of culvert jobbers indicate that for this period of the year more business is being booked than ever before. Sales reports for October and the first half of November indicate that the fourth quarter may break all records. Although there is little railway or railroad work now being done, buying of metal culverts is regular and a very healthy condition exists due to the influx of finances from the Government in its Federal aid work.

Due to the great momentum that the road work in the United States has taken on, it is believed that conditions will continue to improve. Sales for the first half of the year were approximately 10 per cent less than for the corresponding period last year. This, however, was a readjustment period and that condition was rather to be expected.

Prices are as firm as they have ever been in the culvert industry and due to the recent upward tendency in steel and iron it is expected that advances will have to be made. The prices have not advanced recently and it is believed the new schedule of prices, if such becomes necessary, will not be announced until after the first of the year.

Individual orders of considerable size are reported from different culvert companies, but these are confined mostly to counties which are contracting for considerable road work. Naturally the scarcity and high price of labor are two very important items and have had much to do with delaying needed work.

At the present time good deliveries can be obtained from stocks of different jobbers, but owing to the lessening of shipments of raw materials to the rolling mills, deliveries later are expected to be much extended, especially if this phase of the situation does not improve.

Rolling Stock

Beech Grove (Ind.) Traction Company, is in the market for three Birney safety cars.

Southern Michigan Railway, South Bend, Ind., has purchased one snow sweeper and one new trailer.

Washington (Ind.) Street Railway has purchased three safety cars from the National Safety Car & Equipment Company.

Chicago, South Bend & Northern Indiana Railway, South Bend, Ind., is reported to have purchased ten safety cars for operation in South Bend.

Chicago, North Shore & Milwaukee Railroad Company, Highwood, Ill., is reported to have placed orders for ten cars and additional equipment totaling $800,000.

Los Angeles (Cal.) Railway Corporation is advised by the Railroad Commission of the State of California, in a decision handed down Nov. 12, to purchase 400 safety cars at a cost of $2,800,000. Reference to this decision is made on page 959 of this issue.

Track and Roadway

Montgomery Light & Traction Company, Montgomery, Ala.—The Montgomery Light & Traction Company plans a general rerouting of its cars and the elimination of about 2 miles of track.

Tidewater Southern Railroad, Stockton, Cal.—The Tidewater Southern Railroad will begin the construction of a line to Fresno, Cal., early in 1920. The right-of-way of the proposed line is now being surveyed.

Indianapolis (Ind.) Street Railway.—George Lemaux, member of the Indianapolis Board of Works, has announced plans for the construction by the Indianapolis Street Railway of a line from Virginia Avenue to Kentucky Avenue on South Street, and out Kentucky Avenue. The board will order the laying of double tracks in Ohio Street for the accommodation of interurban cars.

Arkansas Valley Interurban Railway, Wichita, Kan.—The Arkansas Valley Interurban Railway is reconstructing its terminal facilities at Wichita. A passenger and freight station is under construction and 5 miles of track are being laid to enable the company's cars to enter Wichita over its own right-of-way.

United Railways, St. Louis, Mo.—Rolla Wells, receiver for the United Railways, has applied to the Federal District Court for permission to purchase 300,000 granite paving blocks at 8 cents each. Mr. Wells has also asked permission to lease the property at 3108-12 Laclede Avenue to the Board of Education for three years at a monthly rental of $65.

Binghamton (N. Y.) Railway.—The Binghamton Railway is extending its lines from Hill Crest to the plant of the Universal Can Company at Hiresville.

Oklahoma Union Railway, Tulsa, Okla.—The Oklahoma Union Railway will extend its line to Okmulgee via Beggs and the Beggs oil district. The Okmulgee extension will be built early in 1920 if conditions continue favorable.

Dallas (Tex.) Railway.—The Dallas Railway reports damage amounting to $25,000 due to the excessive rain in Dallas on the night of Oct. 31. The downpour put out of commission seventy-five of the company's cars. Water in many places was 1 ft. or more deep on the tracks and the roadbed on unpaved streets was badly washed.

Saskatoon (Sask.) Municipal Railway.—The City Council of Saskatoon has voted to extend the Twentieth Street line of the Saskatoon Municipal Railway at a cost of $1,818.

Sherbrooke Railway & Power Company, Sherbrooke, Que.—The Sherbrooke Railway & Power Company is extending its railway lines at a cost of $50,000.

Toronto (Ont.) Civic Railway.—The Ontario Railway Board has approved plans for the construction of an extension of the Bloor Street line of the Toronto Civic Railway.

Toronto (Ont.) Railway.—The Ontario Railway Board has ordered the Toronto Railway to complete its Pape line extension by July 15, 1920. Construction is to begin not later than April 15 next.

Power Houses, Shops and Buildings

Pittsburgh (Pa.) Railways.—The receivers of the Pittsburgh Railways have received from the United States District Court permission for the purchase of a piece of property worth $3,000 in the Lebanon Heights' district on the Washington Street line, the property to be used for the making of improvements in the service. The property, the receivers agree, will be placed in trust.

Trade Notes

National Carbon Company, Inc., Cleveland, Ohio: Brush Bulletin No. 13 describing armature and field coil tests and methods for locating troubles.

Gaston, Williams & Wigmore, New York, N. Y., announce the addition to its staff of G. A. Trube, formerly export manager of the Westinghouse Airbrake Company.

Sanford-Riley Stoker Company, Ltd., Worcester, Mass., announces that G. Brennan has been transferred to the sales department of the Chicago office. He will be succeeded by Otis C. Sheldon.

Acme Electric & Manufacturing Company, Cleveland, Ohio, announces that C. H. Bunch, formerly chief engineer of the Electric Products Company, has become secretary and engineer of the company.

Pierce Fuse Corporation, Buffalo, N. Y., announces the appointment of P. S. Klees, as vice-president and sales manager of the company. He was formerly manager of the Franklin Incandescent Lamp Works, New York City.

Canadian Westinghouse Company, Ltd., Toronto, Can., announces that H. U. Hart, chief engineer of the company, has been appointed general manager, succeeding F. A. Merrick. Mr. Merrick is still vice-president and a member of the board of directors.

Chicago Mica Company, Valpariso, Ind., announces that L. P. Frederick, formerly of the research engineering department of the Westinghouse Electric & Manufacturing Company, is now consulting engineer and production manager for the company.

British Aluminum Company, Ltd., London, Eng., announces the appointment of Ernest B. Pannel as special sales engineer who will be located in New York City. For the past four years he has acted as manager to the Canadian head office of the company in Toronto.

Railway & Industrial Engineering Company, Pittsburgh, Pa., announces the appointment of Harold H. Rudd, as vice-president and secretary of the company. He has been with the Westinghouse Electric & Manufacturing Company since 1904, where he has spent most of his time in the commercial department.

Norma Company of America, N. Y., announces that O. P. Wilson, formerly assistant general manager, has been elected vice-president of the company. He was for many years one of the head buyers in the purchasing department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Kelvin Engineering Company, Inc., New York, N. Y., has organized a new department to do general engineering and contracting work in this country and in Latin America. This department will be in charge of Carlos Lobo, formerly borough engineer, Department of Water Supply, Gas and Electricity, Brooklyn, N. Y. The company is now prepared to execute contracts for furnishing and erecting electrical and industrial machinery and equipment.

Handy Supply & Manufacturing Company, Cleveland, Ohio, announces that E. H. Martindale has accepted the position of president and general manager of the company. He graduated from Case School of Applied Science in 1908 and is widely known as a brush expert, having been with the National Carbon Company for the past ten years. He is a member of the board of directors of the A. I. E. E. and has served two years as chairman of the Industrial and Domestic Power Committee. During the war he was a captain of engineers and spent one year in France.

General Electric Company, Schenectady, N. Y., has leased the rigid-conduit business of the American Conduit Manufacturing Company, New Kensington, Pa. This business, which will continue to be operated at New Kensington, will be conducted by the Sprague Electric Works. The Galvanite and American brands of rigid conduit will be continued, and no change is contemplated in the terms or conditions under which the trade has been dealing with the American company. Plans are being made for the enlargement of the plant, and additional equipment will be installed. There will be no change in the personnel of the American Conduit Manufacturing Company, according to a statement by D. Hayes Murphy, president of the company, but the name will be changed to the American Wiremold Company, and it will concentrate upon the manufacture of "Wiremold" surface raceway and "Wireduct" non-metallic tubing at Hartford, Conn., where the company has taken over the plant of the Franklin Lamp Works. H. B. Kirkland, vice-president, will divide his time between the Sprague Works in New York City and the American Wiremold Company at Hartford.

New Advertising Literature

Harvey Hubbel, Bridgeport, Conn.: Circular No. 183 on Hubbell Current Taps.

General Electric Company, Schenectady, N. Y.: Bulletin No. 47530 superceding Bulletin No. 47503, and describing its type CP air circuit breakers.

Sprague Electric Works of the General Electric Company, New York, N. Y.: Bulletin No. 47942 on safety panel boards and cabinets.

General Electric Company, Schenectady, N. Y.: Bulletin No. 47702A superceding No. 47702 and covering rheostat and compensator operating mechanisms.

Westinghouse, Church, Kerr & Company, New York, N. Y.: Illustrated circular on shops, containing pictures of a large number of shops built for manufacturing companies and railroads.

Merrill Company, San Francisco, Cal.: Booklet describing and illustrating the Nordstrom lubricated plug valve, originally designed for use in mining and milling operations, but now being applied in the general engineering field.