

Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

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A Number of Celebrations Were Held on May 4

THE prominence that was given to National Electric Railway Day by the newspapers generally throughout the country on May 4 and 5 indicates the importance in which the industry is held by those who deal in publicity. The committee on publicity is to be congratulated on the success of its national advertising. It was a notable achievement in so short a space of time to enlist the support of so many companies and to have them successfully stage demonstrations of one sort or another. That this was possible shows a realization on the part of the industry that up-to-date merchandising methods bring results. Few believed that National Electric Railway Day could attract such widespread attention. But when virtually all the papers of the country carried either a national or a local story of the development of the electric traction industry the effort was well worth while. The effect on each property of thus recalling the history of the enterprise to the people's memory must be beneficial. It should result in a better general understanding of the railway's problems, help to change walkers to riders and conduce to a more sympathetic attitude on the part of the public toward the railway's affairs. Means which will bring about these results are worthy of encouragement.

Keep the Coal Moving from Mine to Power-House Bunker

THE National Coal Association is making a strenuous effort to stimulate prompt buying of coal, as the demand during the past four months has been "off" to an alarming extent. As the producing companies have practically no storage facilities this means that there is an accumulated deficiency in production, which will necessarily cause congestion later. The movement will remind electric railway men of the paper read at the Atlantic City convention last October by Eugene McAuliffe of the Union Colliery Company, St. Louis. He explained clearly the coal problem as it is viewed by the producer. He showed how the consumer exerts a powerful influence on the cost and adequacy of coal production, and advocated legislation which would provide for a seasonal variation in freight rates to induce flow at times of otherwise light demand. He showed, also, that the *bête noire* of the coal business is this light demand during the first few months of the year, which is illustrated to an extreme degree by conditions in 1921.

The Coal Association seeks to lay the burden for present conditions on the consumers, but the latter, at least as far as the electric railways are concerned, are justified, to a considerable extent, in "passing the buck" back again. A buyers' market has replaced the sellers' market which existed during and immediately after the war, putting the electric railways in a better position than they occupied formerly. They will undoubtedly, however, co-operate in a movement to cause uniformity

in coal demand, but the producers must so adjust prices as to overcome the present obstacles as to the placing of orders. The railroads have an important part to play here also. Granted, however, that the electric railways are convinced that all is being done by the mines and railroads that can be done, then they are justified in storing the maximum possible quantities of coal, for they will profit in the end financially and otherwise when the mines operate with greater regularity.

Coal Demand Is Affected by Many Considerations

THERE is no doubt it is desirable to keep the coal mines operating and the coal moving. But what are the factors involved? In this connection three main questions arise: First, why is the demand so light this spring? Second, can electric railways buy more coal now than they require for current needs? Third, what economic forces can be modified to improve the situation as a whole?

As to the first question, undoubtedly the situation is a reaction from the condition of last year, when the supply which could be delivered was far less than the demand, and prices soared. Prices are lower now and the former car shortage has been replaced by a surplus, but the consumers do not buy. There are several factors in this which may be suggested by these possibilities: There may not have been a price drop considered to be commensurate with what is justified by conditions, even though prices are now lower than those set by the coal administration during the war; the actual conditions may not be fully understood; there may be lack of confidence in the stability of prices; the financial stringency may cause a willingness to "take a chance" as to higher prices and possible later shortage; there may be some apprehension as to ability to store much coal without serious loss and some question as to the economy of investing money for this purpose; there may not be any conviction that present lack of demand means later shortage.

As to the second question, the electric railways already do a great deal in the way of storing coal. Investigations made by the American Electric Railway Association indicate that on the average about six weeks' supply is carried. The coal requirements of the electric railways are rather uniform, but they naturally need a reserve to insure continuity of service and they desire to take advantage of any money saving which is within reach. Hence they have considered storage a desirable part of their power-plant program. Probably they can stretch their storage space a little if they can see their way clear to buy coal to fill it.

After all, the principal way in which the electric railways can help the producers is indirect rather than direct. Nationally the electric railways now "cut quite a figure," much more so than before the war. Thus they are in a position to help, more perhaps than for-

merly, any practicable scheme for improving the coal situation. They can keep the subject prominently before their constituency and can join as an industry with other great coal-consuming utilities and with coal producers and transporters in removing unnatural barriers to the production, carrying and utilization of that basic necessity, coal.

Conditions Are Better on Several Typical Properties

CORROBORATION of the cheerful outlook for the future reflected in the recent figures of earnings of the electric railways as made public by the American Electric Railway Association is to be found in the returns which are contained in the annual reports of the individual companies for the year ended Dec. 31. These reports are now being received for review and almost without exception they show that the corner was turned some time ago. This does not mean that trying times are over. Far from it. But the returns coming in do indicate most healthy growth in gross receipts, with expenses within bounds and the prospect bright for operation in the future at lower cost.

An example or two will suffice. All the roads examined show healthy growth in gross. In one or two instances, in fact, this growth has been phenomenal. Thus one strictly interurban road shows an improvement in gross over the previous year of about \$1,000,000, while the net increased only \$46,000. This seems disproportionate. It is. The cheering fact, however, is that the growth of the business has been substantial and may reasonably be expected to remain constant and even to go on increasing, while there is every prospect that expenses will be reduced through decreases in operating costs, with the result that the spread between gross receipts and expenses will widen.

On another property doing a combined city and interurban railway and lighting business the gross earnings have grown from \$10,521,000 in 1913 to \$21,350,000 in 1920. The increase in the receipts on the interurban lines in this period has been 99 per cent and on the city lines 52 per cent. The operating ratio, which in the case of this company is always quoted inclusive of taxes, has gone from 58.8 per cent to 72.7 per cent. Even so, a return to the average operating ratio of about 60 per cent would mean a difference to the benefit of the company of more than \$2,000,000. Many there are who will be apt to say that it is too much to expect an early return to the old operating ratio, yet the prospects for this property most certainly appear bright.

On still another property a saving of more than \$1,000,000 was brought about at one fell swoop by a recent reduction in wages. It may be that much of the money thus saved will find its way back into the property in the nature of improvements. Even if it does, the equity of all the security holders will be increased just that much and the financial credit of the company will be bettered accordingly. Sight must also not be lost of the fact that the prospect for the further easing of money rates in the near future should result in no inconsiderable saving in interest charges to companies, when refunding is carried out of borrowings negotiated at high interest rates during the wartime competition for loanable funds. Moreover, the better morale now everywhere apparent is an advantage very often incalculable in the form of dollars and cents, but not intangible in a case such as that at Kansas

City, where 900 fewer employees are this year employed in operating the largest number of cars in the history of the company.

Reports of a group of syndicate properties widely scattered geographically confirm what has been said previously with respect to the outlook of the individual properties to which reference has been made. True, the recent depression in business has affected adversely to some extent the gross receipts of a number of companies, but with a revival in trade and lower cost for labor and supplies, all companies ought soon to be in a much more healthy condition. Here and there a manager still struggling fiercely with the problem of making both ends meet may be inclined to think we are chasing rainbows, but that will be only because he has been so deeply employed in trying to steer his own ship home safely through the fog that the ray of sunshine which is penetrating the mist in the distance has not yet been discernible to him.

Serviceable Use Found for Mr. Edison's Questions

AIDED and abetted by the Encyclopedia Britannica, the Book of Knowledge, Young's Astronomy, Bartlett's Familiar Quotations and Montgomery's American History anybody can answer the question, "Who was Marion?" and a lot of others propounded by Mr. Edison. It is an advantage, of course, to be well informed, and even the encyclopedic mind has its utility, but, as Spencer held, it may be said that education has a much higher function than developing in its recipient the ability glibly to answer questions about a lot of unrelated subjects. More particularly it is hard to see the value of questions such as Mr. Edison has propounded if applied in a test to determine the qualifications of an applicant for the position of a motorman or conductor or one seeking a job in the engineering, accounting or legal department of a railway.

Other doubting Thomases have also come forward. Among them is none other than Frank Hedley, president and general manager of the Interborough Rapid Transit. Mr. Hedley is peculiarly well fitted to judge. A graduate of the school of hard knocks, he knows the weaknesses of both the self-educated man and the college graduate, but he comes out strong, all other things being equal, for the man with collegiate training. It is Mr. Hedley's opinion, based on experience, that the man cannot be held down who does things a little better than some one else. Failure to answer questions such as Mr. Edison has set us as a standard will never daunt the ambition of men who are bent on being well informed on their chosen work or the work into which fortune, good or ill, has cast their lot. The views of Mr. Hedley on measures and men as expressed by him recently before the Cornell Society of Engineers are noted elsewhere in this issue.

While Mr. Edison's quotations may not be directly applicable to railway work, the compilation of his list offers this suggestion to the editors of publications circulating among the rank and file of the employees. Let them publish a dozen or so of such questions each month and answers the next, based on the little-remembered facts of history, civics, biology or chemistry, and even phases of railway work. Such a selection would renew the acquaintance of their readers with this knowledge and would be of much greater value than the general run of puzzle questions. Similar questions could also be propounded in circulars intended for distribution to the

general public, and herein, it appears, lies the greatest utility of conundrums such as those propounded by the "Wizard of Menlo Park."

Remodeling Cars Is Marking Time

REPORTS are coming from all over the country of cars being remodeled and reconstructed for one-man operation. A considerable number of these cars before remodeling were considered obsolete or at least obsolescent. Many are open cars, and a large majority are double-truck cars. The reason for this increase in car remodeling is evident. The railways need additional equipment to maintain their service but have little money available for buying new equipment. The cost of such remodeling runs from \$800 up to more than \$3,000, depending on the extent to which changes are made. In most cases the operating companies are thus enabled to obtain from two to six remodeled cars for the same cost that one new safety car costs.

Generally the reason given for remodeling instead of purchasing new equipment is that of economy, plus necessity. Almost any company will admit that new equipment is more desirable than that built over, but it wants its equipment to keep pace with its growing traffic and claims that this is the only way in which this can be done. But if the question is one of economy, decision as to the policy to pursue can be determined only when all costs are considered, and negligence in this matter may mean that erroneous conclusions are reached.

The cost of old equipment does not end with the shop expenses during rehabilitation. The car body, besides being old and perhaps not well adapted to the new service, is pretty sure to be much heavier than modern equipment. The motor equipment, if old in style, is almost certain to be wasteful of energy, subject to a much higher maintenance expense and slow in acceleration. Finally, with the automatic devices, power-operated doors and step and other equipment for quick acceleration, retardation and passenger interchange, the modern cars make shorter stops and have a higher schedule speed—all of which means a great saving in expensive car-hours. Altogether, therefore, estimates on the economy which will result from the use of rebuilt equipment should include all of these points before definite conclusions can be drawn.

The remodeling which is being done should help to determine the size and capacity of cars that can be handled satisfactorily by one man in various classes of service. Many of the remodeled cars are much larger than the standard Birney car, and their use should demonstrate whether a larger type of car can be used in such service when operated by one man. The question of using a double-truck car instead of the single-truck type now used for

one-man operation will also receive considerable attention. Broadly speaking, there is no doubt that the double-truck car has easier riding qualities than the single-truck type, as at present constructed, and is therefore more popular with the traveling public. Whether the economies resulting from the reduced weight of the single-truck car are more than sufficient to offset the advantages of the double-truck car is a question that this remodeling should help to solve. Viewed in its general aspect, the remodeling of cars is really a marking of time by the railways to tide them over this period of depression, yet this work should help to solve many points which are now open for discussion and eventually lead to a type of car which will be an advance in the art.

The Law of Compensation Remains Immutable

"PALPABLY erroneous and at best irrelevant" are the words with which the receivers of the Pittsburgh (Pa.) Railways dismissed the charges made against the company by George N. Munro, special solicitor for the city. Briefly these charges, as described in the last issue of this paper, were that the property was being rebuilt out of earnings at the expense of the car rider, whereas much of the work done was really a charge to capital. From the evidence at hand, railway men will be inclined to agree with the receivers. The facts are that the Pittsburgh Railways was long made the butt in political intrigue, with the result that the creditors eventually had to appeal for protection to the court. The managers of the road did the best they could before the receivers stepped in, but they were forced, in order to keep things going, to live out of capital. Through no fault of their own, except that of not being able earlier to convince the regulating authorities of the need for higher fares, the former managers had been compelled to see the utility of the property as a public service gradually dwindle. They were powerless to do the impossible. The court, however, said that the first duty of the receivers was to the public, and it is under the mandate of that body that the property is being rebuilt into fuller usefulness.

There is much to quarrel with in the report of Mr. Munro, but the principal objection to it is not so much

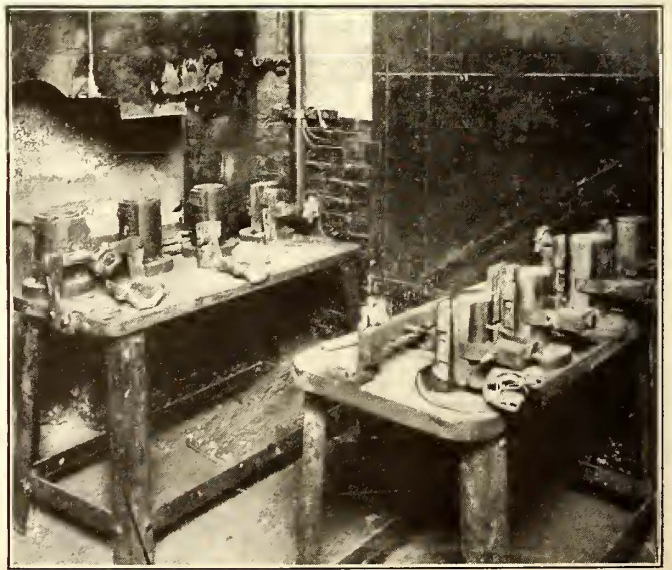
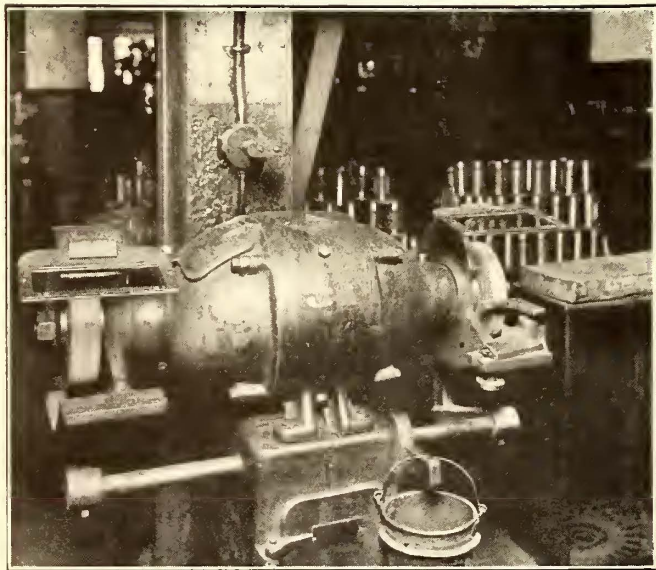
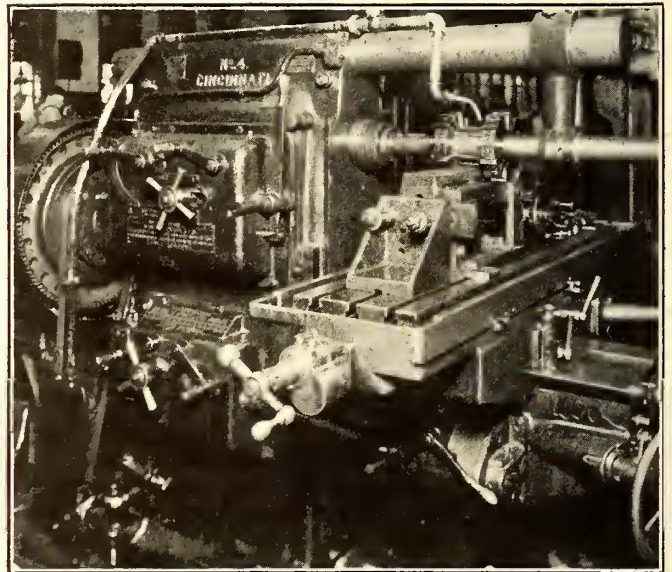
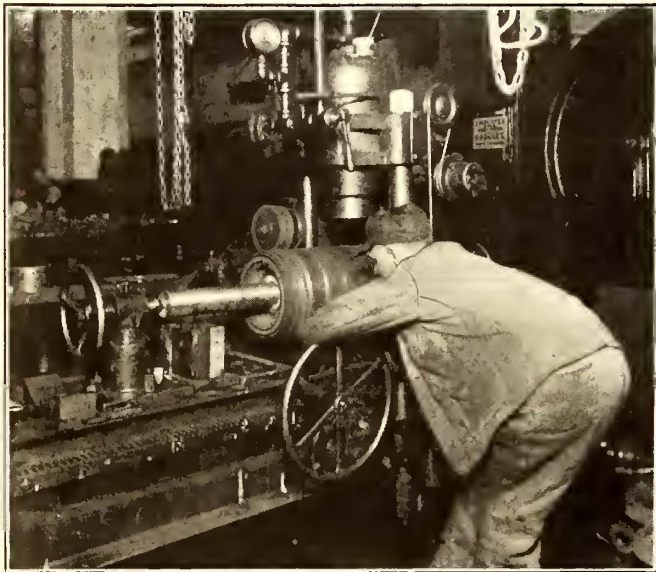
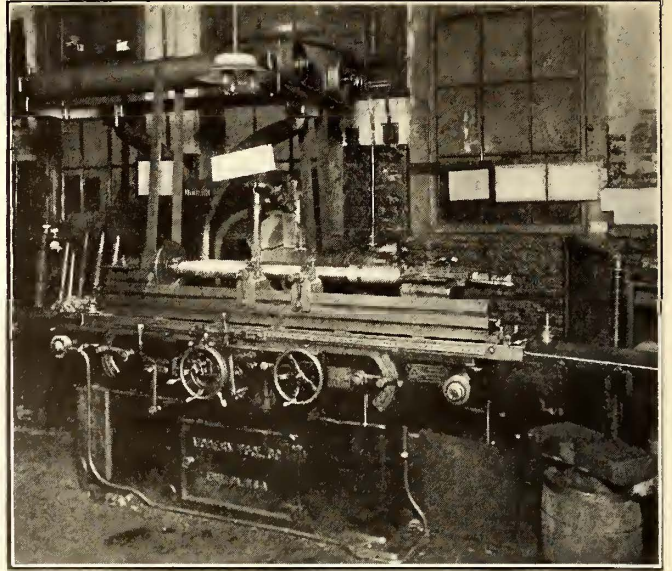
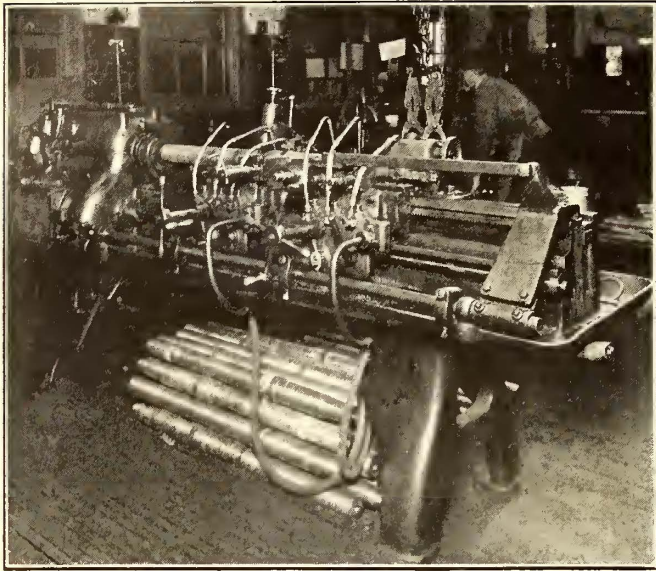
what it says, but in the intimation that the riders of Pittsburgh are being milked by receivers who are interested only in rebuilding the property out of the earnings. This of course is not in accordance with the facts no matter which of the three sets of valuation figures is accepted as a criterion of the value of the road. Residents of Pittsburgh rode for months at less than cost to the company. They must expect now to make good for that orgy. The only other way is abandonment and dismantlement. The law of compensation still remains immutable.

Quotation from the *Federal Electric Railways Commission Report*

No. 21

THAT street railway service and jitney service cannot permanently exist and pay their own way in competition with each other under any ordinary urban conditions seems to be well established by experience and by the conditions inherent in local transportation service, but the belief is general that the motor bus may properly be used to supplement the service rendered by the street cars. The motor bus may be used to render a sort of supplementary service, such as the service now rendered on Fifth Avenue and certain other high-grade residential streets in New York City by the Fifth Avenue Coach Company, or the buses may be operated on other independent routes merely as feeders to the street railway system to take care of traffic in partially developed territory in advance of the time when street railway tracks can be laid with reasonable assurance that the investment will be self-sustaining.

Chicago Surface Lines Tools Which Effect Economies in the Shops!



Top, left, six-operation "Lo-swing" lathe which speeds up armature shaft turning for Chicago Surface Lines.

Top, right, grinder used in finishing armature shafts, brass axle bearings and for miscellaneous work.

Middle, left, one-man shaft straightening machine. Friction driving pulley against armature while chalking eccentricity.

Middle, right, forming cutter and milling machine used in re-machining built-up truck pedestal gibs.

Bottom, left, emery wheels fitted with glass protectors to make certain the protection of workmen's eyes.

Bottom, right, babbiting jig by which uniform dimensioned bearings are assured and which eliminates waiting for cooling.

A Few Chicago Shop Economies

Reducing the Cost of Machining Armature Shafts—Short Keyway Advantageous—Collett and Mandrel Facilitate Grinding of Brasses—One-Man Armature Shaft Straightener—Handy Babbitting Jig—New Air Tank Support

ALL replacement armature shafts for the Chicago Surface Lines are purchased in the rough blanks and machined and finished in the company's shops. This has been the practice for years, but the tools and machines employed were such that there was a good deal of difficulty in keeping up with the demand. Recently a special layout of machine tools was devised which now enables the shop not only readily to keep ahead of requirements but to turn and finish a shaft for a labor and overhead cost of approximately \$4.75, as against an outside comparable cost of \$15.

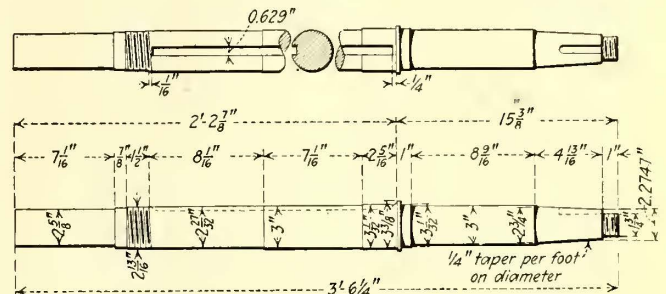
A group of seven machines is conveniently arranged for the progress of a shaft through the seven steps in its manufacture. It is first mounted in a centering machine and the ends drilled and countersunk for the lathe centers. A roughing lathe, adjacent, equipped with a high-speed cutting tool, turns off the rough surface and brings the shaft down in one pass to a size slightly larger than the biggest diameter. The shaft is then placed in a "Lo-Swing" lathe made by the Fitchburg (Mass.) Machine Company, in which the seven or more surfaces are turned. This machine, pictured herewith, is capable of performing six cutting operations simultaneously and each operation is equipped with an automatic feed and stop so that the length and depth of cut are automatically controlled. It is also equipped with a tapering device so that the taper for the pinion seat is made while the shaft is swung in this lathe, and this cut is likewise automatically controlled. The final cut on each surface of the shaft is made with a finishing tool.

The next step is to put the shaft in a grinder, shown herewith, where the various surfaces are brought down to the final diameter and a very smooth finish, an allowance of 0.012 to 0.015 in. being made for this finishing operation.

On the next and fifth step the shaft is swung in a lathe set up especially for threading the shaft. Next, the shaft is placed in a circular mill and the long center keyway for keying the armature core laminations and commutator is cut. For the seventh and last step the shaft is mounted in an end mill in order to cut the keyway for the pinion key. This is cut by first forcing the rotating end and side-cutting tool straight in radially, drilling a hole to the finished depth of the keyway and then side-cutting axially out toward the end of the shaft and coming out of the tapered surface just above the threaded end.

By means of these seven machines it is possible to complete nine shafts per eight-hour day and bring them to an accurate size and high finish. The grinding operation is the limiting step in the speed of production, so that in putting through shafts of a given type in lots of 100 the machinists on the six other steps are used on other work after completing their particular part of the machine work on the lot. By putting the shafts through in quantities of one type the time lost in setting up the machines for the different types is reduced to a very small item.

A new kink has been worked out in connection with the keyway for the pinion, which is designed to preserve the maximum strength of the shaft at the inner end of the taper where the maximum strain takes place. The keyway is machined only from a mid-point of the tapered surface to the end, leaving the full section of the shaft at the inner side of the pinion. It was felt that with a perfectly tapered and finished shaft and pinion, and with pinion properly pressed on, no key whatever is really needed. However, H. H. Adams, superintendent of shops and equipment, and T. A. Shaughnessy, master mechanic of the West Side shops, were not satisfied to depend altogether on friction, though they did conclude that a half-length key would



ARMATURE SHAFT FOR G. E. 226 MOTOR, SHOWING HALF-LENGTH KEYWAY FOR PINION

give adequate insurance against loose pinions. A drawing of a shaft showing the dimensioning of the half-length keyway is reproduced herewith.

OPEN CIRCUITS TRACED TO CORE SLIPPAGE

Considerable trouble with open circuits due to breakage of the commutator leads on a type of motor having a very short core has been experienced in Chicago. The cause of this trouble was sought for a long time and various remedies were applied. The trouble continued, however, until occasion arose to renew several armature shafts. Then it was found that a very slight slippage of the armature core laminations on the shaft, amounting to something less than $\frac{1}{16}$ in. at the periphery of the core, was taking place. Investigation developed this fault to be frequent, the existence of slippage being indicated or determined by sounding, by worn keys, by testing with a bar, rusty shafts, front core castings loose, etc. As any movement of the armature core on the shaft would be transmitted directly to the commutator leads and likely result in crystallization of the copper, this condition was hit upon as one cause of the unduly large number of opens. Hence, as these motors have been in service for a number of years, they are all being dismantled and rebuilt in a fundamental way as rapidly as they come in, so that there should result a material lowering of the maintenance cost in the future. In doing this work the old shaft is pressed out and the laminations bolted together, rebored for a shaft $\frac{1}{8}$ in. larger in diameter and a new keyway cut in them.

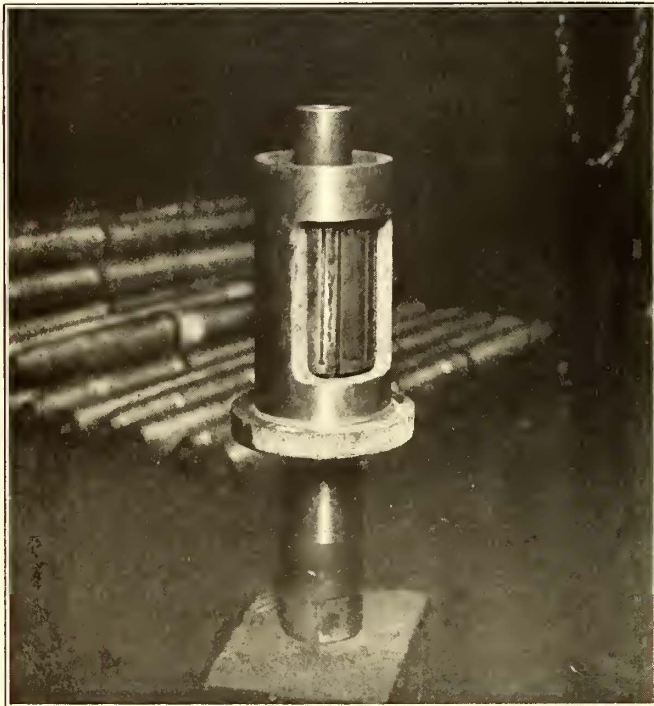
Since this remedy has been applied the trouble has apparently been eliminated. The experience is pointed out here simply to suggest that this is a possible source of open circuit trouble, which, though uncommon, may explain a similar trouble on which other equipment men may have been seeking light.

GRINDING BRASS BEARINGS FACILITATED

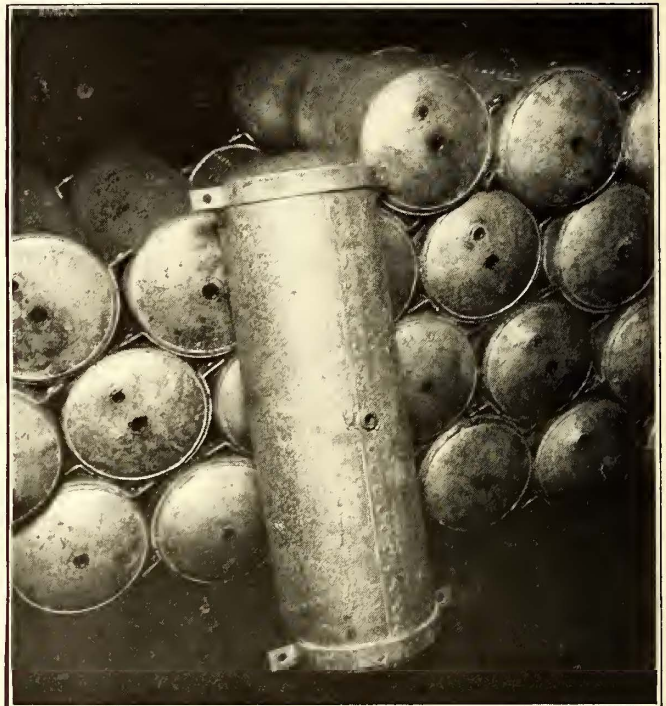
The grinder above referred to is used between armature shaft jobs for grinding the exterior surface of the brass axle bearings. These are turned down to within 0.012 in. of size with a finishing tool and then ground to size. The set-up of the bearings for grinding has been made a very simple and quick operation by the use of an expanding collet. This is put inside the bearing and both are dropped over a mandrel, the large

forming a part of the straightener, was lengthened and a 6-in. pulley attached. This was belted to another pulley mounted on one end of a short countershaft at the end of a pivoted bracket. On the opposite end of this shaft is a leather-faced wood wheel, which, as the bracket is lowered, bears against the periphery of the armature, causing it to rotate. The position of this bracket is controlled by a foot pedal brought down underneath and in front of the machine.

The operator swings an armature requiring attention into the machine and then, resting his hand against the bed of machine, steps on the foot pedal, bringing the leather faced wheel down against the armature. As the latter rotates the eccentricity is gaged and chalked. When this is done pressure on the pedal is released and the bracket automatically pivots up out of the way.



MANDREL COLLET AND BRASS BEARING ASSEMBLY USED FOR QUICK SET-UP OF BRASSES IN GRINDING MACHINE



A HALF BAND BRAZED ON THE AIR RESERVOIRS PROVIDES AN IMPROVED METHOD OF HANGING THEM

end of which is tapped solidly against a block of wood, locking the bearing firmly on the mandrel, which is then quickly placed between the grinder centers. The collet and bearing are easily removed by similarly champing the small end of the mandrel against the wood block. The collet and bearing assembled on the mandrel are shown in an accompanying picture. The collet may be seen through the hole in the bearing. The inside of these bearings is smoothed only with a finishing tool and a film of babbitt is run in to start the bearing off.

It usually requires two men to do a satisfactory job of straightening an out-of-true armature shaft, for with the ordinary rig one man can hardly rotate the armature with one hand and at the same time gage and mark the high spots with the other. In the West Side Chicago shops, however, the straightener has been supplemented by a simple means of rotating the armature so that one man can easily do all of the work alone.

The flywheel shaft of the pump, which runs continuously and supplies the power to the hydraulic press

The armature is then properly set and pressure applied to spring the shaft.

The Chicago surface companies have in use 2,000 Pullman trucks which are provided with no wearing plates on the pedestal gibs or jaws. When these surfaces become worn, therefore, they are reclaimed by welding, building up the worn surfaces and then machining back to size. This machining is expeditiously done by using a forming cutter which mills the three bearing surfaces, front face and two edges, to the final size and finish in one pass. An accompanying picture shows clearly the type of machine and cutter used and the L-shaped pedestal jaw as mounted in the milling machine.

GOGGLES THAT ARE ALWAYS USED

In a picture reproduced herewith it is seen how the need for goggles for workmen while using the emery wheels is dispensed with. It is difficult to secure proper use of goggles; the workmen do not always have them handy, and if they have them they often forget to use them. So 100 per cent safety in this respect is secured

in the Chicago shops by attaching a rectangle of glass in a metal frame to the framework of the emery wheel in such a position that the workman automatically looks at his work from behind this glass shield. All the emery wheels are equipped in this manner.

A HANDY BABBITTING JIG

Some difficulty is experienced in obtaining babbitted bearings of uniform thickness on account of the variation in the shape of the shells. This has been overcome in Chicago through use of the scheme pictured on page 926. On two metal tables adjacent to the melting furnace are mounted four pairs of bearing cores for four sizes of bearings. At the sides of each of these iron cores are blocks against which the bearing shells rest as they are placed in position for pouring in the babbitt. These blocks are held in position by strap springs so that the shell may be brought closer to the core than the position obtaining as it comes in contact with the blocks, by forcing them against the spring supports.

The thickness of the bearing is thus kept uniform by measuring from the core to the outer edge of the shell and forcing the latter to the position giving the correct dimension. The shell is brought to and held in this position by a hand screw which bears against the back of the shell and is supported in a yoke at the front of the table. This yoke is hinged to the center of three iron posts and rests in a slot in either of the two others. After the babbitt in one shell has been poured it is permitted to cool while the workman is getting a shell in place on the other core of the pair. The yoke is then loosened and swung over to the other outside post and tightened against the shell on this core to bring it to the right position. The babbitt is then poured. While this is cooling the other bearing is removed from the mandrel and a new shell put in place, and by that time it is possible to loosen the yoke and swing it over, repeating the cycle. This makes the work a practically continuous performance without lost time and insures a uniform bearing thickness at a minimum cost.

EFFECTIVE AIR RESERVOIR SUPPORT

A new way of hanging the air reservoirs was recently devised in connection with the fifty new trailers now under construction in the West Side shops. At each end of the tank, where the lap of end and side sheets makes double thickness of metal, a band is brazed to the tank, the band extending half way around, with the ends bent out horizontally. After the bands are brazed on, the tank is hot galvanized inside and out. It is supported under the car floor by two U-shaped pieces, which are bolted to the wood cradle above and to the tank bands below, with the U's opening sideways toward the tank. These support connections are turned this way rather than with backs toward the tank to avoid a narrow place between them and the tank in which dirt and water could accumulate.

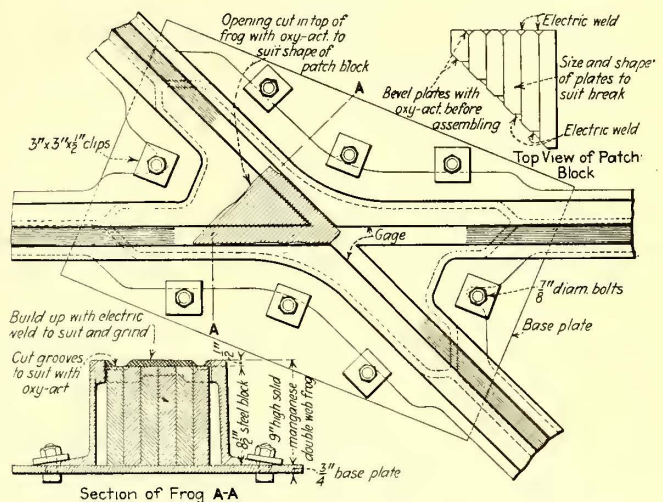
With the old system of hanging tanks by means of bands fastened to the cradle and extending around the tank, but not fastened to it, there is a strong tendency for failure to occur under the bands because of the slight movement between tank and bands and the possibility of water and dirt getting underneath the bands to help corrosion and erosion. With the bands brazed on tight all of this is eliminated and the life of the tank undoubtedly extended.

Broken Manganese Frogs Repaired Without Interrupting Traffic

Solid Plugs Which Were Supported on Steel Plates Inserted Between the Frog and the Ties Were Used to Build Up the Break

TWO manganese girder rail frogs of the box or double web type, at the intersection of Sutter and Market Streets, in San Francisco, recently broke without warning, leaving the crossing in an unsafe condition and likely to do considerable damage to rolling stock or further damage to the crossing itself. Despite the heavy traffic at this part of the system equipment and materials were assembled as soon as the break was discovered and the rebuilding of the two frogs was completed the same day without taking the crossing out of service.

In double web frogs of this type, when a section of the top breaks out, the open space beneath makes it impossible to build up the break in the usual manner because of the absence of any foundation on which to build. It was therefore decided to replace the broken sections with solid plugs, supporting them on steel plates which could be inserted between the frog and



METHOD OF REPAIRING BROKEN WEARING SURFACE OF SOLID MANGANESE FROG

the ties for this purpose. These base plates were made of 3/4-in. metal about 2 ft. x 3 ft. in size and bolted clips were used to clamp frog and plate rigidly together. Eight of these clips were placed around the flange of each frog, as shown in the accompanying illustration.

A triangular shape was selected as the easiest form of plug to build up and a right-angled triangle was measured off on each of the frogs, the size and location being chosen so that when the plug was in place it would give the maximum strength to the broken sections. The dimensions of the larger plug are shown on the accompanying illustration. The plugs were built up of steel plates, the desired shape and exact size being secured by beveling the edges with an oxyacetylene torch and by welding adjoining plates together along the joints. When the plugs had been delivered to the job, the exact dimensions of the openings required in the frogs were marked out and after the base plates were set the holes were cut out with the oxyacetylene torch. With the plugs in place an electric weld was made entirely around the joints between plug and frog,

and finally the entire job was smoothed up with the rail grinder. The plug rested on the base plate without being attached to it in any way.

After the two plugs installed in this way had been in service for a few days, it was almost impossible to tell which of the several frogs at this particular crossing had been repaired.

The work was carried on under the general direction of B. P. Legare, chief engineer maintenance of way and construction, United Railroads.

Hedley Addresses Cornell Engineers

Interborough President Draws on His Personal Experience in Order to Illustrate His Advice to Young Men Who Are Ambitious to Succeed

THE speaker at a meeting of the Cornell Society of Engineers, held in New York City on April 21, was Frank Hedley, president and general manager of the Interborough Rapid Transit Company. Some of his remarks were referred to editorially in the issue of this paper for April 30. This association is made up of former Cornell students in all branches of engineering and Mr. Hedley gave them the benefit of his practical experience, beginning in England, where as a boy he learned the fundamentals of steam railroad shop work.

After some general introductory historical remarks regarding electric railway development before he became interested in it, he told of his first practical work in the Erie Railroad shops, in Jersey City, soon after his arrival in this country. He said that after two years with the Erie he secured work in the New York Central shops in Forty-third Street, New York City, where at that time was an old roundhouse just north of the Grand Central Station. Here he had a very interesting experience while working in a shop gang as machinist. He said that each gang foreman had three engines to look after, and on one occasion his gang had two of its three engines ready, but was waiting to have the valves set. The gang foreman was ill and the master mechanic was about to lay off the rest of the men until his recovery because he supposed that there was no one who knew how to set the valves. Young Hedley, however, had been keeping his eyes open and he volunteered to set the valves. He was permitted to do this and did the job successfully, but when a short time afterward he asked for the same pay as the foreman got his request was turned down with the statement that it was impossible to pay him more than the maximum rate of 24 cents per hour.

Discouraged by this limitation on his earning capacity young Hedley left the New York Central and secured a job as machinist in the Ninety-eighth Street shops of the Third Avenue Elevated Railroad. Here his knowledge of valve setting caused a repetition of the New York Central experience, but this time, after a stormy encounter with the gang foreman, he came out ahead and was himself made foreman. It was only a short time until he became master mechanic of the West Side Elevated Railroad, and in 1889 he became master mechanic of the Kings County Elevated Railroad in Brooklyn. Here he had charge of engines and cars; he inaugurated railroad service and remained with the company until 1893, when he went to Chicago with the contractors who were building the Lake Street Elevated Railroad.

In Chicago Mr. Hedley was general superintendent of construction on the Union loop and the Northwestern

Elevated Railroad and he gained a great deal of operating experience as well, because Charles T. Yerkes, president of the road, left much of the administration to him.

Mr. Hedley said he came back to New York in 1903, first with the construction company, later organizing the operating forces of the Interborough Rapid Transit Company. Still later he was put in charge of the street railways as well.

Referring to some of the things that have occurred in the rapid transit development in New York City, Mr. Hedley spoke of the original large motors which were employed on account of their great accelerating ability, although the operation was far from ideal. He could see that while in the early stages of operation by electricity this operation was not as satisfactory as that with the old steam locomotives, yet the goal of ultimate success was always in sight. A great deal of money had to be spent in rebuilding and redesigning, and the operating department worked very close to the manufacturers' designers, because the latter had to get many pointers from the former. Development went along very rapidly, so that today the operators feel absolute confidence in the electrical equipment.

This, of course, said Mr. Hedley, involves a high standard of inspection and maintenance. The Interborough today does its inspection on a mileage basis, in connection with periodical lubrication. Motor cars make 1,200 miles before they are laid up. They are then taken in for oiling and adjustment, carbon brushes are fixed up, brakes tightened, etc. There are no terminal inspections.

Mr. Hedley explained that as a result of careful inspection rapid-transit trains frequently operate for thirty days at a stretch without developing a single interference with train movement on account of defective inspection or defective equipment. He described a number of the wonders of the subway equipment, and called attention to the fact that the motor cars of one of the ten-car subway trains have more apparatus in them than any steam locomotive ever constructed. Moreover, they have a horsepower capacity that can produce tractive effort sufficient to accelerate the trains at the rate of 1.7 m.p.h. per second. This is about three times as rapid as is possible with the best steam locomotive attached to the best passenger train in the country. In spite of the perfection of this equipment, Mr. Hedley thinks that there is still a wide field for electrical development and that the surface has as yet only been scratched. We are, he said, just in the beginning of electrical engineering, and there is a tremendous field for the young engineer who is resourceful.

Interspersed with the technical part of Mr. Hedley's discourse were a number of observations regarding life and living. For example he said that the best way in which to make a living is to be able to produce, and to be able to convince the other fellow you know how to produce; that is, how to run the business that he needs to have run. Then you can make him pay you well for running it. Again, it is not absolutely necessary for a man to have a technical college education. But this one thing is necessary, if he doesn't get his technical education in college, he must get it after he starts to work. And it is very difficult to get a technical education, night after night, after putting in hard work in the shop. The principal thing is that any one who starts out, no matter what his education, must, in order to be successful, show that he can do things a little better than some one else. Such a man cannot be held back.

Testing Insulating Materials—I*

There Are Certain Fundamental Characteristics Which All Insulating Materials Must Have to Meet the Operating Conditions—
The Presence of These Characteristics Is Determined by Certain Tests as Described

By JOHN S. DEAN

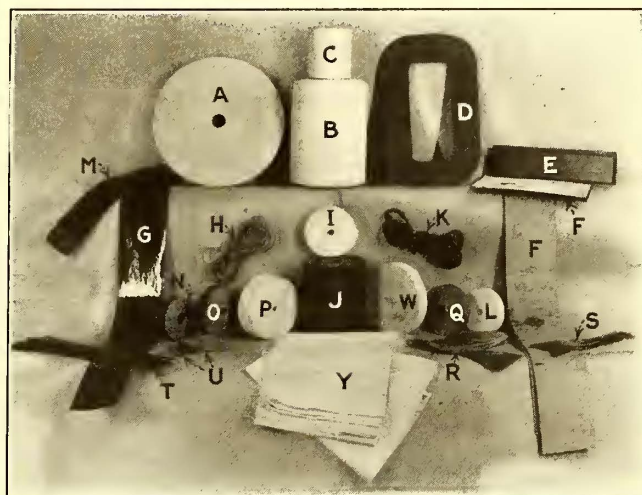
Railway Motor Engineering Department, Westinghouse Electric & Manufacturing Company

IN THE electrical industry the term "to insulate" means to separate conducting bodies by means of non-conductors so as to prevent a transfer of electricity. As applied to railway motors the function of insulating material is to act as a separator between adjacent commutator bars and turns of the copper conductors and to isolate from the ground these conductors, motor leads and wiring connections around the frame.

The variety of insulating materials used in the construction of a railway motor is shown in detail in a chart published in the April 19, 1919, issue of the ELECTRIC RAILWAY JOURNAL, page 778. These materials primarily take the form of either a liquid, paper, cloth, cord or a solid and are segregated and classified in Table I.

TABLE I—CLASSIFICATION OF INSULATING MATERIALS

| | | |
|--------------|----------------|--|
| Liquids..... | | Amber insulator Plastic insulator Asphaltum varnish Insulating varnish Shellac |
| Papers..... | Untreated..... | Fish paper Asbestos Fullerboard Cement paper |
| | Treated..... | Micarta Japanese paper and mica—mica tape Fish paper and mica |
| Cloths..... | Untreated..... | Cotton tape Cotton sleeving Surgical braid Gray webbing Drilling |
| | Treated..... | Treated cloth Friction tape Friction cloth Treated duck |
| Cords..... | | Torpedo twine Jute rope Linen twine |
| Solids..... | | Mica Porcelain Rubber bushings Impregnating gum Cement |



INSULATING MATERIALS FOR RAILWAY MOTORS

- | | | |
|-----------------------|----------------------|--------------------------|
| A—Asbestos paper | I—Asbestos tape | Q—Friction tape |
| B—Cotton sleeving | J—Friction cloth | R—Treated cloth |
| C—Linen twine | K—Jute rope | S—Shellacked fullerboard |
| D—Asbestos and mica | L—Cotton tape | T—Fullerboard strips |
| E—Fish paper cell | M—Treated duck | U—Fish paper U-pieces |
| F—Fish paper and mica | N—Mica tape | W—Surgical tape |
| G—Cement paper | O—Treated linen tape | Y—Drilling hoods |
| H—Torpedo twine | P—Gray webbing tape | |

maintenance, in many cases; (7) ruggedness of construction and accessibility and convenience for repair.

From the standpoint of dielectric strength, glass stands highest among the non-conductors of electricity, but its use for insulating purposes is limited on account of its brittleness. It is not used in any form on railway motors, but has been applied quite extensively and has proved invaluable in certain fields of electrical work.

To meet the above conditions satisfactorily the insulating materials for railway motors must have attention with respect to: (1) Dielectric strength, (2) mechanical strength, (3) flexibility, (4) moisture, acid and oil proofness, (5) heat resistance, (6) heat conduction and radiation, (7) cementing and sticking qualities and (8) suitable finish.

The above properties cannot be had combined in any one insulating material, hence a great variety of individual untreated materials and combinations of treated and composite materials are required. These must be selected for different details of the motor, depending upon the mechanical and electrical strains to which the various parts are subjected and the method of applying during the process of manufacture. Under these conditions a great variety of tests of the untreated materials, the materials used during the process of treatment and of the treated and built-up materials are necessary to insure the proper insulation of the completed machine.

Some of the most important tests which experience has shown are required in connection with this variety of insulating materials are given in Table II to show the refinement necessary in producing a railway motor

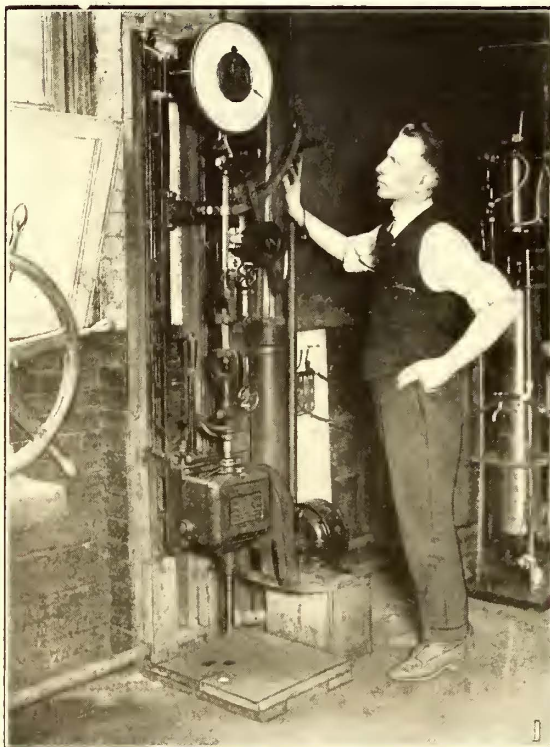
*This is the first of two articles by Mr. Dean on the testing of insulating materials. In the April 16 issue of this paper Norman Litchfield described the essential characteristics that should be specified for insulating materials. This and the following article describe methods and apparatus used for determining these characteristics.

correctly insulated that will finally pass the specified factory tests and at the same time stand up under the severe operating condition to which it is subjected in service.

To test the mechanical strength of cotton tape, cotton sleeving, surgical tape, gray webbing, drilling, treated cloth, friction tape, friction cloth, treated duck, torpedo twine, jute rope and linen twine, an automatic power cloth tester, having a capacity ranging from 50 to 300 lb., is used. Test specimens of cloth are cut 1 in. wide and about 6 in. long and samples of tape and cord are cut 6 in. in length. The test strip of sample material is clamped in the jaws of the testing machine, which are 2 in. apart, and power is applied through a motor-driven worm. The pull

is clamped in the machine over a plunger which is forced up against it by means of a hand-operated pump. When the paper is ruptured the gage pressure is read and recorded. Fish paper such as is ordinarily used in built-up mica wrappers shows a rupture test of about 40 lb.

During the process of manufacturing micarta insulating material it is necessary to select a paper that will take up a certain definite amount of shellac during treating. To determine the degree of porosity, a glass burette graduated from 0. to 100 cu.cm., over a length of 22 in. of the tube, is used, together with two steel clamping disks with a 1-in. hole in the center and a



No. 1—Apparatus used in making tensile tests on tapes, cloths and cords. No. 2—Apparatus used in making rupture tests on papers. No. 3—This apparatus is used in testing the strength of cements.

MAKING TENSILE STRENGTH AND RUPTURE TESTS OF CLOTHS, PAPERS AND CEMENTS

or breaking point in pounds is registered on an indicating scale attached to the upper clamping jaw of the machine. Tests are made on a number of samples and an average value is taken as the final result.

A test made on five samples of cambric such as is used in making treated cloth shows the following:

| Test No. | 1 | 2 | 3 | 4 | 5 |
|----------|----|----|----|----|----------------------|
| Warp | 50 | 52 | 40 | 41 | 42 = 45 lb., average |
| Woof | 22 | 27 | 24 | 31 | 29 = 27 lb., average |

The warp represents the thread running lengthwise in a woven material, while the woof is the name given to the threads carried by the shuttle; *i.e.*, those running crosswise of the fabric.

To determine the comparative strength of the various papers used for winding cells, U-pieces and for foundations for built-up mica wrappers, etc., a Mullen testing machine having a capacity of 100 lb. pressure is used. The test specimens are cut 3 in. square from the commercial rolls of paper. The test piece of paper

125-cu.cm. glass flask. The flask is connected to the lower end of the burette by means of a flexible rubber

TABLE II—TESTS ON ELECTRIC RAILWAY MOTOR-INSULATING MATERIALS

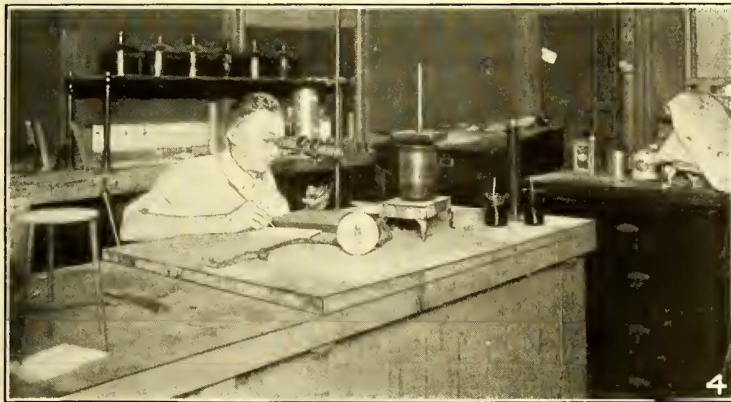
| | |
|---------------------------------|--|
| Untreated materials | <ul style="list-style-type: none"> Tensile test Rupture test Air porosity test Pulling test Destruction test Creepage test |
| Materials used in treating | <ul style="list-style-type: none"> Drop point test Viscosity test Dielectric test—liquid insulating materials Penetration test Aging test Oilproof test Acid, alkali and salt water test Cementing and sticking qualities test Heat conduction and radiation test Baking or drying qualities Weather test |
| Treated and composite materials | <ul style="list-style-type: none"> Adhesion test Slip test Treating test specimens Dielectric test—sheet insulating materials Moisture absorption test Gaging built-up mica board Dielectric test—built-up mica and paper Experimental treating power |

tube. To the top of the burette is connected the lower clamping disk and this connection is fitted with a pinch cock. Test specimens are cut 2½ in. wide lengthwise from the sheets of paper to be tested.

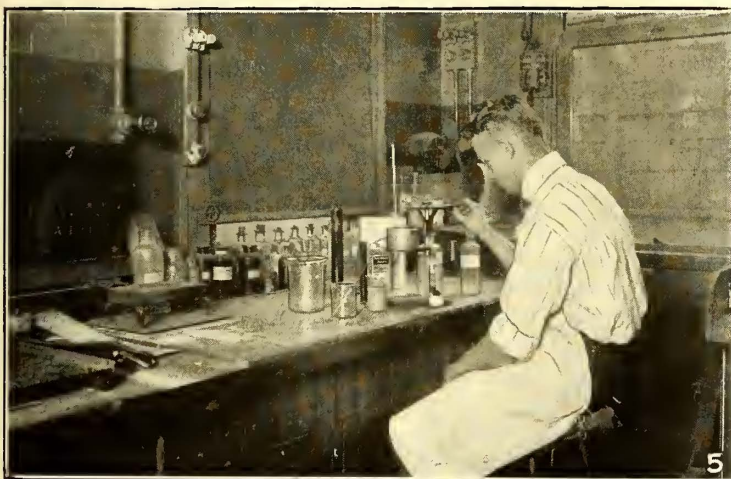
In the test the pinch cock is opened and the flask is placed on the upper ring support opposite the zero on the burette and filled with water until the flask and burette are filled up to the zero graduation on the burette. The test strip of paper is then clamped between the two steel disks and the pinch cock is closed. The flask is then lowered to a position which brings the water level of the flask 24 in. below the zero mark on the burette and the pinch cock is opened for ten

½ x 1 in., an equivalent of one-half square inch, at the point of fracture.

The test is made by placing the sample in the jaws of the testing machine and applying the power through a system of levers, which are balanced for the grade of material under test. The pulling force applied to the upper jaw is automatically adjusted by a transfer of small shot from one receptacle to another. As the shot fall into the retainer on the spring balance they are weighed, registering the pull. When the sample breaks, the transfer of shot is automatically shut off and the maximum recorded pull is read from the dial on the scale. In determining the durability of rubber bushings used to protect the motor lead cables where they come out through the frame of the motor, a spe-



4



5



6

No. 4—Insulating gums are tested to determine the softening at different temperatures. No. 5—Viscosity of insulating varnishes is determined by a viscosimeter. No. 6—Rubber bushings are tested to destruction.

TESTING INSULATING GUMS, VARNISHES AND RUBBER BUSHINGS IN THE LABORATORY

seconds to allow the air to flow into the burette through the sample of paper. The pinch cock is then closed and the flask is raised until its water level coincides with that of the burette and this level is read on the burette. This gives the number of cubic centimeters of air drawn into the burette. This figure is taken as the porosity number. Each strip is tested at intervals of 5 in.

A good grade of Kraft paper such as used in connection with the manufacture of micarta for railway motor parts has a porosity figure of from 40 to 50.

Cements for railway motor construction are used primarily in back of the commutator neck to seal up the openings around the windings and are put in place in a plastic condition and allowed to harden. The apparatus used for testing these is a Riehle cement testing machine.

Test specimens are made up in a special shape, so as to fit into the jaws of the testing machine. They are molded from the cement and have a cross-section of

special intermittent compression testing machine is used. The test rubber bushing is placed in an upright position between the two horizontal parallel plates of the testing machine and the height of the lower plate is adjusted to get a predetermined compression of the bushing when the plates are nearest together. The motor is started and this raises and lowers the upper plate intermittently, compressing the sample about sixty times a minute.

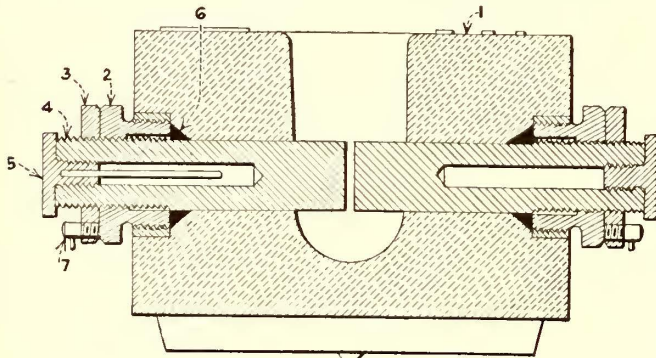
A recording speed indicator is attached to the driving shaft of the machine, which registers the total number of compressions. The sample specimen is tested until it shows signs of destruction. This test gives comparative results as to the suitability of the various grades of rubber bushings.

Porcelain insulators used on railway motor brush holders are tested to determine the ability of the insulator to resist any electrostatic discharges over the surface of the porcelain. The equipment used is similar to the apparatus (which is explained in detail later on)

used to make the dielectric test on sheet insulating material.

The porcelain insulator is placed on a metal rod and a small bare copper wire is twisted around the middle of its outer surface. One side of the testing circuit is connected to the metal supporting rod and the other side is connected to the copper wire on the porcelain. The test voltage is raised until a flash-over occurs across the surface of the porcelain, blowing the breaker. The maximum voltage is read and recorded at the flashing point.

To determine the softening, at different temperatures, of insulating gums such as are used in impregnating railway motor field coils it is important to use a grade of gum that will not soften and run out of the windings under the most severe operating conditions of the motor. The apparatus used in testing gum for this quality consists of two glass beakers, one within the other, and a glass tube to receive a thermometer to which a small platform of aluminum is attached on the outside to hold the test sample of gum. A small telescope is used in noting the various readings. The test specimen is molded in a metal mold and has the following dimensions: Total length 2 in.; width $\frac{1}{2}$ in. for 1 in. of the length, while the other inch tapers



TEST CUP USED IN DIELECTRIC TEST OF LIQUID INSULATING MATERIALS

from $\frac{1}{2}$ in. down to $\frac{1}{8}$ in. at the end. The thickness of the test piece is $\frac{1}{8}$ in. The $\frac{1}{8}$ -in. square tip of the wedge is painted white to increase its visibility. In the test the wedge is placed with the 1-in. tapered end overhanging on the platform attached to the glass tube which is placed in the inner beaker. Glycerine is poured in the outer beaker and heated by an electric stove so regulated as to raise the temperature in the inner beaker at the rate of 2 deg. C. per minute. Observations are made and recorded of the "sag point," which is the temperature at which the test piece begins to bend; the "bottom point," which is the temperature at which the test piece touches the bottom of the inner beaker $2\frac{1}{2}$ in. below the platform, and the "drop point," which is the temperature at which the overhanging test column breaks.

To determine the viscosity or the internal friction of the various grades of insulating varnishes a Stormer viscosimeter is used. In this the outer beaker is filled with water, which is changed from time to time to maintain the test varnish in the inner beaker at a uniform temperature of 21 deg. C. The test varnish, which is taken at the specific gravity used in the factory, is placed in the inner beaker. A small metal cylinder, which is immersed in the test varnish, is rotated due to the action of the force of gravity on a 100-gram weight connected to it through a system of

pulleys and gears. The pointer on the scale of the apparatus is set to zero and the time required to make 100 revolutions of the cylinder is taken as the viscosity figure. This apparatus is sometimes used to record the number of revolutions the cylinder makes in one minute.

The results of a test on insulating varnish such as is used in railway motors show a viscosity figure of 25, which interpreted means 100 revolutions of the drum are made in twenty-five seconds using a 100-gram weight.

To determine the dielectric strength of oils and varnishes the same testing circuit as used in making the dielectric test on sheet insulation material is used. The testing board with the brass terminals is replaced by a standard oil testing cup developed for this purpose.

The test cup, which is shown in detail in one of the illustrations, is adjusted by spacing the electrodes $\frac{1}{16}$ in. apart. The cup, after being carefully cleaned with benzine or gasoline, is filled with the test varnish to within $\frac{1}{2}$ in. of the top. After being filled it is allowed to stand until all air bubbles have disappeared. The terminals of the testing circuit are connected to the binding posts on the test cup, and the voltage is applied first at a low value and then increased at the rate of 3,000 volts per second until the oil in the cup is punctured and a breakdown occurs. During the test the temperature of the varnish is kept at from 20 to 25 deg. C. Five tests are made on the sample varnish and the average of these five voltage readings is recorded as the dielectric strength of the varnish.

To determine the ability of the various grades of varnish to penetrate the fibrous structure of the various grades of cloth used for insulating purposes two glass tubes, $\frac{1}{2}$ in. inside diameter and 12 in. long, open at both ends, are used. These are held in an upright position in a frame which is fitted with a clamping arrangement to hold a number of layers of cloth against one end of the tubes, which are filled with the varnish to be tested. To make the test the test tubes are closed with corks and then filled with the two grades of varnish to be tested. Over each of the upper ends of the tube, which are open, are securely clamped to the same thickness 100 layers of cotton cloth cut $2\frac{1}{2}$ in. square. The apparatus is then up-ended, the corks are removed to give ventilation and the varnish is allowed to soak into the cloth for fifteen minutes. The corks are then placed in the tubes, the apparatus is reversed, the samples of cloth are removed and the number of layers penetrated are counted, which is a measure of the penetrating qualities of the two varnishes. In making this test it is important that both samples should have the same dilution and temperature, as these characteristics affect the penetration figure. This test is only comparative, but it is a good index as to the most suitable varnish to meet these requirements.

Finds Good Painting Pays

THE Chattanooga Railway & Light Company has decided that the old way of painting and varnishing cars thoroughly is after all the best. After trying various kinds of less expensive paints and after experiments with the use of enamel, the management has come to the conclusion that the best final results are obtained by removing everything, starting at the bottom, and putting on seven coats of body paint and two coats of best varnish on top of this. This is naturally more expensive as far as first cost goes, but in the long run there is greater satisfaction and less annual cost over a period of years than by some substitute methods.

Equalized Brakes and Braking Power*

Methods of Obtaining Equalized Brakes on Cars Equipped with Various Types of Brake Rigging Are Described and Examples Solved for Braking Power, Percentage of Braking Power and Total Leverage

By H. M. P. MURPHY

AS ALL practical designs of foundation brake riggings must be properly "equalized" the following definition of an equalized brake will assist in making this term clear: An equalized locomotive or car brake is one which is designed so that, during a brake application, equal forces will be delivered to all brake shoes which are applied to wheels carrying equal weights and performing similar duties, regardless of shoe wear, variable piston travel, etc.

As an illustration of the preceding definitions, consider the air brake portion of the standard car brake

according to the definition. The reasons for employing different degrees of shoe pressure on wheels which do not carry equal weights or which do not perform similar duties will be fully discussed later under the head of "Braking Power," etc.

GETTING EQUALIZED HAND BRAKING ON CARS EQUIPPED WITH EQUALIZED AIR BRAKE RIGGINGS

When a foundation brake rigging is so designed that the air brake portion is equalized the hand brake portion will also be equalized if the hand brake chain, or

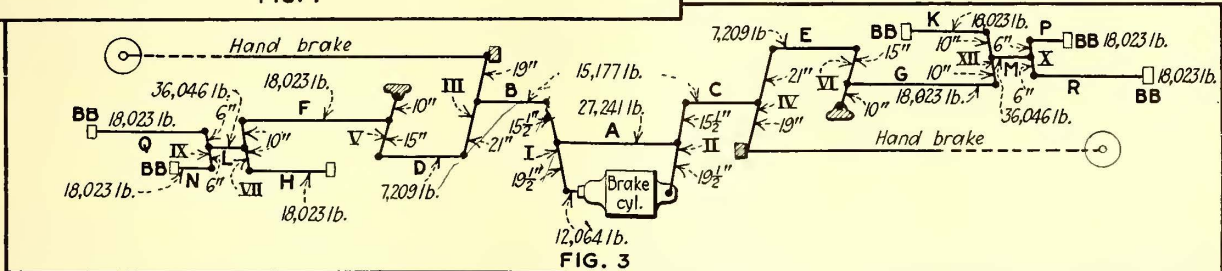
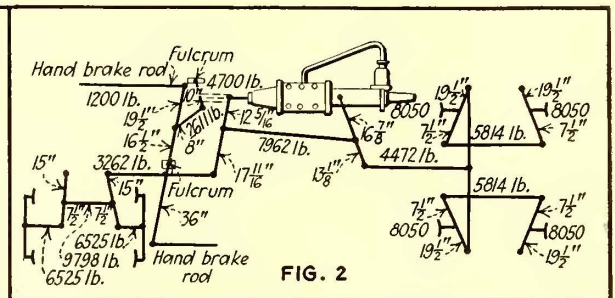
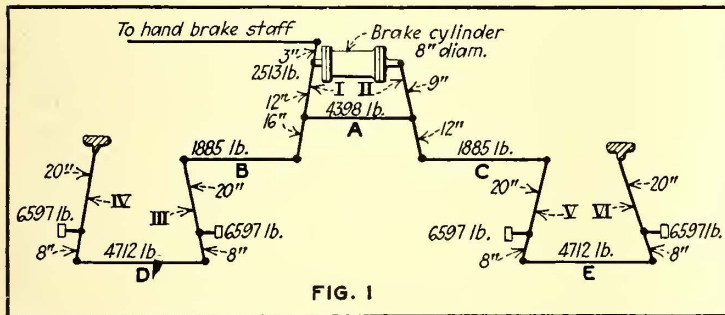


FIG. 1—BRAKE LEVERAGE DIAGRAM FOR DOUBLE-TRUCK FOUR-MOTOR CAR. FIG. 2—BRAKE LEVERAGE DIAGRAM FOR CAR WITH MOTOR AND TRAILER TRUCKS; 32,200 LB. ON MOTOR TRUCK AND 14,500 LB. ON TRAILER TRUCK. FIG. 3—BRAKE LEVERAGE DIAGRAM FOR CAR WITH SIX WHEEL TRUCKS

rigging shown in Fig. 1. It will be observed that this brake is fully equalized because the forces delivered to each of the four brake beams are always equal to each other, and each pair of wheels not only carries the same weight but also performs the same duty and should, therefore, be braked with just the same force as each of the other pairs of wheels on the car. As another illustration, consider the brake rigging shown in Fig. 2. In this case there are two distinct classes of wheels, i.e., drivers and trailers, which not only perform different duties but also carry different weights. Consequently, although the forces delivered to all of the shoes concerned are not equal, the brake rigging must not be assumed to be of the non-equalized type. In fact, as the forces delivered to each of the four driver brake shoes are equal to each other, and as the forces delivered to the trailer shoes are always equal to each other, the brake rigging is properly equalized,

rod, is attached to any one of the air brake levers at some point which constitutes a fixed center during an application of the air brake or if the attachment be made to the push rod pin of the cylinder lever. If, however, the hand brake chain, or rod, be attached to any other point of any of the air-brake levers the hand brake will not be equalized.

In order to illustrate the preceding rule, consider the brake rigging shown in Fig. 3. In this case the hand-brake chains, or rods, are connected to air-brake levers at points which constitute fixed centers during an application of the air brake and therefore as the air-brake portion of the rigging is known to be equalized the hand-brake rigging will also be equalized.

As a further illustration, it is apparent that the form of car hand brake shown in Fig. 1 is not equalized, for by inspecting this it will be observed that the hand-brake-chain rod is connected to the cylinder lever at a point 3 in. beyond the push rod pin center. In general, the greater the distance between these two points the farther will the hand brake be from the

*This is the fifth of a series of articles on forces developed in brake riggings. Others appeared in the Jan. 15, Feb. 19, March 19 and April 16 issues of this paper.

equalized type. Consequently it is important to make the dimension referred to as small as possible, 3 in. being the maximum distance that should be used. The proper construction is, of course, that in which the push rod and hand brake chain rod are attached to the same pin.

In order to ascertain just what inequality of braking force results from the use of the improperly connected hand brake referred to in the preceding paragraph and illustrated in Fig. 1, let it be required to find the force delivered to each of the four brake beams when a pull of 1,200 lb. is exerted on the hand-brake chain.

Considering the middle point of lever *I* as the fulcrum,

$$\text{Force on rod } B = \frac{1,200 \times 15}{16} = 1,125 \text{ lb.}$$

and, considering the lower end point of lever *III* as the fulcrum,

$$\text{Force on brake beam of lever } III = \frac{1,125 \times 28}{8} = 3,938 \text{ lb.}$$

and by finding the force on rod *D*, the force on the brake beam attached to lever *IV* is also found to be 3,938 lb.

Now the force on rod *A* may be found by considering the lower end point of lever *I* as the fulcrum, thus:

$$\text{Force on rod } A = \frac{1,200 \times 31}{16} = 2,325 \text{ lb.}$$

and by considering the upper end point of lever *II* as the fulcrum,

$$\text{Force on rod } C = \frac{2,325 \times 9}{21} = 996 \text{ lb.}$$

and considering the lower end point of lever *V* as the fulcrum,

$$\text{Force on brake beam of lever } V = \frac{996 \times 28}{8} = 3,486 \text{ lb.}$$

and the force delivered to the brake beam of lever *VI* may also be shown to be equal to 3,486 lb.

Thus it is seen that owing to the specified method of attaching the hand-brake chain to the cylinder lever the hand brake is not properly equalized, the force delivered to each of the brake beams of the left-hand truck being 452 lb. greater than the force delivered to each of the beams of the right-hand truck, under the conditions assumed. However, as this variation in braking force is not excessive, the given method of connecting the hand brake with the main leverage system is generally considered as satisfactory. Moreover, although the hand brake in question is not equalized, attention should be called to the fact that in a preceding example it was shown that the air-brake portion of the apparatus is equalized.

BRAKING POWER OR BRAKING FORCE DEFINED

The term total braking power or total braking force simply means the total force (in pounds) with which the brake shoes, on the wheels considered, are forced against the tires.

As braking power must obviously depend not only on the design of the foundation brake rigging and on the size of the brake cylinder but also on the air pressure existing in the brake cylinder it is always essential to specify the "cylinder pressure" considered when discussing the subject of braking power. In cases where a hand brake is the source of power the force applied to the hand wheel should be stated whenever the subject of braking power is involved.

The term "percentage of braking power" means the ratio of the total braking power, on the wheels con-

sidered, to the total weight with which these wheels press on the rails; that is, to find the percentage of braking power, in any case, divide the total braking power by the total weight on the wheels in question and multiply this result by 100, in order to express it in the form of a percentage.

It is also clear that in this case the "brake cylinder pressure" must always be specified, for the percentage of braking power depends on the total braking force, which, as previously pointed out, is directly dependent on the air pressure existing in the brake cylinder. Consequently it is customary to state that a car is braked at a certain per cent of its weight when the "cylinder pressure" has some specified value, or to say that the percentage of braking power on a particular car is a certain amount, based on a specified cylinder pressure.

The preceding definition may be expressed in the following mathematical form, if the cylinder pressure is clearly stated:

$$\text{Percentage of braking power} = 100 \times \frac{\text{total braking force on specified wheels}}{\text{total weight on specified wheels}}$$

The term "total leverage" represents the number of times that the total force, exerted on a specified brake cylinder push rod, is multiplied in being delivered to all of the brake shoes controlled by the cylinder in question, or, in other words, the total leverage, for any given case, simply represents the total number of pounds of brake shoe pressure obtained for each pound of force developed by the push rod of the brake cylinder concerned.

To determine the value of the total leverage for any given brake rigging, connected with a specified cylinder, divide the total braking force developed on all of the beams or shoes controlled by the cylinder by the corresponding total force exerted on the cylinder push rod.

This rule may be concisely stated in the following mathematical form:

$$\text{Total leverage} = \frac{\text{total braking force developed by specified cylinder}}{\text{total force on push rod of specified cylinder}}$$

In using the preceding rule, neither the size of the cylinder nor the amount of air pressure need be known, as the total braking force developed may always be found in terms of the total push rod force. In other words, as the term "total leverage" simply represents the force-multiplying ability of a brake rigging, it is dependent only on the design of the rigging and is in fact a constant quantity for any given set of levers or other force-multiplying devices. Consequently when computing total leverage the force exerted by the cylinder push rod may be assigned any convenient value whatever. Particular attention should, moreover, be called to the fact that in all cases it is essential to consider each cylinder with the brake rigging controlled by it alone as a separate and independent system. This is a most important factor in all total leverage problems, but especially in the case of a car or locomotive which is equipped with more than one brake cylinder.

In order to illustrate the methods outlined in the preceding paragraphs for the computation of braking power, percentage of braking power and total leverage, the following examples are of interest:

Consider the brake rigging illustrated in Fig. 1 and let it be required to find the total leverage for this case. As the magnitude of the push rod force does

not affect the value of the total leverage of any given brake rigging and, therefore, as any force whatever may be assumed as acting on the push rod, it is generally considered best to employ a force of 1 lb. unless the total braking force has previously been computed by the use of some greater value for the push rod force. Consequently, let it be assumed, in this case, that a force of 1 lb. is delivered by the cylinder push rod to the upper end of lever I, then to find the total braking force developed by the cylinder (*i.e.*, the total braking force on the whole car, as all of the brake beams are controlled by the specified cylinder) consider the middle point of lever I as the fulcrum and apply the "General Leverage Rule," thus:

$$\text{Force on rod } B = \frac{(\text{force on push rod}) \times (\text{lever arm of force on push rod})}{\text{Lever arm of force on rod } B}$$

$$\text{Force on Rod } B = \frac{1 \times 12}{16} = \frac{3}{4} = .75 \text{ lb.}$$

Also by considering the lower end point of lever III as the fulcrum,

$$\text{Force on brake beam of lever III} = \frac{.75 \times 28}{8} = 2.625 \text{ lb.}$$

Now by continuing this method throughout the system, the force acting on each of the three remaining brake beams will also be found to be equal to 2.625 lb., and, therefore, the total braking force developed by the push rod force of 1 lb. is $4 \times 2.625 = 10.5$ lb., that is, 10.5 lb. of brake shoe pressure are developed by each pound of force exerted on the cylinder push rod, and consequently the total leverage is 10.5 (see definition of total leverage). If, however, it is desired to apply the rule for determining total leverage when the total braking force and corresponding total push rod force are known, it may, of course, be accomplished thus:

$$\text{Total leverage} = \frac{10.5}{1} = 10.5$$

It will be noted that in the preceding example neither the size of brake cylinder nor the cylinder air pressure were considered, the solution depending only on the proportions of the levers and the number of brake beams (*i.e.*, the number of pairs of brake shoes) but, of course, this problem could have been solved by assuming a definite size of brake cylinder and definite degree of cylinder pressure; thus with the brake rigging shown in Fig. 1 and with an 8-in. diameter cylinder and an air pressure of 50 lb. per square inch, the total force on the push rod is 2,513 lb. and the force delivered to each of the four brake beams of the rigging illustrated is 6,597 lb. Consequently the total braking force developed on the whole car is $4 \times 6,597 = 26,388$ lb., whence by aid of the rule for computing total leverage,

$$\text{Total leverage} = \frac{\text{total braking force developed by specified cylinder}}{\text{total force on push rod of specified cylinder}}$$

$$\text{Total leverage} = \frac{26,388}{2,513} = 10.5$$

From the preceding discussions it is clear that the value of the total leverage for any given brake rigging may always be computed by first assuming that either a force of 1 lb. or any other specific value is exerted on the cylinder push rod, thereby calculating the resulting forces delivered to each of the brake beams or shoes controlled by the cylinder in question, and finally by dividing the sum of all of these last mentioned forces by the assumed force on the push rod.

Suppose now that the car, on which the brake rigging

shown in Fig. 1, is installed, weighs 35,000 lb. and let it be required to find the percentage of braking power on this car when a brake cylinder pressure of 50 lb. per square inch is developed.

As shown in the preceding discussion the total braking force (or braking power) on all of the specified wheels (*i.e.*, for the whole car in this case) is equal to 26,388 lb. when an 8-in. cylinder is used and the air pressure is 50 lb. per square inch. Consequently,

$$\text{Percentage of braking power} = 100 \times \frac{\text{total braking force on specified wheels}}{\text{total weight on specified wheels}}$$

$$\text{Percentage of braking power} = 100 \times \frac{26,388}{35,000}$$

$$= 75.4 \text{ per cent (based on 50-lb. cylinder pressure)}$$

As an additional example consider the American equalized driver brake rigging illustrated in Fig. 4

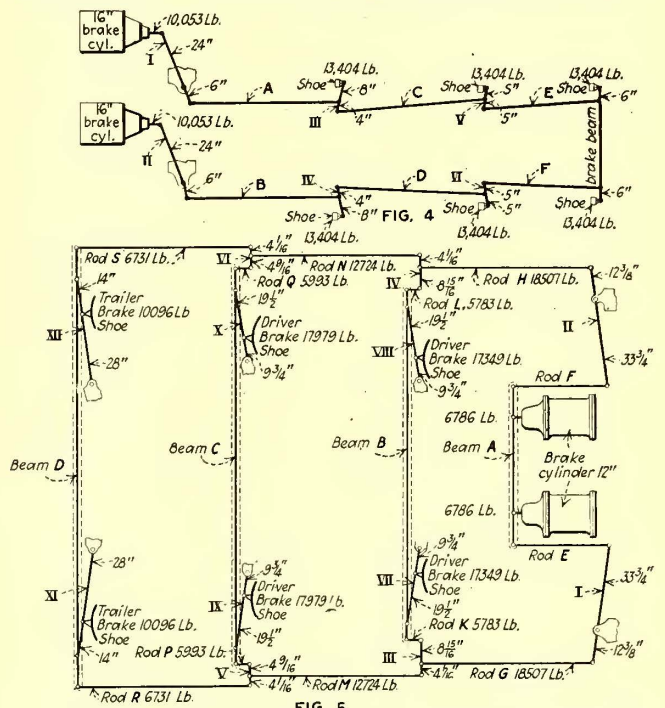


FIG. 4—LEVERAGE SYSTEM FOR AMERICAN EQUALIZED DRIVER BRAKE. FIG. 5—AMERICAN EQUALIZED BRAKE APPLIED TO ATLANTIC TYPE LOCOMOTIVE

and let it be required to find the total leverage and the percentage of braking power when two 16-in. diameter cylinders are used and the air pressure is 50 lb. per square inch, the total weight on the drivers being 107,000 lb. The total braking force on each shoe is 13,404 lb. and therefore the total braking force on all six shoes is $6 \times 13,404 = 80,424$ lb. Consequently,

$$\text{Percentage of braking power} = 100 \times \frac{80,424}{107,000}$$

$$= 75.2 \text{ per cent (based on 50-lb. cylinder pressure)}$$

Now in determining the total leverage, for this case, where two brake cylinders are used, it is merely necessary to consider each side of the engine as a separate system, which it really is, and to find the total shoe pressure developed by each cylinder alone. By referring to Fig. 4 it is seen that each cylinder controls three shoes (*i.e.*, the shoes on one side of the engine), the total shoe pressure developed by one cylinder is, therefore, $3 \times 13,404$, or 40,212 lb., and as the force acting on the push rod of either cylinder is 10,053 lb.

$$\text{Total leverage} = \frac{40,212}{10,053} = 4$$

In each of the preceding examples it happened that the weights of the cars and locomotives were approximately evenly distributed on all of the wheels considered, but it should be pointed out that this is not always the case; for instance, on cars with maximum traction trucks there is much more weight on each of the drivers than on the trailer wheels, and consequently the shoe pressure on these two classes of wheels will not be the same although the same brake cylinder is used for both. This makes no difference, however, in figuring the total leverage and total braking force, but when calculating the percentage of braking power care should be taken not to confuse the average percentage on the two classes of wheels with the specific percentage on each separate class, as these are not necessarily the same.

EXAMPLES OF DIFFERENT PERCENTAGES OF BRAKING POWER ON DRIVERS AND TRAILERS

In order to illustrate the statements just made, consider the leverage system shown in Fig. 5, which is a standard form of the American equalized brake as applied to an Atlantic type of locomotive. Let it be required to find the total leverage, total braking force, average percentage of braking power and specific percentage of braking power for the drivers and trailers, when each brake cylinder is 12 in. in diameter and the air pressure is 60 lb. per square inch. The total weight on the drivers is 78,500 lb., which is evenly distributed on the four wheels, and the weight on the trailers is 28,000 lb.

Under the given conditions the total force exerted on each cylinder push rod is 6,786 lb. and the resulting braking force developed on each of the two forward driver shoes is 17,349 lb., while on each of the rear driver shoes the braking force is 17,979 lb. The braking force developed on each of the trailer shoes is 10,096 lb. Consequently the total braking force for the drivers and trailers is equal to $2 \times 17,349 + 2 \times 17,979 + 2 \times 10,096 = 90,848$ lb. or the total braking force developed by each cylinder on either side of the locomotive (*i.e.*, on two drivers and one trailer) is equal to 45,424 lb., and, as the total force on each brake cylinder push rod is 6,786 lb.

$$\text{Total leverage} = \frac{45,424}{6,786} = 6.7$$

Now to find the average percentage of braking power it is, of course, merely necessary to divide the total braking force, 90,848 lb. for the drivers and trailers, by the total weight on the drivers and trailers and to multiply this result by 100, the total weight being $78,500 + 28,000 = 106,500$ lb., thus,

$$\text{(Average) per cent of braking power} = 100 \times \frac{\text{total braking force on four drivers and two trailers}}{\text{total weight on four drivers and two trailers}}$$

$$\text{(Average) per cent of braking power} = 100 \times \frac{90,848}{106,500} = 85.3 \text{ per cent (based on 60-lb. cylinder pressure)}$$

Also as the total braking force on the trailers is equal to $2 \times 10,096 = 20,192$ lb.

$$\text{(Specific) per cent of braking power on trailers} = 100 \times \frac{\text{total braking force on two trailers}}{\text{total weight on two trailers}}$$

$$\text{(Specific) per cent of braking power on trailers} = 100 \times \frac{20,192}{28,000} = 72.1 \text{ per cent}$$

(Based on 60-lb. cylinder pressure) and as the total braking

force on the drivers is equal to $2 \times 17,349 + 2 \times 17,979 = 70,656$ lb.

$$\text{(Specific) per cent of braking power on drivers} = 100 \times \frac{\text{total braking force on four drivers}}{\text{total weight on four drivers}}$$

$$\text{(Specific) per cent of braking power on drivers} = 100 \times \frac{70,656}{78,500} = 90 \text{ per cent (based on 60 lb. cylinder pressure)}$$

Thus, it is seen that in order to get a correct idea of the true percentage of braking power it is necessary to consider each set of wheels separately, when the braking force applied to each is unequal and the weight of the car or locomotive is unevenly distributed.

In the preceding example, the percentages of braking power on the drivers and trailers were not the same, but in many cases, although the weight of the car or engine may not be evenly distributed on all of the wheels, the same percentage of braking power is used on all wheels; that is, the force with which the shoes are pressed against each pair of wheels bears a uniform ratio to the weight upon them.

DETERMINING TOTAL BRAKING FORCE WHEN TOTAL WEIGHT AND PERCENTAGE OF BRAKING POWER ARE SPECIFIED

By referring to the definition of "percentage of braking power," it will be observed that, by transposing the members of the typical equation there given, a very useful rule for the determination of total braking force may be readily obtained and stated as follows:

To find the total braking force developed on a given set of wheels by a specified cylinder pressure, divide the corresponding percentage of braking power by 100 and multiply the quotient thus obtained by the total weight on the wheels in question.

This rule may be stated in the following concise mathematical form for any given cylinder pressure and specific set of wheels:

$$\text{Total braking force} = \frac{\text{Percentage of braking power}}{100} \times (\text{total weight})$$

In order to illustrate the preceding rule, let it be required to find the total braking force developed on a car weighing 40,000 lb. when the cylinder pressure is 50 lb. per square inch and the corresponding percentage of braking power obtained on all wheels is 60 per cent. To solve this problem apply the rule, thus:

$$\text{Total braking force on car} = \frac{(\text{percentage of braking power})}{100} \times (\text{total weight of car})$$

$$\text{Total braking force on car} = \frac{60}{100} \times 40,000 = 24,000 \text{ lb.}$$

Now let it be required to find the total braking force developed on the trailer wheels of an Atlantic type locomotive, when the total weight on these wheels is 30,000 lb. and the brake cylinder pressure is 50 lb. per square inch, the corresponding percentage of braking power obtained being 60 per cent.

To solve this problem, apply the rule, thus:

$$\text{Total braking force on trailers} = \frac{(\text{percentage of braking power})}{100} \times (\text{total weight on trailers})$$

$$\text{Total braking force on trailers} = \frac{60}{100} \times 30,000 = 18,000 \text{ lb.}$$

A most important consideration connected with the subject of braking power is the marked variation in the percentage of braking power which always results from

the loading or unloading of a car. Of course, the greater the total weight of a car, equipped with a specified design of foundation brake rigging, the smaller will the percentage of braking power be for any given cylinder pressure. (See definition of percentage of braking power.) In order to show how great a difference exists between the percentages of braking power obtained on empty and loaded cars, the following example will be given.

A car weighing 46,000 lb. when empty is braked at 60 per cent with 50-lb. cylinder pressure. Let it be required to find the percentage of braking obtained on this car when it carries a load of 92,000 lb. and all other conditions remain unchanged.

In order to find the percentage of braking power developed, it is, of course, necessary to ascertain the total weight of the car when loaded and the total braking force developed under the specified conditions. These quantities may be found as follows:

$$\begin{aligned} \text{Total weight} &= (\text{weight of empty car}) + (\text{weight of load}) \\ \text{Total weight} &= 46,000 + 92,000 = 138,000 \text{ lb.} \end{aligned}$$

and as the percentage of braking power obtained on the empty car (which weighs 46,000 lb.) is 60 per cent, the total braking force developed by the specified cylinder pressure of 50 lb. may be determined by the rule given in the preceding paragraph, thus:

$$\begin{aligned} \text{Total braking force on car} &= \\ & \frac{(\text{percentage of braking power})}{100} \times \text{total weight} \end{aligned}$$

$$\text{Total braking force on car} = \frac{60}{100} \times 46,000 = 27,600 \text{ lb.}$$

whence, by referring to the definition of percentage of braking power,

$$\text{Per cent of braking power on loaded car} = 100 \times \frac{\text{total braking force on specified wheels}}{\text{total weight on specified wheels}}$$

$$\begin{aligned} \text{Per cent of braking power on loaded car} &= 100 \times \frac{27,600}{138,000} \\ &= 20 \text{ per cent (based on 50-lb. cylinder pressure)} \end{aligned}$$

Although the method outlined in the preceding paragraphs is perfectly general, a much shorter method for obtaining the same results may be stated as follows:

When the percentage of braking power, developed by a certain cylinder pressure, is known for a car of given weight, to find the percentage of braking power obtained on the same car under similar conditions, but with a new specified total weight, multiply the known percentage by the given original weight and divide this product by the new specified total weight.

This rule may be expressed in the following concise mathematical form:

$$\begin{aligned} \text{Per cent of braking power with new total weight} &= \\ & \frac{(\text{per cent of braking power with original weight}) \times \text{original weight}}{\text{new total weight}} \end{aligned}$$

To illustrate the use of this simplified rule, let it be required to solve the example given in the preceding paragraph by its aid. The necessary data are as follows: Original weight (of empty car) = 46,000 lb., new total weight (of car and load) = 138,000 lb., and percentage of braking power obtained with original weight (and 50-lb. cylinder pressure) = 60 per cent. The rule may now be applied thus:

$$\begin{aligned} \text{Per cent of braking power with new total weight} &= \\ \frac{60 \times 46,000}{138,000} &= 20 \text{ per cent (based on 50-lb. cylinder pressure)} \end{aligned}$$

By referring to any of the braking power or leverage examples given in the foregoing, it will be readily seen that if, in each of the cases considered, the brake cylinder pressure had been doubled, the force with which each shoe was pressed against its wheel would also have been doubled, or that, if the brake cylinder pressure had been reduced to half of its given value, the force with which each shoe was pressed against its wheel would also have been reduced to one-half of its original value. In general it is true, therefore, that the shoe pressure varies in direct proportion to the brake cylinder pressure and consequently that the percentage of braking power also varies in direct proportion to the brake cylinder pressure. Now when computing braking force and percentage of braking power it is often necessary to find the value of these quantities corresponding to various degrees of cylinder pressure, the following rule will, therefore, be found of much practical value in such cases.

If a known degree of braking force, or percentage of braking power, is developed by a given brake cylinder pressure, the value which either of these quantities will have, when a new specified brake cylinder pressure is employed as a basis, may be found by dividing the given braking force, or percentage of braking power, by the original cylinder pressure on which it is based and then multiplying the quotient thus obtained by the new cylinder pressure on which the required braking force, or percentage of braking power, is to be based.

This rule may be concisely stated in the following mathematical form:

$$\begin{aligned} \text{Total braking force based on new cylinder pressure} &= \\ & \frac{(\text{original total braking force})}{(\text{original cylinder pressure})} \times (\text{new cylinder pressure}) \end{aligned}$$

$$\begin{aligned} \text{Per cent of braking power based on new cylinder pressure} &= \\ & \frac{(\text{original per cent of braking power})}{(\text{original cylinder pressure})} \times (\text{new cylinder pressure}) \end{aligned}$$

To illustrate this method let it be required to find the (specific) percentages of braking power and total braking forces for the drivers and trailers of the Atlantic type of locomotive considered in the former examples connected with Fig. 5, when the brake cylinder pressure is 50 lb. per square inch, it having been previously shown, in the examples referred to, that with 60-lb. cylinder pressure, the total braking force on the trailers is 20,192 lb. and on the drivers 70,656 lb., while the percentage of braking power obtained on the trailers is 72.1 per cent and on the drivers 90 per cent.

By noting that the "new cylinder pressure" is 50 lb. and the original cylinder pressure is 60 lb. in this case and applying the rule the desired results may readily be obtained as follows:

$$\begin{aligned} \text{For trailers: Per cent of braking power based on 50-lb.} \\ \text{cylinder pressure} &= \frac{72.1}{60} \times 50 = 60.1 \text{ per cent} \end{aligned}$$

$$\begin{aligned} \text{For drivers: Per cent of braking power based on 50-lb.} \\ \text{cylinder pressure} &= \frac{90}{60} \times 50 = 75 \text{ per cent.} \end{aligned}$$

$$\begin{aligned} \text{For trailers: Total braking force based on 50-lb. cylinder} \\ \text{pressure} &= \frac{20,192}{60} \times 50 = 16,827 \text{ lb.} \end{aligned}$$

$$\begin{aligned} \text{For drivers: Total braking force based on 50-lb. cylinder} \\ \text{pressure} &= \frac{70,656}{60} \times 50 = 58,880 \text{ lb.} \end{aligned}$$

One-Man Rear-Exit Cars

Seattle Has Arranged Twenty-seven Large Two-Man Cars for One-Man Operation in Unique Way—The Seating Capacity Sixty—The Operators Have No Difficulty in Handling Them

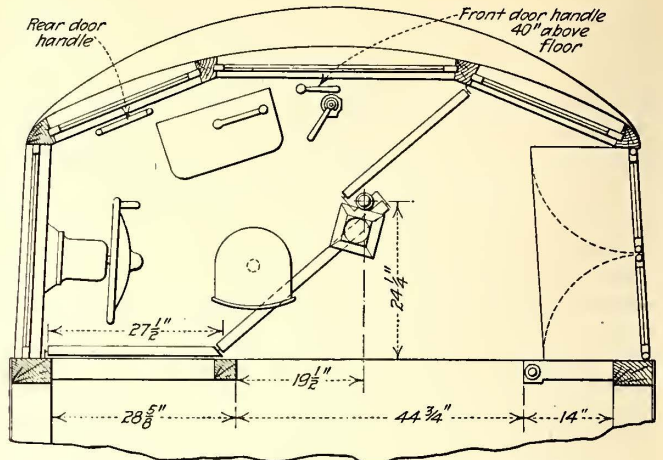
UNDER municipal operation, Seattle has extended one-man operation from safety cars to large double-truck two-man cars. This plan of operating some of the larger cars has been adopted with only slight changes in the arrangement of the cars, costing about \$100 per car. These changes included permanently closing the rear entrance-door and connecting the rear exit-door in such a manner that the operator at the forward end has control of it. This was accomplished by running a rod the entire length of the car just under the left-hand sill and making proper connections with the door levers underneath the car step. The motor-man's cab on the left-hand side of the front platform was removed, and the sand box formerly located therein was moved inside the car and placed under a seat. The bulkhead door at the front end was widened to 44 in., as shown in the accompanying drawing, which also shows the arrangement of fare box, curtains, etc. The controller, operator's seat and air valves were relocated as seen and air sanders, rear-door operating mechanism and a geared-wheel type of hand brake installed at the left of the operator.

In general, the plan embodied the changing of the single-end, rear-entrance and rear and front-exit two-man car into a front-entrance, rear-exit, single-end, one-man car. The following details and accompanying photographs will serve to indicate the type of equipment which has been converted for one-man operation:

| | |
|------------------------------------|--------------|
| Length over all..... | 49 ft. |
| Width..... | 8 ft. 7 in. |
| Length of body..... | 38 ft. 6 in. |
| Truck centers..... | 29 ft. |
| Seating capacity..... | 60 |
| Motors, 2 Westinghouse, 310-C..... | |
| Weight..... | 40,360 lb. |

Commenting on this scheme, D. W. Henderson, general superintendent of railways for the city of Seattle, said: "We converted twenty-seven cars of this type for one-man operation and they have been running since March 1, 1921. The trainmen are very well pleased with the car and we have had no complaints whatever from the public."

These large one-man cars have been in use on the "Ballard-North" and "Sixth Avenue, N. W.," lines dur-



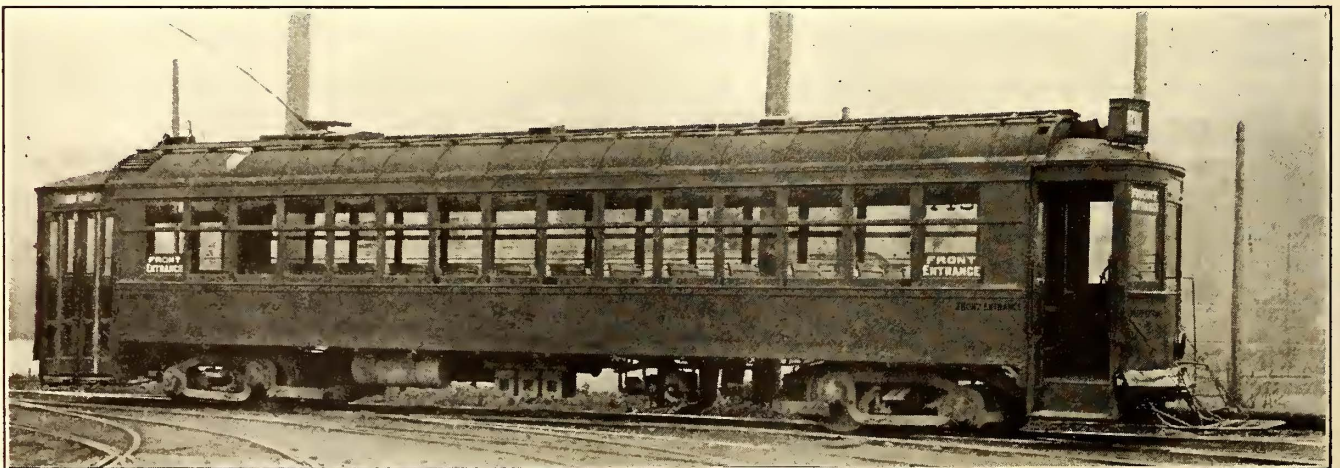
LOCATION AND ARRANGEMENT OF EQUIPMENT ON FRONT PLATFORM OF CONVERTED ONE-MAN CAR

ing the last sixty days and for rush-hour as well as off-peak service. The former line handles about 177,000 passengers per month and the latter about 120,000, which gives some idea of the density of traffic. The average speed called for in the time-table was 8 m.p.h. in January, 9.06 m.p.h. in February and 8.93 m.p.h. in March. A few of these cars have also been operated on other lines where they were interspaced with two-man cars and they are reported to have given very satisfactory service.

Reclosing Circuit Breaker Gives Ideal Service

ON ONE of the lines in Cincinnati power distribution was found last summer to be rather weak. An analysis of the situation pointed out that what was really needed was a one-unit substation out on this line. It happened that the line ran near a carhouse and a 500-kw., 60-cycle rotary was placed in a room in a corner of the carhouse and equipped with an automatic reclosing circuit breaker which is manufactured by the Automatic Reclosing Circuit Breaker Company of Columbus, Ohio.

One of the carhouse men starts this rotary at 5 o'clock in the morning, sees that it is in good condition and leaves it for the rest of the day. This unit has been in service for about eight months now and has given continued satisfaction and perfect operation during the whole time.



DOUBLE-TRUCK SEATTLE CAR CONVERTED FOR FRONT-ENTRANCE, REAR-EXIT, ONE-MAN OPERATION

Destructive Effect of Current on Ball Bearings of Electric Cars

Tests Made Under Various Conditions Show that Very Rapid Destruction of Ball Bearings Results from the Electric Current Which Flows Through Them—Types of Construction Are Suggested for Overcoming the Trouble and Testing Apparatus Is Described for Reproducing Conditions as They Occur in Service

BY HILDING ANGSTROM

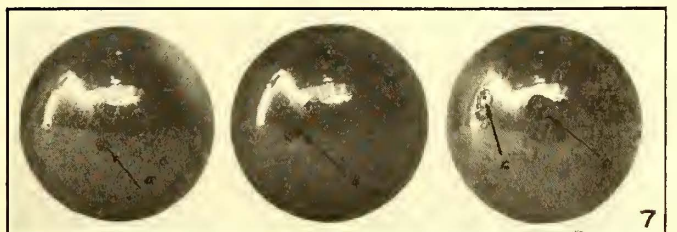
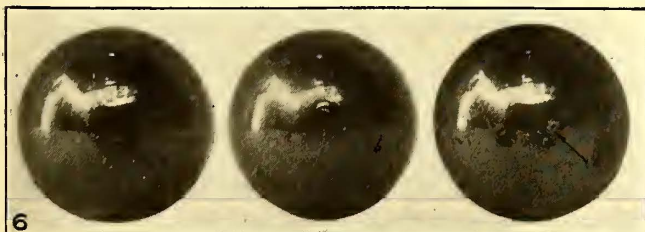
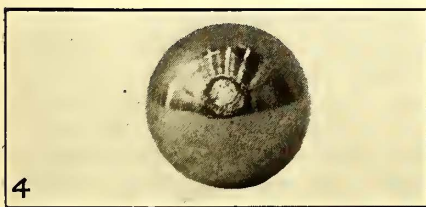
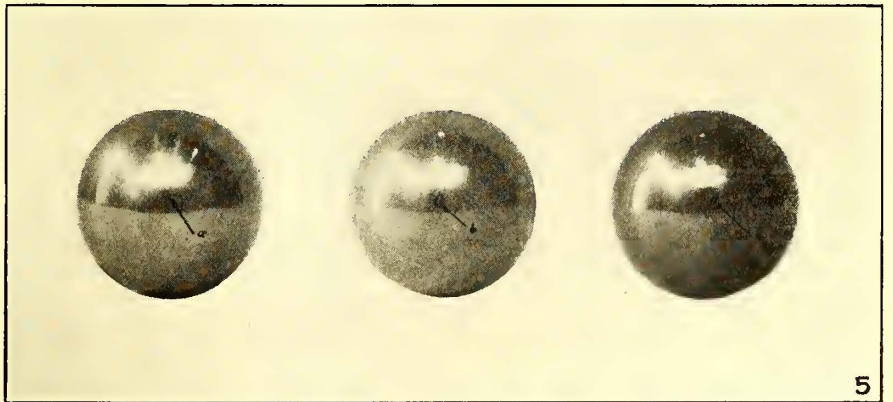
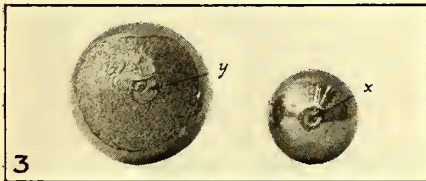
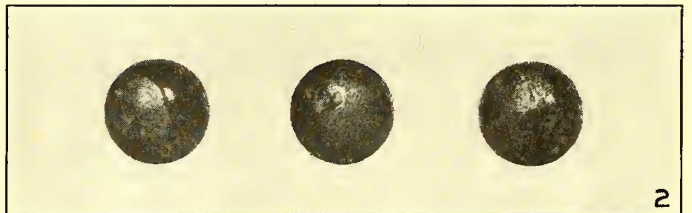
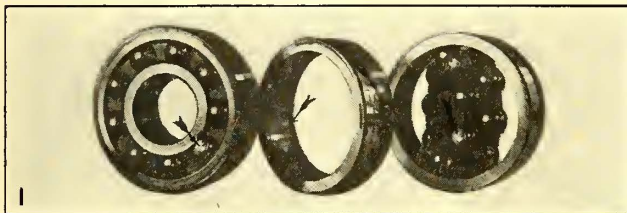
Chief Assistant Malmö Tramways, Sweden

DURING the past ten years various kinds of ball and roller bearings have been developed for use on electric railway cars and their equipment, both in America and in Europe. All of the bearings necessary for the operation of electric cars are subjected to very severe service caused by the movement of the cars on curves and at switches, by the forces developed when the brakes are applied and through the blows at rail joints. None of the anti-friction bearings developed has performed in the manner expected. In some cases the ball or roller retainer has been too weak. Sometimes the bearings have become "shelled" and destroyed due to the severe pounding action to which they are subjected. In some cases strength has been obtained at the expense of bearing friction.

Some of the bearings which have been tried in service in Europe are:

1. Svenska Kullagerfabriken, Gothenburg, Sweden.
 - (a) Spherical ball bearings, two per housing.
 - (b) Ball bearings with the outer ring turned cylindrical and radial bearings, one per housing.
 - (c) Radial bearings, two per housing.
 - (d) Spherical roller bearings, one per housing.
2. Nordiska Kullager Aktiebolaget, Gothenburg, Sweden.
 - (a) Radial bearings, two per housing.
 - (b) Disk bearings, two per housing.
3. Deutsche Waffenfabriks radial bearings in service on the tramways in Copenhagen, Denmark.
4. Jaeger-Bund-Rollenlager in service on the tramways in Dresden, Germany.
5. S. R. O. double-row radial bearings, Oerlikon, Switzerland, in service on the tramways in Berne and Zurich, Switzerland.
6. Delmez radial bearings, Brussels, Belgium.

In America several of the bearings mentioned above have been tried in actual service, and in addition experiments have been made with several types of American bearings.



EFFECT ON BALLS PRODUCED BY RUPTURING CURRENT PASSING THROUGH THEM

Fig. 1—Balls and retainers destroyed by action of current.
 Fig. 2—Appearance of balls when removed from retainer.
 Fig. 3—Shelling effect produced by arcing.
 Fig. 4—Rupturing effect produced by current of 260 amp.

Fig. 5—Balls after being tested with permanent steady load at varying current.
 Fig. 6—Effect on balls produced by rupturing current in air.
 Fig. 7—Effect on balls produced by rupturing current in oil.

When lightweight safety cars came into use, with higher scheduled speeds and increased rates of acceleration, the value of decreased friction to reduce the load placed on the motors while starting was considered an essential advantage. Tests have been made by the General Electric Company and the Union Actien-Gesellschaft among others to ascertain the destroying influence of current on friction bearings. From these tests it appears that a current as low as 1 amp. per square inch corrodes the housings and that a much smaller current will damage the bearing metal.

With ball bearings there is no insulating oil, as is the case with friction-type bearings, but there is an almost metallic contact.

DISTRIBUTION OF CURRENT IN BEARINGS

With the usual type of single-truck car the current passes from the trolley wheel through the controller and motors directly to the truck. The various motor bear-

insulated and with the motor lifted up from its suspension, so that the current could pass only through the axle bearings and the journal bearings.

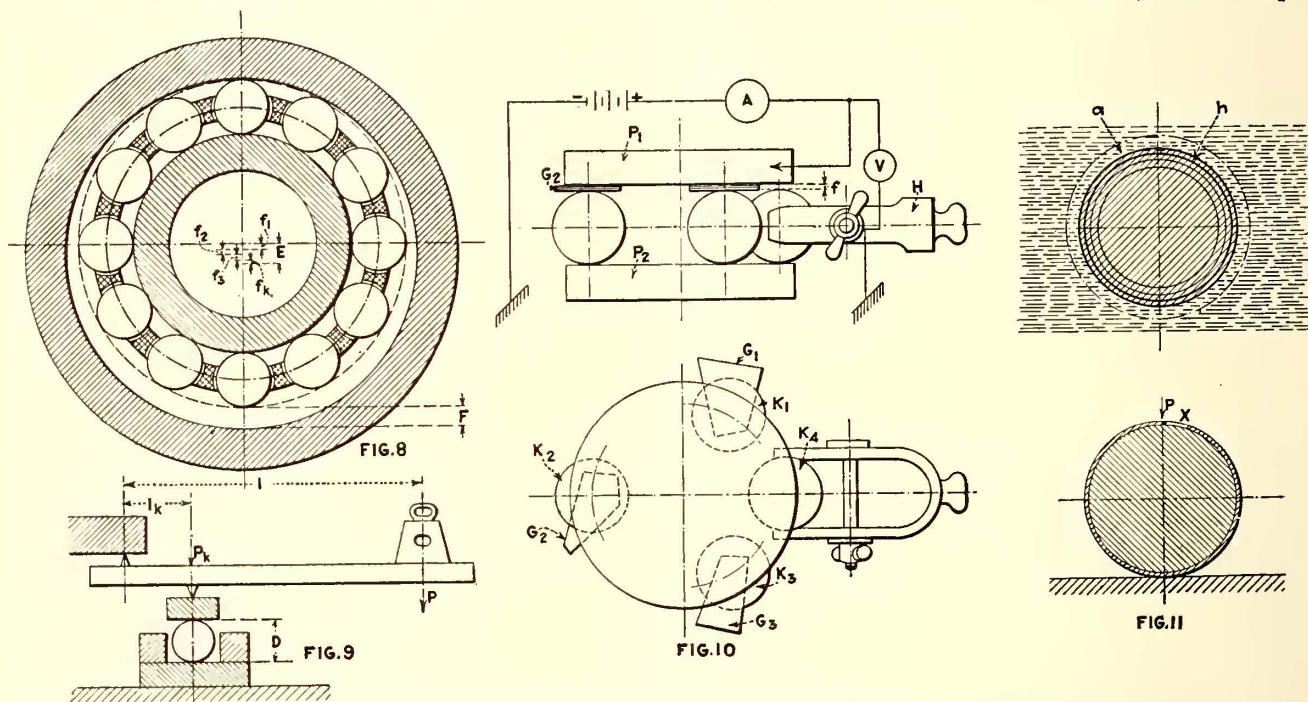
If we indicate the intermediate resistance of the two axle bearings by r_g and let r_k represent that for the journal bearings, we have

$$\frac{1}{R} = \frac{1}{r_g} + \frac{1}{r_k}$$

where R is the total resistance. In actual operation this value for the contact resistance is not quite correct, as the current passing through the ball bearings is in reality not a direct current but one of an alternating variety, with a frequency varying with the speed of the car. This frequency may be represented by

$$v = N \frac{D_m - d}{2 D_m}$$

where v is the frequency, N is the rotative speed of the axle, d is the diameter of the ball, and D_m equals



DIAGRAMS OF BALL BEARINGS AND APPARATUS USED FOR TESTING

Fig. 8—At left (top), diagram of wear on ball bearings.
Fig. 9—At left (bottom), arrangement for determining relation between pressure and contact resistance.

Fig. 10—Center, apparatus used for reproducing arcing from vibration.
Fig. 11—At right, hard layers and craters formed by current.

ings and the gearing are thus in the path of the current to ground. It may happen that in braking, where sand is applied, but one wheel may be in contact with the rail. In this case the current is divided between the axle bearings for one motor, the gearing and one journal bearing.

Assuming that the maximum circuit-breaker setting for a single-truck car is 225 amp., it is possible that this current under unfavorable circumstances may be divided between one journal bearing and the two axle bearings of the motor. In order to confirm this dividing of the current experiments were made with a car equipped with ball bearings. Three of the wheels of this car were insulated from the rails by mica sheets and but one wheel was left in contact. Current from a 550-volt trolley was then applied and the magnitude of the current was regulated through a water rheostat. The value of this current and the voltage drop were read between the ground side of the motors and the rail. This test was repeated with the brake connections

$D_i + d$ if D_i is the diameter of the inner ring. In this calculation, however, no consideration is given to the inductive resistance.

Results of this test showed that the resistance in a ball-bearing journal is about twice as great as the resistance in the two axle bearings of the motor. Of course, the ball-bearing resistance will be decreased by

TABLE I—TEST RESULTS ON BALLS WITHOUT LUBRICANT

| Exp. | Amp. | Volt. Max. | Watt. Max. |
|--------|------|------------|------------|
| a..... | 35 | 2.4 | 84 |
| b..... | 80 | 3.1 | 248 |
| c..... | 150 | 13.0 | 1,950 |
| d..... | 225 | 11.0 | 2,475 |

greater load and will vary with the amount and quality of the lubricant used on the gears and with the condition of the axle bearings as regards wear.

In the following I shall show that it is not the permanent current load, but the effect of rupturing this current on the balls that produces the welding action.

Tests were made of the magnitude of the maximum rupturing effect. Results of these show that the rupturing effect is sometimes under unfavorable circumstances as much as 7 kw. and this is certainly sufficient to destroy ball bearings.

HOW RUPTURING EFFECT IS PRODUCED

When the balls and the inner and outer rings of the bearing are worn, and the upper balls are pressed together and the inner and outer rings compressed, it is possible that the journal bearing under unfavorable circumstances may be insulated from the bearing box. Such a condition is indicated in Fig. 8, which shows how this play between the balls and the inner and outer rings occurs. If we let f_1 represent the diametrical wear in millimeters of the outer ring, f_2 the diametrical wear in millimeters for the inner ring, f_3 the sum of the diametrical wear in millimeters of the two balls, and f_k the pressing together and the compressing of the upper ball, then

$$E = f_1 + f_2 + f_3 + f_k$$

The play due to the loading and unloading of the bearings and which causes the rupturing effect is evidently $E - f_k$, and practical examinations have shown that this may amount to 0.3 mm. (11.8 mils).

Figs. 1, 2 and 3 show some balls and bearings which have been thus destroyed. In Fig. 1 the balls are still in their retainer. The dark stains on the balls were formerly considered as having been caused by acid in the lubricant or from shelling through fatigue. In Figs. 2 and 3 the balls are shown after removal from their retainer. The shelling effect is quite evident in Fig. 3x. The concentric shelling shown in Fig. 3y was probably due to the formation of a small crater.

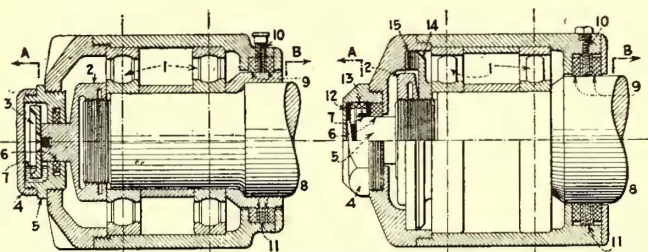
Additional experiments have shown that the current distribution among the balls depends to a large extent on the load placed on the balls and that it is the rupturing effect and not the permanent current due to metallic contact that has the most damaging influence on the durability of the balls.

An arrangement for determining the relation between contact resistance and load is shown in Fig. 9. A ball with a diameter of 36.5 mm. (1.44 in.) is placed between two plane disks, the upper loaded through the lever, as shown. The total length of this lever indicated by l is 1,598 mm. (5 ft. 2.96 in.) and l_k is 348 mm. (13.71 in.). This arrangement does not give the same

K_1 , was the same as the other balls. The average value for the thickness of the three mica disks should be the distance between the ball K_1 and the plane disk P_1 . By measurement this was found to be 0.29 mm. Direct current was then applied to the upper disk P_1 , its value being measured by an ammeter A and the drop in potential between the upper disk and the ball K_1 was measured by a voltmeter V .

The ground for the circuit was connected to the vise H and by the raising first of the ball K_1 to make contact with the disk P_1 and then by the lowering of this ball into contact with the disk P_2 an arc was established while readings of current and voltage were taken. Tests were made with four different strengths of current and the balls were changed after every reading. The voltage drop obtained and the maximum wattage is shown in Table I. Figs. 4 and 6 show the effect produced on the balls.

Other balls were then greased freely and the experiment was repeated. It was found that the rupturing effect was increased, but that it was more difficult to maintain the arc on account of the oil breaking it. Fig. 7 shows the effect on the balls in this latter test, and it will be noted that the size of the welded crater is reduced somewhat through the use of lubricant. The voltage and wattage obtained is shown by Table II.



JOURNAL BOXES FITTED WITH AUXILIARY CONTACTS FOR CARRYING CURRENT

Fig. 12—At left, double nut arrangement.
Fig. 13—At right, additional pressure provided by spring.

To illustrate the destroying effect that should be obtained on a ball bearing with a great load applied, let us consider the two balls shown in Fig. 11. The ball shown at the top of Fig. 11 has a hard layer h , which is thicker and more permanent when formed in oil than in water, due to the inferior ability of the oil to conduct heat. The surface layer of the ball as shown at the bottom of Fig. 11 has been pierced by the formation of a crater at z . The effect of the formation of such a crater is to subject the ball to a shearing or bending stress when a heavy load is applied instead of a compressive stress as would be obtained with a perfect ball.

To prevent damage to the balls through the passage of electric current some form of shunting device should be applied. The insulation of the outer ring of the ball bearing is possible, but does not appear advisable, as the repeated blows and shocks to which ball bearings are subjected would probably rupture or at least compress the insulating material, which would then produce additional stresses in the ball bearings. Tests have shown that the transmission of current through lubricated ball bearings may establish a galvanic element through the acids which the oil or lubricant may contain.

A shunt or auxiliary contact arrangement should be placed outside the ball or roller bearing casing and should have such a low resistance that it will practically exclude all transmission of current through the

TABLE II—TEST RESULTS ON BALLS WITH LUBRICANT

| Exp. | Amp. | Volt. Max. | Watt. Max. |
|--------|------|------------|------------|
| a..... | 27 | 1.8 | 48.6 |
| b..... | 60 | 3.8 | 228.0 |
| c..... | 90 | 3.2 | 288.0 |

contact resistance as would be obtained by the balls between their inner and outer rings in the ball bearings, but the relative proportion from different loads should be about the same. Fig. 5 shows the effect produced on balls by the current.

In order to produce in an artificial manner the current breaking which is supposed to take place in ball bearings, the apparatus shown in Fig. 10 was used. Between two plane disks P_1 and P_2 were placed three balls K_1 , K_2 and K_3 , each having a diameter of 36.5 mm. (1.44 in.). Three mica disks, G_1 , G_2 and G_3 , were placed between the upper plane disks and the balls. The thickness of the mica disks was measured very accurately. A fourth ball, K_4 , was then inserted and to this was screwed a vise H . The diameter of this ball,

balls or the rollers. The contact arrangement should also be constructed so that it will be easy to inspect.

A journal box fitted with N. K. A. disk bearings is shown in Fig. 13. This type of bearing has rollers which are self-centering, so that they tend to adjust their axis of rotation parallel to the axle of the wheel. The right-hand sides of the bearings shown in Figs. 12 and 13, which are marked *B*, show a current transmission arrangement that can be applied to new bearing boxes. This arrangement consists of two brass rings which bear against the collar of the wheel axle. These brass rings also serve to support the felt rings 9, against which they are pressed by means of a spring. To provide a better contact and a path of less resistance for the current, the space between the brass rings is filled with graphite or mercury. The conducting power of graphite is about 10^{11} times as great as that of oil, and it is thus evident that the use of graphite facilitates the transmission of current to a high degree. This type of box provides a path of low resistance for the current and at the same time gives a very tight construction against the entrance of sand or dust from the outside. The left-hand ends of Figs. 12 and 13 marked *A* show a contact nut arrangement which can be applied to old ball or roller bearing boxes. In general this type of construction corresponds to that just described. In Fig. 12A the current passes through the double nut at 4 and 5 to the graphite or mercury layer 7 and then to the contact disks 3, contact pin 2, and then to the axle of the wheel. In Fig. 13A the nut arrangement is simplified somewhat and the tightening ring has been made more effective by the use of a spring bearing on a brass contact disk 7. The path of the current in this construction is through the contact nut 4, the contact spring 12 and the contact disk 7 to the contact pin 5 and then to the axle of the wheel. These types of construction have been patented and are now in use on the tramways of Malmo, Sweden.

Make Bolster Trucks from Side-Bearing Types

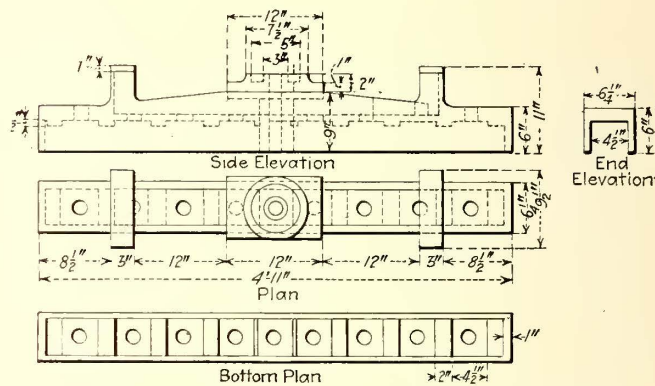
Old Side-Bearing Brill Maximum Traction Trucks Converted Into Bolster Type by the Georgia Railway & Power Company in Atlanta—Specially Designed Bolster Developed

THE Georgia Railway and Power Company, Atlanta, has several open cars which have been used only in intermittent service and they have been inclosing some of these open cars to put into regular daily service rather than extra service. These cars are equipped with Brill Eureka Maximum Traction Truck No. 22, side-bearing type, and the company did not consider this old style truck suitable for continuous service. Rather

than to buy new trucks, it tackled the problem of changing these trucks to bolster type, with completely satisfactory results. Some of these trucks have been in daily service practically two years and have developed no trouble. Eight or twelve more of these trucks will be changed over to the bolster type during the coming year.

In the change-over the company used only the former side bars, journal boxes, wheels, axles and springs of the old trucks, using the same motors, too, of course. It was naturally necessary to equip the trucks with newly designed brake rigging throughout and also to equip them with bolster, transom angles and with spring planks.

The bolster with which these trucks are equipped is a specially designed cast iron bolster, made in the foundry of the company in Atlanta. The accompanying drawing indicates the design and dimensions of this bolster, which is so constructed that the company was



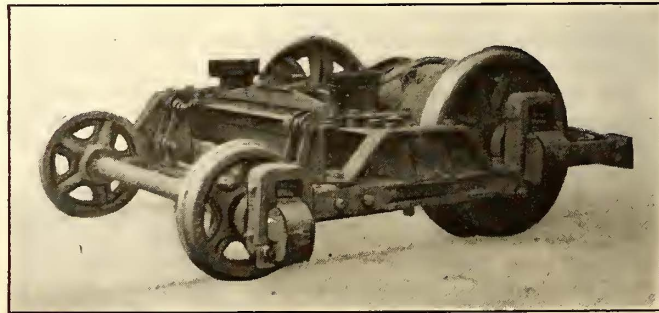
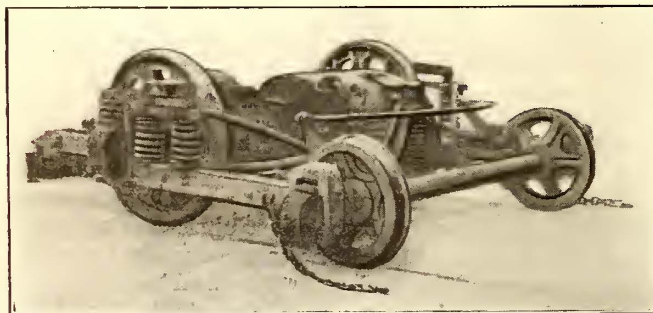
SPECIAL BOLSTER FOR REMODELED TRUCK

able to use the four coiled springs which were previously provided in the original truck to carry the car body. These springs are 7 in. long and have six turns of $1\frac{3}{16}$ -in. wire. The diameter of the coil at the top is $4\frac{1}{2}$ in. and at the bottom 5 in.

The bolster centers are 25 in. from the center of the small wheel axles and 23 in. from the center of the large wheel axles. Twenty-inch and 33-in. wheels are used. In the remodeled truck the motors are outside hung with nose suspension. The motors themselves are Westinghouse No. 68, with a gear ratio of 14 to 68.

The car bodies are some that were built by the company some twenty years ago. As remodeled, the total weight of the body, truck and equipment is 24,500 lb. There is seating capacity for forty passengers. The control on these cars is Westinghouse PK.

The total cost of remodeling these trucks has proved to be about \$300 per truck.



AT LEFT, OLD SIDE-BEARING TRUCK. AT RIGHT, REMODELED TRUCK AS BOLSTER TYPE

Data of New Interborough Turbine

Water Rate of 11 Lb. per Kilowatt-Hour for 30,000-Kw. Turbine Shown by
 H. B. Reynolds, Research Engineer Interborough Rapid Transit
 Company, to Have Been Attained in Test—
 Facts Contained in A. S. M. E. Paper

IN A paper scheduled for presentation at the spring meeting of the American Society of Mechanical Engineers, to be held in Chicago, May 23 to 26, 1921, Herbert B. Reynolds, research engineer Interborough Rapid Transit Company, New York City, gives information regarding the several types of turbine which have been installed by that company during the past dozen years. He also includes the results of tests

in the photographs reproduced is but 26,250 kw., while that of the turbine in the foreground is 35,000 kw.

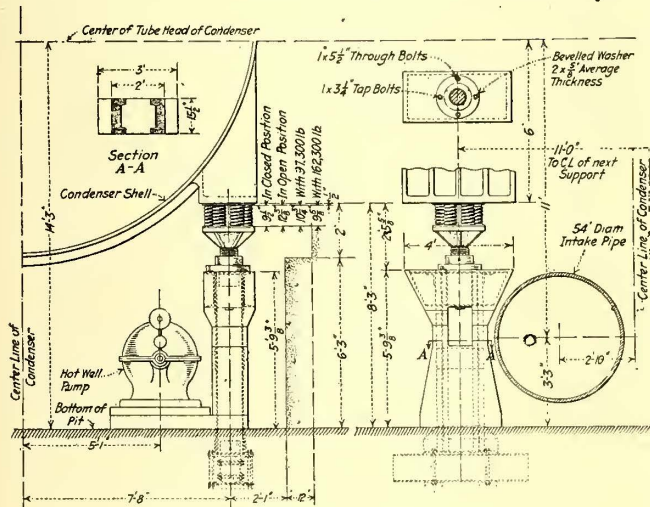
The three 30,000-kw. Westinghouse cross-compound turbines which were completed in 1915 were among the new units installed at the Seventy-fourth Street power station.

In the paper Mr. Reynolds gave structural and design details of the new turbines. Among other things, he said that they are of the straight Curtis impulse type, having twenty pressure stages, each consisting of one velocity stage. The normal steam pressure at the throttle is 225 lb. per square inch, abs., with a superheat of 150 deg. F., exhausting into a vacuum of 29 in. referred to a 30-in. barometer at 58.1 deg. F. The speed is 1,500 r.p.m.

In addition to the primary steam inlet, a secondary valve is provided which opens after the load reaches 24,000 kw. and which enables the turbine to carry a load of 35,000 kw. As all auxiliaries in the station are steam driven, a connection has been provided in the turbine through which any excess auxiliary exhaust steam may be injected. This is at the sixteenth stage of the turbine.

The generators are three-phase, star-connected, generating 25-cycle current at 11,000 volts. The excitation is at 250 volts. The generators are cooled by circulation of air maintained by a fan which forms an integral part of the generator. The air is drawn from the turbine-room basement and discharged from the top of the generator into the turbine room through a short stack.

Each unit comprises one single-shell two-pass Worthington condenser, two Worthington centrifugal circulating pumps, each driven through reduction gears by Kerr turbines; two Worthington centrifugal condensate pumps, each driven by a General Electric turbine, and one Laidlaw-Dunn-Gordon dry vacuum pump. Each condenser contains 50,000 sq.ft. of tube surface in

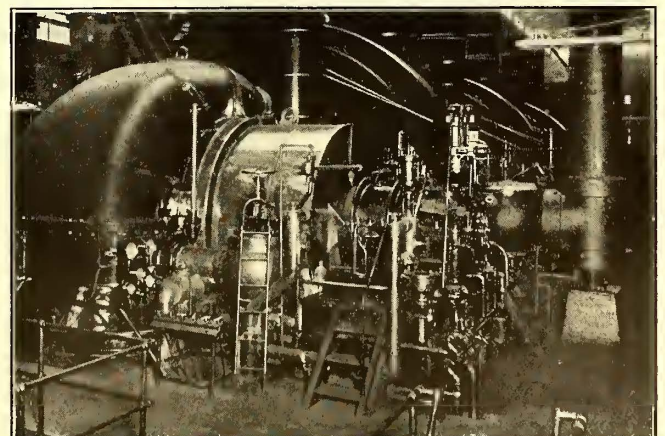


DETAILS OF THE SPRING SUPPORTS FOR THE CONDENSER

on the latest unit installed, namely, the three of 30,000-kw. capacity, the installation of which was completed during the past year.

Mr. Reynolds said that in order to provide additional power capacity for the new subways constructed in New York City during the period from 1913 to 1921, and operated by the Interborough Rapid Transit Company, additional turbine units were installed in both the Fifty-ninth Street and Seventy-fourth Street power stations. He reminded his readers that the original engine-room equipment of the Fifty-ninth Street power plant consisted of nine 7,500-kw. maximum capacity Manhattan-type Allis-Chalmers double-angle compound engine units and three Westinghouse 1,250-kw. turbines, the latter driving 60-cycle generators which supplied current for subway lighting. Later 25-cycle current was adopted for this lighting, the current being taken from the main units. During 1909 and 1910 five low-pressure 7,500-kw. maximum capacity General Electric turbine units were added, taking exhaust steam from five of the engines at atmospheric pressure.

Two of the new 30,000-kw units in the Fifty-ninth Street plant were installed in the space formerly occupied by the three lighting units, while the third turbine was installed at the western end of the station. The concentration of power possible with modern turbines is strikingly shown by the space they require as compared with that for reciprocating engines. The maximum capacity of the engines visible in the background

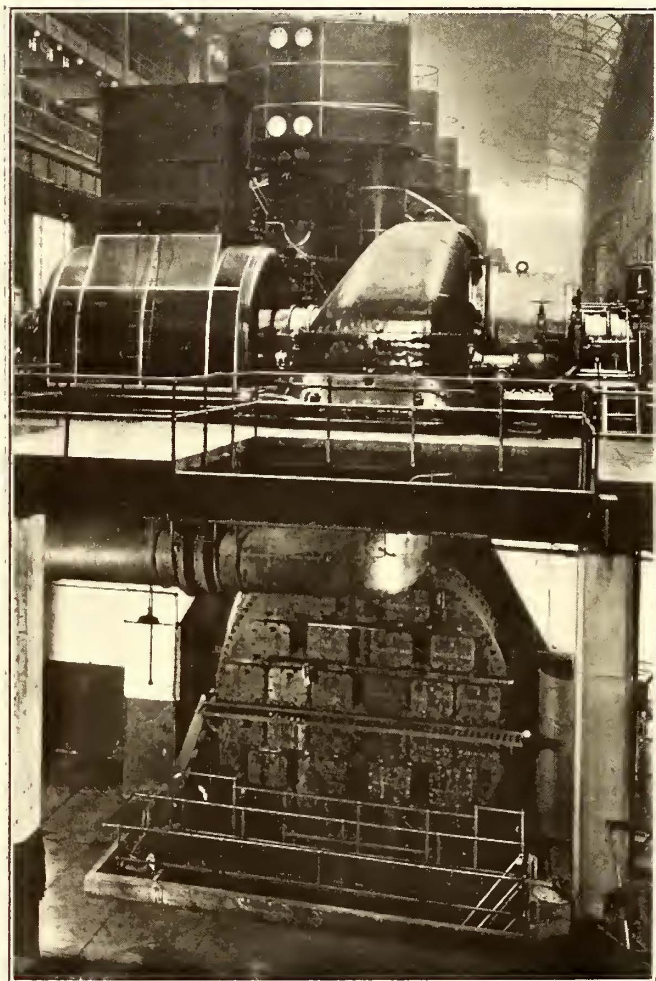


ONE OF THE THREE 30,000-KW. TURBINES INSTALLED AT THE FIFTY-NINTH STREET POWER STATION OF THE INTERBOROUGH RAPID TRANSIT COMPANY IN 1920

10,760 tubes 18 ft. long, 1 in. in outside diameter and of No. 18 B. W. G. thickness. The condenser is of the two-pass type, the water entering at the bottom and passing out at the top. As the condensers are mounted on springs, rubber expansion joints are inserted in the circulating water lines.

ADJUSTMENT OF SPRING CONDENSER SUPPORTS

As no expansion joint was provided between the turbine and the condenser, it was necessary to mount the latter on springs, so as to provide for expansion and contraction. The spring supports are shown in one of the illustrations. To facilitate the setting of the springs and provide a means for detecting and adjusting



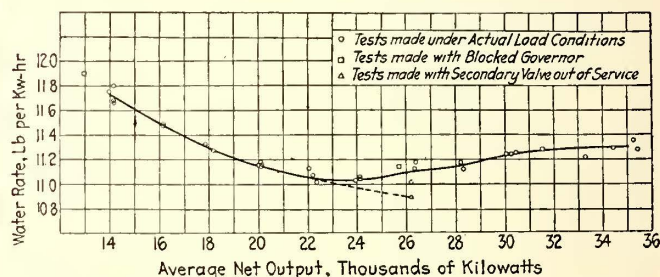
A COMPLETE TURBINE AND CONDENSER UNIT

for fatigue in them, hydraulic jacks were incorporated in the condenser supports.

Mr. Reynolds gave some detail of the procedure followed in setting these springs. He said that after the erection of the condenser and circulating water pipe had been completed, with the exception of making the joint between the condenser and the turbine, the condenser was raised while empty by means of the jacks, leaving $\frac{3}{8}$ in. clearance between the face of the turbine outlet and the face of the condenser inlet. The load on each of the four supports was then determined by noting the oil pressure in the jacks. It was decided that with the condenser empty and cold the downward pull on the turbine should not be less than approximately 17 tons. The distance that the joint between turbine and condenser would have to be pulled in order

to give this load was estimated from the modulus of elasticity of the turbine and condenser metal. The condenser was then raised to within the predetermined distance of the turbine outlet, which was found to be 0.231 in., after which the lock nuts on the jacks were screwed home and the condenser bolted to the turbine. The load on the springs was then determined with the condenser still empty by noting the pressure required just to raise the lock nuts. Every few months the load carried by the springs will be determined in this manner and compared with the load which existed when the condenser was first bolted to the turbine. Any fatigue which may develop in the spring will be compensated by screwing the lock nuts down.

It was found that the minimum condenser load carried by the turbine with the condenser shell empty was approximately 17 tons. As the water required to fill the condenser weighs about 60 tons the load on the turbine increases to 77 tons when the circulating water pumps are started. This is reduced to about 70 tons due to the compression of the springs under the expansion of the condenser during warming up. Immediately after shutting down, and while the condenser is still warm but drained, the load on the turbine is reduced to 10 tons. Thus, the condenser load on



WATER-RATE CURVE FOR NEW INTERBOROUGH RAPID TRANSIT TURBINE

Dotted line shows results that would probably have been obtained if steady-load tests had been conducted within this range of load where the secondary valve is continually opening and closing.

the turbine varies from 10 to 77 tons, out of a total condenser weight varying from 180 to 240 tons.

TESTS SHOWED HIGH THERMAL AND MECHANICAL EFFICIENCY

The equipment used for conducting the turbine tests consisted of two large water-weighing scales for measuring steam consumption, three single-phase rotating standard watt-hour meters for measuring the output, and the necessary thermometers, gages and mercury columns for determining temperatures, pressures and vacua. Most of the tests were of three-hour duration and, with the exception of a few special tests, the turbine was operated under conditions normal as to the type of load.

The results of the tests, in so far as the water rate is concerned, are given in the accompanying curve. The lowest rate obtained while operating under normal conditions was 11.03 lb. per kilowatt-hour. The thermal efficiency, or ratio of the output to the energy in the steam, was 25 per cent. The Rankine efficiency; that is, the ratio of the energy developed to that available within the working range of temperature and pressure, was 75.5 per cent.

In the paper the results of various auxiliary tests were also given, but it is impossible to summarize these within the space limitations of the present abstract.

Railway Valuation in Connecticut—I*

Procedure in Assigning Values to "Inside Plant" Property of a \$50,000,000 Railway System

BY ARCHER E. KNOWLTON

Instructor in Electrical Engineering, Yale University

THE regulation of public utility rates has in most contested cases called for such evidence of physical value of the utility property as appeared to be obtainable only through detailed inventory and valuation. This demand for valuations has come from all three of the parties to regulation, the public, the public utilities and the public utilities commissions. Occasionally sworn statements of utility executives or of disinterested experts have been acceptable, but once a valuation is demanded for rate purposes usually nothing short of minutely detailed inventory and appraisal suffices. Adherence on the part of the commissions, with their quasi-judicial status, to the rules of evidence as laid down by the courts has been a large factor in requiring these elaborate valuations. This, in a measure, has been excusable, considering the ever-present possibility of appeal to the courts from the commissions' decisions.

There is ample basis, however, for questioning the necessity of incurring the expense of making a minutely detailed valuation, and the trend seems to be toward recognition of these negating factors and even in some quarters to concede that proximate methods may result in adequate accuracy. Some of the aspects of recent physical valuations open to criticism are the cost, the length of time to complete, the element of estimate in fixing depreciation and other tangible overhead percentages, the uncertainty as to labor costs in connection with the multiplicity of small items, frequently the inflexibility of the summary as to rational apportionment of the total value among subsequent subdivisions of the property and, more frequently, the insignificance of sizable variations in the physical total as reflected in the rates for the service rendered.

The costs of valuations can hardly be called exorbitant when one observes that for a selection of the recent cases resulting in totals of eight and nine figures the services of the appraisers amounted to from 1.3 per cent to 6.6 per cent of the yearly return (at 6 per cent) on the fair value found. It may be urged that such a small item is negligible among the other constituents of the total needed receipts upon which the rate is fixed, but the same reasoning sanctions the employment of a proximate method of valuation the cost of which is only a fraction of that of a detailed appraisal. It is, however, the public, in its consuming, investing or tax-paying character, which pays the bill, and while only

IN THE VALUATION of railway property so much time and expense have been involved in most cases that a study of methods which will reduce these items to a minimum is worth while. In presenting this story of the valuation of the property of the Connecticut Company by the Public Utilities Commission of Connecticut, Mr. Knowlton, who serves as the electrical engineer to the commission, points out the philosophy of the commission and its engineers in their efforts to arrive at a fair valuation in moderate time, and at moderate expense. In this installment Mr. Knowlton shows the problem as a whole and tells how the "inside plant" and overheads were treated. In a subsequent installment he will develop the interesting unit-of-construction or "yardstick" bases of valuation for outside plant, which was the largest factor in saving both time and expense.

—EDITORS.

recently laws have gone into effect specifying in great detail how values shall be arrived at, there is evident today a tendency to attach less importance to the strictly physical valuation and more to such factors as the value of the service, or even the mere prevention of an operating deficit.

The time taken to make a physical valuation has often been the cause of long delays in rendering decisions on rate changes, and by the time they are reported conditions in the industry may have undergone abrupt changes, especially during and since the war. Any procedure which will facilitate

early decisions is therefore much to be desired.

And again, in actual service the life of a rail bond is not wholly independent of that of the rail nor that of a cross-arm independent of the life of a pole. This feature, in conjunction with the mixture of past experience and future conjecture that establishes the depreciation percentage for each element of property, leads to totals which involve more uncertainty than is ordinarily attributed to a detailed valuation. Another element of uncertainty appears in the labor allowances in connection with the many small items, because, while individually small in themselves, in the aggregate they may result in considerable variations in the total. Incidentally, can any one know to as high a degree of precision the actual labor cost of installing a single trolley bracket as he can the cost of constructing a thousand-foot section of uniform completed bracket construction on wood poles?

Although the tendency has been to regard only the value of the entire connected systems in fixing rates, it is often desirable to be able to demonstrate that local rates are not unreasonable when viewed in the light of the fair value of the corresponding subdivision of the property. Unless precautions are taken the summary of a detailed valuation may not permit ready determination of the physical value for such a subdivision.

And, finally, considerable variations in the physical and fair values are usually possible without in themselves determining the rate. As an illustration, take a million-dollar railway which has an operating revenue of \$370,000 and operating expenses of \$300,000, with resulting net operating revenue of \$70,000. If operating expenses increase one-third, the operating revenues must rise to \$470,000 to provide the same net revenue as before. But if the fare originally was 5 cents, under the new conditions 6 cents will not suffice and 7 cents will be necessary. In order that the fair value in itself should be the determining factor for either

*In two parts.

the 6- or 7-cent fare under the new conditions, the valuation total would have to be as low as \$635,000 or as high as \$1,685,000 as against the \$1,000,000 assumed. Of course these computations imply an undiminished traffic and the application of all net revenue toward interest on capital, but they indicate the extent of variations that are tolerable in the actual case.

PURPOSE AND BASIS OF THE VALUATION

The Connecticut General Assembly of 1919 directed the Public Utilities Commission to "investigate the

conditions under which the street railways of the state are operated and to report . . . such recommendations and suggestions with respect to legislation as it may deem proper and advisable in order to place such street railways upon a safe and efficient operating basis." But if the Legislature contemplated a valuation it must have been guided by some of the considerations advanced above in favor of an inexpensive valuation it must have been guided by some of the commission in following the mandate deemed "it necessary to procure as accurate a valuation of the properties as possible," but added, "we are of the opinion that a reasonably accurate business-like valuation can be made with our existing force and facilities, supplemented by temporary assistance at moderate expense." In this manner the three engineers of the commission, E. I. Rudd, J. P. Wadhams and A. E. Knowlton, were directed to ascertain the cost of reproducing the 750 miles of street railway system under price conditions prevailing from 1910 to 1915. Likewise, the auditor and statistician, Edward Field, was directed to ascertain the actual investment or original cost to date of all the properties.

It was therefore not only imperative but also in keeping with the philosophy of the commission that the engineers, in ascertaining the reproduction cost of the railways, should devise a method which would entail a minimum of time and expense. At the outset it was recognized that if a detailed inventory were demanded it would be the extended portions of the property that would involve the greatest number of men and consequently the most time and expense. It was in the field work that most of the time and expense could be saved. Familiarity with the properties prompted the idea of treating as much as possible of the "way and structures" account by *applying computed costs of unit sections of an appropriate number of types of outside plant construction*. Some \$19,000,000 worth of railway property was valued by this procedure, the portions to which it was applied comprising the following (the numbers are those of the I. C. C. classification):

- 505-7, 510. Track and roadway construction.
- 511. Paving.
- 519-521. Electric line construction, poles and fixtures.
- 521. Feeder and distribution system.
- 544. Transmission system.
- 518. Telephones.
- 517. Signals.
- 507. Bonding.

Not only was economy in time and expense attained by this procedure, but it is believed that the results present advantages not always obtainable from the usual type of detailed valuation. The procedure, in a word, amounted to the establishment of "yardsticks" by means of which to measure the assembled construction as contrasted with a detailed count of elementary units without regard to their assembly. Some of the details of the procedure may interest the railway public and a technical discussion of this method will appear in a subsequent article.

PROCEDURE IN VALUATION OF ACCOUNTS TO WHICH UNIT-OF-CONSTRUCTION BASIS WAS NOT APPLICABLE

A map of the Connecticut Company's system, the principal one in the state, is shown herewith, and the total physical values for the various portions of the property are shown in the accompanying table, arranged according to the Interstate Commerce Commission ac-

CONNECTICUT COMPANY'S OWNED AND LEASED PROPERTY

| Way and Structures | | Appraised Value |
|---|---|-----------------|
| 501 | Engineering and superintendence..... | \$1,556,182.23 |
| 502 | Right of way..... | 722,753.55 |
| | Work done outside company area..... | 397,200.00 |
| 503 | Other land used in electric railway operations | 1,485,845.61 |
| | Land for parks and resorts..... | 605,598.30 |
| 504 | Grading..... | 2,071,605.97 |
| 505 | Ballast..... | 9,858,741.18 |
| 506 | Ties..... | |
| 507 | Rails, rail fastenings and joints..... | |
| 510 | Track and roadway labor..... | |
| 508 | Special work..... | 1,408,709.00 |
| | Electric switches..... | 16,417.50 |
| 511 | Paving..... | 3,696,073.84 |
| 512 | Roadway machinery and tools..... | 93,252.69 |
| 515 | Bridges, trestles and ulverts..... | 1,285,138.25 |
| 516 | Crossings, fences and signs..... | 156,173.30 |
| 517 | Signals and interlocking apparatus..... | 86,723.06 |
| 518 | Telephone and telegraph lines..... | 41,820.28 |
| 519 | Poles and fixtures..... | 3,803,717.85 |
| 521 | Distribution system..... | |
| 520 | Underground conduits..... | 210,956.18 |
| 522 | General office buildings..... | 2,035,084.87 |
| 523 | Shops and carhouses..... | |
| 524 | Stations, miscellaneous buildings and structures..... | 143,240.00 |
| 525 | Wharves and docks..... | 35,911.00 |
| 526 | Park and resort buildings..... | 297,369.56 |
| Total way and structures..... | | \$30,009,014.22 |
| Equipment | | |
| 530 | Passenger and combination cars..... | 4,780,800.00 |
| 531 | Freight, mail and express cars..... | 207,533.00 |
| 532 | Service equipment..... | 330,230.00 |
| 533 | Electric equipment of cars..... | 3,051,329.00 |
| 534 | Locomotives..... | 25,000.00 |
| 536 | Shop equipment..... | 267,687.75 |
| 537 | Furniture..... | 99,233.51 |
| 538 | Miscellaneous equipment..... | 62,347.86 |
| Total equipment..... | | 8,824,161.12 |
| Power | | |
| 539 | Power plant buildings..... | 686,820.00 |
| 540 | Substation buildings..... | 67,908.00 |
| 541 | Dams, canals and pipe lines..... | 90,000.00 |
| 542 | Power plant equipment..... | 3,654,000.00 |
| 543 | Substation equipment..... | 481,328.00 |
| 544 | Transmission system..... | 281,463.41 |
| Total power..... | | 5,261,519.41 |
| General and Miscellaneous | | |
| 546 | Law expenditures..... | 263,676.26 |
| 548 | Insurance (injuries and damages)..... | 158,347.88 |
| 547 | Interest one year..... | 2,781,297.56 |
| 549 | Taxes..... | |
| 550 | Promotion and organization..... | 982,725.12 |
| | Contingencies..... | 1,838,240.20 |
| | Working capital..... | 500,000.00 |
| | General stores and supplies..... | 1,298,744.51 |
| Total general and miscellaneous..... | | 7,823,031.53 |
| Grand total..... | | \$51,917,726.28 |
| Land, buildings and equipment not used for electric railway purposes..... | | 378,864.52 |

CONNECTICUT COMPANY'S OWNED AND LEASED PROPERTY

| Division | Approved Value by Divisions | | Average Value per Mile |
|---|------------------------------------|-----------------------|------------------------|
| | Total Computed Single Track, Miles | Total Appraised Value | |
| Stamford..... | 22.571 | \$991,169.04 | \$43,913.39 |
| Norwalk..... | 24.144 | 1,259,463.42 | 52,164.65 |
| Bridgeport..... | 105.183 | 7,735,827.44 | 73,546.37 |
| Derby..... | 27.493 | 2,025,821.82 | 73,685.00 |
| New Haven..... | 150.987 | 12,269,957.62 | 81,265.00 |
| Meriden..... | 37.981 | 1,765,165.44 | 46,474.96 |
| Waterbury..... | 85.063 | 5,125,073.91 | 60,250.33 |
| New Britain..... | 33.485 | 2,050,356.80 | 61,232.10 |
| Hartford..... | 167.185 | 10,816,982.33 | 64,700.67 |
| Middletown..... | 20.470 | 988,025.09 | 48,266.98 |
| Torrington..... | 12.676 | 542,642.21 | 42,808.63 |
| New London..... | 89.920 | 4,548,496.65 | 50,583.82 |
| Working capital, general stores and supplies..... | | 1,798,744.51 | |
| All divisions..... | 777.158 | \$51,917,726.28 | \$66,804.60 |

Above figures include under New Haven Division 7.426 miles of West Shore Railway Company property and under Hartford Division 0.814 miles of Manchester Electric Company's trolley property.

count numbers. Those accounts which were dealt with on a unit-of-construction basis have already been listed and there is given below a brief description of the means and method of assigning values to the remaining accounts.

501. *Engineering and Superintendence.*—The value allowed for this expenditure was obtained by taking 5 per cent of accounts 504-526, 539, 541, 544, 550a, 550b (largely way and structures items excepting land) and, in addition, 1 per cent of accounts 502, 503, 530-538, 542, 543, 550d, 550e (principally land and equipment items).

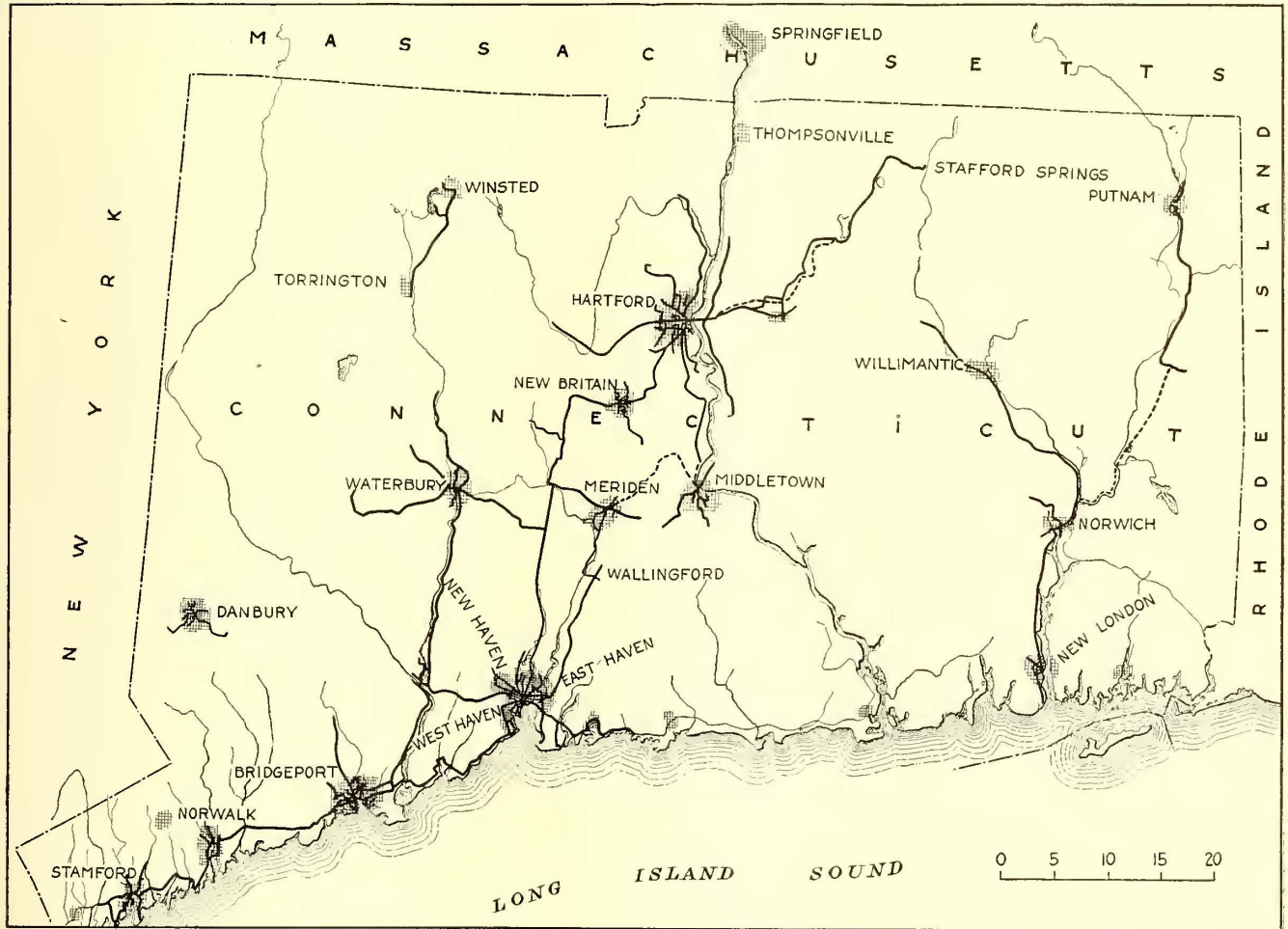
502. *Right of Way.*—For sections adjacent to railroad right-of-way, New York, New Haven & Hartford

cross-sectioned by commission engineers accompanied by company engineers.

508. *Special Trackwork.*—Detailed plans of each installation were available and the costs were computed directly from these plans.

512, 516, 536-538. *Tools, Equipment, Furniture, Etc.*—These accounts comprise roadway machinery and tools; crossings, fences and signs; shop equipment; furniture; miscellaneous equipment. The company supplied the inventory and prices were assigned by commission engineers. These items combined amount to only 0.2 per cent of the physical total for the entire property.

515. *Bridges, Trestles and Culverts.*—Appraised es-



MAP SHOWING CONNECTICUT COMPANY SYSTEM, WHOSE VALUATION IS DESCRIBED IN THIS AND SUBSEQUENT ARTICLES

Railroad figures per acre as supplied to the Interstate Commerce Commission in its railroad valuation were used. Normal values based on the price paid by a willing buyer to a willing seller were multiplied by a factor, which varied from 1 to 5, to cover severance, damages and other costs of acquisition. Other parcels were valued in part by reference to company records and in part by field estimates of commission engineers or real estate men.

503. *Park and Resort Lands, Etc.*—The judgment of real estate dealers, tax collectors and valuation records of the New York, New Haven & Hartford Railroad were relied upon for this account (1 per cent of the total).

504. *Grading.*—In order to check the information appearing on the company's records and maps and to supply missing data a few of the interurban lines were

timates made by outside engineers for the company on the occasion of a regular maintenance survey were supplied by the company to the commission. A field check made by commission engineers at the time of the grading survey indicated a few corrections and additions.

522-526, 539-541. *Buildings and Various Other Structures.*—There are included here general office buildings; shops and carhouses; stations, miscellaneous buildings and structures; park and resort buildings; power and substation buildings; wharves and docks. The company had a record of each of these items covering size and character of construction. With a view to classification each of these structures was visited to ascertain its physical condition and the manner of use. The prices applied were on a cubic content and area basis similar to those employed by the I. C. C.

530-534. *Rolling Stock.*—Cars (passenger, combina-

tion, freight, mail, express, and service) with their electric equipment, and locomotives were examined to determine the type of body, of trucks and of electric equipment. Unit prices were then applied separately to each of these three components of each car. Cars manifestly in need of extensive repairs to permit shifting from part-time to full-time service were averaged at 80 per cent of reproduction value. No value was included for abandoned equipment.

542, 543. *Power and Substation Equipment.*—Lists of all the equipment were supplied by the company and these in conjunction with personal inspection enabled two consulting engineers, one electrical and one mechanical, both of wide experience in the field of steam-electric power, to report over-all values for the equipment in each plant. The commission felt that the candid opinion of these engineers on the lump reproduction value of the plants would be as valuable and reliable as would be the summarized result of a more detailed study unit by unit. Due to relatively recent construction, it was found easily possible to ascertain the equipment costs for the substation in considerable detail. The variation in installed cost of substation equipment per kilovolt-ampere with the capacity of the substation is exhibited in the accompanying curves as an interesting result of this study.

546. *Law Expenditures.* One per cent of the total

component of that account and these were then allowed for the insurance item:

2.4 per cent of (517-521, 544).

0.3 per cent of (530-534).

0.7 per cent of (536-538, 542, 543).

550. *Promotion and Organization.*—Two per cent of accounts 501-549, 500a-550e was the allowance for this capitalized expenditure. General stores and supplies as inventoried by the company and priced jointly by the company and commission engineers amounted to some 2.5 per cent of the physical total.

Analysis will show that the total of the tangible overhead allowances amounts to 22.2 per cent of the total of physical items appearing in accounts 502-544. If general stores and supplies and working capital are deducted the remaining overhead items represent about 18.2 per cent of the physical total.

HISTORICAL COST

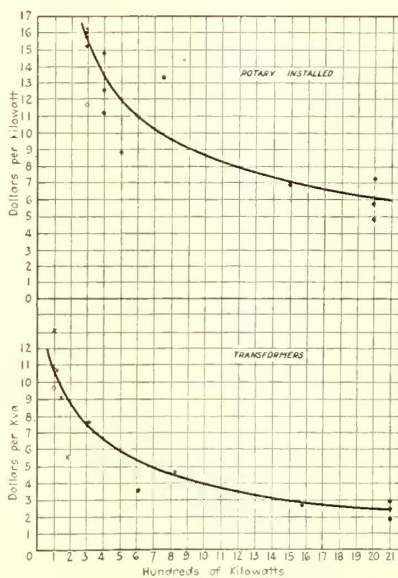
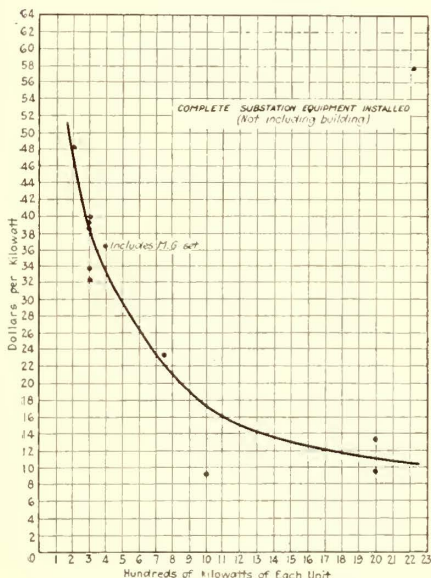
The statistician and auditor made a very careful study of the corporate and accounting history of the company and arrived at the totals in the table below.

A corresponding total of \$19,741,537.14 was found to be the historical cost of the lines leased by the company, making the total historical cost of the company's owned and leased lines \$60,753,352.85.

Much of the difference of \$9,000,000 between the reproduction cost and historical cost is accounted for when it is recollected that many of the component lines started as horse railways, and the capital invested in horses, rolling stock, light rails and roadbed construction, none of which is in existence today, is included in those costs, as well as the cost of the modern tracks, pavement and equipment, built and paid for with new and additional capital.

The foregoing shows in a general way the sources of and the bases for the values assigned to that portion of a street railway property which, for contrast, may be called "inside plant." While no claim is made that all the figures are rigidly exact, it is felt that they surely are entitled to be classed as proximate in their character rather than merely approximate. Or from another angle, such errors, omissions or duplications as may have crept in

in this instance, as is nearly always the case, were well within the limits imposed at the start and, in the opinion of the writer based on the arguments advanced, are



CURVES SHOWING SUBSTATION COSTS AS RELATED TO CAPACITY

amount of accounts 504-526-539, 541 and 544 was allowed for this item. It will be noticed that this includes all physical items except land, rolling stock, furniture and equipment of power plants and substations.

547, 549. *Interest and Taxes.*—In carrying out the instructions of the commission to ascertain the reproduction cost based on prices prevailing during the period 1910-1915, the engineers estimated that the system would be established in five approximately equal sections, each requiring one year to construct. On this basis an allowance was made for interest and taxes of 6 per cent for one year on accounts 501-546, 548, 550a-550e.

548. *Insurance (Injuries and Damages).*—Employers' and public liability insurance premiums (based on payroll) amount to the following percentages of the total of each account when applied to the probable labor

| FINAL TABLE SHOWING HISTORICAL COST OF THE PROPERTY OF THE CONNECTICUT COMPANY | |
|---|-----------------|
| Expenditures for road and equipment on owned lines (8/1/1906 to 12/31/1919) | \$16,032,996.00 |
| Expenditures for road and equipment on leased lines (1906-1919) | 5,159,503.61 |
| Total expenditures on owned lines and leased lines | \$21,192,499.61 |
| Cost of construction and equipment of the several street railway lines purchased by predecessors of the present company, as shown by the last report of such street railway companies to the Railroad Commissioners | 19,819,316.10 |
| Total historical cost of street railway properties of the Connecticut Company, at Dec. 31, 1919 | \$41,011,815.71 |

tolerable in all ordinary utility valuations. A later article will exhibit in considerable detail the method of attack for the "outside plant."



TWO FEATURES IN TWIN CITY'S DEMONSTRATION

Railways Find Real Publicity Pays

Demonstrations on National Electric Railway Day Catch Public Eye for Unusual Sights—Editorial Nose for News that's Different—Makes Folks in the Industry Realize the Importance of Their Jobs—Interest of Public Further Aroused by Competition for Prizes for Essays and Free Passes

THE electric railway industry on May 4—National Electric Railway Day—proved itself the “Babe Ruth” of the public utility league. It knocked the advertising and publicity ball far out over the clubhouse. May 4 was proclaimed National Electric Railway Day by the committee on publicity of the American Electric Railway Association and notices to this effect were sent out to the membership on April 16 over the signature of P. H. Gadsden, president.

The celebration was without doubt a success. In virtually every city in the United States where an electric car is run the increased efficiency of local transportation service and the great importance of local electric railway systems were driven home to the public. This was accomplished by parades showing the contrast between either the horse cars of a third of a century ago or the earlier types of trolley cars and present up-to-date \$15,000 cars, newspaper stories, display advertising and other publicity.

Reports received by the Advertising Section of the association, which suggested details of the program to companies under the direction of the publicity committee, indicate that more than a score of companies staged some form of demonstration in different parts of the country.

Practically every daily newspaper in the country carried either a local or a telegraph story about national observance of the day. These stories not only told the history of the electric railways but also discussed the

It was well to give a public demonstration of the anniversary of the trolley, for it brought vividly to public mind the great advance that has been made in transportation. People are prone to live intensely in the present and to forget or to ignore progress that has been achieved.

—*Washington (D.C.) Star*

present problems of the industry. Two press associations put out national stories to 2,000 daily newspapers which were prepared on facts furnished them by the Advertising Section. Local companies co-operating with their home papers supplied further information that led to a large number of feature stories of community importance. Clippings so far received by the association show that the stories ranged from 300 words to a page and a half. Most of them were liberally illustrated with pictures of former and present types of cars. Many newspapers also commented editorially on the ob-

servance of the day and the growth and importance of electric railways to the welfare and development of urban centers.

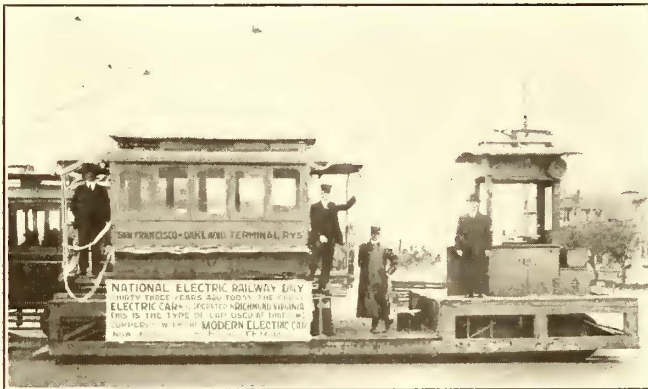
The largest news motion picture organizations of the country took motion pictures of several of the celebrations. Advices from A. H. Herrmann, Virginia Railway & Power Company, say that several motion picture operators were present at the Richmond celebration and took pictures of the parade despite the inclement weather. These pictures were shown later in motion picture houses throughout the country.

Many local companies supplemented the newspaper stories with display advertisements. The Northern Ohio Traction & Light Company and the Virginia Railway & Power Company issued special editions of their own publications, the latter being distributed broadcast to car riders. The Advertising Section also provided special cards for window display and other leaflets.

Three companies, namely, those operating in East St. Louis, Ill.; Charleston, S. C., and Pottsville, Pa., offered money prizes for the best essay or historical review of the development of the local system. In Pottsville the prize offer was limited to the school children and the interest taken is reflected in the illustration shown.

Among the companies that have reported street demonstrations are: Union Street Railway, New Bedford, Mass; Virginia Railway & Power Company, Richmond, Va.; Twin City Rapid Transit Company, Minneapolis and St. Paul, Minn.; Indianapolis (Ind.) Street Railway, Eastern Pennsylvania Railways, Pottsville, Pa.; Rockford (Ill.) & Interurban Railway and the San Francisco-Oakland (Cal.) Terminal Railways. Several companies, including New Orleans and St. Louis, have reported that they intend to stage demonstrations later.

Some difficulty was found in several places in resurrecting old rolling stock that would show the desired contrast between present and former day service and therefore such companies could not put on a parade,



ONE OF THE FEATURES SHOWN IN OAKLAND, CAL.

but contented themselves with display advertising and newspaper publicity.

A letter from Mr. Herrmann regarding the Richmond celebration said in part:

"Despite the cold, rainy day we paraded three cars throughout the city in the afternoon, the front one being the oldest type summer car we could find; in fact, it was the only car of the kind we could secure, and it was quite antique looking, being the first summer car operated on the Richmond lines. The car was signed on the sides as you will note in the illustration and it carried a brass band. The next car was one of the big center-entrance type and then followed a modern safety car, these two carrying the Mayor, City Councilmen and officials of the company. The parade started from Twenty-ninth and P Streets, which was the terminal from which the first electric railway operated.

"Film representatives from Washington came down, arriving just a few minutes before the parade, and they got pictures from several sections of the city.

"Everything worked out very well and I do not believe we could have made a better demonstration if we had had a month's time. In fact, I believe the speed under which every one worked had a stimulating effect."

The celebration in Minneapolis and St. Paul attracted widespread attention, the newspapers giving it publicity prior to and on Electric Railway Day. In Minneapolis Henry Green, a former driver but now in the

legal department, again took hold of the reins of the car. After a trip through the down-town section of the city the car was taken to St. Paul, and there John Prior, the oldest street car conductor, was the driver. The car was preceded by the trainmen's band in both cities. The fourteen persons making application to ride in the car were given seats of honor.

CONTEST BETWEEN OLD-TIMERS AROUSED KEEN INTEREST IN NEW BEDFORD, MASS.

New Bedford, Mass., had a tremendously successful celebration. Immediately after the celebration of the day was suggested, the Union Street Railway began preparations for the event and succeeded in arousing great interest. One of the most successful features of the program was the offer of a year's free transportation over the local lines to the oldest man who rode on the horse car during the parade. A heated contest between old residents ensued and the prize finally was won by Edwin B. Macy, 88 years old. The reins were handled by James Card, one of the oldest former employees of the company. Peter Duprey, another old driver, also was on the platform. A clipping from the New Bedford *Times* says that between ten and fifteen thousand persons witnessed the demonstration. Not only the New Bedford but also some of the Boston papers devoted liberal space to a review of the celebration.

The Pottsville, Pa., celebration also attracted much newspaper publicity. The Pottsville *Republican*, which in the early days led the fight for electric railways in that territory, devoted more than a page to the story. C. A. Hall, general manager Eastern Pennsylvania Railways, and his assistants worked energetically in bringing about a successful observance of the day and they were well repaid for their efforts. Unfortunately, it was impossible on account of rain to keep the old time car out as long as seemed desirable on May 4, so it was brought out again later in the week.

In Indianapolis Robert I. Todd, president Indianapolis Street Railway, quietly slipped one over on the folks by springing his show on the unsuspecting public at about 5 o'clock in the evening. An old-time horse car drawn by two mules followed by a modern electric car started from the Traction Terminal Station and ran through the principal streets of the town. In describing the trip Mary E. Bostwick, a staff writer of the Indianapolis *Star*, says that "all the traffic rules in the world were broken by the mules and that a cop almost arrested the party." Besides Mr. Todd, Joseph A. McGowan, secretary and treasurer of the company; James P. Tretton, superintendent; James F. Lynch, J. E. Sweeney and Edward Noon rode on the car.

In Rockford, Ill., Gus King, who drove a mule car in the olden days, was in charge of the resurrected hay-burner. For a brief half hour the mule enjoyed prominence, being the cynosure of all eyes on the principal streets. But, as is often the fate of heroes, he suffered a fall and in one short half hour after the demonstration he again was dragging a prosaic coal wagon through the back streets of the town.

The East St. Louis & Suburban Railway co-operated very successfully in the observance of the day. Exhibits received show that single and double-page advertisements calling attention to the day and its significance were carried in various local papers prior to and on the day of the celebration. Dashboard signs were also displayed on the cars May 3 and 4. Sleeve

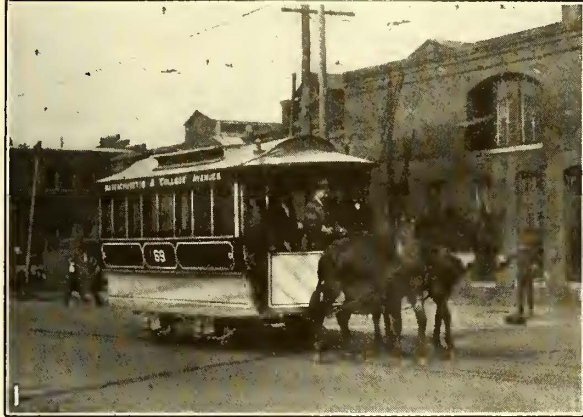
bands, as illustrated, were worn by officials, office employees and car crews on May 4. The advertisements were particularly well executed. One of them contained articles by prominent citizens regarding the growth of the local traction system. One striking feature of this same advertisement was the announcement of the "Funeral of the Dinkies" displayed within inverted rules, as well as interesting illustrations of old time and modern cars.

In Oakland, Cal., a single-truck car of early vintage was mounted on a flat car. The flat then toured the

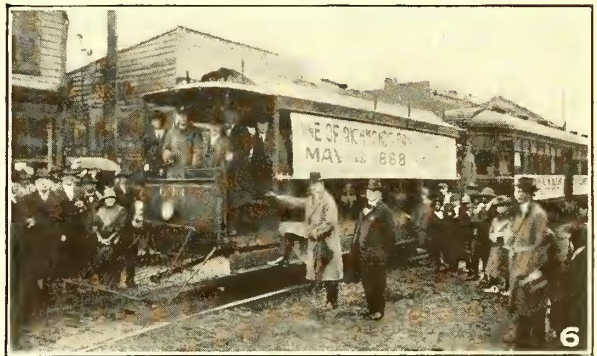
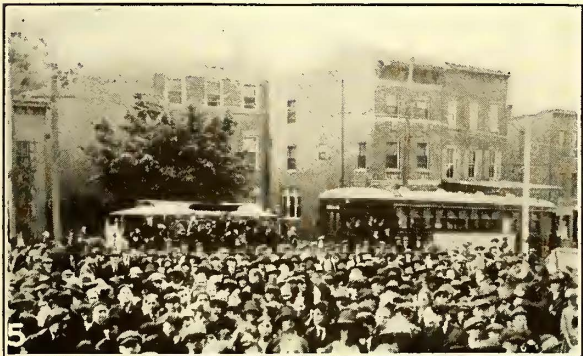
Ark.; Los Angeles, Cal.; Lynchburg, Va.; New Orleans, La.; Oil City, Pa.; Pine Bluff, Ark.; Peoria, Ill.; Savannah, Ga.; Seattle, Wash.; St. Joseph, Mo., and Sheridan, Wyo. In these places either well-illustrated special advertisements or signed staff stories or both were features.

The personnel of the publicity committee, under whose direction National Electric Railway Day was celebrated, is:

Barron G. Collier, New York, chairman; S. W. Huff, New York; B. I. Budd, Chicago; C. B. Buchanan, Rich-



AMERICAN ELECTRIC RAILWAY DAY



ALL SECTIONS OF THE COUNTRY PARTICIPATED IN THE CELEBRATION OF NATIONAL ELECTRIC RAILWAY DAY

1—President Todd of Indianapolis at the reins.
 2—Badge worn by the employees of the Little Rock Railway & Light Company.
 3—First and last types of cars at Pottsville, Pa.
 4—Arm band worn by train crews, officials and office employees of the East St. Louis & Suburban Railway.
 5—School children of Pottsville participating in demonstration.
 6—Earliest type of cross-bench open car operated in Richmond.

city and caused much comment on past means of transportation.

Advices have been received from companies showing that much attention was paid to the day by the newspapers and the public in more than 125 other cities. Among those more than a score need special mention, namely, Bangor, Me.; Charlotte, N. C.; Cincinnati, Ohio; Duluth, Minn.; Elmira, N. Y.; El Paso, Tex.; Evansville, Ind.; Framingham, Mass.; Green Bay, Wis.; Haverhill, Mass.; Jackson, Mich.; Little Rock,

mond, Va.; W. A. Draper, Cincinnati; C. D. Emmons, Baltimore; L. S. Storrs, New Haven, and Horace Lowry, Minneapolis. The details of the program were carried out by Labert St. Clair, head of the association's advertising section.

The committee has great reason to be pleased with the results of the day. It demonstrated the possibilities of nationally advertising electric railways through the co-operation of local companies with the association's Advertising Section.

Large Meeting in Hartford

Joint Session of New England Street Railway Club and Connecticut Company Section No. 7, A. E. R. A., Proves Most Successful

PERFECT weather for the inspection and sightseeing trips added the finishing touch to the success of the joint meeting of the New England Street Railway Club and Connecticut Company Section No. 7, American Electric Railway Association, at Hartford on Wednesday, May 18. More than 250 members of the two organizations spent the day at Hartford and attended the sessions which started at noon and stopped at 10 o'clock at night. While suggestions for holding such a joint session have been made many times in the past, it was not realized until this week.

The meeting started with a luncheon at the Wethersfield carhouse of the Hartford Division of the Connecticut Company, which was followed by the showing of the moving picture reel taken at the New England Street Railway Club outing in Montreal last summer. After this E. Irvine Rudd, chief engineer of the Public Utilities Commission of Connecticut, presented a paper on "Appraisals and Their Uses." After discussing the various purposes of appraisals and showing the progress of engineering valuation, Mr. Rudd discussed the recent valuation which the commission has made of the railways in Connecticut. In this discussion he presented an analysis covering much the same ground that is included in the articles by his associate, A. E. Knowlton, the commission's electrical engineer, in this and subsequent issues of the *ELECTRIC RAILWAY JOURNAL*.

The rest of the afternoon was spent in visits to the Connecticut Company's shops and carhouses in Hartford, in inspecting the power plant of the Hartford Electric Light & Power Company, now in construction, and in sightseeing trips around Hartford by special car and by auto.

At 6:30 dinner was served to the entire attendance at the Hartford Club. Following this dinner a succession of chairmen took charge of the meeting, in the following order: V. S. Curtis, vice-president of Connecticut Company Section No. 7; N. J. Scott, newly appointed manager of the Hartford Division of the Connecticut Company; Edward Dana, president of the New England Street Railway Club, and W. J. Flickinger, vice-president for Connecticut of the New England Street Railway Club. During these successive chairmanships, resolutions were adopted on the death of Warren P. Bristol, late manager of the Hartford Division, and 66 new members were admitted to the New England Street Railway Club.

With Mr. Flickinger presiding, the program of the evening was then commenced. The principal speaker was Richard T. Higgins, chairman of the Public Utilities Commission of Connecticut, the keynote of whose address was to urge co-operation of the rank and file of street railway employees to their executives and to the company in providing good service to the public. Mr. Higgins said that originally it was electric railways themselves which sought franchises and thereby established themselves so that it was therefore up to the companies primarily to furnish service and overcome the obstacles of street railway operation. Their efforts, however, must be coupled with the co-operation of the public, but no amount of sympathy or co-operation by the public will overcome any lack of co-operation on the part of the company. Railway men, particularly exec-

utives, are public servants, but no amount of ability of executive officers is any good without the co-operation of the men. Any one voluntarily entering public utility service takes on the obligations of a public servant.

Mr. Higgins also pointed out that the Public Utilities Commissions are necessarily influenced, whether rightly or wrongly, by public opinion, and it is therefore of vital importance that it be by an enlightened public opinion. From this it is necessarily concluded that the company should make every effort to enlighten the public, for naturally the public wants to be fair, and if it has full information its opinions and therefore its influence on the commissions will be sound.

Mr. Higgins further emphasized the fact that what the public wanted is service much more than a reduction in fares. The public wants good service, for which it, in his belief, is willing to pay. Mr. Higgins also talked on the practical business-like valuation which Mr. Rudd had discussed in the afternoon, and also on the new problems of the Public Utilities Commission in Connecticut due to the placing of jitneys under its control in that state. He said that the Connecticut law now made it obligatory to determine if public convenience and necessity require jitney service, and, while this brought up many problems which he could not discuss and decide now, he did want to point out that the question of public convenience and necessity is very largely the result or function of the feelings of the public, based, however, on fact.

Following an entertaining Roscoe Arbuckle movie, Mr. Storrs, president of the Connecticut Company, gave the final address of the evening, in which he emphasized the almost revolutionary changes which have taken place in electric railway operation in the last four years. He gave some interesting figures for Connecticut, and pointed out that in 1900 the gross revenue of Connecticut railways was \$3,271,000, the operating expenses \$2,016,000, while in 1919, with a gross revenue of \$12,875,000, the operating expenses were \$11,200,000. This left a net in 1900 of \$1,080,000 and in 1919 less than \$1,000,000, while in 1916, an intermediate year, the net was \$3,066,000. Thus, with the investment in Connecticut almost trebled, the net revenue has actually decreased, and while 1920 figures are not available in detail, he predicts a deficit for the state of about \$1,000,000.

However, he pointed out that the railways have gone through four years of stress and strain to the advantage of all. New methods of doing everything have been evolved, and these years have also helped to encourage co-operation and to promote better ideas of railway publicity and information.

Lay Single Tracks Off Center

IN CONNECTION with some repaving being done by the city, the Chattanooga Railway & Light Company recently reconstructed some of the single-track lines in the city, and in doing so placed the single track where one of the two tracks would be in case it were a double-track section of line. This was done because it was felt that development in the near future might make it advisable to double track these sections of the system and that considerable expense would be saved if the one track which had to be laid now were placed so that it would form one of the double tracks in the future without the necessity of doing anything to it at the time the system or section was double-tracked.

Fares and Short-Haul Traffic

THROUGH an error in the printing office last week the concluding lines of an article appearing in that issue on "Fares and Short-Haul Traffic," by Edward A. Roberts, engineer with John A. Beeler, New York, was omitted. The greater part of this article appears on pages 896 and 897 of last week's issue. The concluding two paragraphs, including the omitted portions, are as follows:

"The placing of a definite value on the average car rider's time is not at all a simple task, and one person's estimate is about as good as another's. A person's earning ability should, however, not be confused with the amount of time the same person would feel justified in using in order to avoid spending 5 cents. The average figure of 50 cents an hour seems high, although it would apply to those who are actually being paid for their time by an employer or to those who are hurrying to specific engagements. Under this classification are such people as salesmen, bill collectors, business men and plumbers. The figure of 25 cents an hour fits more closely the estimate that the average person uses in deciding whether to ride or walk. The average woman who keeps house and shops during the middle of the day bases the worth of a street car ride on some such amount as this. The same applies to the vast majority of people going to and from work. It is doubtful if the leisure time of even the well-paid classes should be considered at more than 25 cents an hour.

"The method of analysis outlined in this article is not intended to point out a definite answer to the fare question or to say what fare will yield the most total revenue in a specific case, but it is believed that its use will in many instances shed additional light on some phases of one of the industry's most serious problems."

Discussion of the National Electrical Safety Code

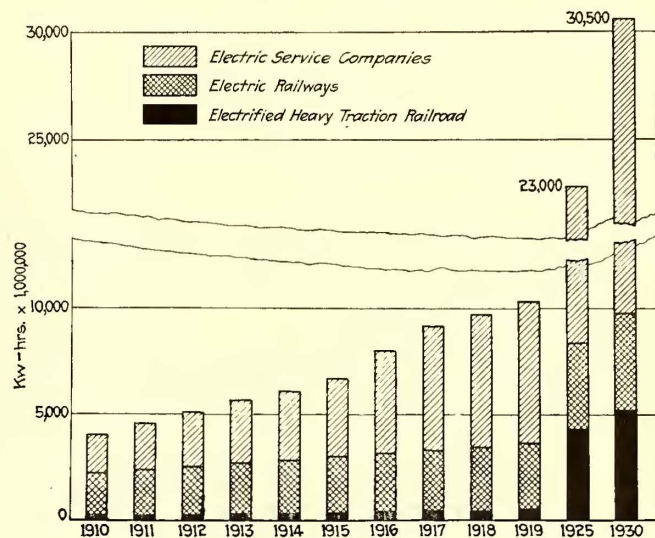
THE Bureau of Standards has just issued Handbook No. 4 on the National Electrical Safety Code, containing a revised discussion of the rules and forming a companion volume to Handbook No. 3, which contains the revised edition of the rules themselves. The discussion of the rules has been considerably amplified. Many items and suggestions have been included which are not involved in the rules themselves but have bearing upon good practice and matters immediately related to the subject of the rules. In addition, the endeavor has been made to make the meaning and interpretation of the rules entirely evident and to give in many cases the reasons which have prompted inclusion of particular rules in the Electrical Safety Code. Illustrations have been provided to show the intent and application of a number of rules.

The discussion of the rules follows the order of the rules themselves and is segregated into the four parts dealing respectively with stations and substations, overhead and underground lines, utilization apparatus, and operation of utility stations and lines. There is also a supplementary section dealing with the subject of grounding. The introduction to the discussion includes the results of a survey of pole lines made jointly with the committee on safety rules of the National Electric Light Association and conducted in the summer of 1919.

Meeting of the Superpower Committee

AT A MEETING in New York on May 13 of the Advisory Board of the Superpower Survey a number of interesting facts were brought out. It is expected that the final report will be finished on June 30.

In making the survey 315 utilities were examined, representing a capacity of 4,000,260 kw., of which 11 per cent was hydraulic and 89 per cent steam. The output of these stations was 10,301,000,000 kw.-hr., hydraulic stations producing 16 per cent of this output and steam stations 84 per cent. The steam stations consumed 11,806,000 tons of coal at a cost of \$63,228,000. The average coal rate was 2.73 lb. per kilowatt-hour. Although the maximum capacity of any steam plant in the territory was 163,000 kw. and that of any hydraulic plant was 83,500 kw., the average of all steam plants was found to be 10,000 kw., while the average of hydraulic plants was 2,700. An investment of \$598,000,000 is represented by these plants, 85 per cent of the total being for steam plants and 15 for the hydraulic. Probably 25 per cent of the power requirements



PAST AND ESTIMATED FUTURE GROWTH OF ENERGY CONSUMPTION IN THE SUPERPOWER ZONE

can be supplied by hydro-electric development. Standardization of 60 cycles as a uniform frequency was recommended.

W. S. Barstow presented an outline of a financial plan for the system. Under this plan a superpower company would be formed, having only one class of securities, i.e., non-par value stock, and all existing public service companies in the territory, as they became customers of the superpower company, would be entitled to subscribe to this non-par stock of the company pro rata, based on demand and load factor or on some other predetermined definite basis. In case any public service company does not become a stockholder in the superpower company the stock to which it is entitled to subscribe can be offered for sale to the investing public.

After the presentation of this plan there was a discussion on the relative merits of a federal or state charter for the proposed company, but no definite decision as to a recommendation was reached. The accompanying chart shows the past and estimated future growth of energy consumption in the proposed superpower zone.

Equipment and Its Maintenance

Short Descriptions of Tools Used Together with Mechanical and Electrical Practices of All Departments to Supplement the Preceding Longer Articles

Connecticut Company Remodels Cars for One-Man Operation

Platforms Were Reconstructed, Air Brakes Installed and All the Usual Safety Devices Were Added to Make the Car Suitable for One-Man Operation

THE Connecticut Company has remodeled forty-three single-truck closed cars and added additional equipment necessary to use them for one-man operation. The actual work of remodeling was done in several of the company's shops, and where new parts were constructed or others changed this was done in the reclamation shop at New Haven. In reconstructing these cars the center

accompanying illustrations, was designed by the engineers of the company, and the work of making the changes necessary in the handle was done in the reclamation shop in New Haven. By pressing down the button in the handle a lever engages a cam installed under the handle around the shaft in a location to replace the controller water cap. With the button depressed the cam is thus turned against the pressure of a coil spring inside the cam. The movement of this cam operates another small lever at the back of the controller, which in turn operates a push-button switch to close the circuit for the auxiliary line switch. Whenever the button in the handle is released the cam



PLATFORM EQUIPMENT GROUPED TO PROVIDE MAXIMUM SPACE



ONE OF THE REMODELED CARS IN SERVICE IN STAMFORD, CONN.



CENTER ROW LIGHTING ARRANGEMENT WITH SHADES

portions of the bulkheads were removed at each end, but the upper and lower end panels were retained. Two short stanchions were installed between the upper and lower end panels on each side to give the necessary support.

The location of the platform equipment was changed and additional equipment was added in a location so as to provide as much space as possible for the entrance and exit of passengers. The K-10 controllers were moved to the extreme left and mounted on a raised platform used by the motorman. Between the controller and the door additional apparatus was installed consisting of the motorman's air brake valve, an upright stanchion with handle for operating the doors, the hand-sanding lever and an additional upright stanchion for holding the Johnson fare box. The hand brake staff was retained in its original location, but a drop handle was installed to afford more platform space.

While the original K-10 controllers have been retained, additional equipment has been added as required to provide the safety features for one-man operation. A type of dead man's handle, as shown in one of the

returns to its "off" position by the action of the spring and the operating circuit is opened by the line switch. The line switches used consist of the General Electric Company's SB-61-11 Auxiliary Form A contactors. Three Westinghouse H-350 push button switches were added at each end of the car. One of these push-button switches is located so that the opening of the door cuts off power and provides so that power cannot again be restored until the doors close. One of these, as just described, operates in conjunction with the handle on the controller to provide the dead man's device so that power will be shut off as soon as the operator releases the handle. The third switch is used as a foot switch so that operation can be continued without the necessity of holding down the dead man portion of the handle. These cars were originally equipped with two hood switches. One of these was removed and one is still retained as a switch for opening the circuit in case of emergency and as a switch ahead of the control equipment.

The remodeled cars were equipped with straight air brakes and the equipment used was taken from obsolete

cars and open cars which were not being used. Old governors, engineer's valves, main reservoirs, brake cylinders and compressors were thus used. The compressors were some which were taken from the Birney type of one-man cars which the company has in operation. These were the General Electric CP-25 and Westinghouse DH-10 type, which were found of too small capacity for the Birney cars, which are equipped with pneumatic door engines, and they were used on these reconstructed cars, as the amount of air required is less than that which is used on the standard Birney car.

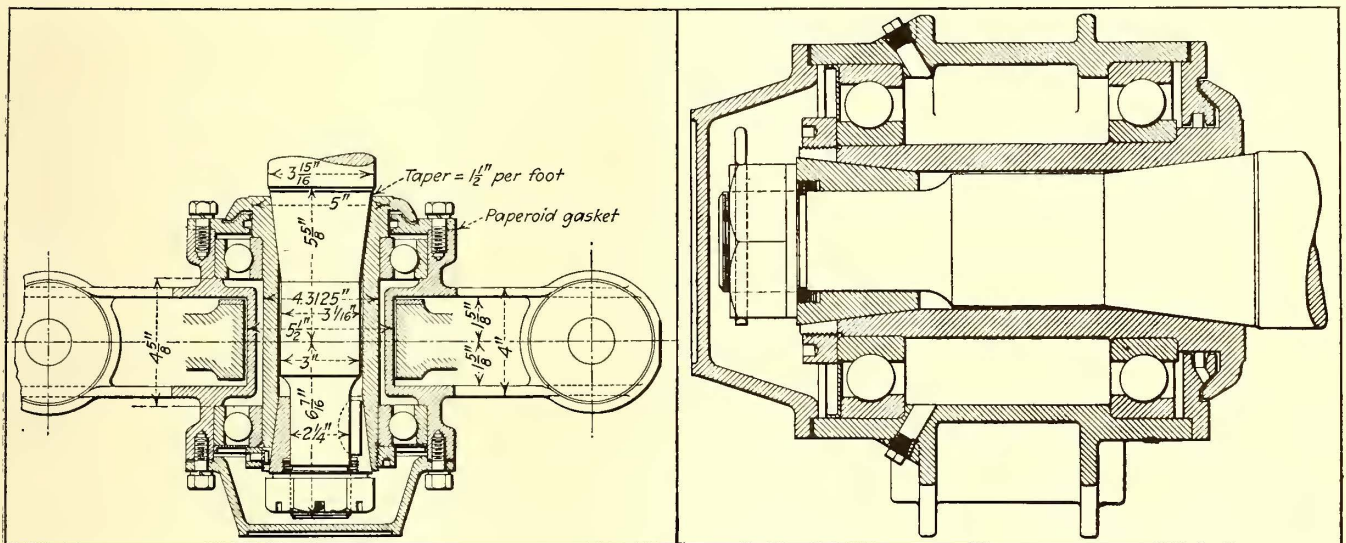
The brake cylinder is installed underneath one of the platforms and is connected to the brake rigging as originally installed for hand-brake operation. The same type of hand-operated sanders are used, but a new sanding lever was installed to make its operation more convenient for the motorman. These cars were provided with fixed steps, and two of these were retained without change. At the two entrances which were not used the doors were screwed shut and the steps were removed. At the entrances retained new

New Ball Bearing Journal Boxes

Journal Box Designed for Brill No. 79-E Truck and Interchangeable with Plain Sleeve Journal Box Developed Which Has Many Improvements Over Old Type

THE principal objection to the ball bearing journal boxes which have been tried out on electric cars during the past few years is the tedious and careful handling necessary in removing and assembling the boxes whenever it is necessary to replace wheels. After the journal boxes have been removed and replaced several times the bearings become loose on the axle and so cannot safely sustain the heavy shock loads imposed upon them for any length of time.

In an endeavor to overcome this objection the Gurney Ball Bearing Company has just brought out a new design, which is illustrated herewith. This type of journal box was designed primarily for the Brill No. 79-E truck and is interchangeable with the plain sleeve journal box now used, with the exception of the axle ends. As the ball bearings are of the angular contact type, mounted opposed to each other, they can be adjusted.



BALL BEARING JOURNAL BOX DESIGN FOR SAFETY CARS

folding doors were installed, arranged to open outward. The doors are hand-operated from a convenient location for the operator.

The lighting arrangement of the old cars consisted of two three-light clusters and one two-light cluster inside the car with additional lights on the platform and in the headlight to make a total of two five-light circuits. Some of the cars had poor headlining and it was decided to replace this, and at the same time a new lighting arrangement was provided, which consists of a row of five lamps down the center of the car, the additional lamps for the platform and headlight making a total of ten lights arranged in two circuits. The platform light is installed over the top of the door to provide illumination for the steps when the doors are open.

Originally these cars had two lights for each dash sign. One of these lights was used for the light over the door, the other being retained in its original position. The original trucks of the cars were retained, these consisting of Brill type 21-E, and the motors used are G.E. 67. These cars seat twenty-four and twenty-six passengers and are provided with longitudinal seats.

The engineers of the Gurney company have found adjustments quite necessary, as no matter how efficiently the dirt seals are designed or how much attention is given to the lubrication of the bearings some will become loose, and this play must be taken up by means of the threaded nut at the outer end of the sleeve, if a long life of the ball bearings is expected.

In the new design the sleeve on which the bearings are mounted protrudes through the journal box inner cover and the cup flanged end acts as a dirt slinger. The sleeve is held in place by the tapered spring adapter sleeve and threaded nuts on the axle end, and as it is supported by the axle on the taper bored ends, the bearing loads are thus transmitted. A Woodruff key inserted into the slot of the adapter prevents any torsional pressure being transmitted onto the axle end nut. This relieves the cotter pin which holds the nut in place from any strain. Should the tapered spring adapter sleeve be clamped solidly between the bearing sleeve and the axle, for removing the journal box from the axle, a tapped hole for the insertion of a special tool to remove this sleeve is provided.

The whole journal box is handled as one complete

unit and can very easily be assembled or removed from the axle to replace wheels or gears. The ball bearings are also not exposed and practically no foreign matter can get into the journal box even if the outside cover is taken off to remove the locking device which fastens the ball bearings to the axle.

Expanding Railway Motor Bearings

To Provide a Tight Fit of Bearings in Their Housings, the Practice of the Third Avenue Railway Is to Expand Worn Bearings Slightly by Means of an Air-Operated Mechanism

BY H. J. KROMBACH

General Foreman Third Avenue Railway, New York City

THE problem of taking up the wear that occurs between the outside of bearings and their housings in railway motors has bothered many master mechanics. Probably the method most universally employed is to insert shims between the bearing liner and the housing so as to provide a tight fit. If this wear is not taken up in some manner after it has once started it increases very rapidly and ultimately leads to the scrapping of the bearing and either the reboring or rebushing of the housing.

In order to meet these conditions the Third Avenue Railway has been expanding both armature and axle bearing liners by making use of an air-operated press constructed in its own shops. The accompanying illustration shows this mechanism, which consists essentially of a 16-in. brake cylinder to which is attached a lever or rocker arm, the opposite end of this arm being arranged to transmit the pressure to a mandrel which is forced through the bearings to expand them. The 16-in. brake cylinder is mounted directly on one of the columns in the shop and the piston rod of this brake cylinder is connected directly to the rocker arm by a pin which works in a slot in the arm. The piston is stopped just before it reaches its extreme position by a mechanical stop which is installed above the cylinder on the same supporting post. The rocker arm is of heavy construction, being made of two 6-in. channels. The distance from the piston-rod connection to the fulcrum is 38 in. and from the fulcrum to the point where pressure is applied to the mandrel is 19 in., so

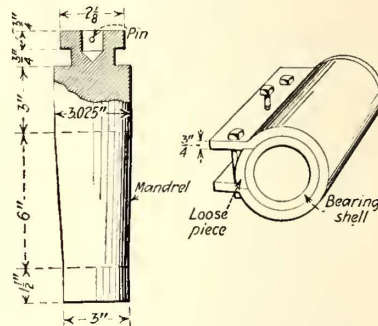
is controlled by an ordinary straight-air brake valve, such as is used on electric cars.

A substantial table has been constructed to support the bearings while they are being expanded. This is supported immediately underneath the outside end of the lever by two large wooden blocks. The table itself is made of an iron plate and is 1½ in. x 18 in. x 4 ft. 8 in. in dimensions.

HOW THE BEARINGS ARE EXPANDED

In order to expand an armature bearing, it must first be made smooth and clean inside. To prevent the cracking of the end flange during expansion it has been found necessary to bore out the flanged end to a diameter approximately ½ in. larger than that of the remainder of the inside of the bearing. The depth of this portion of larger diameter should be approximately ¼ in. greater than the depth of the flange.

This enlarging of the bearing under the flange removes the strain at that point. An accompanying sketch shows a bearing which has been finished to an inside diameter of 3 in. and gives the corresponding dimensions for the parts underneath the flange, together

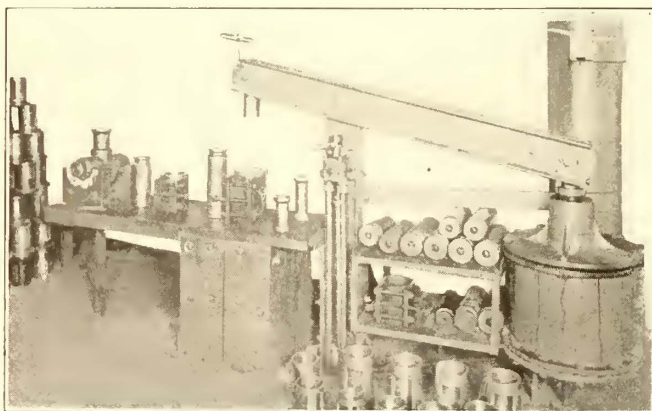


AT LEFT, ARMATURE BEARING AND MANDREL USED FOR ITS EXPANSION. AT RIGHT, SLEEVE FOR HOLDING ARMATURE BEARINGS

with the dimensions of the mandrel which is used for expanding such a bearing. The mandrel is tapered from a bottom diameter of 3 in. to a top diameter of 3.025 in., the bottom end being made straight for 1½ in. and the top for a distance of 3 in. To facilitate the handling of the mandrels a flanged top is turned on them, which is bored out inside and a pin is then inserted through this portion so that the mandrel can be readily lifted and handled with a hook.

To provide for uniform expansion and to support the bearing a sleeve is placed around it while it is being expanded. This is made of ¾-in. steel and is open on one side. When the bearing has been inserted a loose piece is placed in this open space and the entire sleeve is then clamped around the bearing by means of two bolts, as shown in the accompanying illustration.

The operation of expanding an armature bearing consists first of heating the bearing to a temperature of about 75 deg. F. The window of the bearing is then placed against the closed side of the sleeve and the open side of the sleeve is closed with the loose filler as already explained. The sleeve is then tightened into place with the two bolts and the bearing is then placed on the bench with the flanged end uppermost and the mandrel, which has previously been coated with a little white lead, is placed in the upper portion of the bearing. Pressure is then applied and the mandrel is forced entirely through the bearing. The plate on which the



AIR PRESS FOR EXPANDING BEARINGS

that a ratio of 2 to 1 is obtained. An air pressure of from 80 to 90 lb. is used for operating the mechanism. With an air pressure of 85 lb., 17,090 lb. is obtained on the brake-cylinder push rod and twice this amount, or 34,180 lb., is applied to the mandrel for expanding the bearings. The air for operating the cylinder push rod

bearing rests is provided with a hole of sufficient diameter so that the mandrel will go through this and drop down approximately $\frac{1}{4}$ in. below the surface of the table. In pushing the mandrel through the bearing air should be applied slowly and uniformly. After the mandrel has been pushed through, the bearing can be removed by loosening the two clamping bolts and screwing in a third bolt which is located in the center of the sleeve. This expands the sleeve sufficiently so that the bearing can be readily taken out. The mandrel is lifted through the hole in the table by means of a hook, to which is attached a cable and handle. The bearing is then allowed to cool and then it is again pressed with the same mandrel as previously used.

These operations will expand an ordinary armature bearing about $\frac{1}{16}$ in. and the outside of the bearing can then be turned down so as to give a tight fit in its housing, and the inside can be babbitted and turned to the necessary size to fit the armature shaft.

SHAPING AXLE BEARINGS

As axle bearings of the usual type are made in two parts, these are pressed into shape and expanded by use of a type of mechanism shown at the left hand end of the halftone illustration. A large steel block is bored out approximately 0.01 in. smaller than the diameter to which it is desired to have the outside of the axle bearing. The round bar which causes the spreading apart of the bearing is made approximately 0.01 in. larger than the inside diameter of the finished bearing. These bearings are expanded by placing them in a horizontal position and by use of the mechanism already described.

This mechanism is also used for forcing bushings in worn housings. Where the housings are worn to such an extent that rebushing is necessary, a cast steel bushing approximately $\frac{3}{16}$ in. thick is forced into the housings and these are then bored out to exact diameter. The ends of these bushings have a flange and are pinned in place after they are installed. During the past year more than 800 armature bearings have been reclaimed by this method, most of which would have been scrapped had not some such apparatus been available.

New Locomotive for Youngstown & Suburban Railway

THE Youngstown & Suburban Railway has recently placed in service a standard Class B, 45-ton Baldwin-Westinghouse locomotive, which was made necessary due to the increase in carload freight business. A large part of this business is made up of building materials handled by steam road equipment to a new tipple of a construction company. When completed, the total

storage of sand and gravel and other building materials and will be arranged so that a $4\frac{1}{2}$ -ton truck can be loaded in 2 minutes. Directly opposite the tipple there is to be constructed 1,100 ft. of track with a clear space of 900 ft., which will be used for handling brick, tile, sewer pipe and similar material. At the right will be constructed garages and barns for thirty-five motor trucks and wagons and fifteen horses, and on the left will be warehouses, office buildings, etc.

The new locomotive just purchased is equipped with



FORTY-FIVE-TON LOCOMOTIVE OF YOUNGSTOWN & SUBURBAN RAILWAY

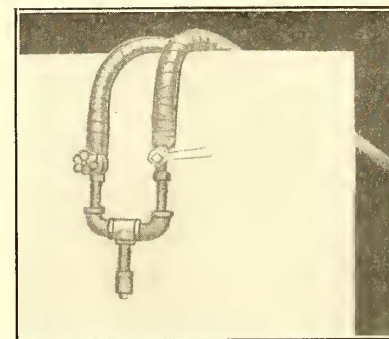
four type 562-D-5, 600-volt, 100-hp. field control motors and HLF control. The maximum grade for this property is 2.05 per cent and the locomotive will handle five loaded 100,000-lb. capacity cars, or a train of fifteen empties, up this grade.

The general characteristics of this locomotive are as shown in the accompanying table.

Cars Washed with Air and Water Flusher

A GREAT saving in cost of washing cars is now being realized by the Chattanooga Railway & Light Company by the use of its combination air and water nozzle, an illustration of which is shown herewith. This is one of the many convenient devices which have followed the installation of the new air compressor in the Chattanooga shops. It is a National compressor

type 3VS-23, of 300-cu.ft. capacity and driven by a single-phase, 54-hp. motor. The flushing device consists simply of two $\frac{1}{2}$ -in. rubber hose lines, one for air and one for water, each leading through suitable controlling valves to a common nozzle. The whole device is a combination of ordinary pipe



AIR AND WATER NOZZLE

fittings. From the two valves there are bushings to $\frac{1}{2}$ -in. ells, which in turn lead to a tee, to which is connected another short bushing which is plugged at the end, a $\frac{1}{2}$ -in. hole being bored through the plug. Any combination of air and water can be discharged from this nozzle.

NEW LOCOMOTIVE FOR YOUNGSTOWN & SUBURBAN RAILWAY

| | |
|---|-------------|
| Weight | 45 tons |
| Maximum tractive effort (25 per cent adhesion) .. | 22,500 lb. |
| Normal tractive effort at 9.7 m.p.h., full field, one hour | 15,200 lb. |
| Continuous tractive effort with forced ventilation, short field | 9,000 lb. |
| Maximum trailing load starting on 1 per cent grade. | 789 tons |
| Balancing speed, short field at 600 volts, on level with 500-ton load | 17.5 m.p.h. |
| Balancing speed, short field at 600 volts on 2.05 per cent grade with 350-ton load..... | 10.2 m.p.h. |

trackage from the railway company's switch to the end of the tipple will be more than 1,000 ft. and the total length of the tipple itself will be 550 ft., with bins having a capacity of approximately 3,000 tons of material. The various bins under this tipple are for the

The present method of cleaning out cars consists of first using the air line to blow out dust, after which a powerful stream of water is provided for flushing out the car, air and water being used here in combination. The results obtained by the use of this combination air and water stream are much better than from old hand-scrubbing or flushing out with water stream only, both from the cleanliness resulting and from the saving in time.

Under the former method of cleaning eight cars constituted a good day's work, whereas it is now possible to wash as many as twelve cars thoroughly with the same labor "besides two or three flivvers," as E. D. Reed, general superintendent, facetiously puts it. The only difficulty encountered, which is a minor one, is the handling of the double-hose line to keep it from getting twisted.

New Rock Crusher an Economical Addition at Charlotte

THE Southern Public Utilities Company has installed in Charlotte, N. C., a rock crusher which is proving to be a most economical addition. This company uses on the average about 200 yd. of crushed rock per month the year around. This had formerly been obtained at a cost of about \$6.25 per ton delivered. With the native supply of rock, however, it seemed to the company that it should be possible to obtain this at less expense.

Accordingly, last December the company installed an Allis-Chalmers rock crusher with a capacity of 60 yd. per day and records since then indicate that the over-all cost of the crushed rock is now \$2.50 as compared with the previous \$6.25. Farmers and others haul rock into Charlotte and deliver it for \$1.50 per ton, the other dollar representing the cost of crushing. In addition to crushing new rock, the crusher is also used to break up old cement and brickbats which are excavated by various contractors in connection with work in and around Charlotte.

Accompanying illustrations show the rock crusher and indicate how it is conveniently located by a siding of the company's electric railway in Charlotte. The crusher installation includes a belt conveyor which carries the rock with a minimum expense of handling. The crusher is adjustable to produce crushed rock from about $\frac{3}{4}$ in. to 3 or 4 in. in size. The company is well satisfied with this move it has made to produce its crushed rock more economically.

New Machines for Removing Pavement

A NEW compressed-air-operated machine for removing pavement and general demolition work has just been placed on the market by the Ingersoll-Rand Company, New York. Two types of paving breakers, termed BC-25 and CC-25, are now available. The BC-25 type is intended for use with an air pressure of over

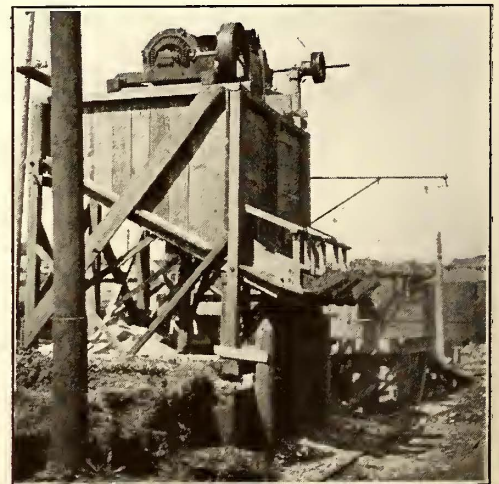
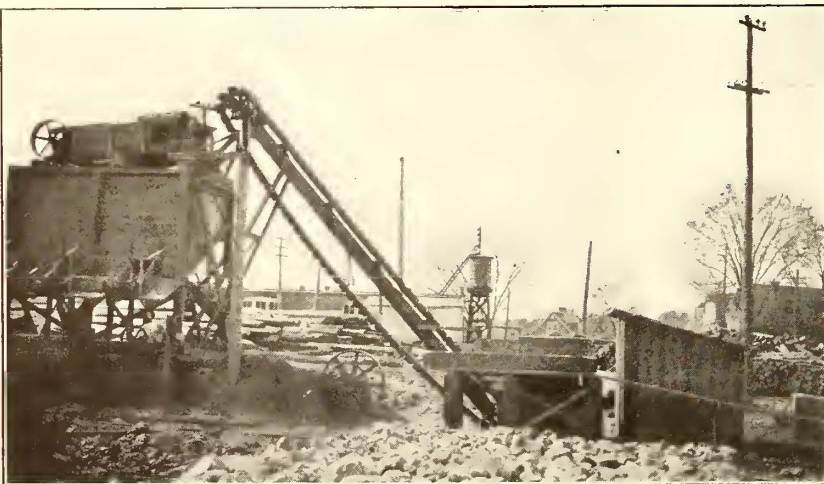


REMOVING PAVEMENT ALONG RAILWAY TRACK

80 lb., while the CC-25 is for use with an air pressure less than 80 lb. The BC-25 type weighs 58 lb. and is 24 in. over all, while the CC-25 weighs 68 lb. and is 25 in. long. Both have a 4-in. stroke. In construction the paving breaker is very similar to the non-rotating type of hand hammer rock drill.

The Los Angeles Railway Corporation used these breakers for cutting openings on either side of the rail through 6 in. of concrete having a covering of 2 in. of asphalt. The openings were about 23 in. long and extended 17 in. on each side of the rail. In this work it was found that two men with one paving breaker could cut twenty-two of these openings in nine hours. Under the old hand method this work would have required fifteen men. These openings were cut in order to give gripping place under the rail for the use of hydraulic jacks to pull the rail out.

The paving breakers are usually used in conjunction with the Imperial type 14 portable air compressors, which are either gasoline or electrically driven.



TWO VIEWS OF ROCK CRUSHER INSTALLED AT CHARLOTTE, N. C.

Letter to the Editors

Suggested Changes in Safety Car Design

TRENTON & MERCER COUNTY TRACTION CORPORATION

TRENTON, N. J., May 12, 1921.

To the Editors:

In a recent issue of the *ELECTRIC RAILWAY JOURNAL* there appeared an article by J. C. Thirlwall entitled "Why Alter the Standard Safety Car Design?" I am heartily in accord with most of Mr. Thirlwall's objections to fundamental changes in the general design of the standard Birney safety car, but our experience in the operation and maintenance of this type of car has convinced us of the desirability of several changes which could be made without sacrificing the essential features, such as dimensions of car body and low wheels.

In the March 12 issue of the *ELECTRIC RAILWAY JOURNAL* mention was made of the substituting of longitudinal seats running the full length on either side of our cars in place of the standard transverse seats. The object of this change was to determine whether the increased aisle width thus provided would not facilitate the loading and unloading of passengers at points of heavy interchange here in Trenton. The effect of this change has been to speed up passenger interchange and has tended to give a more even distribution of the passenger load over the entire car. Most of the crowding on the front end of the cars was due to the passengers' inability freely to move to the rear of the car on account of the restricted aisle space. By increasing the aisle width this handicap has been removed.

There are two other changes in the construction of the safety car which the management here feels would be beneficial and which could be made without increasing the weight or dimensions of the standard car. These are the substitution of a longitudinal seat for the first transverse seat at each end of the car on the entrance side and the elimination of the folding door opening outwardly by substituting a sliding door.

In regard to the safety features, we are considering changes to make the foot valve inoperative. With the many duties which are necessary for the one-man car operator to perform, there is a tendency to abuse this auxiliary to the controller pilot valve, and in considering the accidents which have occurred here in Trenton it has been found that this feature has been directly responsible for a large number.

Another improvement which could be advantageously made in the interests of safety is the removal of the door operating position from the brake valve. By eliminating this feature the brake valve could be redesigned so as to give more space between the various brake valve positions and thus decrease the liability of error. A number of accidents have been caused here due to the fact that in making a service brake application the operator sometimes throws past the service position to lap position, which is between the door opening and service application positions on the brake valve. If more space were available, a longer port and a greater radius could be obtained for the service application position, and the lap position could be moved

further away so that there would be less liability of mistake by the operator. While these two changes may be considered quite radical, we feel that they have a special appeal to maintenance men and operators.

H. E. KROUSE, Master Mechanic.

Association News

Acting Secretary Welsh Addresses Yale Students

A PERSPECTIVE view of electric railway problems was given in a course of two lectures by James W. Welsh, acting secretary of the association, before the engineering students at Yale University, New Haven, Conn., on March 6 and 13.

He first dealt with mechanical and electrical studies such as the application of motor control and auxiliary equipment to railway cars and the economic problems connected with the replacement of old reciprocating type of plants by power generated in large central stations. In the former the development of the present high-speed motor was illustrated by the redesign of a standard city motor for interurban service.

The second lecture took up the traffic problems of a city system, illustrating the surveys to be made, the means of fitting the service to the traffic, and a review of the methods now employed for securing the maximum economy in car operation. The preparation of a working schedule or time-table was shown, starting with the traffic count and with special consideration given to the determination of the trainmen's runs as limited by the rules of the labor agreement.

Mr. Welsh employed a conversational method of questions and answers with the students and pictured the subject in such a way as to give them some realization of the difficulties involved as well as the attractiveness of the work in the field of transportation as a future business of life.

Heavy Traction Men Meet

A NUMBER of the heavy traction experts in the Engineering Association met on May 12 to round out the report of the committee on this subject. A sub-committee presented a remarkable compilation of data on electric locomotives and multiple-unit cars which was accepted for inclusion in the report with a few additions. A plan was also approved for the preparation of an analysis of conditions affecting the use of multiple-unit versus locomotive-drawn trains for suburban service, as a substitute for the statistical summary originally planned. The desirability of co-operation among heavy traction committees of national societies was again emphasized and a determination to push this matter was registered. The committee finally decided to compile a subject bibliography on heavy traction to be used as an appendix to its 1921 report.

Those in attendance were Sidney Withington, New Haven Railroad, chairman; A. H. Armstrong, General Electric Company; H. W. Cope, Westinghouse Electric & Manufacturing Company; J. C. Davidson, Norfolk & Western Railway; C. V. Duer and J. S. Sloan, Pennsylvania System; C. H. Quereau, New York Central Railroad; L. S. Wells, Long Island Railroad.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION
PERSONAL MENTION

Radial Scheme Favored

Mr. Arnold Believes Ambitious Canadian Project Entirely Feasible Under Competent Management

Bion J. Arnold, Chicago, considers that the radial program of the Ontario Hydro-Radial Commission is very advantageously situated with regard to density of population, active industrial territory and probable increases of both these factors in the future, as well as having the advantage of a plentiful supply of cheap power.

In testifying before the commission during the week ended April 30 Mr. Arnold pointed out that carload shipments in large volume have not usually been handled by the average interurban electric line, but that with the type of construction and facilities proposed by the Hydro-electric Commission for the radial lines, they would be in a position expeditiously and economically to handle a reasonable amount of carload freight business.

Taking into consideration the estimated population in 1925, 1930 and 1935 of the various territories served by the different lines, Mr. Arnold showed three lines, the Toronto & Eastern, the Toronto Suburban and the Hamilton & Elmira divisions, as having slight deficits in 1925. He pointed out, however, that these deficits were figured on construction costs estimated at the high peak period of about a year ago. In view of reductions in cost since that time he thought that the newly constructed lines might be found to pay from the start. The Toronto, Hamilton & St. Catharines and the Niagara, St. Catharines & Toronto radials, he estimated would be paying propositions right from the start, having a net income or surplus of \$145,000 and \$129,000 respectively in 1925.

\$800,000 SURPLUS ANTICIPATED

By 1930 Mr. Arnold estimated that the whole system would show a surplus of \$796,000 on the year's operations, and by 1935 this would be increased to more than \$1,000,000.

One point emphasized was that of terminal facilities and grade separation in the cities. The radials must be able to enter and leave the cities at high speed. Regarding the proposed Toronto terminal at Bay Street, he suggested a combination of elevated structure and subway leading from it. The overhead track would end at Front Street, and the cars would then enter a subway extending up to Queen Street. He favored an uptown terminal nearer the business center, but was not ready to state just where this should be located.

The radials would have an advantage in handling less-than-carload freight.

Summing up the transportation requirements, it would appear that the area in which the system is proposed, being the center of population and manufacture of the province, should be provided with every transportation service which will aid its commercial and industrial welfare. This should include transportation facilities of the type proposed by the Hydro-electric Power Commission, the main feature of which is frequent passenger transportation at high speed, supplemented by frequent and prompt deliveries of less-than-carload freight.

LARGE CAPITAL EXPENDITURES REQUIRED BY STEAM ROADS

For the steam roads to give the facilities required and proposed by the Hydro-electric Commission, they would have to make large capital expenditures and would also have to organize additional operating departments properly to handle the different classes of service required.

Regarding fast freight service, Mr. Arnold recommended that as it is proposed to furnish this to all points on the line. This freight would be carried on interurban express and on freight cars which, as a rule, would make two trips daily between the various terminals, providing for one-day shipments from point to point.

The estimates as to earnings had been made separately for the five divisions, and all passenger-earning estimates are based upon population figures and data as to the riding habit of the residents of each locality.

While the system as a whole cannot be compared with any existing interurban, combining, as it does, rapid transit, suburban and interurban features, with despatch and carload freight traffic, each of these classes of service has its parallel in existing systems, and when analysis of the estimated operating costs of these classes of service has been made, they lead to the conclusion that the project now outlined as a whole is feasible, and that if constructed and operated under competent management, with the support of the communities served, success for the road can be reasonably expected.

Readers, Note Well

The United States Civil Service Commission announces an open competitive examination for senior signal engineer. Applications must be filed with the Civil Service Commission, Washington, D. C., prior to the hour of closing business on June 7, 1921.

Union Contract Renewed

Winnipeg Railway Makes Reservations on Wages and Rejects "One Big Union" Idea

The Winnipeg (Man.) Electric Railway has signed an agreement with its motormen and conductors for the next twelve months, granting the trainmen the same wages and working conditions as prevailed last year.

The 1920 agreement was made between the company and "the Street Railway Men's Union," an independent organization with no affiliation with the Internationals or any other body. After the agreement of May 1, 1920, had been signed the trainmen joined the One Big Union—a political organization with revolutionary tendencies which was directly responsible for the strike of six weeks in Winnipeg in 1919.

When the 1920 agreement was about to expire the Street Railway Men's Unit of the One Big Union demanded that the company sign its agreement with them as representing the O. B. U., thus giving recognition to this body. This the company positively refused to do and declined to negotiate with the O. B. U. at all.

EMPLOYEES WITHDRAW DEMAND FOR UNION RECOGNITION

The company said it was prepared to negotiate an agreement with a committee of men, but that if the men insisted on recognition of the O. B. U. the company would go to arbitration and open up the whole agreement as to wages and working conditions. After several mass meetings the demand for recognition of the O. B. U. was withdrawn, the men appointed a committee to represent them, and an agreement was signed on May 9 between the company and "Motormen and Conductors of the Winnipeg Electric Railway as represented by a committee executing this agreement."

In all its agreements so far executed with its employees the company has stipulated that it will maintain the same rate of wages as prevailed last year.

The agreements contain a clause, however, which says "if at any time during the currency of this agreement, by any reason of something beyond its control the company is deprived of any considerable portion of its revenues, and is thereby rendered unable to pay the wages herein agreed to, the company shall be at liberty to give thirty days' notice to terminate this agreement insofar as it affects the rates of wages."

Wages Reduced by East Mass. Arbitration Board

Cut Made Averages 12½ per Cent—Burdensome Seniority Rules and Other Provisions Modified

An average wage reduction of 12½ per cent, elimination of burdensome seniority rules and certain overtime and special allowances featured the decision handed down by the Massachusetts Board of Conciliation and Arbitration in the case of the Eastern Massachusetts Street Railway and its employees who are members of the Amalgamated Association. The ruling of the board was announced on May 14, but is retroactive to May 2, the date when the former agreement expired, to be in effect for one year to May 1, 1922. An immediate reduction in fares is planned.

PRIOR to the expiration of the old agreement the trustees of the Eastern Massachusetts had announced that wages would be cut 20 per cent, and further proposed to cancel the entire agreement. Threats of a strike on the system were heard, and up until the last day of the old agreement it appeared as though no settlement could be made which would avoid a walkout of the men.

On the final day, however, both sides agreed to submit the case to arbitration by the State Board, and arrangements were made to have the case heard and settled promptly. Before going to the board the trustees and the men drew up a new agreement, leaving only the questions of wages, overtime and certain other provisions, twelve points in all, to be arbitrated.

Public hearings were commenced on May 5 and completed on May 9, the decision being given five days later. The case for the company was conducted by Arthur G. Wadleigh, himself one of the trustees. The employees were represented by Attorney James H. Vahey.

Evidence relating to the decline in cost of living was introduced by both sides, Prof. Albert S. Richey testifying as a witness for the company, and Arthur Strugis, connected with the statistical bureau of W. Jett Lauck at Washington, as a witness for the union. Professor Richey produced figures indicating an average decline in the cost of living since May 1, 1920, of 22½ per cent, and predicted a further slow but continuous reduction in prices. Mr. Strugis contended that costs are still double the pre-war basis, and that any apparent decline is only a temporary seasonal fluctuation.

The company introduced statements relative to the still precarious financial condition of the property, and although the attorney for the employees claimed it should not be considered in fixing wages, the board did not rule it out. What consideration the board gave to this matter, if any, the members did not state in their finding, although they referred to it as having been introduced.

The new scale of wages for motor-men and conductors will be 49 cents, first 3 months; 52 cents, next 9 months; and 54.5 cents thereafter, as compared with 56, 59, and 62 cents respectively under the former agreement. The differential of 5 cents for operators of one-man cars remains unchanged, al-

though a strong effort was made by the union to have it increased to 15 cents. Nearly 90 per cent of the car mileage of this property is operated with one-man cars.

The old and new rates fixed for other employees under the amalgamated agreement is as follows:

| REPAIR SHOP AND ROLLING STOCK | | |
|-------------------------------|----------|----------|
| Occupation | Old Rate | New Rate |
| Assemblers | 62 | 54.5 |
| Blacksmiths | 62 | 54.5 |
| Blacksmith helpers | 58 | 51 |
| Babblers | 60 | 52.5 |
| Carpenters | 62 | 54.5 |
| Carpenter helpers | 58 | 51 |
| Car cleaners | 58 | 51 |
| Firemen | 62 | 54.5 |
| Machinists | 63 | 55.5 |
| Machinists helpers | 58 | 51 |
| Painters | 62 | 54.5 |
| Pattern makers | 62 | 54.5 |
| Pitmen | 61 | 53.5 |
| Pitmen helpers | 58 | 51 |
| Upholsterers | 61 | 53.5 |
| Upholsterers helpers | 58 | 51 |
| Watchmen | 58 | 51 |
| Winders | 63 | 55.5 |
| Winders helpers | 58 | 51 |
| Wiremen | 62 | 54.5 |
| Wiremen helpers | 58 | 51 |
| Letterers | 64 | 56 |
| Tuckmen | 62 | 54.5 |
| Truck helpers | 58 | 51 |
| General helpers | 58 | 51 |
| Electricians | 62 | 54.5 |
| TRANSPORTATION DEPARTMENT | | |
| Crossing tenders | 58 | 51 |
| General helpers | 58 | 51 |
| POWER PLANT | | |
| Assistant engineers | 76 | 66.5 |
| Firemen | 66 | 58 |
| Foreman of helpers | 66 | 58 |
| Firemen helpers | 62 | 54.5 |
| General helpers | 59 | 52 |
| Oilers | 62 | 54.5 |
| Pipe coverers | 66 | 58 |
| Repairmen | 64 | 56 |
| Substation operators | 62 | 54.5 |
| Switchboard operators | 65 | 57 |
| Holisting engineers | 68 | 59.5 |
| ROADWAY DEPARTMENT | | |
| Trackmen | 58 | 51 |
| LINE DEPARTMENT | | |
| Linemen | 67 | 59 |
| Linemen helpers | 59 | 52 |
| STORES DEPARTMENT | | |
| Chauffeurs | 58 | 51 |
| Helpers | 58 | 51 |

The twelve specific issues arbitrated and the board's decision in each of the issues were as follows:

1. Shall basic wages be reduced to the scale in effect April 30, 1920? Answer: That there shall be a reduction in the basic rate now in force of 12½ per cent. Where this reduction when applied to the hourly wage results in a fractional part of a cent a fraction of five mills or less shall be paid for as half a cent; fractions over five mills shall be paid for as 1 cent.

2. Shall there be any change in the differential paid to men while operating one-man cars? Answer: That there shall be no change in the differential of 5 cents per hour paid to operators of the one-man car.

3. Shall seniority be abolished? (A) in shops; (b) in carhouses; (c) in track departments; (d) in power plants; (e) in the line department? Answer: Yes, in all classes specified.

4. In case of a curtailment of force shall

employees hold their seniority rights for a period of six months so that in case of increasing force they shall be returned to the service in accordance with such seniority before any new men are hired? Answer: No.

5. Shall the computation of time for runs of conductors and motormen be changed from computation to fifteen minutes and half hour periods to computation to ten minute periods? Answer: No.

6. Shall relief for thirty minutes or less be paid for? Answer: Yes.

7. Shall employees in the mechanical and miscellaneous departments be allowed ten minutes under pay to wash up? Answer: No.

8. Shall men in the mechanical and miscellaneous departments who work eight hours on Sundays and holidays and nine hours on week days be paid nine hours' pay for the eight hours' work on Sundays and holidays? Answer: No.

9. Shall employees be paid at the rate of time and a half for work done on Sundays and holidays? Answer: (A) In shops, in carhouses, in track department, in power plants, in the line department. No in all classes specified.

10. Shall employees in the mechanical and miscellaneous departments when doing overtime work be paid compensation in addition to their regular hourly rates? Answer: Yes, at the present rate of time and a half.

11. Shall employees in the rolling stock shops be allowed Saturday half holiday with pay? Answer: No.

12. Shall it be provided that regular employees of the mechanical and miscellaneous departments, who have worked one continuous year or two consecutive full track seasons, shall not have their wages reduced by reason of occasional rainy or inclement weather? Answer: No.

The decision of the board affects in all about 1,850 out of the 2,400 employees of the Eastern Massachusetts Street Railway. Both sides had agreed in advance to abide by the decision of the arbitrators.

The following brief statement was included in its official findings, as the basis of the board's decision:

It appears that the increase in wages received by the employees upon this system since Oct. 1, 1914, has exceeded in percentage the increased cost of living during the same period. The board recognizes that the justification for such increase was not entirely based upon the increased cost of living. It is generally recognized, however, that such increase has been the controlling factor in justifying the increase in wages of the employees during this period, and further that there has been a substantial decrease in the cost of living, the official report of the Massachusetts Commission on the "Necessaries of Life," covering the period to May 1, determining such decrease from July 1 to be 18.8 per cent. After an examination and consideration of the evidence, including exhibits twenty-eight in number, together with the able arguments of counsel, the board determines that a reduction in wages is warranted at the present time.

The board finds sufficient reason for including in the new agreement certain of the working rules and conditions submitted, but as to the remainder, whatever reason there may have been for their adoption, the board finds no sufficient justification to warrant their continuance.

In accordance with their promise to the public, the trustees of the Eastern Massachusetts Street Railway are planning to put a reduced scale of fares into effect in the immediate future. As soon as the percentage of the wage reduction was made known, they commenced the preparation of a new scale of ticket fares, all over the system, which they expect to announce within a few days.

Nova Scotia Company Cuts Pay.—A general wage cut of from 8 to 10 per cent was put in effect on May 1 by the Cape Breton Electric Company, which operates the interurban tram lines of the island.

Deferred Payment of Taxes Proposed

A bill which would require electric railways operating in Connecticut to pay up their back taxes within a period of six years has been reported by the finance committee of the Connecticut Legislature. The amount of unpaid taxes due at present is about \$2,000,000. The bulk of this approximately \$1,800,000 is owed by the Connecticut Company.

The measure would require each year the payment of one half the annual net income of the companies, in addition to the tax for that particular year. It would go into effect on July 15, 1922, and the taxes for the present year would be deferred until that time, and added to the total of unpaid taxes. Companies which pay up their indebtedness within six years' time would under the provisions of the bill pay interest at the rate of 4½ per cent, while from those not completing payments 8 per cent would be levied. By the time the first payment would come due, it is estimated that the Connecticut Company would be in debt to the State to about the sum of \$2,500,000. The first payment would be in the neighborhood of \$750,000.

The president and treasurer, or receiver, of a company would be required to file an annual statement under oath showing the amount of each item, of which the gross and net income respectively is made up. The net income is to be computed by deducting from the gross income items of operating expenses, expenses of auxiliary operation and leased roads, miscellaneous rents, taxes paid, interest on funded debt, interest on floating debt and miscellaneous charges for the preceding year.

Unions May Be Sued in Massachusetts

An amendment to the General Law of Massachusetts, governing voluntary associations, has just been enacted, which permits all such associations to be sued. The progress of this amendment through the Legislature was marked by the most bitter opposition on the part of organized labor interests. The representatives of labor claimed that the bill was aimed directly at the unions, and sponsored by the financial interests, as it lays the union organizations, as well as other associations of individuals, open to suit.

The objection of the union interests was directed less against the principle of subjecting them to suit, than to the alleged liability of having their funds tied up by employers bringing suit when a strike may be in progress. This, the union interests claim, may be resorted to, in order to break a strike, as the union would be unable to pay its members strike benefits, and expend funds for other purposes which are considered essential in the conduct of a strike.

The strike was termed labor's only weapon, and this legislation was con-

demned as an attempt to weaken labor's one source of strength.

In spite of this opposition the amendment was passed and sent to the Governor. The labor people then carried their fight to the Governor's office, urging him to veto the bill. After hearing all the objections and giving due consideration to the subject, Governor Cox signed the bill. He made a public statement on the matter, saying that the bill was not aimed at labor, but it included a number of other voluntary associations, all of which should be subject to suit at law as well as labor unions. He called attention to the fact that similar legislation is in force in twelve other states, and advised the labor unions that their interests were sufficiently protected.

Day of Emergency Rates Gone

The Board of Public Utility Commissioners of New Jersey will no longer allow temporary rate increases to cover so-called emergency periods, Chairman John J. Treacy of the board announced on May 17, and added that all the factors of a normal rate-making case must be before the board before a decision is made.

Chairman Treacy declared that the theory will no longer hold that was developed during the war to the effect that temporary rates must be granted to tide utility concerns over a period of abnormal costs.

The announcement of Chairman Treacy was made when Rankin Johnson, president of the Trenton & Mercer County Traction Corporation, appeared before the board seeking a date for the cross-examination of Ford, Bacon & Davis, who appraised the company's property for the State when the railway applied for an increase in fare of from 7 cents to 10 cents.

According to law the commission must render a decision in the case by May 31, otherwise the company has the right to put into effect the 10-cent rate.

Mr. Johnson was asked to agree to an extension of this time until June 15, stipulating upon behalf of the company that the new rate would not become effective until the board reached its decision. To this Mr. Johnson demurred, declaring that an emergency existed and that the company's financial situation was desperate. He asked that a temporary rate be granted until the permanent rate could be formally established.

Chairman Treacy of the board in the course of his remarks said:

The board is reluctant to extend a theory which was developed to cover a national emergency, the war, beyond the period of the emergency itself. This board is not going to grant any emergency applications unless the situation is so critical that it is imperative for it to do so.

Commissioner Harry V. Osborne indicated that he thought that continual changing of utility rates was unsettling to the public and to financial conditions generally. The board fixed May 31 for the continued hearing in the Trenton case.

Large Area for Future Development Opened

Governor Miller of New York recently signed the bill proposed by Senator Smith of Staten Island which will give Staten Islanders rapid transit facilities between Richmond and New York City within three years. For over twenty years residents of the island backed by big business interests have fought for a transit connection between the Borough of Richmond and Brooklyn. The passage of the new law will require the city to begin within two years the construction of a passenger and freight tunnel between the two places. Governor Miller commenting on the bill said:

Such a tunnel must necessarily be a part of any comprehensive plan for the development of the port. Indeed, it appears to me that it is one of the obvious things that may speedily be done to relieve congestion and to eliminate much of the costly with a terminal service now required, for by that means it should be possible to provide direct service from the transcontinental railroads to a large territory with a rapidly growing population now cut off from such service. Such a tunnel, with proper connections, will bring the transcontinental railroads to the very centre of the great metropolitan district.

The city of New York already is expending a large sum in the construction of docks on Staten Island and it would seem that transportation means other than by water between Richmond and the other boroughs should be provided as speedily as possible.

The need of such a tunnel is obvious. Its building has now been too long delayed. Nothing can be done under this bill before another session of the Legislature.

Electric Equipment Sale May Settle Title Question

Because he built on an island, made in the middle of the bay, title to which bottomland has been vested in the city but without the right to transfer it, Carl G. Fisher, developer at Miami, Fla., has offered to sell for \$1,125,000 an electric power house for lighting and power, carhouses and other equipment that cost him \$1,265,403. By the purchase the tangle over the title question would be settled. The island was built up by the Fisher interests after the bay bottom had been purchased. Mr. Fisher also offered to sell the trolley line of the Miami Beach Electric Company to the city, "and not at a profit either."

At the conclusion of the general discussion, the offer having been made in an open meeting of the City Council, City Attorney S. P. Robineau was authorized to go to Tallahassee, the state capital, to take up with the Internal Improvement Board the question of title, with the hope that there might be still some way out of the tangle. The tangle actually dates back to a state law a dozen years ago, deeding to Florida cities all submerged lands within their corporate limits, but with the proviso that title shall always be vested in the municipality. Later the Fisher interests approached the Internal Improvement Board, which controls state lands, and neither thinking of the state law, the board sold the Fisher interests eleven acres of bay bottom.

Municipality Follows Up Its Advantage

The figures of the Detroit (Mich.) United Railway on the cost of constructing the 25 miles of day-to-day lines which the city electors voted to take over have been submitted to the city. The total cost of these eight lines is placed at \$1,965,942, or approximately \$80,000 per mile. Accountants for the city will check over the figures submitted by the company and engineers for the city will go over the lines with the company's engineers to determine depreciation.

Arbitration of the construction costs and depreciation will be urged by the city as soon as the figures have been gone over, since Mayor Couzens is anxious to have the question of costs settled before the city declares itself ready to take over the lines. E. W. Bemis, Chicago, has been retained by the city to appraise the eight day-to-day lines.

Announcement has been made by Mayor Couzens that the electors of Detroit will be asked to vote at the next election on the question of giving the Street Railway Commission power to acquire the Fort Street and Woodward Avenue lines, Detroit United Railway lines for which the franchises have expired. This is the first action taken in regard to these lines since the April 4 election when the company's service-at-cost plan was defeated.

Railway Firm—Will Not Arbitrate

Prospects seemed remote on May 13 for the early resumption of service on the Scranton, Montrose & Binghamton Railroad, Scranton, Pa., shut down since April 18. Union officials were still firm then in their stand not to permit the employees to accept a cut in wages or permit the working conditions to be modified except by arbitration. The railroad management was equally firm in its stand not to arbitrate a matter where the possibility existed of it not being able to carry out the arbitration decision. The line runs between Lake Winola and Montrose, Pa.

Failure to agree with the employees over a new contract for wages and working conditions forced the company to suspend service. The company made a contract in 1916 with its trainmen for four years, at a maximum of 30 cents an hour, but voluntarily increased wages each succeeding year, granting two advances in 1920, so that the trainmen in April, 1920, were receiving 60 cents an hour, with other employees paid in proportion.

Shortly before the April, 1921, agreement expired the operating statements of the company were placed before a committee of the employees for their consideration. They showed that the company was fast losing money with wages taking 68 per cent of the revenue. Accordingly the men were asked to take a reduction of 25 per cent. This proposal they flatly rejected.

In a final effort to reach an adjustment the company suggested a 12½ per cent reduction in wages and modification of the working agreement so the company could use one-man cars whenever the management thought it practical.

The company stipulated that if anything were made above fixed charges during the year of the contract, the sum so earned would be applied in the form of an additional wage payment, thus cutting down the 12½ per cent wage reduction. This plan was also rejected, but by a small majority vote.

The men wanted the whole matter arbitrated. This the company has refused to do. The villages along the road have been hard hit, as they depended upon the power plant of the railroad for lighting and power, but an agreement has been made with the power-house men to work at the old scale and the consumers have submitted to an increase of 40 per cent in rates to meet the extra expense which is entailed.

Indeterminate Grants to Be Accepted

The Citizens Gas Company and the Indianapolis Street Railway are preparing to surrender their franchises granted by the city of Indianapolis and operate under indeterminate permits granted by the Public Service Commission, it is understood at the office of the commission. The railway franchise provides for the sale of six tickets for 25 cents, but its provisions have been set aside by the commission, under the emergency relief section of the public utility law.

The Legislature of 1921 authorized utilities operating under franchises from cities to surrender the franchise and operate under the 1913 act creating the State Public Service Commission. Under a section of the 1913 law, any public utility under an emergency can be operated during the emergency under the commission regardless of its franchise. It is under this section that the gas company and the railway are operating temporarily.

Program of Meeting

Pennsylvania Street Railway Association

The Pennsylvania Street Railway Association will hold its annual meeting at the Penn-Harris Hotel, Harrisburg, Pa., on June 16 and 17. One of the prominent speakers will be P. H. Gadsden, president of the American Electric Railway Association. Topics that are of vital interest to the industry will be touched on, such as Financing, Handling of Materials and Supplies, and a paper from an official of the Pennsylvania State Chamber of Commerce on the Value of Co-ordination and Friendly Relations Between the Merchant, Street Railway and General Public.

Details of Detroit United Wage Reduction

Final agreement having been reached between the Detroit United Railway and representatives of the platform employees regarding the wage reductions, notices have been posted by the company stating the change in rates of pay effective on May 1, as affecting motormen and conductors. The rates of pay made retroactive from May 1 for motormen and conductors in passenger and freight service are: 55 cents an hour for the first three months; 58 cents an hour for the next nine months, and 60 cents an hour thereafter.

Regular motormen and conductors will be paid time and one-quarter for extra or tripper work on week days. Time and one-half will be paid for extra or tripper work for Sundays or holidays, and also for the time in runs in excess of eight hours on Sundays and holidays.

The time intervening between the completion of regular runs and the starting time of extra or tripper work will be paid for at the regular rate of pay, when such intervening time does not exceed five hours. The limit of five hours thereby established for the time intervening is not to apply to men operating day runs.

A minimum guarantee of two hours at the overtime rate will be paid night men when they are required to report for and operate an a.m. tripper in addition to their regular run.

Extra men when required to operate tripper or do extra work after the completion of a regular scheduled run will be paid time and one-quarter for such extra service.

Freight men will be paid time and one-quarter for extra service and for the time in the runs above eleven hours on week days, and time and one-half when required to work in passenger service on Sundays and holidays, except where such service is performed for the purpose of allowing men regularly assigned in the passenger service to be relieved from Sunday duty; and at their regular rate of pay for the time intervening between the completion of their regular run and the starting time of the extra or tripper work.

Penalties for scheduled swing runs will be as follows: For the fourteenth hour, fifteen minutes; for the fifteenth hour, an additional fifteen minutes; and for each consecutive hour thereafter an additional thirty minutes.

Employees on the Port Huron, Mt. Clemens and Ann Arbor city lines will receive 2 cents an hour less than the rate for the other Detroit United Railway platform employees.

Wage Cut in Dubuque.—Trainmen of the Dubuque (Ia.) Electric Company have had their wages reduced from 60 cents an hour to 45 cents. The company recently decided to cut wages and lower rates as a readjustment measure. The trainmen remained at work, but referred the reduction to their officers for consideration.

New York State Arbitration to Begin

The arbitration board in the New York State Railways wage dispute with its employees of Utica, Rochester, and Syracuse will begin sessions at Rochester on May 23. The arbitration board will be composed of Judge Arthur E. Sutherland, of Rochester, choice of both factions as neutral members of the board; B. E. Tilton, vice-president of railway, company arbitrator, and James H. Vahey, Amalgamated counsel, arbitrator for the union employees.

The big issues before the board will be the decision of whether the men shall accept a wage cut averaging 25 per cent and will also work more hours than nine, which is their present working day.

Details as to overtime wages are also to be worked out. The new wage agreement is now in force, but any alterations made by the board will be retroactive from May 1.

Wages Reduced in New Orleans

The employees of the New Orleans Railway & Light Company, New Orleans, La., members of the Amalgamated Association, Division 194, have come to an agreement, through a committee representing them, with the receiver by which, beginning on July 1, 1921, a new scale of wages will go into effect. The new scale affects about 2,600 employees of the company. It reduces the present wages of the men, according to the character of the work performed, from 8 per cent to 25 per cent, and removes all possibility of a strike for another year, beginning April 18, 1921.

Both the employees and the company express themselves as satisfied with the arrangements. There is no change in the working conditions. It is estimated that the new wage scales will save the company from \$300,000 to \$500,000 annually.

Although the wage question has been adjusted little progress has been made toward settling other matters facing the company. The citizens' committee that has been opposing the increase in fare from the franchise rate of 5 cents has suspended its activities for the time being pending action by the Commission Council, after the hearing on the injunction before the United States Supreme Court. Assistant Attorney General Hall of Louisiana is now in Washington, D. C., looking after the matter.

Senator E. M. Stafford, who has taken a leading part in the agitation for lower fares, said on May 14:

I know there is a movement on foot to establish a bus system in New Orleans, which will bring about a material reduction in the cost of transportation. As a matter of fact, figures are being compiled from statistics gathered throughout the country, such as the cost of cars and their up-keep which will enable those directing the movement for a bus system to come to some definite conclusion. If the system is put into operation, books of tickets will be sold so as to provide for a 5-cent fare.

J. J. McLoughlin, who has been associated with Senator Stafford, knew

nothing definite about the establishment of the bus system referred to by Senator Stafford, but said that discussion had been held of a plan to install a twenty-car bus system to run out St. Charles Street to either Jackson Avenue or Louisiana Avenue. Beyond that, he knew nothing.

It was announced on May 15 that C. C. Chappelle, New York, representing Eastern bankers who are interested in the company at New Orleans, would arrive in New Orleans on May 16 bringing with him a new plan on which he hopes that the Commission Council and the bankers may reach an agreement.

News Notes

Arbitration in Little Rock.—Trainmen of the Little Rock Railway & Electric Company, Little Rock, Ark., have opposed the 20 per cent wage reduction proposed by the company and the dispute will be arbitrated. W. J. Terry has been selected by officials of the company and T. M. Mehaffy has been chosen to represent the men. These two men will select the third arbiter. The present contract with the men expires on May 22. This company recently applied for a 7-cent fare.

Try to Force Track Repairs.—Some of the town officials of Cicero, a suburb of Chicago, recently tried to enforce their demands upon the Chicago & West Towns Railway for track repair by barricading the right-of-way. After the cars had run through these barricades Bert Collett, general superintendent, and a supervisor and two motormen were arrested on a charge of disorderly conduct. Later steam rollers were used to block the track until a temporary injunction against the town officials was granted the traction company.

Massachusetts Commission Reports Living Costs Decrease 20 Per Cent.—The Massachusetts Commission on Necessaries of Life has recently issued a report indicating a reduction of 17.9 per cent in the average retail price of commodities as compared with peak prices during the summer of 1920. The report cites a group of commodities costing \$202.60 last July as now selling for \$166.40. In the case of food-stuffs the decrease is approximately one-third and clothing about 30 per cent. Fuel and rents, however, still maintain high levels.

Open Shop in Eureka.—A strike of the trainmen of the Humboldt Transit Company, Eureka, Cal., terminated recently with practically a 100 per cent non-union personnel. The men voted to strike on March 18 because some members had been discharged for violation of rules. The company refused to arbitrate and mustered about 50 per

cent of crews the morning of March 19 and in twenty days all cars were operated. For several years past the city of Eureka has been about 90 per cent union. It is stated now that about 60 per cent of the business people have been converted to the open shop plan.

Valuation Bill Signed by Governor.—Governor Miller of New York on April 27 signed the Knight bill amending the law under which the Transit Commission in New York City was created, so as to make the earning ability of traction companies at the rate of fare to which they are limited by contract or franchise stipulations a determining factor in valuation. The act also brings suburban and interurban transit lines operating within New York City under the jurisdiction of the new Transit Commission. The terms of the measure were reviewed at length in the ELECTRIC RAILWAY JOURNAL for April 23, page 786.

Committee to Examine Pittsburgh Situation.—The Pittsburgh Chamber of Commerce has notified the City Council of the appointment of a special committee to study the electric railway situation in Pittsburgh and report on the best solution of any difficulties that may be found to exist. The committee is composed of Samuel Harden Church, president of the board of directors of the Carnegie Institute; George S. Davison, president of the Gulf Refining Company; T. P. Gaylord, acting vice-president of the Westinghouse Electric & Manufacturing Company; A. J. Logan, president of the A. J. Logan Company, and Lawrence E. Sands, president of the First National Bank.

City May Test New Minnesota Act.—According to City Attorney Nelson of St. Paul, Minn., legal action will be taken to test the validity of the bill passed by the recent Legislature putting control of street railway lines under the Railroad & Warehouse Commission. Formal objection by the city will not be made, however, until the St. Paul City Railway takes steps to secure authorization from the commission for issuance of further securities or to obtain an increase in fares. A digest of the provisions of the new law was published in the ELECTRIC RAILWAY JOURNAL for April 30, page 82.

Council Opposed to Wage or Fare Change.—The City Council of Sioux City, Iowa, decided in effect to reject the demands of the Sioux City Service Company for an increase in fares, and through Mayor Wallace M. Short issued a statement saying that the Council is "willing to let" the present arrangement continue in effect. That arrangement provides for a 6-cent fare for a period of three years from September, 1920. The Council also stated that it expects the Service company to make no cut in the present wage scale of employees. This probably will mean the starting of an action in court on the part of the Service company to bring about an increase in fare to either 8 or 10 cents.

Financial and Corporate

\$3,675,050 Increase in Gross Economies Put Into Effect by Receivers at St. Louis Reflected in Earnings—Fare Collections Better

An outstanding feature of the 1920 annual report of the United Railways, St. Louis, issued recently by Rolla Wells, receiver, is that \$500,000 of the increased revenue was due to better fare collections.

Better care in fare collection methods are ascribed by Colonel Albert T. Perkins, manager for the receiver, to the employment of additional car auditors—28 instead of 19—the use of fare boxes, and the weeding out of dishonest conductors. More than 200 men have so far been discharged. At first the union insisted upon arbitration, but after most of the cases had been lost arbitration practically ceased.

Signs carried in the light-box space on the front platforms of cars request passengers to deposit their own fares, and also inform them that "conductors are not permitted to deposit fares except under unavoidable conditions." The public is being convinced that car service nowadays is practically on a cost basis, and that diverted fares have a direct bearing on the rates of fare. Of collections, the report says:

In the Spring of 1920 the Public Service Commission ordered the Receiver to put into effect on April 11, 1920, a flat fare of 7 cents for adults and a flat fare of 3 cents for children; these rates taking the place of previous cash fare rates of 8 cents for adults and 4 cents for children, combined with the sale of two adult tickets for 15 cents (sold on the cars) and 7 tickets for

50 cents and 50 tickets for \$3.50 (sold at stations all over the City), and the sale of children's tickets 2 for 7 cents.

The result of this order was to reduce the average rate of fare by 0.37 cent—cutting down the earnings \$3,000 per day. This great loss was not offset by any material benefit to the public, as the difference had been borne largely by the casual rider who paid cash or by passengers who were not interested enough to buy 7-cent tickets.

The comparative income and expense statement shows gross operating revenue for 1920 to have been \$20,267,730, as against \$16,592,679 for 1919, an increase of \$3,675,051. The total operating expenses, depreciation and taxes were \$16,712,143, as against \$14,303,639, an increase of \$2,408,504. The net income for 1920 was \$1,083,428, as against a deficit of \$265,781 in 1919, an increase of \$1,349,209.

From Jan. 1 to April 11, 1920, the United Railways cash fare for adults was 8 cents or two tickets for 15 cents (sold on the cars) and 4 cents for children. Tickets in lots of seven for 50 cents and 50 for \$3.50 were sold at stations all over the city. Children's tickets were sold on the cars two for 7 cents. On April 11 the basic rate of fare was reduced to 7 cents and to 3 cents for children.

After the rate of fare had been reduced wages went up. The previous wage agreement expired June 1, 1920, and the State Public Service Commission, acting as arbitrator, raised the wages of motormen and conductors 5 cents an hour. This made the scale 55 cents for the first six months, then 60 cents an hour to the end of the second year, and 65 cents an hour for those

who have served more than two years, the latter class including about 80 per cent of the employees.

This increase in trainmen's wages cost the receiver about \$2,000 a day. No increase was granted to mechanics, carpenters, electricians, printers and members of other unions, but the matter was submitted to the State Public Service Commission for arbitration. The commission held, however, it was not mandatory that they should act as arbitrators. The receiver recently filed a mandamus suit in the Missouri Supreme Court to compel the commission to act, alleging that the commission alone has the right to adjust income and expenses. A decision is expected soon.

The total number of revenue passengers carried in 1920 was 287,405,837 and transfer passengers 154,464,735, total 441,870,572, as against 409,010,329 in 1919. The percentage of revenue passengers using transfers in 1920 was 53.74, while in 1919 it was 53.29.

Direct taxes applicable to railways for 1920 were 7.09 per cent of the operating revenue. In addition to these taxes, the United Railways expended during the year \$318,238 for street paving and furnished free transportation for police and firemen. The total taxes and street paving costs—\$1,785,044—amounted to 0.621 cents per revenue passenger. Injuries and damages for the year entailed an expense of \$1,216,064, or approximately 6 per cent of the gross revenue.

Capital expenditures made during the year included \$60,555 for way and structures, and \$448,554 for equipment, a total of \$509,109, the largest items of which were \$303,292 for revenue cars and \$129,551 for new electric equipment for old cars. During the year 0.1253 miles of track were added, and 0.9828 removed. Track reconstruction totaled 26.50 miles. The total mileage of the system now is, in single tracks, 345.20 of city lines, and 115.52 of county lines, a total of 460.72 miles.

Power for the year costs \$2,198,861, or at the rate of 13.5 mills per kw.-hr. at the d.c. switchboard. On a kilowatt-hour basis 59.4 per cent of the average distribution of power was from purchased water power, 27.6 per cent from purchased steam power, and but 13 per cent generated by the company in its own plants. On the peak loads the basis was 40.8, 25.6 and 33.6 per cent respectively.

The average number of passenger cars operated daily, including Sundays, during 1920, was 1,175, as compared with 1,132 in 1919 and 1,107 in 1918. During the peak hours in some weekdays the number was as high as 1,320.

Reorganization Plan Being Arranged

Reorganization of the Pittsburgh (Pa.) Railways and elimination of the receivership may be effected within the next three months, according to an announcement by Mayor E. V. Babcock, following a conference with other city

INCOME STATEMENT—UNITED RAILWAYS, ST. LOUIS

| Year Ended Dec. 31 | 1920 | | | 1919 | | |
|--------------------------------------|---------------------|-------------------------------|-------------------|---------------------|----------------------------|--|
| | Actual | Per Cent of Operating Revenue | Per Cent Increase | Actual | Per Cent Operating Revenue | |
| Operating revenue— | | | | | | |
| Revenue from transportation: | | | | | | |
| Passengers..... | \$20,113,799 | ..... | 22.20 | \$16,463,312 | ..... |  |
| Special cars..... | 32,791 | ..... | 40.70 | 23,297 | ..... |  |
| Express..... | 8,244 | ..... | 27.18 | 11,323 | ..... |  |
| Total..... | \$20,154,834 | 99.443 | 22.10 | \$16,497,932 | 99.43 | |
| Other railway operations: | | | | | | |
| Station and car privileges..... | 80,000 | ..... | 18.50 | 67,510 | ..... |  |
| Rent of equipment..... | 455 | ..... | ..... | ..... | ..... |  |
| Rent of buildings, etc..... | 12,800 | ..... | 40.80 | 9,109 | ..... |  |
| Sale of power..... | 19,641 | ..... | 8.10 | 18,128 | ..... |  |
| Total..... | \$112,896 | 0.557 | 19.15 | \$94,747 | 0.57 | |
| Operating revenue..... | \$20,267,730 | 100.00 | 22.15 | \$16,592,679 | 100.00 | |
| Operating expenses: | | | | | | |
| Way and structures..... | \$1,233,332 | 6.085 | 5.50 | \$1,170,045 | 7.05 | |
| Equipment..... | 1,606,497 | 7.926 | 3.90 | 1,545,241 | 9.31 | |
| Depreciation reserves..... | 1,626,888 | 8.027 | 1.95 | 1,659,268 | 10.00 | |
| Power..... | 2,198,861 | 10.849 | 28.20 | 1,715,604 | 10.34 | |
| Traffic..... | 12,775 | 0.63 | 95.00 | 6,550 | 0.4 | |
| Transportation..... | 6,615,316 | 32.640 | 23.20 | 5,363,205 | 32.32 | |
| General miscellaneous..... | 765,074 | 3.775 | 3.80 | 737,254 | 4.44 | |
| Injuries and damages reserves..... | 1,216,064 | 6.000 | 22.20 | 995,561 | 6.00 | |
| Total operating expenses..... | \$15,274,807 | 75.364 | 11.49 | \$13,292,728 | 79.50 | |
| Net operating revenue..... | 4,992,923 | 24.636 | 47.20 | 3,399,951 | 20.50 | |
| Taxes..... | 1,437,336 | 7.092 | 29.40 | 1,110,911 | 6.70 | |
| Income from operation..... | \$3,555,587 | 17.543 | 55.30 | \$2,289,040 | 13.80 | |
| Non-operating income..... | 145,855 | .719 | 37.04 | 106,442 | .64 | |
| Gross income..... | \$3,701,442 | 18.262 | 54.50 | \$2,395,482 | 14.44 | |
| Deductions..... | 2,618,014 | 12.917 | 1.62 | 2,661,263 | 16.04 | |
| Net corporate income..... | \$1,083,428 | 5.345 | 509.00 | \$265,781 | 1.60 | |

NOTE:—Figures in italics indicate deficit or decrease.

officials, President A. W. Thompson and chief counsel for the Philadelphia Company.

President Thompson outlined his reorganization plan but no details were made public pending the presentation of the plan to the City Council.

Louisville Results Disappointing

James P. Barnes, president of the Louisville (Ky.) Railway, made public on May 5 figures showing that the 40 per cent increase in fares by the company had resulted in an increase in earnings of only 7.49 per cent in the month of April.

In round figures, Mr. Barnes' report shows the gross revenue for the first four months of the year to be 5.09 per cent more than it was for the first four months of last year. For the two months and seven days the 7-cent fare has been in effect the earnings have been 8.56 per cent more than the same period last year. During April just past, the receipts from fares were \$355,085, an increase of \$25,781 or 7.49 per cent over April, 1920.

Mr. Barnes said he hoped the percentage would be increased and believed it would be as people became more used to the 7-cent fare, but that while the company was not discouraged by results to date, the increase in revenue under the higher fare had not been as great as was anticipated.

Samuel Riddle, vice-president, said he was confident fewer persons were riding in jitneys than there were a month ago. He believed the jitneys would gradually withdraw from service owing to the cost of maintenance and inability to run on regular time schedules at 5 cents.

The 7-cent fare went into effect in Louisville on Feb. 21.

Deficit of \$142,030 in Cincinnati in Four Months

Figures of the monthly report of the Cincinnati (Ohio) Traction Company for April filed with William Jerome Kuertz, Director of Street Railways, when compared with other monthly reports since January, show that although there is a deficit on hand at the end of each month, the deficits are being cut down gradually. This is with ex-

ception of the month of February, when the deficit was the largest of the year to date.

During the month of April the gross receipts from all sources totaled \$775,952. The gross expenses were \$806,202, leaving a deficit for the month of \$30,249.

The number of fares collected during the month shows a decrease of 1,103,332, for the number collected during April, 1920. Mr. Kuertz believes that economic conditions combined with high fare are responsible for the falling off in the business of the company as compared with last year. The report states that the cost of service in April was 8.95 cents per revenue passenger, while the income was 8.61 per revenue passenger.

The total accrued deficit of the traction company to date, according to its claims, is \$806,426. The city of Cincinnati dispute these figures pending a decision by the courts on their contentions that the company allowed the Ohio Traction Company and the Cincinnati Car Company to earn large profits at its expense.

The accrued deficit up to Jan. 1, 1921, which had accumulated since a former deficiency was funded under a refinancing plan, amounted to \$664,395. The

Commerce Body Would Explain Refinancing to Public

In order that the citizens of Cincinnati may have an opportunity fully to understand the provisions of the proposed refinancing of the Cincinnati (Ohio) Traction Company and the Ohio Traction Company, as being formulated, the executive committee of the Chamber of Commerce has asked Mayor John Galvin that when the plan is completed it be submitted to the Chamber of Commerce as the representative of the general public, for its consideration, before final action is taken.

Interborough Loses \$877,000 in Three Months

The income statement of the Interborough Rapid Transit Company, New York, N. Y., for the three months of the current year and for the nine months ended March 31 are shown in the accompanying tables. In the month of March more revenue traffic was handled than in either January or February. Although the net income for the month shows a deficit of \$187,743, it is a better showing than was made in the two preceding months. The net corporate income for the nine months ended

| | 1921 | 1920 | Per Cent Change |
|---|--------------|--------------|-----------------|
| Nine months ended March 31: | | | |
| Gross operating revenue..... | \$41,189,134 | \$37,989,848 | 8.4 |
| Operating expenses..... | 27,211,821 | 23,503,599 | 15.8 |
| Net operating revenue..... | \$13,977,313 | \$14,486,249 | 3.5 |
| Total taxes..... | 2,028,258 | 1,958,899 | 3.6 |
| Income from operation..... | \$11,949,055 | \$12,527,350 | 4.6 |
| Non-operating income..... | 472,881 | 422,848 | 11.9 |
| Gross income..... | \$12,421,936 | \$12,950,198 | 4.1 |
| Interest, rentals, etc., including Manhattan Guarantee..... | 15,982,076 | 14,944,978 | 6.9 |
| Net Corporate income (exclusive of accruals under the provisions of Contract No. 3 and related Certificates which under these agreements with the City are payable from future earnings)..... | \$3,560,140 | \$1,994,780 | 78.5 |
| Operating per cent..... | 66.0 | 61.8 | 4.2 |
| Passengers carried (revenue)..... | 756,977,274 | 702,981,440 | 7.7 |

monthly record since then, as claimed by the company, has been as follows: January earnings, \$782,921; expenses, \$814,113; deficit, \$31,192. February earnings, \$707,502; expenses, \$755,497; deficit, \$47,994. March earnings, \$796,418; expenses, \$829,014; deficit, \$32,595. April earnings, \$775,952; expenses, \$806,202; deficit, \$30,249.

March 31, 1921, failed by \$3,560,140 to meet the cost of service, this against a deficit of \$1,994,780 for the corresponding period of a year ago. Since Dec. 31, 1920, the termination of the six months' period through March 31 the end of the nine months period the Interborough's deficit has increased \$877,379.

STATEMENT OF EARNINGS—INTERBOROUGH RAPID TRANSIT COMPANY

| Month Ended | March | | | Feb. | | | Jan. | | |
|---|-------------|-------------|-----------------|-------------|-------------|-----------------|-------------|-------------|-----------------|
| | 1921 | 1920 | Per Cent Change | 1921 | 1920 | Per Cent Change | 1921 | 1920 | Per Cent Change |
| Gross operating revenue..... | \$4,933,632 | \$4,876,561 | 1.2 | \$4,345,109 | \$4,468,923 | 2.8 | \$4,940,995 | \$4,444,137 | 11.2 |
| Operating expenses..... | 3,147,783 | 2,829,713 | 11.3 | 2,839,513 | 2,643,978 | 7.4 | 3,190,225 | 2,854,687 | 11.8 |
| Net operating revenue..... | \$1,785,848 | \$2,046,848 | 12.8 | \$1,505,596 | \$1,824,944 | 17.5 | \$1,750,770 | \$1,589,450 | 10.2 |
| Total taxes..... | 244,544 | 228,812 | 6.9 | 230,790 | 215,931 | 6.9 | 241,654 | 216,638 | 11.6 |
| Income from operation..... | \$1,541,304 | \$1,818,035 | 15.2 | \$1,274,805 | \$1,609,013 | 20.8 | \$1,509,116 | \$1,372,811 | 9.9 |
| Non-operating income..... | 51,892 | 50,426 | 2.9 | 50,613 | 49,446 | 2.4 | 54,122 | 51,046 | 6.0 |
| Gross income..... | \$1,593,196 | \$1,868,462 | 14.7 | \$1,325,418 | \$1,658,460 | 20.1 | \$1,563,238 | \$1,423,857 | 9.8 |
| Interest, rentals, etc., including Manhattan Guarantee..... | 1,780,940 | 1,674,975 | 6.3 | 1,789,213 | 1,673,620 | 6.9 | 1,789,079 | 1,676,596 | 6.7 |
| Net corporate income (exclusive of accruals under the provisions of Contract No. 3 and related certificate, which under these agreements with the city are payable from future earnings)..... | \$187,743 | \$193,486 | 197.0 | \$463,795 | \$15,160 | 2,958.0 | \$225,841 | \$252,738 | 10.6 |
| Operating ratio..... | 63.8 | 58.0 | 5.8 | 65.4 | 59.2 | 6.2 | 64.6 | 64.2 | 0.4 |
| Passengers carried (revenue)..... | 91,727,683 | 91,297,336 | 0.5 | 80,092,357 | 84,193,107 | 4.9 | 88,561,712 | 82,094,063 | 7.9 |

Commission Urged to Indicate Valuation Procedure

The city of Minneapolis, Minn., is very anxious that the Minneapolis (Minn.) Street Railway proceed with extensions and with reconstruction on account of paving. It is impossible for the company to attempt this work, however, without being able to stabilize financing, not only for this year but for some years in advance, in order to lay out a constructive program which will properly serve the public. For this reason it has appealed to the State Railroad & Warehouse Commission, under the recently amended law, to "advise us in what form to make application to your honorable body to undertake as soon as possible the valuation of our property that you may be able to authorize the issuance of securities which we can market to secure the money for the improvements which are being called for."

The company explains that it does not wish to press this matter too strongly, but that it does wish to have it understood that "the public improvements which are demanded are dependent upon your action in the matter."

The same request for information was made for the St. Paul City Railway, while the Duluth Street Railway requested an emergency fare of 7 cents with four tickets for 25 cents.

Foreclosure Sale of Providence Roads Ordered

Decrees for the foreclosure sale of the properties of the United Traction & Electric Company, the Rhode Island Suburban Railway, the Pawtuxet Valley Electric Street Railway, and the Cumberland Street Railway, Providence, R. I., because of the default in payment of principal and interest on the bonds, have been entered in the Superior Court at Providence by Presiding Justice Tanner.

The court appointed Arthur A. Thomas as special master in chancery to conduct the sale at such time as Mr. Thomas may hereafter announce and after six weeks' advertised notice. The roads will then probably be purchased by the joint reorganization committee for the United Electric Railway.

The decrees were entered by the court following a hearing upon the complaint of the Central Union Trust Company, New York, trustee, against the United Traction & Electric Company, and the consolidated cases of the Union Trust Company, trustee, against the Rhode Island Suburban Railway, Central Union Trust Company, New York, trustee, against the Pawtuxet Valley Electric Street Railway and the Central Union Trust Company, New York, trustee, against the Cumberland Street Railway.

The special master will put up the property in separate parts and get bids. If the sum of the highest bids for the properties separately is less than the sum offered for the three together, they will be sold together and

the purchase price apportioned as provided by the decree.

Notice has also been given that the plan and agreement of reorganization of the system, referred to at length previously in the *ELECTRIC RAILWAY JOURNAL* were declared operative, with respect to all the classes of securities previously mentioned, on April 23, 1921.

Merger Reported Arranged

The Capital Traction Company and the Washington Railway & Electric Company, Washington, D. C., have agreed on a plan of merger, the Public Utility Commissioners of the district announced on May 18. The details are withheld.

Court Orders Seizure of Equipment Not Paid For

Judge Martin J. Wade of the Federal court at Des Moines, Iowa, on May 13 granted an order to the General Electric Company authorizing it to seize certain equipment in the three substations and power plant of the Des Moines City Railway.

The order was to satisfy claims of the General Electric Company for equipment valued at about \$68,000, which had been furnished largely for installation in the substations of the railway during the past few years. The financial condition of the railway has not permitted it to pay for the equipment. As a last resort the General Electric Company brought suit in the Federal court a few weeks ago. The order made on May 13 is the result.

F. C. Chambers, operating receiver for the railway, was in Chicago consulting with the Harris interests, owners of the Des Moines plant, at the time the order was made public, and there has been no definite announcement from the company as to just what effect the carrying out of the order would have on service.

Over the long distance telephone, however, A. W. Harris told a Des Moines newspaper that he would refuse to put another dollar into the Des Moines plant until the city and company had arrived at an agreement by which the people of Des Moines would meet the situation.

Announcement was made that the General Electric Company would start removing its equipment from the substations May 16.

In the meantime arbiters representing the railway and the union employees are deadlocked over the choice of a third arbiter. A week ago the company named B. F. Elbert, a Des Moines theater owner, as its arbiter, while Rev. J. E. Kirbye, who was the third arbiter in the last arbitration over the wage scale, was chosen by the union. Many names have been advanced for the third man without an agreement being reached.

The present working agreement between the company and men expired on March 1.

Financial News Notes

Tax Measure Excludes Electric Railways.—The King tax bill, which was recently passed by the California Legislature, as noted in the *ELECTRIC RAILWAY JOURNAL*, issue of March 19, page 570, does not change the rate of taxation imposed on electric railways of the state.

Bonds of Interurban Road Paid.—The \$855,000 of first mortgage bonds of the Detroit & Northwestern Railway, Detroit, Mich., included in the system of the Detroit United Lines, which matured on May 1, 1921, were taken up from the present holders upon presentation to the Central Union Trust Company, New York.

Ten-Cent Fare Unremunerative.—The receipts of the Worcester (Mass.) Consolidated Street Railway were \$8,230 less for April, 1921, than for the month of April, 1920, when the road operated under a 7-cent fare plan. According to General Manager Henry C. Page it was only because of the present business depression that receipts fell off.

May Buy Railway Property.—It is said that negotiations have been under way for the sale of the Gadsden, Bellevue & Lookout Mountain Railway by the Alabama Power Company which operates the city railway system in Gadsden. The Mountain Railway, as it is called, connects Gadsden and Nocalula Falls. It is expected that if controlled by the Alabama Power Company a park movement in the vicinity of the Falls will be fostered.

Service Resumed at Holyoke.—Service on the Holyoke (Mass.) Street Railways lines between Chicopee Falls and Holyoke, suspended thirty-seven days ago because of jitney competition, was resumed on May 4 following action of the Holyoke Board of Aldermen in banning jitanes from that city. The railway refused to operate its cars in competition with the buses and the Chicopee Aldermen refused to revoke permits. The controversy has been settled by the action of the Holyoke Aldermen.

Receiver for Shuttle Line.—George C. Dunlap has been appointed receiver of the Dallas (Tex.) Standard Traction Company, owner of the Mt. Auburn-Parkview line in an order signed by Judge W. S. Whitehurst. Judge Whitehurst's order further restrained the sale of the property by the sheriff on May 3, as was ordered in a previous judgment. The Dallas Standard Traction Company controls a shuttle line in the city of Dallas about 1½ miles long which was operated under lease by the Dallas Railway until May 1, when the contract between the companies expired.

Traffic and Transportation

Knoxville Decision Expected Rumor Says Seven-Cent Fare Will Be Granted but Transfer Charge Refused

With the appraisal figures fixed and arguments heard as to the merits of the petition for higher fare, the Tennessee Public Utilities Commission is expected to render a decision within the next ten days as to whether the Knoxville Railway & Light Company of Knoxville, Tenn., may charge a 7-cent fare, with 2 cents additional for transfers, or whether the fare shall remain as it is, 5 cents.

The commission rendered a compromise decision on the appraisal of the property of the company, fixing the valuation at \$5,983,000. Upon this valuation the commission will hold as to whether or not the company is entitled to a higher fare.

The appraisal of the property followed an order made by the state commission on May 21, 1920, following an application by the traction company for an increase in fare. The appraisal was concurred in by the valuation expert for the traction company. The two men fixed the valuation of the property at \$6,234,141, on an historical basis, including superseded property. Of this amount the traction department was valued at \$4,203,247 and the commercial lighting department was appraised at \$2,030,894.

On a reproduction cost basis, using prices for the first six months of 1920, it was found by the appraisers representing the commission and the company that the value of the property would be \$10,362,964.

The engineer representing the city of Knoxville, which is fighting the increase, demurred from the finding of the other two appraisers and refused to sign the majority report. He held that the property value was approximately \$2,000,000 under the majority report.

Attorneys for the city of Knoxville have announced that they propose to carry the matter to a higher authority in the event the decision is against them.

Indications were on May 16, although without official authority, that the commission will grant the 7-cent fare requested, but that the request for 2 cents additional for each transfer will be denied.

Another Auxiliary Auto Service

The Holyoke (Mass.) Street Railway, through its president, L. D. Pellissier, has applied for permission from the Aldermen to run autos on the so-called West Dwight Street line. The company seeks permission to run two buses with a capacity of 30 passengers each. They

will be operated under the same ordinance on which the street cars are operated, which fixes a minimum period of service.

As the West Dwight Street line, if the petition is granted, will require two shifts of men, and as union men will be employed upon it, the jitneys will be operated at both earlier and at later hours than under the old system. An attempt will also be made so to arrange the time of their running as to stagger the service and greatly increase accommodations from down town to Pleasant Street, West Dwight Street and adjacent sections.

Court Asked to Reopen Galveston Fare Case

The fare case at Galveston, Tex., has been reopened in federal court, and another legal contest is in prospect. This case was recently decided by Judge J. C. Hutcheson of the United States Court for the Southern District of Texas at Houston in a ruling adverse to the railway, when the court held the earnings of the Galveston Electric Company under a 5-cent fare were adequate and declined to permit an increase in rates.

Following arguments on a motion for rehearing Judge Hutcheson announced that he would appoint a special engineer to investigate costs of maintenance and depreciation, unless opposing counsel can agree on certain points involving these questions. Judge Hutcheson intimated that if appointment of such an engineer became necessary, he would be representative of the court and not of either of the parties to the litigation.

Judge Hutcheson's decision holding that the earnings of the company under the present fare charges are adequate was made after a special master in chancery had conducted hearings and had investigated fully the questions of maintenance costs, depreciation, valuation, etc. Judge Hutcheson, however, held adversely to the findings of the special master, Judge Henry J. Dannenbaum, Houston, who found, according to his report, that the Galveston Electric Company can not make a fair and just return on its investment with fares at 5 cents.

The new developments in the case in the motion for rehearing, on the ground that additional evidence is to be presented, is regarded as assuring a reopening of the case. The motion for rehearing, filed by attorneys for the company, alleges that the court erred in deciding against the company on grade raising, depreciation, brokerage, going-concern value, and the court's treatment of operating expenses and maintenance.

Seven-Cent Fare Voted Down in Port Huron

The electors of the city of Port Huron, Mich., voted down the proposition of the Detroit United Railway to increase fares on the Port Huron city lines, which are part of the Detroit United System, from 5 cents to 7 cents, at the April 4 election. The company's proposal was defeated by a vote of 3,200 to 2,026.

As a result of the failure of the proposed increase to carry, wage reductions affecting the employees of these lines were announced by the company to become effective on May 1. The new wage scale proposed by the company calls for rates 2 cents an hour less than the proposed scale for Detroit employees, or 53, 56 and 58 cents an hour.

The State Railroad Commission did not have jurisdiction in the Port Huron case. The proposed increase of fares there would have amounted to a suspension of franchise rights similar to the case when the Detroit City Council granted the company an increase of fares in Detroit even though the rate was fixed at less in the franchise agreements. In the case of the Port Huron Council, the city officials simply refused to act and put the matter of the increased fare up to the voters in referendum. No further action has been taken by the company in as much as the decreased scale of wages on the Port Huron lines went into effect on May 1.

Application for Eight-Cent Fare Dismissed

The Corporation Commission of North Carolina has, upon motion of the Asheville Power & Light Company, Asheville, N. C., dismissed the application of that company for an 8-cent fare in the city of Asheville. In asking for the dismissal of the 8-cent fare case the company applied for authority to increase its gas rates and a date has been set for a hearing on this last application.

It is understood that the action of the company in respect to the railway fare was influenced very largely by conditions prevailing on its gas property, where the need of improvements was great and the earnings from the present gas rates were insufficient to justify additional expenditures. Faced with the necessity of increasing its gas rates in order to furnish adequate service the company was disinclined to inaugurate both higher gas rates and railway fares at the same time, and therefore decided to ask for the dismissal of the railway application with the idea of adhering to the present 6-cent fare if future conditions make this possible.

While the present 6-cent fare is said not to yield a fair return upon the value of the property it is the intention of the company to give this a further trial in the hope that, Asheville being a resort city, the approaching tourist season will bring with it sufficient business to justify the action taken.

Increase Disappointing

Indianapolis Roads Willing to Assume \$1,000,000 Construction Cost for Freight Terminal

Joseph A. McGowan, treasurer of the Indianapolis (Ind.) Street Railway, and attorneys for the company, who appeared before the Indiana Public Service Commission on May 12 concerning the 6-cent fare and 1-cent transfer charge, filed with the commission a document that shows that the four big interurban companies that enter Indianapolis are willing to assume the cost of constructing the \$1,000,000 freight terminal which is proposed on Kentucky Avenue.

FINANCING A PROBLEM

At the present time the officials of the Union Traction Company, the Terre Haute, Indianapolis & Eastern, the Interstate Public Service Company and the Indianapolis & Cincinnati Traction Company are concerning themselves with financing the proposition. In the meantime plans for the construction are progressing with the engineers. It is thought here that there will be no opposition on the part of the Public Service Commission to the proposed construction. Under existing franchises the Indianapolis Street Railway is supposed to provide the interurban companies with freight room, but officials of the interurbans know from the present earning power of the local company that it could not possibly handle such a proposition.

The first move toward the project will be the organization of a separate company as a holding company for the freight project. Stock will be issued, twice as much preferred as common. The common will be held by the four interurban companies and the preferred will be sold. It is the intention to distribute the stock over the entire State where the various interurban companies operate.

John W. McCardle, chairman of the commission, said recently the commission had not decided on the course it will follow in the case of the Indianapolis Street Railway. It may hold a supplemental hearing and issue a new order before the end of the thirty-day period. On the other hand, it may merely issue an order continuing the present fare schedule until June 1, and in the interval hold the supplemental hearing and then issue a new fare schedule order.

697,055 FEWER PASSENGERS

In response to the commission's request, officers of the railway and city officials considered with the company recently the receipts of the railway under the temporary order. The figures were compared with the receipts for the corresponding period last year. Company officers submitted that in April the company carried 697,055 fewer passengers than in April, 1920. General business depression and jitney bus competition were given as some of the reasons.

Mr. McGowan said that if the same rates of decrease prevailed through the remainder of the year the company would lose \$445,000. He showed that of the 3,153,306 passengers carried in April, 1,041,491, or 31.72 per cent, paid the 6-cent cash fare, and the remaining 2,111,815 passengers bought tickets. It was estimated by some, when the commission heard the petition for the present charges, that if passenger business did not fall below that of last year and if 15 per cent of the passengers paid the extra cent, the company would obtain revenue sufficient to keep it going. The experience of the company in the trial period shows that while more than twice that percentage paid the extra 1 cent, the total number of passengers, and consequently the total revenue, fell far below that for the corresponding period last year.

Robert I. Todd, president of the company, and Ferdinand Winter, its attorney, discussed jitney bus competition. George M. Bernard, a member of the commission, requested the officers to produce at the supplemental hearing figures to show the injury done to the company by the jitneys.

Arthur W. Brady, president of the Union Traction Company of Indiana, and Charles L. Henry, president of the Indianapolis & Cincinnati Traction Company, filed a petition with the commission requesting approval of a freight terminal arrangement between the city railway and the interurbans using city tracks. The arrangements were made public some time ago. The interurbans request authority to make a special terminal charge of 3 cents a 100 lb. for freight and express.

City After Detroit United Again

Steps leading to the possible reduction of Detroit city fares to 5 cents have been taken by the city officials. A resolution prepared by Councilman Watson directs the Corporation Counsel to advise the Council relative to the proper legal step to take to have the fare lowered. The company has been asked to submit operating figures so that the city can determine whether or not the reductions in the wages of platform employees will allow a reduction in fares.

The fare on Detroit city lines was increased to 6 cents with nine tickets for 50 cents last June by an agreement between the company and the city. The city officials maintain that the increased revenue provided for by the increased fares was to be used to pay increases to motormen and conductors only. The company maintains that other employees were included.

According to the figures of the city's accountants who have audited the company's books in accordance with the agreement when the increased fare was granted, a surplus income had been accumulated up to the end of February, due to the increased fares, in excess of the amount required to pay increases to all employees.

Omaha Hearing Begun

Deficit Under Temporary Seven-Cent Operation—Valuation Figures Presented

The hearing on the application of the Omaha & Council Bluffs Street Railway, Omaha, Neb., for a permanent rate, before the State Railway Commission, was scheduled to begin in the Omaha City Council chamber on May 16. The company is not asking for any specific rate of fare, but demands a rate that will yield a reasonable return on its investment.

The commission issued a temporary rate order effective on Aug. 10, 1919, allowing the company to charge 7 cents for cash fares, with a four-for-a-quarter ticket privilege. In connection with that order the company was directed to file with the commission a physical valuation report. This has just been done.

A copy of this valuation report was handed to W. C. Lambert, corporation counsel, who will represent the city at the hearing. In this report the company sets up the following valuation figures: Reproduction cost new of physical property, based on a four-year average to 1919, \$17,316,833; on 1919 basis, \$19,671,741; allowing for depreciation, as of 1919, \$17,890,765. The following valuation totals include organization and legal expenses, interest and taxes and going value: Reproduction cost new on a four-year average, \$21,740,254; for 1919, \$25,126,177; allowing for depreciation, as of 1919, \$23,291,772.

The company's gross earnings from operations in 1920 were \$4,807,529. A deficit of \$81,586 is shown for that year. Interest on bonds paid last year, \$479,212; taxes, \$427,861; 6½ per cent dividends on preferred stock, \$250,000. No dividends were paid on the common stock during 1920. The report further shows a surplus of \$16,829, for 1919. The total number of passengers carried during 1919 was 70,151,302, and during 1920, 72,033,229. The property account shows 1,142 motors, 119 miles of main track and 2 miles of leased track.

Court Sustains Denial of Ten-Cent Fare

The Jersey Central Traction Company failed to comply with an order of the Board of Public Utility Commissioners that it provide "proper and safe" service for its patrons. This is the conclusion of Justice Kalisch in an opinion filed in the New Jersey Supreme Court on May 5 in which the court affirmed a decision of the Utility Commission denying an application for permission to establish a 10-cent fare. The company operates in Perth Amboy, South Amboy, Sayreville, Matawan, Keyport, Keansburg, Red Bank, Atlantic Highlands and other municipalities in Middlesex and Monmouth counties. In 1918 the company charged 5 cents in each fare zone, but war conditions prompted the Utility Commission to advance rates to 7 cents. A

further increase to 10 cents was sought in an application to the commission in April, 1920, but the company failed to comply with an order to improve service and the plea was denied. It then appealed to the courts. Justice Swayze in the lower court in sustaining the decision by the Utility Commission, said that the evidence showed the service to be insufficient, inadequate and unsafe.

Hearing on Fort Wayne Fares

At a hearing conducted by the Indiana Public Service Commission at Fort Wayne, on the request of the city of Fort Wayne that the Indiana Service Corporation be forced to reduce the price of city fares from 7 cents cash and four tickets for a quarter, it developed that the company's business is 20 per cent less than what it was last year at this time.

The city attorney claimed that more cars are now being operated than are necessary and that if the number of cars operated was reduced the fare could be decreased. The local federation of labor sent a letter to the commission asking that five tickets be sold for a quarter and that the cash fare be adjusted to 8, 9 or 10 cents or whatever figure was necessary to get the required revenue.

Previous to the hearing the company published a large advertisement in the local newspapers which read in part as follows:

The record of the operating expenses and revenues of the company which were checked by both the city and state accountants during investigations for the past four years, show that the following return was earned on the investment of the company: 1917, 1.38 per cent; 1918, 0.83 per cent; 1919, 2.92 per cent; 1920, 7.27 per cent; average for four years 3.3 per cent.

After taking away bond interest from the investors for almost three years and pouring it back into the property for new cars and track improvements, the company during 1920 was able to earn 7.27 per cent. But remember that a public utility company is not like the ordinary industrial corporation which has a chance to build up a surplus from revenues during prosperous times to carry it over the bad years.

This company has earned far less than a fair return for the past four years and even at the present time is not earning 8 per cent, which is the minimum cost of public utility money. Remember even city bonds are selling to yield 6 per cent.

The company believes that its patrons in Fort Wayne want real service first and that they are willing to pay the fair cost of this service. No one has contested the fact that the company is trying to give real service and pay decent wages.

The company is just as anxious to reduce fares as is the rest of the community to have it do so, but they know that fares cannot be reduced without materially curtailing the service. Fares were not raised as early as they should have been and the 5-cent fare and the six-for-a-quarter ticket was not a self-supporting fare at any time during the past ten or twelve years.

The company believes that a well maintained street railway giving real service is what the patrons want in Fort Wayne. You can have whatever kind of service you are willing to pay for.

The matter of equipment betterments was gone into extensively. Mr. Feustel stated that while it appeared that the company was doing a great deal of repair and construction work, in reality less was being done than was necessary to keep the plant and tracks in good repair and he stated that the increase of 70 per cent in the cost of construction made the figures look large.

Utility Commissions' Joint Attack on Wheeling Ruling

Formal attack on the decision of the Interstate Commerce Commission authorizing the Wheeling (W. Va.) Traction Company, operating an electric interurban railway in Ohio and West Virginia, to advance intrastate passenger fares in Ohio to its interstate level of rates was made on May 8 by the National Association of Railway & Utility Commissioners in a motion filed with the Interstate Commerce Commission asking a rehearing of the case and permission to intervene therein.

In the motion the National Association said in part:

The several state railroad and public utilities commissions, on behalf of which this motion is filed, are interested in this proceeding by reason of their desire to preserve their jurisdiction to serve the people of their states in the manner provided by their laws. If the order of the commission in this case shall stand, and if this commission shall exercise, or attempt to exercise, power to make like orders in other cases falling within the precedent thereby established, said commissions will be largely deprived of their jurisdiction over street railroads, or will be compelled to engage in a multiplicity of suits to defend the same.

The purpose of this motion is to secure a review by this commission of the order which has been made herein, and of the findings of fact and rulings of law upon which said order rests, to the end that said order may be set aside, and this proceeding disposed of without encroachment upon the regulatory jurisdiction and power of the State of Ohio, exercised through the commission and the municipalities of that state.

There is no disguise of the fact that this is a carrier proceeding, designed to bring about an increase of intrastate fares for the purpose of producing larger revenue for the Traction Company, regarded as an interstate carrier. The record was made upon the theory that rates which the commission deems unreasonably low may be found discriminatory against interstate commerce. The case was presented to the commission upon that theory, and decided on that theory. There is no evidence of discrimination of any other sort.

We maintain that this commission ought to rule that Congress has conferred upon it power of supervision over street railroad rates practically by stealth, without mention of the class of carriers over which such enlarged jurisdiction was to be created, and without mention of the purpose designed in any of the proceedings which attended the passage of the act held to effect such enlargement.

We point out that when the transportation act was under consideration the representatives of electric railroads stated that they did not wish to come under it. Nobody urged any extension of rate making power as to them. The commission requested only that if interurban railroads were to be affected by the act they be clearly defined.

The decision in the Wheeling case was reviewed in the *ELECTRIC RAILWAY JOURNAL* for April 23, page 789.

Private Suits Against Railway Are Halted

Until the United States Circuit Court of Appeals at Cincinnati settles the Louisville fare litigation private suits seeking to restrain the Louisville Railway from charging a 7-cent fare will be denied. Judge Evans has ruled that the city is the proper defendant and can protect the rights of all people interested in defense of this action. In a suit pending in the Quarterly Court Reuben Ruthenberg, attorney, seeks to sue for himself and others similarly situated to recover from the railway the entire amount paid by patrons in fares in excess of 5 cents since the in-

crease of 2 cents became effective. Should the final decision in the United States Court be unfavorable to the railway and Mr. Ruthenberg's motion be sustained in the Quarterly Court all those who are seeking to recover excess fare amounts will have to join in one petition. The company has been using rebate slips and the Federal Court will provide the method by which the rebates shall be made to the holders of slips so no action will be necessary in the state or county courts for a refund.

Commission Wants Cities to Indicate Desirable Jitney Routes

Suggestion that officials of cities prepare a schedule of routes desirable for jitney travel in preference to having individual jitney men make application for the right to traverse this or that route is made by the Public Utilities Commission of Connecticut through its secretary in a communication to the Manufacturers' Association of Bridgeport relative to the future status of the buses.

The communication indicates that Bridgeport will be permitted to solve its own jitney problem, and it will practically lie within the power of municipal authorities of Bridgeport to recommend what jitney service shall be continued in order to serve the people of the city. It is further indicated that New Haven officials may similarly recommend if they so desire.

The commission in this letter says that if the local authorities, who should be familiar with existing street railway service and local requirements, would lay out such routes it would materially assist the commission and have a tendency to simplify and systematize the whole situation; and further, that after establishment of routes, the individual application to operate over any such routes could be received and acted upon without involving the question of public convenience and necessity.

The letter says:

The law specifically requires that a public hearing be given on each application for a certificate to operate a jitney and that no such certificate be given without a finding of public convenience and necessity. The law is not specific, however, as to the hearing and finding on public convenience and necessity as to the particular route or manner of establishment other than the implication that such finding be determined in each individual case. In the absence of having established any positive mode of procedure the foregoing is submitted informally as a suggestion which at this time seems the most practical course to pursue as applicable to the city of Bridgeport and vicinity. In view of the large amount of work involved all over the State in this matter it is the desire of the commission to start proceedings as early as can be conveniently arranged. The commission is having prepared a form of application for certificate to operate a jitney and same will be ready in a few days.

The commission adds that it has no form for establishment or travel of routes but the same may be informal and submitted to the commission, specifying the routes and asking for a hearing and finding as to public convenience and necessity.

The jitneys were brought under the jurisdiction of the commission effective July 1 as to their convenience and necessity at the present session of the Legislature.

Transportation News Notes

Niagara Fare Advanced.—The International Railway, Buffalo, N. Y., under a joint tariff covering passenger traffic with the Niagara Gorge Railroad, effective on May 1, increased the Buffalo-Lewiston fare one way via the Falls 13 cents. The round-trip will be increased 11 cents. The Buffalo-Youngstown fare one way will be advanced 8 cents and round trip 5 cents.

Decrease in Passengers Carried.—Industrial depression and the unrestricted operation of jitneys until April are given as the reasons for the alarming decrease in traffic on the Youngstown (Ohio) Municipal Railway. In March, 1921, there was a falling off of 50,000 passengers over the previous month and about 500,000 over the corresponding month of a year ago.

Reduced Fare in Dubuque.—A reduced fare rate has recently been put into effect in Dubuque by the Dubuque (Ia.) Electric Company as part of a readjustment measure which included wage reductions. Instead of seven tickets for 50 cents formerly sold, eight tickets for 50 cents are now for sale, with the cash fare of 8 cents remaining unchanged. The increase in fares was made just a year ago.

Petitions for Seven-Cent Fare.—The Virginia Railway & Power Company, Richmond, Va., has petitioned the City Council for a 7-cent fare with the withdrawal of all labor tickets. The company is at present operating on an amended franchise fixing the fare at 6 cents. The franchise expires on Aug. 1. The petition asks that the existing franchise be amended so that the fare of 7 cents may be charged for twelve months.

Emergency Rate Asked.—The Duluth (Minn.) Street Railway has filed a petition with the State Railroad & Warehouse Commission for an emergency fare of 7 cents. The present rate is 5 cents. The increase will be asked for under a provision passed by the last state legislature which permits the commission to grant an emergency rate pending a valuation of the property. The company was unsuccessful in obtaining an increased rate from the city.

Petitions for Decrease.—The Muskogee (Okla.) Electric Traction Company recently petitioned the State Corporation Commission to put into effect a reduction of fares between points in the city of Muskogee and Hyde Park to 10 cents during the park season. The commission granted the request, stating that it was to the interest of both the public and the traction company to make the fare between these points as reasonable as possible during the summer months.

Fare Injunction Refused.—An injunction against the Cincinnati (Ohio) scale of fares has been refused the residents of Lockland and Wyoming by the Hamilton County Court of Appeals. This decision affirmed the lower court. Residents claimed that under a franchise to the Ohio Traction Company in 1900 the road agreed to carry passengers between those villages and the Zoo for 5 cents, and they sought to have that franchise kept in force. The higher and lower courts agreed that since the city owned the streets it has the right to fix the fares to be charged passengers using them for car rides.

Safety Campaign in Massachusetts.—Brigadier-General Leroy R. Sweetser, Commissioner of Labor and Industries of the Commonwealth of Massachusetts, has appointed two special safety committees, consisting of five well-known street railway men and five steam railroad men, to promote safety methods and reduce accidents among employees of the Massachusetts transportation system. The specific work laid out for these committees is to co-ordinate safety work among the various transportation agencies, adopt standard rules and regulations, and to publish bulletins for the guidance of the various properties. The street railway branch of this committee consists of H. B. Potter, Boston Elevated, chairman; G. W. Mitchell, Eastern Massachusetts Street Railway; H. R. Whitney, Springfield Street Railway; G. H. McFee, Boston & Worcester, and Chester P. Rexford of the Union Street Railway.

Receipts Barely Meet Costs in London.—In May, 1920, the Ontario Railway & Municipal Board took over the operation of the London (Ont.) Street Railway during a third strike of the employees for higher wages. The company sells nine limited and seven unlimited tickets for 25 cents under a franchise secured in 1895, and all efforts of the railway to have the fares increased to meet the present-day conditions have failed. A year ago the citizens voted down a proposed increase. Now Vice-Chairman A. B. Ingram, of the Ontario Railway & Municipal Board, announces that the receipts are barely sufficient to meet the costs of operation and the prospects for the ensuing year are rather dark. The employees have dropped their demands for more money, but the railway board finds it impossible with the existent fares to pay for the company's share of paving on streets traversed by its lines under the existing agreement with the city.

Eight Cents in Oneonta.—The Southern New York Power Corporation, operating in Oneonta, N. Y., has been authorized by the Public Service Commission, Second District, to charge for a year from April 20, and thereafter until changed by order of the commission, an 8-cent fare in place of the present 7-cent fare in the Oneonta urban zone, with seven tickets for 50 cents. Tickets need not be sold on cars if

placed on sale at the company's office and at least three other accessible places in Oneonta. The company asked for a 10-cent fare. In reviewing the evidence the commissioner says the company has made out a case showing the need of a 10-cent fare but the experience of the commission shows that the imposition of such a fare may result in a decreased patronage, which would offset any advantage in amount. Even with the highest fare suggested, he says, it is apparent it will not yield the company a fair return. The fare on the "owl" cars, however, is made 10 cents.

People Must Decide on Jitney or Railway.—The City Commission of Bay City, Mich., recently received a communication from the manager of the Saginaw-Bay City Railway operating in Bay City to the effect that either the jitney or the electric railway must go as both cannot survive. He declared that traffic in the city did not warrant two systems of transportation and the increasing jitney competition had rendered successful operation of the electric property practically impossible. Some conclusive evidence was submitted showing how far behind Bay City was in the matter of railway traffic and revenue compared with other cities of a similar class. During 1920 4,099,419 revenue passengers were carried as compared with 6,291,801 in Saginaw, 7,133,370 in Lansing and 7,265,884 in Jackson, though street car service and car-hours traveled were practically the same for Bay City as for other cities of the same class. The company operated at a loss of \$2,600 in January, \$6,800 in February and \$5,800 in March. The City Commissioners want the matter referred to the Public Service Commission.

Relief Sought for Railway.—Operation of jitneys in Houston, Tex., is costing the Houston Electric Company, which owns and operates the electric railway in that city, an average of \$20,000 a month, according to representations made by W. E. Wood, vice-president and general manager, before the board of city commissioners. If the heavy drain made by the jitneys on the company's revenue continues, Mr. Wood informed the City Commission, the traction company can not carry out the proposed improvement program calling for an expenditure of \$450,000. The records show that licenses for 200 jitneys have been issued and it is estimated that practically the entire number are now in operation. The City Commission has no authority to revoke licenses of jitney operators, but an ordinance is now being prepared giving the commission such authority, and its passage seems assured. It is probable that some action will be taken to afford some relief for the traction company. Jitney warfare has been going on now for some time in Houston. The situation became complicated several weeks back when the railway made the removal of its tracks from Main Street contingent on the abolishing of the jitney.

Personal Mention

Mr. Scott Advanced

Long Practical Experience in Hartford Well Fits Him to Manage That Connecticut Company Division

Nathaniel J. Scott has been appointed manager of the Hartford Division of the Connecticut Company to succeed the late Warren P. Bristol. Mr. Scott has been employed by the company in Hartford and vicinity for twenty-five years and for some time has been filling the position of assistant manager. In the appointment of Mr. Scott to this position is recognized the choice of an ex-



N. J. SCOTT

ecutive trained for the responsibility in the school of practical experience and first-hand contact with the problems of trolley management.

In the Connecticut Company's announcement of the appointment of Mr. Scott, it is indicated that the powers of local managers have been broadened, as was suggested recently in a special report to the Connecticut Public Utilities Commission. It says:

The managers of the various divisions of the Connecticut Company are charged with sole responsibility for the operation of their respective divisions, and are responsible for all matters pertaining to the service and upkeep of the property. They are expected to keep fully posted as to the particular needs of the various committees, and to see that in all matters the convenience of the public is assured. They have full authority to initiate such changes as in their opinion are best suited to meet the requirements of the communities which they serve.

Mr. Scott was born forty-four years ago in the Province of Quebec, Canada. His early education was acquired there and he was graduated from the Knowlton High School. Coming to Hartford shortly thereafter, he entered the employ of the Connecticut Company in July, 1896, and has been with it continuously since. He began as a conductor and spent some five years as a platform man. Later he became carhouse foreman and was successively made dis-

patcher and chief clerk to the manager, rising from that place to superintendent of transportation in which capacity he served for many years until his promotion came to the position of manager.

During this period of service Mr. Scott acquired a wealth of detailed knowledge of street railway conditions, particularly as they pertain to Hartford. His familiarity with the local problems of the company's system contributes in large measure to the qualifications which earned his promotion. He is held in high esteem by all his colleagues, and his long association with the Hartford office has contributed to the best of friendly relationships.

Pioneer Railroad Builder Retires

William Hood, chief engineer of the Southern Pacific Company and one of the greatest railroad engineers in the United States, retired on May 3, according to an official announcement made by President William Sproule of the Southern Pacific. George W. Doschke, formerly assistant chief engineer, has succeeded to the position. Mr. Hood left on the fifty-fourth anniversary of his first connection with the company.

Mr. Hood left the employ of the Southern Pacific Company at the age of seventy-five years, not because of failing health or because of his age, but because he desires to attack more difficult problems than are presented by the railroads in this stage of operation when no large extensions of roads are contemplated. He prefers to labor with the difficulties of new construction and development with its attendant out-of-door activities.

Ever since he went to work for the Central Pacific in 1867, Mr. Hood has been closely identified with the work of uniting the West by steel rails. In the development of the railway system with which he has been connected he has been called upon to solve the most difficult engineering problems, and some of the feats which he has accomplished will prove lasting memorials to his ability.

Mr. Hood was born in Concord, N. H., in 1846. As he was preparing for college at the age of sixteen the Civil War broke out, in which he saw service in some of the most sanguinary conflicts of the struggle. After being mustered out of service he entered Dartmouth College where he remained until 1867. Inspired by the efforts to construct a railroad through the Rockies he left college and came to Sacramento where he obtained employment with the Central Pacific. He soon became assistant engineer and in 1875 was made chief assistant engineer.

Mr. Hood has been chief engineer

of the Southern Pacific since 1885. He is intimately acquainted with every portion of the system which operates over more than 11,000 miles, having traveled on foot across almost every mile of the territory later spanned by the present tracks.

Mr. Hood has saved his company a vast amount of money in construction costs by exercising true engineering skill and evolving many clever expedients to solve knotty problems.

E. F. Eicks, Auditor of Fort Wayne-Lima Line

Edward F. Eicks, who some time ago was appointed auditor of the Fort Wayne, Van Wert & Lima Traction Company, Fort Wayne, Ind., has taken charge of the accounting work of that system. His duties are separate from those of L. W. Van Bibber, auditor of



E. F. EICKS

the Ohio Electric Railway system, which holds and operates the former property.

B. H. Jones is receiver of the Ohio Electric Railway system proper, while some of the other subsidiary companies have been placed under separate receivers. Such is the case of the Fort Wayne, Van Wert & Lima Traction Company, of which H. C. Paul is the receiver. It was his intention, under the general plan of receivership for the whole system, to segregate the accounts of the Fort Wayne line for operating purposes. New offices have been established at Ewing and Pearl Streets, Fort Wayne, in the building owned by the Indiana Public Service Corporation. Mr. Eicks has been placed in charge of these offices.

The receivership of the Ohio interurban system, one of the largest in the world, with its 467 miles of interurban lines and 33 miles of city lines, came several months ago as the result of a succession of unpreventable and unfortunate occurrences. The combination of high war-time costs, preceded by a tremendous property loss by flood in 1919 and followed by an ever-increasing loss of traffic from automobile competition, has precluded the possibility of meeting operating costs alone, to say

nothing of allowing a return to its investors.

The latest report, under the separate management, of the interurban connecting Fort Wayne and Lima, shows an operating surplus of about \$600 for the period from Jan. 26 to Feb. 28, 1921. The statement also indicates that substantial gains in earnings are being made by the other properties included in the Ohio Electric Railway receivership.

Practically all Mr. Eicks' training and experience have been along the line of cost finding and accounting, though more in connection with commercial affairs than with railways or utilities. He has handled this sort of work for branch houses of various firms for the past several years. Previous to his present appointment he was accountant for the Sherman-White Company, wholesale dealers in poultry products and owners of a large cold storage house. Mr. Eicks was a lieutenant in the 33rd Division during the war.

J. A. MacAdams has accepted the position of general manager of the Claremont (N. H.) Railway, succeeding A. C. Ralph, deceased.

J. R. Tozer, for four years power engineer of the Rutland Railway, Light & Power Company, Rutland, Vt., has resigned to accept the managership of the municipal plant at Swanton, Vt.

L. Edward Herrmann, Jersey City, general counsel for the New Jersey Board of Public Utility Commissioners, and Alfred N. Barber, secretary of the body, have been reappointed to their respective positions.

William B. Malone, the general manager for the past year of the Meridian Light & Railway Company, has left Meridian for Salina, Kan., where he will be the general manager of the Salina Light, Power & Gas Company. Mr. Malone has been succeeded as general manager by H. C. Bonner, formerly general manager of the Alliance Gas & Power Company, Alliance, Ohio.

W. O. Clure, general passenger agent for the Twin City Lines, Minneapolis, Minn., returned to his office on May 16 after an absence of several months, the result of injuries from a fall into the company's headquarters building passenger elevator shaft. The accident occurred on Labor Day. Mr. Clure has been making occasional visits to the offices for some time with the aid of crutches.

W. H. Coleman, of the Montgomery Light & Traction Company, Montgomery, Ala., succeeded on April 1 E. W. Ashmead as manager of the street car lines of the Alabama Power Company in Gadsden, Ala. Mr. Ashmead has been promoted to the commercial department of the Alabama Power Company at Birmingham. Mr. Coleman is a practical street railway man, having served mostly in the operating department of the system in Montgomery, where he has had long and varied experience in the business.

Mr. Feiker in Washington

Hoover Selects McGraw-Hill Executive as Assistant to Develop Aids to Business

F. M. Feiker, vice-president of the McGraw-Hill Company and chairman of that company's editorial board, has been appointed assistant to the Secretary of Commerce. An indefinite leave of absence from the McGraw-Hill Company has been granted to Mr. Feiker, so that in accepting the appointment he will lose only temporarily his active connection as an official of the company.

Briefly Mr. Hoover has divided the bureaus of the Department of Commerce into two parts. Assistant Secretary Huston will supervise the bureaus relating to navigation and fisheries, while Mr. Hoover will give his personal attention to the Bureaus of Foreign and Domestic Commerce, Standards and



F. M. FEIKER

Census. Mr. Feiker will directly assist Mr. Hoover in the expansion of these bureaus as aids to business.

The immediate problem is to find out by means of a series of conferences with the representative men of industry what kind of facts and figures industry needs from the Government. Having organized the department to function according to requirements, the next problem is to devise an adequate system of clearing the collected data back to business. It will be apparent at once that with Mr. Feiker's background of engineering training, viewpoint on the needs of industry and sense of publicity, he will be in a position to render unusual service in the furtherance of Mr. Hoover's plans. It is Mr. Hoover's purpose to develop the Department of Commerce so that it will have the same relation to business that the Department of Agriculture now has to farming. In other words, he feels that its function is to aid industry, not to regulate or control it. Considering his intimate knowledge of foreign conditions,

his masterful grasp of economic principles, and his present official position, important results should follow.

Mr. Feiker, an electrical engineer by profession, has been especially interested in aiding Mr. Hoover in the development of his plan for the elimination of waste in industry which was undertaken by the Federated American Engineering Societies at Mr. Hoover's suggestion. Mr. Feiker is a graduate of the Worcester Polytechnic Institute, class of 1904, and for several years was chairman of the editorial board of the A. W. Shaw publications of Chicago. In 1915 he succeeded Dr. A. S. McAllister as editor of *Electrical World* and in 1919 he was appointed editorial director of all the McGraw-Hill publications. Mr. Feiker has served on a number of important committees of the National Electric Light Association and in 1920 was president of the Editorial Conference of the New York Business Publishers' Association.

John E. Zimmerman, Day & Zimmerman, Philadelphia, Pa., has been elected president of the Washington-Virginia Railway, to succeed the late Howard S. Graham. Thomas Roosevelt, also of Day & Zimmerman, has been elected vice-president, succeeding R. Golden Donaldson, who resigned, but will remain as a director and member of the executive committee.

Francis H. Miller, vice-president and superintendent of maintenance of the Louisville (Ky.) Railway, was elected president of the Louisville Rotary Club at the annual meeting of the newly elected board of directors of the organization. Mr. Miller was elected from the board of directors, which elects the president and vice-president, while the other officers are elected by the general membership.

Paul A. Lazenby, who was recently elected engineer of the newly-organized Toronto Transportation Commission, gained considerable of his experience in transportation work in the United States. He is a graduate of the civil engineering course at Massachusetts Institute of Technology in the class of 1904. Mr. Lazenby spent four years in general engineering and construction work with the Chicago, Burlington & Quincy Railroad, Deadwood, S. D. After considerable experience with other roads, in 1911 he accepted a position as associate engineer with the Chicago Plan Commission and was engaged in the preparation of a city plan and in transportation studies for that commission until 1915, when he resigned to become principal assistant engineer for the Civic Transportation Committee, Toronto, which was the forerunner of the present Transportation Commission. While with the Chicago commission Mr. Lazenby assisted in the engineering work in connection with the new Pennsylvania terminal on the west side of the city. He was also associate engineer in the preparation of city plans for Brooklyn, Minneapolis and Detroit.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER,

SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES

BUSINESS ANNOUNCEMENTS

Easy Deliveries Feature Rope and Cord Market

Operating Companies Not Accumulating Stocks and Buying Has Not Increased—Raw Cotton Quoted Higher

A 10 per cent decrease in the prices of trolley rope and bell cord made last month with a view toward stimulating sales has so far had little effect on the market. Operating companies are not accumulating any large stocks of this material under present conditions of prompt delivery, and until present stocks are lowered considerably it seems unlikely that buying will set in on any accelerated scale. Leading manufacturers in the east report both inquiries and sales as below normal, showing practically no change from the recent small volume of transactions. Collections are slow on sales actually made, but that is not unexpected under existing world trade conditions. Spot cotton in New York shows a slight advance to 13.05 cents since last report.

Some divergence exists among manufacturers in the matter of factory stocks and deliveries. Under present conditions of restricted buying and slow payments some refuse to maintain stocks at their plants, agreeing to make as prompt deliveries as possible on orders received. Others report fairly plentiful stocks and immediate shipments on orders. Factories are operating below their capacity, although one establishment is running about six days a week, turning out electric railway and other material.

Prompt Shipments of Safety Tread Material

Some Manufacturers Report Very Little Railroad Buying, but Others Find Demand Is Increasing Satisfactorily

Uneven conditions as regards buying are reported in the market for safety floor and step treads by manufacturers. On the one hand it is reported that very few orders are being received from either steam or electric railways just now. Some manufacturers, however, state that though sales are still below normal, they are increasing satisfactorily, and at least one producer is finding the railway market for safety tread material more active at present than at any time in the past. Large orders have been received from the Pacific Coast, it is stated, and inquiries indicating a future demand are coming from the Middle West, but the market in the East remains quiet.

Raw material stocks are reported to

be large, some manufacturers carrying a heavier stock at present than at any previous period. Consequently, though it is a general policy not to stock the finished product, inasmuch as each order is made to specification, orders can be filled very quickly. In general factories are able to make up material in from one to two weeks' time. Production is naturally curtailed under present market conditions, operation as low as 50 per cent of capacity being reported.

Where labor readjustments have been made in this field, prices have been reduced about 15 per cent from the peak, but in instances where war-time wages are still maintained the slightly lower

price of raw material has not yet afforded sufficient margin to warrant reducing prices. Labor cost, it is stated, is a large element in the manufacture of safety tread material, and, furthermore, the large stocks of raw material that are on hand may very possibly be a factor in the price situation.

The railroad business in this market is of course by no means the most important sales outlet, the general outlook for business depending largely upon the building construction industry. Mail inquiries and reports received from field agents, however, are said to indicate a volume of demand later on that will absorb full capacity production.

Railway Motor Production at About Thirty per Cent Capacity

Stock Delivery of Safety Car Type—Car Builders Working Off Last Year's Supply—Present Market Far Below Normal, but Producers Remain Optimistic

Sales of railway motors show considerable falling off this spring compared with last year, producers report. Buying of this class of material has been sub-normal for several years past but the present market seems especially below par. An estimate that demand this year is running about 50 per cent below normal and about 25 per cent below last year has been regarded as conservative to say the least.

Once the war had an opportunity to exert its influence in the raising of prices, sales of railway motors fell off badly. Increased cost of operation and decreased earning power of the railways kept purchases down although the advent of the safety car afforded some relief. This was reflected in sales last year which for one of the large producers increased to about three-fourths of the average yearly total of motors billed during the four-year period previous to the war. More than half of the year's bookings in this instance were made during the first three months of last year, and in comparison with this the first quarter of 1921 saw only one-seventh the same number of motors sold. Furthermore, whereas in the first quarter of 1920 nearly half the motors sold were for safety cars, in the same period this year only about 5 per cent of the total were of this type.

This would seem to indicate a decided slump in the safety car demand, but other information received is to the effect that sales of safety car equipments are still exceeding those of larger types. The reason for the apparent slump in safety car motor sales noted above is probably because vir-

tually all car builders stocked up heavily in 1920 and are still trying to work off stocks of motors which were left on their hands. Motor manufacturers were forced to carry considerable stocks of safety car motors over into this year too, because at this time a year ago factories were running behind and production was increased accordingly. Production is now down to a level commensurate with the market and ranges from 25 per cent of capacity to 30 or 40 per cent.

Stock shipments of safety car motors are being made and reasonable shipments on those of larger capacity. Standard 40, 50 and 65-hp. sizes would probably range about 60 days. Stocks are being reduced and inasmuch as it seems to be the intention not to increase production before the last quarter, it is quite probable that all motor stocks will be considerably depleted within the next few months. Prices have come down from the peak, of course, the reduction in a representative instance amounting to 10 per cent during the past few weeks. Unless there are further decreases in labor and material cost no further price reductions are foreseen, especially while the necessarily curtailed production entails a high overhead.

The outlook for business, producers report, while not good in the immediate future, is such as to induce an optimistic view of the situation. Notwithstanding business depression, it is stated, the market looks promising due to labor reductions and increased revenue over last year on electric railways, and an easier money market. Almost

every line in the country badly needs equipment and the view is expressed that railways can not hold off purchasing much longer. Consequently, a slow but gradual increase in business each month is expected.

Rush Orders Feeling Pinch of Deliveries

Policy of Manufacturers in Not Stocking Delays Delivery of Material Needed in Detroit

In connection with the tremendous construction program which is under way in Detroit, Mich., where the city is building an extensive municipal railway system, it has been found difficult to obtain shipments of material promptly enough to meet requirements. On the surface this appears to be a unique situation under prevailing conditions of light buying and prompt railroad deliveries, but it may possibly be a more general condition than is imagined. Reasonably good deliveries can be secured on orders placed normally for future use, it is stated, but where anything is wanted in a hurry it is almost impossible to secure it. As is always the case in any large construction program, there is frequently need for various equipment and material on short notice. Almost without exception, the municipal railway officials report, it has been impossible to find any manufacturer with a stock of the thing wanted on hand.

This is quite evidently an outcome of the declining price situation, for with inventories constantly diminishing, manufacturers are keeping their stocks just as low as possible to avoid loss. The purchaser at this time is then confronted with the necessity to await the manufacture of anything he wants. This is also a reflection of the refusal of railway companies to buy beyond their immediate and pressing requirements, in the expectation that prices will decline. Hence, if railway companies are unwilling to take any chance on a diminishing inventory of stocks on hand in their own storerooms, can they be surprised that the manufacturers should refuse to carry stocks and run this risk in order to meet hurry-up orders of their consumers?

Refractories Lower in Price

Output Greatly Reduced with Demand, but Stocks Are Good at the Mills

Recent price reductions in the refractory market brought Pennsylvania fire-clay brick down \$2 per 1,000, while in the middle of April magnesite brick was reduced \$10 per net ton in standard sizes, silica brick came down \$5 per ton, \$5 per net ton was applied to chrome brick and from \$2 to \$5 to fire-clay brick.

The demand for refractories is at a low ebb. Production, consequently, is in the neighborhood of 25 per cent, some of the larger producers working at a slightly higher rate, while among

the smaller producers some shutdowns have been reported. Stocks, however, are in sufficient quantity to last over three or four weeks of normal demand, but at the same time steel mills still have some materials on hand. The steel and glass trades provide the strongest market for refractories, but these two industries are operating at about 40 per cent and 25 per cent rates respectively at present. Fire brick for power boilers provide not only a construction market but also a repair and maintenance market.

Easier Prices Noted on Some Miscellaneous Supplies

With rubber-covered wire selling from jobbers' stocks at prices ranging from \$6.75 and \$6.50 to around \$7.50 per 1,000 ft. in 10,000-ft. lots, depending on the part of the country concerned, it might be expected that other wiring materials could be picked up at considerably lower prices than was the case a couple of months ago. Flexible armored conductor is on a \$55 Pittsburgh base price but some jobbers are selling it for this amount in 1,000-ft. lots. Connectors for this conductor were just lowered 12 to 22 per cent.

Some renewable fuse manufacturers just dropped their prices about 17 per cent and at least one maker of fuse wire and fuse links has taken 20 per cent off his prices. From other quarters comes word of a 10 to 17 per cent drop in price of steel switch boxes and in floor boxes.

Westinghouse's Annual Report Shows Favorable Balance

Billings of the Westinghouse Electric & Manufacturing Company for the fiscal year ended March 31, 1921, from the company's annual report just issued, amounted to \$150,980,106.39. The net manufacturing profit on the year's business was \$12,206,021, even after taking out \$5,315,196 for depreciation and adjustment of inventories. An appropriation for a special contingent reserve of \$5,000,000 has also been made from surplus to provide for further possible shrinkages and adjustments in the inventories. Total surplus on March 31, 1921, amounted to \$56,053,299 after adding a net income for the year of \$12,617,535.

Property and plant account shows an increase over the previous year of \$9,361,403 and embraces construction completed during the year. An important extension was made to the works at Lester, Pa., where the manufacture of steam turbines, condensers and marine propulsion apparatus is now concentrated, making available additional manufacturing space at East Pittsburgh for electrical apparatus. An additional lamp factory was erected during the year at Indianapolis, Ind., and extensions were made to the plants at Milwaukee, Bloomfield, Bridgeport, Mansfield and East Springfield, Mass. Developments and investments were

made in the wireless field and other high-frequency current fields.

Accounts receivable amounted to \$34,551,599, while inventories embrace \$80,724,389. Total capital stock is \$74,812,650.

Electric Railways Place Large Rail Orders

That there is some activity in the field of track construction work this spring, despite general dullness in the business situation, is evidenced by two sizable orders for rails and kindred material recently placed by electric railways. The city of Detroit, Mich., Department of Street Railways has placed an order for rails divided into lots of 900, 200 and 100 tons of different sizes, totaling about \$80,000; 10,000 tons of another type of rail at a cost of nearly \$600,000; special track-work totaling about \$100,000, and double-track specials amounting to nearly \$25,000, or a grand total of almost \$800,000.

The United Railways of St. Louis has placed an order for 5,000 tons of rails for the reconstruction of 32 miles of track during this year. Spikes, bolts and tie plates are also being ordered. The track construction is to cost about \$1,485,000.

Rolling Stock

British Columbia Electric Railway Company, Ltd., Vancouver, B. C., Canada, will change over all its passenger cars with the exception of seventy-one interurbans, to conform to the new rule of the road which is being changed from left to right on or about Dec. 1. The interurban cars are standard but the platforms of the company's 319 city passenger cars will have to be reconstructed. The problem is increased by the fact that out of 231 cars operated in Vancouver, only forty-four are double-end. At least six months will be required to fit up the company's shops for taking care of this work.

Track and Roadway

British Columbia Electric Railway, Vancouver, Can.—Arrangements have been practically completed for changing the rule of the road from left to right in the lower portion of British Columbia on or about Dec. 1 next. Delay was occasioned until the government and the British Columbia Electric Railway could agree to terms on the defraying of the cost of changing the railway system. The government will pay \$350,000 toward the cost which is estimated to be \$800,000 for the change alone while the company will make other expenditures not essential to the change, bringing the total sum up to about \$1,000,000. The change will probably take place in Vancouver and on the rest of the mainland system and later in Victoria, which is on Vancouver

Island. The changing of cross-overs, electric switches and points in the track is involved. On interurban lines changes will be necessary in cross-overs and stations.

Sterling, Dixon & Eastern Electric Railway, Sterling, Ill.—The Sterling, Dixon & Eastern Electric Railway plans to reconstruct its car lines in Sterling, at an estimated cost of \$35,000.

Boston (Mass.) Elevated Railway.—The Boston Elevated Railway has recently placed an order for signal material which will be required for the installation of 68 automatic blocks in double-track sections on the main line in the Charlestown and Roxbury districts. The signals will be the style N, three-indication color-light type and of the same design as installed by the Boston Elevated at Sullivan Square interlocking and on the Everett extension in 1917. Model 15, two-element vane-type track relays will be used throughout. Electro-pneumatic automatic stops will be installed at each automatic signal. A new interlocking is to be installed at Tower D in connection with these improvements. This will be of the A. C. electro-pneumatic type governed by a seven-lever Model 14 power interlocking machine, controlling in addition to the switches, two 2-arm high and three dwarf signals, all of the style N color-light type. Extensive changes are also to be made at the large Tower C interlocking at North Station. These changes involve the installation of 14 two-arm and 10 one-arm style N color-light signals, as well as 15 automatic train stop layouts and 26 A. C. track circuits for the semi-automatic control of signals, detector locks and sectional route locking. All the track circuits will be operated with Model 15 two-element vane type track relays and the same type of instrument will be used for the line circuits. All materials are being furnished by the Union Switch & Signal Company, Swissvale, Pa.

Dallas (Tex.) Railway.—Service has been put into effect on the Lake Avenue extension out Fairmount Avenue to the City Hospital by the Dallas Railway. This is one of the extensions to which the traction company was committed under the terms of the franchise granted the Strickland-Hobson interests in 1917.

Tulsa (Okla.) Street Railway.—The Tulsa Street Railway Co. announces that it will soon begin the work of double-tracking its South Main Street line. Plans are also being prepared for double tracks on other lines and other extensions.

Power Houses, Shops and Buildings

Knoxville Railway & Light Company, Knoxville, Tenn.—The Knoxville Railway & Light Company will install a new substation at Washington and Sixth Avenues.

Professional Note

Parsons, Klapp, Brinckerhoff & Douglas, engineers, announce the removal of their Cleveland, Ohio, office to 743 Hanna Building.

The George H. Gibson Company, New York City, consulting engineers, specializing in commercial research and advertising of technical products, announces the removal of its offices from the Tribune Building to the Hide and Leather Building, 100 Gold Street.

Trade Notes

The Monitor Controller Company, Baltimore, has established a Cleveland office at 420 Permanent Building, in charge of Robert Notvest.

The Lunkenheimer Company, Cincinnati, Ohio, announces the removal of its Chicago branch from 188 North Dearborn Street to 568 West Washington Boulevard.

The Arrow Electric Company, Hartford, Conn., announces that its New York sales office has been removed from 253 Broadway to the Borden Building, 350 Madison Avenue.

C. C. Bradford has been appointed assistant secretary of the Ohio Brass Company, Mansfield, Ohio. Mr. Bradford was at one time sales manager of the United States Light & Heat Company.

The Star Porcelain Company, Muirhead Avenue, Trenton, N. J., manufacturer of electrical porcelain products, contemplates the erection of an addition, 30 ft. x 100 ft., two stories, to its plant.

E. Gindre, president and general manager of Le Carbone of Paris, France, is in the United States for an extended period for the purpose of investigating the prospects in the carbon and carbon-brush business incidental to the possibility of expanding his service in the United States.

Triangle Conduit Company, Inc., Brooklyn, N. Y., on May 5 opened a factory at 1965 West Pershing Road, Chicago, for the manufacture of armored conductors, armored lamp cord and flexible steel conduit. Stocks of these materials will be carried here in addition to stocks of non-metallic flexible conduit, "tri-cord," etc., made in the Brooklyn factory.

Economy Electric Devices Company, Chicago, Ill., has received an order for sixty-eight power-saving railway meters from the American Railways Company, Philadelphia, for use on its Chester Division. These meters will be equipped with car inspection dials to announce intervals between inspections, according to the energy consumption.

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, announces that it is now represented in Pittsburgh by D. C. Paul, formerly with the Gaul, Deer & Shearer Company, Philadelphia. The Pittsburgh office is

at 303 Penn Avenue, where there is also a completely equipped service station with a factory-trained service man in charge. This branch, of which Mr. Paul is manager, includes western New York, western Pennsylvania and the northern part of West Virginia.

John J. Swan has become associated with the Engineering Business Exchange, New York City, engaged in the purchase and sale of engineering and technical business properties. Mr. Swan graduated from Cornell in 1897. He was for a time one of the editors of *Engineering News* and has held engineering and executive positions with the Ingersoll-Rand Company, Chicago Pneumatic Tool Company, Longmead Iron Company, Keller Mfg. Company and others.

The Grindle Fuel Equipment Company, 1901 South Rockwell Street, Chicago, is offering, subject to prior sale, the unsold portion of \$500,000 in 7 per cent cumulative and participating preferred stock at a par value of \$50 a share, together with a bonus of one share of common stock. The proceeds of this sale will be used for additional working capital and for the construction and equipment of a new two-story factory building and a one-story foundry building. The plant will be used for manufacturing and demonstrating coal-handling machinery and equipment and coal-pulverizing equipment, in addition to gray-iron castings for the market.

New Advertising Literature

Fuses.—The Chase-Shawmut Company, Newburyport, Mass., has recently issued bulletin No. 201, describing and giving prices on the full line of material which it manufactures.

Controller.—Bulletin No. 44678A, just issued by the General Electric Company, superseding No. 44678, describes the company's various kinds of drum type controllers for railway service.

Jacks.—The Duff Manufacturing Company is distributing a new bulletin, No. 308, which illustrates and describes its line of automatic lowering jacks especially suitable for use in car repair shops, bridge work and for emergency service.

Engineering Catalog.—The seventh annual edition of "Sweet's Engineering Catalog" has been published by Sweet's Catalogue Service, Inc., New York City, listing in its 1,251 pages "materials, equipment and supplies relating to practical construction, equipment and maintenance of all projects of an industrial or engineering nature."

Tools, Etc.—Ingersoll-Rand Company, 11 Broadway, New York City, has just issued a large new loose-leaf catalog covering its entire line of various track tools, pumps, compressors, condensers, oil and steam engines, etc. A special section is devoted to engineering data covering problems which are frequently encountered in every-day compressed air practice.