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CONTENTS.

STOCK FOR EMPLOYEES

The announcement of a plan under which the employees of the Public Service Corporation of New Jersey may purchase the company's stock by instalment payments is particularly interesting because it represents a further expansion of a policy already embodied by this company in the most comprehensive welfare system thus far established by any public utility. By arranging through a trust company for the purchase of the stock in instalments of $1.50 monthly and for carrying the amounts owing at 5 per cent interest, the corporation has at once made it possible and provided an incentive for every employee to save something, however little; to make a good investment of this saving, and to become a sharer in the profits of the organization of which he is a part. That the welfare committee of the corporation is made the final arbiter in all matters concerning stock purchases, and that preference is to be given to small subscriptions, indicates the spirit in which the plan is to be put into operation. Other details of this plan, as outlined in our last issue, recommend it as an admirable means of making employees profit sharers, while at the same time avoiding the drawbacks and complications of profit-sharing schemes.

THE VALUE OF VALUATION

Our steam railway brethren, interstate electric roads, telephone, telegraph and express properties are to be valued. The valuation law signed by President Taft instructs the Interstate Commerce Commission to ascertain the original cost to date, cost of reproduction new, cost of reproduction less depreciation, and "all other elements of value." This is a large order, and it is more than likely that the radicals who have demanded this valuation, undertaking to prove that the railroads are over-capitalized, will, after it is all over, be greatly disappointed with the results. The undertaking will cost a lot of money and nobody will be much better off when it is finished. An appropriation of $500,000 was to be made to start the work, but this was lost in the shuffle at the end of the session. Before the valuation is completed, a tentative schedule prepared by the commission, accepted or disputed by the carriers, and in the latter event taken into the courts, as provided for in the bill, an army of men will have put in several years' work, and it is estimated that something like $6,000,000 will have been expended by the government and the carriers. The results will not justify this expenditure of time and money, but let us hope that the mania for valuation will have been satisfied.

THE MAINTENANCE ISSUE

The annual maintenance issue of the ELECTRIC RAILWAY JOURNAL appears this year almost a month earlier than has previously been the case. It is believed, however, that this change in date corresponds more closely to the season when plans for maintenance and new construction are most active. For geographical scope the present issue is striking, its contributions ranging from Hamburg to San Francisco. What is of more practical interest to the reader, however, is the fact that the articles taken together relate to car and way maintenance on every one of the great divisions of electric railroading, namely, the electrified steam line as represented by the Pennsylvania Railroad; the high-speed interurban line, by the Michigan United Traction Company; urban and suburban rapid transit, by the Hamburg Elevated & Underground

System, and city transit, by San Francisco, Brooklyn, Norfolk and Milwaukee. The Pennsylvania article will be of particular interest to those steam railroad men who will soon be called upon to operate electrical equipment. The Brooklyn article is devoted particularly to electrical practice in car maintenance and shows what can be done to bring old motors and control up to the standards of efficiency and reliability set by later designs. The maintenance of cars for various classes of service or the structures for housing them are described in all of the longer articles except that on San Francisco, which is devoted exclusively to way department matters. The article on the Norfolk maintenance buildings is of exceptional interest because of the authors' clear demonstration of the factors which must be considered in the scientific design of railway buildings and their analysis of the costs of methods and materials. In addition, shorter articles appear on the manufacture of concrete poles and on feeding overhead lines at street intersections.

THE NEED FOR TESTING APPARATUS

No maker of machinery who values his good name would ship his product to the customer before it had been tried out in the shop. Even when it is impracticable to assemble the machinery at home the same end is attained by having it put together and started on the buyer's premises by one of the manufacturer's experts. Such preliminary tests are particularly desirable in electrical equipment, for it is not easy to detect visually such mischief breeders as crossed wires, loose binding posts, punctured insulation and undersized conductors.

The mechanical substitution of a new part for an old one is not a proper repair until the work is supplemented by a test which proves that the new assemblage of parts, like Kipling's ship, has found itself. This thought is suggested by the practices of those companies which believe that the only necessary test requirement is to wait until the repaired equipment is returned to the car for regular service. This is hardly the best policy, for the cost of one service breakdown with its inevitable derangement of schedules and dissatisfaction of patrons more than offsets the price of a modest testing outfit. Even if trouble is detected by a short run near the shops, the labor and time spent putting in and taking out defective motors and the like have been wasted.

It would be well if more companies were to follow in this respect the practice of the Brooklyn Rapid Transit Company, as described elsewhere in this issue. The field-testing and breaker calibration outfits are more or less orthodox, but the armature apparatus is somewhat unusual in that it is designed to subject the armatures on a stand to the same currents that they would have to carry on the cars. Still more unusual are the jumper line tests, which prevent abraded wires from returning to service, and the checking of heater coils to eliminate confusion in assemblage and waste in electrical energy. The Brooklyn company has other and more comprehensive testing equipments, but only these have been named because their use is within the means of many companies of moderate size.

Much spare material was used in manufacturing all of these equipments. In some of them only the meter constituted a cost item of any importance. The heater-testing equipment cost but $20 and the jumper outfit $30. Where few cars are handled the mountings could readily be arranged to use the same millivolt meter and ammeter with different sets. It should also be noted that these small but important tests do not require the services of expert electricians.

THE SIDE-ROD TYPE OF LOCOMOTIVE

Much written comment has been published on the shortcomings of the side-rod type of electric locomotive owing to the supposed difficulty in maintaining the jack-shaft bearings, but it is evident from the present experience of the Pennsylvania Railroad, as outlined elsewhere in this issue, that the objections have been much exaggerated. It is obvious that when this type of engine was first brought out not only the repair men but the mechanical officials could not have understood without experience what points were likely to cause trouble. Prominent among these was the vital necessity of keeping the lost motion out of the jack-shaft bearings, where it was found that a wear of 1/16 in. was enough to cause a damaging pound.

Now that the necessary experience has been gained with these engines, all of the former troubles have disappeared, and it is quite possible that the same statement will apply to the various types of jack-shaft locomotives in Europe, in which similar difficulties have been reported. There remains, however, much to be done in the line of refinement in design. It is, in fact, admitted that the arrangement of jack-shaft bearing now used on the locomotive is still in process of development. Even now a new design is in the course of preparation which, if it proves satisfactory in practice, will be made standard.

Prominent among the requirements are some means for vertical adjustment of the bearing and a general increase in flexibility. With the present arrangement no opportunity exists for correcting slight mistakes in the location of the housing, in the length of the motor rods or in the finished size of the brass itself, and any one of these errors will cause binding and heating.

For the same reason it is essential not only to cool running but also to smooth running for all cranks to be exactly in quarter. It is not possible, as is the case with the steam locomotive, to have one side of the engine slightly in advance of the other, for both sides are connected with close-fitting bushed rods at three points, the motor shaft, the jack shaft and the axle on the first pair of drivers. The operation of quartering with this type of engine is something which cannot be trusted to the ordinary methods of steam locomotive machinists.

Another opportunity for improvement exists in the means used for lubricating the jack-shaft journal. The problem is complicated by the fact that practically all of the wear on the brass occurs at the bottom, yet if the customary oil cellar and saturated waste are to be used, the brass has to be cut away at this point to let the waste touch the journal. It is also necessary to provide some means for reaching into the cellar to pack the waste properly. Owing to the fact that the cellar in this case is subject to the enormous thrusts from the cranks of the 2000-hp motor, it is evident

that a design which combines accessibility to the lubricant with sufficient strength is a problem of some magnitude.

It is perhaps unfortunate that the novelty of the design directed so much attention to the Pennsylvania locomotives before experience had provided a satisfactory solution of the problems surrounding their operation, for the early difficulties subjected them to a great deal of entirely unmerited criticism, notwithstanding the advantages which the type offers in the shape of a high center of gravity, reasonable cost and extreme simplicity.

THE SCOPE OF SCIENTIFIC MANAGEMENT

The discussion upon the report of the sub-committee appointed by the American Society of Mechanical Engineers to investigate the present state of the art of industrial, or "scientific," management, which is abstracted in the current issue of the journal of the society, is probably the most enlightening piece of literature that has yet been published upon that widely discussed subject. Primarily the printed discussion establishes most clearly the wide divergence in the opinions and aims of the different schools which have developed among those who are popularly termed efficiency engineers. Pointed objection was taken in some instances to the implied tendency of the sub-committee to consider that the field of scientific management was covered when the efforts of the individual workman were directed in such minute detail as to produce the maximum possible output consistent with his physical well-being.

The series of objections to this limitation of the art may be somewhat surprising as they controvert what is probably the popular impression. For the layman scientific management and the Taylor system are often synonymous terms. Indeed, to many minds the term "efficiency engineer" brings, unfortunately, a picture of labor difficulties, upheavals in organization and even sweeping changes in personnel.

One of the contributors to the discussion points out that to be reasonably complete the science of management must cover not only the direction of the operation of a plant but also the direction of the planning and construction of the plant itself, together with the direction of the purchase of supplies and the direction of the marketing of the product. The issue appears to be well taken. It is difficult for the uninitiated to avoid the conclusion that those engineers who have devoted their entire energy to methods of increasing the individual output through exhaustive time studies, elaborate instruction cards and special methods of remunerating labor have picked out the hardest part of the whole problem as well as the one which is least susceptible to satisfactory solution. There is, in fact, hardly a plant in the country in which any experienced visitor cannot with good reason find something to criticise, not because the "pace" is too slow, but on account of inefficient, improperly placed tools and badly arranged buildings. It is not even extraordinary to find the most obvious errors in the "direction of the planning of the plant" in shops where herculean efforts are being devoted to the establishment of wage systems involving the utmost degree of refinement and of complexity. One case in point is an electric railway repair shop where the existence of a somewhat spectacular but reasonably successful premium plan for wage payments was found by a disinterested outsider to have distracted attention from the fact that the small capacity of the wheel press necessitated removing wheels and gears separately and thus involved extra hands and many cracked wheel hubs.

It cannot be denied that vast opportunities for economy exist in increased outputs. The "classic case of Schmidt," one of the first subjects of motion study, who was enabled to handle a really incredible weight of pig iron every day by working in exact accordance with a minutely detailed program covering his every movement as well as his resting periods, is a magnificent example of efficiency as well as of human, or inhuman, tractability. Yet it has never been clear to many people why Schmidt and his co-workers should not have been replaced, as is mentioned in the discussion, by a locomotive crane with a lifting magnet on the boom.

As Tracy Lyon, another contributor, expresses it: "If tools are put in the best operative condition and are so arranged as to minimize the movement of material, if provision is made for material in definite and sufficient quantities, if small tools and other necessities are on hand before the commencement of a piece of work, the result will certainly be to the benefit of the employer and the employee. Any plan of wage payment, whether bonus, piece or day work, can be used without interfering with the principles of scientific management, provided there is a clear understanding that the employers are willing to pay liberally for a fair day's work."

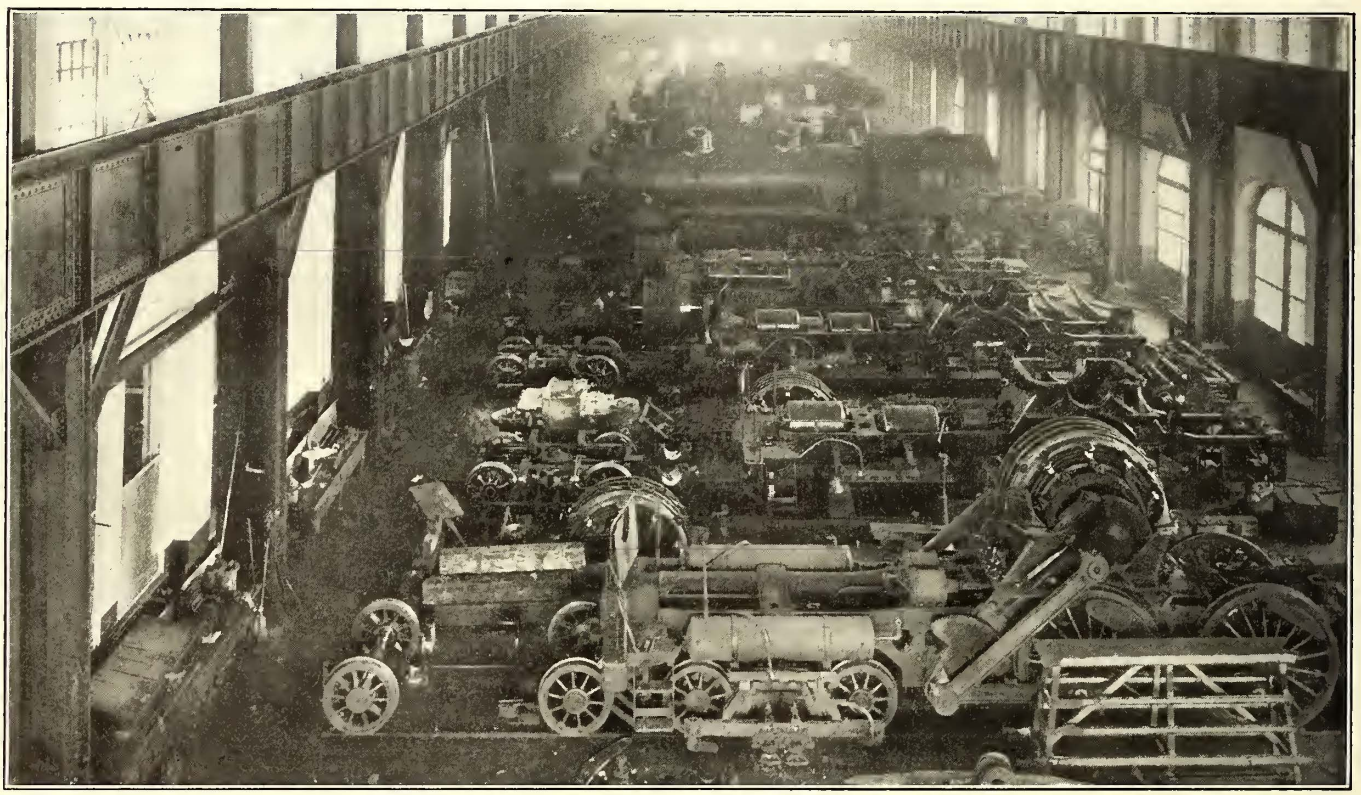
"Some of the systems," he adds, "may have been handicapped by the effort to convey instructions to the workmen in too elaborate a manner." This has been a prevalent suspicion which now finds justification in the remark of H. H. Vaughn: "We believe that we should not have any more system in our work than we can get along with nicely. We would rather have too little system than too much in the operation of the shop."

One of the features of the discussion was a statement by David Van Alstyne that any system of management which could not be made acceptable to organized labor was doomed to failure. This opinion is distinctly interesting, for it is difficult to see how any system of scientific management which includes within its scope the necessity for greatly increased effort from individual workmen could ever be made acceptable to trades unions. Specialization is admittedly the slogan of every such system. It would, in fact, be ridiculous to spend time and money in training a man to perform one task with machine-like precision and then set him at totally different work. Carried to a logical conclusion, this strikes at the very foundation of the trades union. For if time must be devoted to teaching an operator the exact motions required for every job, it might be better spent on some immigrant gifted with a broad back and a narrow forehead than on a mechanic whose mind is already occupied with the knowledge which, right or wrong, he considers as his trade. Wherever work can be done by common labor with the assistance of elaborate supervision the skilled artisan will certainly be eliminated, to the ultimate detriment of trades unionism, and who can believe that organized labor is not fully cognizant of this fact?

Maintenance of the Pennsylvania Railroad Electric Locomotives

A Description of the Methods Used in the Inspection and Repair of the Side-Rod Type of Locomotive Equipped with Jack Shafts—Operating Results and Maintenance Costs Are Included, Together with an Account of the Development of the Design of the Jack-Shaft Bearing

At the time of the construction of the locomotives which operate over the electrified zone of the Pennsylvania Railroad at its New York terminal it was determined, by elaborate tests with different types of locomotives running over track equipped with recording devices, that a high center of gravity would gain more than enough in easy riding qualities and in reduction of damage to the track to outweigh the advantage of simplicity afforded by mounting the motors directly upon the axles. In consequence the motors were located upon the frames, well above the wheels, physical connection to the drivers being effected by means of rods.



Pennsylvania Locomotives—View of Erecting Floor at Meadows Shop, Showing Electric and Steam Locomotives Undergoing Repairs

This arrangement brought the center of gravity up to the approximate level of the cab floor. The arrangement not only eliminated the necessity for gears, but also permitted the engine itself to be designed along lines similar in practically every respect to the steam locomotive, with which the repair-shop forces of the railroad were naturally thoroughly familiar.

Each of these locomotives is made up of two similar units, and each unit or half locomotive receives a number of its own, the whole locomotive having a "run number," an arrangement which permits, if necessary, the interchange of different units. The use of double units was adopted because it was considered that two motors of 2000 hp each would be preferable to one motor of 4000 hp; because, in event of failure, one motor could be cut out, leaving the other element for service and also because the weight on the drivers necessary to develop the large tractive efforts required too long a wheelbase for a single unit. Experience has shown that in case of breakdowns the serviceable unit is generally able to handle the train to the terminal without delay.

The locomotives are operated in passenger and switching service in the tunnels serving the New York City terminal of the Pennsylvania Railroad. On the east the line extends to the Sunnyside yard, a large storage space for passenger car equipment. On the west the line extends across the New Jersey salt meadows to Manhattan Transfer, a point near the town of Harrison, where steam locomotives are substituted for the electric engines on through passenger trains. The length of the run across the Meadows is approximately 6 miles, in the North River tunnel about 3 miles, in the East River tunnel about 3 miles and to the Sunnyside yard about 1 mile. Between the Pennsylvania Terminal and Manhattan Transfer the runs are made at high speed. Through the East River tunnel and in switching service in the Sunnyside yard, however, the service is naturally slow and the loads heavy. Many sharp curves exist on this portion of the line, and in consequence the engines which are used in this service are subject to what may well be considered extremely hard conditions. The tunnels are built with grades of approximately 1.5 per cent in order to dip under the two rivers which bound New York City, the maximum grade being one of 1.93 per cent, on the section west of the terminal.

Altogether there are thirty-three locomotives in service. The first two locomotives constructed differ in some details from the later designs, notably in not having the jack-shaft tie casting, which forms the upper half of the jack-shaft boxes, directly connected to the motor frames and also in the diameter of the driving wheels and in the arrangement of driving rods.

The next twenty-two engines to be furnished were all alike and have been in service for approximately two and one-half years. The remaining nine engines were placed in service about eighteen months ago. These differ only in minor details from their predecessors, one of the most important differences being in the design of the jack-shaft box cap and brass. All of the locomotives, however, are the same in arrangement and have similar general dimensions.

Twenty-five out of the thirty-three locomotives are continually in service, the remaining engines being put in service on such occasions as extra travel demands their use. The average monthly mileage of all engines in service is 3000, the passenger engines which handle through trains between the terminals and Manhattan Transfer being double-crewed and covering about 4500 miles per month.

a bushing at one end and a keyed brass at the other. The side rods connecting the two pairs of drivers are located on the crank pins outside of the main rod. These rods are bushed at both ends.

The truck at the front end of each unit is of the four-wheel type standard on the Pennsylvania for heavy passenger locomotives. Two pairs of 72-in. drivers support the rear end of the unit, the motor being carried on the frames about 5 in. behind the center of the first pair. The driving boxes are fitted with shoes, wedges and binders exactly as in steam locomotives, and the bar frames, equalized springs and foundation brake rigging make the major part of the chassis quite similar to the running gear of the steam engine. The air compressor is motor-driven through gears and rests upon the floor of the cab in the space at the rear of the main motor.

The cab is supported on the frame at four points. It is self-contained and can be lifted off completely, taking with it the control apparatus, the resistance, the compressor, the cab fittings and wiring and the electric steam heater, electricity being used to produce steam for heating passenger coaches.

Pennsylvania Locomotives—View of Crane in Meadows Shop Lifting Cab from a Unit.

GENERAL DESIGN

As before mentioned, each unit or half locomotive is complete in itself. It has a chassis which includes the running gear, the frames and the motors, and mounted upon the frames is the cab, which incloses the control apparatus and can be removed complete. The connection between the motor and the wheels is made through a jack shaft set between the bogie truck and the first pair of drivers, the "motor rods" which connect the motor and jack shaft being set at an angle of a little less than 45 deg. One of these motor rods is connected on each side of the motor, and the two motor cranks are set at 90 deg. from each other with the left side in advance, so that a continuous torque is transmitted to the jack shafts. The motor rods are connected to the cranks on the jack shafts at the outer end of the crank pins, and inside of the motor rods are "main rods" extending horizontally to the crank pins on the first pair of drivers. The motor rods are bushed at both ends, but the main rods are made up with

The jack shaft is carried in a housing which is placed between the upper and lower members of the locomotive frame. At this point the frame is made up with jaws having a binder below them, just as would be the case were the jack shaft replaced by a pair of drivers. To absorb the thrust and pull between the motor and the jack shaft, the jack-shaft housing is made of a single casting extending across between the frames, and this casting is extended diagonally up toward the motor, the motor frame being extended diagonally down to meet it. The two castings are bolted together where they meet, and thus form a rigid connection of invariable length between the motor and the jack shaft.

The shoes for collecting current from the third-rail running alongside of the track are carried on the bogie truck equalizers and are interconnected through fuses which consist of strap copper 1½ in. wide with a ¾-in. hole punched in the center to localize the heating in case excessive currents are taken by the motor. The No. 1 end of the loco-

motive is fused at 6000 amp, the No. 2 end at 4500 amp, the difference being due to the fact that the No. 1 fuses carry current with motors in series and in parallel, while those in the No. 2 end carry current only while motors are in parallel.

INSPECTION

The inspection which is given to the Pennsylvania electric locomotive differs materially from that followed in ordinary steam locomotive practice. The engines, not having boilers to require care, are stored where convenient and are taken into the engine house only at such times as they need minor repairs. For this reason special arrangements are made for frequent inspection of the running gear, as the requirements for operating the large number of trains through the New York terminal without delay demand the absolute elimination of engine failures. Each machine is inspected below the cab at least once each day by inspectors who devote their entire time to this purpose. One inspector is located at Manhattan Transfer, and he makes his inspections from ground level. The absence of link motion and eccentrics provides a surprising amount of room under every part of the locomotive except at the bogie trucks, and this permits reasonably complete inspection without a pit. In the Sunnyside yard at the other end of the line a single inspection pit is provided, and another inspector works at this point, the pit permitting him to make complete inspection of both running gear and bogie trucks on such engines as do not reach Manhattan Transfer.

The inspection of the apparatus inside of the cab, which includes examination of the motor, air compressor and controller, is done entirely by the engine men, who also go over the running gear on their own initiative. The work of inspection consists in examination of brakeshoes, heads, hangers, pins and rods for missing cottars, or interferences, and an inspection of frame and binder bolts, truck hangers, springs, spring hangers and crank pins. The bolts holding the jack-shaft bearings in place are a very important item, as any lost motion at this point results in a serious pound. Worn bushings and brasses are reported by the engineers to the engine-house foreman. No repairs are made on the road, the engines being brought into the engine house for all work. The result of the careful inspection is a surprisingly small number of delays, as shown by the accompanying table of locomotive detentions for the year 1912.

Pennsylvania Railroad Company, Manhattan Division.
Electric Locomotive Detentions in Minutes During 1912.

Month	Electrical				Mechanical		Total, All Causes	Mileage	Miles per Minute Detention
	Fuses	Master Control	Motor Control	Misc. Electrical	Misc. Mechanical	Brakes			
January	..	2	...	...	...	..	2	84,422	42,211
February	..	5	6	5	...	..	16	78,100	4,881
March	..	3	...	...	...	..	3	82,573	27,524
April	..	2	...	...	...	..	2	78,886	39,443
May	..	2	...	...	...	..	2	80,880	40,440
June	..	5	...	...	...	2	7	80,013	11,430
July	...	...	...	...	...	..	.....	84,283	.....
August	..	...	2	...	4	..	6	85,486	14,248
September	..	...	5	...	4	2	11	83,950	7,632
October	..	...	...	...	4	7	11	85,305	7,755
November	..	...	6	...	...	..	6	84,473	14,079
December	..	...	...	...	...	..	.....	86,221	.....
Total	..	19	19	5	12	11	66	994,592	15,070

EXPLANATION OF DELAYS.

Master Control:
- 2 minutes. "J" switch not operating owing to oil on armature.
- 2 minutes. Grease on master controller drum.
- 2 minutes. Broken control battery plate.
- 3 minutes. Loose master controller finger.
- 2 minutes. "J" switch sticking; motors not operating in parallel.
- 1 minute. Bent finger on No. 2 controller plug.
- 4 minutes. Master controller finger loose.
- 3 minutes. Bridge relay finger not making contact; small piece of waste found under same.

Motor Control:
- 6 minutes. Circuit-breaker not resetting owing to glycerine in dash pot gumming, account cold weather.
- 6 minutes. Due to motorman not using power in proper manner and blowing breaker by notching up too rapidly.
- 2 minutes. Broken strap connection.
- 5 minutes. R-5 resistance strap breaking No. 2 motor.

Miscellaneous Electrical:
- 5 minutes. Shoe cable burning off.

Miscellaneous Mechanical:
- 8 minutes. Latch on engine coupler opening when starting.
- 4 minutes. Motor crank disk striking cover (stopped to examine same.).

Brakes:
- 2 minutes. Brakes failed to release promptly.
- 4 minutes. Defective air hose.
- 5 minutes. Loose finger on pilot governor of air compressor.

LIGHT REPAIRS

Light repairs are made at the engine house in the Sunnyside yard. The building has two tracks devoted to work on electric locomotives, and these hold four complete engines, or eight units out of the sixty-six which are available for service. This track space has been found to be more than enough for the requirements of the line, and it is seldom that more than two engines at a time are held in the house.

No work is done at the engine house which requires removal of the cab from the chassis or which requires raising the frames off the wheels. A drop pit is provided for wheel repairs and for use in case a hot driving box necessitates dropping one pair of drivers. This is, however, hardly ever used for this purpose on account of the freedom of the engines from trouble of this kind. A traveling electric crane of 25 tons capacity is installed to serve the repair tracks, but this is also used for repairs to the multiple-unit motor cars, which are used on the electrified zone of the Pennsylvania Railroad and which receive light repairs in the engine house. Pits between the rails are of course installed for the full length of both tracks.

Pennsylvania Locomotives—General View of Double Unit

The live third-rails are not carried into the engine house on account of the danger to the repair men. The electric locomotives are, however, shifted in and out of the house under their own power by plugging a long insulated flexible cable into the bus line receptacles on the engines and thus connecting them to the live circuit. This cable is connected through a heavy single-knife switch incased in a wooden box to the 600-volt feeders in the yard, and the other end is provided with a recessed plug so that no danger exists for employees who make connections when the engines are being moved. Danger signs are always put upon exposed third-rail shoes before power is supplied to an engine in the shop for the purpose of pumping up air or making tests of any kind.

Air-brake repairs, renewal of third-rail shoes and minor electrical renewals and replacements form a considerable portion of work done at this point. The heavier jobs, which come more seldom, consist mainly in closing rod brasses, renewing worn rod bushings, closing or renewing jack-shaft bearings, and the like.

Motor rods are bushed after 1/16 in. of wear has taken place, or in general after 75,000 miles have been run. Main rod brasses require reducing about twice a year, or on a mileage basis at intervals of approximately 20,000 miles. All rod brasses and bushings are left 1/64 in. large when applied, as no direct reciprocating motion takes place anywhere on the locomotive and on account of the gradual application of all forces lost motion is taken up without severe shock. Wedges are set up as required by the inspectors, but they never require lining down between shoppings.

The accompanying list shows a number of the principal items of repair work or renewal which were handled at the engine house during the past year.

Partial List of Repairs and Renewals Made at Sunnyside Engine House During 1912

Arc chute sides replaced	585
Arcing tips renewed	168
Switch contacts renewed	236
Main motor brushes replaced	67
Compressor brushes replaced	234
Contact shoes renewed	617
Main rod brasses reduced	26
Jack-shaft brasses closed or reduced	489
Jack-shaft brasses renewed	14
Motor bearings renewed	4

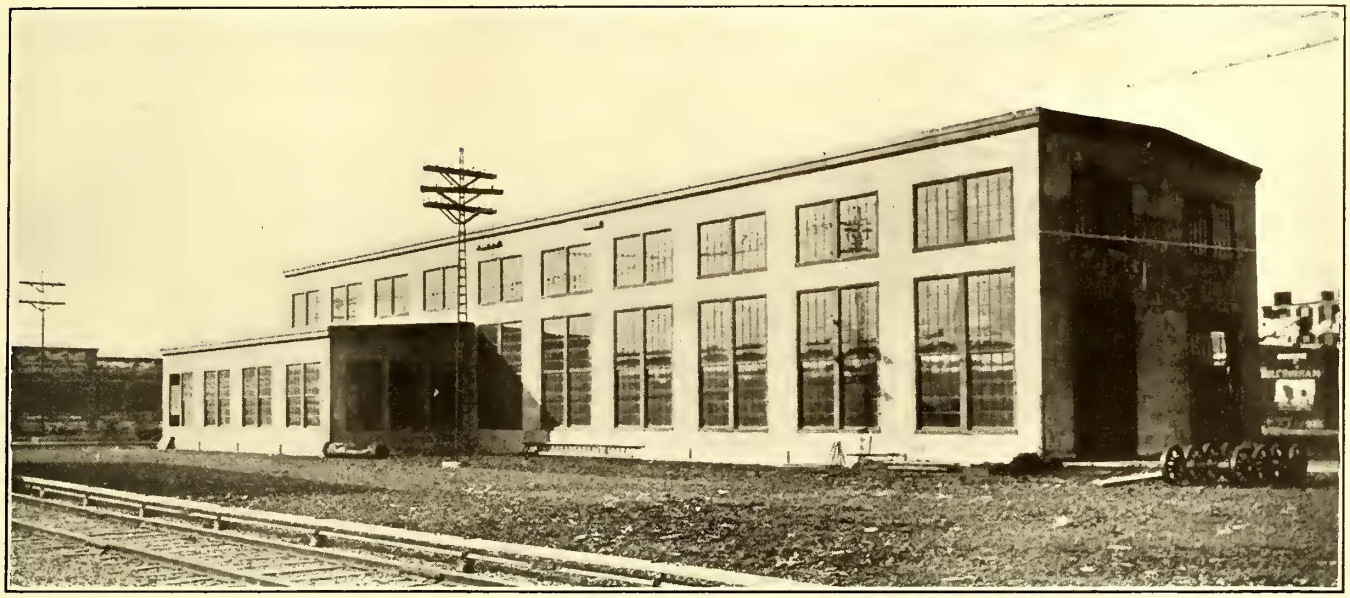
JACK-SHAFT BEARINGS

The jack-shaft bearing is naturally the most interesting feature of the engine, as it is the only item entering into the construction which is not covered by the past experience of repair men on either steam or electric railways. The brass is made up much like a split bushing, as it is turned in cylindrical form both outside and inside with a collar on the outside of each end. It is split along the horizontal center line, the split being made with a shoulder and the two halves fitted together. The brass itself is inclosed in a steel box casting, which in turn is split horizontally slightly above the center line of the jack shaft and is held together by vertical bolts. As before mentioned, the casting forming the top half of the box, or housing, extends up to the motor frame and bolts thereto so that when the two parts of the housing are bolted together the jack shaft is held rigidly at a fixed distance from the motor shaft.

The necessity for this construction was, however, found to exist only after the first two locomotives were built, the original design calling for jack-shaft boxes bolted separately to the frames, as shown in the accompanying illustration of one of the two original locomotives.

In these earliest engines, as well as in the twenty-two locomotives which followed them, the jack-shaft bearing brasses were turned cylindrical inside and out, split in two halves and fitted carefully onto wedge-shaped keys which held the two halves firmly together and in line, and which prevented the brass from turning as a whole. It was the original intention to treat these brasses just the same as motor-bearing boxes, and when they were worn they were to be removed and replaced with complete new brasses. This plan proved to be unsatisfactory for three chief reasons, the first being that even a slight wear in the brass, if not taken up, caused a serious pound, the second being that on account of the exposure to dust and the shifting strains imposed upon it the brass wore more rapidly than was expected, and the third being that all of the wear was found to occur straight downward or on the bottom part of the bearing.

During the early operation of the engines, and before experience had shown that not more than 1/16 in. lost motion could be permitted in the jack-shaft brasses, trouble was encountered from this source, and the result was that the jack-shaft drive was subjected to very general condemnation. As the necessity for promptly taking up wear became apparent, however, the trouble largely disappeared, and in the nine engines built about one year after the others the design of the brass was changed to make the work of adjustment easier. The changes consisted in eliminating the wedge-shaped keys and simply splitting the brass along the center line, the two halves meeting along flat surfaces, although, as mentioned above, the joint was left with a recess along the inside of the upper half of the brass, possibly with the idea of keeping the two halves in alignment. This construction is shown in the accompanying illustration of a jack-shaft brass.



Pennsylvania Locomotives—Engine House in Sunnyside Yards

The statement that practically all wear on the jack-shaft bearings takes place in a vertical plane is admittedly hard to accept. Nevertheless, examination of a number of the brasses demonstrates it to be a fact, and this is confirmed by the experience of those officials directly engaged in maintaining the locomotives. Two reasons may be put forward to account for this paradox. One is that the weight of the jack shaft, while by no means comparable with the shifting forces which are applied to the jack-shaft bearing when starting a train, does exercise a constant tendency toward keeping the jack shaft at the bottom of the bearing. When the torque is not great it certainly reduces the horizontal and upward forces acting upon the shaft and adds to those which press the shaft down. An analysis shows that these forces are constantly moving throughout a revolution but that they do not change direction uniformly, shifting irregularly from one point to another, so that the

constant force exerted by the weight of the shaft is certain to be effective even if it is not of very great intensity.

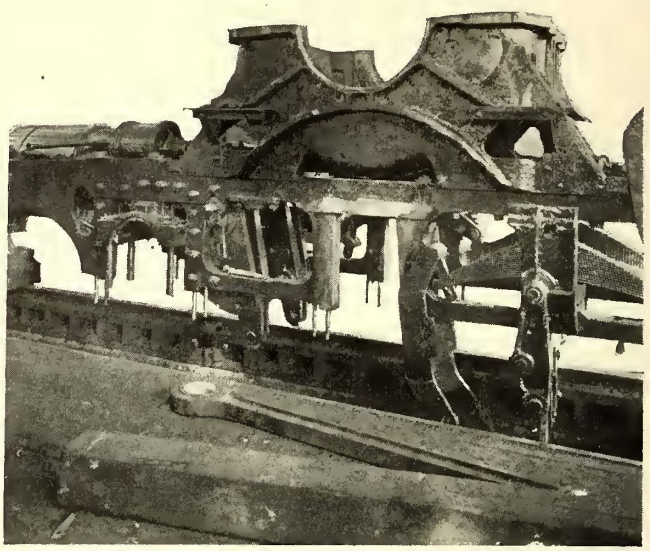
The other reason for localization of wear at the bottom of the bearings is that the brasses were originally designed for bottom lubrication, and a considerable portion of the bottom half of the brass is cut away to expose the oiled waste and permit it to rub against the jack-shaft journal. This naturally increases the unit bearing pressure at the bottom of the bearing and tends to localize the wear there.

In the new type of bearing, since the keys have been eliminated, the brass requires some form of dowel to keep it from working in the box and wearing enough to cause a pound between the brass and the box. In consequence four bolts are run through the lower half of the brass and extended through the box to the outside so that they hold the bottom half of the brass firmly in place and incapable of moving in its seat. These bolts are made with round, flat heads, countersunk in the brass so that there is no possibility of the jack shaft touching them. The nuts are held in place by lock washers.

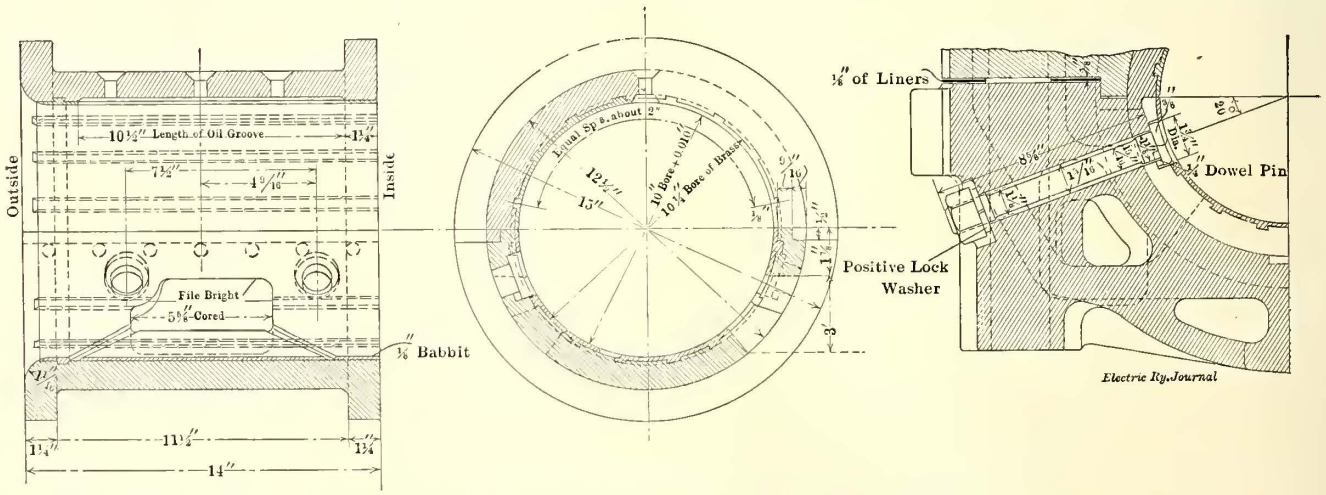
Between the upper and lower parts of the jack-shaft box horseshoe-shaped iron liners are introduced so that these may be removed and the box closed by loosening but without the necessity for removing the four bolts which hold the two parts of the box together. When the brass is first put up the two halves are left 1-32 in. open so that the brass may be closed that much by merely removing liners between the two parts of the box. When the brass has been closed until the two halves of the brass are pressed solidly together the lower half is removed and a shallow cut is taken off the edges where the two halves join, leaving the brass 1-32 in. open as before. This is kept up until the white metal lining of the brass is worn through, at which time a new brass is applied. The upper half of the brass is not permanently fastened to the upper part of the box, so that it can rotate as much as the slight opening between the two halves of the brass permits. There is, however, ample opportunity for introducing bolts to fasten the upper half-brass in place, and on one engine this has been done. No objections to this plan have been discovered, and if it is decided that it is necessary later on, all upper half-brasses may be bolted to the box casting, thus permitting a practically unlimited opening between the two half-brasses and avoiding any necessity for taking cuts off the lower half as the bearing is closed to take up wear.

Since the motor rods are bushed in both ends and are in consequence of fixed length the distance between centers of motor and jack shaft has to be kept constant, and it is likely that some method of vertical adjustment for the jack-shaft brass to provide for the change in position of its center, due to repeated closings, will be introduced in the near future. The box, as before mentioned, is maintained at a fixed distance from the motor, owing to the fact that the casting for the former is bolted solidly against the motor frame, and no opportunity exists for lining down the brass in the box on account of the cylindrical form of the brass.

Lubrication of the jack-shaft bearing was originally effected by oil-soaked waste in the hollow lower part of the jack-shaft box, or housing. This was formed into a receptacle containing a separate compartment for waste and also a larger reservoir for oil which was refilled every 3000 miles. With the new design of brass, however, the reservoir is reduced in size and 5 gills of oil is put into it every twenty-four hours. The lower half of the jack-shaft brass has large openings cut in it, as shown in the accompanying cut, and through these holes the waste extends to lubricate the journal. Packing plates are provided on the sides of the oil cellar so that the waste can be examined or changed as needed.



Pennsylvania Locomotives—Early Method of Mounting Jack-Shaft Housing Separate from Motor, Now Superseded



Pennsylvania Locomotives—Present Type of Jack-Shaft Brass and Method of Bolting the Lower Half in Place to Prevent Turning in the Housing

Exception may be taken in some quarters to the fact that the upper half of the brass is not firmly fastened in the box, even though the opportunity for movement in the box is limited to 1-16 in., on account of the practice of leaving the halves only 1-32 in. open, and it may be held that the halves should always be set "brass and brass." It is, of

course, true that the omission of bolts or some other form of dowel affords an opportunity for the upper half of the brass to work slightly. On the other hand, closing the box by removal of a liner can be done in half an hour, while taking down the lower half of the box, taking a cut off the brass and replacing it requires about five hours' work, so that keeping the two halves "brass and brass" at all times would involve a vast amount of labor.

In any event, the weight of the jack shaft, together with the load imposed by the rods and their counterbalances, which are mounted on the jack shaft, making a total of about 6,000 lb., tends to make the greater portion of the pressure come on the lower half of the brass. In consequence the tendency of the upper half of the brass to turn is much reduced.

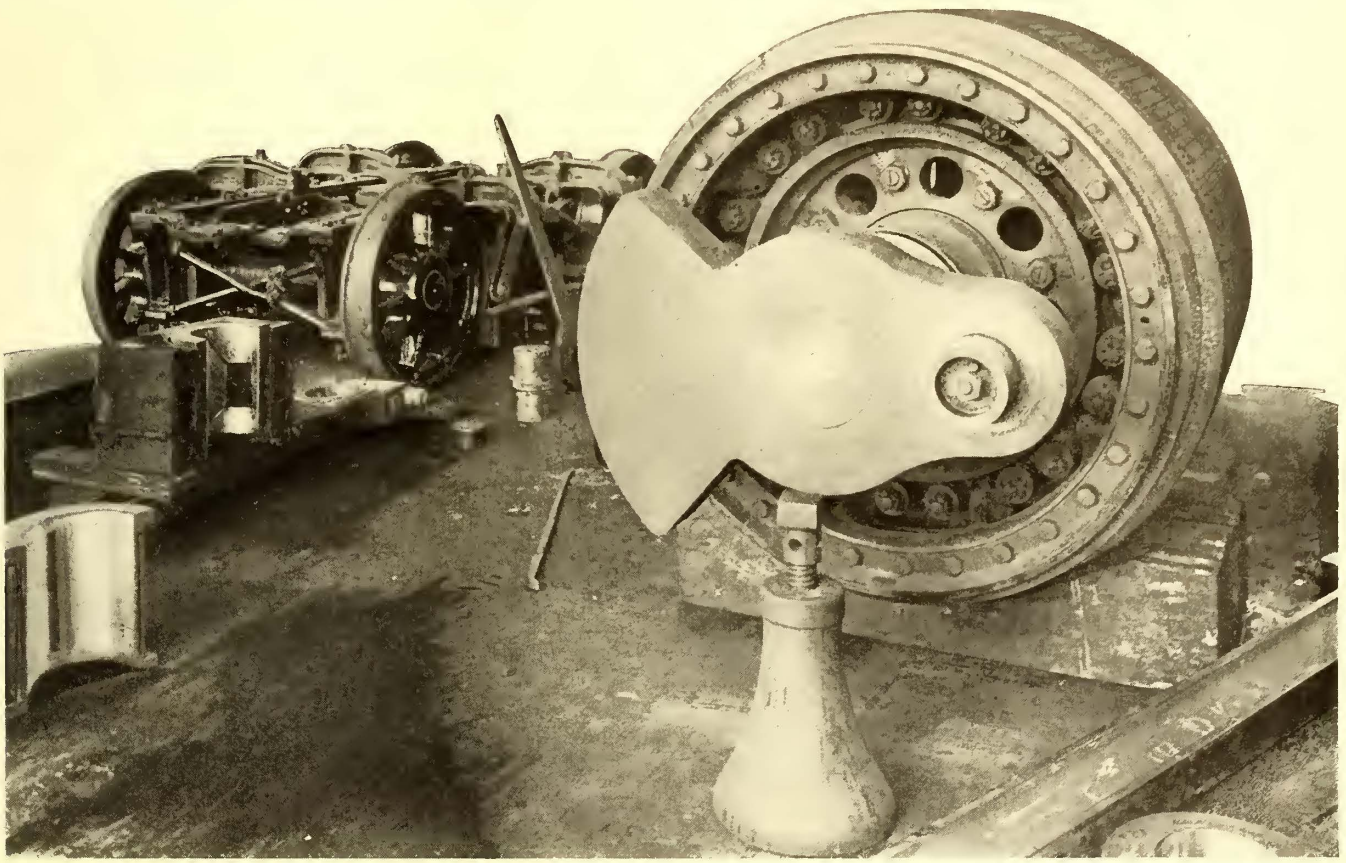
While the upper half of the brass can be fastened into place with bolts, just as in the case of the lower half, the fact that successful operation has been experienced without doing this shows that it is by no means absolutely necessary. There is, however, a point which has arisen in connection with the present practice of taking cuts off the lower half-brass. This is that, as the brasses are lined with white metal, a brass which has been reduced several times to take up wear in the lining and which is then relined with the standard thickness of white metal will, when placed on the journal, be left open by the total amount of all reductions.

The white metal lining which is applied over the interior surface of the brass consists of ⅛ in. of No. 14 Westinghouse alloy, a high tin babbitt. This is applied after the whole surface of the brass has been tinned to avoid its loosening. In addition, the babbitt is held in place by grooves cut in the surface of the brass at intervals of about 2 in. all around the bearing. The metal is exceedingly tough and can even be heated enough to run at one point in the bearing without throwing the remainder out of place.

The lost motion in the jack-shaft bearings has been found to be a serious cause of trouble if it is allowed to go beyond reasonable limits. A play of 1-16 in. between shaft and brass is the absolute maximum, because when this point is reached the wear rapidly increases on account of the pounding out of the babbitt. Brasses are tested for wear at each inspection by means of a pinch bar, with the fulcrum resting on a screw jack under the jack shaft. The leverage thus established enables two men, by jouncing their weight at the end of the bar, to raise and lower the jack shaft and thus feel any lost motion in the brass with certainty. This method, while it may appear somewhat crude, has been demonstrated to be thoroughly satisfactory, the inspectors acquiring a great deal of skill in estimating the extent of lost motion after a very little practice.

The work of taking up wear by loosening the lower part of the box, removing a liner and then pulling the lower part of the box into place again takes two machinists only about half an hour, the cap being held in place by four 2¼-in. bolts. The intervals at which this job is done are variable, locomotives running anywhere between 2,000 and 7,000 miles before it is necessary. Three thousand miles is given as a fair average for the distance which can be run before wear is thus taken up. All four brasses on a locomotive or double unit do not, however, wear evenly, so that only one brass on an engine may require closing at an inspection. Based on the number of brasses closed during 1912 and the average number of engines in service, the average would be 6000 miles per bearing, not per locomotive, between closings. This would give a mileage of 1500 per engine if only one brass was closed at a time, but as the engines almost invariably have more than one brass closed, about twice the latter mileage is made. The engines are not brought in for this purpose between the regular inspections made on a 3000-mile basis.

The removal of the lower half of the jack-shaft brass involves setting up a screw jack under the jack shaft to

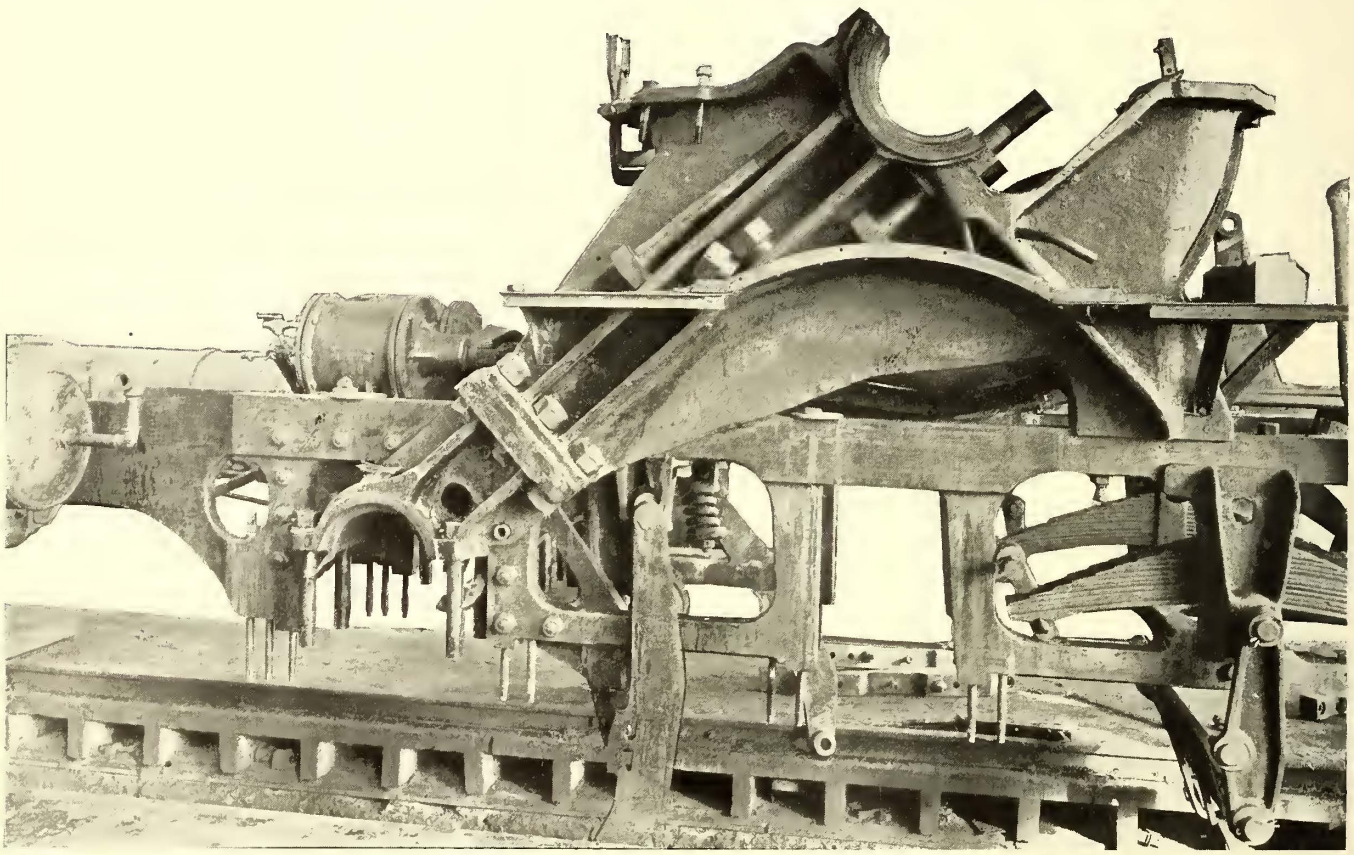


Pennsylvania Locomotives—Motor Armature and Standard Bogie Truck—Upper Half of Jack-Shaft Brass and Lower Part of Housing or Cap, with Brass in Place, at Left

take the weight off the bearings and then dropping the lower parts of the boxes. The lower half of the brass is then removed from the cap and the desired cut taken off. This job can be done by two machinists in about five hours.

When the babbitt lining of the brass has become worn so much that it has to be renewed it becomes necessary to remove both halves of the brass from the box. Brasses are, however, made in jigs to conform to an exact standard, so that it is not necessary to spend any time babbitting an old brass in order to replace it in the box from which it was originally taken. After removing the worn brass the new brass is spotted and scraped carefully by hand to make a fit on the jack-shaft journal, put in place in the jack-shaft box and the whole bolted in position. In spotting the brasses on the jack-shaft journal they are brought to a good straight fit all over, except that for about 1 in. on each side they are eased off slightly, in a way similar to that in which a rod brass is eased off on yoke on top, such as is used for dropping driving wheels. The operations are, however, very much simplified by ready accessibility of all of the parts under the locomotive cab.

The babbitt lining is used because, thus far, it has been found to give the most satisfactory bearing surface for the purpose. It naturally makes the process of fitting the brass to the journal very much easier, and in addition it obviates much of the necessity for extra refinement in the fitting. While the wear on the babbitt is more rapid than would be the case if a plain brass was used, the lining permits an engine to go into service immediately after a refitting of the bearing without the necessity for nursing it in any way. New babbitt can of course be applied much more easily to the jack-shaft bearings than to driving-box brasses, and in case the babbitt should be become hot enough to be thrown out of a brass no damage to the jack-shaft journal is necessarily involved, as practically all the strain



Pennsylvania Locomotives—View Showing Present Standard Design of Jack-Shaft Housing Bolted Direct to Frame of Motor

the quarters. This job complete, including the time required to fit the brass on the jack-shaft bearing, takes two machinists about ten hours. For this work it is of course necessary to lower the jack shaft enough so that the upper half of the brass can be removed from its place in the housing, and in order to do so it is necessary to take off the main rods and the motor rods. The motor rods require for their removal that a section of the cab flooring be taken up, together with the casing which goes over the motor cranks.

The motor crank casing is made of light sheet metal, as it is installed only for the purpose of protecting anyone in the cab from being caught by the cranks while the engine is in motion, and the removable section of the cab flooring is held in place by bolts, so that it can be easily removed whenever necessity arises for taking off either one of the motor rods.

All of the work requiring either supporting or dropping of the jack shaft is effected by using a screw jack with on the brass is removed when the power is shut off from the motor. Hence the jack-shaft bearing would not stand as much chance of being scored or otherwise damaged as a driving brass would in case it was lined with babbitt and became hot. Ordinarily brasses are re-babbitted after 40,000 miles of service, which is in general accomplished in about thirteen months.

HEAVY REPAIRS

Heavy repairs to the locomotive are given at intervals varying between 40,000 and 60,000 miles, depending largely on tire wear. All of this work is done at the Meadows shop, a repair plant near Jersey City, which is equipped with heavy cranes so that the engines may be completely stripped without difficulty. At these shops repairs are also made upon steam locomotives on the New Jersey division of the Pennsylvania Railroad.

Turning driving wheel tires is the main feature of heavy repair work. All of the engines run around heavy curves in the Sunnyside yards and, comparatively speaking, do

very little running on tangents. If anything, the tire wear is slightly less than would take place on steam locomotives in the same service. It has been found, however, that the rear wheels of both units of each complete electric locomotive tend to grind their flanges somewhat more than the forward ones. Within the last year a number of the units have been equipped with flange lubricators which spray hot asphaltum oil upon the wheel flanges, and this has been found to decrease the flange wear very materially. The cost of this flange lubrication is approximately 56 cents per 1000 miles. About 40,000 miles is considered an average year's service, so that the locomotives are shopped at intervals of from twelve to eighteen months.

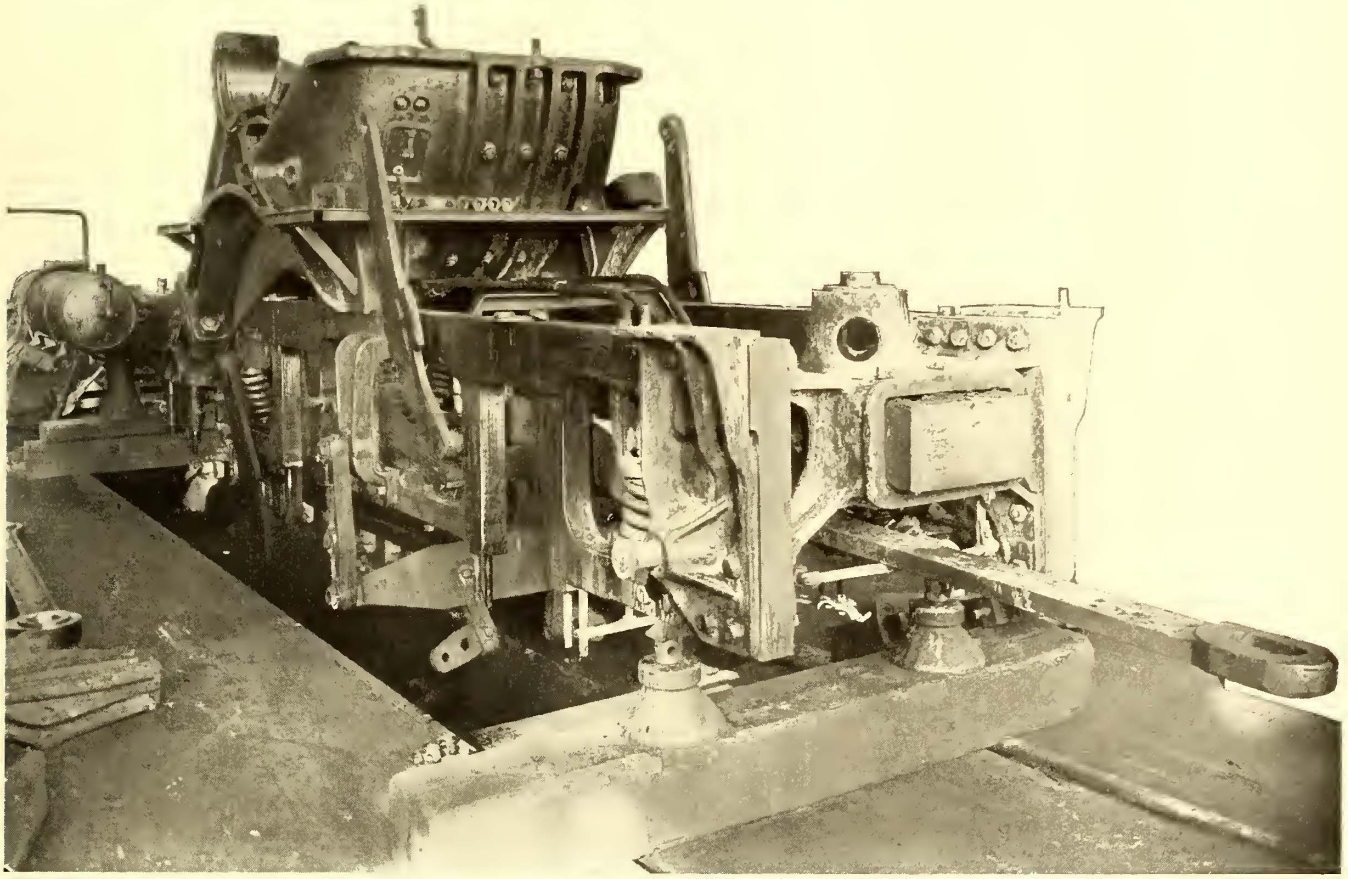
The armatures will, of course, have to be rebanded from time to time as the motors become older, probably at intervals of about three years, as the core bands will eventually become weakened by rust and also tend to become loose, owing to the combined action of armature shrinkage and stretching of the band wire. Tin strips have been placed beneath the core bands in accordance with the latest practice adopted by motor manufacturers as well as by high-speed electric railways. This was generally carried out during the latter part of 1911.

An item of repairs which involves the shopping of the locomotives is the necessity for re-painting the cabs. This is quite a considerable item of expense on account of the high finish which is required, as the locomotives are used largely in passenger service and are very much in evidence. In accordance with the rules common on electric railways, a touching up and varnishing is given to the locomotive annually, and it is expected that the old paint will be completely cleaned off and new coats applied every third year.

In handling the locomotives for heavy repairs in the Meadows shop, the wheels are invariably removed as soon as an engine is brought under the crane, so that the driving-box work and the re-lining of shoes and wedges can be done as required, in addition to the turning of the tires, which is always necessary at ordinary shoppings.

Each unit is handled separately, the two half locomotives being separated before being brought into the erecting shop. In lifting each unit off its wheels one of the two hooks of the traveling electric shop crane is coupled to a claw which catches under the center of the cast-steel bumper beam at the front of the locomotive. The other hook of the crane is coupled to a standard yoke for lifting steam locomotives and lifts the rear part of the unit by a lifting beam hung from it and passing across underneath the frames. After the driving wheels and truck are rolled out from under the engine it is let down upon blocks and short screw jacks in the usual manner.

If it is necessary to get at the motor for any reason, the cab is removed from the frames, taking with it the control, the resistance, the compressor and all cab fittings. The crane hooks are coupled on by means of yokes to two vertical eye-bolts at each end of the cab, these bolts extending down through the roof and being permanently attached to the cab framing. After removal the cabs are generally set upon dolly trucks and hauled to the paint shop. After the cab is off the engine the top half of the motor frame is lifted off by the crane and the armature can be lifted out in rope slings after the motor rods and bearings are removed.



Pennsylvania Locomotives—Rear View of Unit in Repair Shop, with Wheels, Cab and Armature Removed

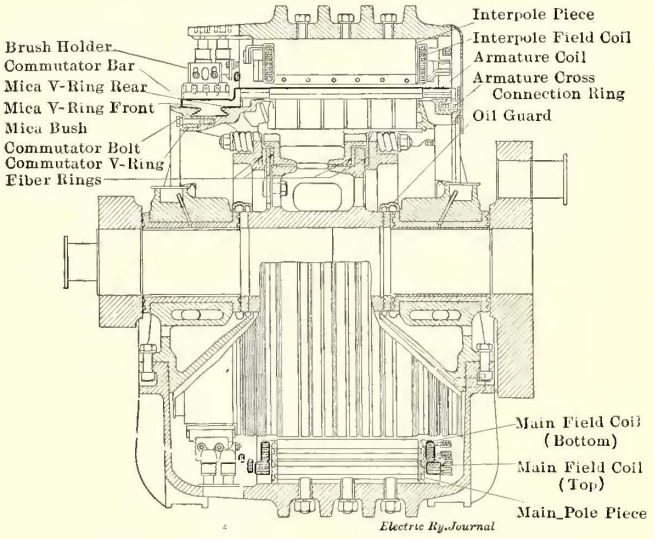
With the exception of the electrical work, which is done at the Meadows shop by the electricians who ordinarily maintain the passenger coach-lighting systems, heavy repair work is so similar to that on steam locomotives that it is carried on by the regular shop force of machinists. A typical shopping report calls for approximately the following work:

Tires turned.
Driving boxes repaired as necessary.
Jack-shaft bearings renewed as necessary.
Shoes and wedges lined.
Rod bushings replaced where loose.

Engine truck overhauled.
Truck-box side play taken up.
Main rod brasses reduced.
Motor re-banded.
Cab painted.

Occasional work which is required at general overhaulings includes relining of motor bearings, equalizing engine on driving springs, overhauling brake rigging.

During the year 1912 the total number of engines receiving classified repairs at the Meadows shops was



Pennsylvania Locomotives—Sectional View of 2000-hp Motor

forty-six. On account of the irregular wear of jack-shaft bearing brasses, it is the custom to examine these when the engine is shopped and to re-metal or renew as necessary, although a large part of this work is done in the Sunnyside engine house.

The spring rigging of these locomotives is exceptionally well designed. No springs have as yet been replaced for any cause, and the only work done on the rigging has consisted in leveling it up in some few cases.

Another item of the locomotive equipment which has made an exceptionally good record for maintenance is the air compressor. No air compressor has required reboring of the cylinders, and, in fact, no new cylinder rings have as yet needed replacement. The wear which exists after two and one-half years of service is not noticeable.

The weights of the different major items which make up the locomotive are as follows:

	Tons		Tons
Cab complete	22	Running gear	18
Motor	21	Chassis	17
Total			78

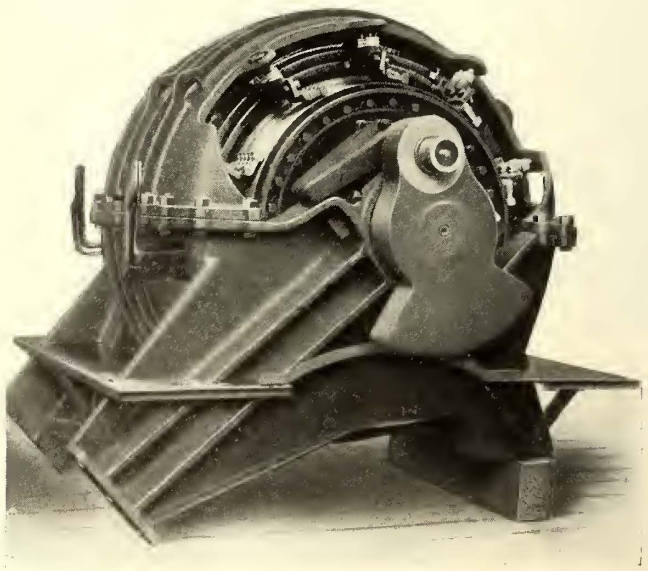
This list shows that a 60-ton crane will handle locomotives in a heavy repair shop, as this weight covers the engine without wheels and running gear. However, in case of necessity a 25-ton crane could be used to strip the engine by removing the different parts separately instead of lifting the whole engine off its wheels.

ELECTRICAL REPAIRS

In general, the electrical repairs on the locomotives are exceedingly light. Some of the work done at present consists in repairs to wiring connections which become broken on account of vibration. The repairs to the motors themselves are limited, as the location of the motors inside of the completely inclosed cab eliminates by far the greater part of the trouble which occurs on the ordinary railway motor mounted on trucks and subject, in consequence, to the effect of water, dust and even mechanical injury. This is shown especially in the remarkable results which are obtained with the motor commutator. Although most of the locomotives have been in service for over two years, none of the commutators have yet been turned and most of the original brushes are still in use. The maximum normal wear which has occurred after some 100,000 miles of service has been found to be only 3/32 in., showing that the protection afforded to the motor on account of its location is no small item in reducing trouble. No flash-overs have yet occurred, although in one case a ground occurred at the commutator on account of a wrench dropping onto it, which set up a short-circuit between the commutator and the motor frame.

As shown in the accompanying line cut, the motor is equipped with a fiber friction clutch, so that in case a short-circuit should be set up while the locomotive was traveling at high speed the tendency of the armature to come to a sudden stop would not be disastrous to the side rods. The armature is mounted on a spool, which is independent of the motor shaft, except through disks on an interior spool keyed directly to the shaft. Against these disks shoulders on the spool are pressed by a series of bolts and springs, strips of fiber being introduced between the shoulders on the spool and the faces of the disks. This permits the spool to revolve independently of the shaft in case sufficient torque is exerted to overcome the friction at the fiber strips, and this friction can be adjusted by tightening or loosening the bolts which compress the springs holding the two surfaces together. Ordinarily these bolts are tightened to a point which will permit the armature to slip when the motor is under a draft of current in excess of 4000 amp. The circuit breaker forming a part of the control system is set at 3500 amp, and the enginemen are under instructions to operate with care after the draft of current reaches 2700 amp, the latter point being indicated by a heavy red mark on the ammeter in the cab.

It is estimated by the operating officials that if all electrical repairs including electrical inspections for the sixty-six units were done at one point a force consisting of one wireman, two electricians and five electricians' helpers would be required. This would include the light repairs to



Pennsylvania Locomotives—General View of 2000-hp Motor

the wiring and control apparatus now carried on in the Sunnyside engine house.

GENERAL

Now that the necessity for keeping lost motion or binding out of the running gear is understood, the riding qualities of this type of electric locomotive are actually better than those of the best types of steam locomotives. Little pounding or nosing takes place.

The maintenance costs, as might be expected on account of the simplicity of the design, together with its adherence

to the principle of the high center of gravity now generally accepted as a requisite for high-speed electric locomotives, are very much less than those for steam locomotives. For six months between June and November of the past year the maintenance costs per unit were as follows:

Maintenance Costs of Electric Locomotive Units

During 1912	Cents per Mile Mechanical	Electrical	Total
June	1.51	1.01	2.52
July	2.18	0.85	3.03
August	2.86	0.66	3.52
September	2.46	0.97	3.43
October	2.84	0.79	3.63
November	2.84	0.90	3.74
Average	2.45	0.86	3.31

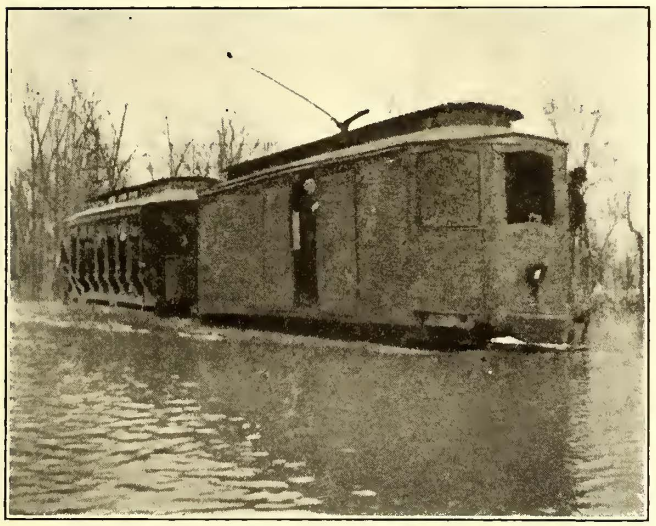
These costs include all operating overhead charges, such as the cost of general labor, supervision, heating and lighting of the shops and the like. They do not, however, include any charges for capital account nor charges due to repairs to buildings or machinery.

These costs are equivalent to those which might be expected from an 80-ton steam locomotive in heavy high-speed service requiring in addition a considerable amount of switching. The average train which is handled consists of seven cars, the smallest type weighing 60 tons and the largest approximately 71 tons. A fair average train might be estimated at about 450 tons exclusive of the weight of the engine, and as before mentioned these trains have to be hauled up grades close to 2 per cent and sometimes even stopped and started on these grades.

CARS FOR FLOOD SERVICE

The accompanying illustration shows a car on the Fort Wayne & Northern Indiana Traction Company operating through water about 19 in. above the top of the rail, or well over the axles. The railway runs a line parallel to the Wabash River, and during a recent period of extreme high water, which lasted for about a week, the tracks on this line for about 3500 ft. were covered with water varying in depth from 6 in. to 20 in.

In order to maintain traffic on this line an old work car was fitted up to operate with a trailer over the flooded section. The rearrangement of the car for this service consisted in turning the motors, which were of GE-800 type, so that the pinions ran on the tops of the gears instead of on the sides. The work was done with the regular shop force and it was reported to have taken only three hours. With this arrangement it became possible to haul the trailer over the flooded track and thus maintain service for the week during which the flood lasted. No trouble was experienced in operation, but the car, of course, was run at speeds not exceeding 3 m.p.h. to keep it from throwing water.



Flood Service on the Fort Wayne & Northern Indiana

EDUCATIONAL EXPERIMENT IN ROCHESTER

For some years there has been in operation at a number of technical and industrial schools one form or another of the so-called "co-operative plan" of education. Under this plan students spend alternate periods in school and shop. Continuity of the shop jobs is maintained by having the students work on them in relays, one set taking the work up where the others leave it when they return to school. An industrial school which has applied this principle in its work is the Mechanics' Institute of Rochester, N. Y. The presence of the institute and the operation of its co-operative scheme has suggested to the management of the Rochester Lines of the New York State Railways the desirability of utilizing the facilities thus conveniently placed at their disposal. It has seemed to them that the co-operative plan, as applied to industrial establishments, does not fit the needs of a railway company and a modification has, therefore, been devised by the master mechanic, G. M. Cameron. The plan is now in operation on a small scale, but the intention is to extend it as rapidly as it demonstrates its value.

For the first year two boys without high school training were selected from the repair shop force. Their work was arranged so that each is on duty one-half day, one in the morning, the other in the afternoon. They work on the same job, which at present is car wiring. In the evening they attend classes at the Mechanics' Institute, the off half-day being devoted, under pay, to the preparation of the evening's lessons. The first year's studies comprise English, mechanical drawing and arithmetic or algebra. These subjects relate directly to the requirements of shop work. English, in which so many young men are deficient, is needed to an increasing extent owing to the reports which employees are expected to be able to prepare intelligently. Practice in drawing is not only directly useful in itself but it leads to accurate observation and attention to detail. Arithmetic is more necessary than algebra, but if a boy is proficient in making simple calculations algebra lends interest and gives an incentive to further study.

The second year will be spent on elementary electricity and mechanics. Mr. Cameron believes that a young man in the electrical shops should be able to make accurate measurements of electromotive force, electric current, power and energy. Laboratory practice will teach this efficiently and will also assist in the understanding of the reasons for certain shop operations. Obviously, if an armature winder, for example, understands the underlying principles of electric motors he will be able to do a better, because a more intelligent, job. Elementary mechanics will give a tangible idea of forces, strength of materials and mechanical movements and should make of any mechanic a more useful all-around man.

The school training is to be supplemented by occasional instruction from an assistant to the master mechanic, one with a technical education. Wiring diagrams and other matters directly related to their work will be taken up with a view to getting rid of the apparent mysteries of these diagrams, which are considered by many shop men to be entirely beyond their comprehension. This supplementary work will also include the holding of written and oral examinations at the close of each year, and the instruction will be continued only to the worthy ones.

A number of interesting results are expected from this co-operative plan. In the first place, it will try out the staying qualities of the boys, automatically eliminating the mental weaklings. Those who survive the test are bound to become useful, resourceful, loyal mechanics. It is also certain that occasionally a young man of exceptional ability will come to the attention of his superiors, who will encourage him to obtain more education. So far the plan is bringing the expected results, and while it is still in the experimental state it will probably be extended.

Track Maintenance and Reconstruction in San Francisco

Interesting Track Appliances and Machinery Have Been Developed in the Way Department for Removing Paving, Old Rail and Track Foundations and for Laying New Tracks and Paving

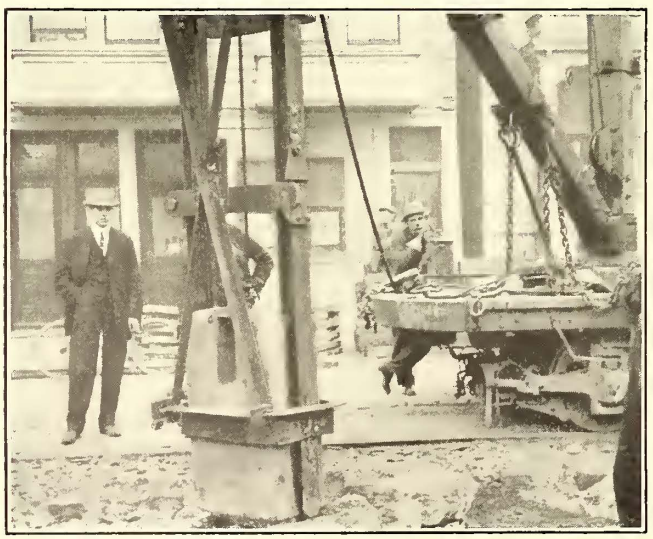
During the past five years the United Railroads of San Francisco have been obliged to undertake a large amount of track reconstruction. This has been due in large part to the fact that prior to the fire many of the lines were operated by cable power. Another reason for the work has been that the near approach of the fair to be held in 1915 in San Francisco has encouraged the company to put all of its equipment, including the track, in good physical condition. As a result of this program of rehabilitation, the company has developed a large number of track appliances and apparatus for track reconstruction and maintenance, which have greatly reduced the cost usually incurred in this work. Some of this apparatus is special and was designed particularly to remove cable tracks. Much of it, however, is of a character which is entirely suitable to ordinary construction and maintenance and could well be employed elsewhere. This work has been conducted by the engineering department of the company, which has charge of all new construction and maintenance of way, and has been under the direction of B. P. Legare, engineer of maintenance of way and construction, assisted by W. C. Chamberlain, assistant engineer.

San Francisco Track—Pulling Old Electric Track with Derrick

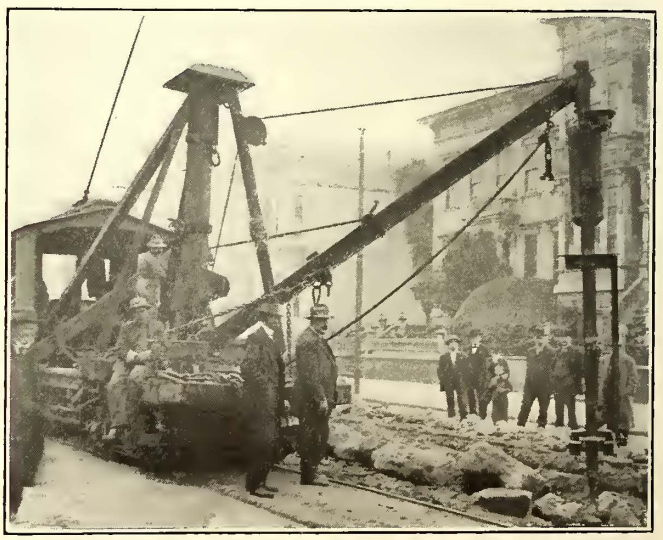
San Francisco Track—Pronged Hook for Tearing Up Concrete

ELECTRIC TRACK RECONSTRUCTION

Most of the old electric track was built with a concrete substructure, and its renewal means that this substructure has to be removed. Where asphalt paving has been used this is first cut away. The concrete between the rails and above the ties is then either loosened by a plow which is pulled by the hoisting winch on a 8-ton derrick car, or it is broken up by means of a 3100-lb. drop-hammer rigged on the boom of the derrick. The cost of the two processes amounts to a small fraction of a cent per foot of track.



San Francisco Track—Drop-Hammer for Breaking Concrete

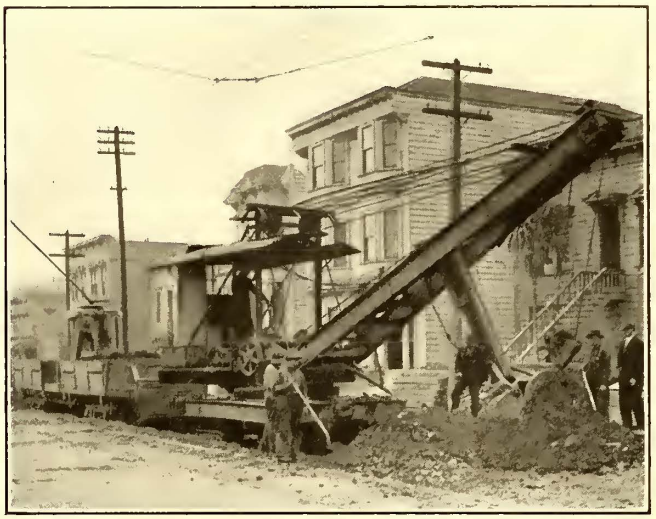


San Francisco Track—Setting Drop-Hammer Legs

The concrete paving base on the 2-ft. strip outside the rails is next broken by means of the same drop-hammer, which strikes a blow on 30-in. sections of 9-in. girder rail, laid on its flat side on the concrete. This shatters the concrete and breaks it approximately on a line 2 ft. from and parallel with the outer rail.

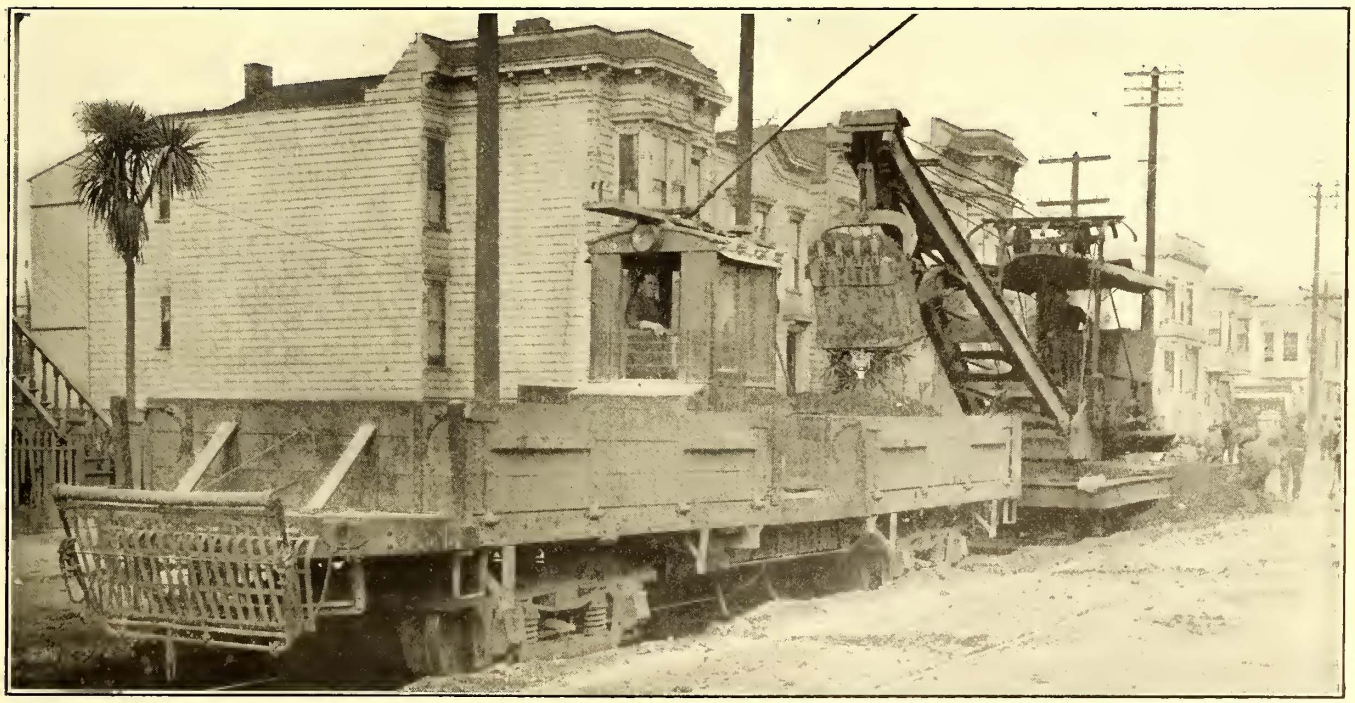
San Francisco Track—Dismembered Cable Track Ready for Excavator

The next process is that of tearing up the old track by means of this same derrick car. The derrick is on the same track that is being pulled, and a hook is attached by means of a chain to the end of a tie. The track, ties, concrete, etc., are then raised bodily from 3 ft. to 4 ft. This process shatters the concrete in the track, breaking everything loose. While the track is suspended in this position, a gang of five men with sledges drive the ties from the rails. Without having its position on the track changed, the derrick is then attached to the other end of the tie and that side of the track is elevated in the same way, the process being repeated. The derrick is then backed from 10 ft. to 15 ft. away from the torn-up track and goes through the same process already described, so that it gradually tears up the track as it advances. When this work has been completed, the rail, ties, concrete, spikes, old chairs, etc., are lying loose and ready to be loaded on cars to take to the dump.



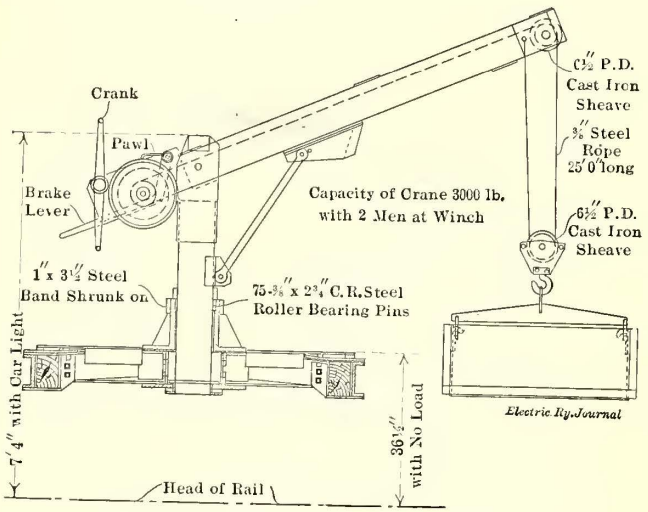
San Francisco Track—Excavating Trench for Track with Shovel Car

The next process is that of excavating the trench by means of an electric shovel equipped with a ¾-yd. bucket. A space at the end of the job, about 30 ft. long, is first excavated by hand, and a temporary T-rail track is laid so that the shovel may get a start. The trench thus excavated is 9 ft. wide and 2 ft. deep. The shovel advances on this temporary track, excavating and loading the material into 22-cu. yd. cars which are stationed behind the shovel on the same track. These cars are equipped with a cab in the center, so that the end of the car is free and the shovel can load into it. When the shovel has excavated a distance of 10 ft. or has advanced the entire length of the temporary track then laid, another section of temporary T-rail track, all made up and spiked together and lying at the side of the trench, is picked up by the shovel by a chain, one end of which is attached to the section of track and the other end is thrown over the teeth of the bucket of the



San Francisco Track—Shovel Car Loading Dirt Cars

shovel. In this way the section of track is lifted and put in place in front of the shovel. This allows the shovel to advance and excavate another 10 ft. This process is repeated until 30 ft. in linear length of track route have been excavated. The two 10-ft. sections of temporary track are then lifted by the shovel, and a built-up section of tempo-



San Francisco Track—Crane for Bitumen Car

rary track, 30 ft. long, is placed in the trench. As this process is continued a series of 30-ft. sections are left behind the shovel.

During the noon hour of each day these temporary 30-ft. sections of track for a distance of 120 ft. to 180 ft. are taken out behind the shovel by a 5-ton crane and are placed at the side of the trench ahead of the shovel, ready for future work. The permanent 9-in. girder rails are then laid in the gap of this temporary track, thus keeping a continuous track behind the shovel, so that each day there is added from 120 ft. to 180 ft. of permanent track. The operation of this shovel method, in place of the ordinary hand method for excavating, has brought down the cost on this particular kind of work from 30 per cent to 50 per cent. The hammering of the concrete and the pulling and tearing up the track with the derrick have also aided greatly in bringing down the cost of track reconstruction over the ordinary hand method.

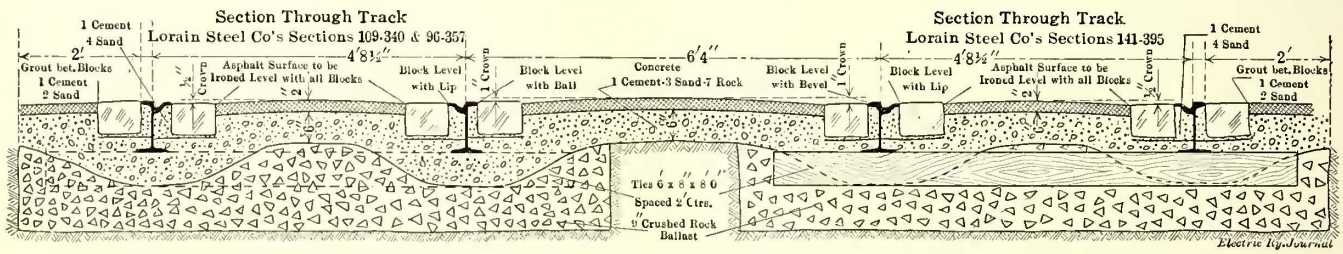
CONVERSION OF CABLE TO ELECTRIC TRACK

The process described is not suitable where old cable track has to be removed because of the existence of the old cable yokes and conduit. In some cases electric track has been built directly on the old cable foundation, but this is not preferred practice, and where any electric track of this kind has to be rebuilt the old cable foundation is now being torn out. Most of the old cable roads were of a 3-ft. 6-in. gage, the yokes were 4 ft. apart and the concrete extended 3 ft. below the surface of the street.

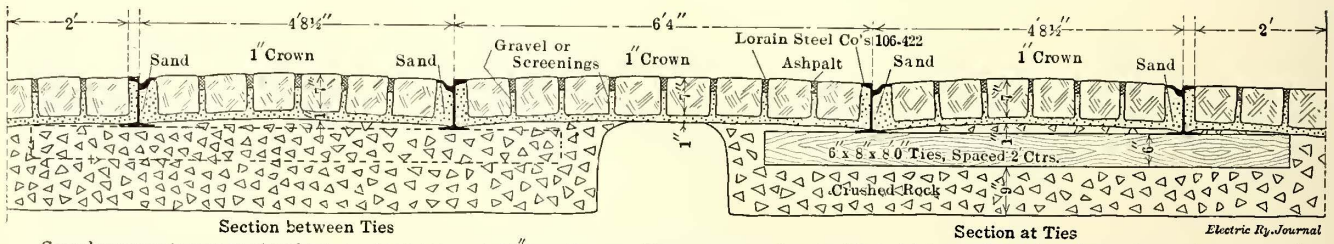
To break up the old foundation, the asphalt or other pavement is first stripped from the track. The 3100-lb. drop-hammer is then used to break the concrete paving base between the tracks. About six blows of this hammer are also delivered at one end of each yoke to crush the concrete about it and free the end of the yoke so that a pulling link may be slipped over the end of the yoke. A 13-ft. lever, as shown in the illustration on page 465, is then slipped through the link. This lever is made of 141-lb. girder rail. The outer end of this lever is placed upon one end of the yoke, and the link is placed under the lip of the other end of the yoke and over the lever. The other end of the lever is attached to the cable at the end of the boom. The derrick car, or a 5-ton crane car on the opposite track, then begins to pull the yokes out by means of a cable attached to the end of the lever. By this combination of leverage a powerful pull, estimated to be in some cases 35 tons, is obtained on the link. This process lifts one end of the yoke out and tears it bodily away from the track. It also tears up the old concrete and fractures it so that everything is lying about loose after the yoke is pulled.

On the outer end of the lever is a lug, which passes over the end of the yoke, and on the lever at the link is another lug which prevents the link from slipping. This also prevents the lever from slipping off the yoke or the link from slipping off the lever and the harder the derrick pulls on the yoke the tighter the link will hold. The only limit of pull obtained is the strength of the yoke and the strength of the derrick.

Another crane follows the pulling derrick and lifts the yokes from the concrete, leaving them ready to be loaded on the car by hand. The derrick car is then sent to the shop and within two hours is returned to the job rigged up with a drop-hammer. This drop-hammer works on the



San Francisco Track—Standard Track Construction with Asphalt Paving

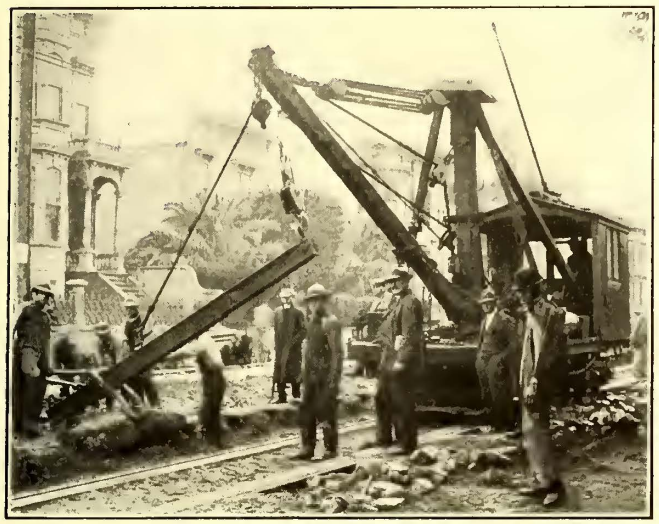


Gravel or screenings to be placed between blocks to a point 2" from the top. The upper space is to be filled with hot asphalt with a layer of screenings or gravel spread over top of blocks. Use 1-50 gal. barrel of asphalt to 250 □' of paving. Ballast and crushed rock base to be flushed thoroly full of sand with water. Crushed rock, from bottom of tie up, to be filled in in two layers, each layer being well rammed. Blocks must be well rammed after laying and before grouting.

San Francisco Track—Standard Track Construction with Block Paving

track opposite the track which has been pulled, the hammer being located on the outer end of the boom. The boom of the hammer is swung out, and the hammer legs are placed on the pieces of concrete which are lying in the ditch. Successive blows are applied, from two to six blows being sufficient. The pieces of concrete are gradually broken in this

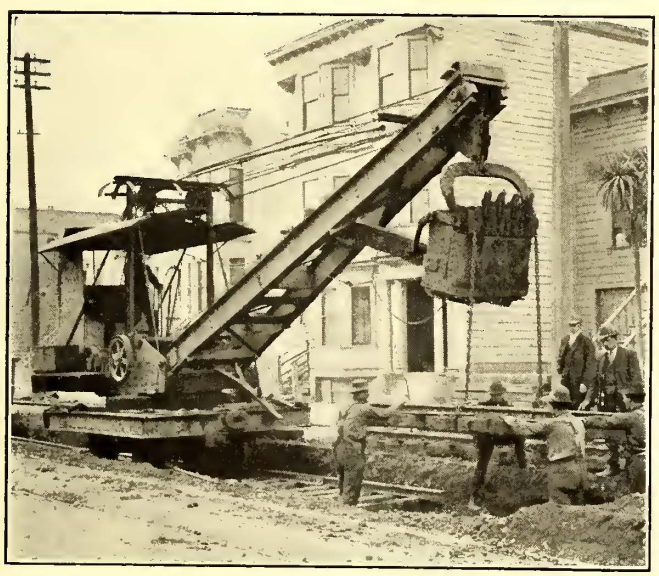
way, large and small. The top layer is broken first. The small pieces are then placed at the side of the trench, after which the hammer goes over the job once more, repeating the process and breaking up the remaining pieces of concrete which were on the bottom layer. It is not necessary to shatter the bottom layer completely. It is sufficient if the pieces of concrete are forced into the soil far enough so that there is space for tamping the ties above them.



San Francisco Track—Tearing Up Track of Old Cable Railroad

San Francisco Track—Portion of Lever and Link Over End of Cable Yoke

The track gang follows the yoke-pulling apparatus and lays a permanent track on the sub-grade. On this permanent track follows the portable crusher, which has a capacity of about 60 cu. yd. per day of nine hours. The pieces of concrete which were lying at the side of the trench and not completely broken up by the hammer are then crushed by this portable crusher, which drops the crushed rock directly in the track between the ties so that the only work which remains is for the track to be jacked up, surfaced and lined, etc. This process of hammering brings down the cost on this particular line of the work 62 per cent over the method in which the concrete is broken with gads and sledges by hand labor.



San Francisco Track—Shovel Car Laying 10-Ft. Temporary Track Section

San Francisco Track—Shovel Car in Service Laying Its Own Tracks

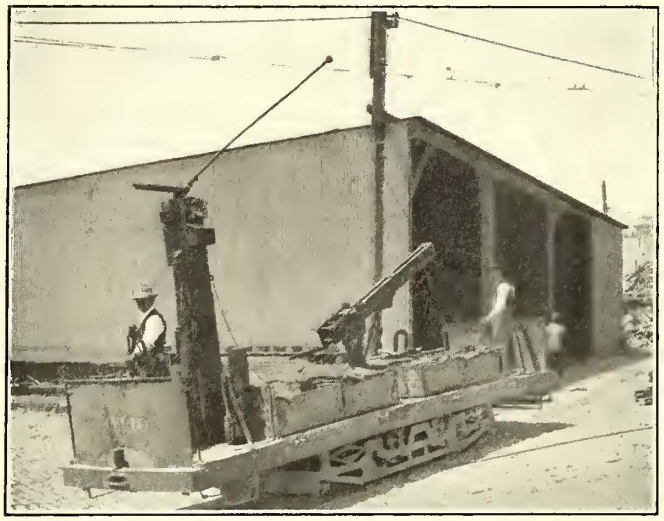
CONCRETE PULLER HOOK

When it is necessary to tear up concrete paving base and asphalt in the track without destroying ties, rails and otherwise damaging the track, a large two-prong hook is used in conjunction with the derrick car, the hook being attached to the end of the derrick rope. The derrick then pulls on the cable, and the hook tears up large pieces of concrete and asphalt. These pieces sometimes are 6 ft. long and the same width as the space between the rails. This process breaks the concrete up in small pieces which are easily loaded in the car or may be placed at the side of the track ready for crushing by the portable crusher, as the case may be. A view of this hook in the concrete is shown.

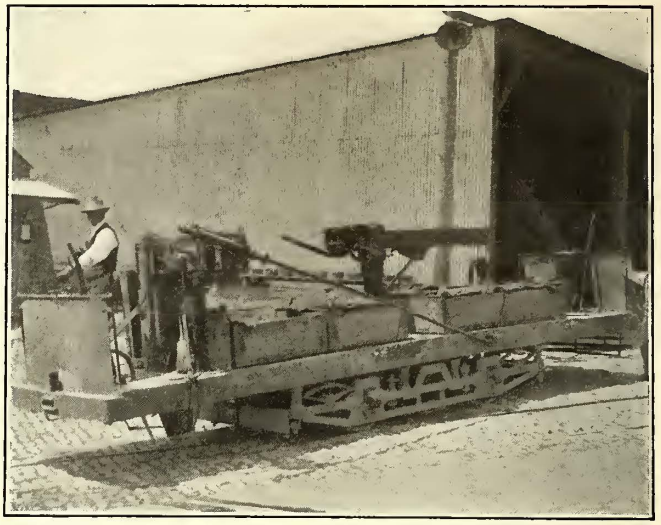
BITUMEN CAR

The United Railroads do a great deal of street paving and have found it desirable to have their own bitumen plant, which is at the corner of Market and Valencia Streets. The bitumen is prepared in the usual way, but the method of taking it to the points where it is to be used is novel, as it is conveyed in a special car. This car is fitted with a 3000-lb. hand-operated pillar crane hoist, which can swing in a full circle, and carries the bitumen in boxes, each box capable of holding ⅔ cu. yd. The usual capacity of the car is six boxes, but eight boxes could be carried if necessary. The view on page 466 shows the car being loaded at the plant where the bitumen is discharged directly from the mixer into the boxes on the car. After the car runs

to the point where the bitumen is required the boxes are unloaded from the car by the crane at points which are most convenient to the paving gang. The car is then run back to the plant for another set of boxes which have been prepared in the meantime. This work of unloading boxes on the street is easily done in a few minutes between the regular passenger service, there being no hold-up of passenger cars on this account, except possibly a minute in some cases. The company is equipped with two of these cars, which take the place of five dump wagons and teams.



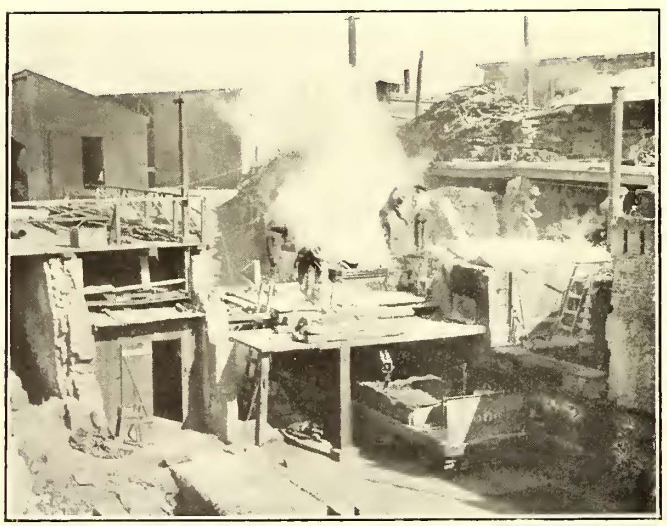
San Francisco Track—Bitumen Car Loaded with Six Filled Boxes



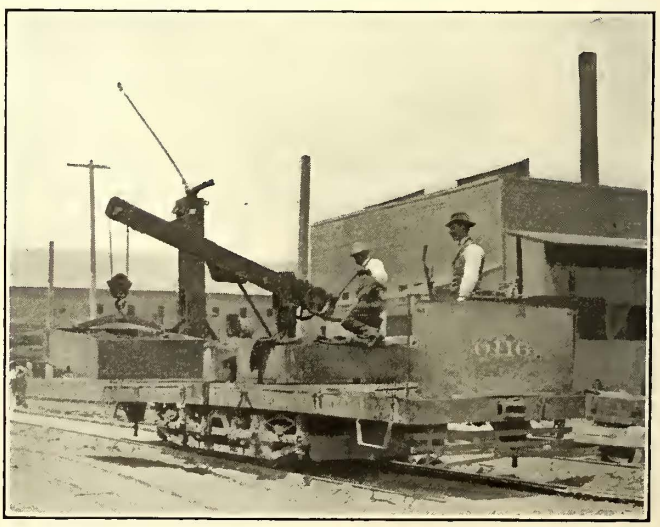
San Francisco Track—Bitumen Car with Trolley Pole Collapsed and Crane Made Horizontal

The crane and the trolley post are made collapsible on account of the head room under the mixing platform at the plant. As this platform is so low, it was necessary to reduce the extreme height of the car crane and trolley post to 7 ft. Before passing under the platform the trolley post and crane are dropped to the low position and can be raised to the working position after the boxes have been filled and the car leaves the platform. The crane was made by the company.

The bitumen paving, 2½ in. thick, is placed on a 6-in. concrete base in and between the tracks. The header blocks, which may be basalt or paving bricks, are laid on the sand on a cement cushion mixed in the proportion of one to four, the space between the blocks being filled with cement grout mixed one to two. Where the tracks are paved with basalt blocks, they are placed on a loose rock foundation, the loose rock voids being filled by flushing sand in with water, the blocks afterward being grouted with liquid asphalt.



San Francisco Track—Loading Bitumen Car at Plant



San Francisco Track—Unloading Boxes Filled with Bitumen

ASPHALT SCOOP

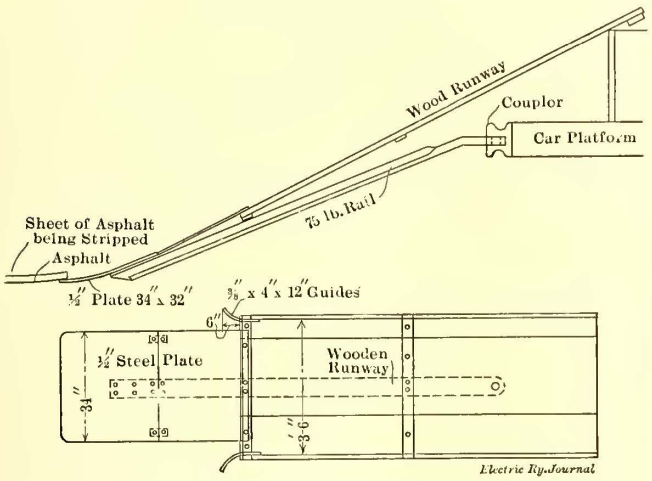
A new machine for removing asphalt between tracks, recently developed by the company, is shown in the sketch on page 467. It is essentially a scoop or plow which is carried in front of a work car which tears up the asphalt directly from the street and loads it into the work car as the car proceeds. The scoop or plow portion consists of a ½-in. steel plate, 34 in. wide and 63 in. long, with a sharp and slightly turned-up front edge. This scoop is supported at the front end of the car on a 75-lb. T-rail frame, about 10 ft. in length. The upper end of this rail is provided with an eye which fits into the coupler on the car to be loaded. A wooden runway or platform extends from the scoop to the loading car. This platform is 4 ft. wide and 15 ft. long. It is provided with sides to guide the asphalt and is sloped at an angle of about 25 deg.

When this apparatus is put in service the asphalt at the starting point is raised with bars slightly, and the point of the scoop is forced under the asphalt by moving the car ahead. As the car proceeds, the strip of asphalt between the rails is forced up the incline and drops over the end of the platform into the car, automatically piling itself, with the aid of two or three men.

Under good conditions asphalt has been loaded by this method with the car running forward at a speed about as fast as a man ordinarily walks. This, however, is not always the case, as occasionally bad spots of asphalt, which cause trouble, are reached.

ELECTRIC ARC WELDING

The company has used very extensively electric arc welding for welding combination joints and in filling in worn spots on the tops of rails, in hollows and in cupped joints. The practice will not be described here because an extended account was published in the ELECTRIC RAILWAY JOURNAL for Jan. 11, 1913. The experience of the company with this method continues to be very satisfactory.



San Francisco Track—Construction Details of Asphalt Paving Scoop

San Francisco Track—Sand Elevator in Operation Loading a Supply Car

SAND ELEVATOR

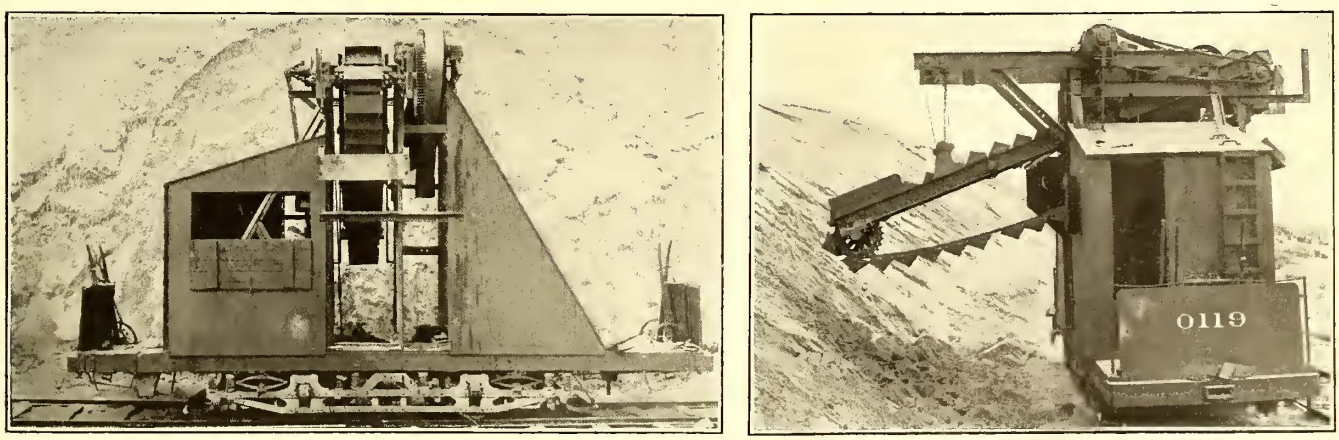
Another appliance used by the way department for securing and conveying sand is illustrated in the three engravings on this page. It is a sand elevator which was made by the company in its shop out of old material, the frame being made completely of old slot rails from the cable tracks. It has a swinging elevator, 21 ft. 7 in. long, the upper end being supported by the frame of the car and the lower end being free to swing. The lower end of the elevator may be raised from its lowest position to a height of about 10 ft. above the track. The car is placed on the track parallel with the sand bank and as close to it as is found possible. The outer end of the elevator, which is located across the car and projects about 8 ft. from the rail, is then lowered into the sand bank. The elevator buckets then excavate the sand and after raising it drop it into a chute on the opposite side of the elevator. It then passes into the car to be loaded, which is on another track parallel with the loading track. The force required to operate this elevator is one operator and one laborer at the end of the elevator.

The sand bank from which the company gets most of its sand is located in the suburbs of San Francisco on Twentieth Avenue, among the sand dunes, where there is an inexhaustible quantity of sand drifting in from the ocean. The bank is at the side of Twentieth Avenue car line, and a spur track leads from the car line to the sand bank. All sand used by the United Railroads is loaded into cars by this machine, which has practically done away with hand labor for loading sand at the sand bank. The sand is used for paving, fills and other work requiring sand. Cars are loaded by this method for a cost of from 3 cents to 4 cents per cubic yard, which is one-half or less than one-half of the cost of hand labor.

STANDARD TRACK CONSTRUCTION

To complete this article and possibly make clearer the purposes of the different track machines described, sections of the company's standard track construction and paved streets are presented. The present standard rail section is the Lorain No. 104-422, with 36-in., twelve-bolt bridge-truss angle plates.

For the past two years the company has been using titanium steel rails and insists upon having all angle plates for these rails rolled from titanium metal also. This practice is followed because the company has found that these plates stand up much better than when angle plates of softer metal are used. These softer plates would tend to crush down or flatten out under the end of the receiving rail, and this condition would be followed by cupped joints. As yet the company has not experienced any corrugation on the titanium rails, although corrugation is frequent on the ordinary rails on account of the steep grades throughout the city and the consequent necessity for the frequent use of the braking equipment.

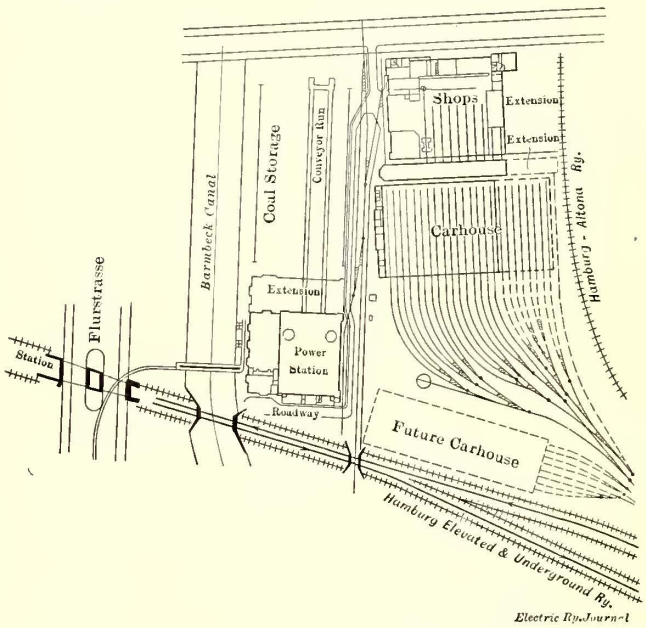


San Francisco Track—Side and End Views of Sand Elevator Equipment Built by the Company to Take Sand from Dunes in the Suburbs of San Francisco

Shops and Carhouses of the Hamburg Rapid Transit System

A Description of the Interesting Constructional and Maintenance Features of These Buildings

An excellent example of the best Continental practice in car maintenance is the new carhouse and shops of the Hamburg Elevated & Underground Railway. These structures are conveniently located adjacent to the power station on a plot close to the Flurstrasse station at Barmbeck, one of the suburbs. This property is bounded on the



Hamburg Shops—General Plan of the Railway Properties at Barmbeck

south by the Hamburg system's own tracks, on the east by the Hamburg-Altona single-phase interurban railway, on the west by the Barmbeck canal and on the north by a public highway. Coal, machinery and other supplies are transported directly to the property over a spur track which extends from the lines of the Prussian State Railroads.

The arrangement of buildings as presented in an accompanying plan shows that the site selected permitted provision to be made for ample enlargements of the three structures named and even for the construction of a second carhouse, the latter to be placed directly along the rapid transit right-of-way. The wisdom of this policy has already been demonstrated, as the remarkable growth in traffic has made it necessary to enlarge the present carhouse to its ultimate capacity. The extension of the shops and of the transfer table between the shops and carhouse will, when made, correspond with the enlargement of the carhouse. However, the excellent behavior of the rolling stock is not likely to make this extension necessary for some years.

CARHOUSE

The carhouse proper as first constructed consisted of four bays having a total frontage of 226 ft. 4 in. and a depth of 183 ft. 4 in. In addition, a group of office and utilities rooms with a maximum width of 18 ft. was laid out along the complete length of the west side of the carhouse. The carhouse consisted of four four-track bays, each track serving four cars. It was believed that this capacity would be ample for some years to come as the total rolling stock did not amount to more than eighty cars. Owing to the rapid increase in traffic, however, it was necessary to order fifty additional cars before the first year of operation had been completed. In consequence, the carhouse has been enlarged by adding two four-track bays, which are similar in every respect to those of the original building which is shown in the accompanying cross-section and halftone views.

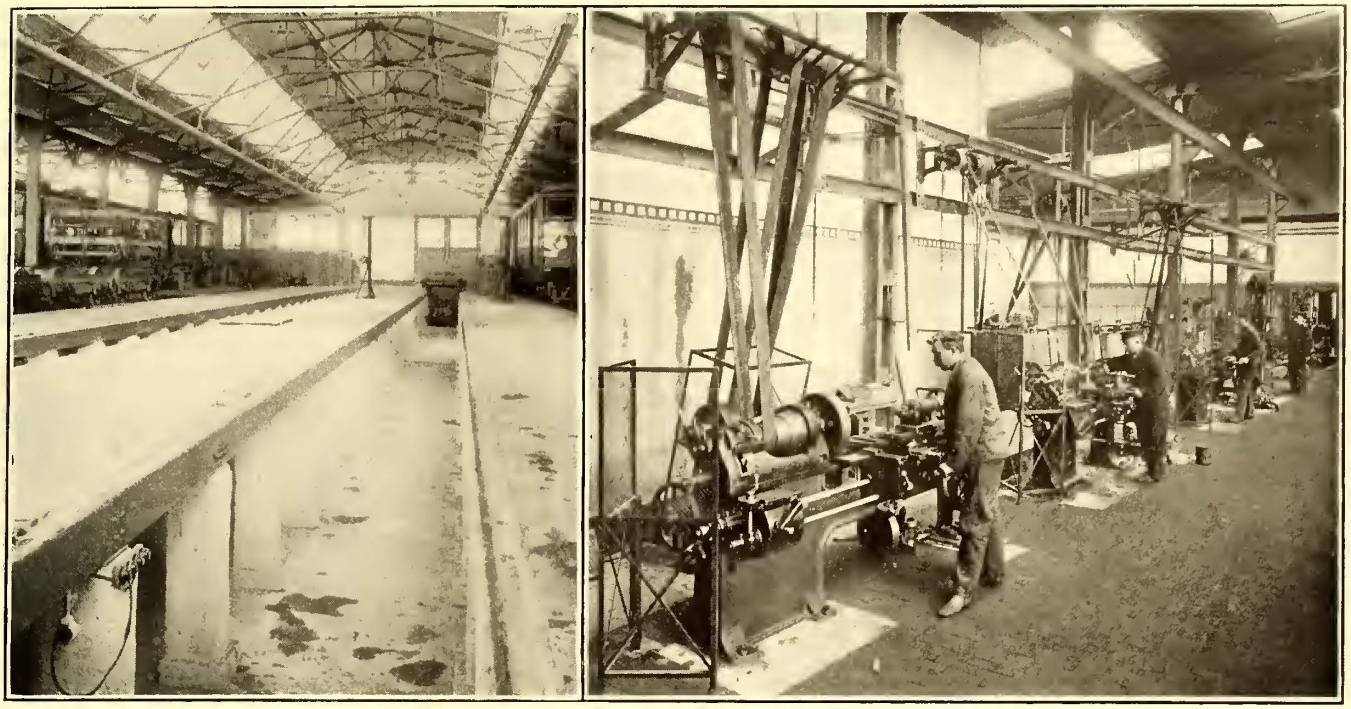
The main walls of the carhouse are constructed of steel and 15-in. red brick, but a large amount of glass is framed into the structure above both the front and rear track openings. Furthermore, the swinging doors which cover these track openings have almost all of their upper half completely glazed, thus affording a most effective addition to the natural light given by way of the longitudinal skylights in the roof.

The roof is carried on eight steel trusses, all of approximately 55 ft. span. Each of these trusses, which are of the rather unusual form illustrated, carries two wire glass skylights for the complete length of the bay. The rest of the roof covering consists of ordinary concrete block. The general direction of the carhouse when facing the rear

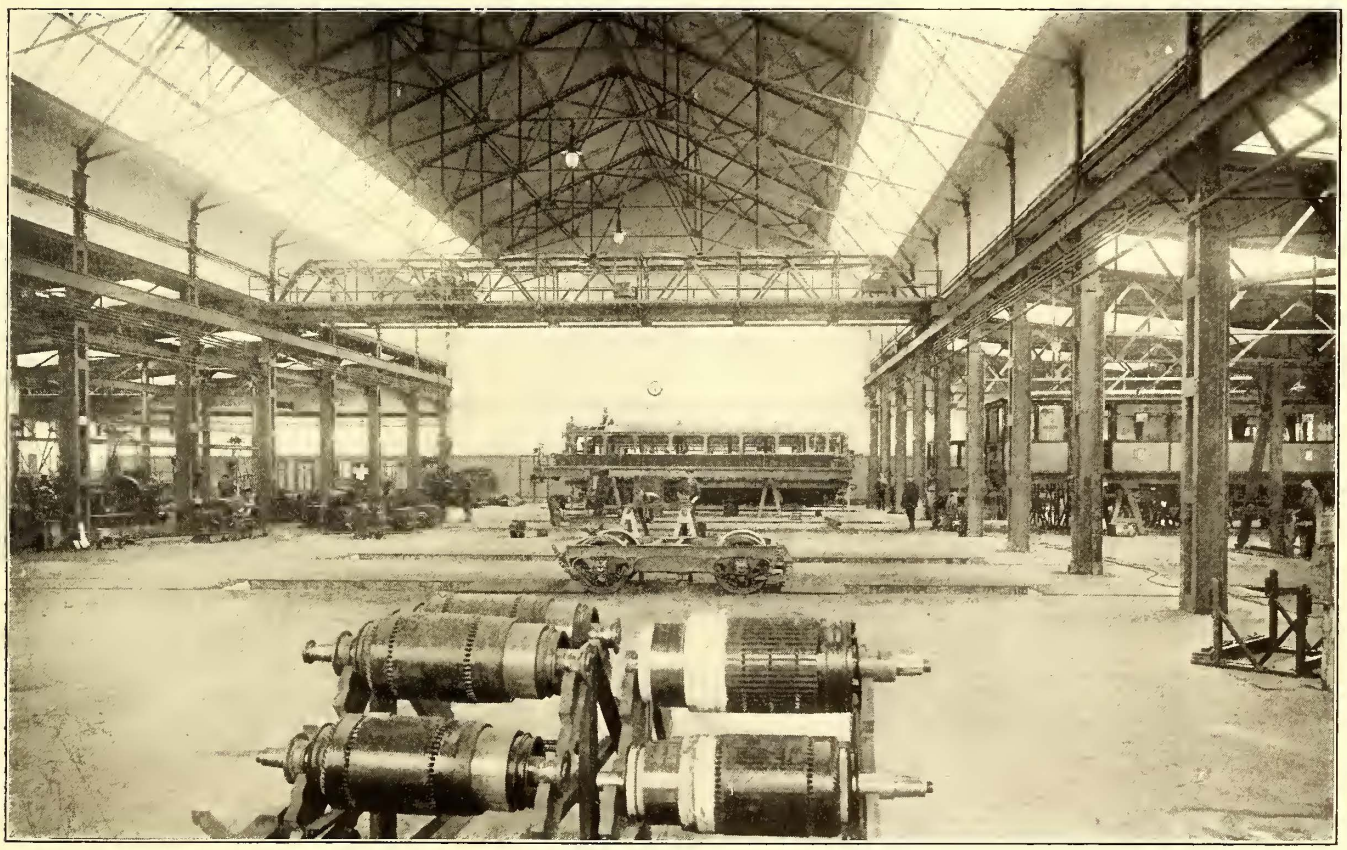
Hamburg Shops—Front View of Carhouse Before Construction of Addition

is north-northeast. For purposes of fire protection, the carhouse is divided into two eight-track sections by a 10-in. brick partition which extends the entire depth of the building, except that a clear opening of 8 ft. 2 in. is left within 4 ft. 1 in. from the front and rear pilasters respectively. The subdivision into four-track sections is ob-

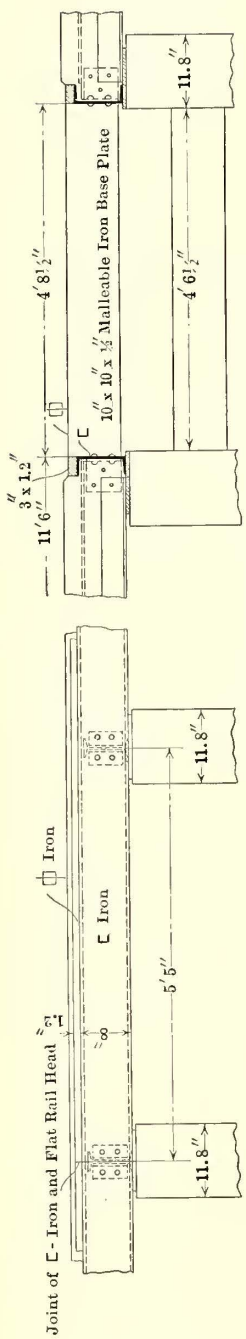
tained by rows of double-channel columns spaced about 16 ft. 5 in. The distance between tracks between these columns is 16 ft. 5 in. and elsewhere 13 ft. 1 in. The clear width between the hinged doors at the track openings is about 11 ft. 5 in. With the exception of the first track in the first bay, pits about 4 ft. 11 in. deep are provided throughout. These are of the open type and they are placed between hard-burned brick devil-strips which, including the pit rails, are 8 ft. 6 in. wide. These devil-strips are crowned to drain between the pits on each side. A rather interesting feature of the pit construction equipment is that the running rails consist of channel beams to which a tread piece is riveted flush with the devil-strip, as shown in an accompanying drawing. The channels themselves rest on a 10-in. x 10-in. x ½-in. malleable iron plate installed on top of each pit column.



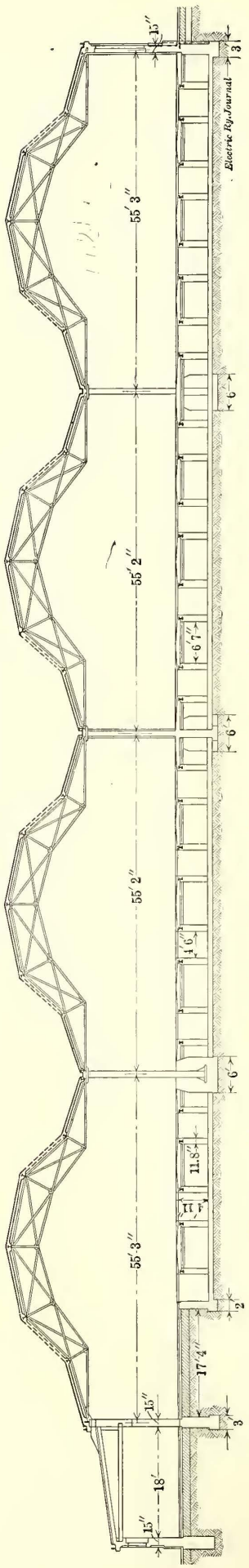
Hamburg Shops—Detail of Open Pit Construction and View of Machine Tools Fitted with Protecting Screens



Hamburg Shops—Interior View, Showing the Truck-Overhauling Shop with Machine and Car-Body Sections at Left and Right Respectively



Hamburg Shops—Detail of Pit Construction, Showing Separate Rail Head



Hamburg Shops—Cross-Section of Original Carhouse Before Addition of Two Bays of Like Width

The building is liberally provided with standpipes and firehose, which are kept in glazed boxes to prevent deterioration from dirt, unnecessary jostling, etc. Fire hydrants are also installed in the yard. Instead of using fire standpipe connections for car washing, small Siamese outlets are built into the devil-strips for the purpose. These outlets are covered when not in use. The radiators under the devil-strips are furnished with exhaust steam from the turbines at the nearby power station. To light the pits, lamps are plugged in only when needed.

Power for moving cars in and out of the building is taken from overhead rails which are installed above the devil-strips. Connection between this contact rail and the third-rail shoe is obtained by means of a wooden pole, the upper end of which has a grooved metal runner for the contact rail and the lower end a lug which fits into a hole at the bottom of the shoe. At first the upper end also had a spring attachment whereby the desired pressure necessary for current collection was obtained without the use of a wheel contact or similar device. In practice, however, it was found that the pressure of the springs of the third-rail shoe would be ample for current collection. The contact pole, therefore, has been simplified, as shown in an accompanying sketch.

CONSTRUCTION OF SHOPS

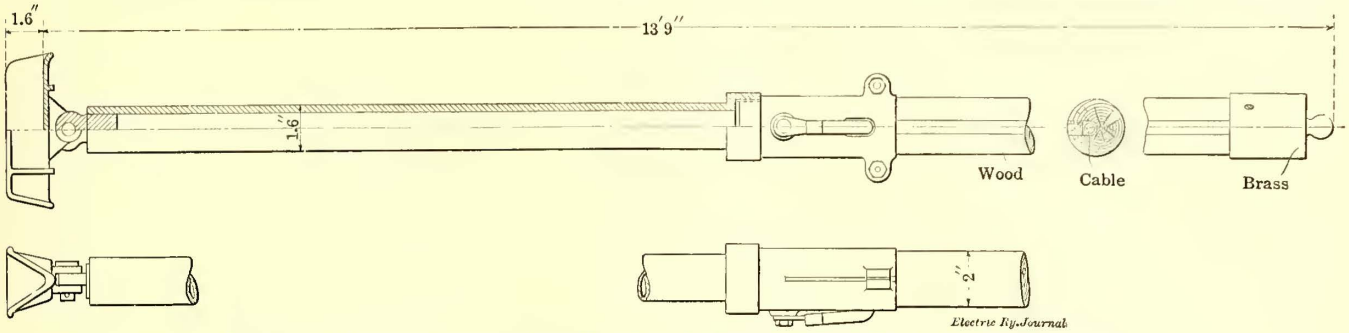
As noted, the repair shops are located practically in line with the carhouse. The interchange of cars between the two structures is afforded by a transfer table, 33 ft. wide, the motor of which, like all other motors throughout this installation, is operated on 220-volt, three-phase current. The speed of this transfer table is about 2 ft. per second.

The construction materials of the shop building are of the same general character as the carhouse, but the skylights and side-sash arrangements differ in the several parts. Thus the skylights of the car-body overhauling section are similar to the longitudinal type used in the carhouse, those of the central or truck overhauling bay are at right angles to the tracks for the convenience of the crane run, while small individual skylights are used elsewhere. Large window areas are also provided in addition to the excellent roof lighting. The best example of natural lighting is the mill room, where almost the entire outer side is composed of steel-framed sash. The view of this room also shows the comparative area and position of the swing sash for ventilation. An incidental advantage of this construction is that the sash can be easily removed when it becomes necessary to dismantle this side of the building in order to extend the shops. The floors of the shops are paved with concrete, but wood is used also near the machine tools where the men have to stand for long periods.

A pleasing feature of the interior painting of both the carhouse and shops which alleviates the usual monotonous appearance of such buildings is the wainscoting effect which is given to the walls by applying different kinds of painted borders. Several decorations of this kind will be noted in the accompanying views. Usually they consist of a grayish-blue border about 1 ft. wide at the floor line, a 6-ft. to 7-ft. belt of some lighter shade and an ornamental striping, the rest of the wall being painted white. The doors of various rooms and compartments are painted to harmonize with this scheme of decoration. The extra cost of this work is really of no importance, as the striping is cheaply applied by means of stencils. In order to keep the walls as clean as possible, work where the spattering of dirt or oil is unavoidable is carried out in inclosed chambers as described later.

Damage from fire has been minimized by the installation of brick partition walls for such places as the paint shop, mill room, smithy, stockroom, etc. In addition, the intermediate trusses in the mill room are covered with reinforced wire concrete. The fire-fighting equipment consists of large hydrants and inside standpipes, all of which are

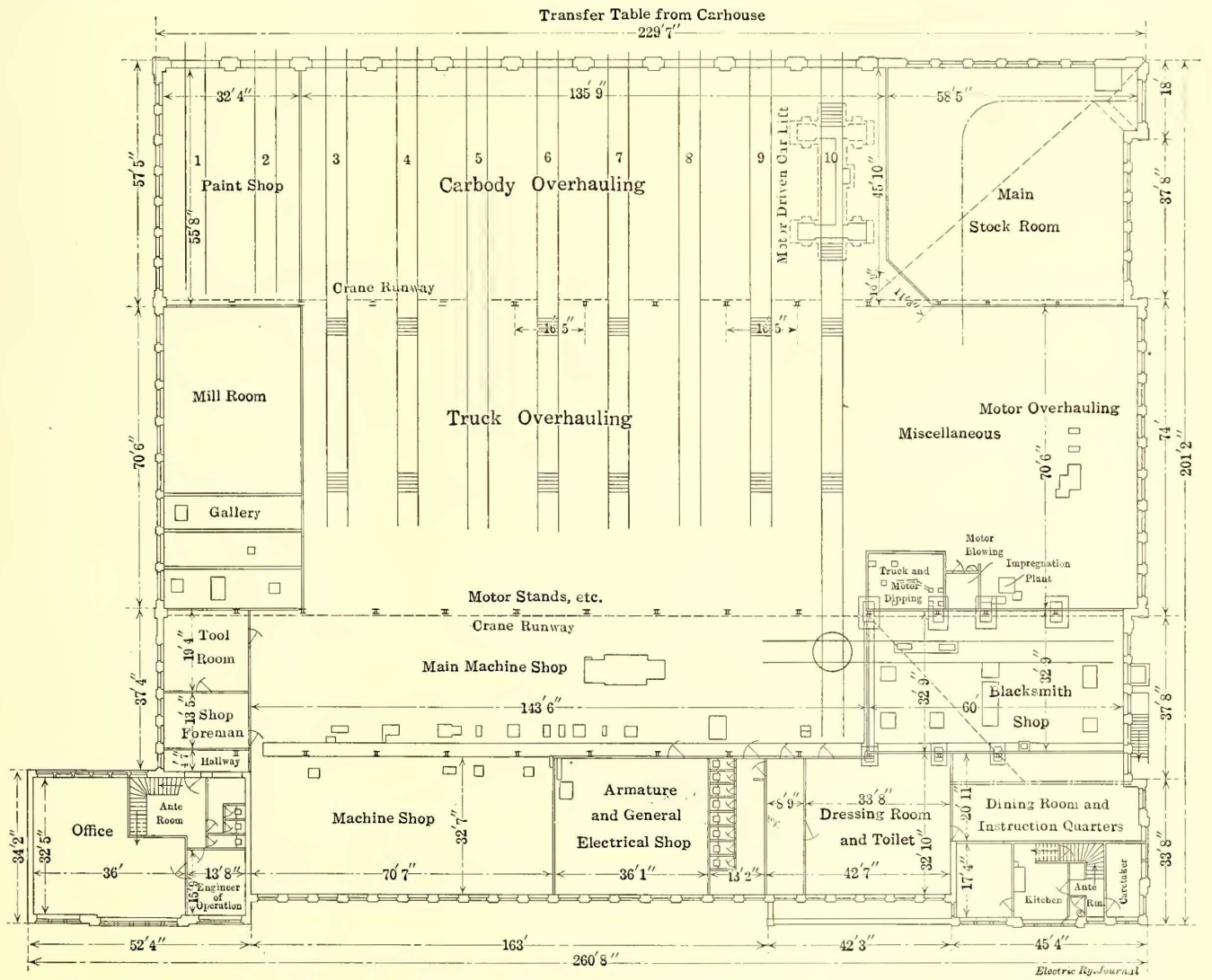
supplied at the city pressure of five atmospheres (approximately 75 lb.). The caretaker of the shops is an experienced fireman, who has selected and trained a corps of men for fire-fighting. The fire alarm can be given by means of the two electric sirens which are used to note the beginning and ending of the working day. The building is heated by steam pipe lines from the power plant.



Hamburg Shops—Construction Details of Contact Rod Used in the Carhouse

GENERAL ARRANGEMENT OF THE SHOP

The general layout and dimensions of the several parts of the shop structure are shown in the accompanying plan. on the right by the paint shop, 32 ft. 4 in. wide; truck overhauling section, 70 ft. 6 in. deep, but of the same width as the car-body shop and located directly behind it, flanked on the right by the mill room but continued to the wall on the left as a miscellaneous motor-overhauling section; the machine shop, of L-shape, the longer leg, which is 140 ft. 6 in. wide and 37 ft. 4 in. deep, placed directly back of the truck shop and the shorter leg, 70 ft. 7 in. wide and 32 ft. 7 in. deep, extending to the rear wall; tool room and shop foreman's office on the left side of the machine shop



Hamburg Shops—Plan of Shop Structure, Showing Relation Between and Areas of the Several Departments

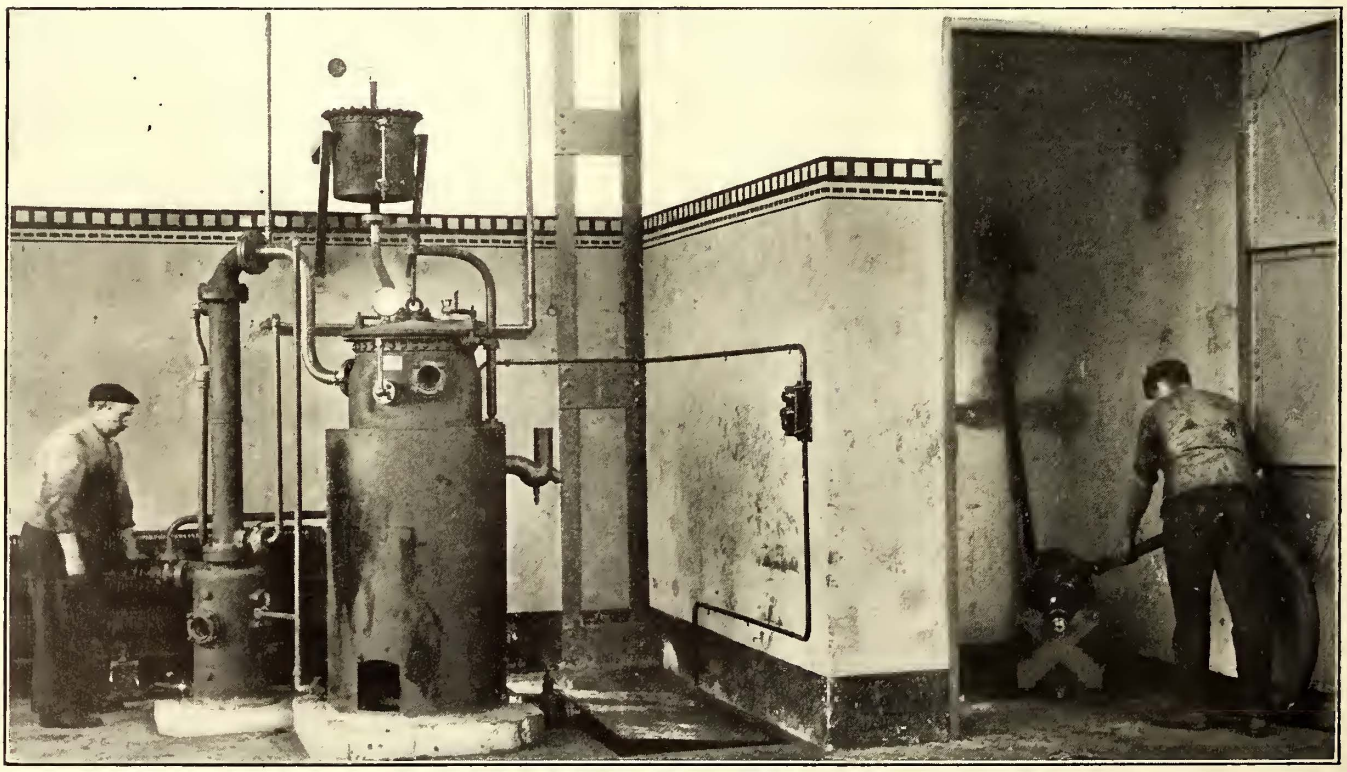
The entire building is approximately 260 ft. 8 in. long and 201 ft. 2 in. deep. At present this area, as seen from the transfer table, is divided as follows: car body overhauling section, 135 ft. 9 in. wide and 56 ft. 7 in. deep, flanked on the left by the main stock room, 58 ft. 5 in. wide, and and blacksmith shop, 60 ft. wide, on the right side of the long machine shop; armature shop, 36 ft. 1 in. wide; dressing room, toilet, dining room and construction quarters and employees' kitchen located in line with the short machine shop.

HANDLING OF CARS AND MATERIAL

It is clear from an inspection of the plan that the shop layout is very well adapted for the logical handling of maintenance work. Furthermore, the benefits of this arrangement have been fully utilized by installing an ample number of cranes, hoists and the like. The transfer table furnishes communication both to the paint shop with its two one-car tracks of flush construction and to the eight two-car tracks which pass through the car-body and truck-overhauling sections. The latter tracks extend to within some 17 ft. of the line of columns which marks the boundary of the longer machine shop. In the truck-overhauling shop six of the eight tracks are built with closed pits, but in the body-overhauling shop track No. 10 has a pit which is furnished with the motor-driven screw-type car hoist shown in two of the accompanying views. This hoist is operated by a 7½-hp motor and is capable of lifting a 20-ton car body at the rate of 0.18 in. per second on the four steel bearers which run on wheels, as shown. Track No. 10 is continued as far as the blacksmith shop, to which entrance is obtained by means of a turntable.

After the car bodies have been raised the trucks are pushed into the truck-overhauling shop, where the parts of dismantled cars are transported by a 7½-ton crane, the runway of which extends to the end of the miscellaneous motor shop. Thus the crane carries trucks and motors to their respective dipping tanks, motors to the motor stands, and wheel axles and other parts to the machine shop. The hoisting speed of this crane is 0.2 ft. per second, the transverse travel 1.6 ft. per second and the longitudinal travel 3.6 ft. per second. Furthermore, the two lines of tools in the machine shop are served by a 5-ton crane, consisting of a hand hoist and electrically operated bridge. The stockroom also has an overhead track with hand-operated

Hamburg Shops—Interior of Carhouse, Showing Lighting Features, Pit Arrangement, Overhead Conductor Rail, Etc.



Hamburg Shops—Vacuum Impregnation Outfit and Chamber for Blowing Out Armatures

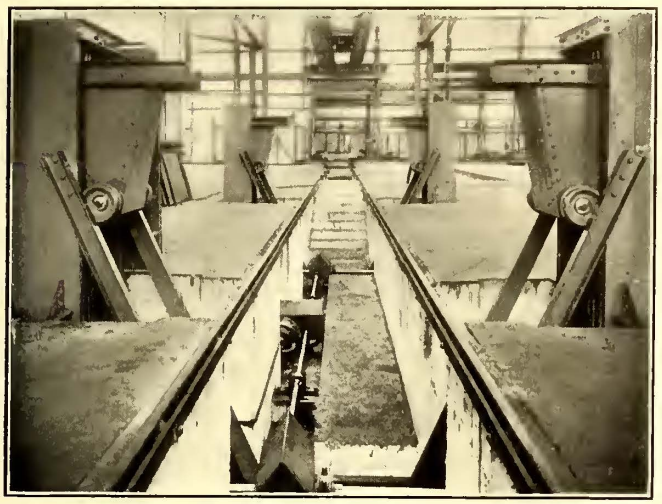
hoist whereby material can be brought within the reach of the 7½-ton crane or taken into the stockroom upon unloading from the steam railroad cars outside the stockroom.

MAINTENANCE PRACTICES

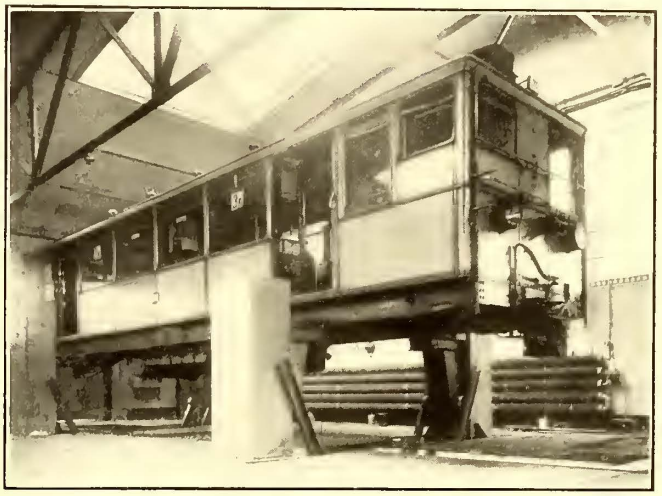
Some interesting maintenance practices of these shops are presented in several of the accompanying illustrations. Two halftones show a complete truck frame minus the journal boxes, which has been brought by the crane for dipping into a cleaning tank containing a solution of caustic soda steam-heated to a temperature of 100 deg. C. Ordinarily a steel, cement-covered sliding door completely closes this compartment at the floor line, but the top is left open to permit ingress and egress for the objects brought to the tanks. By this arrangement no dirty water can bespatter the main shop. A smaller caustic-soda tank, which is not visible in the illustrations mentioned, is provided opposite the larger tank for the dipping of motor shells. The use of a hot caustic-soda solution has proved very effective for the thorough and quick cleansing of metal parts.

Another illustration shows a compartment in which armatures are blown out with compressed air. In order to show the interior of this room the door was left open when the photograph was taken, but in regular operation the door is closed so that the dust will be drawn off directly through an exhaust without the slightest possibility of being blown into the shop. The same illustration shows an installation of the Passburg vacuum system of coil impregnation, the impregnation tank being set in the floor alongside.

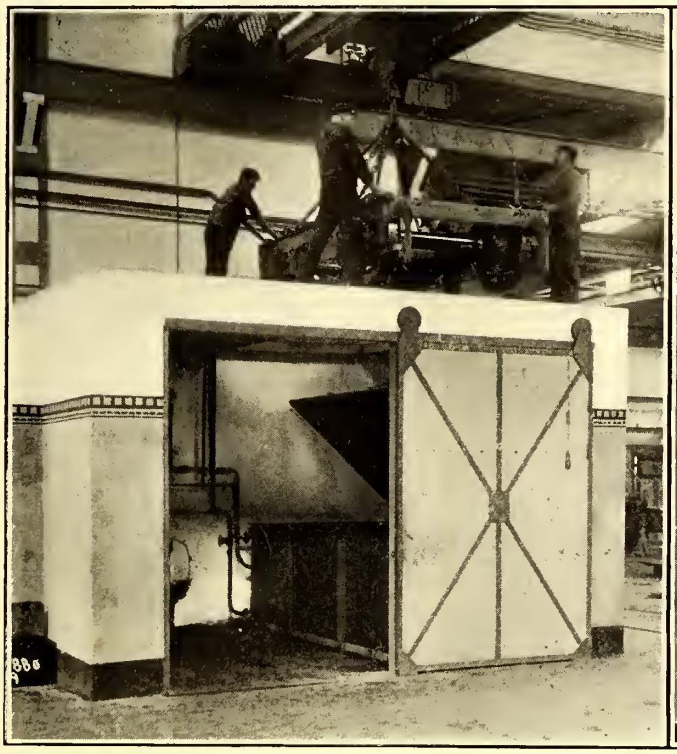
Another illustration shows the method adopted for removing and replacing armatures in the 100-hp motors, all of which are of single-shell construction. This purpose is attained by a combination of a stationary motor stand and of a carriage provided with a ram which fits into the end of the armature shaft. The motor is first placed on the stand with the aid of the 7½-ton crane. Then its end



Hamburg Shops—Electrically Operated Car Hoist



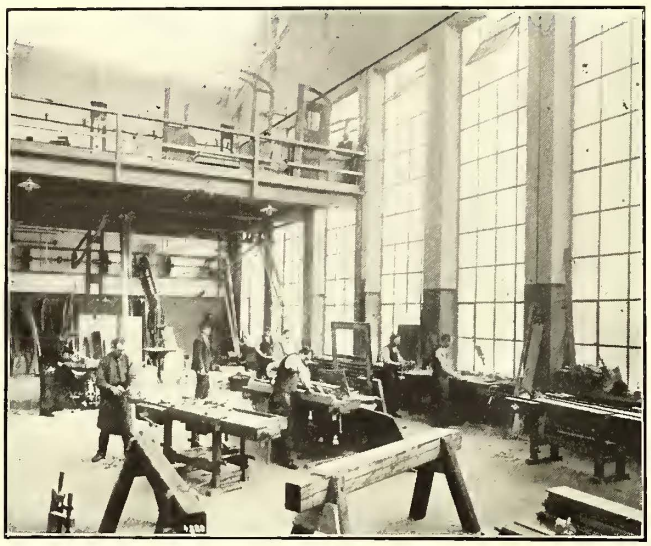
Hamburg Shops—Car Body Raised on Electric Hoist



Hamburg Shops—Crane Delivering Truck to Dipping Vat

Hamburg Shops—Truck Lowered in Dipping Vat

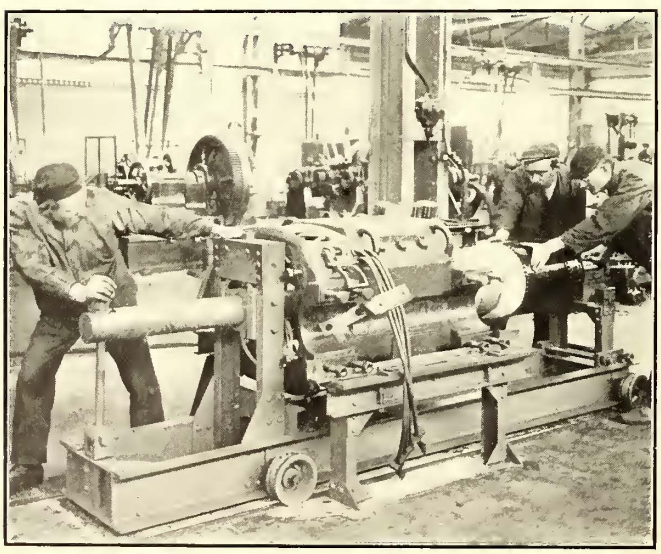
pieces, bearings, etc., are taken off, upon which the armature is ready for removal. All that now remains is to push the carriage along its track until the ram has forced the armature out. The armature will then be supported at one end by the motor shell and at the other end by a vertical frame on the carriage. In this position desired



Hamburg Shops—Glazed Side Construction in Mill Room

repairs can be conveniently made, or the crane can be used to transport the armature elsewhere. The armature is restored to place merely by pushing the carriage in the opposite direction.

The miscellaneous section of the overhaul shop contains a gas-ring equipment for expanding tires when off the wheels, but as yet no work of this kind has been necessary. Up to Feb. 15, 1913, the earlier steel-tired wheels had run 100,000 km (62,000 miles) without any replacement whatsoever. Gas is also used here for the soldering of armature leads and similar work. The machine shop contains the usual tools to permit the management to carry on practically every kind of maintenance work in addition to a certain amount of manufacturing if desirable. These



Hamburg Shops—Ram for Removing Armature

tools include two wheel lathes, shaper, grinder, buffer, drills, etc. Most of them are driven from independent three-phase motors through overhead belting. An illustrated feature which should be of special interest to Americans is the use of wire screens for inclosing the lower portion of the belting and of certain parts of the machines in order to insure protection to the workmen. The high-tension testing outfit is also railed off from the rest of the shop.

The blacksmith shop now contains four down-draft forges, although space has been allowed for four more; it also contains an air hammer. The electrically driven compressor which supplies power for this hammer further supplies air for blowing out armatures and for other miscellaneous work throughout the shop. No work of any account has been done in the armature shop as not a single burn-out has yet occurred on the system. The mill room contains a lathe, mortiser, rip saw, circular saw, grinder, sharpener, etc., all of which are operated from countershafting. This shop is prepared to do all kinds of body woodwork and in fact has already had occasion to rebuild cars in part on account of a collision.

A rather novel form of alarm is attached to the door of the stockroom. This consists of a cylindrical cage which is supplied with heavy steel balls, so that some delay is experienced in opening the door while the rattling of the balls is certain to attract the attention of the storekeeper.

The utilities rooms for the employees comprise a kitchen, dining room, dressing room and toilet, all of the finest character. The employees bring their own food, but the kitchen is provided to enable them to prepare hot luncheons. The dressing room is furnished with individual steel lockers. The toilet room is finished with tile flooring and has a hot-water supply from the power station. It is also equipped with three shower baths.

LINE INSPECTION AND REPAIR IN UTICA, N. Y.

The Utica lines of the New York State Railways and the Oneida lines of the New York State Railways (the electrified portion of the West Shore Railroad) draw power from the Utica steam plant of the Adirondack Electric Power Corporation. The railway company maintains the transmission line, charging the expense to the power company.

The railway company owns 30 miles of 17,500-volt line and the power company 8 miles of 60,000-volt line, all of which is maintained in this way. The high-tension line is patrolled continually and a private telephone system keeps the patrolmen in constant touch with the repair force. On the low-tension system the custom has been to repair carefully any portion of the line which developed defects, in this way keeping the general condition of the whole installation up to standard.

Beginning with this year, however, a new plan has been put into effect which will ultimately insure a much better condition of the line than was possible under the old method. The interurban line will be inspected in great detail every three months and the city overhead construction every six months. The inspection of feeder lines will be annual. The inspection is to involve the climbing of every pole on ladders and a detailed inspection of the equipment. A report of each day's inspection is turned in to the office at night.

The interurban line is divided into two sections, east and west, each one being under the charge of a foreman and four linemen. Three men are required for doing the work on the city lines.

The work of inspection is continuous excepting when the men are required for emergency repairs. The first thorough inspection will require about nine months, as there are many small repairs to be made. The next one, however, will require less time and it is expected that very soon the lines will be in such condition that they can be gone over every three months. The company believes that this policy will result in a reduction in number of interruptions and that in the end the maintenance will cost no more than at present.

Standardization on the Michigan United Traction

A Description of the Organization and Methods Employed in Rehabilitating Track and Roadway—The Article Includes an Account of the Standardization of Rolling Stock for the Interurban and Street Railway Lines, as Well as Other Shop Practice

The Michigan United Traction Company has recently undertaken a complete rehabilitation of its property and at the same time has organized a campaign of standardization of designs as well as methods in all departments. Much has been accomplished during the past year and still more work along this line is contemplated.

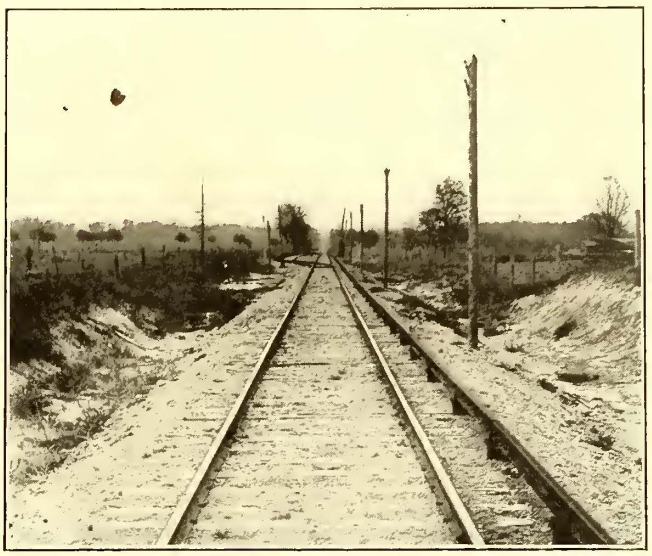
TRACK AND ROADWAY

A large proportion of the reconstruction work devolves upon the track and roadway department, which has developed a number of standards in design for track in paved and unpaved streets, as well as track on private right-of-way. These standards include roadway cross-sections, overhead transmission and trolley constructions and arrangements of bonding for the different types of special work.

Two standard types of track construction, one for paved, the other for unpaved streets, have been adopted by the track and roadway department. Both types include 100-lb. 6-in. T-rail, 24-in. continuous rail joints, 1-in. bolts and 34-in. compressed terminal cable bonds. The rails were purchased in 60-ft. lengths and laid with staggered, suspended joints. The difference between the two types of track construction lies in the kind of ties used and in the method of preparing the track foundation.

The rail is of a special design approximately conforming in section to the 100-lb. A. S. C. E. T-rail. It is 1/4 in. higher than the A. S. C. E. section and has a 3-in. head and a 5½-in. base as compared with the 2¾-in. head and 5¾-in. base of the latter. The slight difference in the height of the rail is met by increasing the web thickness 1/32 in.

Standard construction in paved streets includes an 8-in. concrete base, a 2-in. gravel cushion under the ties and 6-in. x 8-in. x 7-ft. white oak ties spaced on 24-in. centers. The gravel cushion under the ties increases the resiliency of the roadbed and permits the track to be laid and brought to exact surface after the 8-in. concrete base is in position and has had sufficient time to set. The 6-in. special rail section allows a 2-in. sand cushion under the paving material. In practically every case this paving material is brick with a special filler and stretcher of Nelsonville brick to provide a flangeway next to the rail. The track special work in paved streets is practically all of the hard-center design, with a 350-ft. radius in diamond turnouts and a 100-ft. radius in other turnouts. In every case white oak switch ties, 7 in. x 9 in., cut to exact lengths were used.



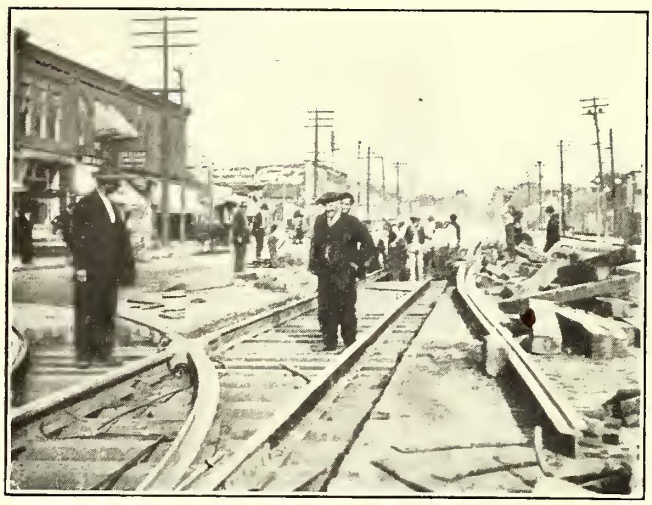
Michigan United Traction—Typical Section of Interurban Track

At the intersections of the electric line with the steam roads 100-lb. A. S. C. E. crossings were installed. These crossings provide an easier rail on the steam roads and a running guard rail on the electric line. In all instances hard-center crossings are used, except that where traffic on the steam road is especially heavy solid manganese

Michigan United Traction—General Repair Shops at Albion, Mich.

steel running rail was installed. In all cases the railroad crossing was laid on 8-in. x 10-in. x 10-ft. white oak ties with from 18 in. to 24 in. of crushed stone for a foundation.

Standard track construction in unpaved streets includes

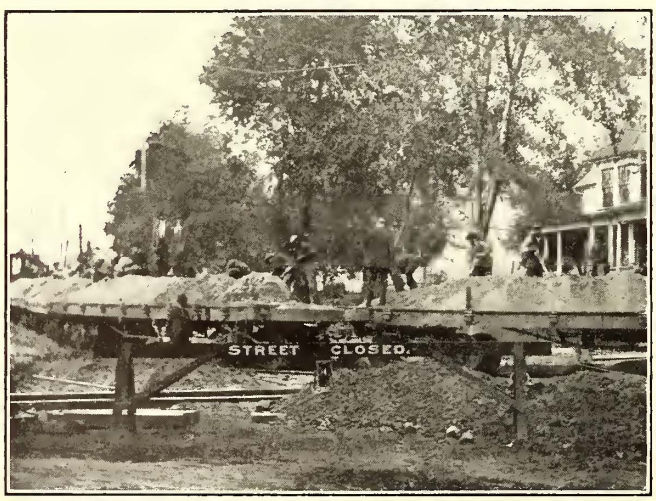


Michigan United Traction—Installing Track on Concrete Foundation

the same type of rail, joints and tie spacing as in paved streets, where the department can anticipate that the street will not be paved within four years. All track in unpaved streets is laid with 6 in. of gravel ballast under the ties. If the time set for paving the street is indefinite, 8-ft. cedar ties with tie plates ⅜ in. thick and 5 in. x 8½ in. in size, having a shoulder for 100-lb. rails, are installed. If the street is to be paved within four years, the track construction exclusive of the ballast is made to conform to that standard in paved streets.

METHOD OF LAYING TRACK UNDER TRAFFIC

Two methods are employed in laying track in paved streets. If it is possible to lay a temporary track in the street, thus permitting the removal of the old rail and ties without interference from traffic, the work of excavating and placing the concrete is let by contract. If this is not possible the work is performed by the company's forces.



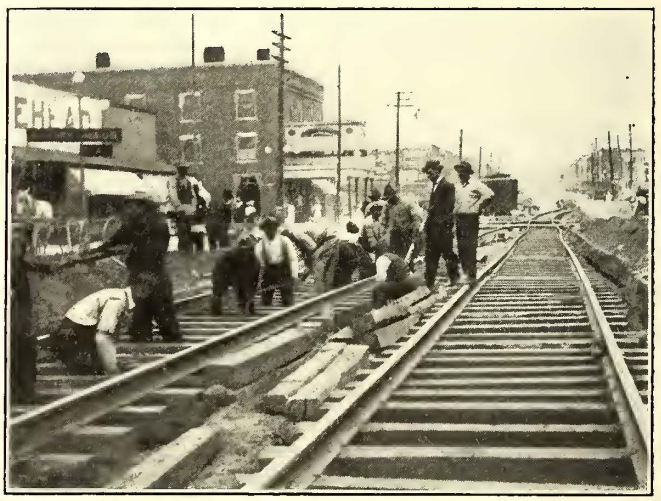
Michigan United Traction—Work Cars for Distributing Gravel on Unpaved Street

The work of mixing and placing all the concrete, the gravel cushion and the paving are handled by the contractor, the company removing the old ties and rails before he starts work.

At least seven days is allowed for the concrete to set before cars are operated over it. The gravel in the 2-in. cushion is actually coarse sand, and screened sand is used for the cushion under the brick. In all cases the filler employed in the brick paving is cement grout, and the space which is left between the edge of the brick and the web of the rail just outside of the track is filled with sand after the paving is in place. The grout filler combined with this sand forms a good quality of concrete. All concrete is placed in the trench by a continuous mixer, set either in the trench on a plank runway or beside the trench on the paving.

An especially low price was paid for concrete per cubic yard. This is due not only to the method of doing the work but also to the fact that all gravel is taken from pits owned by the company. Eight of these gravel pits are operated, and furnish a supply sufficient for all interurban and city work.

After all other work in connection with the laying of track in paved streets is completed, the ball of the rail at all joints is ground to surface. The company has two Kerwin rail grinders which it employs in this work. In repairing cupped or badly worn joints in track in paved streets Atlas special joints are employed. A special study is made of the requirements of each joint to be repaired, and if the wear is uniform on both rails a new straight



Michigan United Traction—Preparing Double Track for Concrete While Continuing Traffic

joint is applied and the rails are ground on both sides, giving a long approach. If one rail is cupped the offset joint is applied and both rails are ground to a perfect surface.

In the track rehabilitation work which was done in 1912 the standard spikes were 5½ in. x 9/16 in. in size. Owing to the fact that a great many ties were under size or checked by seasoning, the large spikes split them, and as a result of this experience the company has decided to use 5-in. x ½-in. standard spikes in oak ties and 5-in. x 9/16-in. spikes in cedar ties and switch ties.

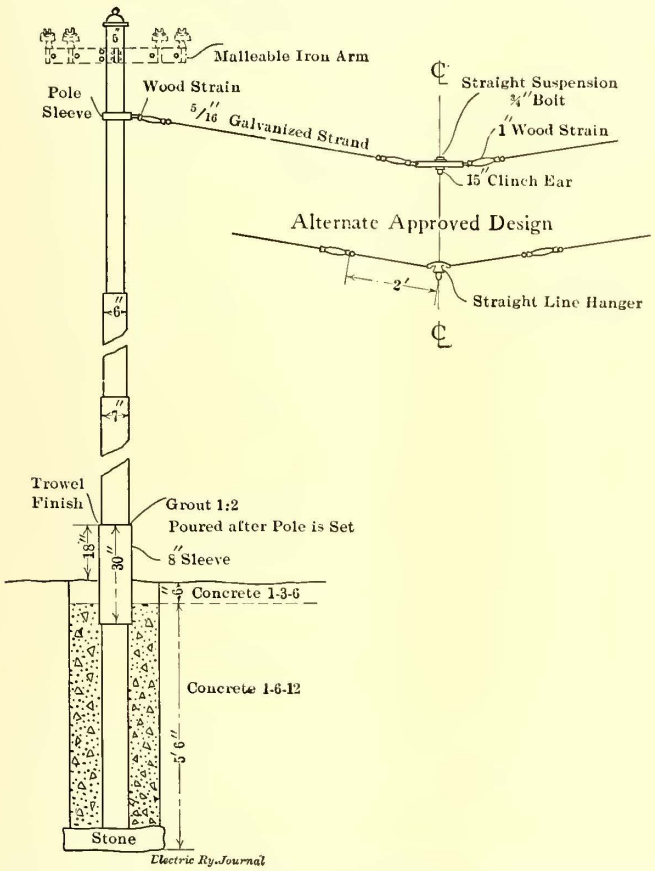
A special gang is detailed to install the bonds in each city for both construction and maintenance work. As a direct result of this arrangement the foremen of gangs have become expert and the company has obtained better results and a very low unit cost of bonds which were thus installed. The standard arrangement of bonds around special work, as shown in the plan on page 478, greatly facilitates the work of bonding at these points.

All track rehabilitation in unpaved streets was handled by the company's own forces, and in some instances it was necessary to suspend regular service during the progress of the work. If the rehabilitation covered double track the service was continued on one track and portable cross-overs were used to permit sections of the second to be used as a passing siding. When the rehabilitation was on single

track and the traffic was continued, alternate ties were removed and replaced with new ones, and new rails were fastened to the new ties alongside the old rails. By means of a set of switch points at each end of the section of new track it was thus possible to transfer traffic from the old track to the new, and after this was done the old rail and the remaining old ties were removed. As it was not possible, however, to use this method in sections of track special work, after the track was in readiness for the change-over the new special work was laid in places at night when the cars were off the line.

Following the completion of track laying, the gravel ballast was dumped in the trench and the track raised to its permanent elevation. The ballasted track was left open for several days before replacing the road material, so that the weak spots might be picked up as they developed under regular traffic.

Standard overhead construction in city streets is of two types—one made up with ordinary span wire and iron poles



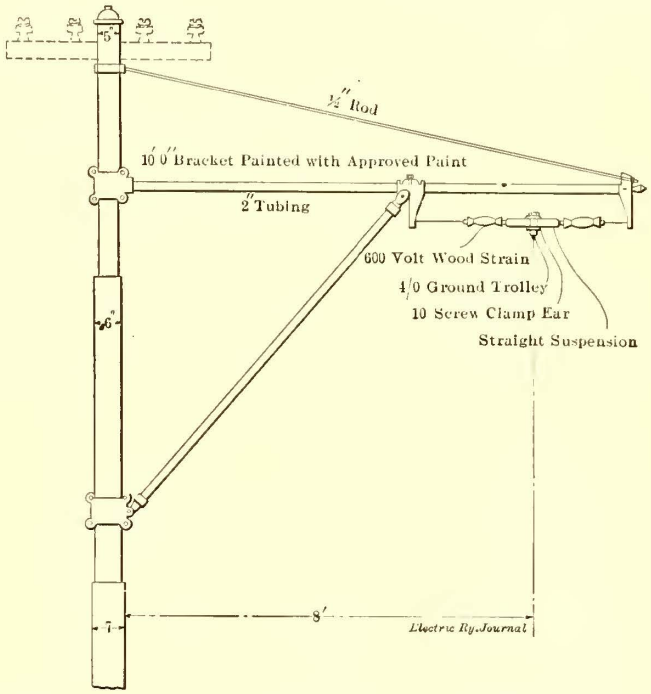
Michigan United Traction—Overhead Construction for Cities, Type 1-D

and used when the track is in the center of the street, and another, made up with iron poles and pipe-mast arms, which is installed when the track adjoins the curb line. Both of these types of construction are shown in the illustrations.

INTERURBAN TRACK AND ROADWAY STANDARDS

Two types of standard track construction are used on the interurban lines, one to take care of third-rail construction and the other of trolley construction. With few exceptions all track is laid with 70-lb. A. S. C. E. rail and continuous joints. The track on third-rail sections of the interurban line is built with a 9-ft. tie in the place of every fifth standard tie. Eight-foot cedar ties are used on all tangent track and white oak ties on curves. In order to obtain the maximum life from the cedar ties mechanical wear is lessened by the use of tie plates. White oak switch ties cut to length are used in all turnouts from the main line, these turnouts being No. 10, with a spring rail frog and an 87-ft. lead. In order to reduce further the curvature in the No. 10 lead a No. 12 turnout has been adopted as standard for use in main line, and this type will be installed as fast as renewals are required.

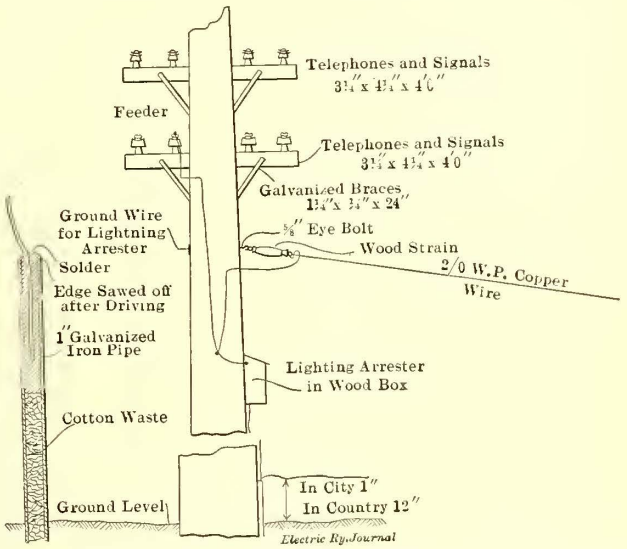
Other track standards include the use of 8 in. of gravel



Michigan United Traction—Overhead Construction for Cities, Type 1-C

under the ties, a 16-ft. roadbed, with 3-ft. ditches, in cuts and fills, slopes of 1½ to 1 in the cut, and the same slopes on embankments. The standard roadbed width for double track is 29 ft.

Two standard types of overhead trolley construction are used on different sections of the interurban lines, one with mast arms and the other with span wires. In either case 30-ft. poles with 7-in. tops are used. These are set 6 ft. in the ground and given sufficient rake to withstand trans-

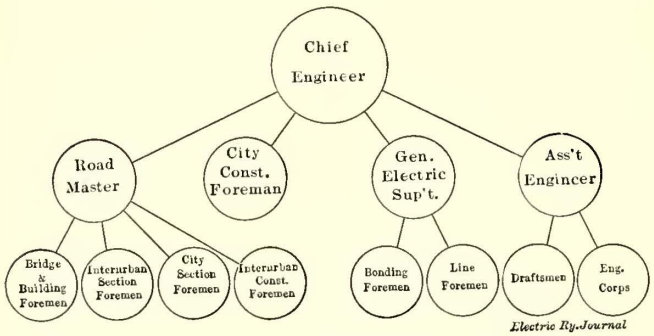


Michigan United Traction—Typical Wooden Pole Arrangement

verse strain. Other construction details are practically the same as those used in city streets. The arrangement of the telephone, feeders and transmission lines as well as the ground-wire construction details is shown in an accompanying illustration on this page.

TRACK AND ROADWAY DEPARTMENT ORGANIZATION

The jurisdiction of the chief engineer, who reports to the general manager and general superintendent, includes supervision over track and roadway. His authority also extends over the track and roadway on the four city railway properties. The track maintenance forces include a



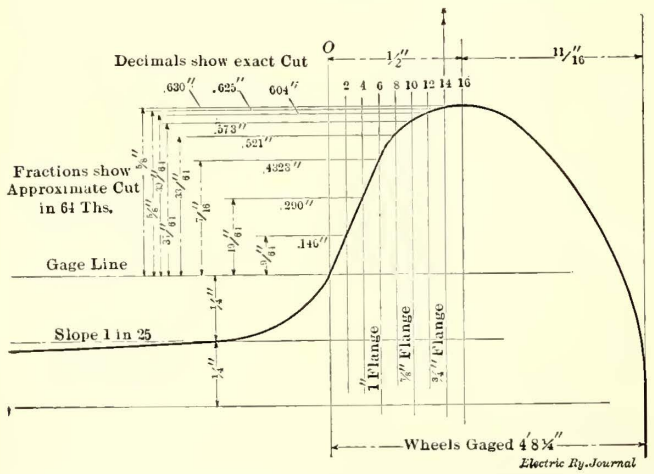
Michigan United Traction—Track and Roadway Organization Chart

section foreman for an average of every 8 to 10 miles of track. Each foreman has a gang of two men during the winter months and five men during the rest of the year. Each section gang is provided with a section tool house.

Four track foremen have charge of track work on the four city railway lines. During the winter months their gangs include four men each and during the rest of the year about seven men. In cases of extraordinary construction or rehabilitation extra gangs are provided so that the work of the regular maintenance forces will not be interrupted.

ROLLING STOCK STANDARDS

The work of developing standards and refining shop practice in the general repair shops of the Michigan United Traction Company is in a transition stage, but a vast amount of work has been accomplished along this line. Previous to the reorganization the general repair shops were sparingly equipped, so that it was necessary to purchase and install additional facilities and replace a number of the machine tools in order to accomplish appreciable results during the rehabilitation period. A wheel grinder, a wheel-turning lathe, a boring mill, a wheel press, an 1800-lb. hammer, a large lathe for turning and straightening axles, a drill press and a number of smaller machines

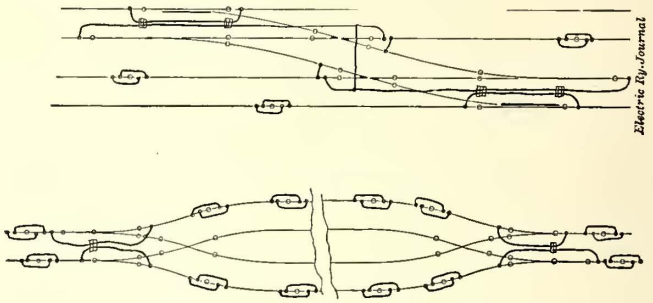


Michigan United Traction—Standard Interurban Flange, Showing Cut on Tread Required to Restore Full Flange

have been added to the machine tool equipment of the shop.

The wheel grinder is a special tool manufactured by Fox Brothers & Company. It includes a pair of beveled emery wheels, which are fed into the work automatically, and a set of bearings in which the axles of a pair of car wheels can be supported. The car-wheel drive is obtained by applying a sprocket wheel in two segments to the axle by means of clamps and wedges and by connecting this by a chain to a second sprocket mounted on the main shaft of the grinder. The car wheels are thus revolved at a speed of 14 r.p.m

The average life of cast wheels on this road has been



Michigan United Traction—Typical Bonding Layout for City Tracks

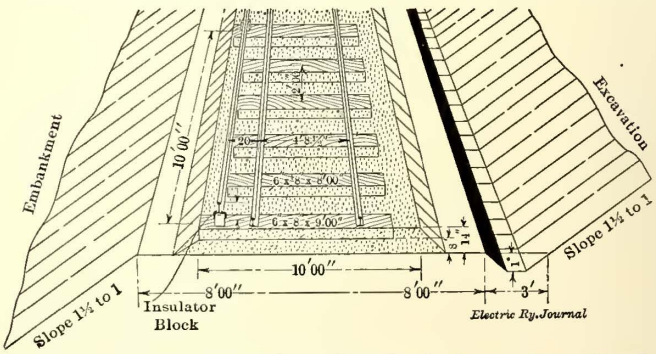
approximately 40,000 miles. The life after grinding is approximately 20,000 miles. The average quantity of metal removed reduces the diameter approximately ⅛ in., and the cut requires about four hours for completion. As the cost of the grinder was only $750, the added mileage obtained from the wheels represents a considerable saving.

Another economy recently introduced in this shop is that of providing second-hand rolled-steel wheels for city car service. After the tires of these wheels have been reduced from approximately 3 in. in thickness to 1⅜ in. they are removed from interurban cars, mated as to diameter, bushed and pressed on the standard 5-in. city car axles. The standard axle used on interurban equipment is 6 in. with a 7-in. gear seat. The bushings are made of cast iron turned with a slight taper and pressed into the car wheel on the wheel press. After the wheels have been placed on a standard city axle they are turned true. Wheel practice on the city railways allows a tire to wear to ⅜ in. thick; therefore, figured on a basis of 1/16-in. wear to 12,000 miles, which is generally accepted, it will be seen that over 190,000 miles of renewed life is obtainable under average wear conditions.

The cost of obtaining this renewed life is given as follows:

Cost of cast bushings, 53 lb., at 3 cents	$1.59
Turning bushing for press fit in wheel, two hours, at 27½ cents	0.55
Boring bushing, one hour, at 27½ cents	0.27½
Pressing on axle, two men, fifteen minutes	0.15
Turning wheels on axle, two hours, at 25 cents	0.50
Total cost of renewed life	$3.06½

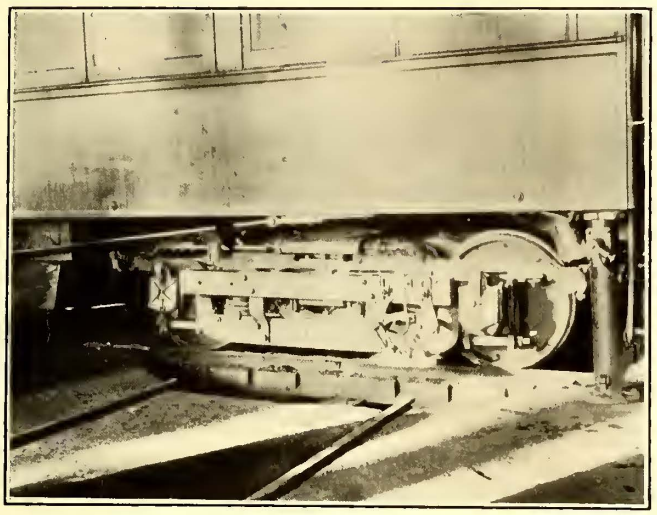
Cost based on wear, to final thickness of ⅜ in., 1.6 cents per 1000 miles.



Michigan United Traction—Standard Interurban Roadbed, Including Slope

Just as soon as a lathe can be properly equipped this company will grind all bearings on axles by means of a motor-driven grinder. Instead of purchasing a special tool for this the grinding attachment will be applied on the slide rest of a lathe, and it is estimated that the complete outfit

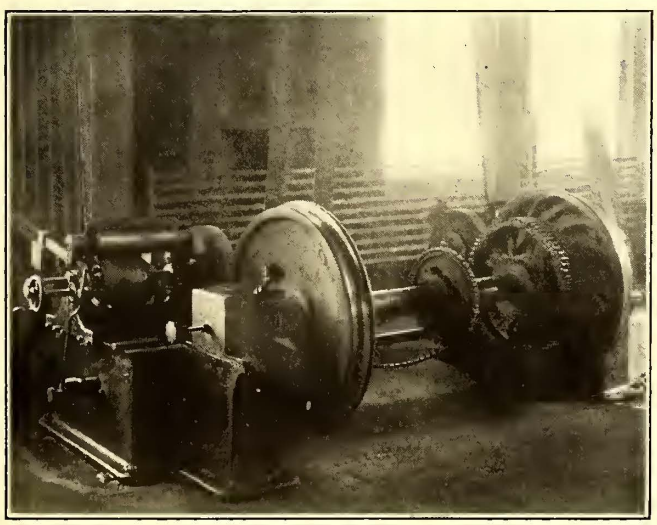
will cost approximately $200. Both new and old axles will be ground. The grinding tool will be arranged so that it automatically grinds a bearing of any length after making proper adjustment. It is contemplated that the more perfect bearing surface will save wear and tear on the bearings as well as assure better results by the reduction in the number of hot boxes.



Michigan United Traction—View of Truck Turntable in Repair Shop

The boring mill and the wheel lathe are especially powerful tools. The lathe will take a ½-in. cut at ½-in. feed. In order to reduce the time required in making a finishing cut a special tool shaped to the contour of the wheel has been purchased. Both the wheel lathe and the boring mill were designed and built by the Niles-Bement-Pond Company.

In order to provide a quick method for arriving at the proper depth of cut on any wheel tread necessary to restore a full flange conforming to the standard contour, R. C. Taylor, superintendent of equipment Michigan United Traction Company, has prepared the chart shown in the accompanying illustration. The chart shows the standard tire contour drawn six times the actual size. The vertical lines shown



Michigan United Traction—General View of Wheel-Grinding Machine

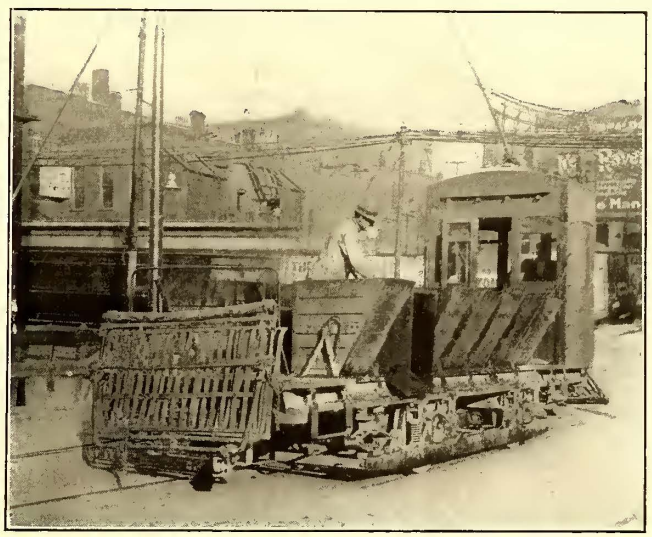
on the flange are arranged to show various thicknesses of worn flanges, and by selecting the line which corresponds to the actual thickness of the flange on the wheel to be turned the proper depth of cut in the tread will be at the point where the vertical line intersects the standard contour line. To determine the depth of cut on the tread for flanges worn to ⅞ in., for example, it is necessary to follow the vertical line marked ⅞ in. to the point where it intersects the line of standard contour. At this point the horizontal line indicates the depth of cut in decimals and fractions. Thus the depth of cut for ⅞-in. flange wear is 0.573 in., or 37/64 in.

The 1800-lb. steam hammer mentioned in the list of new machine tools has been fitted with a set of dies for making ordinary bonds, thus serving the purpose of a bulldozer as well as a hammer.

The American Electric Railway Engineering Association standard 5-in. axle has been adopted for all city cars and the standard 6-in. heat-treated axle for interurban cars. Trucks are being rebuilt to meet these requirements. The standard motor equipment is four 333-B-2 Westinghouse motors with HL control for interurban cars. This type of motor was selected because of the field control feature, which is suitable for either limited or local service. It has the advantage of low-gear ratio for starting, but is also suitable for high-speed operation. The city car motor equipment has been standardized by using two GE-210 motors with K-36 control. All wiring is being installed in conduit to standard diagrams, and the electrical equipment mounted under the car floor is arranged and balanced on an inch-pound basis.

ASPHALT CAR AT KANSAS CITY, MO.

One of the problems in making asphalt repairs is the transportation of the prepared asphaltum from the mixing and heating place to the place where repairing is required. To do this economically, A. E. Harvey, chief engineer



Asphalt Delivery Car for Kansas City

Metropolitan Street Railway Company, Kansas City, Mo., recently built the large asphalt car shown herewith.

This asphalt delivery car consists of the underframe of an old single-truck car which had been arranged for single-end operation. As asphalt is very heavy and hard to handle in large lots by hand, fourteen separate bins of 7½ cu. ft. capacity each are provided. These are supported on brackets and trunnions which are slightly off center and are arranged symmetrically on the car deck, seven on each side. The size of these bins is such as to provide for an aisle along the center of the car, and the method of balancing the bins on trunnions as well as the shape of the bins themselves makes dumping by hand possible with little effort. The bins are built of 2-in. yellow pine lined with sheet asbestos and 16-gage sheet steel. The control cab at one end is glazed on all sides to give the motorman a clear view at all times.

Maintenance of Electrical Equipment of Cars in Brooklyn

A Description of Improvements Made by the Brooklyn Rapid Transit System in Recent Years in the Maintenance of Motor and Control Equipments—Particular Attention Is Given to the Development of Testing Sets

Three previous articles published within the last four months have described chiefly the mechanical improvements made during the past three years by the Brooklyn Rapid Transit System in the maintenance of rolling stock. The present article, which is the last in the series, will describe in detail the improvements which in general may be considered to be of an electrical character.

Reduction in Electrical Defects

No better criterion of the improvements in electrical maintenance could be afforded than the table of electrical defects as kept from month to month and year to year by the mechanical department. These statistics are of particular value, inasmuch as they have been made in accordance with the same method of tabulation for all the years under review. As it would be impracticable to reproduce all of these figures, it has been decided for purposes of publication to select the month of December of the years 1908 to 1912 inclusive as typical of the report for each year, in so far as the number of control and motor equipment defects on both the surface and elevated divisions is concerned.

As shown in Table I, covering the surface division, the number of control defects decreased from 316 in December, 1908, to 185 in December, 1912. The actual improvement, of course, is greater than these figures indicate, owing to the increase in passenger mileage from 3,606,136 miles to 4,084,803 miles, so that 11,411 miles were operated per defect in December, 1908, and 22,080 miles in 1912, an improvement of nearly 100 per cent. Upon examining the figures in this table, it will be seen that of the larger items the greatest decrease is in troubles relating to control fingers, cam rollers, circuit-breakers, main fuses and broken resistances. The second part of this table, enumerating defects of surface motors, shows a reduction of 329 defects in 1908 to 300 in 1912, the corresponding change in mileage per defect being from 10,963 miles to 13,616 miles. It will be noted that the number of motor troubles was actually greater in December, 1909 and 1910, than in 1908, but this was due largely to special conditions which have since been eliminated. The figures for 1912 show that conspicuous improvements have been made in practically abolishing flat, low and short-circuited commutators and greatly reducing motor lead and carbon brush troubles. Perhaps the greatest single factor was the introduction of a high-grade brush in conjunction with the slotting of the commutators.

Table II, relating to the elevated control and motor equipment, shows what remarkable reductions have been obtained by the application of the several major and minor improvements hereinafter described. Thus the control troubles diminished from 414 in December, 1908, to 104 in December, 1912, thereby increasing the mileage per defect from 6098 miles to 25,928 miles. The most prominent improvements were the reduction of defects relating to reversers, control fingers, seven-point jumpers, magnetic limits, magnetic releases, circuit-breakers, resistances and storage batteries. Even the great improvement in control troubles is exceeded by the reduction of elevated motor defects, which decreased from 392 in December, 1908, to 64 in December, 1912. The corresponding change in mileage per defect was from 6440 miles to 42,133 miles. It will be noted that the principal improvements were in brush-holder leads, motor flash-overs and mica and string band troubles. The last defect was due to the carbonization and burning of the string band when the brushes were cut by the high mica of non-slotted commutators. The reduction of flash-over troubles was effected by several changes in maintenance practices, among which was the thorough blowing out and painting of motor shells at each inspection and the elimination of short-circuited fields or armatures. Further, the monthly records were used to detect and to have removed armatures which showed an excessive number of flash-overs despite the fact that they had been reported by the inspector as "cleaned and tested out, O.K." The examination of the removed armature in such cases indicated that short-circuited coils had been the cause of the repeated flashes, and in preventing this the rule that after three successive flash-overs the armature should be replaced at once, whether the commutator showed evidence of short-circuit or not, has proved very successful. To insure compliance with this rule, a separate flash-over record was

Table I.—Control and Motor Equipment Defects—Surface Division

	December				
	1908	1909	1910	1911	1912
Mileage	3,606,136	3,630,347	3,841,834	4,004,311	4,084,803
Control:					
Control grounded	..	1	1	..	3
Control open-circuited	..	..	..	1	..
Control short-circuited	1	..	..	..	..
Control back	4	3	3	5	4
Control cover	..	..	..	..	1
Control water collar	..	..	..	18	..
Control cylinder	6	3	14	5	6
Control segment	..	1	..	..	..
Control finger board	3	1	2	2	..
Control finger	63	35	48	31	40
Control reverse cylinder	1	1	1	2	7
Control deflector	..	..	..	..	..
Control arc shield	..	..	..	..	1
Control blow coil	..	2	..	1	1
Control cut-out	..	2	..	..	..
Control cam roller	50	56	49	40	22
Control miscellaneous	9	5	7	3	..
Control circuit-breaker	64	83	49	36	47
M.M. switch	3	..	1	..	..
Main fuse	35	47	10	6	2
Resistance broken	..	52	41	43	24
Resistance grounded	8	26	3	3	6
Resistance open-circuited	4	14	3	2	2
Resistance short-circuited	2	10	4	3	2
Resistance miscellaneous	60	28	32	17	12
Lightning arrester	3	1	..	..	1
Controller wiring	..	..	..	..	4
Total	316	371	268	218	185
Motor:					
Motor bolts	..	..	..	..	..
Motor covers	3	..	..	..	..
Axle housing	..	..	..	..	..
Armature housing	..	..	1	..	..
Armature bearings	..	4	2	6	5
Axle bearings	..	3	24	5	2
Axle cap bolt	8	22	15	3	3
Motor suspension	7	8	6	4	5
Armature grounded	52	90	84	80	81
Armature short-circuited	4	7	10	4	5
Armature open-circuited	19	22	20	13	3
Armature bands	18	33	29	13	23
Armature shaft	1	..	1	1	1
Fields baked	..	..	..	..	..
Fields grounded	17	27	41	39	26
Fields water-soaked	..	1	1	..	1
Fields open-circuited	6	12	16	14	21
Commutator flat	13	26	5	..	..
Commutator low	..	6	..	..	..
Commutator short-circuited	21	40	..	3	4
Gear	1	9	10	3	1
Gear case	1	3	13	4	2
Gear case bolts	2	..	..	..	..
Pinions	2	13	26	5	6
Leads	60	101	91	44	44
Junction box	10	1	..	..	..
Brush holder	32	51	78	54	61
Cable	2	5	15	4	4
Carbon brush	50	53	7	1	..
Commutator carbonized	..	..	14	..	..
Hand-hole cover	..	..	..	1	..
Motor shells	..	..	..	..	2
Total	329	537	509	301	300

instituted with the highly successful results indicated in the lower part of Table II.

The work described in the following paragraphs is done at the Fifty-second Street general repair shops except the maintenance of multiple-unit control, which is carried out at the elevated maintenance shops.

TABLE II—CONTROL AND MOTOR EQUIPMENT DEFECTS—ELEVATED DIVISION

	December				
	1908	1909	1910	1911	1912
Mileage	2,524,577	2,692,154	2,699,351	2,676,783	2,695,516
Control:					
Main drum	9	13	15	2	..
Reverser	24	31	34	4	1
Reverser drum	..	..	..	..	..
Reverser finger	..	..	..	..	..
Control finger	73	38	30	9	4
Main fingerboard	6	15	16	..	..
Reverse fingerboard	13	6	3	..	..
Jumper, four-point	1	2	1	..	..
Jumper, seven-point	27	8	14	12	18
Magnet limit	10	13	8	..	..
Magnet operating	5	9	18	5	2
Magnet reverse	6	3	21	5	..
Magnet release	21	19	24	..	1
Circuit breaker	25	9	11	..	..
Operating cylinder	..	..	2	..	..
Reverse cylinder	..	..	1	..	..
Resistance	12	17	12	1	1
Receptacle, four-point	1	2	4	2	1
Receptacle, seven-point	2	1	10	2	3
Receptacle covers	1	..	7	2	..
Storage battery	24	36	47	2	2
Spring, operating	14	12	1	2	3
Spring, pawl	10	8	23	7	6
Spring, wiper	..	..	..	..	..
Interlocks	10	1	8	5	4
Switch, battery	2	..	1	1	..
Switch, main	3	7	8	..	..
Switch, master	2	4	18	1	1
Switch, operating	..	..	..	..	..
Switch, repeating	5	2	8	2	1
Switch, reverser	..	..	..	..	..
Switch, safety release	11	10	12	1	5
Line switch	8	18	29	9	8
Series and multiple switch	28	7	10	..	1
Reducing valve	8	8	12	1	4
Magnets	34	28	30	..	..
Switches	13	7	26	..	..
Leathers	6	2	33	6	5
Contact tips	..	14	5	2	..
Feed valve	..	..	6	..	..
Pawl	..	..	..	18	4
Other control springs	..	..	..	1	1
Magnets	..	..	..	4	3
Magnet leads and terminals	..	..	..	4	..
Junction box	..	..	..	1	..
Switches, U. S. G.	..	..	..	5	6
Line switch trip	..	..	..	2	1
Line switch cut-out	..	..	..	1	..
Line relay	..	..	..	4	3
Auxiliary relay	..	..	..	1	..
Battery-charging relay	..	..	..	1	1
Limit switch	..	..	..	5	6
Battery fuse	..	..	..	1	3
Resistance, insulating bolts	..	..	..	1	..
Blow-out coil	..	..	..	1	..
550-volt lead	..	..	..	..	2
Resistance leads	..	..	..	..	1
Controller air piping	..	..	..	..	2
Total	414	350	508	133	104
Motor:					
Axle bearings	..	..	2	1	..
Armature bearings	1	..	7	7	1
Armature shaft	..	2	..	..	..
Armature grounded or short-circuited	54	33	54	25	25
Armature open-circuited	12	8	5	1	1
Armature wire band	7	1	2	2	2
Armature mica or string band	118	..	..	..	1
Commutator loose	3	5	1	1	..
Commutator flat	20	..	..	..	4
Brush holder broken	..	1	..	..	1
Brush holder grounded	28	9	9	1	8
Brush holder lead	18	5	15	8	2
Brush holder shunt	..	5	4	..	1
Brush holder spring	20	3	4	1	..
Carbon brush	..	..	..	..	..
Babbitt block	..	..	1	..	..
Field leads	..	11	12	3	3
Fields	2	3	4	5	2
Gear wheels	2	5	2	1	3
Gear case	..	..	..	..	..
Motor shell and parts	..	..	..	..	..
Motor leads	7	4	3	4	3
Motor flashed	93	86	126	21	5
Pinion	5	20	15	5	2
Motor smoked	2	..	..	..	..
Total	392	201	266	86	64

CONTROLLER RECORDS AND REPAIRS

Early in 1909 the mechanical department began to overhaul its surface controllers on an eighteen-month basis. Owing to the excellent results shown by these overhauled controllers, it was decided that from Jan. 1, 1913, the period should be extended to two years so that now one-twenty-fourth of all surface controllers go through the shop every month. The decision to adopt this long overhauling period is all the more interesting in view of the fact that most of the controllers are of the older types. Exclusive of the

BROOKLYN RAPID TRANSIT SYSTEM — MECHANICAL DEPARTMENT
52ND ST. SURFACE SHOP — ELECTRICAL ROOM
CONTROLLER RECORD. Plate No. 26323

Type K11 | Factory No. 63424 | B.R.T. Shop No. | Date Purchased

Date Received	From	Repairs Made	Repaired By	Date Returned
6-8-08	Ridgewood	Overhauled	Schuth	6-9-08
2-9-10	Canarsie	" Standard	"	2-15-10
8-11-11	" 58 St	"	Schmidt	8-23-11

B. R. T. Electrical Shops—Shop Card Record of Controller

equipment of the 101 center-entrance cars, the surface controllers now in use on the Brooklyn Rapid Transit System are made up as follows: 42 type K-27A, 188 type K-6, 204 type K-28L, 270 type K-2, 1104 type K-28B and 2975 type K-11.

Records of controller repairs are kept on 5-in. x 8-in. standard cards both at the Fifty-second Street shops and

BROOKLYN RAPID TRANSIT SYSTEM
MECHANICAL DEPARTMENT — SURFACE DIVISION

Controller No. 27550 — Mfg by General Electric Co.
Type G. E. K-11. — Owning Co. NASSAU ELECTRIC RAILROAD CO. — Date of Purchase June 16, 1899 to June 4, 1907.

Date Installed	Car No.	Date Removed	Shop	CAUSE	OVERHAULED Date	OVERHAULED Shop
6-13-10	1823	9-8-10	Ridgewood	Overhauling		
9-12-10	202					

B. R. T. Electrical Shops—Home Office Card Record of Controller

at the office of the superintendent of equipment. As shown in one of the accompanying reproductions, the shop card is a record of the individual controller showing the dates when it was received from different carhouses for overhauling, when overhauled, by whom and when completed. The shop does not keep a record of the location of the controller but notifies the office of the superintendent of equipment once a month that certain controllers are due

ORIGINAL

BROOKLYN RAPID TRANSIT SYSTEM
MECHANICAL DEPARTMENT ..... DIVISION
..... SHOP — DATE 19
CAR No. .....
CONTROLLER OVERHAULING REPORT

DESCRIPTION	TYPE	NUMBER	REPAIRS MADE	OVERHAULED BY
Controller				

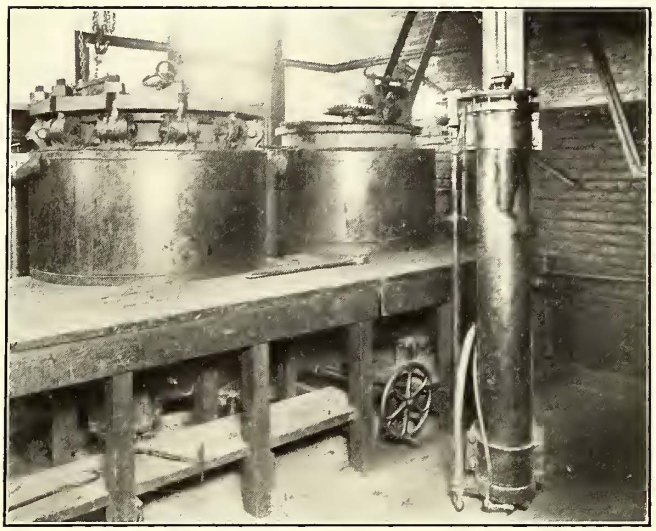
..... SUPERINTENDENT

Original (white) to be forwarded to Supt. of Equipment's office.
Duplicate (yellow) to be retained at shop.

B. R. T. Electrical Shops—Report on Controllers Overhauled Sent by Shop to Home Office

for overhauling. The record clerk at headquarters then determines the location of the controller by referring to a record card, also reproduced, which shows the cars upon which the controllers are in use and the carhouses where the cars in question are in service. The carhouses are then

notified on a form entitled "Controllers Due for Overhauling." Another form in connection with this work is the report on which the Fifty-second Street shop notifies the superintendent of equipment that certain controllers have been overhauled and are ready for assignment. The date of overhauling shown for each controller is then transferred to the proper cards at the office. Later this information serves as a check on the shop should it ask for a controller which is not really due for overhauling. This last form is also furnished with spaces for recording similar information on the overhauling of circuit-breakers, line switches and storage batteries.



B. R. T. Electrical Shops—Vacuum Impregnating Equipment at Fifty-second Street Shops

The overhauling of control equipments of elevated cars is carried on at the elevated maintenance shops in accordance with a regular annual schedule which shows the location of elevated cars throughout the system. The changes in the elevated control equipment will be detailed at length hereinafter, but it will be appropriate to summarize here the improvements in surface controllers, the K-11 type offering the most typical case on account of the fact that it is the oldest and most used design on the system.

B. R. T. Electrical Shops—Dipping and Hanging Coils

The cost of stripping a K-11 controller and replacing all worn material averages about $2.50 for both labor and material. Among the departures which have been made from the original design of this controller during the past five years are the following: A board of ½-in. vulcabeston has replaced the 1/16-in. fiber barrier between the main and reverse cylinders; in addition to the single-arc shield above the trolley controller finger four arc shields have been installed; the binding posts have been changed to permit the screws to go in perpendicularly so that the wires are no longer cut by the threads as occurred when the screws were inserted at an angle to the wire; the back is treated with asbestos and shellacked and all wires and cables are also shellacked. It may be added that the controller contact plates are lubricated with vaseline at the regular inspections.

SURFACE MOTOR IMPROVEMENTS

As a number of important electrical improvements made by this company have already been described in these columns, it may be convenient to summarize them as follows, before describing those which have not been mentioned hitherto:

Reboring of Westinghouse 68 and 81 motor shells and use of tin-base bearing metal for all surface and elevated motor and truck journal bearings, issue of Jan. 18, 1913.

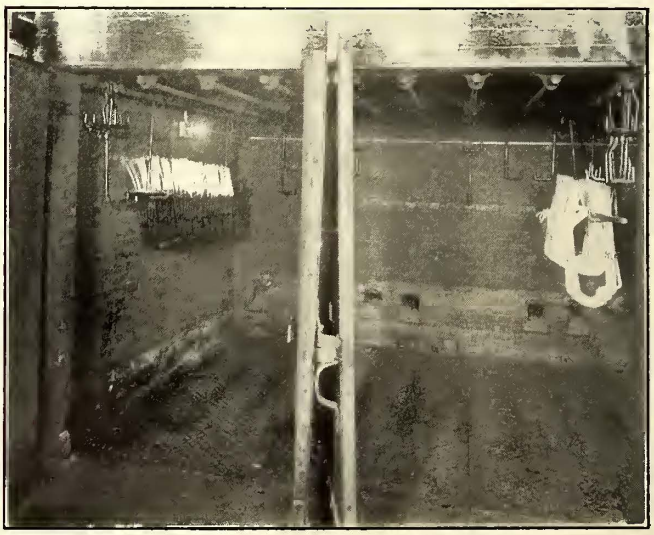
Heater standardization and specialization of maintenance, issues of June 26, 1909, and Feb. 18, 1911.

Substitution of Westinghouse three-point suspension grid resistances for old and obsolete types and rearrangement of resistance steps, issue of Feb. 18, 1911. In an article on "Resistance Standards," in the issue of May 11, 1912, it was brought out that the number of resistance types had been decreased from nine to four, that there had been a decrease of 7.3 per cent in the maximum starting torque on the first notch, a decrease of 8.6 per cent in the maximum starting current, and a decrease of 9 per cent in the maximum variation in torque during acceleration.

The slotting of commutators by this company in connection with the use of high-grade carbon brushes began in 1908 with the slotting of the commutators of the 150-hp elevated motors. The company's comprehensive tests with such brushes were described and tabulated in the issue of June 19, 1909, and the excellent results from the practice of using these brushes with slotted commutators was described in the issue of April 22, 1910.

IMPREGNATION OF FIELD COILS

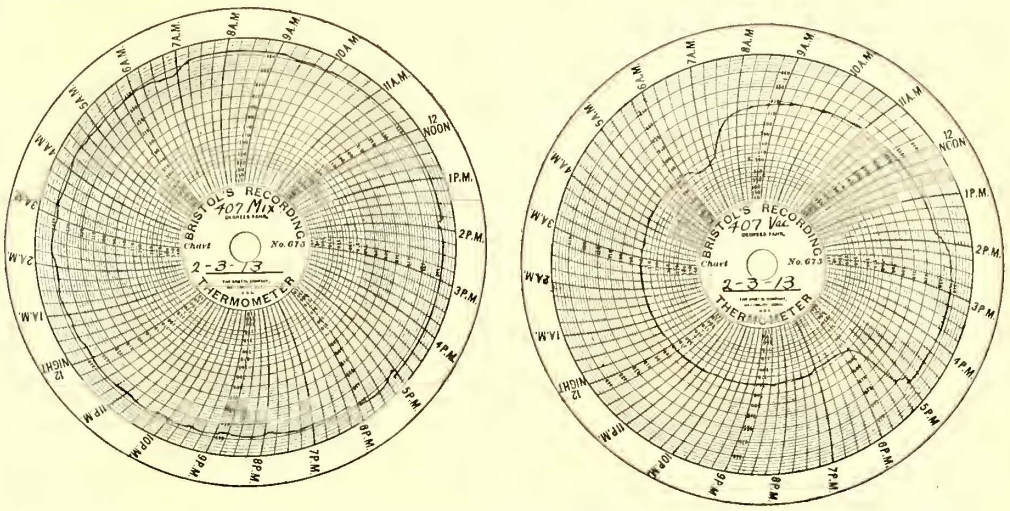
For two or three years previous to 1910 the company had in service several thousand field coils that were impregnated by the manufacturers of the motors. The impregnated coils proved so satisfactory that the company decided to install a plant of its own at the Fifty-second Street shops. This equipment, which is shown in an accompanying illustration, consists of one vacuum and one pressure tank furnished by the Buffalo Foundry & Machine Company. The tanks of this design are heated by a steam



B. R. T. Electrical Shops—Coils in Drying Oven

jacket instead of steam coils, allowing them to be cleaned with greater ease. No trouble has been experienced from leakage of the steam jackets. This equipment has been in operation from June 4, 1910, and from that date to Dec. 31, 1912, 12,817 field coils, or approximately 73.33 per cent of a total of 17,478 coils, had been impregnated. Experience has convinced the company that impregnation has easily paid for itself in lengthening the life of the coils and thus minimized their rewinding.

An important auxiliary to each tank is a Bristol recording thermometer. The dial of each thermometer bears an identification number which is also stamped on the tin tags which are attached to each field coil of the group impregnated at any given time. In this way a record of the temperature conditions which exist in each tank at the time the work is done is obtained so that a possible clue is afforded to determine the cause for any trouble which an impregnating coil may develop later in service. The accompanying reproductions of a pair of these records refer to the impregnation of twenty-two Westinghouse No. 81 coils which were tagged as part of group 407. The records show the changes in temperature from the time the coils were placed in the tank, 5 p. m. Feb. 3, 1913, to the time they were taken out, 5 p. m. the next day.



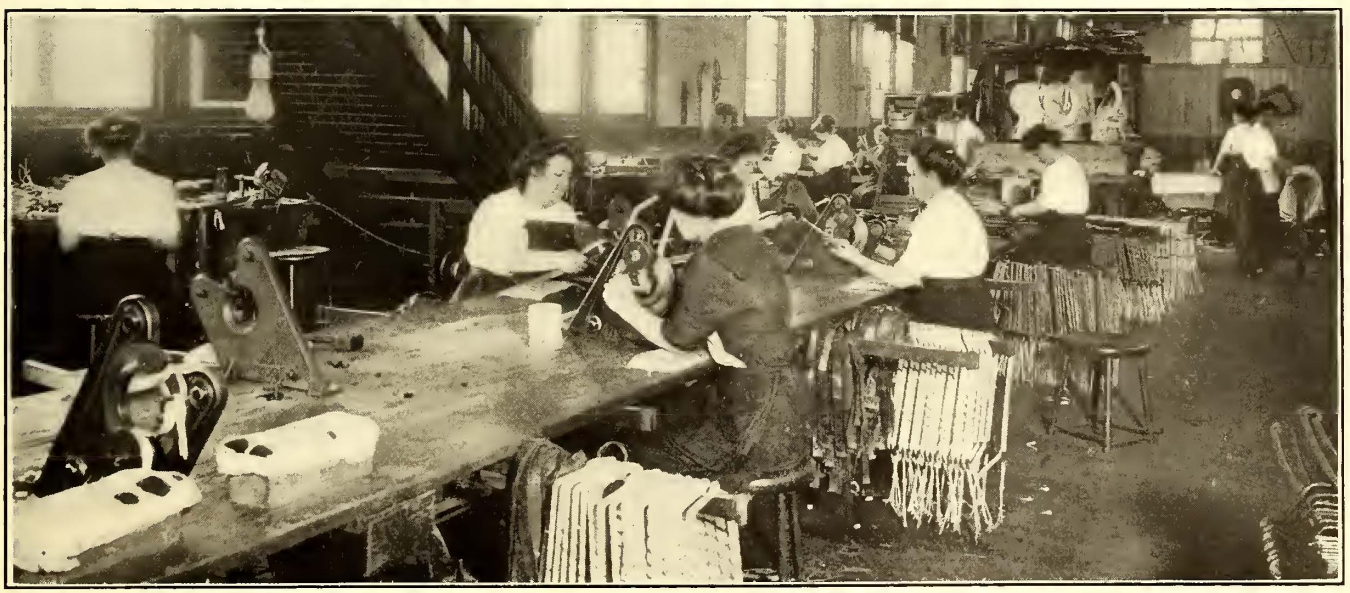
B. R. T. Electrical Shops—Temperature Records of Compound and Vacuum Tanks

FIELD-COIL PRACTICE

Field coils which are returned to the shops for impregnation are first tested as hereinafter described. If found in good condition they are covered with what is termed a "sacrifice tape" of 1½-in. width cotton which is put on as a preliminary to the impregnating process. After the coils have been kept in the vacuum for four and a half hours they are placed for a like period under pressure after Sherwin-Williams impregnating compound is drawn in. When the coils have cooled and hardened, upon removal from the pressure tank, the sacrifice tape is pulled off, thus leaving a smooth coil which is insulated like a new field in the following manner: Put on the leads, apply one layer of friction tape, one layer of Empire cloth 15 mils thick, place canvas cap on the motor side of the field and complete with one layer of 1½-in. Imperial waterproof tape and dip in Sherwin-Williams air-drying varnish.

ARMATURE AND COMMUTATOR PRACTICE

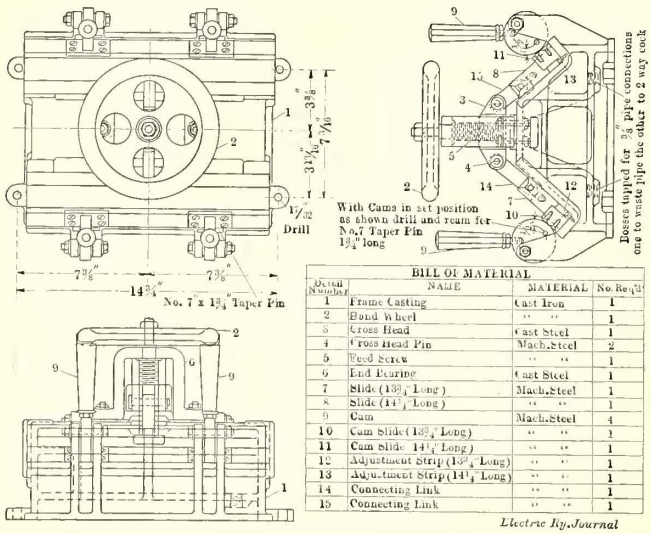
After an armature coil has been wound on one of the coil forms, the ends are taped and sleeving is placed on the leads. The coil is then baked in an oven for two hours, after which it is dipped in Sherwin-Williams baking varnish. The coils are then hung up to drip, as illustrated, after which they are baked for four hours. Upon completion of the second baking the coil is taken to the winding room, where both sides are covered with three thicknesses of Empire cloth, each layer 8 mils thick. This cloth is applied with shellac and covered with fish paper, which is tied on until the shellac is dried sufficiently to retain it. The coils are now ready for the hot presses. The details of one of these presses are shown in an accompanying drawing. In this design a central screw is used to transmit the pressure to steel plates which bear on the sides of the coil. There are one or more side clamps, depending upon the size of the coil, to secure a uniform distribution of pressure. The presses are steam-heated and water-cooled. Of the sets of four valves illustrated in connection with each press, two are for steam inlet and exhaust and two are for water in-



B. R. T. Electrical Shops—Winding Department at Fifty-second Street Shop

let and exhaust. When the coil has been hot-pressed it is taped and dipped again and returned to the oven for the final drying. The leads are then tinned and the coil is ready for assembling. The use of hot presses has greatly improved the insulating qualities of the coils.

A simple but important improvement in the banding of all surface and elevated armatures is the use of tin binding strips to prevent the loosening of the bands in service. The



Detail Number	NAME	MATERIAL	No. Req'd
1	Frame Casting	Cast Iron	1
2	Band Wheel	" "	1
3	Cross Head	Cast Steel	1
4	Cross Head Pin	Mach. Steel	2
5	Feed Screw	" "	1
6	End Bearing	Cast Steel	1
7	Slide (13 3/4" Long)	Mach. Steel	1
8	Slide (14" Long)	" "	1
9	Cam	Mach. Steel	4
10	Cam Slide (13 3/4" Long)	" "	1
11	Cam Slide 14 1/4" Long)	" "	1
12	Adjustment Strip (13 3/4" Long)	" "	1
13	Adjustment Strip (14 1/4" Long)	" "	1
14	Connecting Link	" "	1
15	Connecting Link	" "	1

Electric Ry. Journal

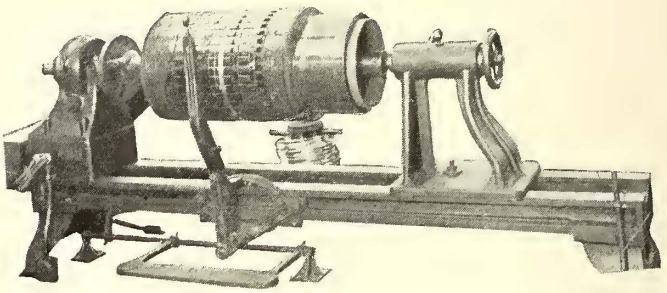
B. R. T. Electrical Shops—Armature Coil Press for Westinghouse 81 Motor

strips are laid over the banding insulation which is in the bottom of each banding slot. Then the wire bands and clips are installed in the usual manner and the tin strip is soldered to the entire wire band.

When armatures are brought to the Fifty-second Street shops for repairs they are blown out by compressed air, the cleaning being done in a horizontal cylindrical tank of the type illustrated. This tank is provided with an exhaust which carries off all dust and dirt.

The commutators of all types of motors are now slotted. The slotter in use for the surface armatures at the Fifty-second Street shop has a slide rest which carries a small swinging frame and an arbor for a circular saw. Means are provided to adjust the machine for commutators of various dimensions. The slotter for elevated armatures is shown in one of the illustrations. It is of the reciprocating type and is based on a design used by the General Electric Company. It will be seen that the armature is arranged to rest on a channel beam framework, and that two screw posts are provided for height variation with a horizontal screw in each post to make adjustments to prevent end motion. The reciprocating-type slotting saw is belt-driven.

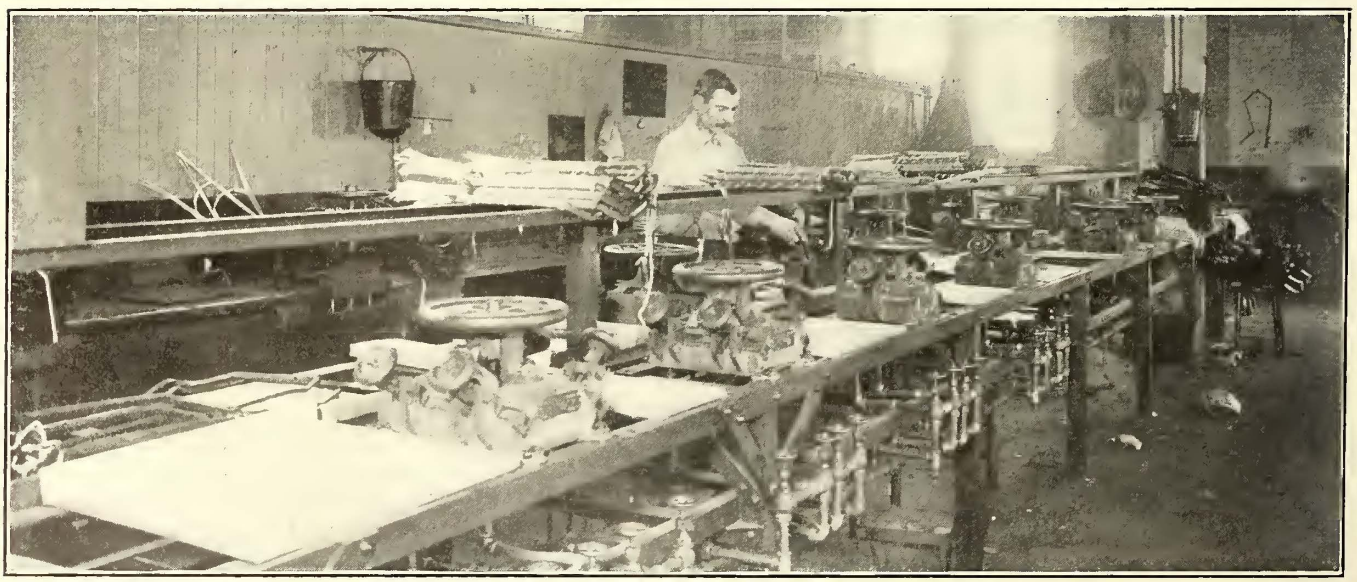
The two slotting machines referred to are used now in reslotting commutators that may be sent in to Fifty-second Street for repairs and for the slotting of new commutators as installed. Since it was impracticable when slotting was inaugurated to have all armatures sent to Fifty-second Street for that purpose, on account of the time set for the completion of this work, each overhauling shop was furnished with a pneumatic slotting machine of the type used by the Westinghouse Electric & Manufacturing Company. These machines consist of a small circular saw on a shaft



B. R. T. Electrical Shops—Type of Standard Bander in Use at Fifty-second Street Shops

operated by a pneumatic rotary engine. Adjustable guides or rests on a square shaft are also provided to permit the operator to rest the machine on the commutator. These machines are still being used at the maintenance overhauling shops for reslotting.

An interesting point in connection with the commutator work is that all nuts are tightened while the cone ring is under pressure so that there is no strain on the threads when the nuts are sent home. The pressure on the cone ring under these conditions varies from 5 tons to 15 tons, according to the type of commutator.

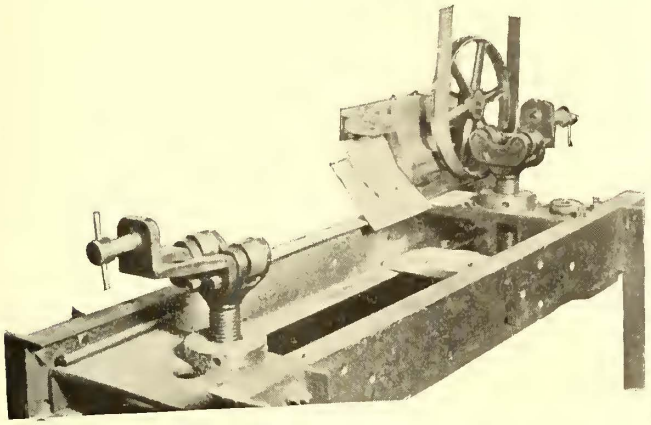


B. R. T. Electrical Shops—Table of Hot Presses at Fifty-second Street Shops

TESTING EQUIPMENTS

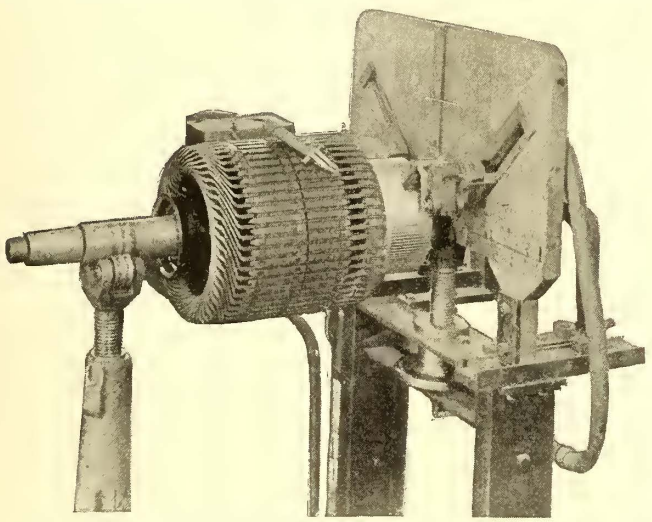
A very important factor in the reduction of maintenance costs has been the installation of equipments for testing fields, armatures, heaters, jumper connections, circuit-breakers, etc. The most elaborate installation of this kind is

the armature outfit for testing poor soldering, commutator short-circuits, or short-circuits in the armature itself. The equipment comprises a rheostatic controller, a set of car resistances which give any desired amount of current from 8 amp to 300 amp in order to include the currents used by the motors in service, an ammeter to measure the current going through the armature coils and a millivoltmeter to note the drop between commutator bars. By passing an operating current through the armature it is possible to discover such defects as would otherwise develop after the armature had been placed in service on the car, namely, melting of poorly soldered connections and the burning off of abraded wires. By permitting the armature to receive exactly the same current as if it was installed between the fields of its motor, the practical benefits of an actual test on the car are obtained without the inconvenience of removing and replacing an armature which might prove defective.



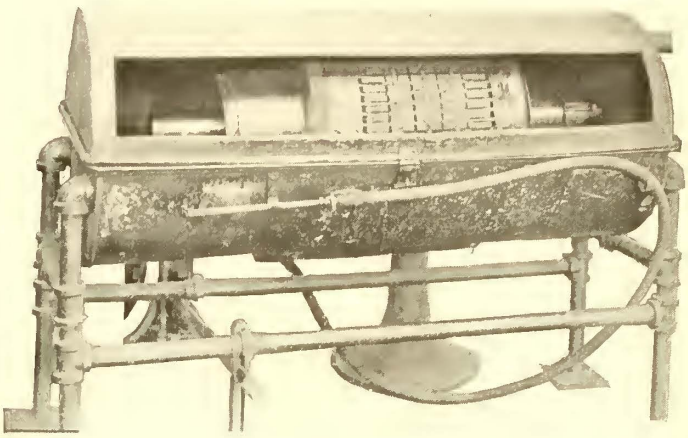
B. R. T. Electrical Shops—Commutator Slotter for Large Armatures

The connections of the armature-testing outfit are indicated in the accompanying wiring diagram and other details are shown in two accompanying halftones, particularly the adjustment of the brush holders for any size commutator. This adjustment is obtained by means of two slots in the board through which the terminals are connected to the brush holders. The illustrations also show a shelf above the armature stand which is used for trying out and adjusting circuit-breakers. For this purpose the controllers and resistances are used to increase the current until the circuit-breaker blows, the current being indicated by the ammeter. Circuit-breakers used on four-motor equipments are set to blow at 325 amp, and those on two-motor equipments are set at 275 amp. Armatures of compressor motors can have an additional given running test by installing them in a compressor located near the field-testing outfit. As this compressor is furnished with a split frame, the armatures are taken in and out very readily.

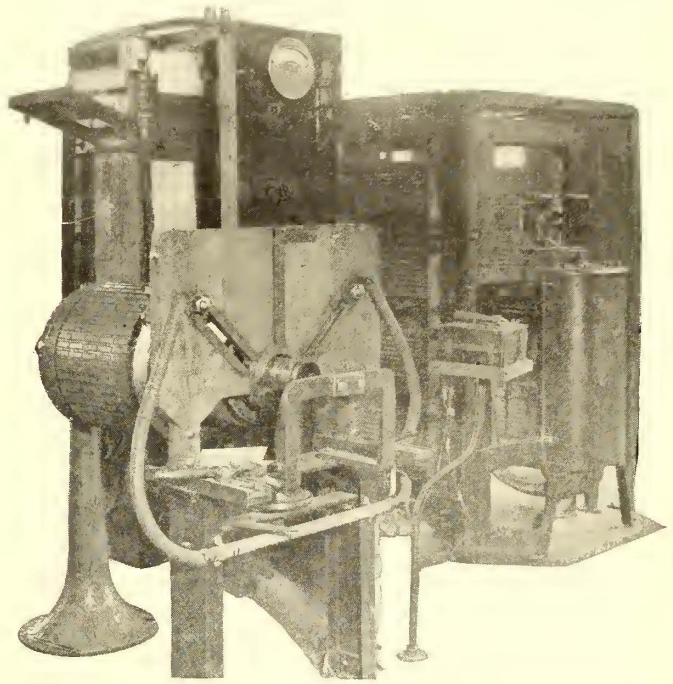


B. R. T. Electrical Shops—Brush-Holder Mechanism for Armature-Testing Outfit

In the field-testing apparatus shown on page 482 the principle of the transformer is used. The field under test acts as a secondary and a coil made up of eighty-one turns of No. 5 D. C. C. wire acts as a primary. The primary coil receives current from a small 110-volt, 35-cycle generator, which is driven directly from the main shaft. This coil also has a 40-amp circuit-breaker, an ammeter and a 90-amp double-pole, single-throw switch in series. First the reading of the ammeter is noted when the switches are closed and without a field coil in position for testing, this reading corresponding to the primary current of the transformer when the secondary is open-circuited; or this will be the reading of the ammeter when the field coil under test is in good condition and without short-circuits. A reading higher than this normal reading indicates that the field coil has a short-circuit, the reading varying in accordance with the number of turns thus short-circuited. If the current is maintained for a while, the point of short-circuit will be indicated by the additional heating of that portion of



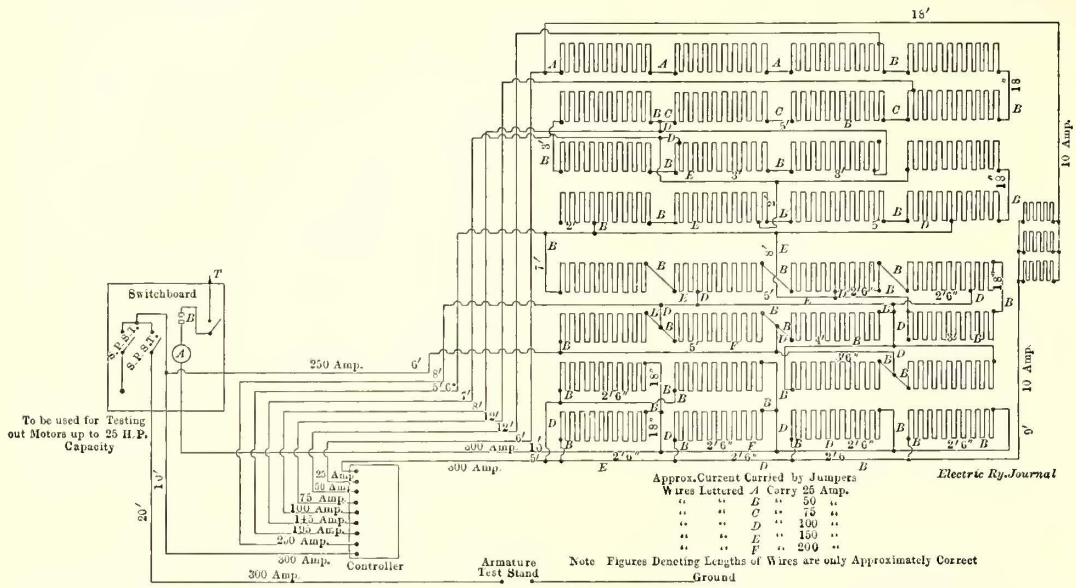
B. R. T. Electrical Shops—Cylindrical Tank for Blowing Out Armatures



B. R. T. Electrical Shops—Armature-Testing Outfit Showing Also Bracket for Circuit-Breaker

the coil. In testing for open circuits one terminal of the coil is grounded and a light circuit is put on the other terminal. The burning of the lamps, of course, will show the absence of open circuits.

The construction of the field-testing outfit consists of the parts shown in an accompanying drawing. The framework part, *A*, is made of wood. Part *B* is a slate panel, 20 in. x 11½ in. x 1 in., on which the circuit-breaker, ammeter and switch are mounted. Parts *C*, *H* and *D*, which comprise the magnetic circuit, are made up of several thicknesses of 1/32-in. wrought iron dipped in shellac. After the shellac is dried, the laminations were placed between the two ¼-in. side pieces and riveted together. The primary coil is made up of eighty-one turns of No. 5 B. & S. D. C. C. wire with twenty-seven turns between *T*-1 and *T*-2 and eighty-one turns between *T*-1 and *T*-3. Part *E* is a cast-iron counterweight 6⅝ in. in diameter and 6 in. wide which assists in raising part *D* and also in keeping it in the upper position while a field coil is being placed in position for testing or while one is being removed. The arms, part *F*, are made of ½-in. x 2-in. flat iron, are bolted to part *D*, have the counterweight attached at the other end and are free to turn on a pin. Part *D* and counterweight *E* thus revolve on the same pin, which is supported by two brackets, one on each of the upright members of the wooden frame.

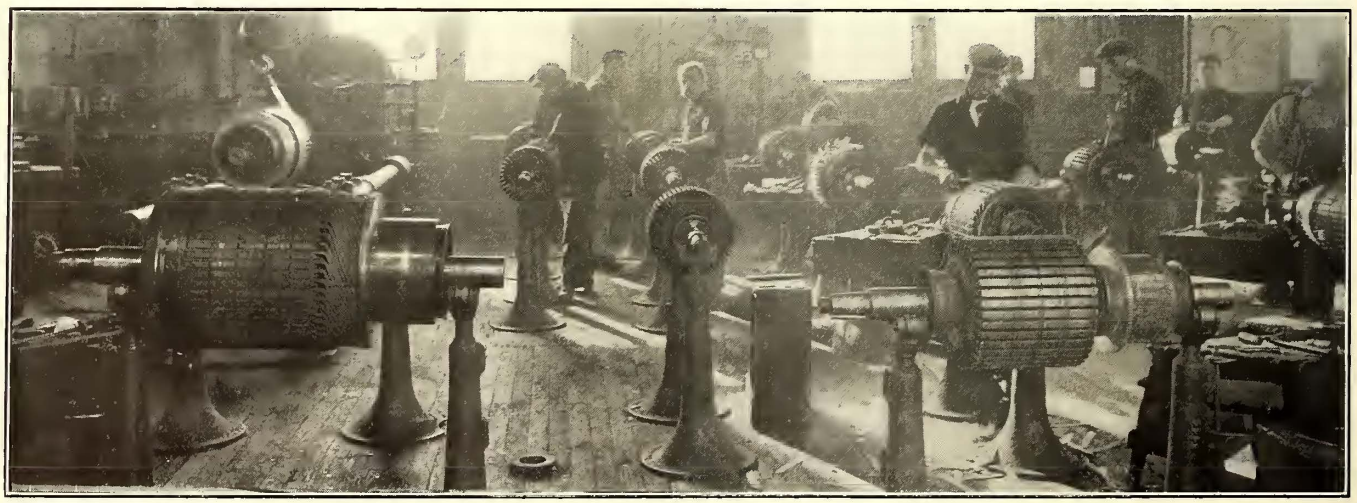


B. R. T. Electrical Shops—Switchboard and Resistance Wiring Diagram for Armature-Testing Outfit

To test a field coil, *D* is raised and the field coil is slipped over *H*. *D* is then lowered, in which position it rests on *H* and *C*. After the field coil is in position and *D* has been lowered, the circuit-breaker and switch are closed, thus sending alternating current through the primary coil. The terminals of the field coil under test should be entirely free and not connected together.

A transformer box is used for testing windings for any potential up to 6000 volts. The 500-volt d.c. lighting circuit is used for testing individual coils before they are assembled.

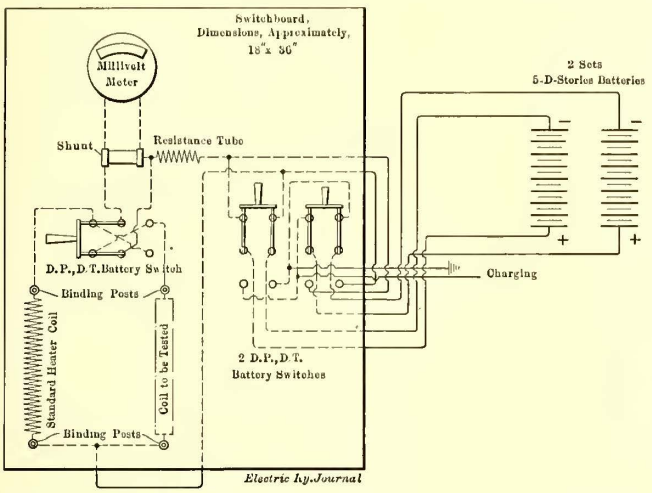
Heater tests are of two kinds, those of energy consumption, which are made by the heater maintenance specialists directly on the cars, as described in the Electric Railway Journal for Feb. 18, 1911, and those which are made in the Fifty-second Street shops as now described. The purpose of the shop tests is to make certain that individual coils of heaters sent in for repairs are of the proper resistance. The method of tests is to use a modified Wheatstone bridge on which the individual coil is balanced against the resistance of the master coil of a given type of heater. The necessity for tests of this kind is indicated by the fact that there are twenty-nine types of Consolidated and ten types of Gold heater coils on the Brooklyn Rapid Transit System. The master coils of each type are kept on a board in the local storeroom of the department of electrical repairs at the Fifty-second Street shop, whence they are taken out as required for comparisons with new coils for size of wire, number of turns, resistance, etc. If the coil is of unknown type it can readily be identified by means of a calibration curve which shows what the resistances should be for different values of current.



B. R. T. Electrical Shops—Part of Fifty-second Street Shops, Showing Armature Workstands, Armature Sling Carried from Crane Track, Hydraulic Press, etc.

The heater-testing equipment, as shown in the accompanying drawing and halftone, consists of an 18-in. x 36-in. board on which a millivoltmeter and two double-pole,

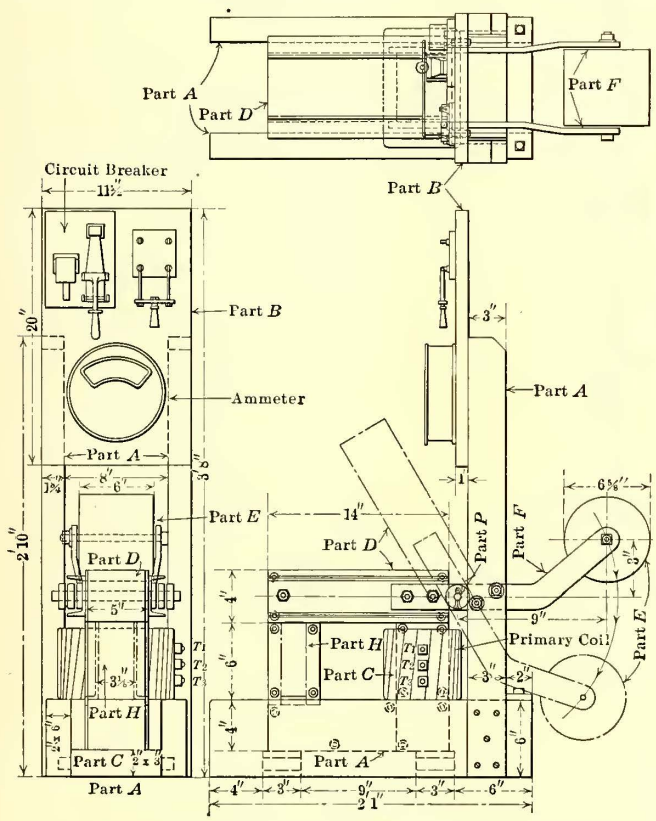
double-throw battery switches and a third double-throw, double-pole switch are mounted. The battery switches are thrown one way for charging and the opposite way for discharging, while the third switch is so arranged that when thrown in one direction the current goes through the master coil to give a reading on the meter and when thrown



B. R. T. Electrical Shops—Wiring of Board for Testing Heater Coils

in the opposite direction the current is sent through the coil under test. If the resistance of the coil is correct, the two readings must be practically the same. This testing outfit is also used for magnet coils and the like.

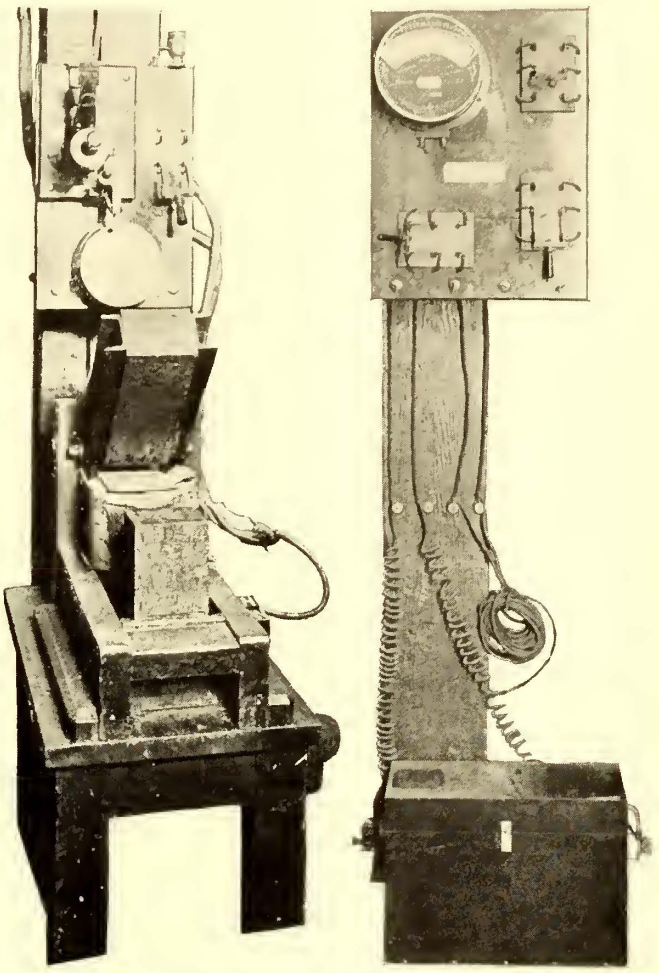
The shops which maintain elevated equipment have been



B. R. T. Electrical Shops—Field-Testing Outfit

equipped with seven-point jumper testing outfits. The test part is fitted with jumper receptacles and with sixteen 5-ohm coils so wired that a current of 50 amp will pass in series through all of the wires of the test jumpers. As the normal service current which passes through these jumpers is not more than 2 amp to 3 amp, a trial with 50 amp results in burning out any weak connections such as are due to the abrasion of wire or similar causes. A fuse is installed to limit the testing current to 50 amp. There is also a lighting circuit of five 115-volt, 16-cp lamps to indicate that the jumper circuit is closed. If the lamps light up but go out immediately, the operator knows that the connection has been burned out. This test board also carries a jumper and receptacle gage, of the design shown in the drawing, to make certain that good train-line connections will be secured without having recourse to a hammer or other violent means. The inspection of jumpers is made once a month upon which occasion a streak of red or green paint is applied to indicate the month when the test was made.

It is intended to install one Herrick testing outfit, as manufactured by J. G. Kjellgren, in each of the general repair shops and in each of the overhauling shops. All cars, immediately upon being brought into the overhauling



B. R. T. Electrical Shops—Field and Heater Testing Equipments at Fifty-second Street Shops

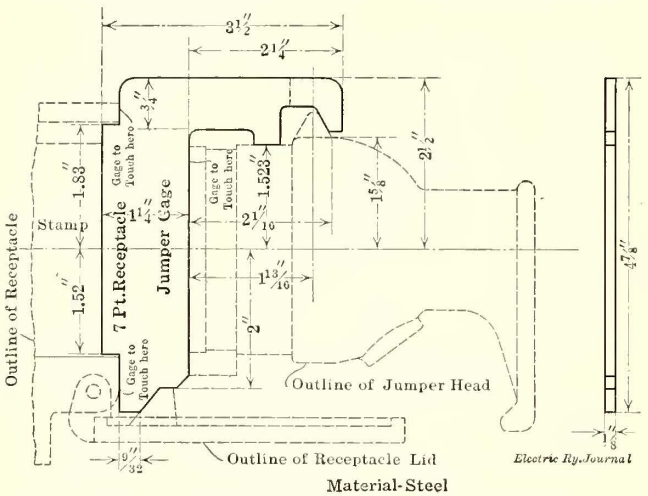
shops for regular overhauling on the mileage basis, and all cars brought into the general repair shops for the periodical varnishing will be examined by means of these outfits, and any defects thus found will be corrected. Tests again will be made after all work on the cars is completed and just before they are returned to service.

The work will be the testing of the resistance of all electrical parts as follows: First, of the equipment by steps from each controller; second, resistance of each motor; third, resistance of compressor motor; fourth, resistance of heaters, and fifth, insulation resistance of car wiring.

The first test will locate any crossed leads, wrong connections or improperly made-up resistance; the second and third tests will locate short and open circuits in motors or

fields, the fourth test will locate wrong connections, crossed circuits or defective heater equipment, and the fifth test will locate partial grounds or watersoaked wiring. These are the principal tests which will be made, but other tests will, no doubt, be found advantageous.

It is expected that these tests will enable the mechanical department to locate and eliminate at once those incipient defects which are not detected with the ordinary tests made



B. R. T. Electrical Shops—Seven-Point Jumper and Receptacle Gage

on inspection, and which while not sufficient to cause trouble at first are liable to increase and cause difficulties in service later.

EQUIPMENT AT FIFTY-SECOND STREET SHOPS

Before considering the multiple-unit control circuit improvements made at the Thirty-ninth Street shops, brief reference may be made to the equipment for handling electrical work at the Fifty-second Street shops. A general view of that portion of the shops where the heavier work is done is presented in the illustration on page 481. This illustration shows the stands on which the armatures are assembled and repaired, an armature sling carried from the 1½-ton crane which spans this bay and one of the two hydrostatic presses. Besides the 1½-ton crane a number of jib cranes and armature trucks are used to eliminate manual labor. In addition to the two slotting machines already described and the hydrostatic presses, these shops contain the usual coil winders, banders, etc. The armature trucks, coil forms, coil-winding machines and banders were manufactured and furnished by the American General Engineering Company. Of the presses, the 150-ton Watson-Stillman press is used for removing the armature shafts of elevated motors and the home-made hydrostatic press is employed for removing and replacing commutators. The usual pressure of application for the commutators is 5 tons to 8 tons. The shop also contains a home-made upright commutator press for convenience in building up new commutators.

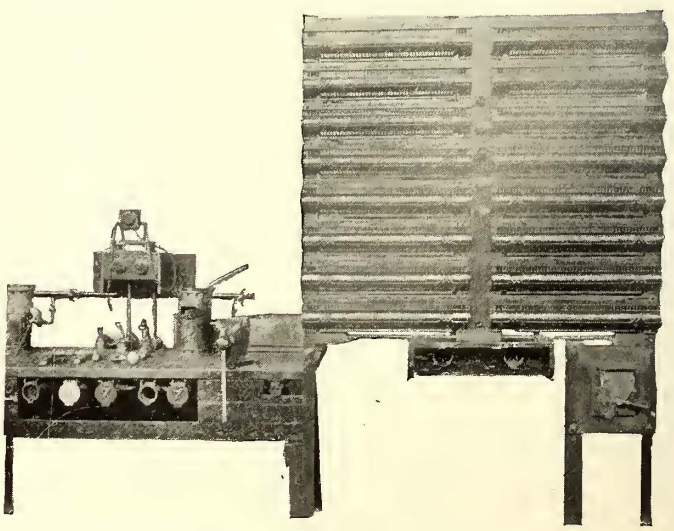
CHANGES IN MULTIPLE-UNIT CONTROL CIRCUITS

Several important changes which add greatly to reliability and safety in service have been made during recent years in both the main and auxiliary circuits of the multiple-unit control systems.

Formerly the batteries were charged through the lighting circuit so that charging occurred only when the lights were on. This method proved particularly unsatisfactory in the short summer season when an average of 250 to 300 weak batteries a month was reported. The batteries are now charged from the compressor circuit, the current passing through sufficient resistance to secure the desired maximum of 2 amp to 3 amp. The resistance can be changed to have the rate of charging vary according to the type of control. The resistance to ground is merely one shunt of the circuit in which the battery forms the other shunt. A relay in this circuit opens the battery circuit whenever the compressor is not operated, thus preventing the batteries from discharging through or, in other words, attempting to operate the compressor.

Another battery change was to place in parallel all batteries on cars equipped with the old drum-type controllers. The batteries on each motor car were formerly connected to a single train line, the opposite terminal of each battery being grounded. In operation, however, it was found that if any set of batteries on one car was weaker than the others there would be a reversal of current because the high-voltage batteries would try to charge the low-voltage battery, thus reducing the available train-line voltage. The evil was corrected by placing all batteries in parallel so that their differences in voltage would always be equalized. This end was accomplished by so changing the connections in the control circuit that an additional train-line wire was obtained to serve as the battery minus wire. The availability of a wire for the battery minus circuit was due to the fact that a wire which had previously been in the reverser circuit was now utilized in the operating circuit by placing an interlock on the reverser. The change in train wiring was directly associated with the general alterations made to permit the interoperation of the older and newer types of automatic control. Formerly the unit switch group type of control could not be operated with the older drum type because the seven wires of the train line did not perform the same functions. Consequently, the circuits in the older type were rearranged so that the corresponding train-line wires of both systems would have the same duties.

The second important change in the drum-type control was the installation of the limit switch in series with the armature and field of No. 2 motor, instead of placing it in a shunt around the field of this motor. One trouble with the shunt connection was that the switch was frequently out of adjustment owing to the difficulty of maintaining the proper ratio of current division, for since the shunt carried a small current it was more easily affected by minor variations in voltage than if placed in the series circuit. The shunt limit switch also gave trouble in case of an open circuit in the armature of No. 2 motor, for in



B. R. T. Electrical Shops—Jumper-Testing Outfit

that event there was the possibility that all current would go through the switch and burn it up. Of course, when connected in series, the limit switch is also on open circuit when the rest of the equipment is.

A third change in the drum-type control was the substitution of a line switch in place of a circuit-breaker. Formerly when dropping off the main motor circuit in this control was opened directly at the controller, thus causing

the burning of fingers and contacts. Controller explosions were also possible on account of short-circuits. These controllers are mounted above the floor level in a compartment adjacent to the motorman's cab, and it was therefore considered desirable to eliminate defects of this character. Consequently a line switch was installed to open the circuit independent of the controller. This line switch is placed in a box underneath the car, where its operation cannot disturb the passengers. It not only serves to open up a circuit during ordinary operation, thereby taking the arc away from the controllers, but it also replaces the circuit-breaker as a means for opening the circuit on overloads.

The release safety switch cylinders of Westinghouse 131 and 160 control have been drilled to secure air connections which insure uniform acceleration throughout the train even when cars with old and new types of automatic control are operated together. This change was made because the old controller gave considerable trouble from what is termed "hanging up" owing to the sluggishness of the repeating switch in cases where the motorman desired to secure a quick release. The trouble was that the operating pawls would fail to complete their forward stroke for advancing the controller drum before the rack and pinion of the release cylinder was at work pushing in the contrary direction. The consequence was a wedging action at the star wheel. The control equipment is now so interlocked that air cannot enter the port of the release cylinder until the interlocking circuit for the operating cylinder has been opened.

All elevated car equipments have been fitted with the Ellcon interlocking stop cock, which makes impossible the operation of the controller until the stop cock in the train line is opened. In other words, the motorman cannot operate his train until he is certain that he has air for the operation of the brakes. The stop cock contains a conducting metal strip whereby contact is established with the line switch circuit when the handle of the stop cock is at the open position. When the stop cock handle is at the closed position the circuit to the line switch is open so that no power is available for starting the car. The stop cock furnished with these equipments is of standard design except that it had to be enlarged at the head to allow for the addition of the electrical connections.

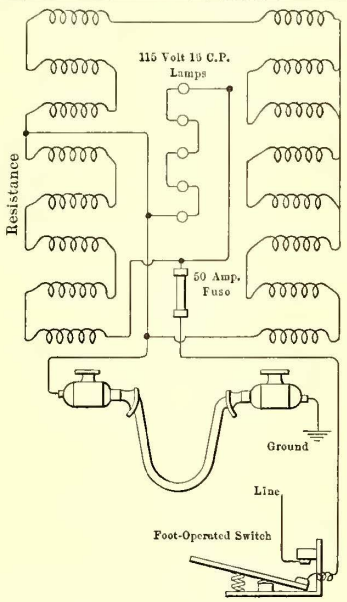
One of the accompanying drawings shows the slate panel switchboard in the motorman's cab of the elevated cars. Formerly transite-lined boxes with a board equipped with snap switches were used for this purpose. The new outfits are better constructed, better insulated, use knife switches instead of snap switches to secure greater mechanical efficiency, and, furthermore, the back of the box is arranged so that every wire can be easily inspected when desired.

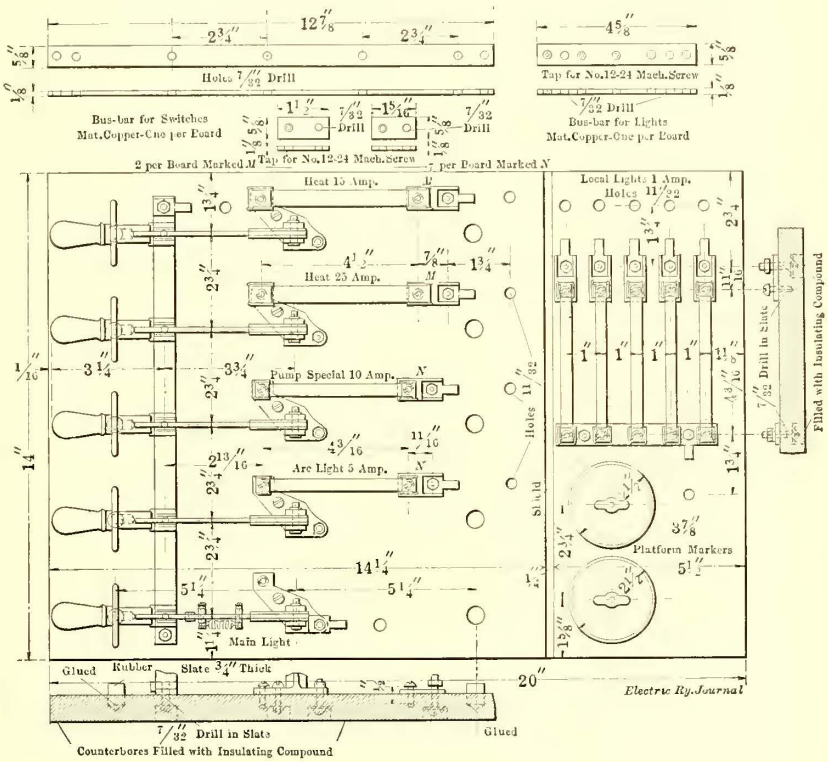
LIGHTING IMPROVEMENTS

Beside the foregoing improvements, a number of minor changes have been made, including an additional circuit of five lights in the 1000-1100 series of elevated motor cars, making a total of twenty-one 16-cp lamps inside the car and four lamps for other purposes.

In this connection the Brooklyn Rapid Transit System is arranging for the use of twenty-three-watt tungsten wire lamps in its 100 new center-entrance surface cars which are to be placed in service during the coming summer. The use of these tungsten lamps will be gradually extended to all cars of the system.

No. Req'd	Material Required for Testing Sets Description
2	West. 7 Point Receptacles
16	Consol. No.33 Heaters - 5 Ohm Coils
5	115 Volt - 16 C.P. Lamps
1	"Noark" Fuse - 50 Amp.-500 Volts
1	Fuse Block for "Noark" Fuse - 30 to 50 Amp.
40 ft.	No.6 Wire - T.D.-6-2





B. R. T. Electrical Shops—Wiring Diagram of Board for Train Line Jumper Tests, and Layout of Switchboard for Cabs of Elevated Cars

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At a recent meeting of shop superintendents a novel point was brought up in connection with the unequal service of paint on opposite sides of car exteriors. It appears that a certain electric railway observed that the paint on one side of its cars was deteriorating much faster than the paint on other side. This seemed inexplicable until it was suggested that as the cars were operated east and west without looping the difference might be due to the fact that one side of the car was always exposed to the south and the other to the north. Arrangements were thereupon made to overcome this inequality in future by turning the cars occasionally.

Scientific Design of Carhouses and Shops

The Authors Analyze the Rquirements, Design and Construction of a Carhouse Installation as Applied by Them to the Planning and Erection of the Norfolk Car Maintenance Plant of the Virginia Railway & Power Company—The Reasons for Selecting Certain Designs and Materials from the Dual Standpoints of Cost and Operating Convenience Are Explained in Detail

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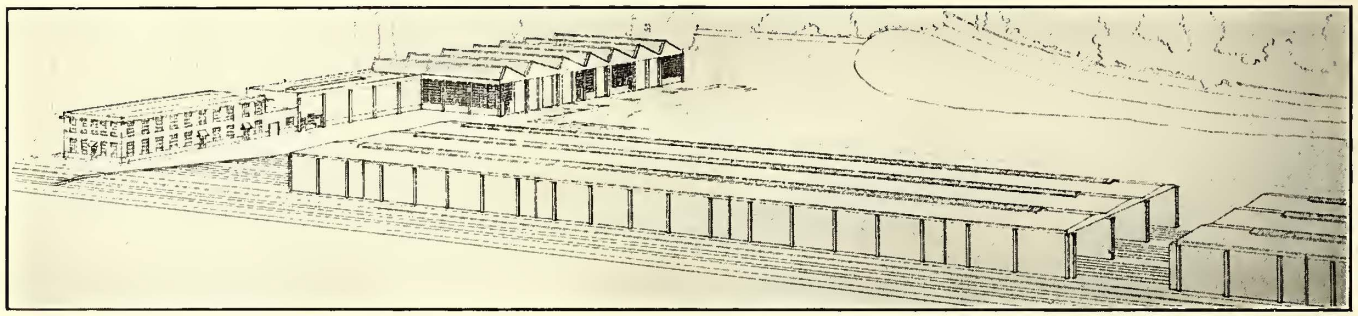
A decade ago the average shop superintendent would have hooted at the idea of applying scientific methods in his shop, but nowadays he is either alert to the changed conditions or he is looking for a new job. To-day the farmer who does not know how to grow more corn to the acre than he used to think possible is a back number and must take summer boarders to help make ends meet. Just so will it be with electric railway and other industrial managers who cannot see the advantages of scientific design as compared with the usual haphazard, poorly studied, often copied and wasteful arrangements which are being used throughout this country in the construction of carhouses, storage structures, shops and other bui'dings for industrial purposes.

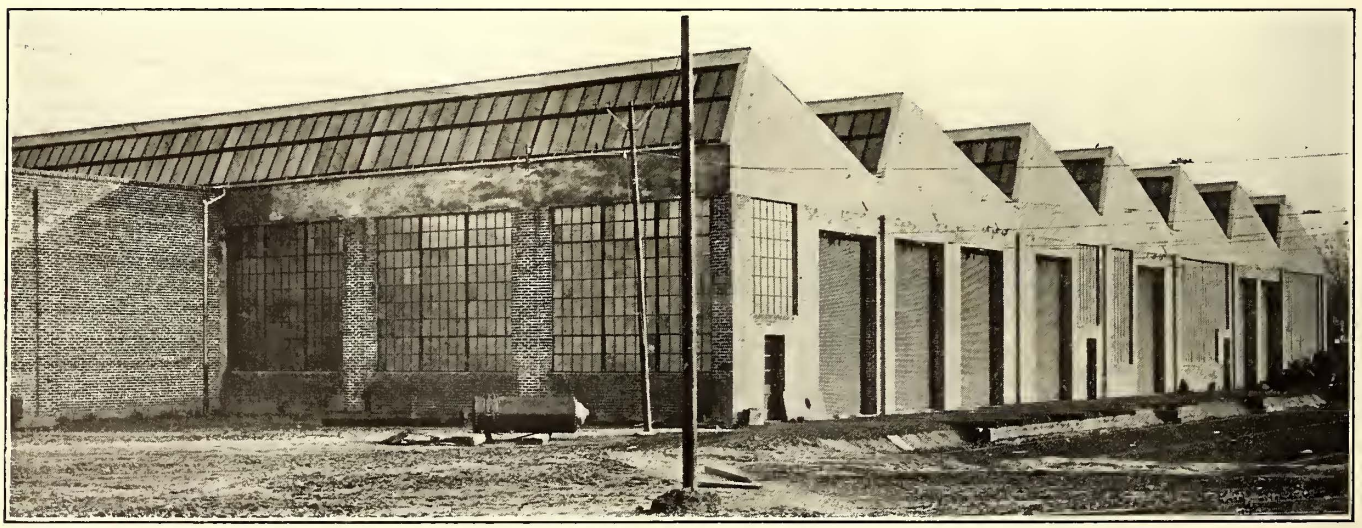
"Scientific design" is nothing more nor less than a design which has been evolved after scientific research and study.

A carhouse consists primarily of walls and their foundation, a roof and its waterproof covering and some skylights. Therefore, to design a carhouse which shall be most economical to construct, it is necessary to find the most economical type of foundation, the most economical kind of wall, the most economical form of roof and the most economical form of skylight. When all of these features have been combined in one plan, a design for the most economical carhouse has been developed. This dictum sounds simple and is simple, and it is exactly the method which should be followed in order to produce a successful solution.

Each problem, however, has tied to it a great many special conditions which must be met. If it were not for these, a standard carhouse would soon be designed and this would be universally adopted. However, the most satisfactory form of foundation is different in different localities, prices for the same materials vary in different cities, labor conditions differ, some carhouses have to be large and some small, underwriters' regulations have to be considered, building ordinances have to be observed; so that in a multitude of ways this problem, primarily so simple, is complicated to such an extent that it is necessary to resort to scientific design in order to discover the most economical form of the various parts and to combine these in the most economical whole.



Norfolk Installation—Panoramic View of Shop Buildings and Carhouses. The Offices, Storerooms and Shops Are in Line at the Left and the Two Carhouses of Equal Size Are in the Foreground



Norfolk Installation—Front and Part Side View of the Shop Building, Illustrating the Liberal Use of Glass at the Sides and Front, the Reinforced Concrete Saw-Tooth Roof, Etc.

QUESTIONS BEFORE THE DESIGNER

When complete data upon all of these limiting condi-

tions have been obtained, a careful study should be made to determine the most economical form of the building and to give a comparison of the costs of the various types of construction in detail. It goes without saying that before a designer can make such an analysis intelligently he must not only be capable of designing the several types of construction in detail but by experience and data available he must also be able to estimate correctly the market costs of the various materials and labor and thereby determine accurately the actual cost of the different parts of the buildings. To the careful designer a large number of questions such as the following immediately arise for investigation:

Will a short wide building cost more than a long narrow building?

Will a two-track unit or a three-track unit or a four-track unit be most economical?

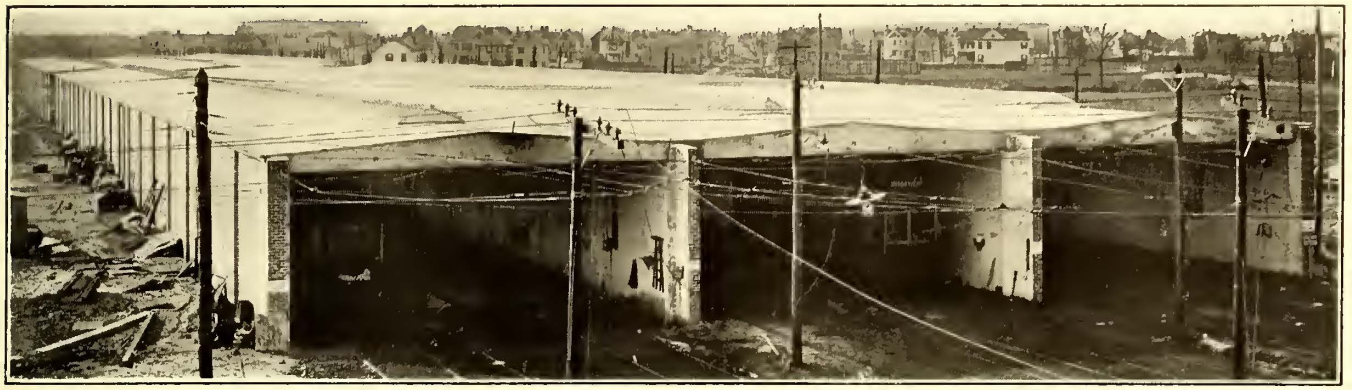
Will a brick foundation, one of concrete or one of stone be best suited to the needs of the building?

Should the walls be constructed of brick, terra-cotta blocks, concrete blocks or concrete?

Should the roof construction be of structural steel protected or unprotected, of reinforced concrete, of a combination of reinforced concrete and structural steel, or of some of the many patented types of construction on the market?

Should the waterproof covering be "built up" or of the "prepared" type, and should pitch or asphalt, slag or gravel be used?

These questions cannot be considered singly, for in many ways they are interdependent. A type of foundation for one wall will not always be best for another wall, the most economical form of roof may not lend itself to the most economical type of roof support, and so on through the entire design. Each type of foundation, each kind of wall, every form of roof must be analyzed and designed and costs tabulated so that the designer can select with a free mind from these tabulations the most economical combination which is applicable to the problem in hand. It will usually be found that after a careful study is made and the results properly tabulated the matter of selection is very simple; in fact, the correct combination is generally obvious.



Norfolk Installation—General View of One of the Three-Bay Carhouses, Showing the Unusual but Most Economical Form of Roof and Most Favorable Skylight Arrangement

For the purpose of illustrating the methods herein discussed, views of the carhouses designed by the authors and erected for the Virginia Railway & Power Company at Norfolk, Va., are reproduced, and details of the methods used in designing these buildings are explained.

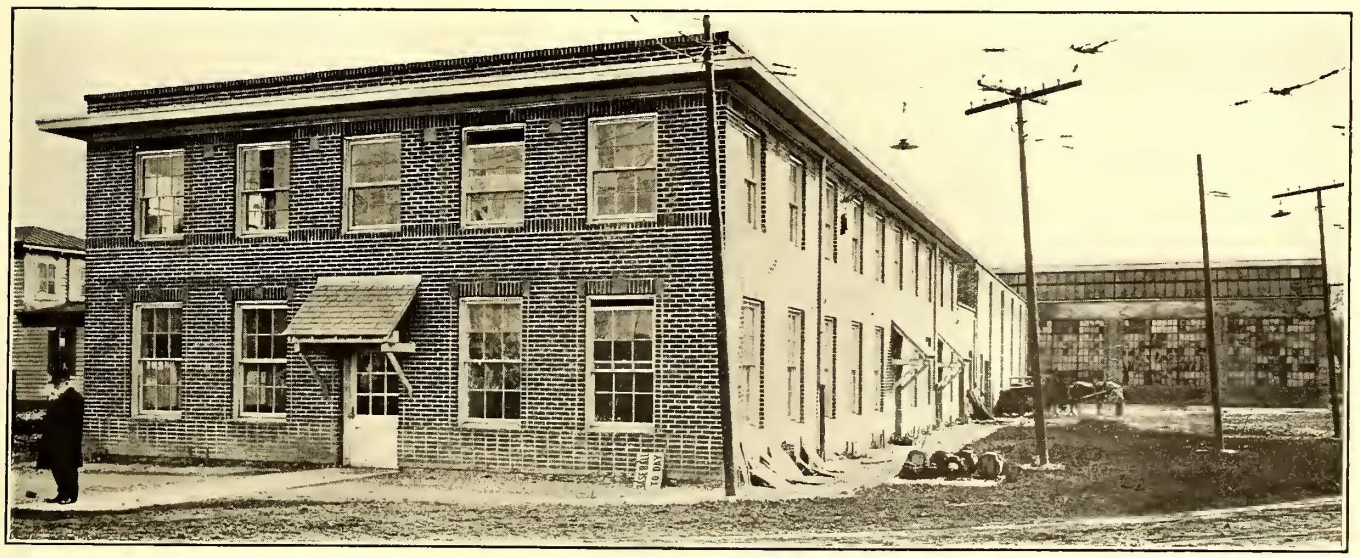
ACTUAL CONDITIONS OF THE NORFOLK LAYOUT

It is impossible in an article of this kind to treat fully all of the factors considered in evolving the design. An attempt has been made, however, to outline in general the methods employed.

In the present case the designer had to meet the following primary conditions:

(a) The carhouses shall contain 7200 ft. of track.

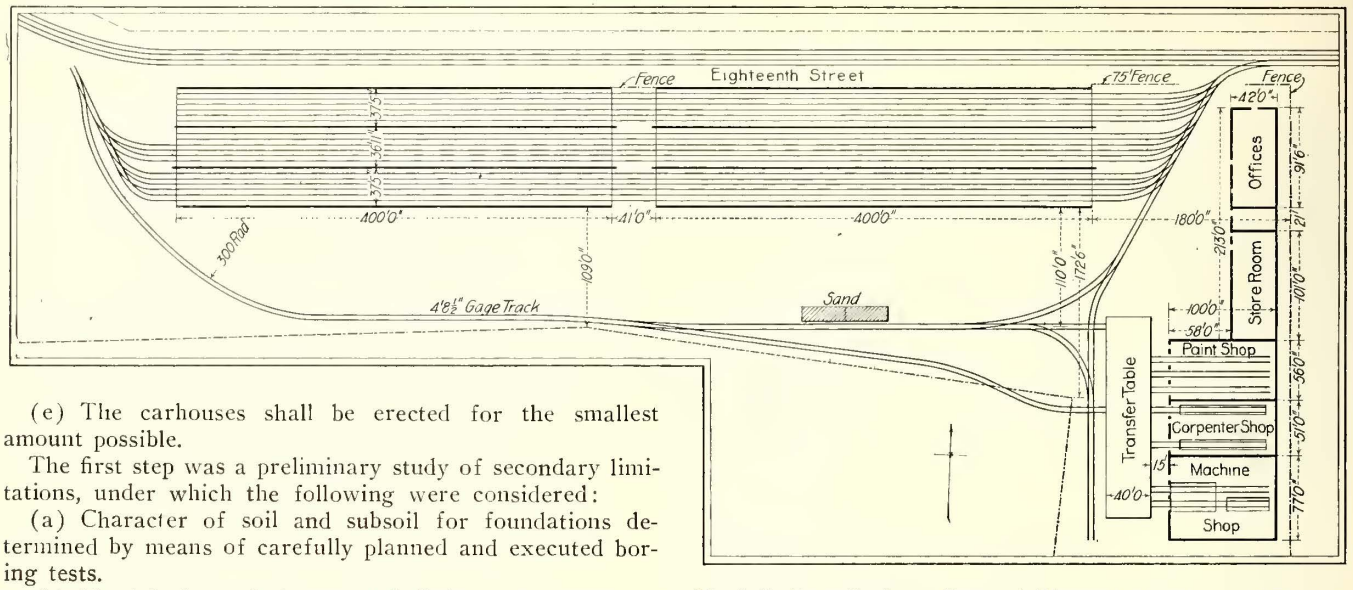
(b) The carhouses shall carry the minimum rate of insurance.



Norfolk Installation—Brick Office Building and Storage Structure, Showing Also One of the Glazed Sides of the Shop Building at the Rear

(c) The carhouses shall be erected upon a lot already owned by the the railway company and set aside for this purpose.

(d) There shall be a free headroom for trolleys of 16 ft. above tracks.



Norfolk Installation—General Plan of the Shop, Office, Storeroom and Carhouse Properties

(e) The carhouses shall be erected for the smallest amount possible.

The first step was a preliminary study of secondary limitations, under which the following were considered:

(a) Character of soil and subsoil for foundations determined by means of carefully planned and executed boring tests.

(b) Municipal regulations and building ordinances applicable to the contemplated operation.

(c) Rules and requirements of fire underwriters having jurisdiction.

(d) Accurate costs of various building materials and kinds of labor.

(e) Cost of special work and tracks to equip carhouses.

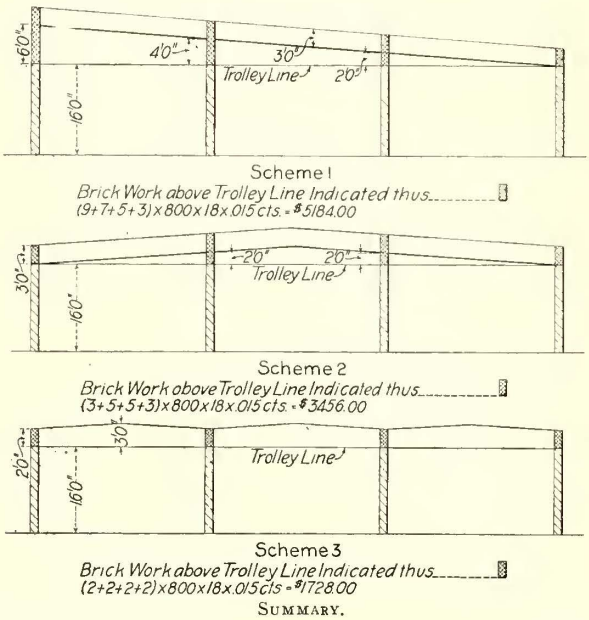
(f) Practicability from operating standpoint.

FORM OF BUILDING

A study of existing and necessary trackage, size and shape of lot and insurance regulations showed at once that several units or stalls would be required and that two detached buildings each containing three units would probably be most practical and afford better opportunity for extension.

The number of stalls was fixed by two factors, the shape of the lot and the underwriters' requirement that no section should contain more than 20,000 sq. ft.

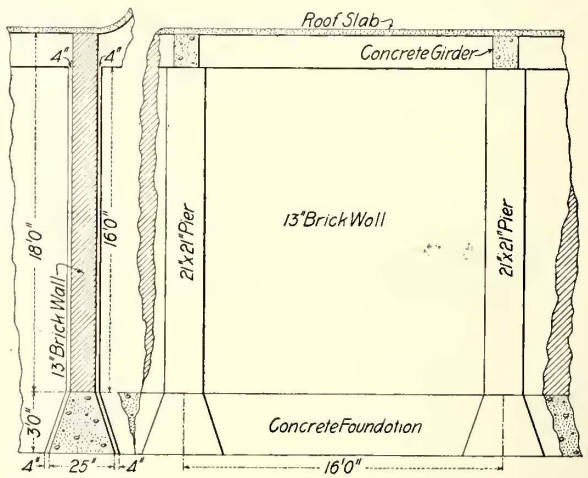
Fig. 1 is a reproduction of the study sheet prepared to show the results of an investigation of three different plans of roofing three units in one building. It will be noted that scheme No. 1 shows the roof over the three units high on one side and low on the other and sloping all one way. Scheme No. 2 shows the roof high in the center of the center unit and sloping two ways, while scheme No. 3 shows the roof high over the center of each unit and sloping two ways over each unit. In each scheme the slope per foot of the roof is the same. As the necessary distance between track and trolley was fixed at 16 ft., it was considered that all wall used above the horizontal



SUMMARY.

Scheme No. 3 saves over scheme No. 1	$3,456.00
Scheme No. 3 saves over scheme No. 2	1,728.00
Scheme No. 3 saves over form of roof on certain carhouses built by others	5,580.00

Norfolk Installation—Fig. 1—The Three Roofing Schemes Compared on the Basis of Cost

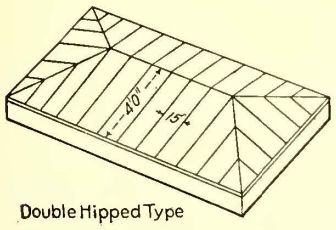


	Quantity.	Cost.
Brickwork:		
Piers, 18×1.75×30	945	
Wall, 18×14.25×18	4617	
Total brick at $15 per 1000	5562	$83.43
Concrete Footing:		
Under wall, 3×1.5×16	72	
Extra for pier	5	
Total at 17 cents per cu. ft.	77	13.09
Excavating:		
3×3×16, at 27 cents per cu. yd	144	1.44
Forming:		
110 sq. ft. at $12.50 per 1000	110	1.37
Total cost per panel		$100.33
Total cost per linear foot		6.27

Norfolk Installation—Fig. 2—Typical Analysis of Wall and Foundation for Carhouse Construction

line 16 ft. above the tracks should be charged against each scheme in considering the relative cost. For purposes of comparison, the walls were considered as 13-in. brick walls, the figures being based on brick laid in the walls at $15 per 1000 and each wall being 400 ft. long. The indicated calculations show a saving for scheme No. 3 of $3,456 compared with scheme No. 1; a saving for scheme No. 3 of $1,548 compared with scheme No. 2, and a saving for scheme No. 3 of $5,580 compared with a certain building previously erected by others. It will be noted that in three-track or four-track unit would be most economical and whether units constructed with or without columns would be best. Actual roof construction which had been used for carhouses already built by others was carefully measured and analyzed.

Some forty-odd different study sheets as shown in Fig. 4 were prepared. These sheets covered the various systems of steel supports with concrete slabs, combination tile and concrete construction, ferro-inclave and ferrolithic plates, magnesia fireproofing and numerous reinforced concrete systems both "monolithic" and "unit built." When the proper form had been determined by this process, a detailed study was made to consider the possibility of further reduction in cost by adapting the design to stock sizes and lengths of forming lumber, by including skylight curbs and by utilizing in every way possible every pound of material entering into the construction to produce greater strength at less cost.

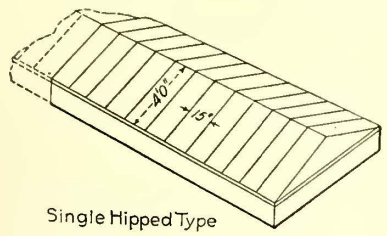


Double Hipped Type

FOR UNITS 15 FT. × 7 FT. 6 IN.

Glass, 36×4×1.25×11 cents.....$19.80
Bars, 32×4×10 cents..... 12.80
Ridge, [7.5+(5.5×4)]×10 cents..... 2.95
Cap, bars, [7.5+(5.5×4)]×10 cents.... 2.95
Curb, (15+15+7.5+7.5)×13 cents..... 5.85
$44.35

$$\frac{\$44.35}{15\times 8} = 37 \text{ cents per sq. ft.}$$



Single Hipped Type

FOR UNITS 15 FT. × 7 FT. 6 IN.

Glass, 24×4×1.25×11 cents..$13.20
Bars, 26×4×10 cents..... 10.40
Ridge, 15×10 cents..... 1.50
Cap, 15×10 cents..... 1.50
Curb, (15+15+7.5+7.5)×13c. 5.85
Ends, 7.5×2×1.5×10 cents.. 2.50
$34.95

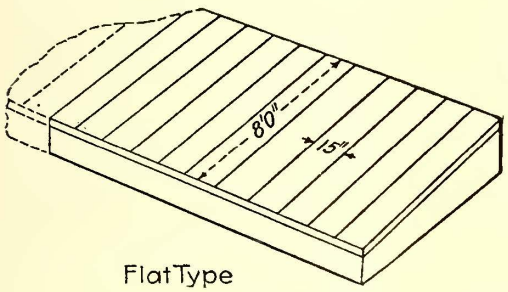
$$\frac{\$34.95}{15\times 8} = 29.1 \text{ cents per sq. ft.}$$

For continuous units 7 ft. 6 in. wide deduct:

Bars, 2×4×10 cents..... $0.80
Curb, (7.5+7.5)×13 cents..... 1.95
Ends, as above..... 2.50
$5.25

$34.95—$5.25=$29.70

$$\frac{\$29.70}{15\times 8} = 24.75 \text{ cents per sq. ft.}$$



Flat Type

FOR UNITS 15 FT. × 7 FT. 6 IN.

Glass, 12×8×1.25×11 cents.....$13.20
Bars, 13×8×10 cents..... 10.40
Curb, (15+15+7.5+7.5)×13 cents . 5.85
Ends, (7.5+7.5)1.5×10 cents..... 2.50
$31.95

For units 7 ft. 6 in. wide continuous deduct from above
Bars, 1×8×10 cents..... $0.80
Curb, (7.5+7.5)×13 cents..... 1.95
Ends, as above..... 2.50
$5.25

$31.95—$5.25=$26.70

$$\frac{\$26.70}{15\times 8} = 22.25 \text{ cents per sq. ft.}$$

ALLOWANCE FOR EXTRA CONCRETE CURB.

Concrete curb, one side, 15×0.5×30 cents 2.25
Metal covering of same, 15×1.5×10 cents 2.25
$4.50

With curb allowance, units 15 ft. × 7 ft. 6 in. =

$$\frac{\$31.95+\$4.50}{15\times 8} = 30.4 \text{ cents per sq. ft.}$$

Continuous 7 ft. 6 in. wide with curb allowance =

$$\frac{\$26.70+\$4.50}{15\times 8} = 26 \text{ cents per sq. ft.}$$

Norfolk Installation—Fig. 3—Comparison of Skylight Costs for the Carhouse

scheme No. 3 there are only 2 ft. of brickwork above the trolley line at the outside wall, whereas in schemes Nos. 1 and 2 there are 3 ft. of brickwork. This seeming discrepancy results from the fact that in scheme No. 3 a girder 3 ft. deep in the center and only 2 ft. deep at the wall line was possible, whereas girders 3 ft. deep throughout were required in the other two schemes for the same strength.

TYPE OF WALL AND FOUNDATION

In a similar manner the various types of walls and foundations were analyzed. Fig. 2 shows the results of an analysis of one type of wall and foundation which was considered. Several other types were analyzed in this manner. The cost of excavation, of forming, of mixing concrete, of handling concrete, of brick and laying of same, of concrete blocks, of terra-cotta blocks and of each operation and all materials required for each type was tabulated as indicated and the final selection made after considering all of these data. In the buildings actually erected it was not practicable to use the cheapest form of wall developed on account of difficulty in erecting that form in the time which the railway had allotted for the completion of these structures.

TYPE OF ROOF

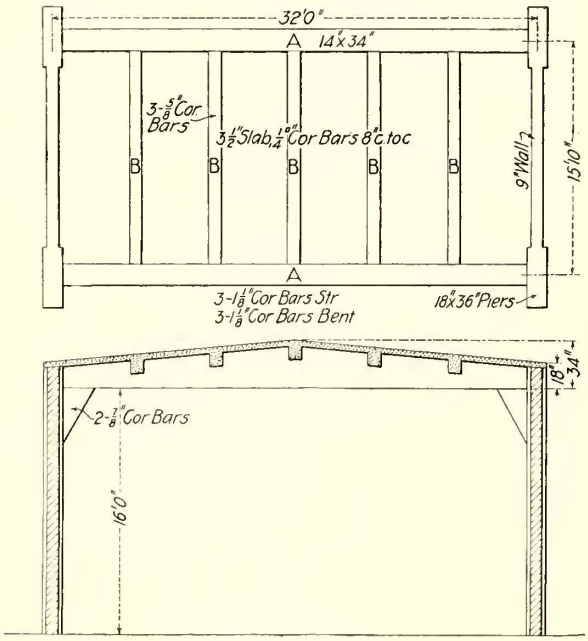
The type of roof afforded a broader opportunity for study and analysis than any other feature of the design because here there were so many more types of construction which could be used and which would meet all of the primary conditions.

A study was made to determine whether a two-track, The girders in the finished building were designed to conform to the form of roof which had been found to be most economical, and at the same time the costs of these were reduced, for the lowest cost corresponded with the theoretical form of a beam of uniform strength which gives the maximum strength for a minimum of materials.

A large amount was saved by standardizing the design so that in the actual construction each slab and each beam was exactly like every other slab and beam in the building. This standardization resulted in economy in forming, in erection, in placing steel, and in other ways. At the same time it reduced to a minimum the possibility of error in the actual construction work.

When the details were being designed for the reinforced concrete members, care was taken to assure a "balanced design," namely, to have the same factors of safety for all parts and at the same time the correct economic combination of concrete and steel. It is true, in general, that any required strength can be obtained in a number of different ways. If the designer's problem is to obtain the desired strength with the minimum amount of steel, the construction will require more concrete than is economical, or if the minimum amount of concrete is sought, it is probable that the amount of steel will be excessive; but when a designer's problem is to produce the most economical design from a total cost standpoint he proceeds to find the correct relation between the quantities of steel and concrete to be used and is repaid for his tedious study by a considerable reduction in the cost of the building. This

desirable result is seldom obtained commercially unless the designer of the building is the actual designer of the reinforced concrete work which enters into it. It is true that the quite common practice of architects and railroad engineers to rely upon those who sell steel for the actual design of the reinforced concrete has led to wasteful and unnecessarily expensive designs. Often even a greater damage is done by accepting designs of this kind and becoming thereby obligated to use the particular type of reinforcement sold by the party who furnished the design, instead of buying under competitive conditions. It is the same old story that something cannot be obtained for



	Quantity.	Cost.
Concrete:		
Girder A, 26×14×32.15÷144	82	
Girder B, 5×8×14×14.66÷144	57	
Knees, 3×4×14÷12	14	
Slabs, 14.66×28.9×3.5÷12—4.75×4.66×3.5÷12	104	
Total concrete at 20 cents	257	$51.40
Steel:		
Girder A, 6—1⅛ c.r.×34	895.	
Girder B, 5×3—⅝ c.r.×17	344.	
Knees, 2×2—⅞ c.r.×9	95.5	
Slabs, 1×16×34× area ¼ sq. c.b.	190.	
Total steel	1524.5	45.74
Forming:		
2560 bu. at 25 cents per 1000 = 65 + 5 for knees		70.00
Total cost		$167.00
Total cost per sq. ft.		0.33

Norfolk Installation—Fig. 4.—One of the Typical Study Sheets of Construction Materials (Not Adopted)

nothing. When the owner pays for reinforced concrete design, he will get more for his money from a competent engineer who represents him than he can by buying his steel from the representative of a steel concern who furnishes designs "free." One man studies the problem as a whole while the other is merely selling steel.

SKYLIGHTS

The underwriters require a certain glass and certain details of construction, but they are not concerned with the form of the skylight. The size and location of the skylights must be determined after a study of the location and needs of the building. When it has been decided what percentage of light is desirable the designer should consider the various forms of skylights. Fig. 3 shows the study sheet prepared for this purpose.

It will be noted that the "flat type" embodying continuous construction is the cheapest for the skylight alone, as would have been expected, but actually the most economical type cannot be selected until careful calculations have been made to determine the relative cost of curbs and flashings for the various types. A consideration of these factors in the present case showed the "single-hipped type" of continuous construction to be the cheapest under the prevailing conditions. There are often limiting conditions which make the selection far more difficult than in the present case. In some latitudes snow and ice have to be carefully considered in this connection. Special lighting is often required over inspection pits and various problems of ventilation are encountered, but in each case the same general method of investigation as outlined should be employed.

RATE OF INSURANCE

Part of a designer's duty is to predetermine all of the requirements of the underwriters in connection with the building and to establish the exact rate which will be given upon the completed structure. This is very important, but it is not a difficult task when taken up in an intelligent manner. The abuse which is usually hurled at the insurance companies by designers and operators is frequently born of ignorance and results from the application of penalties for defective design, construction or equipment.

The engineering departments of the underwriters have formulated certain requirements and restrictions which by experience they have found to be helpful in their effort to

Norfolk Installation—Roof, End and Side Lighting in the Machine Room

prevent loss by fire. A designer can obtain these rules and requirements and will find a sincere desire on the part of the underwriters to co-operate with him in his efforts to justify a minimum rate of insurance. Of course, a certain familiarity with their regulations is necessary before a designer can successfully apply their rules to any separate problem, but to submit detail plans and specifications to the underwriters for criticism even before proceeding to take bids will often be found to be of value and will eliminate the possibility of error and disappointment later on.

The rate of insurance on a carhouse is of far greater importance than the rate on most buildings because the value of the rolling stock is many times the value of the building and its rate is based on the rate upon the building.

The carhouses herein illustrated have been given the lowest rate possible in their district. This rate is 20 cents per $100. To this rate 5 cents per $100 was added on account of defective wiring in cars. The average rate on old buildings in the same district is $1.29 per $100. Therefore, the rate granted will mean a saving to the company in premiums on building and cars of about $3,562 a year, or 5 per cent interest upon $71,240. If all buildings in use by the company containing tracks were reconstructed in the

same manner as those herein illustrated the saving in premiums would represent 5 per cent upon a total sum of more than $90,000.

DETAILED STATEMENT OF COST

The following tables cover the detailed costs of the carhouses as actually erected:

1000 cu. yd. earth excavation, at $0.30		$300.00
Labor, eight-hour day	$1.50	
Carts, ten-hour day	3.00	
Double team, ten-hour day	5.00	
1,460,000 bricks, at $14 per 1000		20,440.00
Bricks delivered to site, per 1000	$8.50	
Sand delivered to site, per cu. yd	.65	
Lime delivered at site, per bbl	.90	
Lime (slaked), per bbl	.20	
Cement (sacks returned), per bbl	1.02	
Bricklayer, eight-hour day	5.20	
Laborers, eight-hour day	2.50	
1527 cu. yd. concrete, at $11.16 per cu. yd		17,041.32
Gravel delivered to site, per cu. yd	$1.85	
Cement (sacks returned), per bbl	1.02	
Sand delivered to site, per cu. yd	.65	
Forming lumber, per 1000	18.00	
Carpenters, eight-hour day	3.25	
Common labor, eight-hour day	1.50	
110 tons reinforcing steel, at $42.78 per ton		4,705.80
Placing steel at $3 per ton		330.00
715 squares tar and gravel roofing, at $3.15		2,252.25
Labor, eight-hour day	$2.00	
Pitch, f.o.b. Norfolk, per ton	15.00	
Felt, f.o.b. Norfolk, per ton	29.00	
Gravel, f.o.b. Norfolk, per ton	2.25	
Hauling to site, per ton	.60	
17,300 sq. ft. wire-glass skylights, at $0.24		4,152.00
¼-in. wire glass cut to size, f.o.b. factory, per sq. ft.	$0.09	
Freight on glass, per sq. ft	0.01	
Hauling and handling glass, per ton	3.00	
No. 24 galvanized iron, per 100 lb., f.o.b. city	3.80	
Sheet-metal workers, average eight-hour day	3.50	
Terra-cotta drain pipe		412.00
Gutters and down-spouts		206.00
Permit, bond and incidentals		375.00
Contractors' profit		5,021.44
Total cost		$55,235.81

Norfolk Installation—Painting Section of Reinforced Concrete Shop

It may appear that the cost of leaders and drainage piping should be analyzed for each form of roof, but when it is considered that it is customary to apportion leaders on a basis of area of roof surface and that the cost of drainage piping, at best, is small, the factors are negligible.

For purposes of comparison, this cost may be expressed in the following terms:

	Cents
Cost of carhouses per square foot of floor space	61.66
Cost of carhouses per cubic foot of contents	3.09
Cost of carhouses per foot of track	$7.67
Cost of carhouses per car (50 ft. of track)	$383.50

RÉSUMÉ

The same methods of design were employed in connection with the shops, storehouse and offices as illustrated. The carhouses, however, being the simplest of the buildings erected, have been used to explain the methods.

The general character of the shop and office buildings is apparent from the accompanying half-tone views. The shops are constructed of reinforced concrete and brick with steel sash and saw-tooth roof. Attention is called to the successful use of large glazed surfaces in the side-wall construction, a principle so extensively applied to modern factories. The saw-tooth trusses are composed of reinforced concrete instead of the customary structural steel, thereby eliminating the usual penalty assessed by the underwriters. In the use of the saw-tooth roof the question of exposure is often neglected. It is erroneous to expose a large glazed surface in a position which will cause it to receive the direct rays of the sun during an extended period of the day. It is obvious that such lack of forethought will tend to make the building unendurable to the workmen in summer on account of the excessive heat. The office building is also built of fireproof materials. While the saving in insurance might not justify this construction, the additional saving in upkeep unquestionably does. The cost of fireproof construction, as a matter of fact, is not so excessive as is generally supposed.

The authors believe that the results justify the painstaking and tedious processes which they have employed. Success does not depend alone upon the design. The methods used in obtaining bids and in preparing contracts and in superintending the actual work of construction are all important factors.

The fallacy which is probaby responsible for the greatest waste in constructing buildings of this kind is the common one which prompts a manager to say "Let's do it ourselves." This idea is based upon the assumption that the master mechanic or chief engineer knows better than anyone else what is needed and how it should be built. No matter how able these officers of the company may be, they cannot be specialists in designing buildings, and if they were they would not be suited for their other duties. Even if they know how, they seldom have the time to make an exhaustive study of the problem and they rarely have the experience and data before them to make an efficient study assuming that they do have the time. Excessive cost is the natural result of this condition. Sometimes the same unfortunate result is obtained by attempting to copy some satisfactory building, and ignoring entirely the local conditions which were involved in its success from a cost standpoint.

In other cases architects are actually required to put use-

Norfolk Installation — Interior View of the Carpenter Shop, Showing End Lighting

less ornamentation on the building or the "designing" services of the steel salesman are secured "free of cost."

If the problem is to be studied thoroughly and the building erected for a minimum of cost, it is certain that considerable time must be devoted to it by someone who knows how, and that someone is going to be paid for his services somehow. It is pretty generally recognized nowadays that it is better and cheaper to buy services, as well as commodities, directly rather than indirectly, and that in the long run the service of the specialist is cheapest.

BLOCK SIGNALS ORDERED BY INDIANA LINES

In accordance with the order of the Railroad Commission of Indiana, outlined in the Electric Railway Journal for Oct. 26, 1912, page 920, the Terre Haute, Indianapolis & Eastern Traction Company and the Union Traction Company of Indiana have placed an order with the General Railway Signal Company for light signals to protect the following sections of track:

Terre Haute, Indianapolis & Eastern Traction Company

		Miles
Indianapolis-Lafayette Division	County Line to Whitestown	8.39
	Marts to East Mulberry	3.13
Indianapolis-Martinsville Division	Carhouse to Martinsville	13.81
Indianapolis-Richmond Division	Dunreith to Blue River	3.02
Indianapolis-Terre Haute Division	Tucker to Greencastle	1.94
	Boys' School to Dilley	3.47
Total		33.76

Union Traction Company of Indiana

		Miles
Noblesville to Tipton		16.40
Gas City to Marion		5.84
Indianapolis-Anderson Division	Siding 22 to Siding 26	8.38
	Siding 13 to Belt Railway, Anderson	5.56
Total		36.18

Protection for both railways will be afforded by light signals with a. c. track circuits and polyphase relays, similar to those which have been installed on sections of these two railways heretofore as described in the Electric Railway Journal for Aug. 24, 1912, page 286.

The Kokomo, Marion & Western Traction Company has also ordered signals of this type from the General Railway Signal Company to protect the track for 5 miles west of Kokomo. This installation was not included in the original order of the commission, but at a later date the company was required to protect a 5-mile section of its track with block signals. The Fort Wayne & North Indiana Traction Company has also ordered signals from the General Railway Signal Company for 24.6 miles on its Fort Wayne-Logansport division.

It is also reported that the other railways which are included in the order of the commission will close contracts for signals of the track circuit type in the near future, part of the orders to be placed with the Union Switch & Signal Company and part with the General Railway Signal Company.

Construction has begun on a 15,000-hp water-power plant at Martigny, in the canton of Wallis, Switzerland, to utilize a fall of 5400 ft., making this station the highest-head water-power plant in the world. Special interest attaches to the penstock lines, which are 3 miles in length. The upper section, which will be under comparatively light hydraulic pressure, is being built of welded steel pipe, 23.6 in. in diamete. The lower section, which will withstand a hydrostatic pressure of nearly 2500 lb. per sq. in. or 165 atmospheres, is to employ special ingot-pressed seamless steel pipe. The tube sections vary in wall thickness from 1.24 in. at the top to 1.77 in. at the region of highest pressure. The turbines, which will be of the Pelton type, will be furnished by Piccard, Pictet & Company, of Geneva. Only 30 cu. ft. of water per second will be necessary to develop the output.

CONVENTION LOCATION COMMITTEE VISITS WASHINGTON

The committees on location of the 1913 convention of the American Electric Railway Association and allied bodies visited Washington on Wednesday evening and Thursday, March 12 and 13. The party, which left New York on the Congressional Limited, was composed of C. Loomis Allen, C. L. Henry and Secretary H. C. Donecker, as representatives of the American Electric Railway Association, and E. H. Baker, James H. McGraw and H. G. McConnaughy, as representatives of the American Electric Railway Manufacturers' Association. The object of the trip was to study in person the facilities which the capital offers in accommodations for convention guests and exhibits. This problem has become one of ever-increasing difficulty owing to the greatly increased attendance and more elaborate displays at the annual meetings. At the 1912 gathering in Chicago, for example, accommodations had to be found for some 4500 visitors, and about 85,000 sq. ft. of exhibit space, exclusive of aisles, etc., was in use.

On arrival at Washington the party was met by President Callahan and Secretary Grant of the Washington Chamber of Commerce. It was met also by Clarence P. King, president Washington Railway & Electric Company; George E. Hamilton, president Capital Traction Company, and other electric railway officials, who expressed their desire that the 1913 convention shall meet in Washington. To accommodate the convention the Chamber of Commerce proposes to erect a temporary structure on the site of the old Pennsylvania Railroad station. It will make a definite proposition to the convention location committee within a few days. The committees were entertained at luncheon on Thursday at the New Willard by Mr. Hamilton. Those present in addition to Mr. Hamilton and the committees were D. S. Carll, general manager, H. D. Crampton, secretary, R. D. Simms, treasurer, and J. H. Hanna, chief engineer, Capital Traction Company.

The committee will also give consideration to invitations received from cities in several sections of the country.

BALANCING THE ROTORS OF TURBO-ALTERNATORS

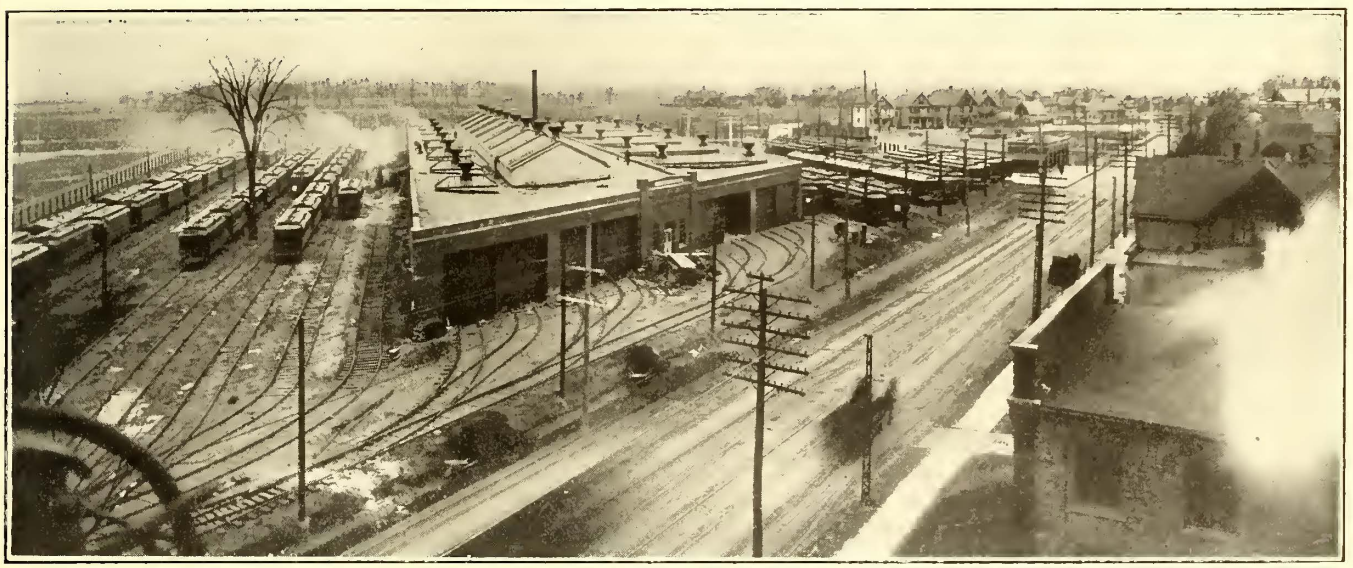
In American factories practically all turbo-alternators are balanced by a cut-and-try process. The turbine is first assembled on the test floor and connected to the steam and exhaust mains and to the oil and water systems of the plant. As the machine is driven under its own power, the test men determine which end of the machine is the roughest by placing the forehead against the casing at different places. A weight is then inserted into one of the tapped holes provided in the runner, and the machine is speeded up, the result of the "shot" being noted. If the vibrations are less violent but still noticeable, another and heavier weight may be inserted in the same hole. If the first attempt produces more violent vibrations, the weight is removed and placed in some other part of the runner. Each tester generally has his own "follow-up scheme" of placing the successive weights. This process is continued until both ends of the turbine are free from vibration at rated speed. When the generator is attached to the shaft this process is repeated and weights are placed upon the ends of the rotor at various points on the circumference until all bearings and the casings of both the turbine and the generator are free from vibrations as far as can be detected by placing the forehead against them. Many of the foreign factories balance the rotors of their generators dynamically before they are assembled in the machine. Special apparatus fitted with delicate balancing mechanism is required in this work. As a precautionary measure these machines are generally subjected to a high-speed test before they are allowed to leave the factory.

Fond du Lac Avenue Carhouse of The Milwaukee Electric Railway & Light Company

Detailed Account of a Modern Carhouse Embodying a Number of New Design Features—A New Trainmen's Club House Connected with the Carhouse Is Described

The new Fond du Lac Avenue carhouse, recently completed by The Milwaukee Electric Railway & Light Company, is situated in the extreme northwest portion of the city and serves thirteen street railway lines which are readily accessible to it. Milwaukee is laid out like Chicago, with the business district on the lake front and the residence and industrial sections adjacent to it on three sides. Avenues cutting the north and south and east and west streets diagonally extend out from the business district in a northwesterly and southwesterly direction. This arrangement of streets and avenues permits the cars of various lines in the northwest portion of the city to reach the new carhouse without excessive non-revenue mileage.

As indicated by its name, the new carhouse is located on a triangular plot at the intersection of Fond du Lac Avenue, a main thoroughfare extending from the city limits into the heart of the business district, and Thirty-fifth Street, upon which is a double-track line extending north and south. The over-all dimensions of the property are 850 ft. east and west, 550 ft. north and south and 1200 ft. along Fond du Lac Avenue.



Fond du Lac Avenue Carhouse—General View of Property, Showing Buildings and Storage Tracks

The carhouse proper is situated 140 ft. north of the south line of the property. Three entrance leads from the double track on Fond du Lac Avenue and three from the double track on Thirty-fifth Street form the approaches to an eight-track storage yard south of the carhouse and also to the through tracks in the carhouse and the eleven storage tracks on the north of the building. The south storage yard has stub-end tracks with the leads from Fond du Lac Avenue. The north storage yard also has stub-end tracks, the leads coming in from Thirty-fifth Street. Eight tracks through the building and one at the extreme north side of the north storage yard provide access to the yards from either side of the property. The present storage capacity is sufficient for 230 cars with 66 inside the building and 164 outside. Except for cars that require inspection, running repairs or washing, all storage is in the open.

All track special work in the approaches is laid with 60-lb. A. S. C. E. rail with hard-center tongues, mates and frogs, and an 80-ft. radius turnout. The yard tracks are spaced at 11-ft. and 13-ft. intervals alternately, with provision for a future 13-in. brick firewall extending the full height of a car, and room for a future storage track is provided adjacent to each set of three tracks. A small cast-steel bumper bolted to the end of the rail has been installed at the end of each stub storage track.

The carhouse, which includes a general repair shop bay and a car-washing bay, is 136 ft. 6 in. wide with one end paralleling Thirty-fifth Street and the other Fond du Lac Avenue, making the south extreme length 503 ft. and the north extreme length 372 ft. The general repair shop bay occupies the south portion of the building, 78 ft. in width. Four through tracks spaced at 13-ft. intervals were built adjacent to the south wall so as to leave a 5-ft. aisle next to this wall and a 33-ft. aisle adjoining the north wall of this section of the building. This arrangement permits the north aisle to be used as shop quarters, and the track and pit spacing allows a 4-ft. walkway between cars.

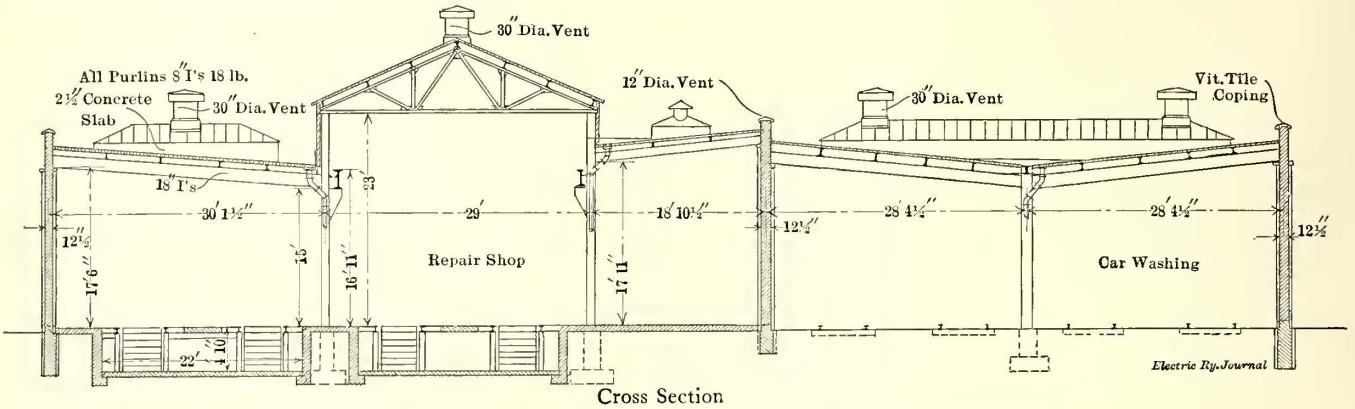
The entire car-washing bay, which is 56 ft. 9 in. wide,, is occupied by four tracks spaced at 13-ft. centers. The track capacity in this section permits thirty-one cars to be set for washing at one time. All four tracks extend through the building, connecting with the Thirty-fifth Street line as well as the Fond du Lac Avenue line.

BUILDING CONSTRUCTION DETAILS

The building walls are constructed on concrete foundations and are of sufficient height to provide a minimum clearance of 15 ft. under the roof structure. They extend approximately 2 ft. above the roof and are capped with a vitrified tile coping. Exterior and interior pilasters at 20-ft. intervals provide ample bearing area for the roof beams, and those on the exterior also serve in combination with brick corbels and stone trim to carry out a paneled architectural treatment. In order to eliminate exterior fire hazard windows were omitted from the longitudinal walls. In fact, the only windows in the building are those provided in the walls at the ends of the shop aisle in the repair bay. The floors of the repair bay are of concrete, 6 in.

thick, with a sidewalk finish, and that in the car-washing bay is of crushed stone on a cinder fill.

The roof is supported upon I-beams resting on the building walls and on a row of columns in the center of the wash bay. The roof over the repair bay is divided into three panels, the two outside ones being supported on I-beams. The center panel projects above the rest of the roof, providing a 23-ft. clearance under the bottom chord of the roof truss. The columns which support this roof truss, as well as the ends of the I-beams on the adjoining bays, were designed with the object of carrying a runway for a 20-ton bridge crane.

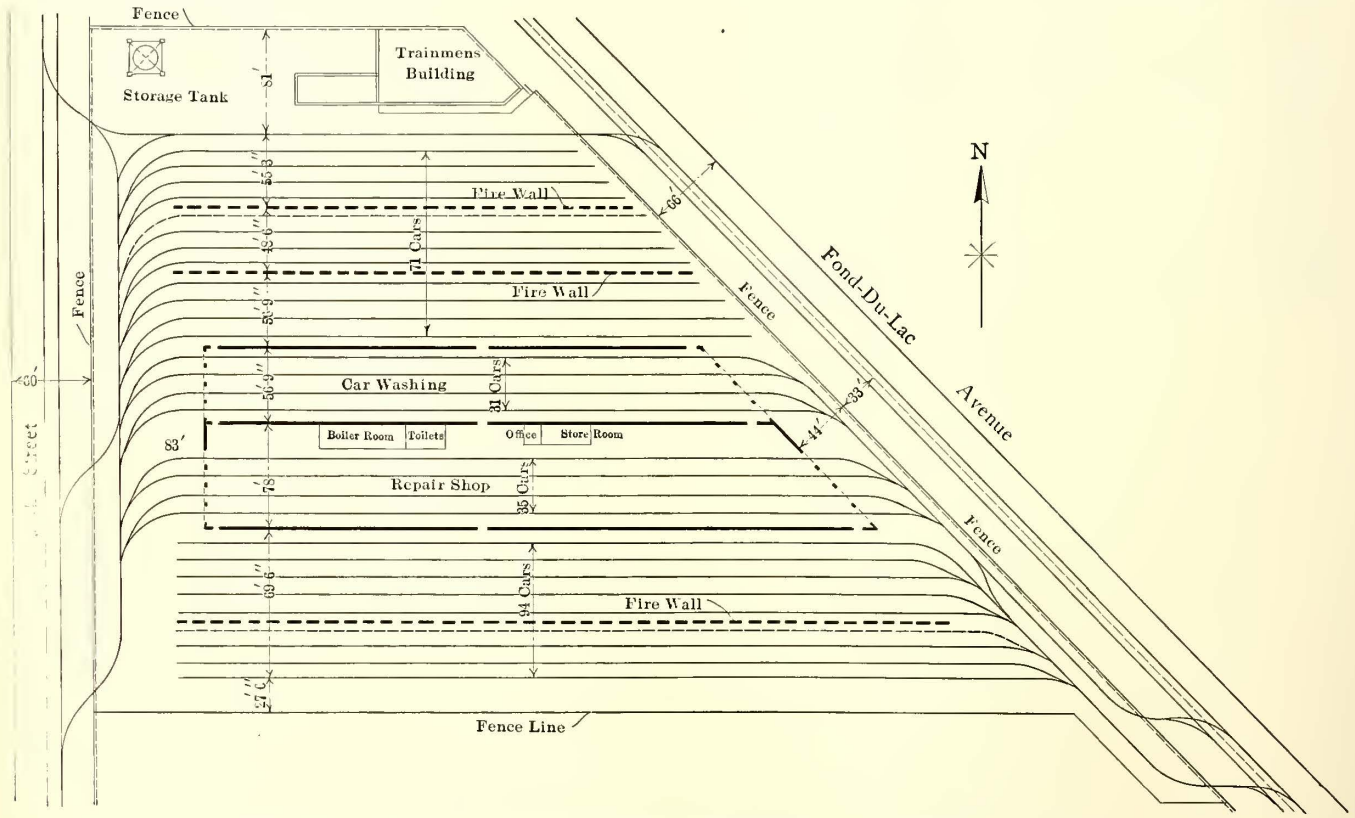


Cross Section

Fond du Lac Avenue Carhouse—Cross-Section of Main Building

The roof proper is a 2¼-in. concrete slab reinforced with bars and covered with a four-ply composite asbestos sheathed roofing. In providing drainage to the down-spouts which lead to the carhouse sewer by way of the building columns no change was made in the supporting structure, but enough cinder concrete was applied on top of the concrete roof slab to give a gentle slope to each down-spout. Concrete curbs built in conjunction with the roof slab bound the numerous skylight openings, which are the only source of natural illumination. The skylight frames are built of twenty-gage sheet steel and glazed with ¼-in. rough wire glass. Six skylights, 8 ft. x 44 ft. in length, spaced at 60-ft. intervals, were installed over the wash bay, each skylight containing two 30-in. globe-type ventilators. Seven 8-ft. x 22-ft. skylights of similar design and spaced at the same intervals were installed in the roof over the south panel of the repair bay. Several smaller skylights of the same design also furnish individual illumination to portions of the shop in the north panel of the repair bay.

The skylights over the central panel or crane runway section of the repair bay are flush with the roof surface, the glass area replacing the reinforced concrete slab. Nine sections of this glass roof, having approximate dimensions of 16 ft. x 32 ft., are spaced at 40-ft. intervals. Each glass area is provided with a 30-in. ventilator and the whole is supported on a pressed-steel frame.



Fond du Lac Avenue Carhouse—Central Arrangement of Tracks and Buildings

Sixteen rolling steel doors of the interlocking slat design are installed at the car entrances. These doors are in two sizes, eight of them being 12 ft. x 15 ft. and eight 17 ft. x 15 ft. All are manually operated by way of chain hoists and locks beside the entrance. At each opening in

the longitudinal walls of the building is an Underwriters' automatic fire door.

PIT DESIGN DETAILS

Pits are provided under the four tracks in the general repair shop bay, and those under the three south tracks occupy practically the full length of the building, except for the 10-ft. aisle across the center and a 30-ft. space at the Thirty-fifth Street end. The two pits under the north track are approximately 45 ft. in length, one at each end of the building, so as to give additional floor area in the center of this section for the repair and inspection forces.

A single pit 40 ft. 10 in. deep extends across two tracks, and the running rail, as well as the floor in the aisle between the two tracks, is supported on a structural-steel frame. To avoid reinforcing the track rail between the columns, which are spaced at 5-ft. intervals, a 7-in., 95-lb. T-rail is used over the pits. Special bearings and clips formed of two angles, 9 in. long, riveted to the 6-in. I-beam column, support this rail. No footings are provided under the columns, but the pit floor, which is 6 in. thick, is reinforced with ⅜-in. round bars to take the load. Each column is anchored to the floor by two anchor bolts.

To provide for lateral stiffness and against overturning, the two inside columns between parallel tracks are connected by 6-in. I-beams and two knee braces formed of angles, the beams being strong enough to carry the reinforced aisle floor slab. This slab spans the 5-ft. interval between columns and its edges are protected by an angle against chipping. The columns under the outer rails are stiffened by 6-in. I-beams riveted to them just under the rail supports and anchored in the concrete pit wall by a ⅝-in. round pin 2 ft. long. The 8-in. concrete pit walls are reinforced both vertically and horizontally against any thrust or strain that may come to them from this strut. The space outside of the pit walls is filled and covered with a 6-in. concrete floor.

The opening outside the rails of each track is approximately 24 in. wide. This permits the inspector or repair man to make truck adjustments from either side of the rail. It is of special value in inspecting and adjusting brakes.

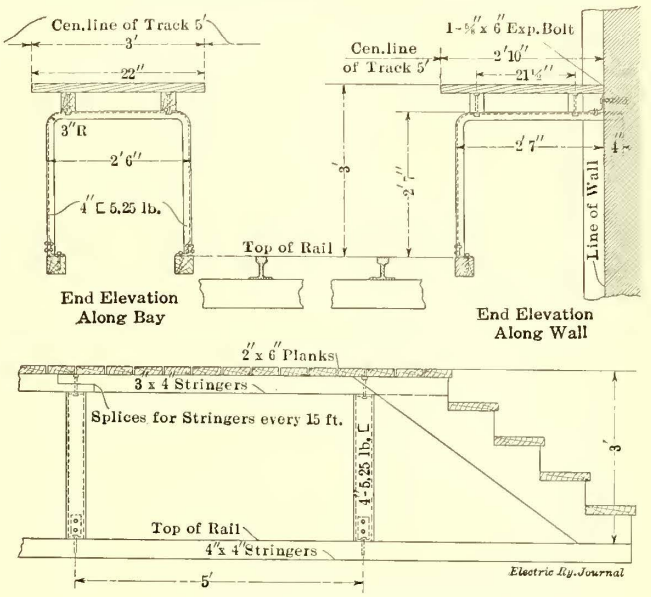
No general pit illumination is provided, but lamp sockets, to which extension cords may be attached, are installed in the pit walls at uniform intervals.

CAR-WASHING FACILITIES

All cars are scheduled for an exterior soap wash every fourth day, the floors being mopped and the woodwork rubbed with a damp chamois at the same time.

Permanent car-washing platforms extend the full length of the four tracks in the car-washing bay, except for an aisle through the center of the building. These platforms are 3 ft. wide between cars, a 2-ft. 10-in. platform adjoining the building walls. They are elevated approximately 3 ft. above the top of the rail. The platforms are built of 1¾-in. yellow pine supported on 3-in. x 4-in. stringers, which in turn are bolted to 4-in. channel bents. As shown in the illustration, these bents are formed of a single section of 4-in. channel bolted to yellow pine stringers by way of angles riveted to the base. The bents are spaced at 5 ft. and the supporting stringers rest directly on the crushed stone floor of this section of the building. Each washing platform may be reached by steps provided at each end.

Drainage under the car-washing bay is provided by installing 4-in. drain tile laterals at 40-ft. centers the full length of this bay and sloping them to the center of the bay where they tap the main sewer. These drain tiles are laid in a cinder trench, the bottom of which is about 6 in. under the ties. To provide for cleaning the main drain under the car-washing floor several manholes are provided.



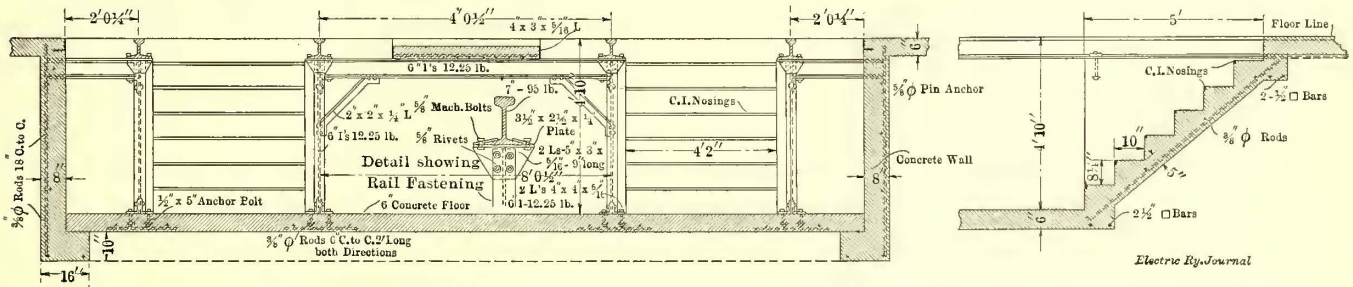
General Elevation of Platform Stairs

Fond du Lac Avenue Carhouse—Details of Car-Washing Platforms

OTHER SHOP DETAILS

A portion of the 33-ft. aisle on the north side of the general repair bay is occupied by the running repair department. A number of small machine tools required to facilitate this class of work have been installed and include the following: a ¼-hp sensitive drill, a 24-in. drill press, a 6-hp. 18-in. double emery grinder and a 48-in. x 50-in. forge. Near these tools and against the partition wall are two 15-ft. workbenches. A section of this aisle, 15 ft. x 36 ft. 8 in., has been screened off by a heavy wire-mesh partition to be used as a storeroom, and adjoining it is a portable office, 12 ft. x 15 ft. in size.

Another portion of the 33-ft. aisle in the repair bay has been partitioned off for toilet facilities and heating plant. The partition walls are of 6-in. hollow tile, providing a toilet room 14 ft. 6 in. x 29 ft. in size and a boiler room 13 ft. x 40 ft. in size. The floor of the boiler room as well as that of the coal bins is dropped 7 ft. below the carhouse floor level. This was done in order to provide drainage for the heating pipe system and to put the boilers on the same level as the coal bins. The arrangement also permitted the reinforced concrete floor to be carried over



Cross Section Through Pits — Section Through Stairs Leading to Pits

Fond du Lac Avenue Carhouse—Construction Details of Repair Pits

the coal bins, thus giving additional shop floor space without limiting the coal-storage capacity. Coal may be dumped into these bins from a car set on the north track in the general repair bay, through three 24-in. openings in the reinforced concrete floor.

The heating plant proper is of the vacuum-return type with pipe coils mounted on the building walls as well as on the walls of the car pits. Two 50-hp horizontal tubular boilers compose the steam generating plant.

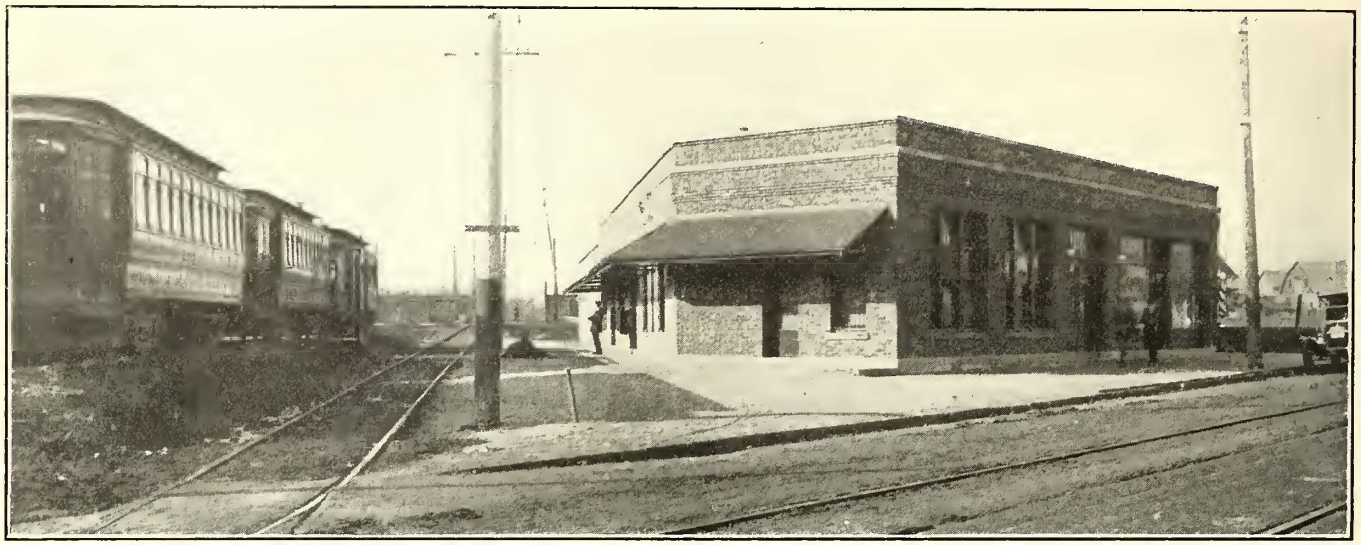
Artificial illumination is provided by 150-watt tungsten lamps swung by drop cords from the ceiling. These lamps are spaced at 20-ft. intervals longitudinally with the building, and a row is provided directly over the center of each aisle. Yard illumination is obtained from a number of inclosed-arc lamps swung from brackets at the tops of the poles from which the trolley span wires are supported.

In the buildings wood trolley trough construction is used. Provision is made for continuous trolley through the rolling-steel door entrances by dead-ending it on either side of the building walls and closing the break by a V-shaped clip attached to the bottom of each rolling door. The trolley wire in the yard is span-wire construction.

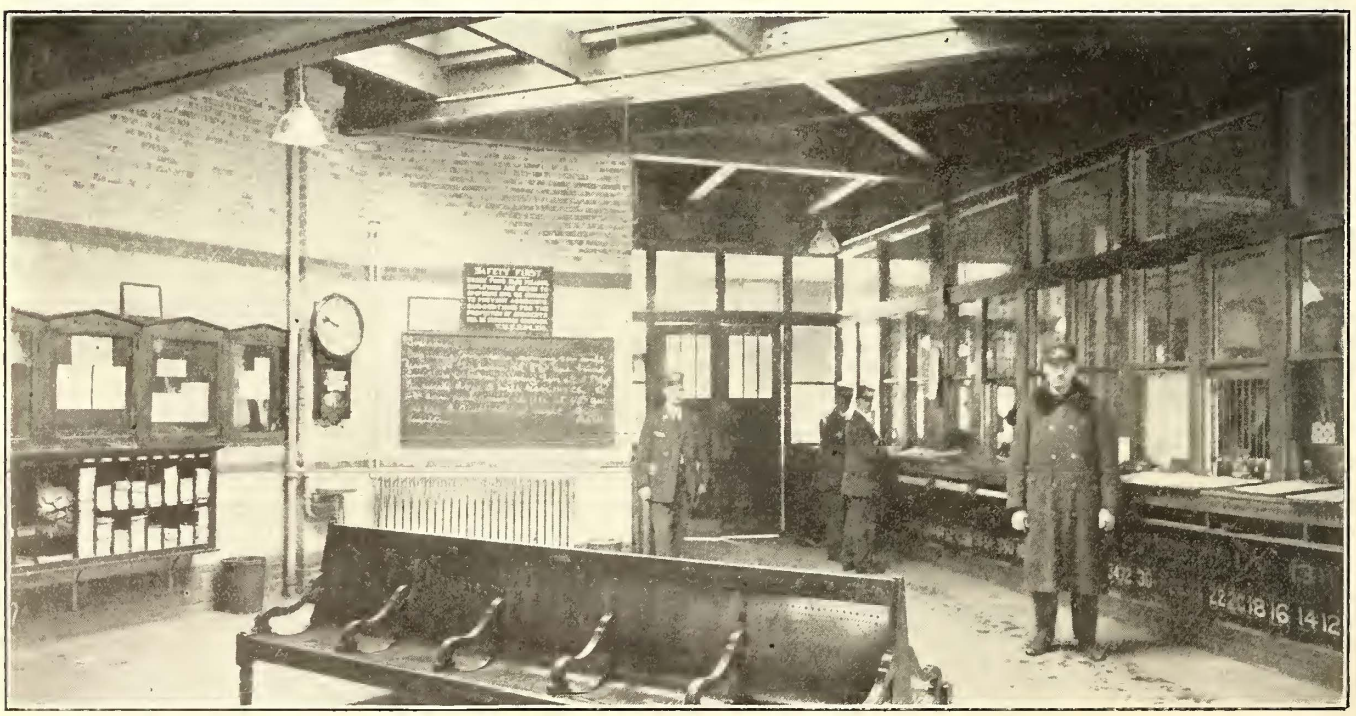
FIRE PROTECTION

A complete system of water mains for fire protection purposes has been installed in the carhouse and storage yard. The system normally depends on the city water supply, but to provide for emergency cases a 50,000-gal. water supply tank is supported on a tower 90 ft. above the ground. This water tank is supplied from the city water mains and connected to the fire protection system by way of a check valve which opens whenever the city pressure falls below the tank pressure, which is approximately 40 lb. per sq. in.

Storage yard fire protection is obtained by installing standard fire hydrants with Underwriters' hose houses and equipment at 125-ft. longitudinal intervals and 50-ft. transverse intervals. Fire protection inside the carhouse is obtained by a complete arrangement of dry sprinklers supported on the roof beams with outlets about 9 in. below the tops of the car windows.



Fond du Lac Avenue Carhouse—Exterior of Trainmen's Quarters



Fond du Lac Avenue Carhouse—Interior of Registry Room

TRAINMEN'S CLUB ROOMS AND OFFICE BUILDING

As a necessary adjunct to the general carhouse and storage yard layout, an attractive looking club house has been built fronting on Fond du Lac Avenue, just north of the north storage yard. This building is constructed with 13-in. brick walls on concrete foundations, a gabled roof and the dimensions are approximately 60 ft. x 176 ft. It contains a spacious trainmen's club room with adjoining toilet rooms and shower bath, a barber shop, a lunch room and an office for the station clerk. An addition to the rear of the building, 23 ft. wide by 64 ft. long, provides space for the heating plant as well as a small office for the way department and a stable for the track repair wagon and horses.

The interior of the trainmen's quarters is finished in natural yellow pine with concrete floors in the club room, toilet and shower baths and wooden floors in the rest of the building. Liberal natural illumination is obtained from the five skylights in the roof in addition to the windows in the exterior walls of the building. All of the skylights, excepting one containing a 20-in. globe-type ventilator and two 30-in. ventilators, are installed in the hip of the roof over the trainmen's club room.

Artificial illumination is obtained by a liberal installation of 150-watt tungsten lamps in the trainmen's club room, 100-watt lamps in the toilet and shower-bath rooms and lamps varying from 25 watts to 150 watts in the other rooms in the building.

The design of both the carhouse and club rooms was prepared by the engineering department under the supervision of R. H. Pinkley, engineer of way and structures, and R. B. Stearns, vice-president in charge of interurban and street railway operation of The Milwaukee Electric Railway & Light Company.

BLOCK SIGNAL MAINTENANCE NOTES ON THE ILLINOIS TRACTION SYSTEM

Approximately 80 miles of automatic block signals have been in operation on the Illinois Traction System since 1911. The protected track includes six sections of continuous blocking ranging from 5.7 miles to 20 miles in length and eleven sections each containing two signals for curve protection. The equipment consists of about 160 "style B" semaphore signals built by the Union Switch & Signal Company, the design and construction details having been described in the Electric Railway Journal for June 24, 1911. As about two years have elapsed since the first section was put in operation, it is now possible to draw some conclusions as to the efficiency of this system as well as the cost of maintaining it.

When operation was started under these block signals two sets of maintenance men were assigned to each division, one for telephones and the other for signals. This meant that two men covered practically the same territory on different classes of work, because the supervision of the telephones and the signals came under two different departments. The arrangement continued in effect from March, 1911, until April, 1912. At the latter time the signal engineer received charge of all the overhead lines and he combined the two departments, making one man responsible for both telephones and signals. Although the responsibility of each maintainer was thus considerably increased, the new plan has worked out very satisfactorily and has greatly reduced the expense of maintaining both classes of apparatus.

In the signal and telephone maintenance organization direct supervision over the men is obtained through a supervisor or inspector, to whom the division maintainers report. The territory assigned to each maintainer varies somewhat in length, but is based on the principle that the work on a mile of telephone line is equivalent to that on one signal. The divisions cover from 108 to 150 miles of wire or the equivalent. Investigation has shown that the amount of time required to maintain one automatic signal is somewhat less than for one mile of telephone line.

Reports are mailed daily to the signal engineer's office if no signal failure has occurred. In case of a failure, however, an additional report is sent explaining, if possible, the reason for the failure, and what delay, if any, was occasioned in making repairs. From the commencement of operation under this system, the signals have operated at 99.98 per cent efficiency.

Under the original arrangement—that is, where one telephone and one signal maintainer were detailed to each division—the expense of maintenance per blade per month

ILLINOIS TRACTION SYSTEM SIGNAL DEPARTMENT

Monthly Report for January 1913

Number of signals	173
Number of movements	258,074
Number of failures	109
Number of trains stopped	109
Minutes delayed	292
Movements per failure	2,368
Movements per train stopped	2,368
Movements per minute delayed	884
Per cent perfect operation	99.960
Failures chargeable to:	
Signal department	9
Blown fuse	14
Defective apparatus	1
Track department	—
Power department	20
Overhead department	3
Operating department	—
Broken wire	6
Bad bonding	46
Miscellaneous	2
Creditable failures	8

Remarks:
Eight creditable failures due to trains in the block.
Two broken-wire failures caused by sleet.

was approximately $4, and after the extra man had been dropped from the division the cost was reduced to approximately $3 per blade per month. As soon as other contemplated refinements in organization and in methods are made it is believed that the cost will be reduced to about $2 per blade per month. These figures include the cost of tools, material and labor, the cost of labor alone being about 50 cents per blade per month.

The largest single item to which signal failures may be attributed is the effect of bad bonds. Whenever a bond failure occurs the signals controlled by the affected track circuit give false indications, and to eliminate this trouble the Illinois Traction System is at present engaged in completely rebonding all signal territory. However, the fact that a signal failure occurs whenever a bond fails practically prohibits waste of propulsion energy through signaled territory. It is estimated that the amount of energy saved by the detection of defective bonds by the signals is more than the current consumption required for the signal operation.

COASTING RULES IN DENVER

The Denver Tramways, through Norman Read, its electrical engineer, makes the four following suggestions to its motormen for improving coasting records:

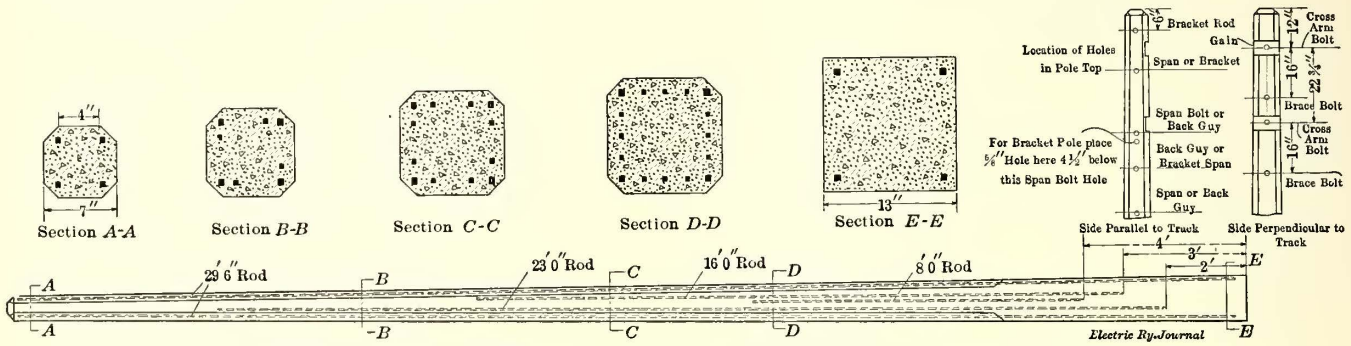
1. Coast behind a leading car. Keep far enough behind so that all its stops will not cause you to stop.
2. Coast to a passenger or bell stop. Throw off the power a few seconds before applying the brakes.
3. Coast to a traffic stop.
4. Coast to curves. Don't keep your power on till the very last moment. Utilize some of the stored-up energy in your car to carry you to the point where you should apply your brakes.

During the last week of December, 1912, the installation of coasting recorders on all cars was completed. For the first month of operation, January, 1913, the entire system averaged a saving of 24 per cent, with the four divisions ranking as follows: South, 28.30 per cent; Central, 26.60 per cent; North, 21.46 per cent; East, 20.08 per cent.

Experiences with Concrete Poles by the New York State Railways

Regular Manufacture of Several Standard Weights of Pole Is Now Carried On in the Model Pole Yard of the Company, for Use in Syracuse and Utica—The Poles Are Giving Excellent Satisfaction—Details of Manufacture and Specifications Are Given

For the past three seasons concrete poles have been manufactured in Syracuse for trolley and transmission line work in that city and in Utica. The poles have proved so satisfactory that last year a plant was built at the East-

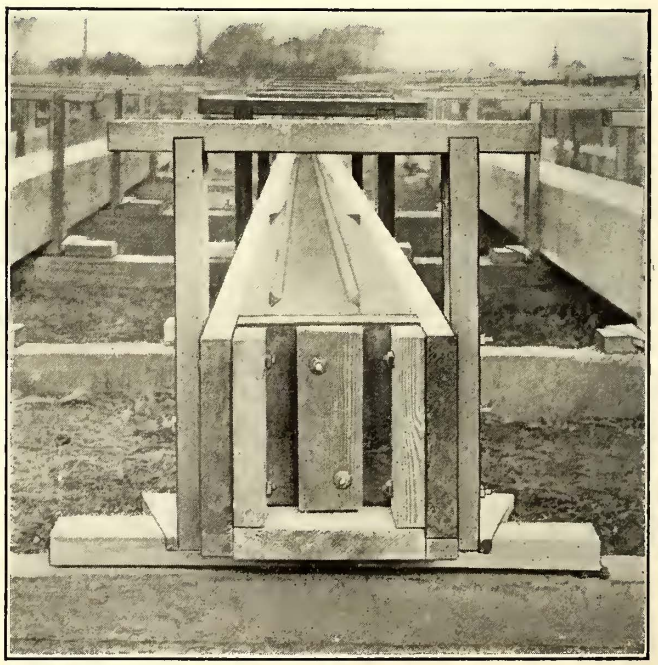


Concrete Poles in Syracuse—Arrangement of Reinforcing and Holes in Pole Top

wood yards, having a capacity from ten to fifteen poles a day. The plant is carefully laid out to facilitate economy in handling and storage. It occupies an area 50 ft. x 300 ft. at one end of the company's material-receiving yard and is adjacent to a steam railroad over which poles can be shipped to distant points. A spur also connects it with the company's tracks. A gantry crane of 36-ft. span and equipped with a triplex hoist of 3 tons capacity travels on rails the length of the yard. This improved crane handles the concrete hopper and the poles both to the storage and to the cars.

The poles are cast in molds, like that shown in the illustration, consisting of three 2-in. Georgia pine planks. The side planks are clamped in position by means of notched 2-in. x 4-in. studding above and below. The chamfer of the pole corners is provided by strips of triangular cross-section nailed inside the side planks. Pieces of round iron are inserted wherever holes in the pole are required. The gains are produced by blocks nailed in at the proper places. The concrete mixture consists of one part cement, two parts sand and two parts broken stone of ⅜-in. to ¾-in. size. The concrete is mixed by hand and transported in a hopper of 1-ton capacity handled by the crane.

Four standard sizes of poles are made at present as follows: one with 7-in. top, 30 ft. long, the standard trolley pole for city construction either bracket or span; one with 7-in. top, 35 ft. long, for interurban work; one with 8-in. top, 30 ft. long, for heavy city construction, and one with 8-in. top, 45 ft. long, for feeder lines. The reinforcement of these poles has been designed for maximum economy of steel on the basis of theoretical calculations and actual tests.



Concrete Poles in Syracuse—View of Form Ready for Concrete

New York State Railways, Utica-Syracuse Lines

SPECIFICATIONS FOR FORMS FOR CONCRETE POLES

This form to be built of hard pine and chamfer strips to be put on with screws and finishing nails. Side cleats to be bolted.

Chamfer strips to be placed on side sections of form. Gain block placed on bottom section; if chamfer strips come higher than gain block two small strips are to be placed on gain block as shown. ¼ ¼

Forms should be oiled before using inside and out with raw linseed oil. Holes through pole for bolts made by blank bolts, same size as hole, embedded in concrete through form and pulled out two days after casting pole.

Bolts should be loosened by turning slightly six hours after pole is cast.

New York State Railways, Utica-Syracuse Lines

INSTRUCTIONS FOR CASTING CONCRETE POLES

Before casting poles oil form inside with a mixture of one part black oil and one part gasoline. This oiling to be done immediately before casting pole.

The concrete mixture to be formed from one part cement, two parts sand and two parts stone, measurement to be made by volume.

All stone used to be clean and free from loam or dirt. Thoroughly wet the stone in the pile before mixing.

Sand to be free from loam or dirt. Place the proper amount of sand on the mixing board and spread out to a thickness of 4 in. On this sand place the cement and turn both three times, after which apply the water and turn so that the mass is entirely wet. Spread out this mortar again in a 4-in. layer and dump the stone in another layer on top. Turn the mortar and stone until mortar and stone are thoroughly intermixed. The concrete mixture must not be left on the board long enough to require retempering, but should be placed in the forms at once.

In placing the reinforcing rods great care must be used properly to locate the same and maintain in the proper position.

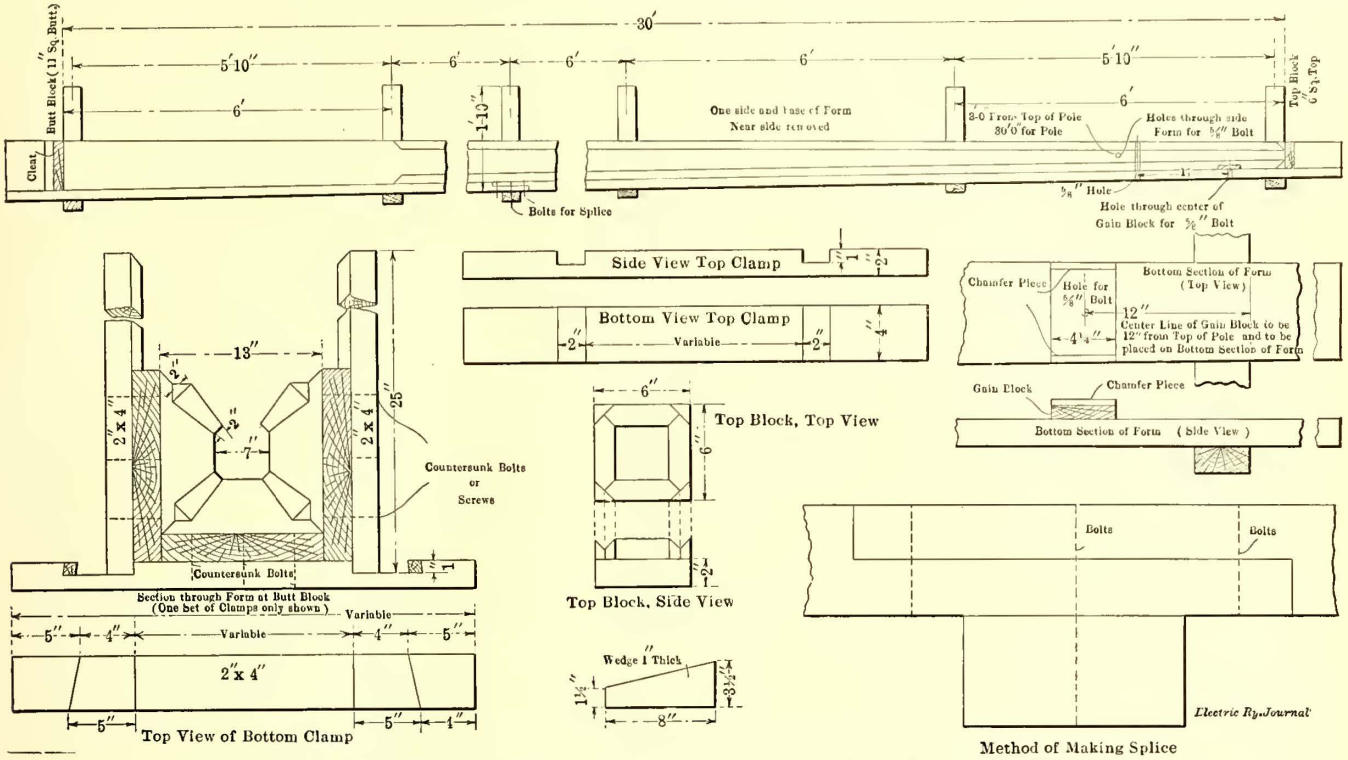
The time of removing of side forms and moving of pole to storage will vary with the weather, but in no case shall a pole be lifted until ninety-six hours have elapsed after casting. After removal from the forms the pole shall be painted with a mixture of one part cement and one part sand, the pole being wet before the application of this paint.

Remember that a crack formed in a pole by handling too green cannot be healed.

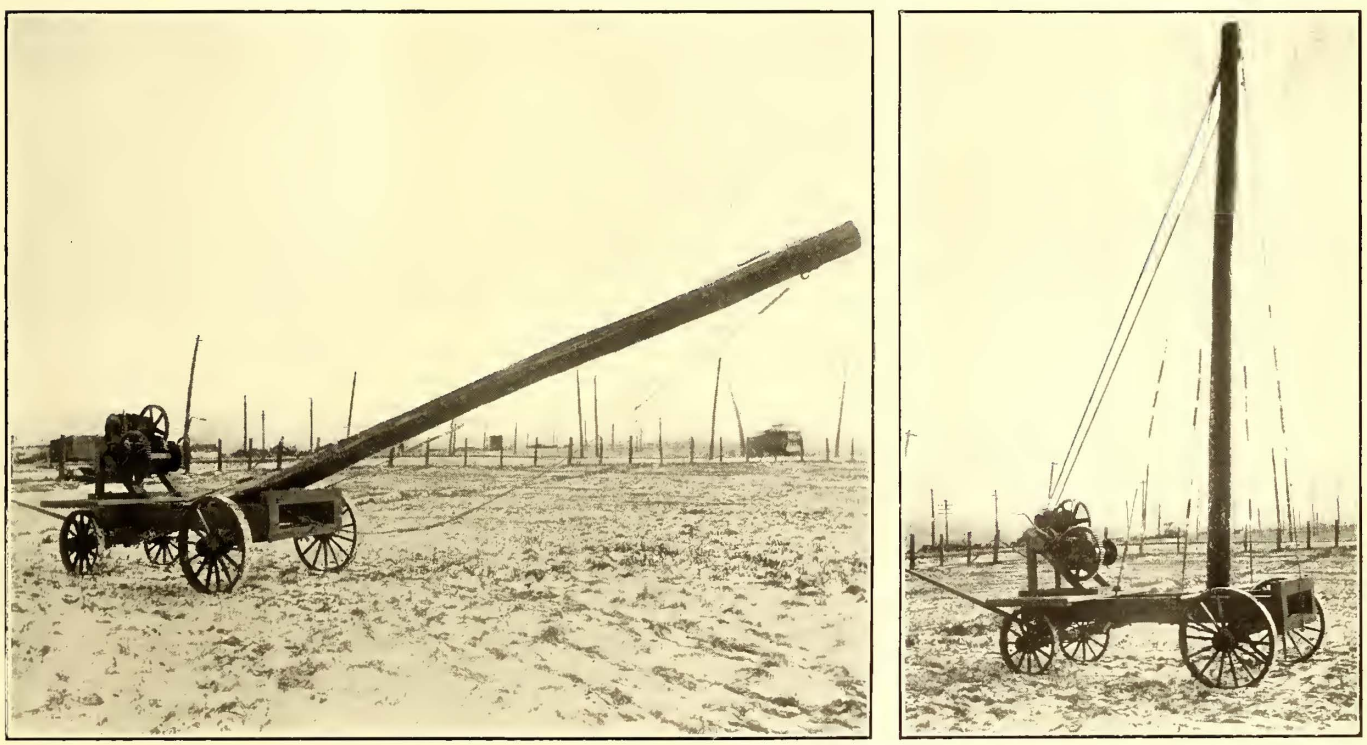
In the storage and shipping of poles 2-in. cleats must be placed between the separate horizontal layers of poles to allow attachment of clamps for handling.

The standard 7-in. x 30-ft. pole has the following reinforcing: twisted steel rods placed about 1 in. from the surface—four ⅝ in. x 29 ft. 6 in., four ½ in. x 23 ft., four ½ in. x 16 ft., and four ½ in. x 8 ft. The details of this reinforcing are shown in the drawing on page 502. The poles with 8-in. tops have the same arrangement of rods, all ⅝ in. instead of ½ in. The longer poles have the rods lengthened at the top ends. The cost of the standard pole is from $9.50 to $12 each, not including fixed charges on the plant. This cost is based on stone and sand at $1 a cubic yard, cement at $1.10 a barrel and labor at from 16 cents to 17½ cents an hour. On page 502 are reproduced the specifications for building forms and the instructions for casting poles which are issued to the workmen in blueprint form.

In the spring of 1911 some tests were conducted on the 30-ft. pole with 6-in. top which had been adopted tentatively. In this test two poles were set about 38 ft. apart with a 15-in. rake. A ring of concrete was placed at the butt of each pole and at the ground line. A span wire was stretched between the top of the two poles and pulled up to a tension of 1100 lb. This initial pull produced a deflection of 3 in. Next a platform was suspended from the span wire from points corresponding to the center



Concrete Poles in Syracuse—Details of Construction of Wooden Forms



Concrete Poles in Syracuse—Views of Derrick Wagon Used for Installing Poles

lines of the two tracks and loaded to 1332 lb. On the removal of this load a permanent set of 2¾ in. remained in the pole. The same load was again applied and the span wire cut at the center. The pole then returned practically to its original position. Last June this test was repeated with the new standard pole with a 7-in. top, with the result that it showed sufficiently greater strength to warrant its adoption in place of the lighter pole. The new pole has a much greater area of steel at the ground line, where the older design gave indications of failure.

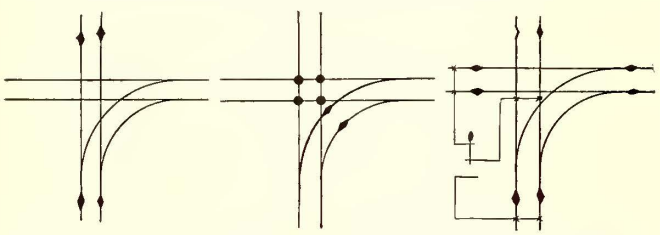
It was found that success with concrete poles depended partly upon the facilities provided for handling them. As the 30-ft. x 7-in. pole weighed 330 lb. and the large ones correspondingly more, the ordinary methods of erection were not applicable. The company originally used a portable derrick made from an old road scraper to erect the poles. From the experience thus obtained the derrick wagon shown in the accompanying halftones was built in Utica for use during the season of 1913.

FEEDING STREET INTERSECTIONS

BY G. H. M'KELWAY, ENGINEER BROOKLYN RAPID TRANSIT SYSTEM

It is an easy matter, so far as assuring continuity of current supply is concerned, to care properly for the feeding of a street intersection where the only special work installed is a plain crossing. All that is required in that case is the installation of insulated crossings and, as the trolley wire will not have to be cut to put them in, there will be no trouble from the stalling of cars on one line because the intersecting line happens to be dead. The only exception to this rule would be to have a car roll into a position across the crossing and stop there with its trolley pole on the dead wire.

On the other hand, when connecting curves are included in the special work such trouble cannot be avoided so



Figs. 1, 2 and 3—Methods of Feeding Trolley Wires at Crossovers

easily and cheaply. The most usual way of feeding the more complicated intersection is to put plain uninsulated crossings in the trolley wires and section insulators in the main line wires of one of the lines on both sides of the intersection and outside of the curves. This arrangement, shown in Fig. 1, is not entirely satisfactory because, being fed entirely from one of the lines, if that line goes dead the crossing too must remain dead until the line is made alive. If the motormen on the cars of the live line crossing the dead one know that the other line is dead, they often can operate their cars across the special work by running quite fast on their own section and then coasting across the dead portion. Many times, however, the first notice that the motormen of the live line will have that the other one is out will be when one of their number starts across at the normal speed and this proves too slow to enable the car to roll across after it has lost its power. The result will be that both lines will be blocked.

One way to avoid this trouble is to install insulated crossings where the straight trolley wires cross and also to place circuit-breakers in the connecting curves. This arrangement, as shown in Fig. 2, makes impossible the blocking of both lines if power is off on only one of them unless a car should be stalled directly across the track of the intersecting line. It therefore gives the same freedom of operation as a crossing without connecting curves if wired with insulated crossings. The only disadvantage of the arrangement is confined to the use in the curves of the section insulators, which are a cause for increased trouble not only owing to the trolley poles of the cars leaving the wire and so hindering operation but also because of the resulting pounding that the overhead work receives when the poles do leave the wire. This drawback can, however, be largely overcome by careful location and setting of the circuit-breakers.

Although it is quite unusual to have one line blocked because a car of another one has become stalled on the crossing, this possibility can be prevented by the layout shown in Fig. 3. Here section insulators are installed in all four of the main line wires outside of the special work, thus insulating it from both of the intersecting lines. A double-throw switch is provided, however, with connections running to the feeders or trolley wires on both of the streets. By this means the special work can be cleared from the dead feeder and thrown over on to the live one at any time.

A double-throw switch should always be employed, because if two single-throw switches are used in its place there is always the possibility of both being closed at the same time, thereby putting the two feeders into multiple, which, if both feeders are alive, may be undesirable. However, if one is grounded and dead and the other thrown in before the intersection is cleared from the first, the supply of current from the second will do no good so far as moving cars is concerned and may make more trouble.

The only disadvantage of this last arrangement, aside from its greater cost and the necessity of caring for four circuit-breakers in addition to the uninsulated crossings, is that when the line feeding the crossing goes dead the whole special work is killed, thus affecting both lines, and remains so until the switch is thrown over. At any rate, if the motormen and conductors as well as the inspectors have been instructed how to operate the switch and it is placed in an accessible position, the delay should be only for a moment. Where an efficient and intelligent class of men operate the cars, the third arrangement should be the most satisfactory of the three, at least from the standpoint of the transportation department.

SUCCESS OF ONE-MAN NEAR-SIDE CAR AT LOCKPORT

On Feb. 9 a number of one-man near-side cars were put into operation on the Lockport line of the International Railway Company. This type of car was described in the Oct. 5, 1912, issue of the Electric Railway Journal. The car is 30 ft. 7½ in. long over platforms and its seating capacity is thirty-six. Like the larger two-man near-side cars used by the same company in Buffalo it is equipped with the Dayton fare recorder. This is an important element in the operation, for by its use the motorman is relieved of practically all clerical work.

During the first week's operation the increase in gross receipts was 39 per cent. The road is operating with twelve conductors fewer than before and even without the increase in gross receipts it is expected that the new cars will pay a good return on the investment. The increased receipts are accounted for by the better service possible with the new cars. No material increase in the length of stops is noticeable. The additional time required for the motormen to collect fares is made up for by the condition that they are not obliged to wait for bell signals but start their cars immediately after the passengers have boarded. The favorable showing of the first week has been maintained since and the management is greatly pleased with the results of the experiment.

Meeting of the Keystone Railway Club

Papers Were Read on Electric Railway Management and Parks; a Blackboard Talk Was Given on Motor Testing, and the Question Box Was Discussed

The fifth meeting of the Keystone Railway Club was held at the Hotel Walton, Philadelphia, Pa., on the evening of March 10 and the morning and afternoon of March 11. The routine business was transacted at the evening session.

ELECTRIC RAILWAY MANAGEMENT AND PARK BUSINESS

The first order of business on March 11 was the paper on "Electric Railway Management," by William H. Heindle, general manager Wilmington (Del.) & Philadelphia Traction Company, which is published in abstract elsewhere in this issue. Mr. Heindle's paper was actively discussed, particularly as to passes. Most of the delegates said that they had, with advantage, abolished passes for outsiders.

C. F. Crane, superintendent Eastern Pennsylvania Railways Company, Pottsville, Pa., then read his paper on "Parks and Their Transportation Problems," which is abstracted elsewhere in this issue. In discussing this paper, F. M. Davis, Harrisburg, took exception to Mr. Crane's strictures on free attractions. For the last two years his park had had balloon ascensions at a cost of $175 a week with the result that the daily travel increased from 2500 to 5000 and the weekly travel from 1200 to 20,000. Of course, the company's other attractions, such as the merry-go-round, figure-eight coaster and the theater, benefited in proportion. Fireworks also greatly increased the evening attendance. As booking conditions had been greatly improved in recent years, the railway manager could obtain his attractions at the same prices as any regular theatrical man. He approved the idea of a park theater circuit, but one must not overlook the fact that the tastes of the public differ in various localities.

C. F. Crane, Altoona, said that about six years ago his company had leased its park on a percentage basis to an amusement company, thereby relieving itself of much annoyance. However, the maintenance and order of the park were still in the hands of the company. The company also provided the band. No matter who supplied the attractions, the railroad would still be held responsible by the public for the attractiveness and order of the park.

Mr. Heindle thought that most of the street railways would be better off without parks. He was sorry that his company had a park at Wilmington. It was a fact that nine-tenths of the parks really were like circuses and had to be treated as such.

Mr. Davis remarked that Mr. Heindle's idea was right in most cases. The Harrisburg company's park, however, was ideally located as it was within a five-cent zone from each direction and furthermore was located on a line which had all-year travel. As to extra cars, he was also favorably situated in that connection because his company used for park service the additional rolling stock which it needed for its rush-hour travel between Steelton and Harrisburg.

MOTOR TESTING, QUESTION BOX, ETC.

The next speaker was Harry W. Branson, Philadelphia, who gave a blackboard talk on motor testing and trouble finding.

Following Mr. Branson's talk, an active discussion arose on the slotting of commutators. W. J. Jeandron, New York, said that some companies had poor results from slotted commutators because they slotted them too deep. The cut should not be more than the thickness of mica, say 1/32 in. Slotting permitted the use of brushes of higher current-carrying capacity and the removal of mica reduced voltage losses. Probably 90 per cent of brush trouble was caused by too much tension. He recommended for slotted commutators a general maximum of 4½ lb. and believed that it was possible to go down to 3 lb. One fault of the operator was to use a brush 2¼ in. instead of 1¾ in. long. In the longer brush the effect of continued side wear would cause arcs between the brush and its holder.

At the conclusion of the morning session it was announced that J. G. Baukat had tendered his resignation as secretary owing to the increased work placed upon him as superintendent of equipment for the Lehigh Valley Transit Company. R. J. Pike, purchasing agent Lehigh Valley Transit Company, was chosen as his successor. It was also decided to hold the next meeting of the club during the month of June at York. At 1:30 an adjournment was taken for luncheon.

During luncheon W. E. Harrington, Philadelphia, introduced H. H. Adams, engineer Ford, Bacon & Davis, New York, as one who had been a pioneer in bringing electric railway car maintenance to a high standard. Mr. Adams then made a brief address in which he pointed out how an organization like the Keystone Railway Club could supplement the work of the American Electric Railway Association.

The Question Box discussion began with Question 22, relative to life of car axles. The discussion developed the fact that several delegates were not fully satisfied that heat-treated axles had reached the desired point of reliability, as they had experienced breaks with such axles.

J. G. Baukat, Allentown, said that the Pennsylvania Railroad changed its axles from passenger to freight service after three years. He had had practically new axles break in the same place as axles which had been in service for nine or ten years. Most axles broke next to the wheel and generally near a tight fit. Mr. Hill, American Brake Shoe & Foundry Company, discussed the whitewashing method of the Interborough Rapid Transit Company, New York, for determining the location of cracks, and J. G. Cooley, Standard Roller Bearing Company, gave a blackboard demonstration of axle breakage.

A. Stucki, Pittsburgh, did not believe that a mileage limit would help to avoid cracked axles. First of all one must be certain that the fiber stresses in the axles were kept to a minimum. He had seen enough of treating carbon steel to realize that a heat-treated axle must come. Improvement could also be attained by using an alloy steel such as vanadium which could take great dynamic punishment.

Questions 23, 24 and 27, relating to inside-hung brake rigging, use of brake beams and brake power, were answered in detail by W. G. Kaylor, Westinghouse Traction Brake Company. He pointed out that if inside-hung brake rigging was properly designed it was much better than outside-hung rigging, but it was necessary to give more thought to its design in order to make it adjustable. Inside-hung brakeshoes used with a fairly long wheelbase were released separately without release springs, whereas outside-hung shoes did require them. A release spring on a brake-beam was always undesirable, for with the wear of shoes and wheels its tension almost invariably increased, often to such an extent as to affect seriously the efficiency of the brake. Brakeshoes were held in better alignment with the wheel when mounted on a brakebeam, and the use of the brakebeam with inside-hung brakes also permitted the employment of a single lever at the center of the beam so that the braking power was evenly distributed. As to braking power, he believed that for interurban service a maximum of 100 per cent should be obtainable with full service appli-

cation of 50 lb. in the brake cylinders, but this braking power should be increased to 130 per cent in an emergency application. In city service under average conditions a maximum braking power of 100 per cent was as great as was desirable.

Mr. Baukat, referring to a visit to Columbus, Ohio, said that he had found that the Columbus company, which had the low brakeshoe cost of 30 cents per 1000 car miles, used brakebeams on 75 per cent of its trucks with both inside-hung and outside-hung brake rigging. He had almost decided to adopt brakebeams entirely.

Question 25, on field testing, was not discussed, as it was announced that the Electric Railway Journal for March 15 would contain a description of the Brooklyn Rapid Transit Company's equipment for this purpose.

W. H. Rushton, Altoona, said that on a number of his interurban cars weighing 44,000 lb. light the braking power was 144 per cent. The first trouble was with the brakebeams, which had to be strengthened, and the body bolsters also had a tendency to tilt. He had expected much trouble from flat wheels and higher brakeshoe cost, but these disadvantages had not followed. He did not consider it good mechanical practice to exceed 100 per cent in braking power, but it had been done to meet transportation requirements.

Question 26, on electric welding, was then discussed. Mr. Branson said that the Philadelphia Rapid Transit Company had begun electric welding some nine years ago. He did not know just how economical it was in comparison with other methods, as no record was kept on the amount of electrical energy used, but he did know that it had cut down the blacksmith labor from twenty to seven men.

In reply to A. F. Rexroth, Harrisburg, Mr. Baukat said that the oxy-acetylene welding might be cheaper than electric welding but it was not so convenient because the gas and auxiliary appliances were not readily obtained like electric current.

Mr. Stucki stated that he would not recommend electric welding for brake rods or other parts which are subject to great stresses. He had also used oxy-acetylene, but found that it was costlier than electricity. In one case the cost for electric welding was $4, as compared with $7 for oxy-acetylene.

President Gould, Reading, said that his oxy-acetylene welding of armature shafts had not proved successful, as they broke at the point where the weld had been made, but three shafts electrically welded three years ago were still in service.

The meeting was then adjourned.

A TALE OF TWO CITIES

BY WILLIAM A. HEINDLE, GENERAL SUPERINTENDENT WILMINGTON & PHILADELPHIA TRACTION COMPANY

Unlike Dickens' "A Tale of Two Cities," I propose to relate, not a story of intrigue or conspiracy, but events which occurred within the past few years in the management of the street railway systems in two cities not far from here. The population of city "A" was, roughly, double that of city "B." As the combined population approximates but 135,000, trolley operations were on a moderate basis.

The trolley lines of each city were formerly operated under separate local managements but controlled by the same ownership. System "B" operated a through line of cars to the railroad center in system "A." The lines of both systems had reached the age in which wear and tear greatly overbalanced much needed maintenance.

In 1910 new interests assumed control, facing the problem of building up the properties both physically and financially. They were at once besieged with numerous complaints and suggestions for better service. A careful survey of conditions was made, a program of work and expenditures mapped out in advance and authorization given the manager to proceed at once with the most urgent improvements. From the start two rules were laid down as necessary to success—first, the public must receive courteous treatment; second, good service must be given.

Some of the cars were very old, and the replacement of many older motors by modern machines was carried out. Standardization of other parts, such as brake rigging, brakeshoes, wheels, etc., went into effect as rapidly as possible. Changes in shops and in the working conditions of shop and carhouse men and the installation of efficient heating plants, lockers, improved lighting and regular cleaning of carhouses and shops quickly resulted in greater efficiency from the men and equipment. The three "R's" of rolling stock—namely, water, paint and varnish—helped to better the appearance of the car bodies. The request to change from longitudinal to cross seats on cars operating on the 20-mile suburban line was heeded and the patrons greatly pleased. To meet the need for new cars, the semi-convertible type suitable for all year operation was selected after careful consideration. The cars had large platforms without the prepayment feature, but the design was such that this could be added if found desirable. The new cars were spaced on the principal lines, and public comment was very encouraging.

While the program as outlined above was in progress, new joints were installed and the best special track work obtainable was purchased invariably. Sample sections of high T-rail construction were built and contrasted with tram and grooved girder types to demonstrate that the objections to it by the city officials were unfounded, at least for certain locations.

The chief problems were to instil loyalty into the employees, to encourage all to co-operate toward the general good, to make the former separate city divisions act as a unit under the same management, and finally to win public favor through good service. The new operators first made known that merit alone marked the man; there were to be no favorites. Particular care was exercised in selecting new men; great attention was given to their training, and a small school of instruction was added for training recruits. A weekly bulletin was issued treating on live topics, and a word of praise here and of condemnation there was addressed to the trainmen. Each week the total number of accidents was recorded with short comment on their causes and remedies.

An employees' relief association was organized with customary dues, sick and death benefits, and club rooms for the men were established on a small scale. An annual field day at the company's park with sports and games between individuals and divisions was inaugurated. Gun clubs were formed, match shoots were held and general good feeling was soon found to prevail.

All employees had the fact impressed upon them that they held important positions worthy of their best attention, that the company employing them was a public servant in the fullest sense of the word, and that the public expected courteous treatment on their part.

In the treatment of the public all suggestions or complaints received investigation, and courteous replies were always made. Often calls were made in person by the manager or his assistants. The pass privilege was abolished, newspapers received all news of interest and no part was taken in politics. The orders of municipal bodies received prompt attention, without, however, waiving the company's rights in the matter.

When demands were made for more service on a particular line the total number of passengers hauled on each trip as shown on conductors' trip sheets, or by actual count, was plotted on cross-section paper, this curve indicating the true conditions at a glance. Across this curve a line was drawn to represent the seating capacity of a car. These

curves proved valuable in discussing the question of service with the parties interested and indicated very forcibly what could be accomplished by shortening the headway during the rush hours as against the use of trippers. By working along these lines improved service was possible with but a small increase in the total number of car hours, and the friendly feeling of the public which finally was brought into being was exemplified by the often repeated remark that the schedule was so perfect that clocks could be regulated by it.

PARK MANAGEMENT AND ITS TRANSPORTATION PROBLEMS

BY C. F. CRANE, SUPERINTENDENT OF RAILWAYS EASTERN PENNSYLVANIA RAILWAYS

A few years ago summer electric parks came into existence and were fathered principally by electric railways for the sole purpose of creating traffic. They did create quite an increase, but, unfortunately, it seems to be the history of parks catering to a population of 100,000 or less that in the course of a few years public interest in each particular park seems to die out. The railroad manager is generally at a loss to keep this public interest alive, and in order to make his park appear profitable he may resort to what is termed "bookkeeping jugglery."

Unless the property is large enough to employ a park manager, his duties generally fall on a railroad operating official, so that after years of study and experience in operating railroads this person finds himself called upon to be practically an amusement expert. It is gradually dawning on the electric railway managers that, instead of operating a park in this manner, it would be much better to lease the entire park grounds and privileges outright to an amusement company. Such a company should be divorced entirely from the electric railway, which could then devote its labor and studies solely to the profitable transportation of park passengers, its legitimate business, while the responsibility of amusing the public would be placed directly in the hands of people trained for such purposes. I might further suggest that the electric railways go a step farther and work toward the creation of a park amusement company composed of practical amusement men who would lease the park grounds and privileges on long terms and maintain an amusement park circuit similar to the many successful theater circuits now in being. If your local theater is part of a circuit, why not your park?

Take your theater privilege, for instance. The average electric railway official will book his attractions through a booking agent and generally will pay a higher rate for acts than a professional amusement man. Often the railroad man finds himself in this position: A new show has arrived at his park and rehearses. It is to open on Monday evening and will probably consist of four or five vaudeville acts, with moving pictures, or possibly an illustrated song, between. The man who is thoroughly competent to operate a railway must now attempt the rôle of critic for his park patrons. During the course of the performance he may feel that something is wrong, but nine times out of ten he has not had the dramatic training to enable him to determine the real source of trouble with any degree of accuracy. On the other hand, a practical theatrical man might be able to produce a first-class show from the same materials merely by rearranging the order of the acts and eliminating some objectionable features.

One of the greatest leaks in park operation is the free attraction. For some reason or other in years gone by the electric railway officials imagined that they must give a free attraction. Evidently they obtained this notion from the circus method of giving a "free open-air performance immediately before the big show starts"; but a summer park is entirely different from a circus. With the increased cost per mile of carrying a passenger and the constant tendency to lengthen the distance a passenger is carried for a 5-cent fare, only a very small margin is left for a free attraction. We will assume that 60 per cent of the gross fare receipts are required for operating expenses. This would be 3 cents out of your 5-cent fare. On allowing 1 cent for fixed charges, you would have left approximately 1 cent profit per passenger. If you give a free attraction that costs you $50 a day, you would necessarily be obliged to handle 5000 passengers every day just to pay for this feature. This first 5000 passengers would be handled at practically a total loss and with no margin of reserve to cover the greater liability for accidents due to the use of open cars and inexperienced extras. Hence one of the problems a park manager should study most thoroughly is that of placing each and every attraction in his park upon a self-sustaining and, if possible, upon a profitable basis. This end would naturally be the sole aim of the amusement company which leased your park property and privileges outright. Thus each operator, the railway company and the amusement purveyor, would be in the best position to earn a profit from its own legitimate business.

Another problem of the smaller companies is the satisfactory handling of park traffic. If the park is in territory serving working people, it necessarily becomes an evening resort. Consequently, extra cars are required in the evening. For a period of one and one-half to two hours the people travel to the park. After the performance and dances, there must be available enough equipment to handle the traffic on the home trip in less time than it took to transport the people to the park earlier in the evening. If the company has ten extra cars stored up waiting for the rush trip home, it necessarily loses ten car hours' service, or twenty hours' platform time, for each hour the cars are stored up.

Another serious problem is to have the park located on a division that is operated only during the summer. The railway manager finds himself called upon to operate some sort of a schedule for a few weeks before he opens his park, if the weather is pleasant after a winter siege. Generally, this schedule barely pays for axle grease. To console himself for the loss, the manager tries to place a value on it in assuming that he is pleasing the public. When he closes down the park, generally Labor Day week, after, say, 115 days' operation with good and bad weather, he stil finds that some sort of an unprofitable schedule must be operated until the weather becomes too cold for outdoor excursions. These losses would be avoided if the park was located on one of the suburban or interurban divisions where a schedule is maintained by the company all the year round as a matter of course.

In conclusion, do not lose track of the fact that your park season may be of 100 or 115 days' duration, during which time you may carry a greater number of people than for any corresponding period during the rest of the year; but, to offset this, you must maintain your park properties, carry expensive building insurance and pay interest on your investment in parks and summer cars. Hence the question of eliminating the park property on a number of roads might be seriously considered. It is the day-to-day travel for 365 days of the year that the railroad manager most desires. I believe in creating and developing such day-to-day travel by co-operating with the local business men's associations and boards of trade with a view of increasing the number of manufacturing interests in each locality, and thereby increasing the traffic from the transportation of working people and shoppers. The same amount of money that you now expend to induce 1000 additional people to travel to your park would bring in far more revenue at the end of the year if it was expended carefully along these co-operative lines of creating every-day-in-the-year travel.

ANNUAL MEETING OF ILLINOIS ELECTRIC RAILWAYS ASSOCIATION

The postponed annual January meeting of the Illinois Electric Railways Association was held on March 7 at the La Salle Hotel, Chicago. This meeting was unusually well attended, practically all member companies being represented. The morning session opened with E. C. Faber, the president, presiding, and, following an announcement that the association would give a "get together" luncheon at the noon hour, the secretary proceeded with the roll call and the minutes of the last meeting.

COMMITTEE REPORTS

The next subject in the regular order of business was the report of the various standing committees.

Frank E. Johnson, Ohio Brass Company, reported, as chairman of the membership committee, an increase of 40 per cent in the membership for the second year of this association's existence. Secretary Flenner reported for G. W. Quackenbush, chairman of the traffic committee, on the adoption of an interchangeable coupon ticket. He said that the ticket had been accepted as to form and each company has filed its concurrence in the tariff. Copies of these concurrences as well as the tariff have also been filed with the Interstate Commerce Commission. The interchangeable coupon ticket would be ready for delivery in time for general use by April 10. The chairman of the traffic committee will furnish requisition blanks for coupon ticket stock to each of the member companies and will issue tickets in accordance with these requests, keeping a record of their distribution.

A report of the signal committee was made by its chairman, John Leisenring. It included a written description of the Simmen signal system as installed on the Greensburg division of the Indianapolis & Cincinnati Traction Company. Mr. Leisenring called attention to the proposed set of rules for construction, reconstruction and maintenance of interlocking plants which was being prepared by the railroad commissions of Illinois, Indiana and Wisconsin. He said a letter had been issued by the engineer of the Illinois Railroad and Warehouse Commission requesting the signal engineers of the different roads in these three states to appear before a joint meeting of the three commissions held in Springfield, Ill., to discuss the proposed rules. Signal engineers from twenty-five different railroads attended this joint meeting, and in conclusion it was decided to continue the hearing until the roads could have sufficient time to prepare their objections. Following the hearing, the signal engineers appointed a committee to prepare a set of objections to the proposed rules. Mr. Leisenring advised that a number of requirements in them should be opposed vigorously by all roads operating and maintaining interlocking plants. The principal objections are to the amount of protection required at these plants as well as the location of the signals. H. E. Chubbuck suggested that the standing signal committee be requested to attend the final hearing before the Railroad and Warehouse Commission, which is to be held in Chicago in the near future. B. J. Fallon, engineer maintenance of the elevated railroads of Chicago, was requested to assist the signal committee in its work.

Chairman F. G. Buffe of the committee on publicity stated that his committee was having excellent success in obtaining all kinds of newspaper publicity throughout the State. At the conclusion of this report the president urged this committee to proceed with the statistical information so that it could be used to impress the new public utility commission with the importance of this industry in Illinois. Mr. Chubbuck urged that a large delegation meet the new commission at the first opportunity, as well as the various House and Senate committees considering bills affecting electric railways. The secretary was instructed to write each of the member companies in case one of these committees desired the appearance of representatives to discuss a particular bill.

Following the completion of reports from the different standing committees, President Edwin C. Faber, general manager Chicago, Aurora & Elgin Railroad, read the annual address of the president to the association, as follows:

PRESIDENT'S ANNUAL ADDRESS

"A brief survey of the work done in this organization during the past two years reveals the fact that the Illinois Electric Railways Association has already much more than justified its existence, and that its purposes and aims have been demonstrated as capable of successful accomplishment. I think we may look with considerable satisfaction on the progress made by our association in so short a time. Necessarily the first year of our association's life was devoted chiefly to organization and the working out of those details necessary to secure a continued existence. Yet at the very beginning important questions thrust themselves forward—questions and problems that could be met most successfully by the concerted action of the association.

"Matters affecting the common interests and welfare of our members have been brought up, investigated and in some instances settled to their mutual advantage. The coordinated interests of the various properties which constitute our membership and the increasing complexity of their relations to the State and the various municipalities demonstrate with ever-growing insistency the necessity of unified action to conserve their welfare.

"Since our association has been organized laws have been passed affecting the railroad interests of the State. During the pendency of these enactments your executive committee was active and on the ground at various times, observant of the interests of the members and alert to secure for the railways the best consideration obtainab'e. The committee's efforts and watchfulness undoubtedly obtained beneficial results that would otherwise have been lost.

"Besides the concrete examples of good work done by the committee along these lines, an important and influential attainment may be found in the recognition its work has gained for electric railroads before legislative committees and the State commission. This will be of increasing value to the interests represented by this association. It will eventually result in establishing the true status of the electric railways of this State. It will secure recognition before the legislative bodies and commissions commensurate with their importance among the industries of the State.

"Shortly after the recent State election Mr. Chubbuck and myself, representing the association, had a most satisfactory interview with the Governor-elect. At that meeting the affairs of the electric railways of Illinois were discussed and the important position they occupy in the industrial life of the State was impressed upon him. As a result of this conference we secured the assurance that our interests will be properly considered by the executive department during the present administration.

"It has been a matter of common knowledge that hitherto steam roads have been reluctant to give electric roads any recognition or accord to them the rights to which they are entitled as common carriers. In this field a new light is dawning and electric roads are coming into their own. Steam roads are generally showing a disposition to treat with us and enter into friendly and reciprocal relations, in some instances taking the initiative in seeking to promote an alliance for the development of interchange business, physical connections, etc. The steam road organizations also are opening their doors to us. At least two of our member companies have been admitted recently to the per diem rules agreement, which carries with it membership in the American Railway Association and the Master Car Builders' Association. They are also inviting us to cooperate with them in organizations designed to promote the welfare and protect the interests of both classes of railroads.

"A short time ago the principal steam roads of the Central States organized for the purpose of anticipating and safeguarding against unfavorable legislation in various states. Electric railways were invited to co-operate in this movement, and the executive committee of this association was represented at the initial meeting held at Chicago early this winter. Some of our members have joined hands with the steam roads in this organization and others will no doubt do likewise.

"The initiative taken by this association last October in subscribing to membership in the American Association and in establishing headquarters at the convention hall at the last annual meeting created a new departure. It has resulted in the American Association formulating a plan to bring into closer relations with that body all the sectional associations of the country.

"The work done by other standing committees has been no less important and successful. The traffic committee has labored faithfully with many questions and produced important results, such as the adoption of an interchangeable coupon ticket, a sectional map of the electric railways of this and adjoining states, joint freight rates, etc. The signal committee's report, which has been printed by the association and distributed, is a notable achievement, embodying a vast amount of investigation, statistical data and scientific information on the subject. This work will prove a valuable guide and most helpful to all our railway members in their consideration of this highly important element in railway operation. The membership committee should receive the highest praise for its active and successful work during the past year. The success of our association is due in no small part to its earnest and efficient endeavor. Twelve new members were admitted this year, and more would have been added had this committee not deemed it prudent for certain reasons to slacken its efforts toward the end of the year.

"In addition to that which has been outlined, the educational side has been strongly featured. The program committee has placed before our meetings many meritorious papers, in the preparation of which various members have responded in a most praiseworthy manner. With two or three exceptions, all the papers read before this body have been prepared by our own members. By the literary excellence and learning displayed these papers reveal the fact that we have among us many men of high attainment in their respective lines—men qualified to give this association a character and standing second to none.

"In view of what we have already done, in the light of the achievements of our brief career as an organization, can we not safely predict more notable successes, greater accomplishment, more good, in the future? Busy as we all are in our own special environment, I know how difficult it is to spare even a few moments from the duties that engross every hour. But I must urge upon every one of you to spare enough of your time, your brains, your energy, to build up this association to the highest success. Let every member make our meetings more beneficial by his presence and hearty participation."

ELECTION OF OFFICERS AND OTHER BUSINESS

The "get together" lunch was informal and was served in a private dining room where the members could freely discuss subjects of interest to themselves and the association.

The report of the nominating committee was received immediately following the luncheon and adopted as a whole. The new officers of the association are: President, Marshall E. Sampsell, president Central Illinois Public Service Company and Central Illinois Traction Company, Chicago; first vice-president, Britton I. Budd, president Chicago Elevated Railway Companies; second vice-president, F. E. Fisher, general superintendent Chicago, Ottawa & Peoria Railway Company, Ottawa, Ill., and secretary and treasurer, C. E. Flenner, auditor Aurora, Elgin & Chicago Railroad Company, Wheaton, Ill.

The executive committee will be composed of E. C. Faber, chairman; H. E. Chubbuck, Peoria, Ill.; W. C. Sparks, Rockford, Ill.; L. C. Haynes, East St. Louis, Ill.; J. R. Blackhall, Joliet, Ill., and H. T. Dillon, Springfield, Ill.

Other standing committees include a traffic committee, of which G. W. Quackenbush, Springfield, Ill., is chairman, and R. Breckenridge, F. D. Eckmann, A. W. Jordan and C. C. Shockley are members.

John Leisenring again was appointed chairman of the signal committee, the membership of which includes E. F. Gould, J. O. Tucker and M. J. Feron.

F. E. Johnson, Ohio Brass Company, was again appointed chairman of the membership committee, which includes G. T. Seeley and R. H. Heyworth. The committee on publicity is composed of F. G. Buffe, chairman; C. E. Patten, A. B. Furlong and Joseph Bush.

Following the appointment of the several standing committees by President Sampsell, Mr. Chubbuck called the association's attention to an important decision rendered for his company in a case before the Interstate Commerce Commission in which the Peoria & Pekin Union Railway was made the defendant. His road had asked for a general interchange of traffic with the defendant company by the establishment of through routes, which the latter had refused to grant. The result of this important decision was that all steam roads were forced to handle electric railway cars in traffic interchange. This gave the Illinois Traction System use of the defendant company's terminals as well as its connections to various industries. The decision was subject to further appeal, but no action had yet been taken by the defendant company. Mr. Chubbuck emphasized further the effect this decision would have on the future of electric railroads, and he suggested that the secretary be instructed to secure copies of the decisions for the member companies, which was so ordered.

In further discussion of the subject of interchange between steam and electric roads, F. E. Fisher, general superintendent Chicago, Ottawa & Peoria Railroad, suggested that the member companies of the association should exchange information as to their traffic relations with steam roads. He suggested that information of this character could be used by all roads in urging a request for general interchange of traffic.

Upon motion, it was decided to make this annual meeting of the association take the place of the regular March meeting and that the next meeting should take place on the third Friday in May, the place of meeting to be selected by the executive committee. The meeting then adjourned.

COMPARATIVE ENERGY CONSUMPTION ON THE SPIEZ-FRUTIGEN RAILWAY

According to an article by J. Bourdel in a recent number of *Le Génie Civil*, the results of recent energy consumption tests on the Spiez-Frutigen Railway, a part of the Lötschberg tunnel route, were as follows for the conditions noted:

	Siemens-Schuckert Motor Car	Oerlikon Locomotive	Allgemeine Locomotive
Length of test track, miles	8.37	8.37	6.14
Greatest difference in height, feet	492	492	337
Weight in metric tons	125	346	497
Per cent load	100	50	100
Performance, metric ton miles	1048	2790	3038
Calculation of work done at the wheels, kw-hr.	84.5	220	227
Calculation of watt-hours per ton mile	80	78.4	74.1
Metered energy, kw-hr.	107.5	264	310
Metered energy, watt-hours per ton mile	101.6	94.4	101.6
Total efficiency, per cent	78.5	83.5	73.3

According to these figures the series motor appears to be superior to the repulsion motor from the standpoint of economy in energy consumption, and more particularly at starting. It was also found that a coefficient of rail friction of one-fifth was sufficient for good starting.

RESULT OF INQUIRY INTO COST OF LIVING IN PHILADELPHIA

The following statement from Co-operative Bulletin No. 12 issued by the Stotesbury management of the Philadelphia (Pa.) Rapid Transit Company gives substantially in full the result of the inquiry by the company into the cost of living of its trainmen as contained in the bulletin:

"The committee of six members from the co-operative committee appointed to audit the returns decided to base its report of housekeeping expenses on the statements of the 500 families who had no other income than the wages received from the company by the head of the family and who were paying a monthly rent for their homes.

"The result of the investigation by the committee is as follows:

Expenses Month of January, 1913
(500 typical families having no other income than wages of head of family received from company)

	Total	Per family
Rent	$7,007.00	$14.01
Foodstuffs	16,092.21	32.18
All other expenses	10,356.27	20.71
Total expenses	$33,455.48	$66.90

"The average rent as shown, $14.01 per month, was found to secure a comfortable two-story house with from four to six rooms with bath, located in a respectable residence neighborhood.

"The average cost of foodstuffs, $32.18, includes fresh meats, $9.65; groceries, $13.20, and all other foodstuffs, $9.33.

"In the item 'All other expenses,' amounting to $20.71 per family, were included all other expenditures actually made by the 500 families in January, i. e., heating and lighting, clothing, insurance, entertainment, charities, taxes, interest, doctors' bills, etc. In this item were also included purchases of household effects such as carpets, furniture, kitchenware, etc.

"Inasmuch as the expenses for heating and lighting, winter clothing, doctors' bills and other items are usually higher in January than at any other time of the year, the average total expenses per family of $66.90, as shown in the committee's report, may be fairly said to represent the maximum monthly expenses that the motormen and conductors are called upon to meet out of their wages.

"The average size of the families of these motormen and conductors was found to be four persons, i. e., two adults and two children.

"This committee on cost of living was continued and instructed to secure a comparison as between the wholesale and retail prices of the several standard articles of foodstuffs which are in general use in the homes of the men.

"The earnings of the 500 men whose expenses are included in the foregoing statement were carefully drawn from the pay rolls for January, 1912, as well as for January, 1913. This was done not only for the purpose of arriving at the income of the men as compared with the cost of living, but also for the purpose of supplying definite information as to the exact result of the wage increases secured by means of the co-operative plan and 22 per cent fund during the past year.

"During January, 1913, 131.147 hours of service were performed by these 500 men, the average time of service per month per man being 26.2 ten-hour days. The wages paid for this service at 27 cents per hour amounted to $35,409.66, making an average of $70.82 for each man.

"These 500 men performed in January, 1913, one and a half days' service more than they did in January, 1912. The men in working 26.2 days in the thirty-one-day month of January, 1913, performed that amount of service which would approximate working every day with an average lay-off of one day in seven. The increased wage of $$11.42 per man was partially due to the one and a half days of added service rendered as compared with January, 1912 but mostly because of the increase of 3 cents per hour, which is the amount wages have been increased during the past year. The net average result of $70.82 per man for the month as compared with the wages paid last year, $59.40 per man, has, it is plain, not only made possible a higher scale of living but raised the wage paid to the men from the point of a bare sufficiency to that which provides a small amount in excess of the cost of living. We may, therefore, expect further increases, as they occur, to make possible to the men the laying aside of savings and the ability to provide in a better way for their own necessities and those of their families."

UNION TRACTION COMPANY SHOP NOTES

The Union Traction Company of Indiana has been making an efficiency campaign in shop methods and processes. In order to keep the high-priced workmen constantly employed on a given repair job and at the same time keep them supplied with tools and material, several shop errand boys have been added to the force. Heretofore it has been necessary for the workmen or foreman personally to make trips to the tool room or stock room for additional tools or supplies. Now a properly signed order carried by an errand boy receiving $5 a week accomplishes the result.

Another source of economy has been obtained by carrying an assorted stock of second-hand hardware. All hardware, such as car fittings, bolts, screws, etc., is carefully removed from a car which is being overhauled and thrown into a heap where it is sorted by the errand boy into the different sizes and types. If the threads are faulty on bolts and it is possible to make them good by rethreading, this is done. In case the threads are so badly battered that the bolt cannot be rethreaded for use in its original length, it is cut off and rethreaded to some shorter standard stock size. The cost of obtaining this renewed life is nominal.

Hardware and fittings for use in cars which are being rebuilt are dumped into a nitric-acid bath to remove the lacquer and then polished with a scratch wheel. This applies a satin finish, making the metal appear as though new. In order that the foreman in the erecting carpenter shop may know what second-hand hardware is on hand at all times a board of sufficient size to take the various sizes and types is mounted conveniently on the shop wall. Samples of all the different kinds of second-hand hardware are attached to this board and remain there as long as there is any of the type in the second-hand stock. All workmen are required to use this supply of second-hand material as far as it will go in making repairs to old cars.

In a number of instances it has been necessary to remove air compressors from rolling stock because they were of an obsolete type too low in capacity to meet operating needs. Rather than scrap them or sell them as second-hand equipment one has been installed in each of the substations on this company's line. The air compressor in combination with a reservoir is used in cleaning around the substation, as well as for supplying air to car reservoirs in case of failures en route. The possibilities of an installation of this kind at each substation are evident and this company has found that the compressors are worth more in such locations than their value as scrap or second-hand equipment.

This company has equipped all of its passenger cars with a complete outfit of fire-fighting apparatus. A soda-ash fire extinguisher is installed in the baggage compartment, a Pyrene extinguisher in the passenger compartment and a canvas bucket in the tool box under each car. In addition to the canvas bucket, which also is used in case of a hot bearing, the tool box is supplied with a grease bucket containing saturated waste and packing tools.

A reduction in the damage resulting from a short-circuit in an armature or field coil is being effected by

the introduction of the type of armature band recently adopted by motor manufacturers. This consists of a 24-gage tire channel cut so as exactly to encircle the armature. The usual wire banding ranging from 15-gage to 17-gage is wound around the armature inside the channel. After the wire has been applied, the flanges of the channel are bent down over it and the whole is filled with solder. The advantages of this type of banding are that it produces a stronger band at about the same cost as the ordinary method and at the same time the whole acts as a unit. In case a short-circuit appears in the armature near the band and a portion of this is fused, the wire does not unwrap, resulting in great damage to the armature and fields.

The addition of a portable welding outfit to the shop equipment has been made recently and will be used in rehabilitating all kinds of rolling stock equipment as a welder and building-up tool. It will also be used in obtaining renewed life from badly worn special work in paved streets along the company's line.

SAND CUSHION SUPPORT FOR CROSS TIES*

As a part of the discussion on a paper read before the American Society of Civil Engineers and abstracted in the Electric Railway Journal for Oct. 19, 1912, page 883, C. B. Vorce contributed an account of his experiences with track on the British Columbia Electric Railway in Vancouver, B. C. He stated that very poor results had been obtained with the concrete-girder and steel-tie form of construction. This type had been standard, but, on account of poor foundations, the concrete girders had broken badly with most disastrous results to both the pavement and the track. The type of construction shown in the accompanying line cut was thereupon recommended and later adopted, since which time about 15 miles of double track had been laid. Up to the present time no signs of failure had been noticed.

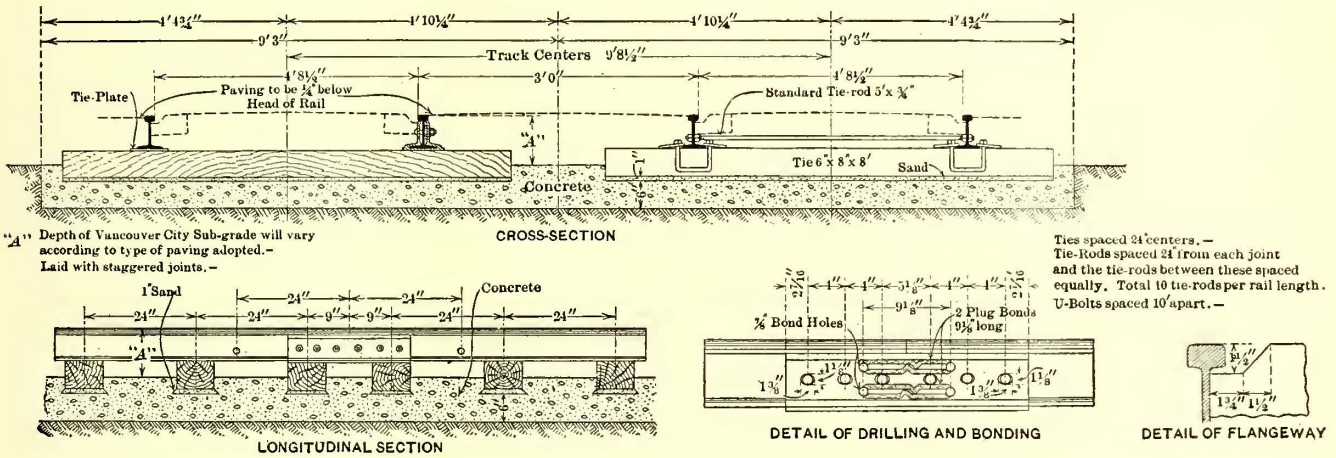
It was the writer's opinion that it was possible to build too rigid a track and it was desirable to avoid hardness and lack of elasticity, which increased the cost of maintenance for both cars and track. He objected to the use of steel ties embedded in the concrete, as the concrete between the ties and between the rails would shrink, allowing the rail to move slightly. Wooden ties spaced 2 ft. center to center and surfaced on about 1 in. of sand to act as a cushion were preferable. The life of the wood was stated to be satisfactory, as in Vancouver ties which had been embedded in concrete for fourteen years had been taken up and found to be perfectly sound.

*Abstract of discussion of a paper presented Oct. 16, 1912, before the American Society of Civil Engineers, entitled "A Brief Description of Modern Street Railway Construction," by A. C. Polk. Printed in full on pages 249 to 255 of the society's "Proceedings," for February, 1913.

The writer stated that although the best paving bricks obtainable on the Pacific Coast had been tried, the results with them in forming a flangeway on the running side of the rail had been very poor, and for this reason the company had been forced to adopt granite flangeway blocks although the cost was at least 50 per cent greater than that of brick. As many of the streets in Vancouver were paved with wood blocks which were narrower than the granite flangeway blocks no bond was possible and a straight joint parallel to the rail resulted. However, since the adoption of the concrete slab type of construction there had been very little trouble with this.

The selection of a type of permanent track for the city of Vancouver was influenced by the fact that the streets had first been planked and then macadamized, the macadam seldom being renewed before laying the permanent pavement on the concrete base. For this reason the foundation was very poor and the type of construction used was selected to meet the peculiar existing conditions.

The construction work was carried on with a temporary track outside of the track allowance to take care of traffic during construction, thus enabling the company to build both tracks at once. When the traffic was turned over to the temporary tracks the old track was torn up and piled on the side of the street for removal by work cars. Grading was then started and forms were set by the company's engineer to the proper grade for the top of the slab, a small gang of fine graders following up the rough graders. As soon as one city block had been rough-graded work on the concrete slab below the level of the ties was commenced, concrete being run through the mixer and delivered into a traveling bucket on a 30-ft. boom attached to the mixer and which swung through 180 deg. The rails were distributed by an electric derrick car and the ties by the company's motor car. After the lower portion of the slab had set twenty-four hours the ties were distributed and the rails were laid, the track being surfaced to grade with sand varying in thickness from ¾ in. to 1¼ in. After the track had been surfaced, the sand was scraped out from between the ties and the final concrete course was laid. The four operations—grading, laying the lower part of the slab, laying the track and putting in the upper part of the concrete slab—were carried on at the same time, resulting not only in rapidity but also in economy.

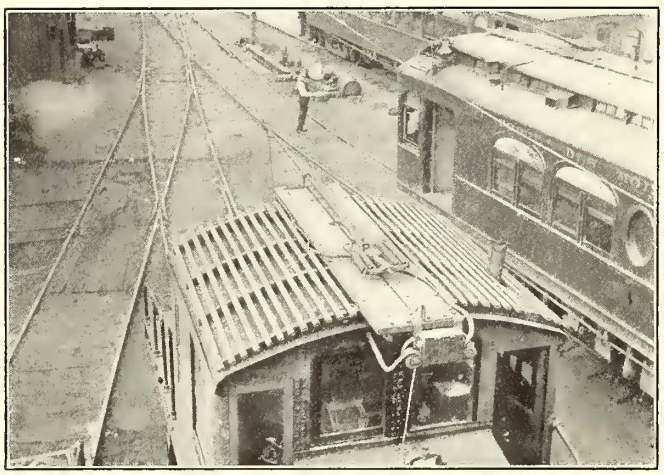


Vancouver Track—Section Showing Ties Supported on Sand Cushion

The record of passenger train performances on the steam railroads of New York State for January shows that during the month the number of trains run was 65,892. Of the number of trains run, 82 per cent were on time at the division terminal. The avergae delay for each late train was 29.1 minutes and the average delay for each train run was 5.2 minutes.

AN INSULATED ROOF FOR ELECTRIC LOCOMOTIVES

The Fort Dodge, Des Moines & Southern Railroad, Boone, Ia., which is now being operated at 1200 volts d. c., has insulated the entire roof of each engine with wooden slats. The nailing strips, 3-in. x 6-in. yellow pine, are cut to fit the contour of the roof and bolted to it. The slats are 1-in. x 2½-in. yellow pine applied so as to leave a 2-in. space



Fort Dodge, Des Moines & Southern—Insulated Cab Roof for Electric Locomotives

between them. The addition of this protective feature is simple and inexpensive and adds greatly to the safety of trainmen, who in emergencies may have to mount the engine roof. The slatted roof of one of these locomotives is shown in the accompanying illustration.

LIGHT SIGNAL PERFORMANCE RECORD ON THE TERRE HAUTE, INDIANAPOLIS & EASTERN

Although the light signal installation on the lines of the Terre Haute, Indianapolis & Eastern Traction Company has been in operation less than one year, some idea as to its efficiency may be drawn from the performance record for the three months ended Jan. 31, 1913.

The protected section is situated between Greencastle and Brazil on the Brazil-Terre Haute division and includes twelve signals in six blocks, covering approximately 15 miles of road. The signals are of the General Railway Signal Company's light-signal type arranged for the absolute-permissive block system. The engineering details, as well as the design of the signals themselves, were described in the Electric Railway Journal of Aug. 24, 1912.

For the three months' operation ended Jan. 31, 1913, the total number of signal movements recorded was 44,896. In this total number of movements there were twenty-seven failures, giving an efficiency average of 99.937 per cent, or one failure in 1662 movements. The record of the failures and the causes therefor are as follows: five false red indications from unknown causes, one false red indication caused by changing a check relay, one false red indication on account of maintainer working on blocks, two false red indications due to bad bonds and one false red indication on account of sluggish relay. On Jan. 20 all blocks were out of service from 7:30 a. m. to 8:10 a. m. on account of a fuse being burned out by lightning.

It will be seen from this record that in no case was there a false clear signal, that several of the false movements were of a character which it is possible to eliminate, and that of the twenty-seven failures twelve occurred on Jan. 20 because of fuses burned out by lightning. Failures from the latter cause are extraordinary, and when the average signal performance for the year is available the efficiency will show an increase.

JOINT CALIFORNIA COMMITTEE ON INDUCTIVE INTERFERENCE

The Railroad Commission of the State of California has had brought to its attention many cases of inductive interference between power lines and lines of communication systems. In considering these cases the commission has found that much theory but comparatively little accurate information is available as to the quantitative effect of different factors in such interference. For the purpose of formulating plans to remedy this condition a conference of representatives of power, communication and railroad interests of the State was held on Dec. 16, 1912. The commission was also officially represented. A committee of fifteen was appointed, with sub-committees on ways and means, finance, transportation, program and publicity. A special committee was also appointed to supervise the tests and to analyze the results obtained. The work will be supported by voluntary contributions.

The committee on tests will first utilize all data now available and will continue tests already begun by the Pacific Telephone & Telegraph Company and the Coast Counties Gas & Electric Company. These companies have a parallel in the Santa Clara Valley, which they have been investigating for some time. The preliminary program has been laid out on the basis of making tests on telephone circuits, on telegraph circuits and on railroad signaling circuits and of making miscellaneous tests on special types of equipment not otherwise covered. In making these tests it is expected that the companies concerned will be willing to allow the use of circuits for testing purposes whenever this will not interfere with public service and that they will cooperate in every way in obtaining the desired results. For example, in making telephone tests it is proposed to disconnect at both ends parts of circuits exposed to interference and thus isolate the testing sections. From these isolated sections insulated wires will be run to the testing stations, the wires being well transposed en route.

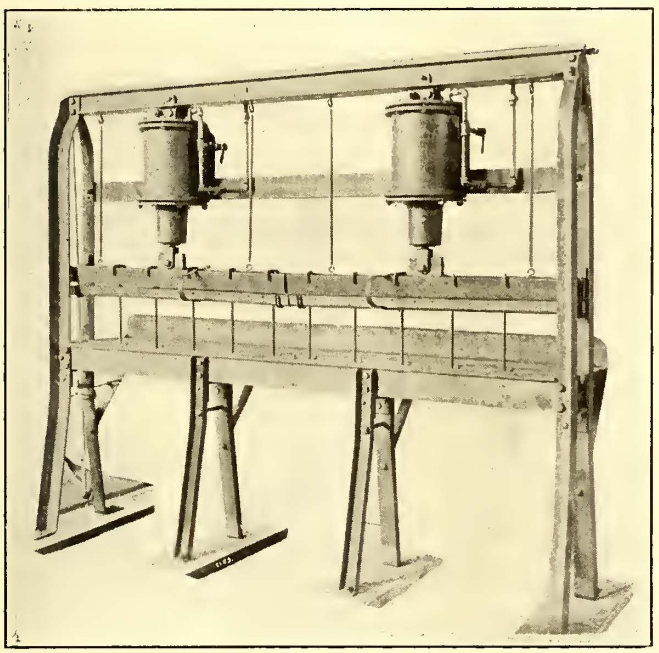
As examples of the kinds of tests that will be made the following are outlined: determinations of the capacity and insulation balance of each telephone circuit; of the total noise induced in the telephone circuits; of the current flowing between the telephone wires and ground on short-circuit; of the voltage induced between telephone lines and ground on open-circuit, etc. Oscillograms of the voltages and currents in connection with the above-mentioned tests will be made. The tests on telegraph circuits and on railroad signaling circuits will be carried on in the same comprehensive manner. Special attention will be given to the conditions of the power circuits liable to cause disturbance. The committee has outlined the following as tests which seem desirable:

(1) With the power line cut dead, to determine that under these conditions the signaling circuits are free from disturbances. (2) The inductive disturbance under normal operating conditions, both light and heavy load. (3) The effect of different transformer connections on the induction in signaling circuits. (4) The effect of grounding and opening the neutrals of star-connected transformers. (5) The effect of operation of relief and emergency steam stations. (6) The effect of charging aluminum lightning arresters. (7) The effect of switching high-tension lines. (8) The disturbance caused by known residual voltages and currents. In these tests the conductors of the power line involved in a given parallel will be cut dead and a known voltage will be impressed between the three power wires in parallel and the ground. Tests of the effects of unbalanced current will be made by passing a known current through each of the line wires with a ground return. (9) Tests with one line wire grounded. In these tests the method of procedure will probably be to create a ground on one wire when the line is dead and then to switch potential on the circuit.

RATTAN BROOM FILLING MACHINE AT MILWAUKEE

In order to replace rotary brooms quickly and economically in the sweepers used by The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., the mechanical department of this road has designed and built an efficient rattan broom filling machine. The machine consists essentially of a structural-steel frame 12 ft. long, a length sufficient to permit filling an 8-ft. sweeper segment at one time, and 10 ft. in height, which places the work at a convenient elevation. Two standard 10-in. x 12-in. brake cylinders, which are mounted on the upper portion of the frame and to which two bars are attached, furnish the pressure necessary to force the outer core and rattan into position in the U-shaped inner core. These when bolted together form a sweeper segment.

Just below the pressure bars is a table provided with a limit gage on one side and a slot formed with a Z-bar and angle on the other side. This slot receives the outer core, which is a U-shaped sheet-steel form with holes for bolts at uniform intervals. Hook bolts hung on the pressure bar guide the inner wooden core into position so that bolts may be inserted both through the outer and the inner cores when they, with the rattan, have been forced into permanent position. Four small spiral springs attached to the frame and pressure bars return them to the upper position when the



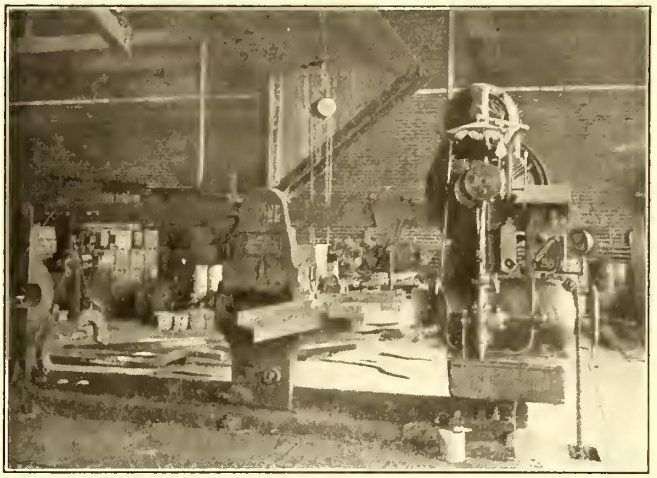
Rattan Broom Filling Machine

air is released from the cylinder. Air for the pressure cylinders is supplied from the shop compressed-air system at 90 lb. per sq. in. A view of the machine is shown in the illustration.

The process of filling a rotary broom segment, of which eight are required on each broom, consists in first placing the outer U-shaped core in the slot and then placing strips of thoroughly steamed rattan on the table as closely together as they can be conveniently laid with one end against the limit gage. After a sufficient number of rattan strips have been placed for a 4-ft. or an 8-ft. segment and the inner wood core has been clamped temporarily in position so that the hook bolts may be passed through the holes in both outer and inner cores, the temporary clamps are removed and the inner core lowered to the rattan. The air valves are then opened at one or both cylinders as required, which lowers the pressure bar until the outer and inner cores with the rattan between them are forced into position. Bolts are then passed through both and pulled up tight, and next the air is released from the cylinders, allowing the pressure bar to return to the normal position. The removal of the hook bolts then permits the finished broom segment to be removed. The whole process requires about twenty minutes, but when it was done by hand the same work used to require about two hours.

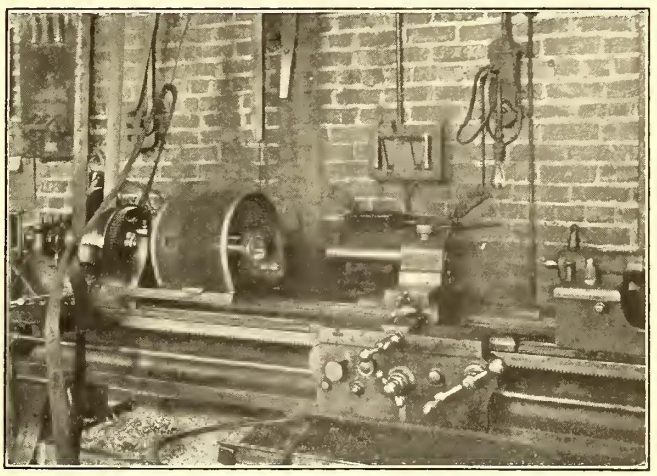
SHOP NOTES FROM OMAHA

The Omaha & Council Bluffs Railway has solved in an ingenious manner the problem of adapting standard tools



Omaha Shop Notes—Wheel Press Used for Bending Platform Knees

to special operations. The lathe in the armature shop serves for a commutator slotting machine and an armature taping, banding and testing machine, and in addition is also used in boring bearings. The slotting feature is obtained by a special lathe attachment which takes the place of the tool post in the carriage. The attachment consists of a slotting saw driven by a belt passing around a small pulley attached to it. A quarter-turn belt drives this pulley from the countershaft of the lathe and is passed over two guide pulleys, one of which acts as an idler and permits the tool carrier to pass through a con-



Omaha Shop Notes—Armature Lathe and Armature Test Yoke

siderable movement with proper tension in the belt. As an armature banding tool no special equipment aside from a tension device for the band wire is needed, but as soon as an armature is banded and ready for service an armature testing yoke mounted in a slot in the wall just back of the machine is slipped into position for testing. The bracket supporting the test yoke is mounted on the wall slot so as to be in correct line with any armature set in

the lathe. A series of holes in the slide and a pin permit the test yoke to be held firmly in position for an armature of any diameter.

When the lathe is not required for handling armatures it is used in boring the babbitted lining of bearings, a Davis boring bar with two cutting edges being employed for this purpose. The use of the boring bar eliminates chattering of the tool, performs the work in one-half the time and assures a perfectly circular bearing. The application of the screen shown in the illustration of this lathe is to keep the babbitt chips from being thrown away from the machine and to deflect them instead into a box under the lathe.

Another machine from which maximum service is being obtained is the wheel press. This and the punch take the place of a bulldozer at the mere cost of making the castings used for dies. The dies are supported as shown in the illustration between the plunger head of the press and the large bearing casting. All bends in bolsters, platform knees, and in fact practically all structural shapes, are handled by the wheel press after preheating the material in a small portable gas oven. Short bends in bars up to 1 in. x 6 in. are made in the punch after preheating. This tool has also been fitted with a set of cast dies for all standard short bends and will turn out the work almost as fast as a workman can remove the bent bars and replace them with straight ones.

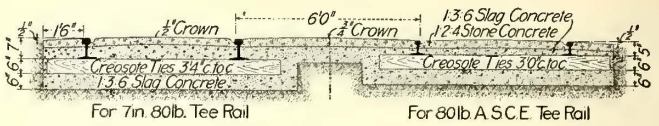
CONCRETE PAVING BETWEEN CAR TRACKS IN BIRMINGHAM

Concrete pavements between the street railway tracks have been in service in Birmingham, Ala., since April, 1910. Although the concrete was laid directly against both sides of the T-rails, the pavement alongside is in good condition. About three and a half blocks of double track were placed originally, but during the last year there have been added 6½ miles of single track, making a total of 7 miles on streets having ordinary heavy teaming traffic. In the accompanying drawing the dimensions of the pavement and the kind of concrete used in the various layers are given. The line dividing the 2½-in. top-coat layer is imaginary be-

Concrete Mixer for Track Work at Birmingham

cause it was placed over the slag concrete before the latter had a chance to set.

After traffic had been removed to one track, the sub-grade for the other track was excavated, the material removed, the track built and concrete material dumped alongside of the trench. Very little rolling was necessary, as generally the sub-grade is in stiff red clay. First, the track was raised approximately to grade and line and supported on piles of slag or blocks under the ends of ties. A Chicago mixer mounted on a short flat car running on the tracks deposited concrete under the ties and between them to a depth of about 3 in. above the bottom. When the mixer was moved along, the track behind it was brought to final line and grade by shovel-tamping the concrete under the ties and allowing it to set for seven days. After the base concrete had set the mixer was again run along the track



Cross-Section of Birmingham Track

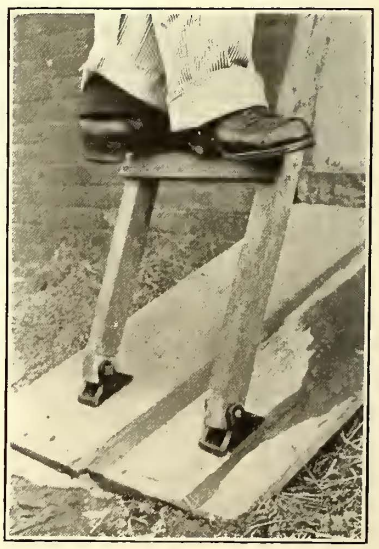
and the two upper courses were poured, the top course being placed before the bottom one had set. Expansion and contraction, longitudinally, were provided for by laying a ½-in. creosoted pine board, cut to conform to the crown, on top of a 1-in. board laid in the concrete base. These boards were laid transversely every 16½ ft.

To form a flangeway next the rail a wooden strip of the proper cross-section was forced down with the top level with the top of the rail. The surface was floated but not troweled. After the top had been allowed to set seven days, traffic was resumed. While the top coat was approximately one part Portland cement to two parts sand to four parts crushed stone passing a ¾-in. ring, the proportions were varied from time to time according to analysis of the aggregate with the idea of having an excess of small material to fill the voids.

The work was carried on under the direction of Thomas R. H. Daniels, engineer of the Birmingham Railway, Light & Power Company.

A NON-SLIPPING SHOE FOR LADDERS

The American Mason Safety Tread Company has recently placed upon the market a novel device for the prevention of accidents due to the slipping of ladders which have to be used on smooth floors. The accompanying illustration shows the general arrangement of the shoe: One of these is attached to the lower end of each leg of a ladder by means of a bolt, which allows it to swivel and thus adjust itself automatically to its proper position, no matter at what angle the ladder may be placed. The base of the shoe, as shown, is provided with a heavy, rough carborundum surface which holds the ladder firmly in place and thus prevents it from sliding from under its occupant.



Non-Slipping Ladder Shoe

The composition of the bottom surface is the same as the well-known Mason safety stair tread, and it has in consequence a permanently rough face regardless of its age or of the amount of usage to which it is subjected. As this surface is composed of material of almost diamond-like hardness, it will exert a grip on the hardest classes of flooring, stone, wood or even glass, and yet will not leave a mark or other disfigurement such as occurs when spikes are used in the bottoms of ladder legs.

News of Electric Railways

Electrification of Pennsylvania Railroad Between Philadelphia and Paoli

The directors of the Pennsylvania Railroad on March 12, 1913, authorized the electrification of the company's main line for suburban traffic out of Philadelphia as far as Paoli, a distance of 20 miles, as part of a comprehensive plan to change the motive power from steam to electricity on all the company's branches within the city limits of Philadelphia. The official announcement follows:

"The president of the Pennsylvania Railroad announces that the board of directors has authorized the taking of the second important step in the improvement of the Philadelphia passenger terminal, i. e., the electrification of the main line for suburban passenger traffic between Philadelphia and Paoli. It is expected that this improvement will be completed in 1914 and will involve an expenditure of about $4,000,000.

"In reaching this decision, the company realizes that negotiations with the city as to the company's property that will be required for the Parkway, the acquisition of all the property on Filbert Street by the company and the working out of the final terminal plans will take considerable time.

"Relief in the shape of increased track capacity at Broad Street station is essential and should be provided at the earliest possible date. Therefore no time should be lost in proceeding with this electrification work.

"The first step in the terminal improvements has previously been undertaken and announced, namely, the construction of an eight-track station at North Philadelphia and the increased tracking of the connecting railway, including a new arch bridge crossing the Schuylkill River at Girard Avenue."

It is stated unofficially that the company has decided to erect its own power station. The estimate of $4,000,000, given as the probable cost of the work, is understood to cover in general only the track and the electrification work and not the power plant or equipment changes.

Results to City and Companies in Chicago Under 1907 Surface Railway Ordinances

Bion J. Arnold, chairman of the board of supervising engineers, Chicago Traction, sent a letter on March 6 to the sub-committee of the local transportation committee of the City Council of Chicago which is considering the proposed consolidation of surface and elevated railways. He said that he believed it to be his duty as a citizen to set forth some of the opinions and conclusions which he had formed as the result of his study of transportation in many large cities of the country without in any way attempting to commit the Board of Supervising Engineers.

In summarizing the work of which the board has had charge Mr. Arnold said that the amount paid into the city treasury as its proportion of the net profits divisible under the 1907 surface railway ordinances during the six years these measures have been in effect was $10,108,212, which with accrued interest to date made the total as of Dec. 31, 1912, $10,504,334. There had been placed in the renewal funds of the companies during the three years since the rehabilitation period ended, that is, up to Dec. 31, 1912, the sum of $5,857,484. Of this sum there had been expended upon the properties in betterments not chargeable to capital up to Dec. 31, 1912, the sum of $4,415,764, leaving now in cash in the renewal funds $1,441,720. In addition to this the companies have received $45,781,793. The companies have received an average of 7.4 per cent upon their investment and the city has received an average of 7 per cent of the gross receipts during the life of the present ordinances. Supervision of the entire work of rehabilitation and capital expenditure has been done by the board of its staff at an expenditure of approximately 1.6 per cent of the cost of the work constructed.

Mr. Arnold also made a detailed criticism of the provisions included in the 1907 ordinances.

Provisions of Indiana Public Utility Measure

Governor Ralston of Indiana has signed the public utility bill. The Governor is to appoint two new members of the commission and the three members of the Indiana Railroad Commission are, by the new law, made public service commissioners. The new law declares that it is the legislative intention to substitute the Public Service Commission for the Railroad Commission, and it confers the powers of the Railroad Commission upon the new commission. Public utilities are defined so as to include street railways, interurban railways, telegraph and telephone companies, heat, light, water or power companies, and elevator and warehouse companies. Steam railroads are not called "public utilities" under the law, but are continued under the railroad commission law which is given to the new public service commission to enforce after May 1.

In the matter of valuations it is provided that where the physical property of interurban railways is valued by the Interstate Commerce Commission the Indiana Public Service Commission may accept the physical valuation made by the Interstate Commerce Commission. In addition it is provided that in valuing utilities the Indiana Commission "as one of the elements in such valuation . . . shall give weight to the reasonable cost of bringing the property to its then state of efficiency."

The law says the commission "shall value" the utilities, and that valuation shall be one of the things on which the commission shall base rates, charges and tolls in the future. The utilities have the right to appeal from an order of the commission to any Circuit or Superior Court of the State and to the Appellate and Supreme Courts, giving the Appellate Court power to determine appeals transferred from the Supreme Court.

Ten citizens or any civic body or council may complain to the commission about service, charges, rates, tolls or fares of any public utility, and the commission is empowered to alter schedules, after proper hearing, and to enforce its orders. Rate sheets are to be published by the companies. The law provides that cases appealed from the finding of the commission shall have precedence over other civil cases in the courts. New evidence presented in court on appeal shall be sent back to the commission to be considered in a new hearing before the commission. There is a provision for indeterminate permits for utilities to be issued to the utility by the commission in place of the existing franchise or grant. A certificate of public necessity issued by the commission will enable a utility to enter territory where there already is service of the kind the new company plans to render, but any existing concern can so fill the field as to show there is no necessity for competition.

No city is to supply utility service where there already exists a utility under an indeterminate permit furnishing like service. A city may take over a public utility plant and service under the supervision of the commission and at a price fixed by the commission, subject to appeal. A municipality, under the law, could enter into competition with a utility which does not hold an indeterminate permit issued by the commission. All franchises hereafter issued are to have the effect of an indeterminate permit and are to be subject to revocation by the commission for cause.

All franchises which contain any term interfering with the existence of a rival public utility are "against public policy" and the law amends such franchises in such manner as to permit any city to grant a permit to a second utility concern. It is provided under the law that a municipality owning a utility plant must obtain the approval of the commission before disposing of the plant. In the matter of rates and charges the new law defines unjust, unreasonable and unlawful charges. A provision says that "nothing in this act contained shall authorize any public utility during the remainder of the term of any grant or franchise under which it may be acting at the time this act takes effect to charge for any service in such grant or franchise contracted exceeding the maximum rate or rates therefor, if any, that may be fixed in such grant or franchise."

The law provides for uniform reports to the commis-

sion by the utilities. Stock is to be issued at a discount or other premium only with the approval of the commission, and where sold at a discount the commission is to record the fact and give the matter such publicity as it deems necessary. There is a provision to prevent the issuing of bonds at less than 75 cents on the dollar, but in the case of bonds authorized but not issued before Feb. 1, 1913, it is provided the bonds may be issued as low as 65 cents on the dollar. There is a provision under which the commission may consent to the issue of refunding bonds to take up issues made after Feb. 1, 1913, but no such refunding bonds may be put out without the consent of the commission. A public utility which desires to issue stocks or bonds must obtain a certificate of authority from the commission to enable it to make the issue. The commission may consent to the issuing of securities to raise money to reimburse the income funds for moneys used heretofore for extensions or additions, but the utility must apply for such consent before Jan. 1, 1915. There can be no merger of utilities except under a written order by the commission after a hearing. Non-assenting stockholders are to be paid in cash for their holdings at values fixed by the commission. The members of the commission are to receive $6,000 a year. A general counsel who is to serve the commission and the Governor jointly is to be paid at the rate of $6,000 a year. There is to be a secretary at $3,600 a year, and a clerk at $3,000 a year.

With the advice and consent of the Governor, the commission is authorized to appoint counsel or attorneys, engineers, examiners, experts, clerks, accountants and other assistants and to fix their compensation. The commission is to organize within thirty days after the law goes into effect, the appointments to date from May 1, 1913. The commission is to select its secretary and its chief clerk.

Board of Estimate Acts on New York Contracts

Unless some unforeseen difficulty intervenes, the negotiations will be consummated within a few days for the building and operation of the dual system of rapid transit which will give to New York City a subway and elevated system having 629 miles of single track and costing, for new work and new equipment, upward of $300,000,000. The Public Service Commission for the First District adopted the contracts with the operating companies on March 4, and sent them to the Board of Estimate and Apportionment, which acted upon them at a special meeting on March 11. They were then returned to the Public Service Commission for execution. The only contract not included is the certificate for the third-tracking of the elevated railroads in Manhattan and the Bronx. This certificate originally was made out to the Manhattan Railway, owner of the elevated roads, which refused to accept it. The commission thereupon made out a new certificate to the Interborough Rapid Transit Company as lessee of the roads. A public hearing on this certificate was arranged for March 15, and after that hearing it is expected the certificate will be approved by the commission and the Board of Estimate and then executed. Excluding the assignments of Contracts Nos. 1 and 2, covering the existing subway, for which the new contracts will be substituted, there are eight different instruments involved in the new agreement. These are as follows:

Operating contract with Interborough Rapid Transit Company covering the existing subway, the proposed extensions thereof and the equipment and operation of the enlarged system.

Operating contract with the New York Municipal Railway Corporation (Brooklyn Rapid Transit) covering the new subway system to be operated by that company and its existing elevated lines, to be operated in conjunction therewith, and the reconstruction of those lines, and the equipment and operation of all.

Certificate to the Interborough Rapid Transit Company for extensions of the elevated railroads in Manhattan and the Bronx and the equipment and operation thereof.

Certificate to the New York Municipal Railway Corporation (Brooklyn Rapid Transit) for extending, equipping and operating the elevated railroads in Brooklyn and Queens.

Certificate to the Interborough Rapid Transit Company for the construction and operation of additional tracks on the Second, Third and Ninth Avenue elevated railroads.

Certificate to the New York Municipal Railway Corporation (Brooklyn Rapid Transit) for the construction and operation of additional tracks on the Brooklyn elevated railroads.

Agreement between the Interborough Rapid Transit Company and the New York Municipal Railway Corporation (Brooklyn Rapid Transit) conveying to the latter trackage rights over the Queens rapid transit lines.

Agreement with the Interborough Rapid Transit Company giving that company, as grantee under the elevated certificates, trackage rights over the Jerome Avenue, White Plains Road and Steinway Tunnel extensions of the subway system.

When all these contracts are signed, the Public Service Commission will push the work of letting construction contracts on such portions of the new system as have not been already awarded. The most important of these are the proposed extension of the existing subway from Times Square down Seventh Avenue to Park Place and under the East River to Brooklyn, and the Broadway-Fifty-ninth Street subway, running from the Queensboro Bridge to Seventh Avenue and down Seventh Avenue and Broadway to lower Manhattan and by tunnel under the East River to Brooklyn. There are also the tunnel under the East River at Fourteenth Street and its extension through the Eastern District of Brooklyn; the cut in Thirty-eighth Street, Brooklyn, and the new tracks in Flatbush Avenue necessary to connect the South Brooklyn lines of the Brooklyn Rapid Transit system with the Fourth Avenue Subway and Centre Street Loop Subway, now about completed.

The Board of Estimate and Apportionment has approved the construction contracts awarded by the commission for the building of the main portions of the new rapid transit lines in Queens. These are the elevated roads projected from the Queensboro Bridge to Astoria and Corona, over which both the Interborough and Brooklyn companies will operate. The contractors for the Astoria line are Cooper & Evans and the contractor for the Corona line is the E. E. Smith Contracting Company.

Cincinnati Company Makes Proposal to City

W. Kesley Schoepf, president of the Cincinnati (Ohio) Traction Company, sent a communication to Mayor Hunt and the City Council on March 6, 1913, in which he declined to accept the proposal of the city to surrender the fifty-year franchise of the company on the terms proposed. He made a counter offer for the consideration of the authorities. Mr. Schoepf's principal reason for refusing the city's proposal is that adequate provision was not made to secure the interest of the stockholders.

One of the features of Mr. Schoepf's proposition is that the operating company, in the event of the exchange of the franchise for an indeterminate grant, shall receive as a minimum the amount which it now pays for rental, interest and dividends. The largest items are the rental paid the Cincinnati Street Railway and the interest on the bonds of the Ohio Traction Company.

In regard to the operation of the proposed loop, the letter suggests that the city prepare to issue bonds to cover any loss in the operation of the loop line, the company to pay the interest of 5 per cent per year as a part of the rental.

The fare is to remain as it is until the city authorizes a reduction. This can be done by the city allowing its half of the earnings above the actual expense of operation and payment of fixed charges to be used for the purpose of reducing the fare. Mr. Schoepf shows in his communication that it would be inadvisable to agree to operate for less than 5 cents. He presented a statement showing the average rate per passenger received in 1912 and the average cost of carrying passengers.

By giving two years' notice in writing the city may purchase the property at any time after ten years from the date of the indeterminate franchise by paying in cash the par value of the outstanding securities plus 10 per cent, except for the common stock and bonds of the Ohio Traction Company, for which other provisions are made.

In making this proposal Mr. Schoepf discussed each point in the city's proposition and cited his objections. Attached to the proposal is a statement from the Cincinnati

Street Railway stating that the plan will be approved, provided the lease to the Cincinnati Traction Company remains in full force during the term of the indeterminate permit.

As a result of conferences since the receipt of the letter from President Schoepf, the city's representatives have agreed to allow 6 per cent on the $18,000,000 of stock of the Cincinnati Street Railway, and it has been practically settled that a board of arbitration shall fix the value of the improvements and extensions made within the last ten years by the Cincinnati Traction Company. The company estimates these expenditures at $11,000,000. The city is to continue to receive 6 per cent of the gross revenue, including income from the proposed loop line, while the company will maintain the sinking fund and pay the interest on the bonds to be sold for its construction. If in any one year the receipts fall below the expenditures the city's 6 per cent of the gross receipts may be used to make it good, but this stands as a lien against the company, to be paid at a future time. Of the surplus earnings the city is to receive 55 per cent and the company the remainder.

First Employees' Store Opened in New York

The first of the employees' stores of the New York Railways and the Interborough Rapid Transit Company, New York, N. Y., was opened to customers at 7 a. m. on March 12 at 816 and 818 Eighth Avenue, between Forty-ninth and Fiftieth Streets. There are to be five other stores for the use of employees, which it is proposed to operate in accordance with the plans outlined in the ELECTRIC RAILWAY JOURNAL for Feb. 1, 1913. About 4000 men are employed at the carhouse in which the Eighth Avenue store is located, and the employees themselves and members of their families will be permitted to make purchases on the presentation of a card or pass properly certified. It cost approximately $20,000 to equip and stock the first store, and it is expected that the receipts will be from $500 to $800 a day.

Over the entrance to the store is the sign "New York Railways' Employees' Store No. 1." Both the exterior and the interior are finished in white. At the left of the entrance, occupying the entire side of the store, are the butter and egg counter and the dry groceries. The entire right side of the store is taken up with the meat counter. In the middle of the store is an inclosed cashier's desk, and immediately back of this in the center are the green goods. Still farther back of this and just in front of the refrigerator are the fruits and green groceries. The store has started with twelve clerks and two cashiers and all sales will be for cash. There will be no home deliveries. Everything has been arranged for dispatch and ease of access. There are computing scales and two tracks lead from the carhouse to either side of the store so that deliveries in bulk from wholesalers can be made readily.

The store is in charge of F. H. Garde with the title of superintendent of stores. Mr. Garde has had considerable experience in the management of retail stores and is thoroughly familiar with the chain idea as applied to retailing. The goods will all be sold at cost, but the prices that will be charged will, of course, vary with the market quotations. An idea of the difference between the prices which will be charged employees and those elsewhere is furnished by the quotations made by the company's store for butter, eggs and meat for the opening. Butter sold at the company's store for 35 cents a pound fetched at least 40 cents a pound in chain stores, which sell for even less than the single or isolated store; eggs sold at the company's store for 20 cents a dozen fetched 28 to 30 cents a dozen elsewhere; hindquarters of lamb sold at the company's store for 16 cents fetched 24 cents elsewhere; broilers sold at the company's store for 17 cents fetched in the neighborhood of 27 cents elsewhere.

Transit Commissioner Taylor's Views

The Philadelphia *Public Ledger* contained an interview with A. Merritt Taylor, city transit commissioner of Philadelphia, in a recent issue, in regard to the plans to be suggested for a perfected transportation system for Philadelphia. Mr. Taylor, who is at Atlantic City recuperating from an attack of typhoid fever, is reported to have said that the transit report will probably not be ready for three months. The *Ledger* said in part:

"Mr. Taylor's plans will link subway and elevated lines with parts of the present steam railroad branches into the suburbs in a way that will wipe out geographical divisions by bringing sections close together by the power of swift transit and make Philadelphia a metropolis instead of being a confederacy of wards or a mere collection of units.

"Broad Street, said Mr. Taylor, which offers unparalleled opportunities as the center of a great system of railways, has, for some reason which he considers inexplicable, been permitted to lie unused in the very period of expansion when it has been most needed. Until it is used for a subway, he declares, the growth of the city will be retarded.

"Essential to the scheme of Transit Commissioner Taylor is the proposed legislation, and the bills that have been prepared were drawn largely upon his suggestion. He considers the right of eminent domain as absolute for a transportation plan for Philadelphia, for it will involve not only the present system in Philadelphia but the electric railways that now reach terminal stations at the borders on the north, west and south. This will mean that freight can be carried into any part of Philadelphia from adjoining counties without the cost of rehandling at the electric railway terminals and thus make real one of the schemes which the Mayor and Director Cooke have decided shall be brought to pass during this administration, if possible.

"The proposed legislation is also needed, Mr. Taylor believes, to determine the right to run cars through the Market Street subway if the city should operate the Broad Street underground system or lease to some operator other than the Philadelphia Rapid Transit Company. In either event, the enlargement of the Market Street tube east of the City Hall to four tracks will be the inevitable need, it is declared, when the Broad Street system has been constructed."

Mayor Jost of Kansas City Submits Franchise Draft

Mayor Jost of Kansas City, Mo., made a tentative franchise offer on March 6, 1913, to the receivers of the Metropolitan Street Railway of that city, based on the par value of outstanding bonds and mortgage obligations of the company to the amount of $20,000,000. His proposal eliminates the stockholders of the company from consideration. He has suggested that "the light company," which he describes as a "twin corporation," take care of the $5,600,000 of stock of the Metropolitan Street Railway which is outstanding. Following the presentation of the Mayor's proposal, the conference at which it was made adjourned to consider the matter. In the course of his statement the Mayor said:

"I appreciate the situation of the company and its need for assistance. This contract ought to guarantee the integrity of the bonded debt—anything else would be indefensible."

Commenting on the proposal of the Mayor, the Kansas City *Post* of March 7 said in the course of an editorial:

"Mayor Jost says the important thing in these negotiations is that his conscience shall be kept beautiful, clean, clear and intact. Other people of Kansas City have consciences too. It is no new thing to them. Strangely enough they have been able to go along the ordinary paths of life, living and letting live, and yet kept their consciences clean and sweet. Mayor Jost hasn't, after all, the only conscience in Kansas City. He hasn't discovered an entirely new thing in life."

Catalogs and Bulletins Desired.—Catalogs and bulletins of electric railway supplies are desired by G. W. Dunlap, mechanical engineer of the International Railway, Cold Spring shops, Buffalo, N. Y.

New Texas Road Opened.—The Riviera Beach & Western Railway has been placed in operation between Riviera and Riviera Beach, which are 10 miles apart. The line is equipped with McKeen motor cars.

Order in Regard to Paving in Detroit.—Corporation Counsel Lawson has notified the Detroit (Mich.) United Railway that it must pave the strip between its tracks on Jefferson Avenue from Hillger Avenue east to the city limits, in pursuance of a resolution of the City Council.

Electrification of Buffalo & Fort Erie Line Proposed.—The Buffalo & Fort Erie Railway & Ferry Company, Fort Erie, Ont., which operates 4 miles of standard-gage steam railroad, is reported to be considering plans to electrify the line and extend it to connect with the Niagara, St. Catharines & Toronto Railway, which operates a 50-mile combined steam and electric railway.

Progress of Southwest Missouri Railroad Reviewed.—The Joplin *Daily Globe*, Joplin, Mo., in its annual mining and industrial edition, dated Sunday, March 2, 1913, reviewed briefly the progress of the Southwest Missouri Railroad, which operates an interurban electric railway system that connects the cities of the Missouri mining district. The artcle was illustrated with halftone engravings of the power house of the company, the main office building, one of the substations, the employees' club house and carhouse and one of the cars built at the Webb City car shops of the company.

Rapid Transit Matters Before the Pittsburgh Council.—The resolution introduced into the Council of Pittsburgh to ask the Pennsylvania House of Representatives to appoint a legislative committee to conduct an inquiry into the affairs of the Philadelphia Company, which controls the Pittsburgh Railways, has been referred to the law department of the city for an opinion as to whether the city has the right to appropriate money to finance an investigation by the Legislature. The public service and surveys committee of the Council has laid on the table the ordinance to grant the Pittsburgh District Railroad a franchise to construct a subway in Pittsburgh.

Ticket Suggestion in Cleveland.—H. E. Seidl, of the Metropolitan Engineering Company, in a letter to Street Railway Commissioner Witt, of Cleveland, has suggested that season tickets be sold by the Cleveland Railway as a means of relieving the situation during the rush hours in Cleveland. The proposed crosstown line in the East End will follow East Seventy-ninth Street from the St. Clair to the Woodland Avenue line, with the exception of a short distance where it will run over East Eighty-second Street, on account of difficulty in securing property on the former street. It is probable that a loop will be built from St. Clair Street to Gordon Park and that eventually the line will be extended from the present southern terminus to Broadway.

Review of Iowa Syndicate's Operation.—The Des Moines *Leader* contained recently an article by its correspondent in Cedar Rapids in regard to the Dows-Smith-Reed syndicate and the probable plans of this syndicate and the Harris interests of Chicago with regard to connecting the systems in Cedar Rapids and Des Moines. The article contained portraits of W. G. Dows, I. B. Smith, John A. Reed, A. W. Harris and N. W. Harris, together with views of the exterior of the power station of these interests and a map showing the lines of the Iowa Railway & Light Company, the proposed interurban railways of this company, its proposed high-voltage transmission lines, the cities served by high-voltage lines and the location of the power plants of the company.

Negotiations for Franchise Extension in Akron.—The Council of Akron, Ohio, has decided to retain A. B. DuPont, Cleveland, in an advisory capacity in connection with the negotiations for the extension of the lines of the Northern Ohio Traction & Light Company in Akron. Following a recent meeting with Will Christy, vice-president; Charles Currie, general manager, and other representatives of the company, the Council addressed a letter to the company in regard to the extensions. This letter it concluded with the suggestion that the company appoint a committee with authority to agree on the terms for the proposed extensions and that this committee, together with an engineer representing the company, meet the railroad and bridge committee of the City Council and its expert to determine the means for securing extensions on terms reasonable to both the company and the city.

Strike in Binghamton.—A number of employees of the Binghamton (N. Y.) Railway went on strike on Saturday, March 8, 1913, at 7 p. m., to enforce their demand for the reinstatement of five or six men who had been discharged for cause. There was no other grievance. About one-third of the cars finished the runs that night with loyal men. The next day the company operated more than half the cars and since then has been operating on schedule. The patronage is excellent. The first of the year the company raised the wages of its men 10 per cent and announced that it expected the men to obey all of the rules which the company laid down for their guidance. The effort to enforce strict discipline met with some opposition and the attempt was made to organize a union by the few men who resented being held strictly accountable for their shortcomings.

Storage Battery Car for Service Between Waterbury and Meriden.—The New York, New Haven & Hartford Railroad is planning to place Beach-Edison cars in service between Waterbury and Meriden running on a combination of electric street railway and steam railroad tracks. The cars are to be of the standard double-truck type of the Federal Storage Battery Car Company, 50 ft. long over all, with combination express and passenger body and a seating capacity of forty passengers. They will be charged while running on the trolley lines at each end of the road, namely, at Waterbury and Meriden, and will be operated from the batteries while on the steam tracks between these points. The proposed use of this type of car in this class of service by the New York, New Haven & Hartford Railroad is a departure from methods adopted elsewhere for similar service.

The Electric Railway at Panama.—It is expected that the electric railway which is under construction in Panama City will be ready to be placed in operation about May 15, 1913. The system will extend from Balboa on the west nearly to the Zone boundary line, in the summer resort of Las Sabanas, on the east. The line is owned by the Panama Tramways Company, of which Minor C. Keith, an official of the United Fruit Company, is president. Fourteen cars have been ordered. Power will be supplied from the Canal Commission plant at Miraflores. The company proposes eventually to erect its own power house. On Oct. 22, 1892, an English company, registered in London, was organized. It was named the United Electric Tramways and was capitalized at $150,000. It began work of construction in 1893, and in October of that year a part of the line was placed in operation. From 1893 to 1896 the line was gradually added to, until in the latter year there was a total length of about 5000 ft. in operation. Service was suspended in 1898. Up to and including 1896 the company had expended the sum of $182,656.25. When the Americans came in 1904 the only remaining evidence of this line was the old rails. These were removed when paving was begun in 1905. The contract for the construction of the line which is now nearing completion is held by R. W. Hebard & Company.

Public Utility Measure in Washington, D. C.—The session of Congress which lasted from Dec. 2, 1912, until March 4, 1913, resulted in the passage of thirteen new laws affecting the District of Columbia. Most important and far-reaching in effect of this legislation is the District appropriation bill. It creates a public utilities commission composed of the District Commissioners to supervise and regulate the public utility corporations in the District other than steam railroads. The public utilities commission and anti-merger laws, which were appended to the appropriation bill, became effective with the President's signature. Inasmuch as the public utilities clause goes into effect immediately, the District Electric Railway Commission no longer legally exists. It is provided that the duties of the railway commission shall be taken over by the new commission, which will maintain headquarters in the Municipal Building. The new commission will be provided with a chief clerk, or executive officer, and official appraiser and other assistants. One of the first duties of the commission after it has organized will be to value the properties of local public service corporations. Besides Secretary Marble, who will be a member of the Interstate Commerce Commission to succeed Franklin K. Lane, now the Secretary of the Interior, the District Electric Railway Commission was composed of Henry L. West, former commissioner of the District, and Thomas W. Smith, a lumber merchant of Washington.

LEGISLATION AFFECTING ELECTRIC RAILWAYS

MICHIGAN

The amended Verdier home rule bill was passed by the House on March 6. Most of the amendments relate to the municipal ownership of public service properties. It is provided that the measure shall go into effect at once. The bill had been passed by the Senate, but the amendments added in the House will make it necessary to resubmit it to that body. Municipal ownership of public utilities is provided for in the bill and municipalities may create operating commissions to have charge of all transportation, including proposed subways in some of the cities. One amendment makes definite the language of that portion of the bill which will allow cities to construct public utility properties and still another changes a hazy provision for payment of bonds to a clear expression requiring that a sinking fund be established for that purpose. Another amendment makes it legal for cities to acquire and operate street railways in suburbs and outlying villages and towns within a distance of 10 miles.

Senator Ogg has introduced a bill which provides that motormen and conductors shall work not more than ten hours out of each twenty-four and that this labor shall be performed within a period of twelve hours.

MINNESOTA

Garfield W. Brown, of Glencoe, has introduced a new public utilities bill in the House. The measure would place all public service corporations, whether owned by individuals or otherwise, under the control of a state commission of three members to be appointed by the Governor, respectively for two, four and six years, and after the first appointment for six years.

NEW YORK

A bill has been introduced to amend the rapid transit law so that the same provision is made regarding acquisition of easements by corporations organized under the rapid transit law as now exists regarding easements acquired by the city. The bill would prevent an encumbrance upon property which would militate against it as security for a loan when an easement is obtained in the property for subway purposes.

OHIO

The House has approved the Bigelow bill, which repeals the law making it necessary for a company to secure the consents of owners of abutting property along streets where it wishes to build a street railway. Should the bill pass the Senate and be signed by the Governor owners of property will have no legal right to object to the construction of a railway in front of their properties.

PENNSYLVANIA

The rapid transit measures drafted at the instance of Mayor Blankenburg of Philadelphia, mention of which was made in the Electric Railway Journal of March 8, 1913, page 434, have been introduced in the Legislature.

There has been another postponement of the public hearing in the hall of the House on the three Public Utilities Commission bills now in committee of that branch of the General Assembly. This hearing is now announced for Tuesday, March 18, at which time, it is expected, the committee will finally hear arguments for and against the bills in question.

Among measures introduced in the Legislature recently are the following: Empowering counties to construct, or acquire by purchase, condemnation or lease, street railways and other public utilities, and to operate them; permitting all cities to enact ordinances relating to repairs to streets in cases where the obligation to repair rests upon corporations, such as electric railways, gas and electric companies, with a penalty of 25 per cent added to the actual cost of said repairs for non-compliance with the ordinance; requiring individual drinking cups in all passenger coaches under penalty of a $100 fine; creating a bureau of public utilities in second-class cities; providing that a right obtained under an extension of a street railway shall not be exclusive until local consent is granted.

It is stated that an agreement has been practically reached between the state administration men and the Republican state convention's legislative committee whereby the two parties will unite on one of the two bills providing for a public utilities commission.

RHODE ISLAND

An act to incorporate the Boston & Providence Interurban Electric Railroad has been introduced in the House. This company seeks the right to construct a railroad through Woonsocket, Central Falls, Pawtucket, Providence and Cranston, using a portion of the roadbed and the right-of-way of the Southern New England Railway, a subsidiary of the Grand Trunk Railroad. The company plans to run steamers from Providence to New York, and arrangements have already been made to build two steamships to ply between the ports.

Two bills intended to further the extension of the lines of the Rhode Island Company from their present terminal at Centerdale to Chepachet, a distance of more than 10 miles, are under consideration. The measures are rather unusual. They provide that Smithfield and Gloucester, the towns through which the proposed extension would pass, shall meet any deficiency which may accrue to the operating company as a result of extending the road. The bills are before committees and an early report is expected.

UTAH

The Senate committee on railroads held a public hearing on March 5 on the railroad and public utilities commission bill. No one appeared before the committee to advocate the measure. George H. Smith, assistant general counsel of the Oregon Short Line, said that the expenses of the commission would not be compensated by any benefits that might accrue. The House made the bill a special order of business for March 7.

WASHINGTON

A bill has been introduced in the House to amend a provision of the present street railway law to read as follows: "Every street railway shall, upon such terms as may be just and reasonable, furnish to its passengers transfers entitling such passengers to one continuous trip over and upon portions of its line within the same city or town not reached by the originating car." Under the law as it now stands a company cannot charge more than 5 cents for one continuous ride within the corporate limits of the city.

PROGRAMS OF ASSOCIATION MEETINGS

New England Street Railway Club

The thirteenth annual meeting and banquet of the New England Street Railway Club will be held at the Hotel Somerset, Boston, Mass., on March 27, 1913. The business meeting will be held at 3 p. m., the reception at 6 p. m. and the banquet at 6.30 p. m. The committee of arrangements has planned for a "club night" on this occasion. The program, which is in course of preparation, will provide for a few short speeches. The tickets for members of the club will cost $3 each, and for guests who are not members the price will be $4 each. Each table will seat six persons, and as the capacity of the banquet hall is limited H. A. Faulkner, secretary of the club, requests that reservations be made promptly.

American Railway Engineering Association

The program for the convention of the American Railway Engineering Association, which is to be held at the Congress Hotel, Chicago, Ill., on March 18 to 21, inclusive, provides for the presentation on March 18 of the report of the committee on signals and interlocking, the committee on track and the committee on rail. It provides for the presentation on March 19 of the reports of the committees on wood preservation and on ties. On March 20 the report of the committee on electricity will be presented. The annual dinner of the association will be held in the gold room of the Congress Hotel on the evening of March 19. The speakers at the dinner will include B. A. Worthington, president of the Chicago & Alton Railroad; George A. Post, president of the Railway Business Association; Rev. R. W. Dickie, Montreal, Can., and P. G. Rennick, Peoria.

Financial and Corporate

Stock and Money Markets

March 12, 1913.

A feature of the trading on the New York Stock Exchange to-day was the decline in a number of the newer industrial issues. The contrast between the state of the stock market and the condition of general business remains as marked as ever. The money market showed the effect of Europe's urgent demand for gold. Call money rose to 6 per cent to-day and it is thought that further considerable amounts of gold will be taken for export before the end of the month. Rates in the money market were: Call, 4¼ @ 6 per cent with a last loan of 5 per cent; sixty days, 5½ @ 6 per cent; ninety days to six months, 5½ @ 5¾ per cent.

The Philadelphia market was broad and active. There was a good demand for bonds.

The Chicago market was broad, but the volume of sales was not large. The bulk of the bond transactions was in the railway issues, the sales of Chicago Railways 5's totaling $50,000.

In the Boston market the railroad issues were dealt in more freely to-day. There was little demand for bonds.

The Baltimore market for stocks was narrow and extremely dull. The demand for bonds continued good.

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

	Mar. 5.	Mar. 12.
American Brake Shoe & Foundry (common)	90½	90¼
American Brake Shoe & Foundry (preferred)	131¼	131
American Cities Company (common)	47½	47½
American Cities Company (preferred)	76½	76⅞
American Light & Traction Company (common)	380	370
American Light & Traction Company (preferred)	107	107
American Railways Company	39¾	39⅝
Aurora, Elgin & Chicago Railroad (common)	44	44½
Aurora, Elgin & Chicago Railroad (preferred)	86½	87
Boston Elevated Railway	108½	108¼
Boston Suburban Electric Companies (common)	7½	7½
Boston Suburban Electric Companies (preferred)	65	63
Boston & Worcester Electric Companies (common)	6	7¼
Boston & Worcester Electric Companies (preferred)	40	43
Brooklyn Rapid Transit Company	90⅝	87
Capital Traction Company, Washington	120	121
Chicago City Railways	150	150
Chicago Elevated Railways (common)	30	25
Chicago Elevated Railways (preferred)	91	88
Chicago Railways, ptcptg., ctf. 1	90	90
Chicago Railways, ptcptg., ctf. 2	24	22¼
Chicago Railways, ptcptg., ctf. 3	6½	6⅞
Chicago Railways, ptcptg., ctf. 4	3½	3½
Cincinnati Street Railway	111	111
Cleveland Southwestern & Columbus Ry. (common)	*6	a5½
Cleveland Southwestern & Columbus Ry. (preferred)	*30	a30
Cleveland Railway	103¼	103¾
Columbus Railway & Light Company	18	18
Columbus Railway (common)	69	69½
Columbus Railway (preferred)	88½	82½
Denver & Northwestern Railway	117	108
Detroit United Railway	85	85
General Electric Company	139	138
Georgia Railway & Electric Company (common)	122	120
Georgia Railway & Electric Company (preferred)	84	83¾
Interborough Metropolitan Company (common)	18	16⅝
Interborough Metropolitan Company (preferred)	61⅛	58
International Traction Company (common)	42	35
International Traction Company (preferred)	95	a95
Kansas City Railway & Light Company (common)	20	15
Kansas City Railway & Light Company (preferred)	38	30
Lake Shore Electric Railway (common)	6½	6½
Lake Shore Electric Railway (1st preferred)	91	a91
Lake Shore Electric Railway (2d preferred)	25½	a25½
Manhattan Railway	131	130
Massachusetts Electric Companies (common)	16⅞	16½
Massachusetts Electric Companies (preferred)	75½	74⅝
Milwaukee Electric Railway & Light Co. (preferred)	102	100
Norfolk Railway & Light Company	*26	25¾
North American Company	79	77
Northern Ohio Light & Traction Company (common)	75	80
Northern Ohio Light & Traction Company (preferred)	105	105
Philadelphia Company, Pittsburgh (common)	46	45¼
Philadelphia Company, Pittsburgh (preferred)	41	40
Philadelphia Rapid Transit Company	25⅝	25⅜
Portland Railway, Light & Power Company	67	67
Public Service Corporation	115	115
Third Avenue Railway, New York	37½	35½
Toledo Railways & Light Company	2½	2½
Twin City Rapid Transit Co., Minneapolis (common)	106	104
Union Traction Company of Indiana (common)	*4½	4½
Union Traction Company of Indiana (1st preferred)	*81	81
Union Traction Company of Indiana (2d preferred)	*34	34
United Rys. & Electric Company (Baltimore)	*23¼	23½
United Rys. Inv. Company (common)	27½	26
United Rys. Inv. Company (preferred)	51⅞	49
Virginia Railway & Power Company (common)	54	55
Virginia Railway & Power Company (preferred)	92½	89
Washington Ry. & Electric Company (common)	84	84½
Washington Ry. & Electric Company (preferred)	88¼	87⅞
West End Street Railway, Boston (common)	78	78
West End Street Railway, Boston (preferred)	*97	95
Westinghouse Elec. & Mfg. Company	70½	68½
Westinghouse Elec. & Mfg. Company (1st preferred)	118	116

*Last sale. a Asked.

ANNUAL REPORTS

Cleveland, Painesville & Eastern Railroad

The following is a comparative statement of the results of the operation of the Cleveland, Painesville & Eastern Railroad, Cleveland, Ohio, for the years 1912 and 1911:

	1912	1911
Gross earnings	$386,967	$366,143
Operating	190,005	189,195
Net earnings	$196,962	$176,948
Interest and taxes	138,787	113,045
Surplus	$58,175	$63,903

E. W. Moore, the president, says in part:

"Four thousand five hundred and fifty-seven feet of track on Euclid Street, through Wickliffe, was relaid with 7-in. 80-lb. T-rail on treated oak ties with 9-in. crushed stone ballast. This section of track was also paved. We relaid 2 miles of track between Euclid and Stop 17 with 70-lb. A. S. C. E. rail, and 12,000 6-in. x 8-in. x 8-ft. oak ties were put under the track, and of these 3000 were treated with wood preserver.

"A new telephone line was built from Willoughby to Euclid, a distance of 8½ miles. The new transmission and telephone line between Painesville and Willoughby, 11½ miles, was completed and put in operation in July, 1912.

"The installation of new machinery and general repairs of the old machinery in the Painesville power house was completed during the year. The plant now has a normal generating capacity of 3720 kw, with a normal boiler capacity of 2200 hp. The boilers have 50 per cent overload rating, which is equal to 330 hp in boiler capacity. The Willoughby substation was put in operation on July 15, 1912, having 1000 kw converting capacity in railway converters. This station furnishes power for both lighting and railway service.

"There are at present 247 lighting customers and 199 100-watt series tungsten street lamps. In addition to this we furnish the village of Willoughby current at the switchboard. Willoughby village has at present 235 lighting customers and 165 series tungsten street lamps.

"One electric locomotive was built to take care of the switching of coal and other carload material from our connection with the steam road in Painesville to the power house and other points on the line. Two passenger and two baggage cars were rebuilt.

"Twenty-five-year franchises and ten-year street lighting contracts were granted to the company by the villages of Fairport and Richmond."

Statistics of traffic compare as follows:

	1912	1911
Per cent of operation	49.10	51.67
Car miles	931,328	935,952
Income per car mile	41.55c	39.12c
Operating per car mile	20.41c	20.20c
Net earnings per car mile	21.16c	18.92c
Passengers carried	2,609,117	2,491,235
Earnings per passenger	11.51c	11.71c

Dominion Power & Transmission Company, Ltd.

The report of the Dominion Power & Transmission Company, Ltd., Hamilton, Ont., for the year ended Dec. 31, 1912, and the profit and loss account of the company follow:

Earnings and Expenditures

Gross earnings	$2,563,371	
Operating expenses	1,359,459	
		$1,203,912
Bond interest and interest		352,152
Surplus earnings		$851,759

Profit and Loss Account

1912			
Jan. 2	Balance from 1911		$764,606
Dec. 31	Surplus earnings, 1912		851,759
Dec. 31	Transferred to replacement	$15,727	
Dec. 31	Bad and doubtful accounts written off	2,446	
Dec. 31	Dividends declared	362,301	
Dec. 31	Reserve for deferred dividend	230,176	
Dec. 31	Balance	1,005,715	
		$1,616,365	$1,616,365

J. R. Moodie, the president, says in part:

"There is nothing very special to comment upon in connection with the report for the year ended Dec. 31, 1912, beyond pointing out that the year was a good one and that our prospects for 1913 are also good. The sales of power exceed those of any previous year. The physical condition of the properties is excellent and continues to improve,

large sums having been expended to that end, particularly on the power house and the street railway. A third transmission line has been built from Hamilton to the power house on our own right-of-way. Brantford and Welland have passed by-laws committing the municipalities to competition with us in the power and lighting business. Application has been made to Parliament for an extension of the charter of the Brantford & Hamilton Railway to enable us to extend that railway to the town of Galt. Before this report comes to your hands your directors will have declared and paid all deferred dividends on the preference stock, and they can say that this was warranted upon a most conservative basis. This action of the board will afford, without doubt, great satisfaction to the preference shareholders."

Toronto Railway

The income account of the Toronto (Ont.) Railway for the year ended Dec. 31, 1912, and the profit and loss account of the company follow:

Income Account		
Gross earnings		$5,448,050
Operating, maintenance, etc.	$2,866,550	
Interest on bonds, etc.	190,992	
Percentage on earnings	798,950	
Pavements, taxes	143,090	
		3,999,592
Surplus earnings		$1,448,458
Profit and Loss Account		
Balance from last year		$3,125,894
Surplus earnings, after payment of all expenses, interest, taxes, etc.		1,448,458
		$4,574,352
Dividends, four of 2 per cent each, on the paid-up capital		$879,595
Balance from 1911	$3,125,894	
Surplus carried forward	568,863	
		3,694,757
		$4,574,352

William Mackenzie, the president, says in part:

"The increase in gross passenger earnings is most gratifying, showing as it does the amount of $567,035, when compared with the previous year, the earnings being $5,367,502, while those for 1911 amounted to $4,800,467. Notwithstanding the large increase in gross earnings referred to, said surplus was reduced largely by the operation of additional cars placed in service, a higher rate of wages paid to our conductors, motormen and other employees, and also from the cost of material of all classes having advanced in price. The charges for the year amounted to $2,866,550. When compared with the previous year, when they were $2,653,361, they show an increase of $213,188. The operating cost amounted to 53.4 per cent of the passenger earnings.

"The payments made to the city of Toronto in accordance with the agreement between the company and the city amounted to the sum of $942,048, which shows an increase of $119,815, or 14.6 per cent, over the amount which was paid in the previous year.

"In addition to renewing the battery plant at Frederick and Front Streets, there was expended during the year on capital account the sum of $591,484 in building additional rolling stock and procuring electrical equipment for same, the construction of new tracks and erection of overhead work in various sections of the city, additions to buildings and other improvements.

"On March 25, 1912, a fire occurred at the King Street East division, completely destroying the car storage house in rear of the main building, together with about 150 cars, practically all of which were of the open, or summer type. The property was insured.

"The company's agreement with its employees having expired on June 15, 1912, your directors are pleased to report that, after a number of conferences, all differences were amicably adjusted and an increase in wages was granted and a new agreement was entered into with the men for three years.

"The second drawing of the company's currency and sterling bond issues, under the terms of the mortgage deed dated Sept. 1, 1892, took place on June 27, 1912, the company being obliged under the mortgage deed to redeem by drawing annually 5 per cent of the amount of bonds issued, same to be redeemed on Aug. 31, following the date of drawing, from which date no interest is payable. The full number of bonds drawn in June, 1911, amounting to $168,693, have been presented and paid, and of the bonds drawn during 1912 $159,500 have been presented and redeemed. The total amount of bonds so drawn for redemption aggregates $339,386.

"Careful attention has been paid to the maintenance of the plant, rolling stock equipment and other properties of the company.

"Your directors declared out of the accumulated surplus earnings of the company four quarterly dividends of 2 per cent, all of which were paid on the several dates set for payment."

Chicago Elevated Railways

The income statements of the Metropolitan West Side Elevated Railway, the Northwestern Elevated Railroad and the South Side Elevated Railroad for the eighteen months ended Dec. 31, 1912, follow:

Metropolitan West Side Elevated Railway		
Earnings:		
Passenger	$4,268,862	
Other earnings	201,459	
Miscellaneous income	21,672	
		$4,491,993
Operating expenses:		
Maintenance of way, structure and buildings	$116,829	
Maintenance of equipment, including power plant	155,071	
Conducting transportation, including cost of power	1,659,081	
General expenses	169,927	
		2,100,908
		$2,391,085
Charges:		
Interest	$908,922	
Taxes and car licenses	287,052	
Rentals, etc.	471,220	
		1,667,194
		$723,891
Deduct:		
Dividends	$675,478	
Reserves, etc.	25,000	
		700,479
Surplus		$23,412
Northwestern Elevated Railroad		
Earnings:		
Passenger	$3,681,418	
Other earnings	161,753	
Miscellaneous income	62,750	
Union Loop net earnings	883,848	
		$4,789,769
Operating expenses:		
Maintenance of way, structure and buildings	$106,264	
Maintenance of equipment, including power plant	160,546	
Conducting transportation, including cost of power	1,591,795	
General expenses	144,041	
		2,002,646
		$2,787,123
Charges:		
Interest	$2,176,185	
Rentals, etc.	49,850	
Taxes and car licenses	438,730	
		2,664,765
		$122,358
Deduct:		
Dividends	$98,888	
Reserves, etc.	15,000	
		113,888
Surplus		$8,470
South Side Elevated Railroad		
Earnings:		
Passenger	$3,545,771	
Other earnings	132,962	
Miscellaneous income	26,440	
		$3,705,173
Operating expenses:		
Maintenance of way, structure and buildings	$88,679	
Maintenance of equipment, including power plant	171,756	
Conducting transportation, including cost of power	1,246,504	
General expenses	133,409	
		1,640,348
		$2,064,825
Charges:		
Interest	$679,620	
Taxes and car licenses	229,628	
Rentals, etc.	359,206	
		1,268,454
		$796,371
Deduct:		
Dividends	$690,579	
Reserves, etc.	25,000	
		715,579
Surplus		$80,792

Union Traction Company of Indiana

The Union Traction Company of Indiana, Anderson, Ind., has made public the report of all the properties comprised in its system for the twelve months ended Dec. 31, 1912, and not merely for the period since the consolidation of the Union Traction Company of Indiana and the Indiana Union Traction Company, which became effective on May 13, 1912. This course was adopted as best calculated to facilitate comparison with results of former years. The income account of the company for the year follows:

Revenue from transportation:		
Passenger		$1,944,480
Baggage		10,498
Parlor, chair and special car		8,723
Mail		643
Express		80,580
Milk		13,827
Freight		187,337
Total		$2,246,088
Revenue from operation other than transportation:		
Station and car privileges	$6,528	
Parcel room receipts	972	
Storage	11	
Car service	8	
Rents of tracks and terminal	12,033	
Rent of equipment	1,070	
Rent of buildings and other property	5,719	
Power	28,393	
Miscellaneous	3,957	
Light and power	3,870	
Total	$62,560	
Total operating revenue		$2,308,649
Operating expenses:		
Way and structures	$269,942	
Equipment	184,401	
Traffic	15,169	
Conducting transportation:		
Superintendence	23,361	
Power	184,982	
Operation of cars	390,188	
General and miscellaneous	266,721	
Light and power	1,075	
Total operating expenses		$1,335,841
Net operating revenues		$972,808
Taxes		88,612
Net operating revenue less taxes		$884,195
Other income		8,108
Gross income		$892,303
Deductions from gross income (bond and other interest, discount and rentals)		765,711
Net income		$126,592
Dividends paid:		
Union Traction Company of Indiana preferred, April 1, and first preferred Consolidated Company, Oct. 1		37,500
Surplus for year		$89,092

Note.—From the above surplus of $89,092.10 there should be deducted $12,500 to be applied on April 1, 1913, together with earnings from Jan. 1, 1913, to March 31, 1913, to the payment of the dividend on the first preferred stock due on that date.

No dividends have been declared or paid to date on the second preferred stock of the consolidated company. A 1 per cent dividend on this stock is cumulative from and after Jan. 10, 1913.

Revenue ($28,553.66), expenses, etc., on account of the Indianapolis-Newcastle line from Oct. 25, 1912, are included in the foregoing statement.

The annual report calls attention to the installation of automatic block signals over practically 18 miles of the line between Anderson and Indianapolis at a cost of $17,953.07. The report further shows that during the year the Union Traction Company had enlarged its operations by furnishing light and power in Pendleton, Middletown, Summitville, Bunker Hill, Selma, Yorktown, Atlanta, Carmel and Walton. It is also stated that contracts were made in June, 1912, for ten all-steel interurban cars and for six steel cars for the Broad Ripple line at a total cost of $159,342.

Traffic statistics of the company for the year ended Dec. 31, 1912, follow:

Passengers carried, interurban lines	8,834,655
Passengers carried, city lines	8,233,495
Total passengers carried	17,068,150
Freight handled, tons	69,261
Express handled (exclusive of United States express), tons	5,635
Mileage of cars, interurban lines	5,819,486
Mileage of cars, city lines	1,642,409
Total mileage of cars	7,461,895
Coal consumed at all plants, tons	74,833
Power generated (a. c.) at all plants, kva.	39,766,250
Power generated (d. c.) at all plants, kva.	26,035,936

At the annual meeting of the stockholders of the company held on March 4 Frank C. Ball, Arthur W. Brady, John P. Frenzel, Harold D. Hibben, J. Levering Jones, Randall Morgan, Philip Matter, W. Kesley Schoepf and R. K. Willman were re-elected directors.

London Street Railway

A statement of earnings of the London (Ont.) Street Railway for the year ended Dec. 31, 1912, compares with the previous year as follows:

Earnings:	1911	1912
Passengers	$274,887	$301,196
Miscellaneous	4,718	5,034
Gross earnings	$279,606	$306,231
Expenses:		
Maintenance:		
Way and structures	$22,325	$23,743
Equipment	30,337	28,516
Transportation:		
Power plant	35,556	40,015
Car service	74,985	86,367
General	29,530	31,635
Total operating expenses	$192,736	$210,278
Net earnings	$86,870	$95,952
Deductions:		
Interest on bonds	$28,750	$28,911
Interest on overdraft	93	.....
Total deductions	$28,843	$28,911
Net income	$58,026	$67,041

Henry A. Everett, the president, in his statement to the stockholders under date of Feb. 5, 1913, after calling attention to new track construction and other improvements, says in part:

"The expected increases in gross earnings and surplus during the past year have been exceeded, and as general business prospects in the city at present are unusually good, our anticipations for the coming year are that it will be by far the best year in our history. Your directors are pleased to state that our relations with the public continue very satisfactory and that no litigation of any consequence appears against the company."

Statistics of traffic for the last two years compare as follows:

Year ended Dec. 31	1911	1912
Expenses, per cent of earnings	68.9	68.5
Net income, per cent of capital	10.51	12.06
Passengers carried	7,582,120	8,353,230
Car earnings, per revenue passenger, cents	3.67	3.64
Transfers	1,178,885	1,292,705
Total passengers	8,761,005	9,645,935
Car earnings, per passenger, cents	3.13	3.12
Car mileage	1,440,611	1,476,738
Gross earnings, per car mile, cents	19.10	20.40
Operating expenses, per car mile, cents	13.37	14.24
Net earnings, per car mile, cents	6.03	6.50
Number of miles of track	33.25	33.25
Gross earnings per mile of track	8,409.23	9,209.95

Organization of Eastern Power & Light Corporation

The Eastern Power & Light Corporation has been incorporated under Virginia laws to take over and operate a number of electric light and electric railway properties in New England, Pennsylvania, West Virginia and Indiana. The officers of the company follow: W. S. Barstow, president; Joseph B. Taylor, of W. S. Barstow & Company, 50 Pine Street, New York, and G. H. Walbridge, of William P. Bonbright & Company, New York, vice-presidents; A. P. Taliaferro, secretary and treasurer. Directors include the officers and F. V. Henshaw, of William P. Bonbright & Company; Henry E. Cooper and A. Ludlow Kramer, of the Equitable Trust Company, New York. The authorized capital of the new company will consist of $10,000,000 of preferred stock, of which $2,350,000 is to be issued immediately, and $10,000,000 of common stock, of which $5,000,000 is to be issued at once. The preferred stock is to receive dividends at the rate of 6 per cent until March 1, 1916, and then at 7 per cent and is also to be redeemable after that time at 125. In addition, $2,350,000 of five-year 5 per cent convertible gold bonds have been authorized, all of which are to be issued at once.

The New England properties which have been taken over by the Eastern Power & Light Corporation are the Claremont (N. H.) Power Company, the Claremont Railway & Lighting Company, the Clarendon (Vt.) Power Company and the Colonial Power & Light Company of Vermont, which includes the Manchester Light & Power Company, Manchester, Vt., and the electric department of the manufacturing concern at Springfield, Vt., now serving that community with electrical energy. The Pennsylvania properties taken over by the new company are the Reading Transit Company, including the United Traction Company, the Lebanon Valley Street Railway, the Edison Electric

Illuminating Company, Lebanon, and the Schuylkill Valley Traction Company, together with the twenty-four subsidiaries of the last four companies. In West Virginia the Eastern Power & Light Corporation will control and operate the West Virginia Traction & Electric Company, Wheeling, W. Va. The Indiana properties taken over are the City Electric Lighting Company, Vincennes, Ind., and the Vincennes Electric Company.

The construction requirements of the Eastern Power & Light Corporation for 1913 call for a total expenditure of $1,386,000. With $350,000 of this the company is to install a hydroelectric station rated at about 3000 hp at Clarendon, Vt., on the Mill River, and energy will be supplied from this plant to Clarendon, Cavendish, Springfield and Manchester, Vt., and to Claremont, N. H., as well as to intervening communities. It is also planned to spend $786,000 on the system of the Reading Transit Company and $250,000 on the properties in West Virginia.

Prospects of Illinois Traction System

T. B. Macaulay, Montreal, Can., managing director of the Sun Life Assurance Company and secretary of the Illinois Traction System, Peoria, Ill., has addressed a circular in part as follows to the holders of the common stock of the Illinois Traction Company, reviewing the progress of the company and the future prospects of the property:

"In view of the increased prices being offered for the common stock of the Illinois Traction Company, it has been suggested that the shareholders would welcome a word of advice on the subject. What follows expresses my personal opinions as one of the largest stockholders, familiar with all the circumstances, but is not written in my capacity as an officer of the company.

"The following considerations have great weight with me:

"1. The Illinois Traction Company is probably the greatest corporation of its kind in the world. It has more than 560 miles of street railway and interurban railway mileage. It is located in the richest section of central Illinois, with grand agricultural soil on the surface and coal fields beneath. It serves Peoria, Bloomington, Springfield, Danville, Urbana, Champaign, Decatur, Jacksonville, Edwardsville and St. Louis, in addition to a host of smaller places in Illinois. It serves also Des Moines, the capital of Iowa, and Topeka, the capital of Kansas.

"2. Besides its interurban lines, the company owns some or all of the local utilities in most of the cities served by it. The combination of street railways, interurban railways, electric light and power companies, gas companies and steam-heating companies is indeed a strong one. The prosperity of the Illinois Traction Company is not dependent on any one kind of public utility, or on any one city, or even on any one State.

"3. The revenue grows wonderfully.

	1906	1907	1908
Gross revenue	$3,013,107	$3,779,187	$4,098,620
Net revenue, deducting operating charges and taxes	1,361,952	1,650,699	1,744,496

	1909	1910	1911	1912
Gross	$4,752,082	$6,218,037	$6,902,221	$7,379,182
Net	2,003,013	2,498,226	2,768,580	3,025,968

"4. The common stock of the company bears an unusually small proportion to the underlying securities. In connection with the system, and its numerous controlled companies, there are outstanding bonds of more than $30,000,000 besides the preferred stocks. All of this immense sum is earning not merely interest but profit. The underlying securities, however, receive no part of that profit; they get only their stipulated interest or fixed dividend. All the enormous funds and magnificent properties of the company are working to earn dividends for the $10,000,000 of common stock.

"5. The company has already attained marked prosperity. After providing for all interest and preferred stock dividends there remained last year a balance equal to almost 7½ per cent on the common stock.

"6. The policy has hitherto been to strengthen the company by re-investing in the properties all the surplus earnings year after year, but it is felt that those earnings are now so large, and the company's position so strong, that the shareholders may rightly expect to have their patience at last rewarded. Quarterly dividends at 3 per cent per annum are expected to begin on May 15, 1913. Some consider that the rate should be 4 per cent, but ultra-conservative policy suggests that a beginning be made at the lower rate, leaving the question of an increase or a bonus to be considered a year later. I fully expect that as the years roll round the dividends on my stock will be increased to 4, 5, 6 per cent, or even more. It is a mere question of time.

"7. The company's system is practically complete. No large extensions or purchases are contemplated. A company which serves such progressive cities must, of course, grow with the population, and new capital will always be needed, but the requirements should hereafter be comparatively small."

Athol & Orange Street Railway, Athol, Mass.—The Athol & Orange Street Railway has petitioned the Railroad Commission for authority to increase its capital stock by the issuance of 905 shares of common stock and 1500 shares of preferred stock at $100 a share, the proceeds to be used to pay indebtedness incurred in the purchase of the Templeton Street Railway.

Central Arkansas Railway & Light Corporation, Hot Springs, Ark.—The Central Arkansas Railway & Light Corporation, the incorporation of which was noted in the ELECTRIC RAILWAY JOURNAL of March 1, 1913, page 395, has taken over the property of the Hot Springs Street Railway and the Hot Springs Water Company. The company has an authorized capital stock of $10,500,000, of which $7,000,000 is common stock and $3,500,000 is 7 per cent cumulative preferred stock. Of this stock $2,500,000 of common and $1,200,000 of preferred are outstanding. The company has authorized an issue of first lien fifteen-year 5 per cent gold bonds due in 1928, and of this amount $2,000,000 is outstanding. The preferred stock is guaranteed as to dividends by the Federal Light & Traction Company and it has no voting power unless two of the quarterly dividends are in default, in which case it will have the entire voting control.

Colorado Mines, Railways & Utilities Corporation, Colorado Springs, Col.—The Colorado Mines, Railways & Utilities Corporation, the incorporation of which was noted in the ELECTRIC RAILWAY JOURNAL of Feb. 22, 1913, page 349, proposes to bring under one control the El Paso Consolidated Gold Mining Company, the Golden Cycle Mining Company and the properties of other companies. The company is said to be negotiating to lease the property of the Colorado Springs & Cripple Creek District Railway. Joseph Walker & Sons, New York, N. Y., are interested.

Columbus, Marion & Bucyrus Railway, Marion, Ohio.—Judge Daniel Babst lifted the dual receivership of the Columbus, Marion & Bucyrus Railway on March 8, 1913, in the litigation started by the Cincinnati Trust Company in 1909. He had intended to fix the date for selling the property, but postponed this to give the bondholders more time in which to arrange their affairs. George Whysall was appointed general manager of the road until it is sold. Fred E. Guthery, receiver, was allowed $2,000 and George B. Scofield and D. R. Crissinger were allowed $1,000 each as counsel.

Harrisburg (Pa.) Railways.—The holders of the first mortgage bonds of the Central Pennsylvania Traction Company, the property of which has been taken over by the Harrisburg Railways, have been notified that the bonds will be paid on May 1, 1913, at par, accrued interest and a premium of 2½ per cent at the office of the Harrisburg Trust Company, Commonwealth Trust Company, Dauphin Deposit Trust Company or the Mechanics' Bank. The Harrisburg Railways has organized as follows: H. D. Walbridge, Edward Bailey, J. M. Cameron, S. I. Dunkle, F. B. Musser, B. F. Meyers, George W. Reily, Dr. W. H. Siebert and E. Z. Wallower, directors; H. D. Walbridge, New York, president; F. B. Musser, vice-president and general manager; John O'Connell, secretary and treasurer; A. Spickler, assistant secretary and treasurer.

Interstate Traction Company, Duluth, Minn.—R. R. Dunn, president of the Interstate Traction Company, is quoted as follows in regard to the affairs of that company: "It is simply a question of improvements. Many of the

stockholders are unable to meet an assessment to make them. For this reason and no other the property will be turned over to the bondholders. There will be no change in the officers nor in the policy of the company."

Manhattan & Queens Traction Corporation, New York, N. Y.—Upon application of the Manhattan & Queens Traction Corporation, the Public Service Commission of the First District of New York has fixed March 24 for a public hearing on a request for permission to issue $1,500,000 of stock and $1,500,000 of bonds, and for the approval of a first mortgage of $10,000,000 on all the properties, franchises and rights of the corporation. The corporation now owns the surface lines from the Queensboro Bridge to Jamaica, L. I., for which the franchise was originally granted to the South Shore Traction Company. The road is being constructed by MacArthur Brothers Company. The company is now operating a local service over the Queensboro Bridge and for 2 miles on Greenpoint Avenue toward Jamaica.

Manila Electric Railroad & Lighting Corporation, Manila, P. I.—A regular quarterly dividend of 1¾ per cent has been declared on the $5,000,000 of stock of the Manila Electric Railroad & Lighting Corporation, payable on April 1, 1913, to holders of record of March 19. This increases the regular rate to 7 per cent yearly.

Montreal (Que.) Tramways.—The stockholders of the Montreal Tramways have approved an increase in the common stock of the company from $2,000,000 to $5,000,000. The new issue will be offered pro rata to common stockholders at not less than par. Harris, Forbes & Company, New York, N. Y., are offering at 99 and accrued interest $2,000,000 of first and refunding mortgage 5 per cent gold bonds of the company.

New York State Railways, Syracuse, N. Y.—The Public Service Commission of the Second District of New York has authorized the New York State Railways to issue its first consolidated fifty-year mortgage bonds to the amount of $2,748,000, the bonds to be sold at not less than 91½ per cent and the proceeds to be used for the discharge of notes and matured bonds outstanding of the New York State Railways, the Rochester & Eastern Rapid Railway, Oneida Railway, Rochester & Suburban Railway, Syracuse Rapid Transit Railway and the Utica & Mohawk Valley Railway.

Otsego & Herkimer Railroad, Hartwick, N. Y.—The Public Service Commission of the Second District of New York has authorized the Otsego & Herkimer Railroad to make a mortgage for $2,500,000 and issue subject to the security thereof bonds of a par value of $1,200,000. On May 17, 1911, the commission authorized the company to issue capital stock to the amount of $500,000 and mortgage bonds to the par value of $400,000—$900,000 in all—to acquire the property formerly operated under the name of the Oneonta, Cooperstown & Richfield Springs Railroad, which was sold at foreclosure. Since the date of that order the company has expended considerable sums for additions and betterments and the rehabilitation of its property, including additional cars. At the time the former order was made the property sold at foreclosure was divided into two parcels, the right-of-way and rolling stock of the electric railroad being taken by the Otsego & Herkimer Railroad and the steam and hydroelectric power plants being acquired by the Hartwick Power Company, which then sold electricity to the railroad. The railroad has found it difficult to market its securities owing to the fact that it did not have its own source of power, and the power company has had similar difficulty because its business depended upon the good will of a single consumer, the railroad. A part of the proceeds of the bonds just authorized are therefore to be used to acquire all the property of the Hartwick Power Company, so that these two properties will be reunited. Bonds to the amount of $1,036,000 are to be expended for property or the cancellation of liabilities at par. The balance are to be sold at 80 for cash.

Pittsburgh, McKeesport & Westmoreland Railway, McKeesport, Pa.—The property of the Pittsburgh, McKeesport & Westmoreland Railway was sold under foreclosure recently to Andrew Peck, I. I. Robertson and William Chilvers, who have called a meeting of those for whom they acted to be held in McKeesport on March 14, 1913, to organize a new company to take over the property.

Union Railway, Gas & Electric Company, Rockford, Ill.—Hodenpyl, Hardy & Company, New York, N. Y., are offering for subscription at 97¼ and interest, to yield more than 6 per cent, $1,500,000 of three-year 5 per cent gold notes of the Union Railway, Gas & Electric Company. These notes are dated March 1, 1913, and are due March 1, 1916. The total authorized issue is $4,000,000 and of this amount $1,500,000 is outstanding. The present issue of notes is secured by deposit of $2,000,000 of bonds of constituent companies having a present market value of $1,750,000. The proceeds of the present issue of notes are to be used to pay for several small properties recently acquired and for extensions, betterments and improvements. The common stock of the company has been placed on a dividend basis by the declaration of a dividend of 1 per cent payable on April 1, 1913.

Woodstock, Thames Valley & Ingersoll Electric Railway, Woodstock, Ont.—The stockholders of the Woodstock, Thames Valley & Ingersoll Electric Railway have directed Gibbons, Harper & Gibbons, London, Ont., to move at the next court of competent jurisdiction for the appointment of a receiver for the company.

Dividends Declared

Chicago (Ill.) City Railway, quarterly, 2½ per cent.
Manila Electric Railroad & Lighting Corporation, Manila, P. I., quarterly, 1¾ per cent.
Philadelphia (Pa.) Traction Company, $2.
Toronto (Ont.) Railway, quarterly, 2 per cent.
United Traction & Electric Company, Providence, R. I., 1¼ per cent.
West Penn Traction & Water Power Company, Pittsburgh, Pa., quarterly, 1½ per cent, preferred.

ELECTRIC RAILWAY MONTHLY EARNINGS

BATON ROUGE (LA.) ELECTRIC COMPANY

Period.			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
1m.,	Dec.,	'12	$14,384	*$7,651	$6,733	$1,734	$4,999
1 "	"	'11	12,453	*6,059	6,394	1,729	4,665
12 "	"	'12	147,381	*87,907	59,475	20,768	38,707
12 "	"	'11	119,476	*75,886	43,590	20,687	22,903

BROCKTON & PLYMOUTH STREET RAILWAY, PLYMOUTH, MASS.

1m.,	Dec.,	'12	$7,849	*$7,469	$370	$1,076	†$697
1 "	"	'11	8,040	*6,706	1,334	1,046	288
12 "	"	'12	120,008	*90,872	29,136	12,554	16,582
12 "	"	'11	119,301	*90,434	28,766	12,920	15,846

CAPE BRETON ELECTRIC COMPANY, LTD., SYDNEY, N. S.

1m.,	Dec.,	'12	$34,387	*$16,124	$18,264	$5,682	$12,582
1 "	"	'11	31,417	*15,798	15,620	5,653	9,967
12 "	"	'12	360,177	*194,881	165,296	68,105	97,191
12 "	"	'11	337,555	*181,764	155,791	67,830	87,961

DALLAS (TEX.) ELECTRIC CORPORATION

1m.,	Dec.,	'12	$174,240	*$99,374	$74,866	$24,635	$50,231
1 "	"	'11	152,927	*96,049	56,878	19,657	37,221
12 "	"	'12	1,821,562	*1,092,794	728,768	290,257	438,511
12 "	"	'11	1,632,291	*1,103,449	528,842	245,699	283,143

DETROIT (MICH.) UNITED RAILWAY

1m.,	Dec.,	'12	$1,037,460	$645,795	$351,664	$177,681	$173,982
1 "	"	'11	913,503	570,324	343,178	180,138	163,040
12 "	"	'12	11,904,387	7,730,409	4,173,978	2,123,513	2,050,465
12 "	"	'11	10,431,947	6,580,042	3,851,905	2,123,398	1,728,507

PORTLAND RAILWAY LIGHT & POWER COMPANY, PORTLAND, ORE.

1m.,	Dec.,	'12	$586,857	*$278,683	$308,174	$151,403	$156,771
1 "	"	'11	556,397	*256,733	299,664	132,750	166,914
12 "	"	'12	6,642,308	*3,328,911	3,313,397	1,760,991	1,552,406
12 "	"	'11	6,336,703	*3,069,897	3,266,806	1,510,280	1,756,526

ST. JOSEPH RAILWAY, LIGHT, HEAT & POWER COMPANY, ST. JOSEPH, MO.

1m.,	Dec.,	'12	$110,874	*$57,373	$53,501	$19,710	$33,791
1 "	"	'11	101,401	*55,966	45,435	19,708	25,727
12 "	"	'12	1,179,839	*669,023	510,816	236,060	274,756
12 "	"	'11	1,099,285	*681,327	417,958	231,608	186,350

UNION RAILWAY, GAS & ELECTRIC COMPANY, ROCKFORD, ILL.

1m.,	Dec.,	'12	$438,168	*$243,324	$194,844	$93,348	$101,496
1 "	"	'11	325,314	*183,505	141,809	64,168	77,641
12 "	"	'12	3,992,134	*2,327,901	1,664,233	964,148	700,085
12 "	"	'11	3,190,110	*1,829,651	1,360,459	744,167	616,292

*Includes taxes.
†Deficit.

Traffic and Transportation

The Utility of the Commerce Court

Notwithstanding the fact that the recent Congress provided for the further existence of the Commerce Court only until June 30, 1913, it is not likely that the court will go out of existence at that date. At least, this is the opinion of Democratic leaders in the Senate and the House who will sit in the new Congress to be called on April 8 in extra session. President Wilson is stated to have expressed his desire to have Congress at the coming session provide for the continuance of the court. Ample provisions were made by Congress for the carrying out of all work before the court, and the court is going ahead, confident that legislation will be passed during the coming few months for its continuance.

It is considered necessary to the validity of the principle of administrative regulation embodied in the interstate commerce law that somewhere in the federal judiciary, subordinate to the Supreme Court, shall be reposed original jurisdiction to hear and determine legal objections to the affirmative orders of the administrative agency—the Interstate Commerce Commission.

So far as any opposition to the continuance of the Commerce Court is based upon an opinion that the orders of the Interstate Commerce Commission ought not to be subject to judicial review, suspension or control, it is apparent that it rests upon preference for a system of regulation that cannot be adopted under the Constitution as it now reads. The moment the Commerce Court should cease to exist, without a previous transference of its substantial powers to some other federal court or courts, the constitutional validity of the whole regulative system would depend upon the successful performance of the difficult task of reading into the statutes the essential provision for recourse to some judicial forum capable fully to protect the rights of every citizen or corporation that the commission might command to act. The only logical ground for a desire for the abolition of the Commerce Court would be the belief that the jurisdiction it exercises would be more satisfactorily exercised by some other court or courts. The dividing line is thus seen to be between the present plan and the one that it replaced, in which the jurisdiction of the Commerce Court was distributed among the inferior federal courts of general jurisdiction, whose time and attention is much occupied by other matters.

The objections to the Commerce Court have rested mainly upon its disagreements (a) with the Interstate Commerce Commission and (b) with the Supreme Court. Regarding the former, the apparent objection is due only to the centralization of responsibility that has been noted. In fact, the Commerce Court has reversed the commission in a much smaller proportion of the cases presented to it, proportionately, than, under the old system, was the case regarding reversal by the circuit courts. Statistics show that less than one in one hundred of the commission's orders is contested. The rule of railway counsel is to recommend obedience to every order of the commission which is not, in their opinion, at once intolerable in substance and indefensible in law.

Such disagreements with the Supreme Court as have occurred were the natural and almost inevitable consequence of an experimental jurisdiction and an uninterpreted statute. To a large extent these possibilities of difference have been removed and their recurrence in the future has been made impossible by the authoritative decisions of the court of last resort. The appellate jurisdiction exists primarily for the correction of error and not for the purpose of sanctioning that which would need no sanction if error were impossible. Reversals of the Commerce Court have been rather less than those of other courts of original jurisdiction. If such courts were able to establish unimpeachable records of correct decision, all reasons for the exercise of appellate jurisdiction would disappear. Neither shippers nor carriers would be likely to be satisfied with a statute that would deny the right of appellate review in the Supreme Court of the decisions of any court or courts on which might be conferred the present jurisdiction of the Commerce Court.

Connections at Intersecting Lines in Brooklyn.—A regulation has been in force in Brooklyn for a long time past that cars on all lines of the Brooklyn (N. Y.) Rapid Transit Company shall wait at intersecting points during the hours when the schedule calls for a considerable headway. In the daytime and in the evening rush, of course, with a very short headway, this is not practicable, but after 8 p. m., and particularly between 12 p. m. and 5 a. m., the company strives constantly to enforce this requirement.

Ohio Electric Railway Employees Insured.—W. Kesley Schoepf, president of the Ohio Electric Railway, Cincinnati, Ohio, has arranged to insure 1500 employees of the company with the Travelers' Insurance Company under the group insurance contract of that company. The total amount of insurance involved is upward of $1,500,000, and the plan provides life insurance as well as accident benefits. The premiums are to be paid by the Ohio Electric Railway and a portion charged to the employee in monthly installments.

Decision in Regard to Elimination of Stops in Cleveland.—Judge Vickery of the Cuyahoga County Common Pleas Court has dismissed the case of George D. Hile against the Cleveland Railway, Street Railway Commissioner Witt and the city of Cleveland, to compel the company to restore stops which were eliminated some time ago. The court held that the elimination of some of the stops is necessary in order to care for traffic and that the City Council has a right under the Tayler franchise to make these changes. The case will be appealed to the Circuit Court.

Protest Against "Dead" Cigars on Cleveland Cars.—The civic committee of the Cleveland Council of Women has protested against the practice of men in carrying "dead" or smoking cigars or cigarettes into street cars. They say that the rules of the Cleveland Railway forbid this practice and that they will have the rules printed in connection with the ordinance forbidding the use of long hatpins. This committee will also endeavor to have all vehicle traffic barred from the Public Square during rush hours. This was done for many months, but some weeks ago the rule was abrogated.

Tidewater Railroad Held to Be Street Railway.—Romaine Boyd, city attorney of Birmingham, Ala., has rendered an opinion to the effect that the Birmingham, Ensley & Bessemer Railroad, familiarly known as the Tidewater line, is a street railway and is therefore entitled to profit by the provisions of the statute which requires street railways to permit other street railways to operate over constructed lines. He says that in any event it is within the power of the board of city commissioners of Birmingham to grant the Birmingham, Ensley & Bessemer Railway a street railway franchise, and thus remove all doubt about its being a street railway.

Report of Ohio Public Service Commission.—The annual report of the Ohio Public Service Commission shows that in 1912 steam, interurban and street railways carried 686,000,000 passengers and collected $59,949,289 fares. The steam roads carried about 43,000,000 passengers an average distance of 35.7 miles and at an average fare of 66½ cents. The interurban railways carried 188,000,000 passengers at an average fare of 8.3 cents and the street railways hauled 455,000,000 passengers at an average fare of 3.9 cents. The number of transfers issued was 13,000,000. The net profit of the steam roads was $50,196,058; that of the interurban railways, $6,756,723, and that of the street railways, $6,237,379.

Progress in Equipping Cars with Fenders in Portland, Ore.—According to F. W. Hild, general manager of the Portland Railway, Light & Power Company, Portland, Ore., all of the cars of that company subject to the city fender ordinance will be equipped with the prescribed fender by July 31, 1913. Already 159 cars have been so equipped, leaving 342 others to be supplied with fenders within the time specified. The total cost of installing the fenders is estimated at $62,000. The automatic fender cannot be installed on the Portland Heights cars of the company, and it is prescribed by ordinance that the Hunter fender shall be used on these cars. Nearly all of these latter cars have been equipped in accordance with this requirement.

Destination Signs in Milwaukee.—J. D. Mortimer, president of The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., made a statement recently in part as follows in regard to car route and destination signs: "The development of a system of signs for properly and clearly designating the route upon which, and the destination to which, cars run has been under consideration for a long time past. The installation of the Hunter illuminated roof signs formed a part of the general plan for the improvement of the car sign system. The illuminated glass deck signs formerly in use were abandoned as a standard on account of the expense of maintaining them and their lack of flexibility. In lieu of route numbers we are providing for the installation of dash signs which will designate the route upon which cars operate. The illuminated roof sign will indicate the destination."

Progress of Safety Movement in New York.—More than 175,000 school children of New York City are wearing the green and red button of the Safety League and a thousand or two more become members of the league every school day. A children's safety crusade has been carried on in New York since last December by the American Museum of Safety with the co-operation of the Board of Education. Its object is street safety for children, and the basis of the campaign is daily classroom talks to the school children, both of public and parochial schools, by lecturers from the Museum of Safety. These talks are followed by the distribution of pamphlets containing "safety fairy tales," which the children are encouraged to take home and discuss with their parents. The lectures are illustrated by models, which enable the speaker to point out graphically the dangers in public streets and how to avoid them.

"Safety First" Movement of an Ohio Company.—W. R. W. Griffin, general manager of the Tri-State Railway & Electric Company, East Liverpool, Ohio, has inaugurated a campaign of publicity which includes a determined effort to insure the safety of the public. Charles W. Murphy, the general passenger agent of the company, has secured a number of illustrations which show various phases of the company's work, and these together with easily understood descriptions are being published in the papers along the upper Ohio valley. In connection with the "safety first" movement the company is inserting advertisements in the newspapers each week calling attention to preventive measures. These apply especially to children and women and to drivers of automobiles and horse-drawn vehicles. More than 50,000 blotters, on each of which is reproduced a picture of some accident caused through personal carelessness, have been distributed to the school children of various cities.

Order in Regard to Continuous Ride.—The Public Service Commission of the Second District of New York has directed the New York State Railways, as successor to the Utica & Mohawk Valley Railway, to provide transportation between the Blandina Street and South Street lines in Utica at a 5-cent fare for a continuous ride, or if in operating practice passengers riding from one line to the other are required to change cars, such passengers must be transferred at a single fare under suitable regulation, confining the use of the transfer practically to the next car moving from the point of intersection, except as such rule may be necessarily varied to provide adequate transportation facilities for transferred passengers. The lines referred to parallel each other for the greater distance and are about 1360 ft. apart. The complaint was occasioned by the fact that the company refused to issue transfers between the lines. The commission holds that under Section 181 of the railroad law it is the duty of the company to provide transportation between the lines as indicated. The opinion quotes the regulating provision of the law and states: "The carrier is not compellable under the statute to afford two rides instead of one continuous ride or to permit a stop-over on a transfer from one line to the other which would accomplish that result. Its right to run a through car over both lines with a 5-cent fare between the termini must be conceded. Its right to require a passenger at the intersecting point to take immediately a waiting car upon the other line is not to be denied. Its authority to put a time limit upon the use of the transfer sufficient to enable the passenger at all times to use the next car over the line shown upon the transfer must be recognized."

Personal Mention

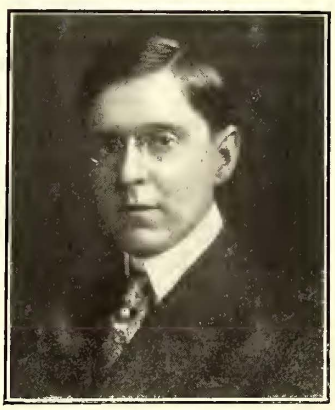
Mr. E. Smith, heretofore assistant secretary of the Toronto (Ont.) Railway, has been appointed secretary to the general manager, Mr. R. J. Fleming.

Mr. Herbert S. Balliet, engineer of the maintenance of way of the Grand Central Terminal and signal engineer of the electric division of the New York Central & Hudson River Railroad, with headquarters at New York, has been appointed assistant manager of the Grand Central Terminal. He continues to perform the duties of signal engineer of the electric division and engineer of the maintenance of way of the terminal.

Mr. Richard McCulloch, vice-president and assistant general manager of the United Railways, St. Louis, Mo., presented a paper on "Electric Railway Problems" at the luncheon of the Jovian Chapter, St. Louis League of Electrical Interests, on March 4, 1913. He dealt with track and car construction, the scarcity of efficient laborers and supervision of traffic. Figures were quoted which showed the ratio of transfer passengers to total passengers as 46 per cent. According to Mr. McCulloch, the taxes paid by the company amount to 5.5 per cent of the gross receipts. The average revenue per passenger for 1912 was 3.31 cents.

Mr. Frederick L. Hubbard, former secretary to the general manager of the Toronto (Ont.) Railway, has been appointed assistant to the general manager of the company. The position is a new one with the company and was created by reason of the increased responsibilities devolving upon Mr. R. J. Fleming, the general manager, as head of the Toronto Electric Light Company and Toronto & Niagara Power Company. Mr. Hubbard entered the service of the Toronto Railway in 1904 as secretary to the manager. He was subsequently placed in charge of the executive offices of the company and the organization of timetable and traffic and transportation departments. For several years Mr. Hubbard has been assisted in his secretarial duties in order that he might devote more time to the operation of the road and relieve the general manager of executive details. Mr. Hubbard is a member of the American Electric Railway Transportation & Traffic Association and served on the schedule and timetable committee in 1911 and is a member of the committee on fares and transfers for the current year. Previous to entering the service of the Toronto Railway Mr. Hubbard was for five years secretary to the commissioner of assessment and property for the city of Toronto.

Mr. Marshall E. Sampsell, president of the Central Illinois Public Service Company and the Central Illinois Traction Company, was elected president of the Illinois Electric Railways Association at its annual meeting held in Chicago on March 7. Mr. Sampsell was born in Marshall, Tex., on Feb. 28, 1874. He attended the public schools in Marshall and was graduated from the University of Chicago in 1896. He attended the Chicago College of Law and was graduated from that institution in 1899. From 1903 to 1910 he served as receiver of the Chicago Union Traction Company and the North & West Chicago Street Railway and took a prominent part in the settlement of the Chicago street railway ordinances of 1907 and 1910. In 1910 he was elected president of the Central Illinois Public Service Company and the Central Illinois Traction Company, which office he now holds. Mr. Sampsell is also a member of the bondholders' committee of the Chicago & Milwaukee Electric Railway and a director of the Middle West Utilities Company. He was a member of the executive committee of the Illinois Electric Railway Association for 1912.



M. E. Sampsell

Construction News

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

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

RECENT INCORPORATIONS

***Tuscaloosa Railway & Utilities Company, Birmingham, Ala.**—Application for a charter has been made by this company in Alabama to operate electric railways and other public utilities. Capital stock, $3,000. Incorporators: C. R. Gannon and W. S. Adams.

***Mexico & San Diego Railway, San Diego, Cal.**—Application for a charter has been made by this company in California to build an interurban railway from National City to South San Diego. Capital stock authorized, $215,000. Incorporators: E. S. Babcock, president; R. B. Talbott, L. M. Brown, A. Goodrich and Thomas M. Leevey. All are officials of the Los Angeles & San Diego Beach Railway, San Diego, Cal.

***Richmond, Portland & Fort Wayne Interurban Railroad, Portland, Ind.**—Application for a charter has been made in Indiana by this company to build an interurban railway to connect Portland, Fort Wayne, Decatur, Monroe, Berne, Ceylon, Geneva, Bryant, Winchester, Lynn, Fountain City, Richmond and other intervening points. Capital stock, $100,000. Directors: G. B. Staub, W. F. Harbison, R. J. McCarty and C. H. Frank.

***Iowa Northern Railway, Clinton, Ia.**—Chartered in Iowa to build an interurban railway from Clinton to Turkey River in Clayton County. S. G. Durant, president.

***Cincinnati & Northern Kentucky Traction Company, Newport, Ky.**—Incorporated to build an electric railway in Kentucky. Capital stock, $10,000. Incorporators: J. M. Dawson, R. C. Green and E. J. Green.

***Oregon Railway, Salem, Ore.**—Application for a charter has been made by this company in Oregon to build an interurban railway between Salem and Bend. Capital stock, $500. Incorporators: J. F. Mounce, A. L. McLeod and G. A. Kylwand.

***Fayette Traction Company, Fayetteville, W. Va.**—Incorporated in West Virginia to build an electric railway from Fayette Station, about 40 miles east of Charleston, to Oak Hill, via Fayetteville. Capital stock, $50,000. Incorporators: George Love, Robert H. Dickinson, C. W. Dillon, E. L. Nuckolls, A. W. Hamilton, R. L. Carter and M. M. Malcolm, all of Fayette.

FRANCHISES

Birmingham, Ala.—The Kelly Company has receeived a franchise from the Council over Twenty-first Street in Birmingham.

Contra Costa, Cal.—The San Ramon Valley Railroad, a subsidiary corporation of the Oakland & Antioch Railroad, has received a permit from the Contra Costa County Board of Supervisors to build and operate the following electric lines: From Walnut Creek via Danville to Green Valley; from Danville through San Ramon to Sycamore Valley; from Danville to the Alameda County line. The branch to the Alameda County line will probably be extended to Livermore and Pleasanton later. The construction of the lines will be begun at once.

***Orange, Cal.**—Sealed bids will be received up to April 1 by the Board of Supervisors for a fifty-year franchise in Orange.

***Redding, Cal.**—Albert C. Agnew has asked the Board of Supervisors for a franchise on the highways of Shasta County for an electric railway and power line. A similar application has been asked of the City Trustees of Redding. The board has ordered the sale of the franchise advertised. Oakland capitalists are supposed to be interested in this proposed electric railway.

Sacramento, Cal.—The Oakland, Antioch & Eastern Railway has applied to the Railroad Commissioners for authority to construct crossings in Sacramento under franchises granted on June 26, 1912, by the Sacramento Board of Trustees.

San Francisco, Cal.—The Supervisors have passed the ordinance ordering the construction of the Van Ness Avenue extension of the Geary Street Municipal Railway. They have directed the Board of Public Works to prepare plans and specifications. The Supervisors have also prepared the way for the construction of a municipal short line from the Geary Street line through the Fillmore Street tunnel and on to the fair grounds. [E. R. J., Jan. 18, '13.]

Upland, Cal.—The Pacific Electric Railway has received a fifty-year franchise from the Board of Trustees over certain streets in Upland.

Woodland, Cal.—The Sacramento & Woodland Railway, Sacramento, has received permission from the Railroad Commissioners to construct its tracks at grade on Second Street, Woodland, crossing seven interseeting streets between the north and south boundary lines in Woodland.

Hastings, Fla.—The Palatka-Hastings Interurban Railway, Palatka, has received a franchise from the Council to use the Boulevard, St. John's Avenue, Lattin Street and Dancy Avenue, Hastings. This 10-mile line will connect Palatka and Hastings. T. R. Byrd, treasurer. [E. R. J., Feb. 22, '13.]

***Miami, Fla.**—J. E. Lummus, J. N. Lummus, John C. Gramling, H. F. Atkinson and others have asked the Council for a franchise to build a 4-mile electric railway in Miami. A reinforced concrete bridge will be built from the foot of First Street across Biscayne Bay, over which the line will run. From Miami the line will be built to Fort Lauderdale, passing through Buena Vista, Lemon City, Little River, Arch Creek, Ojus, Hallandale and Dania. To the south the line will pass through Cocoanut Grove, Larkin, Kendal, Benson, Rockdale, Perrine, Peters, Goulds, Naranja and Modello to Homestead. The government will be asked for a permit to build the proposed bridge over Biscayne Bay.

Albany, Ga.—The Albany Transit Company has received an extension of time until Aug. 1, 1913, on its franchise in which to complete its 2 miles of new track in Albany.

Atlanta, Ga.—The Georgia Railway & Power Company has asked the County Commissioners of Fulton County for authority to double-track the river line on Mason and Turner's Ferry Avenue, from the point where the double track now ends 6coo ft. along the avenue to Chapel Street.

Lewiston, Idaho.—A. L. Strum has received a franchise from the Board of County Commissioners for the construction of a line from Clarkston, Wash., to Asotin, Wash., and from Clarkston to the Clarkston Heights section.

Jerseyville, Ill.—The Alton, Jacksonville & Peoria Railway has asked the Council for a franchise along State Street to Pearl Street in Jerseyville.

Taylorville, Ill.—The Decatur, Sullivan & Mattoon Transit Company has asked the Council for a franchise over Franklin Street in Taylorville.

Paducah, Ky.—The Kentucky Southwestern Railway, Light & Power Company has asked the McCracken County Commissioners for a franchise through McCracken County.

***Crowley, La.**—The Crowley Board of Trade is considering plans to build an electric railway from Crowley to some available point in the State.

Springfield, Mass.—The Springfield Street Railway has received a franchise from the Council for an extension west on Franklin Street in Springfield.

Cushing, Okla.—The Cushing & Oil Field Electric Railway has received a franchise from the Council to build an electric railway in Cushing. This line will connect Cushing and Perry. John B. Queen, Perry, is interested. [E. R. J., March 8, '13.]

Henryetta, Okla.—C. H. Kellogg and associates have received a twenty-five-year franchise from the City Council in Henryetta. [E. R. J., March 8, '13.]

Portland, Ore.—The Portland Railway, Light & Power Company has received a franchise from the Council for an extension of the Hawthorne Avenue line through South Mount Tabor, a distance of 1 mile.

Bridgeport, Pa.—The Phoenixville, Valley Forge & Stafford Street Railway has asked the Council for a franchise in Bridgeport.

Harrisburg, Pa.—The Valley Railways will ask the City Council for a franchise to construct and operate a belt line on Market and Front Streets via Walnut and Second Streets and Market Square in Harrisburg.

Nashville, Tenn.—The Nashville Railway & Light Company will ask the County Court for a franchise to extend the Buena Vista line to the new Hyde's Ferry Road, Nashville.

Port Townsend, Wash.—The Key City Light & Power Company has received a fifty-year franchise from the Council to build an electric railway in Port Townsend.

Seattle, Wash.—The Puget Sound Traction, Light & Power Company, Seattle, has received a franchise from the Council for an extension of its Kinnear Park line in Seattle.

Huntington, W. Va.—The Ohio Valley Electric Railway will ask the Council for a franchise to double-track all of its lines in Huntington, W. Va.

TRACK AND ROADWAY

Edmonton (Alta.) Radial Railway.—About 32 miles of new track will be built by this company during 1913.

Northern Electric Railway, Chico, Cal.—Plans are being made by this company to build another line to Redding from Chico.

Glendale & Eagle Rock Railway, Los Angeles, Cal.—Work has been begun by this company on the extension to Montrose.

Pacific Electric Railway, Los Angeles, Cal.—Work will soon be begun by this company rebuilding the main line between Redlands and San Bernardino from San Bernardino Avenue to Citrus Avenue. The company proposes to lay 90-lb. rails.

Oakland, Antioch & Eastern Railway, Oakland, Cal.—This company has placed in operation its line between Oakland and Antioch.

San Francisco-Oakland Terminal Railways, Oakland, Cal.—This company has awarded contracts to Twohey Brothers, Portland, to build the extension from Oakland to San José.

Geary Street Municipal Railway, San Francisco, Cal.—This company has awarded the contract to F. Rolindi, San Francisco, to build the extension of its line from its present terminus at Kearny Street and Geary Street to the corner of Market Street and Sansome Street, San Francisco.

Tidewater & Southern Railroad, Stockton, Cal.—During the year this company plans to build 15 miles to complete its line from Stockton to Turlock.

Springfield (Ill.) Consolidated Railways.—Plans are being considered by this company to build a new crosstown line to connect the Hill sections of Springfield and to relieve the congested traffic conditions on Main Street.

Arkansas Valley Interurban Railway, Wichita, Kan.—Work will be begun at once by this company on a 2-mile extension from Newton terminus to Bethel.

Louisville (Ky.) Railway.—This company is asked to consider plans to extend its Brook Street line in Louisville past the present crosstown terminal to Hill Street or possibly Shipp Street, where a connection might be made with the Second Street line serving southeastern residential territory.

New Orleans Railway & Light Company, New Orleans, La.—Plans are being made by this company to improve its Villere Street line in New Orleans.

North Louisiana Electric Railway, Shreveport, La.—The citizens of Arizona, 5 miles east of Homer, have agreed to vote a tax to aid in extending this proposed railway from Homer to Arizona. This line will extend from Shreveport to Monroe, via Minden and Homer. A. B. Blevins, Jefferson, president. [E. R. J., March 1, '13.]

Fryeburg (Maine) Horse Railroad.—Plans are being made by this company to build the section of its line from Fryeburg to Chatham via North Fryeburg, crossing the Saco River at Swan's Falls, with a branch running to Lovell Center and Lovell.

Union Street Railway, New Bedford, Mass.—This company has been asked to consider plans to extend its line from the present terminus near the head of Coggeshall Street, Fairhaven, to the Parting Ways in Acushnet, thence west on the line leading to Lunds Corner to connect with the Acushnet Avenue line.

Berkshire Street Railway, Pittsfield, Mass.—Work has been begun by this company on the big cut on the right-of-way between North Blandford and Gore.

Cape May, Delaware Bay & Sewell's Pont Railroad, Cape May City, N. J.—This company plans to build about 1 mile of new track during 1913.

Morris County Traction Company, Morristown, N. J.—Surveys have been made by this company in connection with a reported plan to operate between Boonton and Paterson.

International Railway, Buffalo, N. Y.—Surveys have been begun by this company at Pendleton on the Buffalo and Lockport line. It is reported that the company plans to double-track the railway between Lockport and Paynes Avenue in North Tonawanda.

Hornell (N. Y.) Traction Company.—Plans are being made by this company to begin work in the spring rebuilding its lines in Hornell. The Canisteo line will also be rebuilt. The company has just closed a contract for 4000 ties to build this line. The North Hornell line will also be reconstructed.

New York Central & Hudson River Railroad, New York, N. Y.—During the year this company plans to build 9.5 miles of new track, to be electrified in Grand Central Station only.

Columbus Railway & Light Company, Columbus, Ohio.—Extensive improvements are to be made at once by this company on its line extending to Westerville.

Toledo & Indiana Railway, Toledo, Ohio.—Work will be begun by this company in the spring on its extension from the present western terminus at Bryan to Montpelier.

Oklahoma Public Service & Interurban Lines, Stillwater, Okla.—Work has been begun by this company on the interurban lines to Morrison, north of Stillwater, and Perkins, south, Louis J. Lampke and Charles Gresser, New York, N. Y., being in charge. Rails have been purchased from the Illinois Steel Company for the 15 miles from Stillwater to Morrison. A sum of $13,000 has been pledged by the farmers living in the Cimarron River Valley and Wild Horse Valley for an interurban railway to connect Stillwater and Guthrie, via Perkins, Ripley and Coyle.

Hamilton (Ont.) Street Railway.—Plans are being made by this company to build a 5-mile extension with 70-lb. rails in the eastern section of Hamilton.

London (Ont.) Street Railway.—Plans are being made by this company to double-track several of its lines in London.

Niagara, Welland & Lake Erie Railway, Niagara Falls, Ont.—At a recent meeting of this company T. R. Cummings was engaged as engineer and plans were decided on to carry out the construction of the whole line during the coming summer. There will be about 36 miles of track running from Niagara Falls to Welland and Port Colborne, and then east along the lake short to Fort Erie. The extensions in Welland on North Main Street to Parkway Heights, on East Main Street to Rosedale, and south into Crowland, will also be built during the summer. Material is now on hand for these extensions and construction will begin as soon as the weather will allow.

Forest Hill Electric Railway, Toronto, Ont.—Plans are being considered by this company to build a line from the northern limit of the city of Toronto at Dunvegan Road north to Forest Hill, and thence out through the Eglinton Avenue and Dufferin Street district in Toronto. [E. R. J., March 9, '12.]

Humber Valley Railway, Toronto, Ont.—The plans for this railway have been presented to the Ontario Railway and Municipal Board by James and R. Home Smith, engineers. The railway will parallel the old Belt Line from the Lake Shore road to Bloor Street, and east along Bloor to the riverside. The highest grade will not be more than 2 per cent, with a minimum of 150 ft. radius at the subway on Queen Street. Plans for that section of the line to cross Queen and College Streets and the section to go north of Bloor have still to be filed, and Herbert Price, the com-

pany's solicitor, stated that these will be presented shortly. The city was not represented at the hearing. The board approved the plans, subject to the indorsement of its engineers, the right being reserved to make its orders about level crossings. The construction of the railway will be proceeded with at once.

Rogue River Valley Railroad, Medford, Ore.—Plans are being made by this company to electrify its entire line between Medford and Jacksonville.

***Portland, Ore.**—The East Seventy-second Street Improvement Club is back of the movement to have the Rose City car line extended to East Eighty-second Street and Barr Road. All but $7,000 of the construction cost has been subscribed, and property owners along the proposed route have signified their willingness that the work should be done.

Bloomsburg, Millville & Northern Railway, Bloomsburg, Pa.—During the year this company plans to build 9 miles of new track to connect Bloomsburg, Mordanville, Eyers Grove and Millville.

Philadelphia & West Chester Traction Company, Philadelphia, Pa.—This company has placed in operation its new line from the Sixty-ninth Street terminal to Media.

Montreal & Southern Counties Railway, Montreal, Que.—During the year this company will build from 30 to 40 miles of new track to connect St. Lambert, La Prairie, Richelieu, St. Cesaire, Abbottsford and Granby.

Regina (Sask.) Municipal Railway.—This company will build 24½ miles of city track during the year.

Bristol, Tenn.—Right-of-way is being obtained to build an electric railway between Bristol and Johnson City, via Austin Springs. It is the intention of the promoters to build the railway over the old C., C. & O. grade as far as Austin Springs and there cross the Watauga River and after crossing the Holston River at the Devault bridge follow Muddy Creek by way of Blountville over the proposed turnpike to Bristol. James B. Cox, Knoxville, and B. L. Dulaney, Bristol, are interested. [E. R. J., Feb. 8. '13.]

Lake View Traction Company, Memphis, Tenn.—This company plans to extend its line to Clarksdale, Miss., in the near future.

Nashville Street Railway & Light Company, Nashville, Tenn.—Work will soon be begun by this company on the extension of the Fatherland Street line to Shelby Park.

Riviera Beach & Western Railway, Riviera, Tex.—This company has placed in operation its 10-mile line from Riviera to Riviera Beach. It is expected soon to extend this line to Kingsville.

Yakima Valley Transportation Company, North Yakima, Wash.—During the year this company plans to build 12 miles of new track between North Yakima, Selah and Moxee.

Kirkland-Redmond Railway, Light & Power Company, Seattle, Wash.—Preliminary surveys are being made by this company for its line between Kirkland and Monroe, and it is expected to begin construction shortly. W. P. Perrigo, Redmond, vice-president. [E. R. J., Nov. 9, '13.]

Seattle, Wash.—The Rainier Valley Commercial Club is working to have the proposed interurban railway between Portland and Seattle, via Olympia, to be built by the Northwestern Electric Company, enter Seattle through Dunlap Canyon, Rainier Valley.

SHOPS AND BUILDINGS

British Columbia Electric Railway, Vancouver, B. C.—This company has purchased the northeast corner of Pandora Avenue and Douglas Street, Victoria, B. C., for its new terminals. It is the intention of the company to erect at an early date a ten-story building to house the various departments of the company. In the rear of the office building the terminal station for the Saanich & Suburban System will be erected. The cars will reach the building from Douglas Street, via Cormorant Street, on three tracks, running through the station to Pandora Avenue.

Union Traction Company of Indiana, Anderson, Ind.—Plans are being made by this company to build a new passenger and freight station at the corner of Main Street and Fourth Street in Jonesboro.

Cedar Rapids & Iowa City Railway & Light Company, Cedar Rapids, Ia.—This company has purchased the Masonic block, at College and Clinton Streets, in Iowa City, on which it plans to build soon a new depot.

Winnipeg (Man.) Electric Railway.—It is reported that this company has purchased 10 acres of land in Portage la Prairie on which it plans to build new carhouses and repair shops.

Detroit (Mich.) United Railway.—This company has authorized its architects, Smith, Hinchman & Grylls, to complete plans and specifications for the second building in its general shop layout so that the building may be contracted for and completed during the current year. The general shop layout includes four large buildings of reinforced concrete construction, namely, a paint shop, a carpenter shop, a machine and truck shop and a storehouse. The paint shop has been completed and is now ready for occupancy, and the building to be completed this year will house the machine and truck shop. It will be 244 ft. x 310 ft. in plan, with a second floor over a portion of the building, 155 ft. x 150 ft. in plan.

Interurban Railway & Terminal Company, Cincinnati, Ohio.—This company's carhouse and depot in Cincinnati were destroyed by fire on March 6. The loss on the building and contents is unofficially estimated to be about $200,000.

POWER HOUSES AND SUBSTATIONS

Detroit (Mich.) United Railway.—This company has ordered a 7500-kw Curtis horizontal turbine from the General Electric Company. The order for the condenser and switchboard equipment to go with this turbo-generator was placed with the Westinghouse Electric & Manufacturing Company. The new unit will be installed in station B, at the foot of Riopelle and Atwater Streets.

Piedmont Electric Railway & Power Company, Charlotte, N. C.—It is reported that this company has bought the Burlington electric plant and the Graham Electric, Ice & Water Company and has made contracts for the installation of a central plant near Burlington which will involve an initial expenditure of approximately $1,000,000.

Carolina Light & Power Company, Raleigh, N. C.—This company plans to enlarge the capacity of the local steam plant in Raleigh to 5000 hp and the Gaston Shoals plant will be enlarged to a capacity of 12,000 hp. The company is reported to be considering the construction of a new power plant on Broad River.

Columbus Railway & Light Company, Columbus, Ohio.—Plans are being made by this company to build a new substation at Milo.

Tri-State Railway & Electric Company, East Liverpool, Ohio.—This company announces improvements aggregating $2,500,000. The work includes a new $2,000,000 power house at East Liverpool and a new 3200-kw turbine for the Fallston power house, Beaver, Pa., to cost $60,000.

Cleveland, Painesville & Eastern Railroad, Willoughby, Ohio.—This company plans to abandon the present steam power plant at the Lake Shore and build an addition to its substation west of Geneva.

Ottawa (Ont.) Electric Company.—This company will soon build a new substation in Ottawa. The structure will be of brick construction with concrete and pine floors and felt and gravel roofing. The cost of building and equipment is estimated to be about $75,000.

Rhode Island Company, Providence, R. I.—Improvements at the Manchester Street power station of this company that will cost about $750,000 and eventually give the plant about 75,000 hp are under way, and it is said also that the New York, New Haven & Hartford Railroad is to erect a separate power plant or else make additions to the Manchester Street station, giving the plant 150,000 hp. The improvements now under way will comprise the erection of two additions to the present power house and will mean the installation of two 15,000-kw steam turbines.

Blue Ridge Interurban Railway, Spartanburg, S. C.—This company plans to construct a dam at the mouth of Big Hungry River, near Hendersonville, N. C., 164 ft. high, to develop 50,000 hp and transmit electricity to Spartanburg and other South Carolina towns.

Manufactures and Supplies

ROLLING STOCK

West Penn Railways, Pittsburgh, Pa., expects to build six 56-ft. steel passenger cars in its own shops.

Pittsburgh, McKeesport & Westmoreland Railway, McKeesport, Pa., is asking for prices on two cars.

Pottstown & Phoenixville Railway, Pottstown, Pa., expects to purchase six semi-convertible cars and two freight cars.

Aurora, Elgin & Chicago Railroad, Wheaton, Ill., has specified the following details for the ten combination passenger and smoking cars which are being built by the Jewett Car Company:

Seating capacity.....59	Interior trim.....mahogany
Weight (car body only), 42,000 lb.	Headlining .....composite
	Car trimmings.....bronze
Length of body..44 ft. 4½ in.	Couplers.....Van Dorn
Length over vestibule, 52 ft. 6¼ in.	Curtain fixtures...Cur. S. Co.
	Curtain material...Pantasote
Length over all..53 ft. 8½ in.	Fare boxes.....International
Width over sills.. 8 ft. 7¾ in.	Seats.....H & K
Height, rail to sills.41 11/16 in.	Seating material.split leather
Body .....wood	Step treads.....Stanwood

Northern Texas Traction Company, Fort Worth, Tex., reported in the Electric Railway Journal of Feb. 15, 1913, as having ordered four closed interurban cars from the St. Louis Car Company, has included the following details in the specifications for this equipment:

Seating capacity.....54	Bumpers..Hedley anti-climb.
Bolster centers, length, 30 ft. 5 in.	Car trimmings.....St. L.
	Couplers.....Van Dorn
Length of body.....40 ft.	Curtain fixtures....Forsythe
Length over vestibule, 51 ft.	Curtain material...Pantasote
	Gongs .....Dayton
Width over sheathing, 8 ft. 10 in.	Hand brakes.....St. L.
	Heaters .....Consolidated
Width over all.....9 ft.	Headlights .....Wagenhals
Height, rail to sills.....43 in.	Sash fixtures.....Edwards
Sill to trolley base, 9 ft. 4 15/16 in.	Seats.....H. & W.
	Seating material.....leather
Body .....wood	Step treads.....Universal
Interior trim.....mahogany	Trolley catchers....Knutson
Headlining .....Agasote	Trolley base.....Knutson
Roof .....monitor	Trucks .....Baldwin
Underframe .....semi-steel	Ventilators.....St. L.
Air brakes....Westinghouse	

TRADE NOTES

Camden Forge Company, Camden, N. J., after several years of experimental research, is enlarging its steel heat-treatment plant by the installation of annealing furnaces and quenching facilities. The first unit of this installation is now in operation.

W. H. Smith Electrical Engineering Company, Portland, Ore., has been incorporated by W. H. Smith and associates to undertake the installation of electrical machinery, the building of power plants and the electrical equipment of buildings. The office of the company is in 1003 Spalding Building, Portland.

Industrial Works, Bay City, Mich., have recently established a Chicago agency in charge of Burton W. Mudge & Company, in the People's Gas Building. This office will handle in the Chicago district the Industrial Works line of wrecking, locomotive and freight station cranes, pile drivers, transfer tables and grab buckets.

Mead-Morrison Manufacturing Company, Boston, Mass., manufacturer of coal-handling machinery and steam and electric hoists, has purchased 10 acres of land on the Boston & Albany Railroad at East Boston, and will erect a large plant at this location to take care of its manufacturing business. The plant will consist of a plate shop, erection shop, machine shop, power plant, pattern shop, foundries and general offices. The company will employ about 1000 men in the new plant.

Electric Service Supplies Company, Philadelphia, Pa., has placed on the market a line of panelboard lightning arresters for d.c. and a.c. service in railway, lighting, mine and industrial plants. These boards are built on the well-known law that no matter how efficient a lightning arrester may be, it will never carry off every bit of a lightning discharge from a given line. These panelboard arresters effectually take care of this leakage by interposing additional choke coils between the line and the apparatus to be protected and by connecting lightning arrester units ahead of these coils. By the addition of extra arrester units and extra choke coils the protection to apparatus has been increased ten times by a double panelboard, a hundred times by a triple panelboard and a thousand times by a quadruple board. The boards are made in station types, mounted on heavy impregnated oak framework, and are furnished complete with insulators for attaching to any suitable supporting means. The arrester units are furnished with highly polished and lacquered metal work. The choke coils are of copper, black-enameled and baked. They are designed especially for the protection of apparatus up to 6600 volts a.c., up to 2500 volts d.c. for railway circuits and up to 6000 volts d.c. or a.c. for arc circuits, and are furnished in any ampere capacity for voltages within this range.

ADVERTISING LITERATURE

Harold R. Wilson Machinery Company, St. Louis, Mo., has issued List No. 10 of second-hand electric and steam apparatus which the company has on hand for immediate shipment.

Hoppes Manufacturing Company, Springfield, Ohio, has issued a booklet in which the various types of steam specialties manufactured by the company are briefly described and illustrated.

Electric Service Supplies Company, Philadelphia, Pa., has issued the *Keystone Traveller* for March, 1913, which contains much interesting information regarding the company's products. The increase in the adoption of prepayment car operation is shown clearly with figures in one section of the publication.

George Herman Anger, Strand Road, Preston, England, has issued a bulletin which fully describes and illustrates the Anger improved automatic brake adjuster and its method of operation. This type of adjuster is manufactured for either single or bogie trucks with any type of platform brake gear.

Trussed Concrete Steel Company, Detroit, Mich., has issued two new folders on Trus-con armor plate for protecting expansion joints in concrete roads and the Trus-con curb bar steel protector of concrete curbs, in which these two recent additions to the Kahn building products, with their applications, are fully described.

Canton Culvert Company, Canton, Ohio, has just published a most interesting booklet on the subject of "Acme" nestable corrugated metal culverts and other products. A brief history of the corrugated culvert is given, followed by a discussion of corrosion. Numerous illustrations with explanatory text are then shown to prove the strength, lightness, compactness, ease of shipment and simple installation of this type of culvert. Another feature which shows the great care given to the subject is the table of culvert diameters, gages, thicknesses, weights and water-carrying capacity. The publication includes illustrated descriptions of corrugated metal sheets and of the Imperial corrugated metal culverts with hints as to the methods of installation.

An opinion in regard to franchises issued recently from the office of Attorney General T. S. Hogan of Ohio has been explained partially. The opinion, which was prepared by Assistant Attorney General Charles Marshall, contained the statement that franchises, which must be considered as contracts between municipalities and corporations or individuals, cannot be impaired by acts of the Legislature. This, of course, was in a measure the same as saying that the proposed Bigelow bill, which is intended to revoke all fifty-year franchises, would be invalid. Mr. Hogan has explained that the opinion related to the authority of the Public Service Commission to intervene between municipalities and public service corporations and decide whether the ordinance has been complied with. Personally, he had always hesitated to make so broad an assertion as is contained in the opinion because the matter to be contracted may not always be a proper subject for contract.