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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 294,100 copies, an average of 8169 copies per week.

Telephones in Car Houses and Shops

That every operating car house on a street or interurban railway system needs a telephone admits of no discussion, for it is difficult to see how a road could be operated without means of instantaneous communication between the various power stations, offices, repair shops and car houses. The usefulness of the telephone within the shop or car house itself is another matter, however. It costs good money to rent telephones on the private branch exchange plan in a shop or office, and although rates on extension instruments are very reasonable in most cities, it is doubtful whether it pays to install such equipment in any but the largest and most important car houses and shops.

A local private telephone system, however, should be the means of saving a great deal of time in car houses and shops, just as in any industrial plant it is essential that all the departments should be connected by an interior telephone system to secure the most speedy despatch of business. In the car house it would be a convenience to have a small telephone set between the starter's office and the quarters of train crews awaiting trips on the road, and in cases where light repairs are made in the pits or on the floor, a telephone connection between the further end of the building and the office is most desirable. There is no great need of connection with the main system of the company or the city telephone lines, if the office is so connected, but in large shops and car houses the time saved by reducing the amount of moving to and fro by employees is well worth considering. Again, it is often difficult to locate an important executive official in case he is visiting different parts of the system. Sometimes business of great consequence comes up at the office during the absence of the manager, superintendent or other responsible executive, and if it were possible to bring him to the telephone promptly for due and sufficient cause, immediate and valuable results might be obtained without delay. Proper care to avoid needless calls on the part of subordinates would eliminate most of the abuses of such a system, and in ordering materials and supplies great convenience would certainly result. The cost of private telephones owned by the company, at say $5 per station, is a small matter in proportion to the benefits obtained. Doubtless such systems are needed more in shops than in car houses, but there is certainly a field for their practical use in the latter also.

Abandoning the Older Types of Motors

If more close investigations of the electrical efficiency and cost of repairs of the older types of railway motors were made, probably fewer of them would be kept in service. The question of abandonment of the older types of railway motors was brought up at the February meeting of the Street Railway Association of New York, and it was suggested that actual data regarding the cost of maintenance of different types of street railway motors be kept by operating companies with a view to finding out the advisability of discarding the older machines. Figures submitted at that time showed that the cost of maintaining some of the older types on one road was more than $3 per 1000 miles, while for some of the newer types which had been in service about four years the cost was $1.22 and $0.57, respectively, per 1000 miles. For some new motors which had not begun to deteriorate the cost for a period of six months was only 3 cents per 1000 miles. When a car makes in the neighborhood of 50,000 miles per year, the saving with such a difference in the cost of maintenance as that given would pay interest on the investment

required for new equipment, and there would still be a surplus left at the end of each year to liquidate the cost of the new motors.

The reliability of a motor might be said to vary inversely as the cost of maintenance. In other words, if shop cost records show heavy expense of maintenance for any one style of motors, other records will usually show that the motors of this type have caused a large number of "pull-ins" per 1000 miles. These "pull-ins" affect the profits of a company in more ways than one. In the first place, they cut down the revenue because they decrease the reliability of the service. In addition they occasion direct expense and cause more extra cars to be kept to take the place of those that fail.

Where the cost of maintenance is abnormally high, it is probable that the motors are overloaded, and in many instances this overloading is caused by operating the motors at a higher voltage than that for which they were intended. At the time of their manufacture a line pressure of 500 volts was found almost everywhere. Without any change in their windings these older types of motors are put under heavy cars and are operated at from 600 volts to 650 volts. Considerable overheating necessarily follows, and the armatures make repeated trips to the winding room. The bearings also give considerable trouble. On the greater number of lines on which these older types of motors are overworked due to high line voltages or heavier cars, it is not practicable to lower the schedule in order to reduce the load on the motors, and in the majority of such cases it would in all probability be wise to abandon the small motors and replace them with newer types of greater capacity. Further, if investigations were made as to the difference in the electrical efficiency of old and new types of motors under ordinary running conditions, this difference would no doubt be an item of considerable importance in favor of the abandonment of the older types.

While the keeping of detailed shop records necessitates the expenditure of a great deal of time, the suggestion to keep records on the cost of maintenance of the older types of motors in use seems to be a very good one. In many instances a definite knowledge of the proportion of general shop expenses caused by a few old types of motors would result in the relegation of these motors to the scrap heap or their exchange in partial payment for new equipments without delay.

Some Risks of Standardization

We have so often said a good word for standardization in equipment that it seems almost thankless to become critical in the matter, yet we cannot fail to see certain dangerous tendencies in ultra-conservatism. In mechanics as in politics there are times when it is best "to let well enough alone." But there can be no improvement in mechanisms or governments without breaking away from "well enough" and beginning to make changes in accepted standards. The case for progress was beautifully put by Mr. W. C. Kerr in a recent address, so apt that we cannot refrain from a quotation. "We hear rather too much about standards. They are all right in their way if they do not tend to crystallize error." There may be principles of mathematics and morals so finely and finally settled that they can be held as perfect and immutable guides to conduct, but in mechanics it is dangerous to assume perfection. The most one can be justified in doing is to hold to certain things as the best available for the time being. Just so soon as change ceases, there is an end to improvements. If the standardized form is good enough it will long persist; if not yet satisfactory it will inevitably be modified. The danger of standardization is in holding to things and methods clearly not the best in order to avoid the trouble of changing them. In manufacture the constant tendency is to standardize things not because they are thoroughly good but because they yield a larger profit when freed of the cost of improvement.

There is, however, another practical side to the question involving not changes of kind but changes of degree. If one looks back into the decades just ended one sees that the standards of yesterday are the scrap heap of to-day. Change in the art has compelled the replacement of apparatus before it has been worn out, and depreciation due to change in the art is a very large item in the valuation of a plant. Yet a point undoubtedly comes at which improvement ceases to pay if pushed too fast. In the long run a certain improved apparatus may save money, yet against that saving must be set the losses due to discarding the old one. And depreciation has been too generally neglected for the facts regarding it to come out at their true value. It is hard to remember it with respect to apparatus in hand, and harder still to see its bearing on the future. One does not buy a 6 per cent bond, with one year to run, at 110, unless he has quite lost his mind, but he may be hypnotized into buying a new device of doubtful durability at an enhanced price on the strength of increased returns. With modern railway equipments a point of good performance has been reached at which changes merely in degree must be sharply examined to make sure of their real economy. It is the changes in kind that may sometimes be of sensational value, but they may be compared to speculative investments which should be taken up only after the keenest scrutiny. There is then a genuine reason for some degree of conservatism, for caution in rejecting present standards and for a definite effort to determine such future standards as shall tend to avert needless and fanciful changes.

On the other hand, it is well known to those who have closely followed the progress of the art that so-called standards may represent two very different things—first, the general acceptance of certain things as upon the whole best suited to meet general conditions, or second the adoption of certain forms which later become obsolete from changes in the art. For the latter class there is little defense, since standards so inaugurated are a positive menace to future improvements. They may at the start represent a satisfactory development, but are certain to be held up long after improvements are due. The kind of standardization which is of real service is that which presses into convenient uniformity things which by proved usefulness have settled into approximately definite shape. In such cases the minor differences of dimensions and finish serve no useful purpose, not being essential to the use of the thing itself. They are, on the contrary, inconvenient either as preventing interchangeability or as producing needless variations in manufacture which cause disproportionate increase of cost. Fancy the endless annoyance which would ensue if nuts, bolts, screws and bits were made of irregular sizes, each maker having different standards. So far as standard dimensions and shapes can be used they should be used, the chief criterion

being that in determining these they should not be so regulated as to cause inconvenience in making improvements. One settles upon standard forms to simplify equipment, and not to complicate changes. Of the general equipment of a street railway system most of the important features can be standardized without in any way interfering with freedom of action in improvements. One must beware, however, lest dimensions, even, may unintentionally be fixed so as to discriminate against some future just as useful make of apparatus or other equipment. In so far as uniformity can be secured without checking the liberty of the individual inventor or preventing competition it is a blessing. In particular it enables street railway men by united action to put some pressure upon manufacturers so as to obtain a product upon the whole more suitable and obtainable at a standard low price.

Rail Corrugation

The subject of rail corrugation on electric railways still continues to attract considerable attention abroad, and further attention has recently been attracted to the lack of knowledge which we have on the subject, and which was commented upon in a recent editorial in the Street Railway Journal. The new data on rail corrugation appear in a ponderous volume of 650 pages issued by the International Street and Interurban Railway Association in advance of its Milan meeting this month, and which contains answers prepared by the members of the association to questions submitted to them by the authors of the papers to be read at the meeting. One of these papers is on track construction, and one of the questions is whether rail corrugations have occurred on the lines owned by the member-companies, whether these corrugations occur at special locations or under all conditions, what the causes of the trouble are, so far as the companies have been able to determine them, and what remedies have been adopted. From the replies we find that out of seventy-eight roads, mostly city lines, comprising the principal roads in Continental Europe, forty-nine lines have suffered from this phenomenon and twenty-nine, mostly the smaller roads, have been practically free from it. All of the lines do not describe the character of the corrugations, but from those which submit this information we learn that the corrugations are about a millimeter (0.04 in.) in height and that they occur at intervals of from 1.4 ins. to 2.8 ins. apart. There are considerable differences, however, in the distance between the crests. Thus in Brussels 2.4 ins. is given as the minimum distance, whereas in Cologne it is reported as the maximum distance, while many companies give 1.4 ins. as the usual spacing of the corrugations. In Zurich a difference has been found in track laid on concrete and on broken stone ballast. In the former the distances apart are 1.76 ins. and in the latter 2.08 ins.

Coming now to the location of this peculiar kind of wear, we find all sorts of experience. Many of the roads do not state where the wear occurs, but among those that do give particulars we find a great variation. Thus, some roads say that it occurs only on the outer rail of curves, and attribute the trouble to the sliding of the wheels; others find it more common on straight track. One company has suffered only in its short-radius curves, another only in its long-radius curves, that is, in curves of over 320 ft. radius; still another has met the trouble only in curves of over 600 ft. radius where the outer rail was given no super-elevation. In Glasgow, Scotland, the greatest wear comes on the descending track in long-radius curves, and in Wurzburg on ascending curves. Many others find the trouble independent of the curvature. Two companies report corrugations only on their high-speed lines, another says that they occur in all lines, but more in the high-speed lines, still another said that they originally appeared only in the high-speed lines but now exist on all lines, even those where the cars run at only 5 miles per hour. Three others report that speed has nothing to do with the occurrence. The Brussels company has found considerable trouble where the pavement is loose about the rails. In Lyons corrugations occur principally where the rail is rigidly supported. Nuremberg and Cologne find them in both flexible and rigidly supported track. Grades seem to cause the trouble in Turin, but Stettin reports that it occurs both on grades and level track. One of the Parisian roads has had more trouble with rails rolled in 1900 than in the vintage of any other year. Zurich finds the trouble confined entirely to rails of one section; still another company states that on track seemingly alike the corrugations will appear for a short section and then will not be present for considerable distances on each side of the affected portion.

From this variety of evidence it is not surprising that there should be a large number of theories. The greatest number of roads favor the claim of defects in rolling, or lack of homogeneity in the metal. In all, nine companies attribute the trouble to this cause. Two companies think corrugations are caused by braking, three by harmonic vibration of the car springs, two by poor ballast and loosening of the rails, two by too great rigidity of the track, one by fatigue of the metal, one by the rolling out of the rails by the wheels, three by sliding of the wheels, three by lack of rhythmical driving of the gears, and three by softness of the rail or hardness of the wheels. Most of the companies, however, decline to be drawn into any theory as to the cause.

Very few of the companies have any remedy to suggest other than the temporary expedient of grinding down the high spots. This seems to be practiced by most of the companies which have suffered from this cause. The crests are either filed by hand or ground down by an emery wheel or by a special block carried on a car. Ghent and the Paris Eastern think that there is no remedy but the installation of a new rail, but Hamburg, after considerable filing but no other remedial measures, finds the corrugations are gradually disappearing by themselves. The companies which attribute the trouble to a too rigid support are introducing a more elastic roadbed by employing wooden blocks under the rails, as in Glasgow, or pads of felt or lead as in Lyons. Those which consider the trouble due to lack of support have installed extra long ties to anchor the rails to the soil, and in Brussels, where the corrugations were especially noticeable in low places in the tracks, steps have been taken to secure better drainage and to coat the joints with asphaltum so that water cannot assist in disintegrating the joints. In those roads where the corrugations have been most prominent on curves, steps have been taken to widen the gage at these points. As a whole, however, there seems to be no consensus of opinion as to the cause and remedy for this trouble.

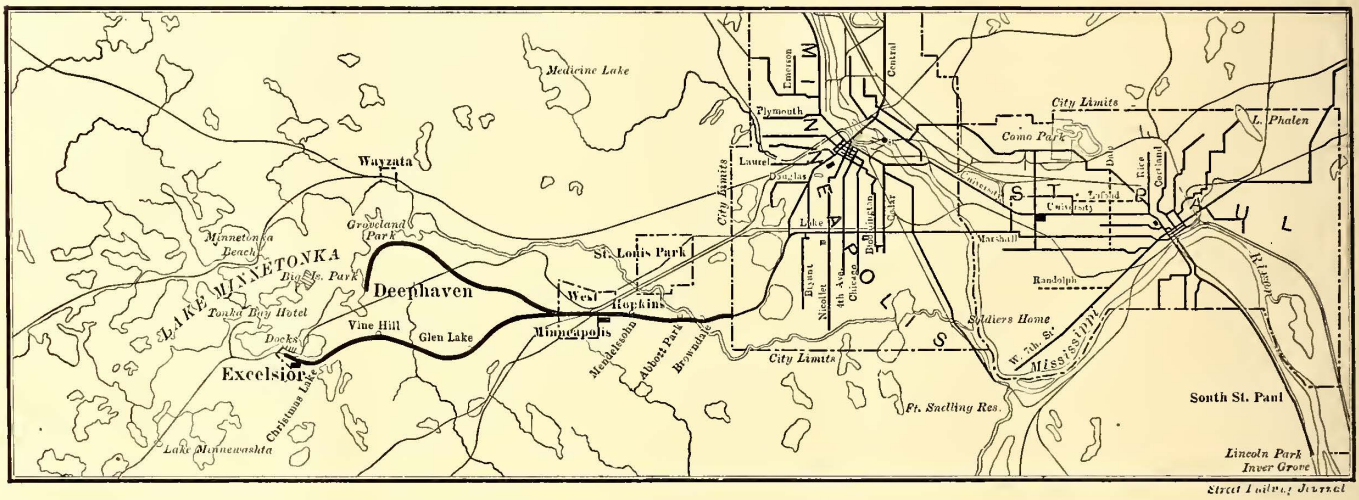
The matter has also received the attention of the Tramways and Light Railways Association, which represents the electric railway companies of Great Britain, and a discussion of the investigations made under the auspices of this body appears in a letter published in our Correspondence column this week.

THE DEVELOPMENT OF LAKE MINNETONKA BY THE TWIN CITY RAPID TRANSIT COMPANY

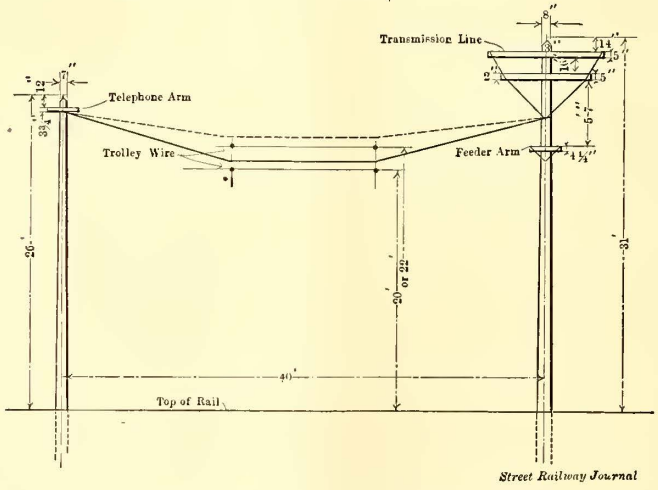
Lake Minnetonka, about 19 miles west of Minneapolis, is one of the largest and most picturesque of the many lakes in Minnesota. Although it has been for many years a favorite resort for people of Minneapolis and St. Paul and of the surrounding country, the fact that the transportation facilities were rather limited has prevented it obtaining the patronage that its bathing facilities, the opportunities it offers for fishing and boating, and the beauty of the surrounding country have deserved. Until the completion of a single-track electric line to Excelsior, on its south shore, last year by the Twin City Rapid Transit Company, the only means of reaching the lake was by the Great Northern Railway, which serves the north shore, and the Minneapolis & St. Louis Railroad and the Chicago, Milwaukee & St. Paul Railway Company, which reached several points on the south shore. As the shore line has a total length of 150 miles or more, the steam roads did not by any means reach all of the attractive points fronting on the water.

During the past season the Twin City Rapid Transit Company has been making extensive preparations not only to handle heavy traffic to the lake, but also to give a ready means of access to all of the interesting points on the shore and to develop some of these points into pleasure resorts. Through the courtesy of Willard J. Hield, general manager of the company, this publication is enabled to present an account of these preparations, which include, in a general way, the double tracking of the single-track line to the lake, the construction of two fleets of steamers for service on the lake, and the development of a park on an island two miles from Excelsior, the terminus of the double-track line.

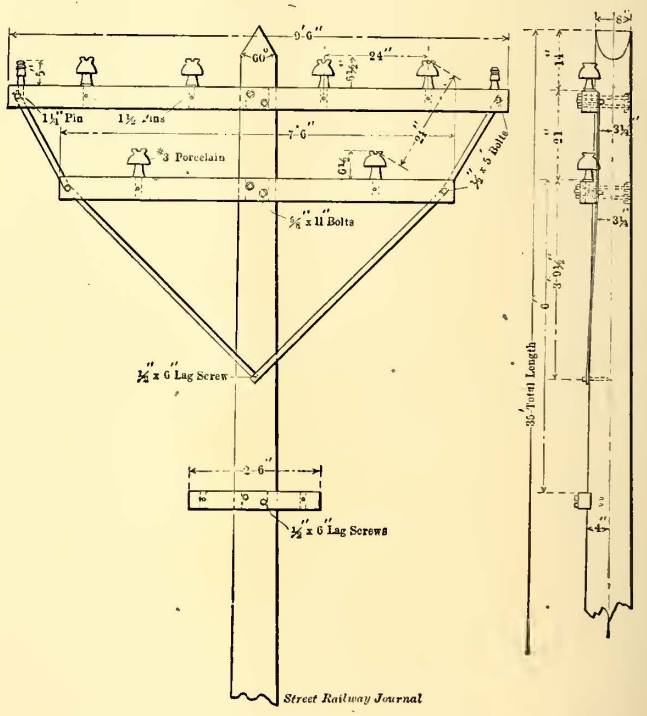
An idea of the patronage that will be given the lake by the people of Minneapolis and St. Paul may be judged from the fact that the railway company has made arrangements to operate cars over the line to Excelsior on a 2½-minute schedule. Some of the cars will be of the double-decked type built by the company especially for this service.



MAP OF TWIN CITY RAPID TRANSIT COMPANY'S SYSTEM, SHOWING THE NEW LAKE MINNETONKA LINE



DETAILS OF OVERHEAD WORK ON THE LAKE MINNETONKA LINE



DETAILS OF STANDARD POLE CONSTRUCTION

To supply power for the heavy schedule contemplated, two sub-stations of unusually large capacity for interurban lines have been constructed, and the feeding of these sub-stations, together with the natural growth of the system and other extensions in turn, has necessitated additional generator capacity in the main generator station. In this there has just been installed a 3500-kw General Electric generator driven by an Allis-Chalmers vertical cross-compound engine, and there

are also being installed two 5000-kw Curtis steam turbines. The boiler capacity of the station has also been increased by the installation of six new boilers, each of 550-hp capacity.

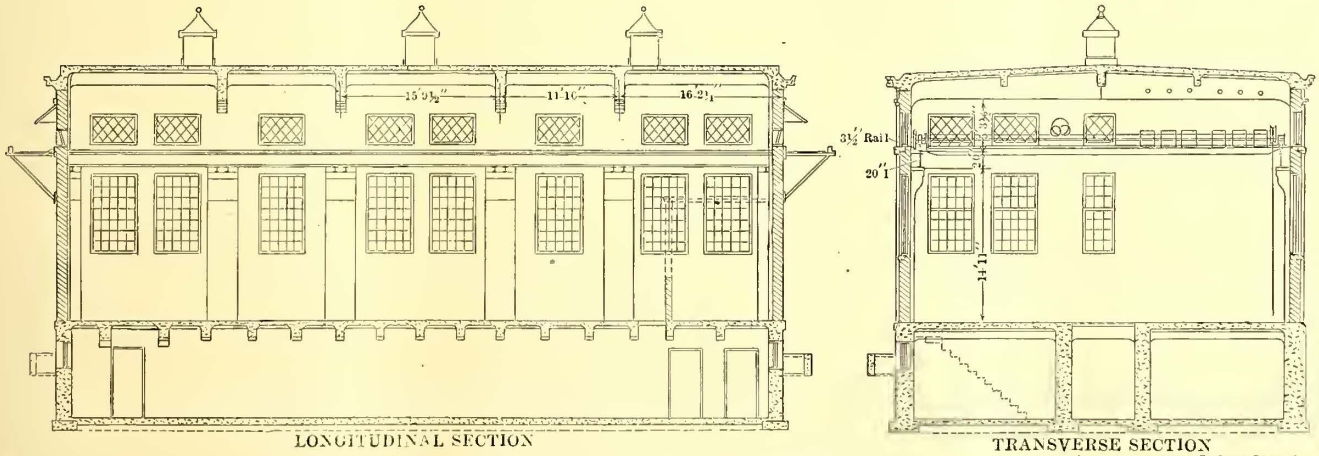
HIGH-TENSION FEEDER SYSTEM

The high-tension feeder system to the two sub-stations on the Minnetonka division consists of two portions; that carried underground from the generating station to a point near the west limits of Minneapolis, and the overhead portion from this point to the sub-stations. One of the two three-conductor cables leaving the station contains a No. 0000 and the other a No. 0 three-phase line. Both are carried into the sub-station at Eleventh Street & Hennepin Avenue, Minneapolis, where switches are provided for connecting the conductors to the main high-tension buses of this sub-station. Leaving the sub-station the cables continue underground to a point near the city limits and about seven miles from the power house. Here they run up into the cable house shown in one of the accompanying illustrations, which contain lightning arresters, choke coils and disconnecting knife-switches. After emerging from the cable house, the high-tension lines are carried to the sub-stations at Hopkins and Excelsior on the poles supporting the span wires. These poles, which are 35 ft. in length and of cedar, support the six high-tension wires on two upper cross-arms in the manner shown in an accompanying drawing. Each of the cross-arms is secured to the posts by two 5/8-in. bolts extending clear through the post, and they are further held in place by braces bolted to the pole. On the ends of the upper cross-arm are placed ground wires which, instead of being continuous throughout the length of the line, are cut into sections, each one mile in length, each length being grounded near the middle. Erecting the ground wire in short lengths avoided the loop circuits which are present where the line is run continuously and grounded at several points.

A branch line from the high-tension system will be taken off the main line a short distance west of the Excelsior sub-station, and will be carried about two miles overhead and one-half mile under the lake in submarine cable to a sub-station of 600-kw capacity, located on Big Island. The sub-station will supply current for lighting the island, and will furnish power for operating the several amusement features of Big Island Park. A terminal containing lightning arresters will be constructed at the point where the line drops down into the submarine cable. The design and construction of the electrical features, the high-tension transmission system, as well as of the sub-stations, was under the immediate charge of E. H. Schofield, chief engineer of the company.

The sub-station buildings at West Minneapolis and Excelsior are practically of the same construction. The one at Excelsior is shown in an accompanying illustration. It is a concrete and brick structure, the walls being of brick and the floors and roof of concrete. Heavy reinforced concrete girders running across the building, with smaller wire girders extending between them, support the roof slabs. The slabs are covered with felt roofing material, and openings in them over the middle of the building are provided with ventilators. The apparatus in the station is arranged after the general plan upon which several sub-stations have been constructed by the company. This plan places all of the alternating current apparatus on one side of the building, the rotary converters along the center line, while the direct current switchboard is on that side of the building opposite the alternating current apparatus. The high-tension lines enter the building and continue on through it, taps for feeding the station being brought down the wall underneath the entrance and through the disconnecting knife switches and lightning arresters mounted on the wall. Entrance of the high-tension wires into the building is made through Locke insulator tubes placed in slate panels, a drip roof of corrugated iron protecting the entrance. The high-tension wires pass through the building overhead and through the heavy concrete girders already mentioned as supporting the roof. Through these

THE EXCELSIOR SUB-STATION



LONGITUDINAL SECTION TRANSVERSE SECTION

Street Railway Journal

THE MINNETONKA SUB-STATION

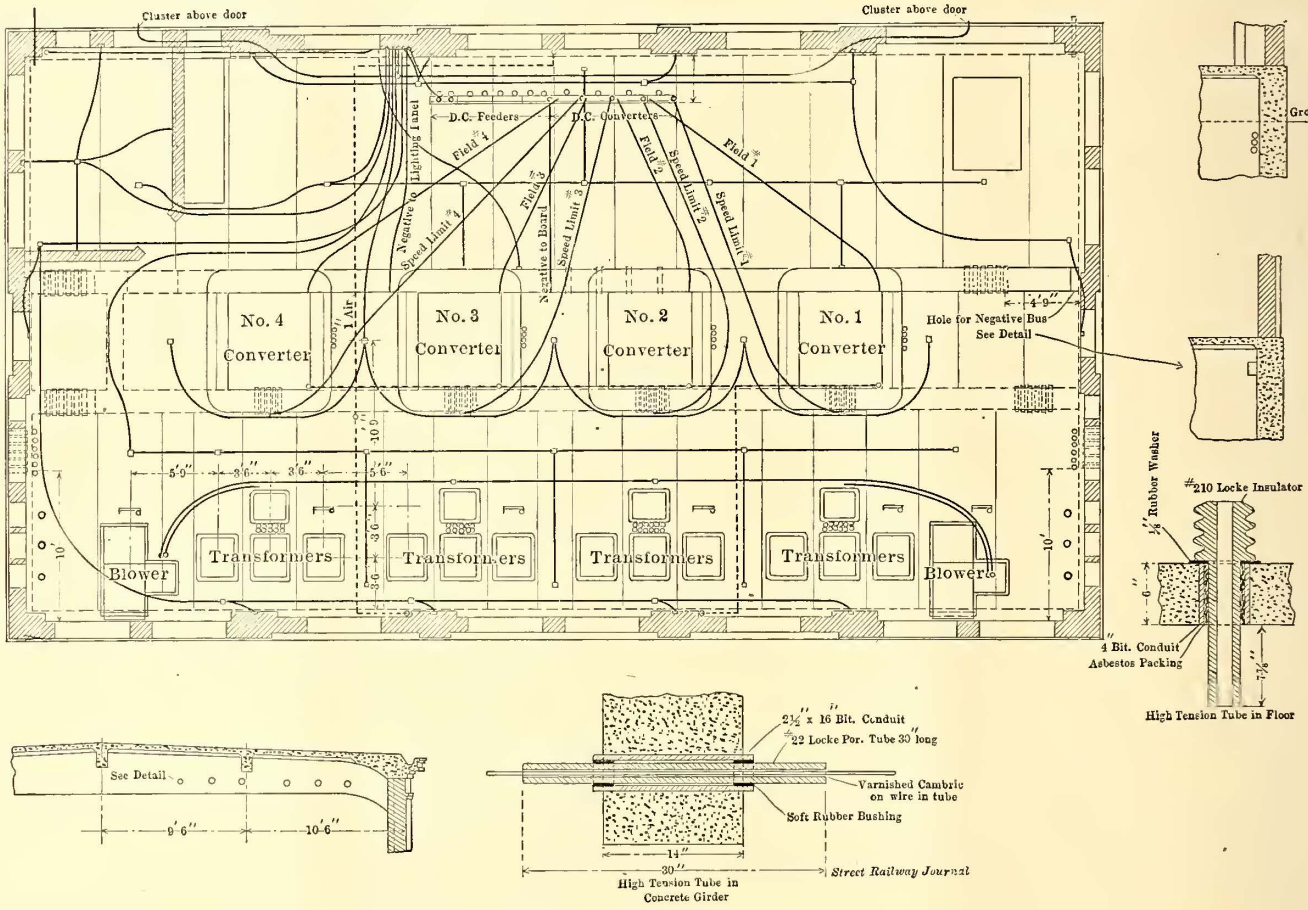
girders the wires are carried in the manner shown in detail in one of the accompanying drawings. Into the girders, which are 14 ins. wide, is inserted a 2½-in. x 16-in. bituminized conduit tube, and inside this is supported by means of soft rubber bushings at each end of the tube a 30-in. Locke porcelain insulator tube which carries the bare wires. On passing through the arresters and switches already mentioned as being mounted on the wall, the high-tension cables drop through the floor to the basement, where connection is made to the high-tension buses by means of hand operated oil switches provided with automatic overload trips, both the switches and buses being located in the basement. Similar oil switches connect the buses to the step-down transformers immediately above on the main floor. The transformers are of the air-cooled type, a centrifugal fan being placed at each end of the row of transformers near the rear wall of the building. It may be noted that the relative location of all the high-tension apparatus, the bus-bars, switches and transformers, is such as to necessitate the least amount of high-tension wiring, all of them being placed within a few feet of each other.

The foundations for all of the rotary converters consist of two parallel concrete walls in the basement running the full length of the building, the base of the converters bridging the two walls. No floor slabs are placed in the center of the converter frames, and the cables from the machines are carried down through these openings into the passageway between the two parallel walls serving as foundations for the converters. The openings in the floor under the machines not only prevent the accumulation of dirt, but also give better ventilation.

The direct current feeders from the switchboard are carried out of the building at a point just underneath the entering high-tension wires through porcelain tubes inserted in the walls. Thence the two d. c. feeder cables are carried the full length of the road on cross-arms below those carrying the high-tension wires. While the station buildings are constructed for four 600-kw converters, only three of these are being installed at the present time.

THE TRACK AND OVERHEAD CONSTRUCTION

For about half the distance the single-track line to Excelsior was constructed on the abandoned grade of the old Minneapolis, Lyndale & Minnetonka Railway, which grade was cut down in places and filled in at other points when the electric line was built to secure a more uniform profile. The country traversed is rolling in character, and several heavy cuts and fills were necessary in the western end of the road, some of the fills being about 50 ft. high. At the bottom the cuts are 32 ft. wide, and at the top of the fills the banks are



PLAN AND OTHER DETAILS OF MINNETONKA SUB-STATION

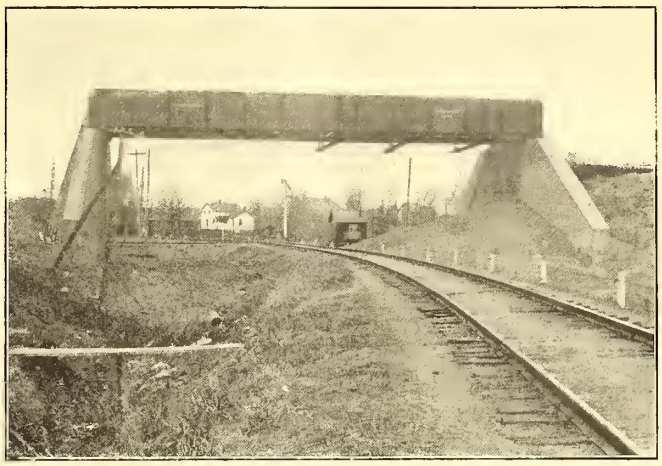
28 ft. across. Only two heavy overhead structures were required. One of them is the viaduct at Hopkins, where the line passes over the tracks of the Chicago, Milwaukee & St. Paul, the Minneapolis & St. Louis, and the Great Northern Railroads. This is of steel construction and was originally built for a single track, but a second viaduct has been built to accommodate the double-track line. In preparation for the heavy traffic, the electric railway tracks are carried over the tracks of the Minneapolis & St. Louis Railroad near Excelsior, and a steel girder bridge resting on concrete abutments, and shown in the course of construction in an accompanying illustration. Until June, 1906, the single-track line was at the steam-road grade and a short distance north of the new double-track route.

In addition to the double-track road to Excelsior, the lake may be reached by a single-track line, which, branching off from the main line at West Minneapolis (Hopkins), continues a distance of 7 miles to Deephaven, on the east shore

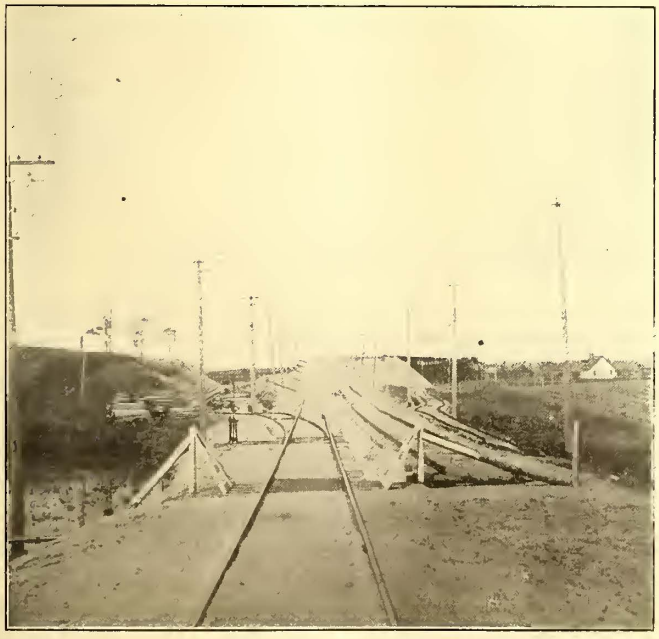
of the lake. This line, which was formerly operated as a steam road by the Chicago, Milwaukee & St. Paul Railway Company, has been equipped with a trolley. The only town of any consequence on the Minnetonka line is West Minneapolis, which is primarily a manufacturing center; and in addition to the through service to Excelsior a branch line has been built into West Minneapolis and a local service opened. Excelsior is now a small town of but a few hundred inhabitants during the winter months, but in view of the fact that through service will be put on to accommodate residents of Excelsior whose business is in Minneapolis, it will, no doubt, become the permanent home of many Minneapolis people.

CONCRETE BRIDGE NEAR THE CITY LIMITS

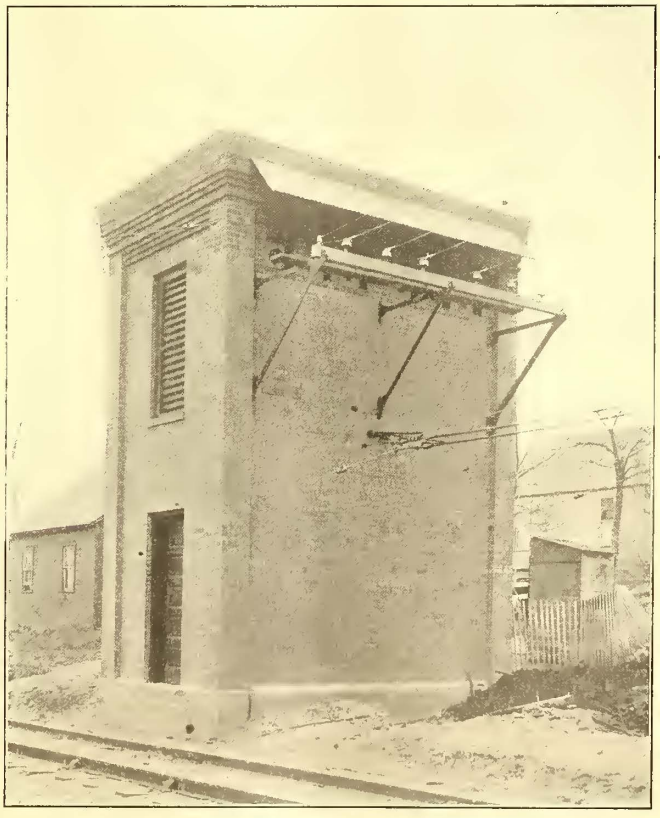
The track construction, which is in charge of George L. Wilson, engineer and roadmaster of the system, is being carried out much in accordance with steam railroad practice so far as grades, type of special work and heaviness of construction are concerned. The tracks are laid with 80-lb. rails bonded with 250,000-circ.-mil pin bonds on the main line, while soldered bonds have been used on the line to Deephaven. Gravel is found in large quantities at several points along the line, and this is employed as ballast. Practically all the curves are of sufficient radius to permit of full-speed operation of cars around them, and the most excessive grades are encountered at the approaches to the viaducts. The trolleys of No. 00 wire are supported 20 ft. above the rail. Quite an unusual feature in connection with the line will be the arrangement for lighting it. Arc lights will be suspended from the span wires, ordinarily at intervals of about 300 ft., but on curves and at approaches to overhead bridges the distance between the lamps will be much less. The lamps will be wired five in series and current will be taken from the trolley. A relay-system circuit-closing device will be employed to throw the lamps on the circuit, and this arrangement will avoid the necessity of men traveling the full length of the line to throw the lamps in. All of them will be placed on four independent circuits controlled by switches at the two sub-



GIRDER BRIDGE ON THE LAKE MINNETONKA ROUTE



APPROACH TO VIADUCT AT HOPKINS, CROSSING THREE STEAM RAILROADS. VIEW TAKEN DURING LAYING OF SECOND TRACK

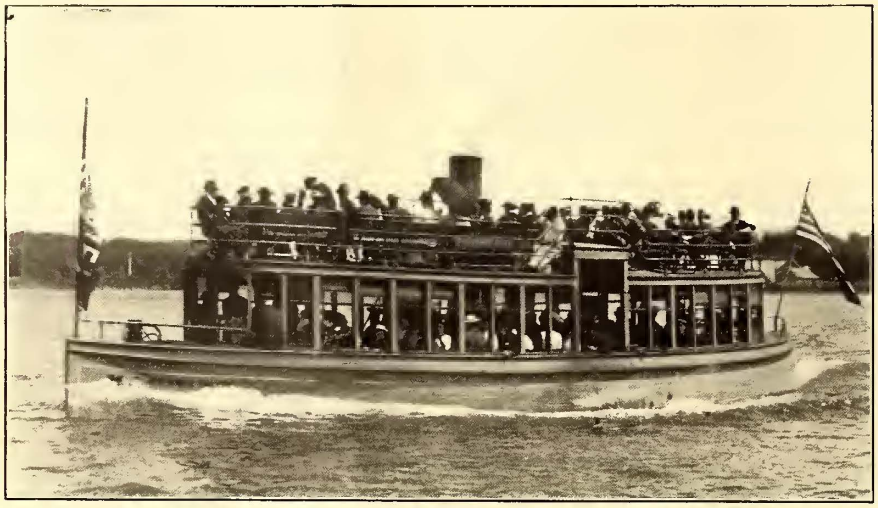


BRICK CABLE HOUSE NEAR CITY LIMITS

stations. Throwing the sub-station switches will close the circuit through the first five lamps, and a relay in this circuit gives current to the five beyond. The action progresses on down the section in a similar manner.

BIG ISLAND PARK

While every portion of the shore line of the lake offers attractions to those seeking relief from the city, the main attraction at the end of the line other than the lake is the park now being developed on Big Island in the middle of the lake. The park, which contains about 60 acres, covers the east end of the island. It is high above the water, and consists of rolling land covered with elm and other natural forest trees. One section is being provided with roller coaster, mystic chutes, dancing pavilions, and similar amusement features, while another portion will be kept in its natural state. A feature of the park will be the open-air kitchens, equipped with stoves for the free use of picnic parties in making coffee or warming food. Facilities will be provided for bathing, and plans provide for an extensive concrete bathing pavilion.



ONE OF THE SIX SMALL STEAMERS BUILT BY THE TWIN CITIES RAPID TRANSIT COMPANY

A complete water works system is being installed. Water from a deep well will be pumped by an electric driven pump which will obtain its power from the sub-station, to which previous reference has been made. This sub-station will be provided with a motor generator set for furnishing power to motors which drive the apparatus of the amusement features, and a three-phase alternating current system of distribution for lighting will be supplied with current from it. Arc lamps of the constant-current type will be employed in addition to the incandescent lamps.

THE LAKE STEAMERS

Mention has been made of the boats built for the company for service on the lake. Three of these, which were constructed out of doors on the lake near Deephaven, measure each 108 ft. x 35 ft. They are all built on the plan of the "Saint Paul," shown in an accompanying illustration. They have a capacity of 1,000 people, and are equipped with side wheels driven by separate engines.

The remaining six boats, which are of much smaller tonnage, were built in the shops of the company in Minneapolis. These smaller ones are termed express boats, and are for service between distant points on the lake, while the larger ones will ply only between Bib Island Park and Excelsior. The smaller boats are built with a torpedo stern, are 70 ft. long, and measure 15 ft. wide at the beam. Each has a total displacement of 60,000 lbs., and is equipped with a 44-in. propeller driven by a 150-hp triple-expansion condensing engine. A water-tube boiler, carrying steam at 250 lbs. pressure, is located a little forward of the center portion of the boat, and the engine is placed immediately behind it. As passengers are allowed in close proximity to the boiler, this has been well lagged to lessen the heat radiation. An asbestos covering is placed on the boiler plates, and an air space is allowed to intervene between this and an outer asbestos covering. The boat is lighted by electricity, current being obtained from a 10-hp De Laval steam turbine driven generator of 50-light capacity. This is placed in the machinery pit behind the boilers and near the engine. With the condensers, the boat contains 28,000 lbs. of machinery. Storage space is provided for six tons of coal. The boat is capable of making 15 miles per hour, and when fully loaded it draws 3½ ft. of water. Passengers are carried both in the cabin and on the upper deck or roof of the cabin. The upper deck is sheltered by a canvas top stretched on a steel framework. This covering not only protects passengers from the sun, but also shields them from the smoke and soot issuing from the smokestack. A stairway immediately in front of the boiler gives access to the upper deck.

ONE OF THE THREE LARGE STEAMERS BUILT FOR SERVICE BETWEEN BIG ISLAND PARK AND EXCELSIOR

Quite an unusual feature in a boat is the arrangement of the windows in the cabin. The design has been copied from street railway practice, and in fact the posts are identical in their general design with the posts of the cars of the Twin

City Rapid Transit Company. The lower sash drop into pockets underneath, and these pockets permit the sash to drop down below the floor line so that it is possible to place the arm rail down to within 27 inches from the floor. Entrance to the cabin is through a large door on either side of the boat, at the center. There were several objections to placing sliding doors at this point, and Kinnear rolling steel doors were employed. The cabin seats 65 passengers, while 70 people can be carried on the upper deck, giving a full capacity for the boat of 135. The ceiling of the cabin has a natural oak finish, while the sides are finished in cherry. The hull of the boat is painted a canary yellow and is trimmed a light olive. Aluminum striping is also employed. The finish of the hull is in fact identical with that employed on the cars. The six boats have been named after lakes in the vicinity of St. Paul and Minneapolis, including Lake Minnetonka, Como, Stillwater and Harriet.

OPERATING FEATURES

The despatcher's office for the new line is in the Excelsior terminal station. A cable of twelve pairs of telephone lines will be carried from the main office of the company to Excelsior and Big Island Park. A number of the lines will be used for despatching cars, while the remainder will be connected to the central switchboard at the main office and to telephones in several buildings in the park.

The one-way fare to Excelsior from Minneapolis is 25 cents. However, a twenty-five-ride commutation ticket may be purchased for $4.50, which is equivalent to 18 cents per ride. The commutation ticket includes not only fare to Excelsior, but in addition the fare on one of the express steamers to any point between Wayzata and Zumbra Heights, located respectively at the extreme east and west points of Lake Minnetonka. On trips to Minneapolis the fare includes a transfer to any local line.

CLEVELAND TRACTION SITUATION

For the time being at least Mayor Johnson has successfully forestalled the efforts of the Cleveland Electric Railway Company to bring the franchise extension matter to a popular vote, but in so doing has incurred the indignation of the thinking people of the city. The latest development grew out of the action of the Cleveland Electric Railway in relaying its track on Fulton Street which had been torn up by the city authorities. It will be remembered that this action was taken by the city several weeks ago, and in the injunction suit which followed the court held that the city had acted in an irregular manner and held that the track could be relaid in its old place in the center of the street. Acting under this order the old company asked for a permit to go to work. This was refused. The Mayor and Council committee threatened to arrest the officials of the company if they commenced work and to stop the cars on the lines where it was claimed franchises had expired. But the old company laid the track, and the threats were not carried out. Two days after the track had been laid in the center of the street the Council, having gone through the legal procedure of ordering the tracks moved to the side of the street, the old company changed over, at the same time asking for an injunction restraining the Forest City Company from laying any other tracks.

At the next Council meeting the old company attempted to get through its ordinance for a referendum vote of the people on the entire proposition. The Mayor worked the Council into a frenzy at what he characterized as the old company's defiance of the wishes of the Council, and as a result a vote was passed postponing indefinitely any action on propositions advanced by the company.

The offer of the Cleveland Electric on the referendum is a remarkably fair one. It offered to pay all the expenses of the election and to allow the Forest City Railway Company to place its proposition side by side with it on the ballot, each company setting forth its proposal in its own words.

The daily papers heretofore largely on the fence and if anything leaning toward the new company have come out strongly denouncing the Mayor for his obstruction policy. One of the papers had reporters interview several hundred pedestrians indiscriminately as to their views on the subject, and by an overwhelming majority the proposition of the Cleveland Electric was favored. Several of the Republican Councilmen have been making a house-to-house canvass of their constituents with the same results, while a postal card inquiry by another Councilman shows the sentiment favorable to the old company. The facts of the situation are that the remarkably fair proposition made by the old company and its skilful campaign of publicity, coupled with this latest development, are making it plain to the public that there is small chance of a speedy settlement of the controversy in the schemes advanced by the Mayor and his associates.

Several other matters of interest have transpired meanwhile. The Cleveland Electric has secured a twenty-five-year franchise for an extension of its system in the village of Collinwood, and a similar grant for a new line in the village of Cleveland Heights, and it has started to build both lines. For the latter it needs a grant from the city for an extension of a few hundred feet to make the connection, and although backed by the petition of all the property owners in the neighborhood for this little grant, it has small chance of getting it through the Council unless conditions change.

Both companies are endeavoring to secure the majority of consents on Gordon Avenue for a cross-town line, but the methods of operation differ. The officials of the Forest City Railway Company unblushingly admit that they are paying for consents and for revocations. While charged with doing the same thing, President Andrews of the Cleveland Electric has denied that one cent has been paid by his company or its representatives for either consents or revocations, and defies any one to prove the charges made.

Without giving the old company a chance at a hearing the Council committee met the other day and decided that the Forest City Company should pay the Cleveland Electric Railway Company $9,200 for the right to use certain of its tracks.

The Forest City Railway Company has leased from the city, at what is considered a very low figure, the old water-works pumping station for use as a power station. It is stated that temporary generating equipment has been arranged for to be delivered in the near future, and that a contract has been placed for two large units. The Cleveland Electric Railway Company offered to submit a very low proposition to supply the new company with power from its nearby Viaduct station, but the offer was disregarded. It is believed that Mayor Johnson proposes to install in the station equipment which will enable the "Municipal" company to supply the downtown section of the city with street lights, thus furthering the Mayor's schemes for more municipal lighting plants.

The Ft. Wayne & Wabash Valley Traction Company is hauling large quantities of wheat from the wheat fields along the line to the markets. This company and other electric railway lines which penetrate the agricultural districts of Indiana expect to capture considerable wheat business from the farmers this fall.

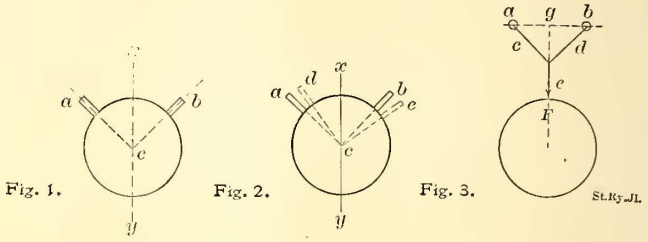
IMPORTANCE OF EFFECTIVE BRUSH-HOLDER INSPECTION

BY HENRY SCHLEGEL

Some time ago the writer had occasion to count off the set of the brushes on a number of railway motors; the conditions revealed by this incidental inspection were somewhat surprising. Out of thirty counts, only four were correct, and there was reason to suspect that this was purely a matter of accident. Of the remaining twenty-six, a few of the counts showed an error of as much as five bars, the majority of the others ranging from one bar to three. This condition of affairs did not seem to cause a panic to any one interested in the welfare of the motors, because, as was explained, there had never been serious trouble that could be traced with certainty to this source. This might have been so; for general electrical car troubles seem to have the ingenious faculty of leaving none of the marks that point to a particular cause; but the observation reminded the writer of a particular management that attributed all of its troubles to severe lightning storms, when as a matter of fact lightning neither bends armature shafts nor lets armatures down on the pole pieces, that is, so far as he has been able to ascertain. General electrical car troubles are, no doubt, due to general and conspiring causes, but it is a significant fact that overhauling of brush holders has in several recent cases known to the writer greatly decreased many ailments acknowledged to be incident to sparking. This should justify the belief that improper setting of the brushes might be considered as at least one of the causes of general car troubles; and suggests that it might be interesting to consider the degree to which the brush holder may be responsible for the improper setting of the brushes. Such a consideration may not include troubles due to weak brush-holder springs, tight brushes and other irregularities incident to careless or ignorant inspection, but it may be profitably confined simply to the functions required of the brush holder itself and to a brief consideration of wherein these may be overlooked in actual practice.

The function of a brush holder is not only to hold the brushes a distance apart represented by one-quarter of the circumference of the commutator, in the case of a four-pole street railway motor, but also so to support the brushes that they shall be at equal circumferential distances on the two sides of a vertical line passing through the center of the commutator when the motor rests absolutely level; only when this latter condition is fulfilled will the armature give as satisfactory performance in one direction of rotation as in the other, that is, from the point of view of sparking. Thus in Fig. 1, xy is a vertical line through the center of the armature when the motor rests level. Here not only must the number of commutator bars included between brushes a and b from center to center be one-quarter of the total number of bars in the commutator, but the number of bars from the center of brush a to line xy must be the same as that from the center of brush b to the line xy. In some cases an error in the setting of the brushes has been due to the count being taken between the inside edges of the brushes. It is all right to take the count between inside edges because it is difficult to locate the bar under the center of brushes, but in doing so due allowance must be made for the thickness of two half brushes. For example, if a commutator has 99 bars, the number of bars to be included between brush centers is, $99 \div 4 = 24\frac{3}{4}$ bars; if the thickness of a brush is such that the brush covers $1\frac{3}{4}$ bars, the number of bars to be counted off between inside edges of brushes is, $24\frac{3}{4} - 1\frac{3}{4} = 23$ bars.

It is an easy matter to have the two brush holders so disposed as to space the brushes the correct number of bars apart, but to have one holder further from the vertical center line than the other, that is to say, the two holders as a whole are too far to one side or the other. This condition is indicated in Fig. 2, where a and b represent the brushes in their correct positions, and e and d where they have been forced bodily to the right. Such a condition may be due to too much clearance in the holes through which pass the stud bolts that secure the brush holder yoke to the motor frame; or it may be due to error in the horizontal alignment of the brush yoke owing to the alignment having been taken without adopting the precaution to have the motor level before doing so. That is, the yoke may be level in regard to the earth but not level in regard to the motor, thereby throwing the vertical center line from which the count is made to one side or the other of the highest point on the commutator. When the motor is perfectly level the point that is midway between the two holders will be the highest point on the commutator, unless, for special reasons, both holders have been thrown to one side or the other to facilitate inspection. Ordinarily the commutator covers of railway motors set in a horizontal plane, and irrespective of whether the motor poles may be on horizontal and vertical diameters or on diagonal diameters the



leads of the armature coils are such that the non-sparking points of the brushes are in positions where an inspector can most conveniently reach the brushes for inspection and renewal. In such cases inspection is made through trap doors in the car floor. On a few of the more recent heavy types of railway motor, the commutator cover has been placed at an angle to admit of inspection and brush renewal from beneath the car. In this case the two holders are not at equal distances on either side of the vertical center line, but are at equal distances on either side of a line making a certain angle with the vertical center line. In either case the two holders must be located symmetrically in regard to the line; and the commutator bar that such a line would cut, which bar is the one from which the count is made in both directions, may be obtained by means of a templet so constructed as to engage simultaneously the centers of the brush holder stud holes in the motor frame and the surface of the commutator. Fig. 3 indicates the principle on which such a templet might be constructed. Here a and b represent the brush holder stud holes in the motor frame, and F the commutator; cde is a rigid forked steel construction such that when legs c and d are seated in holes a and b, the pointer e will rest on the commutator bar intersected by an imaginary line, ge, passing midway between a and b and projecting at right angles to line ab. This is the bar from which both holders must be equidistant. The practical result of having the holder set over bodily is to have the brushes spark for one direction of rotation but not for the other. This condition has suggested the practicability of providing railway lines with loops, to avoid the necessity of operating the cars from both ends, and hence the motors, at high speed in both directions, and setting the brush yoke back against the direction of normal rotation to minimize sparking in regular operation. In such a case, to avoid excessive sparking at such a time as

it may be necessary to operate the car in the reverse direction, the controller and reverse drum are so interlocked as to prevent moving the controller drum past the last series notch when the reverse drum is in the reverse position.

Troubles incident to irregularities in the brush gear may be due to any or all of three causes: Faulty construction of the metal part of the holder; shrinkage of the wooden yoke caused by the heat of service; faulty construction of the yoke itself. The metal holders obtained from the factory are, with rare exceptions, to be depended on; trouble with such parts generally begins when a street railway repair shop undertakes to make its own holders and continues until due experience, often a sad and expensive one, begets a proper knowledge of the shrinkages to be allowed in the matter of casting. There are cases innumerable where an old brush holder has been smoothed up, its correctness insured and the holder then used as a pattern from which to cast new holders: result, new holders short in all dimensions. Where a holder is used as a pattern, error is almost unavoidable. Where the new holders are to be cast from a wooden pattern the dimensions of which are taken from an old holder, only one shrinkage must be allowed; that is, the dimensions of the pattern must be made sufficiently larger than the dimensions of the sample holder so that after the casting has shrunk on cooling its dimensions will be the same as those of the sample holder. In cases where the new brush holders are to be made from a metal pattern, double shrinkage must be allowed in taking the dimensions from the sample holder, because

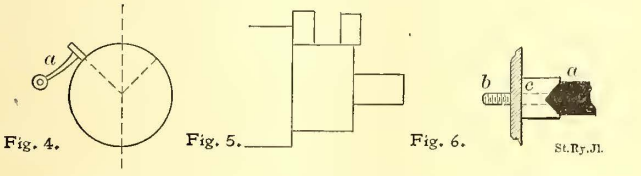


Fig. 4. Fig. 5. Fig. 6.

the metal pattern will shrink on cooling, and so will the new holders made from it. The effect of error or indifference in allowing for shrinkage is most strongly felt on holders that have an overhanging arm such as *a* in Fig. 4, where if the arm is too long the holder will space the brushes too close together, and it the arm is too short it will space them too far apart. In other types of holder error may result in the holder rubbing the head of the commutator or in brushes hanging over the end of the commutator, as indicated in Fig. 5.

The second named source of trouble, shrinkage of brush yoke due to the heat of service, is one that has given a deal of trouble in its time and gives some trouble yet. The main cause is to be found in the use of wood that is not properly seasoned. The result of shrinkage due to heat may be to loosen the brush-holder fastenings, or simply to skew the holder out of shape, thereby pulling the brushes out of set; in either case the final result is a flash-over. Shrinkage of a yoke can only be detected in time by periodically testing the set of the brushes. Yokes have been known to shrink sufficiently to bring the brushes three bars closer together than they should be and without loosening the holder fastenings.

On motors that do not employ a yoke, but support the holders on wooden blocks the axes of which are parallel to the armature shaft, the equivalent of yoke shrinkage may be obtained by carelessness in babbitting the seats that support the construction as a whole. On such motors tightening of the brush-holder stud generally draws a V-shaped end on the holder down into a V-shaped guide on the motor frame as indicated in Fig. 6, where *a* is the holder, *b* the stud, and *c* the V-shaped guide on the frame. If the holder is correct, and there is no foreign matter between the holder and guide, the V construction insures that the brushes will rest parallel to the commutator and that the two sets will include the correct number of bars between them. Irregularity in any of the factors named, however, will introduce error equivalent to shrinking of the yoke on a yoke type of holder.

The third source of error, wrong construction of brush yoke, has given, is giving, and probably will give more trouble than all other causes put together, because apparently it is a very simple matter to get the yokes correctly made, while really such a condition is the exception rather than the rule. Factory-made yokes are generally correct, but they are not always so. Errors will creep in notwithstanding the care and precautions taken to keep the templets, gages and jigs up to standard, and such errors should be checked on each lot of new holders received. The principal field for error, however, lies in the home-made yoke constructed by mechanics who do not really know what a brush holder is required to do and keep doing. The following discussion may throw some light on the matter. Fig. 7 indicates a simple form of yoke; *a* is a wooden board in which two holes *b* are bored to take the studs that fasten the yoke to the motor frame. Sides *a* receive the metal guides in which the holders proper slide to and from the center of the commutator to allow for wear in the commutator. The angles of the two sides are equal and they must be such that the imaginary center lines passing through the axes of the brushes may always pass through the center of the commutator. Fig. 8 shows that when this condition is fulfilled the brushes will always include the

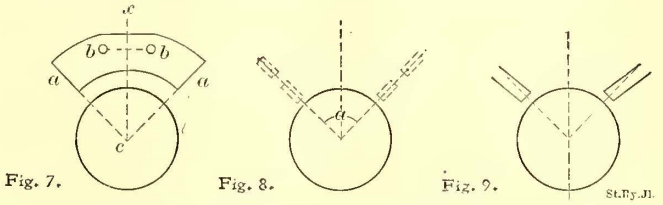


Fig. 7. Fig. 8. Fig. 9.

correct number of bars between them (provided they do in the first place), because as the commutator wears down the commutator bars get proportionally thinner; in other words, the circumferential distance between the centers of the brushes will always include one-quarter the total number of bars in the commutator. Brushes that fulfil this condition are radial brushes. Fig. 9 illustrates a type of brush holder that is radial in action, in that the contact surface on the commutator must move toward the center of the commutator as wear takes place, but the set of an individual brush is not radial, because the center lines passing through the axes of the brushes do not meet at any point representing the center of the commutator—the only condition under which the number of commutator bars included will remain the same throughout the wear of the commutator. In such a case, either the guides in which the holders slide must be so disposed that the brush contact surfaces must move at right angles to a line connecting their centers to the center of the commutator, or a vertical adjustment must be provided to admit of dropping the holders in a vertical direction as wear takes place. In any case, if the bearing surfaces move inward along any other line than the line passing between the center of the commutator and the centers of the bearing surfaces and at right angles to the bearing surfaces, the setting of the brushes will become untrue as wear obtains. Fig. 10 represents an exaggerated case where the angle between the brush-holder guides is less than a right angle. In this case, as wear takes place the brushes get further and further apart, the number of bars between them of course increasing. Fig. 11 represents an exaggerated case where the angle between the brush-holder guides is greater than a right angle. In this case, as wear takes place the brushes get closer and closer together, the

number of bars between them, of course, decreasing. These two possibilities should impress one with the necessity of carefully inspecting all brush yokes, not only to see that the surfaces on which the guides are to be mounted make the correct angle with each other, but to see that the point of intersection of the axes of the guides meet at the correct point. In the case of radial brush holders, the angle that the guide axes should make with each other is a right angle, and their correct point of intersection is the center of the commutator. In the case of holders that take brushes the bearing surface of which is greater than the cross-section of the brush, as in

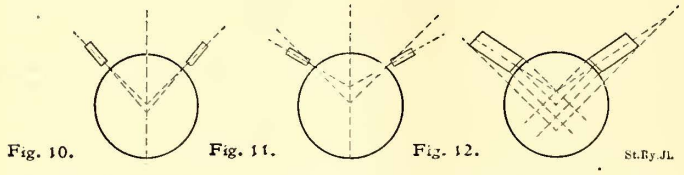


Fig. 10. Fig. 11. Fig. 12. St.Ry.Jl.

Fig. 9, the angle of the guide axes will be a right angle, but the point of intersection will be at a point vertically under the center of the commutator. Fig. 11 indicates the intersection of the axes of brushes that are truly radial. Fig. 12 indicates the intersection of the axes of brushes the bearing surface of which is greater than the cross-section of the brush. In the first case the brush axes and the axes of the holders coincide; in the second case the brush axes meet at a point way above the center of the commutator, and in order that the axes through the bearing surfaces shall move rapidly the axes of the holders must meet at a point considerably below the center of the commutator, and the exact location of this point depends on the amount by which the brushes are inclined from the radial direction. In the case of truly radial brushes, where the axes meet at the center of the commutator, as indicated in Fig. 7, care must be taken that surfaces x and y are not only at right angles to each other, but that they are so disposed that the axes of the brushes will meet at point c, the center of the commutator. Fig. 13 indicates an exaggerated case where the surfaces are at right angles to each other, but which have been so finished that the axes do not meet at the center.

Fortunately the correct construction of the yoke can be insured in all cases by the use of a comparatively simple jig, the principle of construction and application of which is indicated in Fig. 14. Here A represents a wooden cylinder finished to two sizes on the end. The larger size corresponds to the diameter of a new commutator and the smaller size to the diameter of a commutator that has worn as small as they are going to be allowed to wear. Points a and b represent the points of support of the yoke to the motor frame. Distances ax, bx and xy are carefully taken from an actual motor of the type in question. Cylinder A then has the same relation to a finished holder supported at a and b that it would have were it installed in the motor in place of the armature. Points c and d are marked off on either side of vertical line xy at a distance representing exactly one-eighth the circumference of the commutator when new; points c' and d' are points marked on the smaller cylinder and on the same radii that pass through c and d, and they represent the bearing points of the brushes on a worn commutator. To test a finished holder, it is supported at a and b; when the holder is in line with the large part of the cylinder and brushes are inserted, the centers of the brushes should coincide with marks c and d respectively; if they do not, some part of the yoke or holder is wrong. Assuming that they do, the cylinder is then shoved back until the holders register with the smaller part of the cylinder. The holders are then run in radially in their guides and the brushes once more inserted. Again, the centers of the brushes should coincide with the marks c' and d'. Assuming that they do, the holder and yoke constructions may be considered as correct. Assuming that they do not, there is an error somewhere, and it must be located before allowing the device to pass inspection. In either case it will not do to test the setting by simply allowing the brushes to feed from the larger cylinder down into the smaller one, because the clearance between the brushes and holders is sufficient to give misleading results; the guides are being primarily tested and not the trueness with which the brushes feed along the containing holder. The trueness of the containing part of the holder should be tested separately by allowing the brushes to feed from the larger cylinder down onto the smaller one without moving the holders.

Another important point that inspection will often show to be very much neglected is the distance of the holder from the commutator. A new armature is installed, and should it be fortunate enough to outlast the wear of its commutator, it will probably do so without its holder ever being run in radially to take up the wear. The most frequent field for this trouble, however, is where an armature with a worn commutator is installed in place of one having a large commutator. Brushes give the best satisfaction when the holders are run in as close as they can be with safety. The brushes then chatter less, are less liable to break, and show minimum tendency to develop two wearing surfaces at angles with each other; also, if the distance is great and the brush is comparatively loose in the holder, the set of the brushes when the car runs in one direction is likely to be different from what it is in the other direction. By all means, then, adjust the holders to suit the size of the commutator.

Another important but often ignored condition necessary to the successful operation of brush holders is to gage the containing part of the holder and maintain the containing parts at standard size. This precaution applies especially to home-made holders, usually finished with a file regardless of whether they may fit a standard plug gage or not. To get the full benefit of this precaution, however, the brushes should be tested with a gage. Some brushes will be thicker than others and some brushes will be thicker on one end than on the other. The result of the first condition is that the brushes fit the holders with varying degrees of clearance: one brush

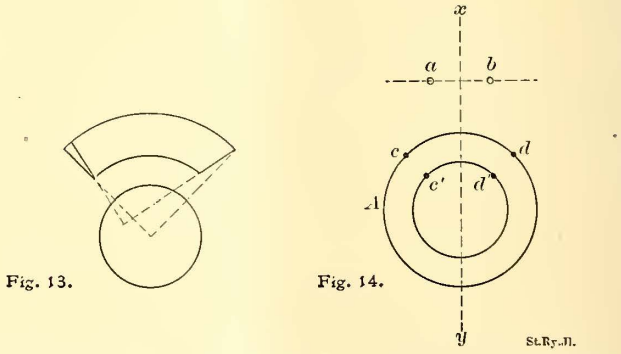
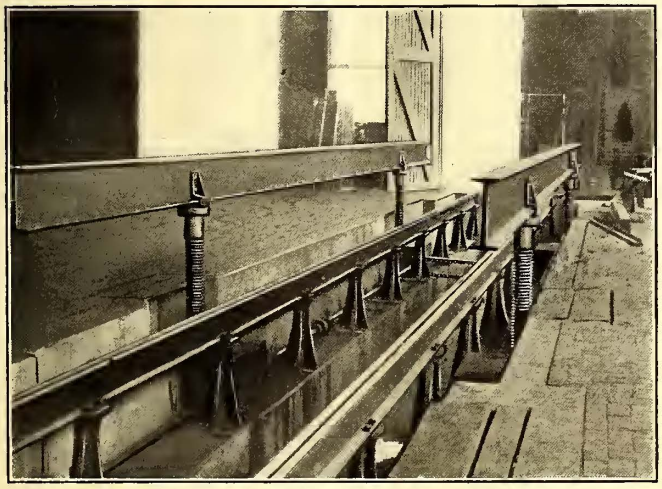


Fig. 13. Fig. 14. St.Ry.Jl.

may be so loose as to wobble and permit its contact surface to wear into two surfaces at angles with each other; another may be sufficiently loose to just go into the holder when the holder is warm and the brush is cold, only to stick and cause a flashover as soon as the brush expands from the heat. The result of the second condition is that the brush may enter the holder easily when presented thin end first, but as soon as wear permits the thicker part to enter, there results a wedging action which will ultimately cause a flashover. Where brushes are not subjected to the gage test the only way to avoid the troubles incident to lack of uniformity in thickness is to try every brush end for end before installing it perma-

nently in the holder. The only way to avoid the bad effects of non-uniformity in brushes and in the containing parts of holders is to have all brushes and holders gaged before being allowed to leave the store room. Finally, if a brush is too large, neither the brush nor the holder should be changed until a test determines which is at fault. If a holder that is already sufficiently large be made larger, all brushes of standard size will have too much clearance; and if a brush is for any reason sandpapered to make a fit, the result is to remove the copper film that is provided to improve the conductivity of the contact between the brush and holder; the removal of this film is apt to make the brush run hotter than it should.



GENERAL VIEW OF CAR-LIFTING DEVICE AT ARABELLA CAR HOUSE, NEW ORLEANS

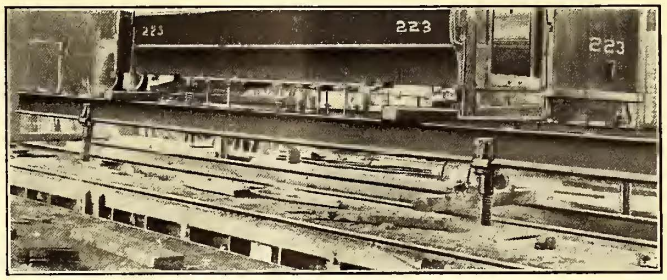
Proper care of brushes and holders will forestall and prevent many of the troubles that are ordinarily listed as unaccountable.

On the recently opened railway between Viborg and Hérning, in Finland, Denmark, belonging to the Danish State Railways, women are for the first time employed exclusively as station masters. These women, whose position is denoted by a special ribbon worn on the right arm, are the wives of the track foremen, of whom there is one to each station. When a "station master" dies the husband is bound to marry again within a reasonable time, the new wife becoming in turn station master.

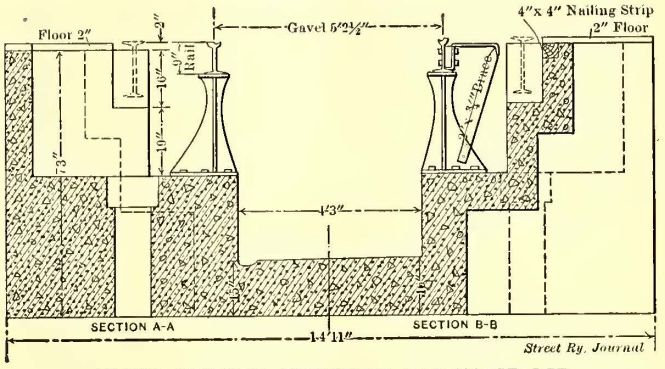
CAR HOIST AT NEW ORLEANS

The New Orleans Railway & Light Company has for some time used with satisfaction at its Arabella car house the form of car hoist shown in the accompanying engravings. The hoist consists of two I-beams supported on four jacks (two right-hand and two left-hand), which are operated by worm gears. The motive power is supplied by a GE-800 motor mounted in the pit, and direct connected to one line shaft running the length of the pit, the power from this shaft being transmited to the shaft along the opposite side of the pit by a Reynolds noiseless chain belt passing across the pit near the center of the hoist.

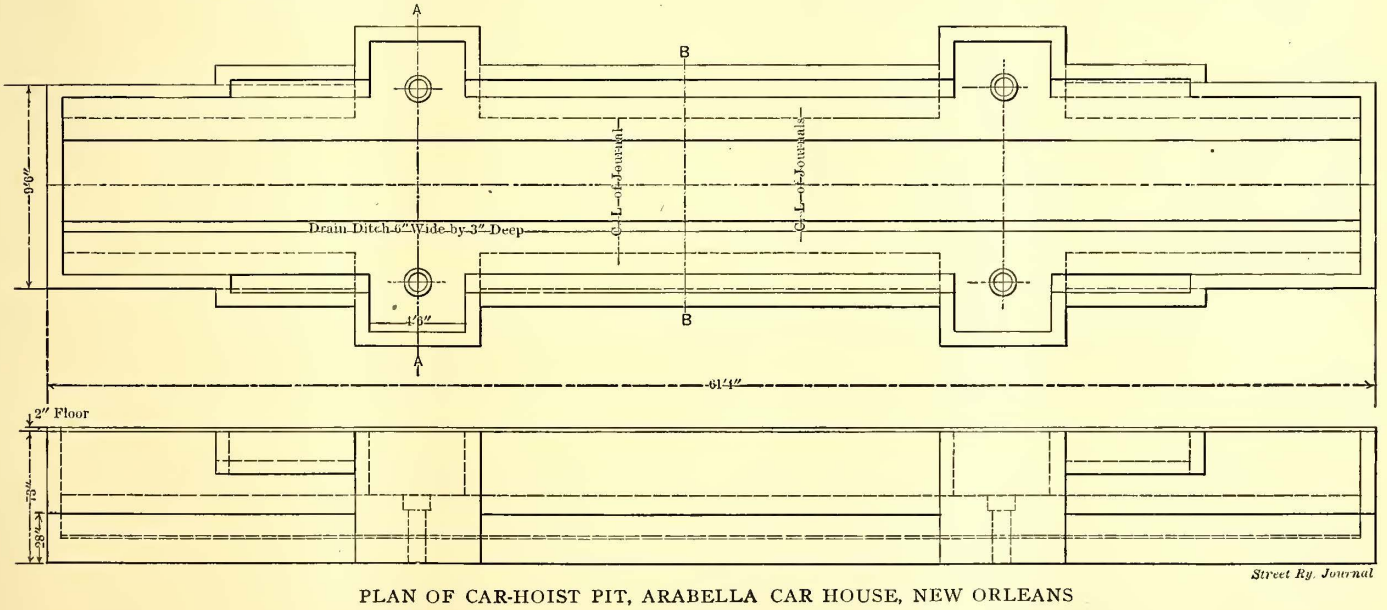
The hoist pit, the form of which will be understood from the drawings, is built entirely of concrete reinforced with corrugated steel beams 6 ins. apart. All bolts for jacks, journal boxes and pedestals were set by template before the concrete was poured and rammed. The pit was installed by M. P. Houlard, assistant engineer of the New Orleans Railway & Light Company.



CAR-BODY WEIGHING TWELVE TONS PARTLY RAISED ON JACK LIFT, ARABELLA CAR HOUSE, NEW ORLEANS



CROSS SECTION THROUGH CAR-HOIST PIT



PLAN OF CAR-HOIST PIT, ARABELLA CAR HOUSE, NEW ORLEANS

INTERURBAN TRAIN TESTING APPARATUS

BY SYDNEY W. ASHE

During the past few months it has been the privilege of the writer to develop a new simple type of train testing set and to demonstrate its practicability by a series of train tests.

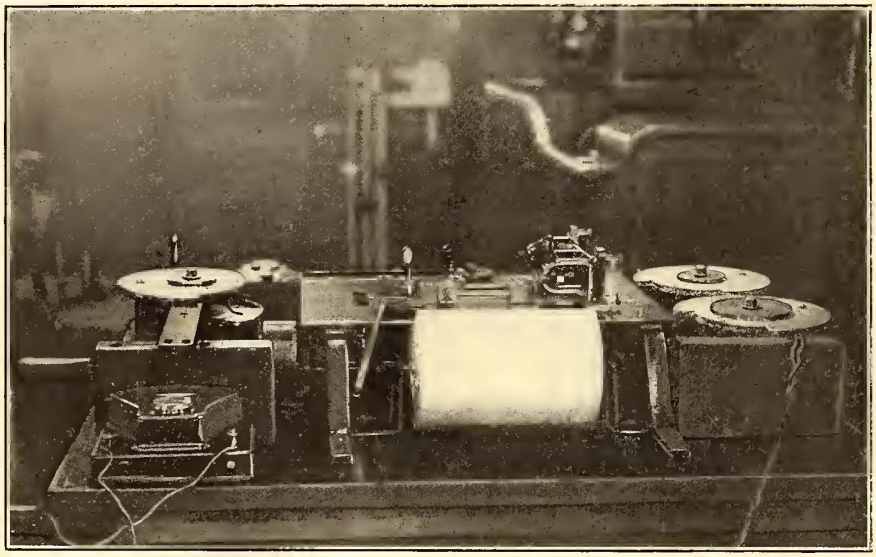


FIG. 1.—RECORDING INSTRUMENT IN POSITION

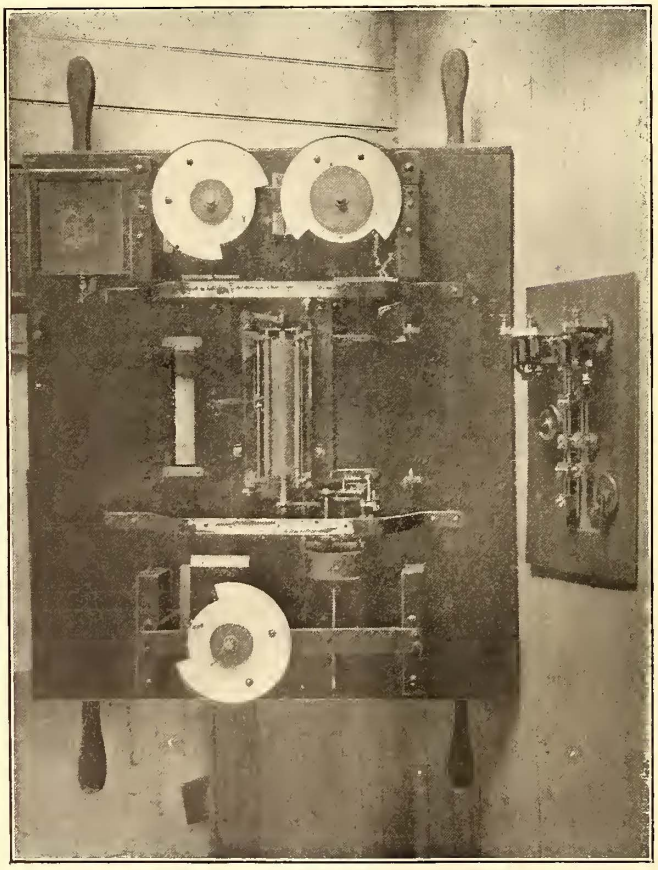


FIG. 2.—SHOWING ARRANGEMENT OF ROLLERS

These tests were made on new rolling stock property of the Brooklyn Rapid Transit Company. They were four in number, and consisted of a run with a single motor car equipped with Westinghouse unit switch control, a run with the Brooklyn Rapid Transit instruction motor car, a test on the Coney Island Express, and a test on a large four-motor interurban trolley car.

The instrument used in connection with these tests recorded line voltage, motor current, wheel revolutions, time in half seconds, and instantaneous speed. The instrument is built upon lines somewhat similar to the Keiley recorder described in Vol. 1 of "Electric Railways," published jointly by the writer and Mr. Keiley. Unfortunately, with the Keiley recorder it was impossible to obtain a satisfactory speed-time curve, as it was first necessary to plot a distance-time curve and then draw tangents to this curve to obtain values convertible to speed. In drawing such tangents results were obtained whose accuracy varied anywhere from 10 per cent to 40 per cent. With the recorder built by the writer, a continuous record was obtained direct of instantaneous speed of the car. The instrument could be modified so as to record acceleration directly, but it was realized that a speed-time curve was of greater moment than an acceleration curve. For instance, from a speed-time may be obtained the maximum speed, the speed passing around curves, the rate of acceleration, the rate of braking, the distance traversed, and the average speed. Most of these quantities are indicated directly by a speed-time curve, whereas with an acceleration curve the curve must be integrated with an integraph to give speed values.

The instrument Fig. 1 consists of a spring motor taken

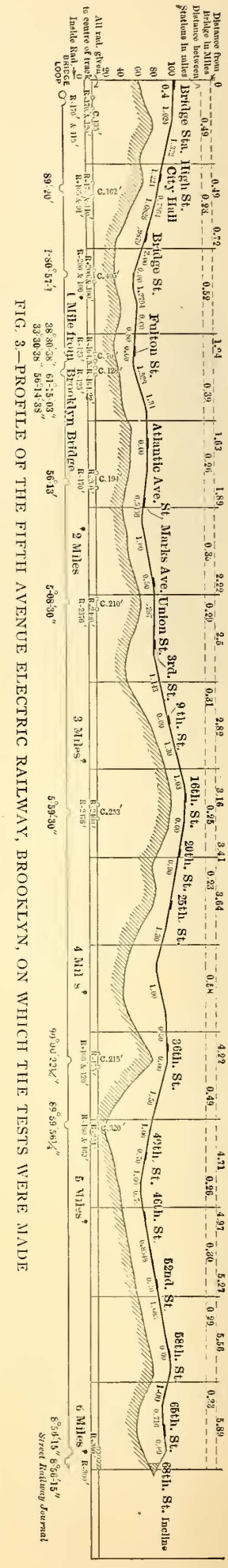


FIG. 3.—PROFILE OF THE FIFTH AVENUE ELECTRIC RAILWAY, BROOKLYN, ON WHICH THE TESTS WERE MADE

from a large Edison home phonograph. This motor is geared directly to a shaft carrying a wooden roller. Pressing against this roller are two other rollers covered with rubber tubing. One of these rollers is pressed against the large wooden roller by a spring. The other roller has a small play between it and the large roller. The motor is equipped with a gov-

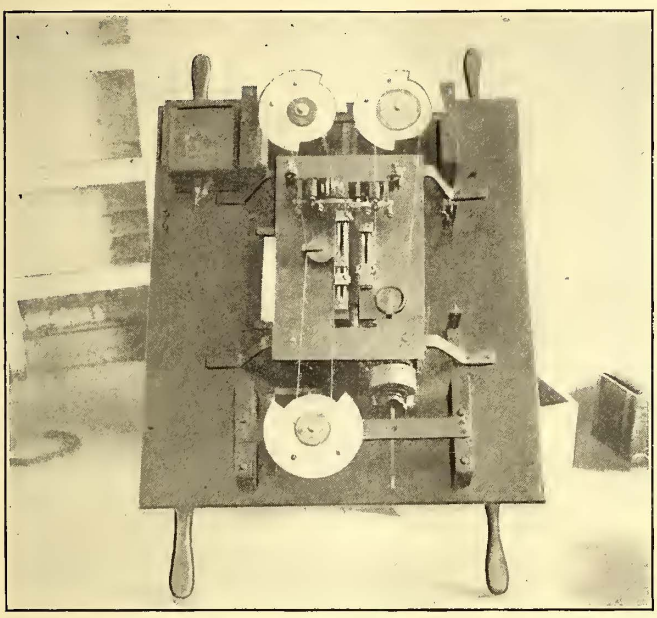


FIG. 4.—TOP VIEW OF PORTABLE INSTRUMENT, SHOWING PENCIL HOLDERS

ernor which is set so as to pass the records at a rate of 5 inches of paper in nine seconds. The paper as illustrated in Fig. 1 is 8½ ins. in width, and is mounted upon wooden cones in turn mounted upon an axle which revolves upon centers. Pressing against the paper holder is a flat spring which keeps the paper taut. Two small guides are provided to limit the

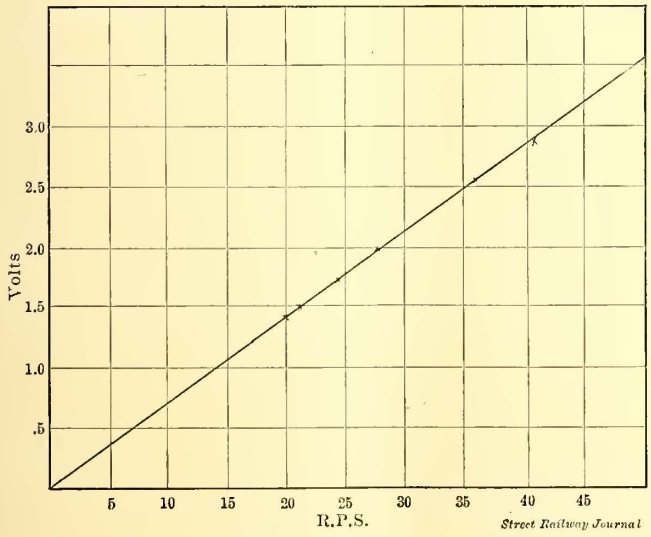


FIG. 6.—CALIBRATION CURVES OF WESTON MAGNETIC TACHOMETER

side play of the paper. By this arrangement it was found that the paper passed through very smoothly and evenly. The records were made with soft wooden pencils, mounted so as to pass through small brass tubes and weighted with pieces of lead. Care was taken to see that all of the pencils were in line. The method of using springs for the pencils was abandoned, owing to the conditions demanding some arrangement whereby the pencils could be quickly removed in case of breakage of the points or hard spots in the lead, and also that the proper pressure of the pencils against the paper when once determined could always be kept the same. The method selected was simple and never failed once during the tests. Another point in its advantage is that it is impossible with this arrangement for the tension of the pencils to be so great as to tear the paper.

Referring to Fig. 2, the arrangement of the rollers is evident, and in Fig. 4 the arrangement of the pencil holders as mounted on sliders may be seen. The general recording ap-

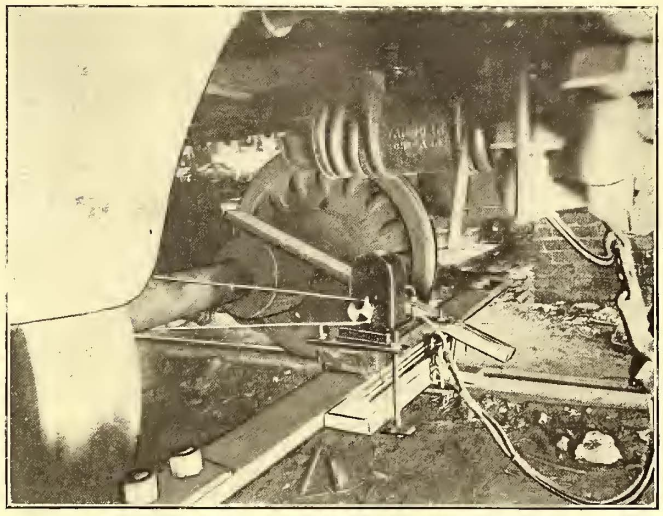


FIG. 5.—MAGNETO FASTENED TO TRUCK

paratus is mounted upon an ⅛-in. steel plate over the paper moving mechanism.

A portable Weston ammeter and two voltmeters are mounted rigidly on both sides of the recording mechanism as illustrated in Fig. 1. Circular discs with pointers attached are mounted over these instruments so that variations of the pointers of the needle may be followed. Flat-grooved pulleys

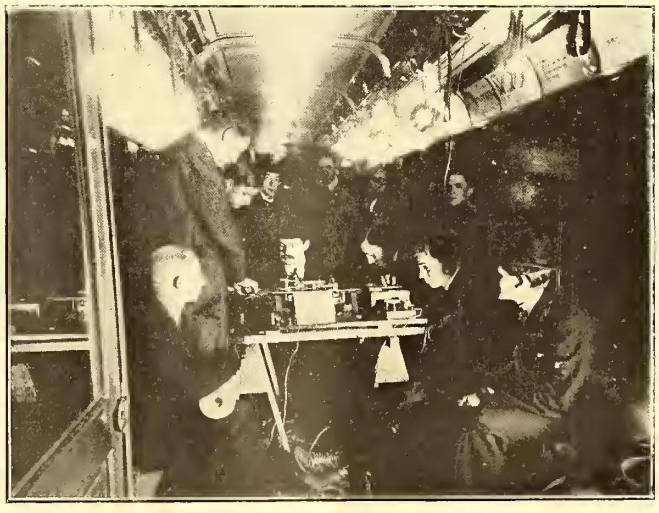


FIG. 7.—WATCHING THE TEST RECORD

are mounted upon these sectors and wires passed around these pulleys, and pulleys on the plate of the instrument transmit the motion of the sectors to the pencil holders which are fastened to the wire. This arrangement is constructed to be absolutely free of play or lost motion of any kind. The wire is steel piano wire, and its extremities are fastened to the sectors by screws when the wire has been drawn taut. The wire is passed twice around the pulleys so as to obtain good bearing surface. The diameter of the sector pulleys

varies, depending upon the amount of distance to be moved over by the recording pencil. Referring to Fig. 4, the largest pulley on the sectors records current, to its side is the speed recording sector, and opposite is the line voltage sector.

Mounted upon the bed plate of the instrument are two relays, equipped with pencil holders. One of these relays records wheel revolution, being connected in series with six cells of a dry battery and a contact maker mounted upon the trailer truck. The other relay records half-seconds, being connected in series with three dry battery cells and an electric time contact. The time contacts are made by platinum contacts, one of which is mounted upon the balance arm of a Seth Thomas clock, the other contact being mounted upon the retaining case of the clock. One terminal of the battery circuit is grounded on the casing of the clock. As the balance arm of the clock moves to and fro it closes the circuit at half-second periods. The platinum contacts are one-half inch in length, and are carefully adjusted so as to make contact only in one spot and not to be so rigid as to stop the motion of the clock. A little care in adjustment results in a very satisfactory performance of the clock. The clock is then adjusted by means of a stop watch so that the regulator is in the proper position, in which place it is rigidly fastened, as the whole accuracy of the results of the test depend upon the performance of the clock. A true record of instantaneous speed is obtained with the recorder by mounting upon the cross-beam of the trailer truck a Weston magnetic tachometer as illustrated in Fig. 5. In the tests made by the writer the magneto was mounted upon one-inch rubber cushions to lessen the vibration. A small ⅛-in. leather belt connected the magneto to the 5-in. car axle. A little care in fastening the belt resulted in very satisfactory operation of the magneto. It is interesting to note here that throughout the tests the magneto belt never left the pulley and there was no slippage, as it required practically no power to revolve the magneto shaft. When we consider that the axle is equivalent to a pulley of 5 ins. diameter of extreme width of face, the advantages of this method of attachment are at once apparent. It is, of course, essential that the car axle be true, but if this is not so the condition is soon obvious by variations of the voltage generated. As the magneto has permanent field magnets, it generates a pressure directly proportioned to the speed with which it is rotated, bearing a constant relation to the car speed. The calibration curve for this instrument is reproduced in Fig. 6. Before and after the test the magneto was recalibrated to determine what effect the vibration of the truck had upon the permanency of the field magnets. Repeated calibration showed absolutely no variation from the standard curve. As to whether this condition would remain so for an indefinite time can only be demonstrated by future tests. With a good roadbed, smooth rails and standard tracks, the amount of pounding is much smaller than is ordinarily supposed.

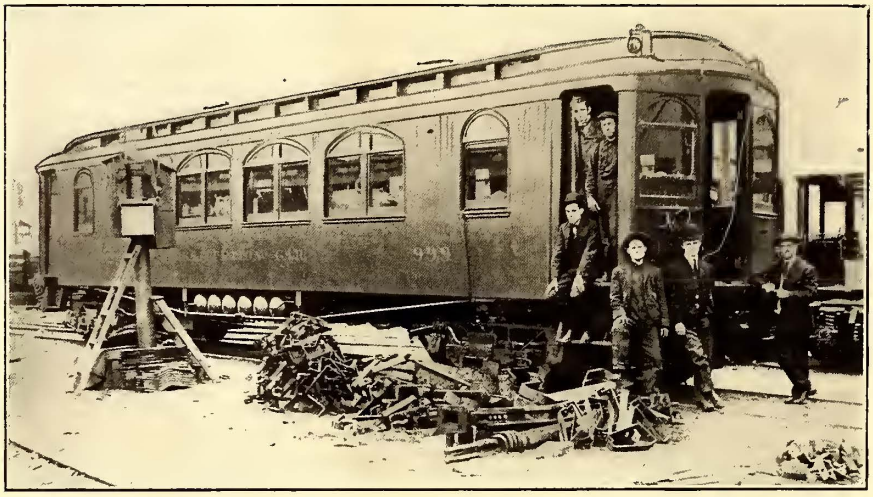


FIG. 8.—BEFORE THE TEST OF THE "CONEY ISLAND EXPRESS"

Leads were led up from the magneto to the recording device, sufficient slack wire being left so that the leads would not pull passing around curves. At a speed of 24.8 miles an hour the magneto generated 1 volt. The variation from this value depends upon the diameter of the car wheel and the exact diameter of the car axle. For ordinary speeds a 1½-volt voltmeter gives about the maximum range over the paper, and consequently the greatest accuracy. Prior to the test the car was moved over a given stretch of track, and the distance passed over by a given number of wheel revolutions was noted. This distance was accurately taped and the circumference of the car wheel determined. This is essential before every test, as the wheels may have been turned down owing to skidding by a green motorman. The true running circumference of the magneto pulley was determined by driving it in the laboratory at the Polytechnic with a variable speed motor to which it was belted. The speed of the motor and the magneto were measured, and with a knowledge of the circumference of the variable speed motor pulley the running circumference of the magneto was quickly determined. This is essential, as the magneto pulley is grooved.

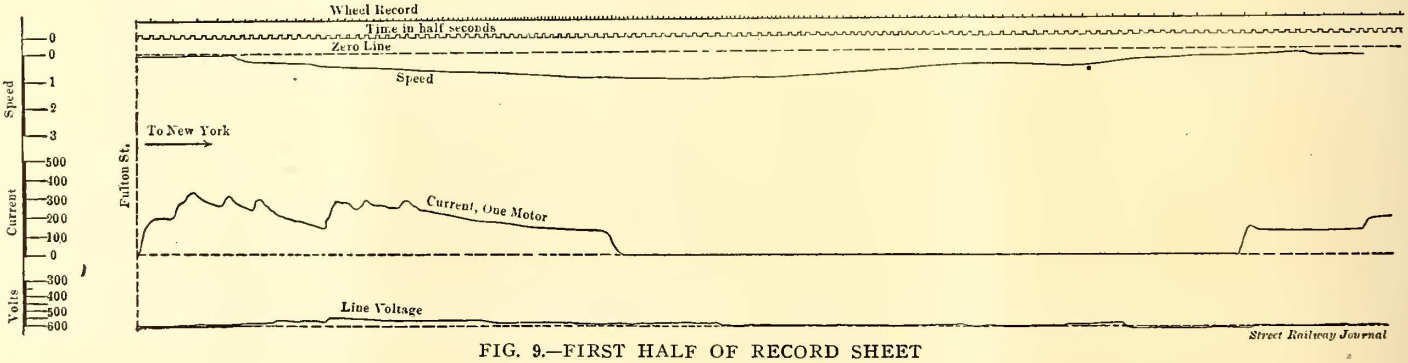


FIG. 9.—FIRST HALF OF RECORD SHEET

When the car is about to start, the paper moving mechanism is started in operation, the time circuit closed, the motor spring and the clock spring wound, the pencils carefully looked over, and one man stands over each sector so that the variations of the pointers may be followed (see Fig. 7). The signal is given and the car starts. One man looks after the

paper as it comes through, carefully rolling it up and watching the operation of the instrument. At each station the name of the stop is called out and marked down on the paper by the previous individual. The variations in speed and the variations in the line voltage are easily followed by the men at the pointers. The man at the current device has to watch closely while the controller is notching up, but with a little practice he is able to follow with surprising accuracy the variations of the motor current. There is a very slight personal lag on the part of the operators, which is about equivalent to that due to the inertia of an automatic instrument. The only difficulty appears to be in following the maximum peaks of the current curve, but these values are checked up by two other men on other ammeters connected in the circuit. Furthermore, the duration of the peaks is extremely small. These men note the value of every peak between stations and tabulate these values in proper form. The ammeters are connected one in the line circuit and one in the F′ or ground circuit of one of the motor field coils. This is done to avoid changing over ammeter leads when the reverser is thrown. The line voltmeter is connected across the circuit from line switch to ground. As the paper passes through, records are made by the pencils as illustrated in Fig. 9, namely, wheel revolutions, current in half seconds, instantaneous speed, current, line voltage. At frequent intervals the instrument is calibrated by passing through paper and placing the pointers of the sectors over various definite positions of the instrument scales. The scale for the instrument is subsequently drawn on the run sheets as illustrated in Fig. 9.

The results from the run sheets can be very readily transferred to co-ordinate paper by means of proportional dividers. The zero lines are drawn on the run sheets for current, speed and the normal voltage datum line is drawn, 600 in this case. Assume that the speed time curve is to be plotted from Fig. 9, the proportional dividers are set so that one volt on the speed scale corresponds to 24.8 miles per hour on the sheet of co-ordinate paper. As stated before, this factor of conversion varies with the diameter of the car wheel and the diameter of the car axle upon which the magneto belt plays. By placing the run sheet on a drawing board so that the datum speed line is parallel to the side of the board the time values in seconds or half seconds may be readily transferred to the speed curve and the dividers adjusted so as to transfer the speed ordinate to the curve sheet in the proper proportion. The train sheet represents the various values from the record plotted to scale. The distance curve is readily transferred to this plotted. Passing a planimeter over this curve, the kilowatt-hours are determined and converted into kilowatt-hours per ton-mile. In the problem under consideration (curve sheet Fig. 10), the run was for a single car between Fulton Street and Bridge Street on the Fifth Avenue line of the Brooklyn Rapid Transit Company. This run was selected, as it represented a point on the line where considerable energy was consumed. The watt-hours per ton-mile amount to 179. This was caused by a sharp curve and a grade (see profile map, Fig. 3) which necessitated two applications of power. The run was selected car moving to New York. A convenient check on the results of the power curves is a record-

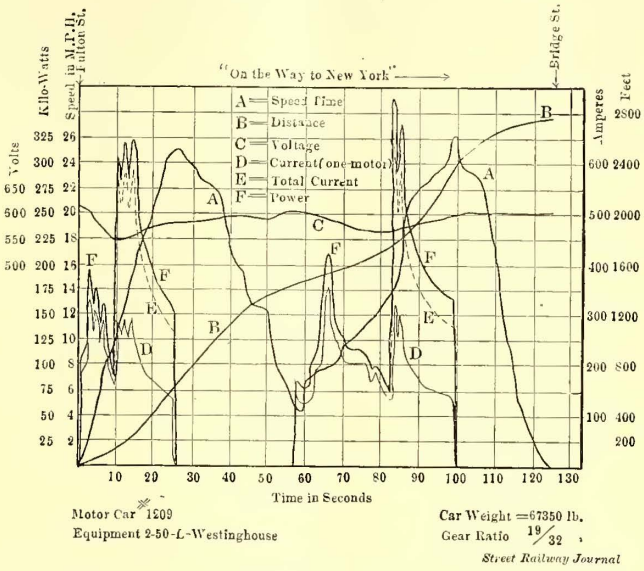


FIG. 10.—RESULTS OF RUN BETWEEN FULTON STREET AND BRIDGE STREET STATIONS SHOWN GRAPHICALLY

ing wattmeter connected in the train circuit to give values between stations and for the whole run.

With this method of obtaining a speed time curve there are three checks on the distance traversed, namely, the known distance between stations, the distance as indicated by the distance curve, and the distance represented by the area of the speed-time curve. In the case worked out the distance between stations was .52 mile, the distance corresponding to the distance curve varied four feet and the distance corresponding to the speed-time curve varied 4 per cent. This latter error could be caused by the variation of the thickness of a line when setting the proportional dividers.

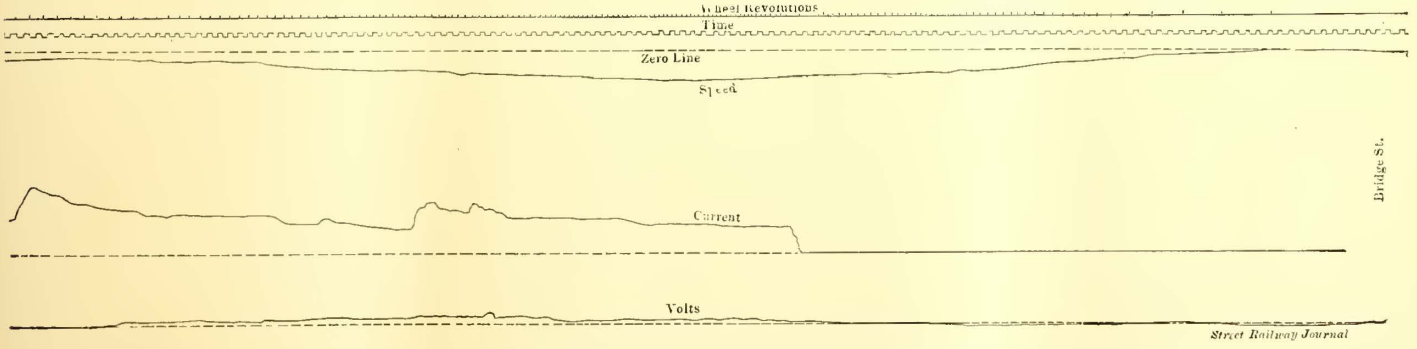


FIG. 9.—SECOND HALF OF RECORD SHEET

sheet by counting the wheel revolutions for a number of seconds and multiplying by the circumference of the car wheel the distance traversed is at once determined. The record indicates current passing through one motor, so the current values in the multiple position are doubled to give the total line current for this equipment. The voltage values are multiplied by the current values and the kilowatts determined and

The acceleration is practically one mile per hour per second as obtained from the record. This is rather low, but the conditions under which the car was run justified it, as the station stops were short. One great advantage of the record of current produced by this recorder is that various types of control may be studied, the action of the throttle relays in notching up the control may be observed, and the character-

istic of the motorman may be determined. In closing, the writer wishes to state that the successful construction and operation of this instrument was due in large part to Messrs. Hewlett and McCarty, of the Brooklyn Polytechnic, whose thesis covered this work. The success of the tests was due largely to Messrs. Calderwood, Gove, Smith, Dempsey and Brown, of the Brooklyn Rapid Transit Company, whose kindly co-operation the writer appreciates.

CAST-IRON AND STEEL WHEELS IN CITY SERVICE

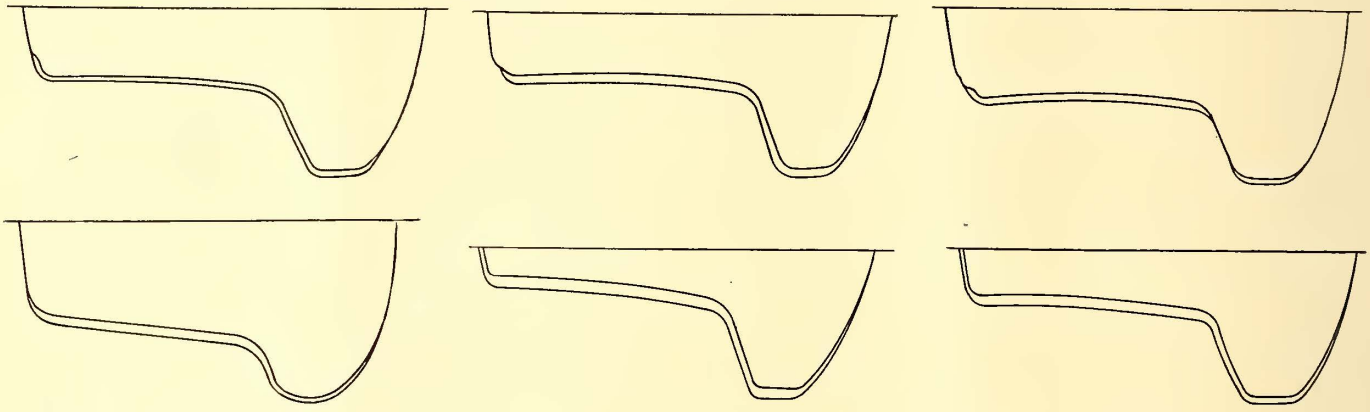
BY JAMES ANDREWS

If memory serves me aright, there were troubles even in the old days of 16-ft. cars and horse power, with wheels, axles and journals. Everything was not bright and serene for the foreman, but the low-flange, narrow-tread, light cast-iron wheel did its work well and satisfactorily and no one dreamed that anything else in the way of increased weight or better material would ever be required. Street railway men were comparatively reluctant to change the type of rolling stock that had served so well, and there was more or less opposition to the introduction of trucks, the lengthening of the cars, the raising of the floors and the other modifications demanded by the successful introduction of electric traction. But when the necessity for these modifications had been fully realized, street railway managers swung promptly into line, and it is many a day now since there has been any criticism of these one-time novelties. In the matter of wheels we have clung to old practices longer than would have been expected, and longer than would have been done had not first cost been a factor that had to be considered. We have retained the multitude of flange shapes that existed in the horse-car days, and have made few changes in their dimensions or contour. It seems that a flange 5/8 in. or 3/4 in. high is amply sufficient to hold even the heavy cars of present-day service on the rails, and for urban work there seems to be little reason why there should be a change.

In material we are coming nearer to steam railway practice because the requirements are also approaching it. The making of horse-car wheels was recognized as an entirely different art from that of manufacturing steam-car wheels, and they were usually made in separate establishments, the maker of one class seldom trespassing on the domain of the other. But now that street cars weigh more than the old cars on steam roads and wheels are made to weigh more, the practice in the two classes is coming together.

On a city road with a heavy and short headway service the wheel question is a serious one and is attracting close attention. It should, and in many cases it has, resolved itself into a consideration of economy of operation rather than that of first cost. There are three points in the matter that demand attention: shall the wheels used be of a cheap cast iron, an expensive cast iron, or steel? It would seem that the first of these two should be eliminated from the discussion, but it is not. However, that is a point that will be disregarded here and taken up later in another article. What we have to deal with is the relative merits of steel and cast iron as metals for street-car wheels, in the light of ultimate economy.

In first cost the steel wheel requires by far the greater outlay, ranging from two and a half to three times as much, dependent upon the grades of the two types that are compared. Hence it is evident that the steel wheel must offer some very decided advantages relatively to its rival, in order that its purchase may be warranted. That some managers think it does offer such advantages is evidenced by the fact that after a long and careful trial they have become large purchasers of steel wheels for equipment that was formerly carried safely and satisfactorily by those of cast iron. The word "satisfactorily" is used in the sense that a man will be satisfied with the best he knows of until something better has been used. The well curb satisfies until the housewife has tested the convenience of running water and a bathroom.



FIGS. 1 TO 6, ILLUSTRATING THE WEAR OF CAST-IRON WHEELS

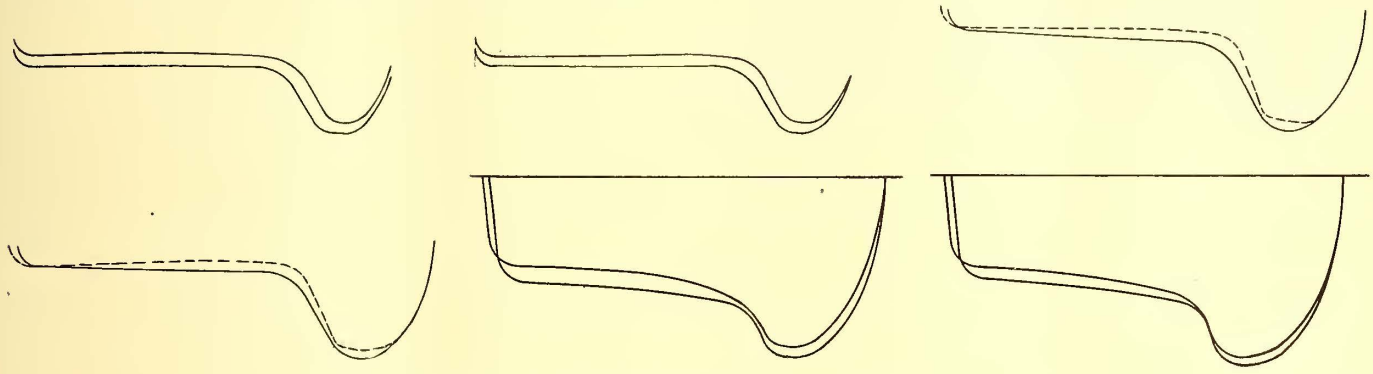
The argument that has been advanced most vigorously against the steel wheel is that, in city service, it is the brake shoe that is responsible for most of the wheel wear, and that this will be as hard on the steel as the cast wheel; therefore there will be nothing but extravagance in the use of steel. This conclusion would be all right if the premises could only be granted without modification. But it can hardly be acknowledged that the brake shoe is responsible for the major portion of wheel deterioration, and the statement that it will wear the steel wheel as rapidly as the cast one will not hold water at all, for just the opposite is the case.

As for the peculiarities of abnormal wear, it is probable that what will affect one class of wheel will affect the other also. That is to say: suppose truck or track conditions are such that there is a tendency of the wheels to run sharp in the flange. Cast and steel wheels will be affected in the same way; but with the cast wheel every fraction of an inch that is worn from the chill cuts into softer and softer material, increasing the rate of wear, while with steel this does not occur. In fact it seems to be true that the resistance of a steel tire to wear increases to a depth of about 1/2 in. below the surface, then falls off a little, after which it remains constant at a point somewhat higher than at the surface of the tread. This point, however, needs further corroboration. In any event, a removal of the causes tending to running sharp leaves the metal of the steel unimpaired, while that of

the cast wheel is ready for further natural deterioration.

As for the form assumed by the tread and flange under normal conditions of wear, there is not much difference. Figs. 1 to 6 show the original and worn contours of a number of cast wheels taken from three different roads. In these it will be seen that the worn contours conform very closely to the shape of the originals: the wear of the top of the flange is about equal to that on the tread, so that when this condition prevails the wheel remains in first-class shape until it is worn out. The same state of affairs is shown by the wear of steel wheels in Figs. 7 to 12. From this it appears, then, that as far as character of wear is concerned there is not much difference. Experience also shows that where wheels are not subjected to abnormal influences, this uniformity of wear may continue to the end, for steel wheels have been run for 150,000 miles without turning and with the tread and flange in good condition.

As for the rate of wear, that is different. Cast iron wheels are frequently bought on a guaranteed mileage of 40,000.



FIGS. 7 TO 12, ILLUSTRATING THE WEAR OF STEEL WHEELS

The makers know that the roads do not keep accurate mileage accounts and so cannot hold them to the guarantee; while the roads consider the contract as a piece of successful bluffing on their part. As a matter of fact, 30,000 is a big mileage for a cast wheel in city service, and 20,000 is much nearer the average mark. That of the wheels shown in Figs. 1 to 6 ranges from 2395 to 5611 per 1-16 in. of wear, with an average of 3454. In the case of the steel wheels shown in Figs. 7 to 12, the mileage per 1-16 in. of wear runs from 4210 to 7233, with an average of 5520. This is nearly 60 per cent in excess of the cast wheel. If the total wear of the cast wheel is put at 6-16 in., and it is granted that the rate will remain consistent with that of the tread, which is granting a good deal, the final mileage will be something less than 21,000.

Steel wheels can readily be obtained that will give 2 ins. of wear. But even 1½ ins. wear on the tread will give 132,880 miles at the rate stated, or a guarantee of 150,000 miles can be obtained. In short, one steel wheel can be counted upon to outwear five of cast iron, at an original cost of three times as much. To this must be credited the cost of four removals and refitting of the cast wheels, which will run their cost still farther above that of steel. Interest on the excess cost of the steel wheel will not cut down the saving to a serious extent, and we still have a substantial gain in dollars and cents on the books to warrant the original expense. There is, however, another saving that does not appear on the books, but which, in the opinion of some managers, at least, is sufficient to warrant the use of steel wheels. It is worth something, much, in fact, for a road to have its equipment ready for service. The use of steel wheels contributes toward this end. The running in of cars for wheel renewals, especially for flat spots, is avoided to a great extent, thereby making it possible to utilize a larger percentage of rolling stock at all times and thus cut down that unknown item that might properly be called the rental of repair tracks. Just what this may amount to no one can tell, but those who have studied the matter claim that it is quite enough to pay the interest on the extra first cost of the wheel equipment.

This renewal for flat wheels and chipped flanges and treads drops into insignificance and wheel troubles are reduced to a minimum. As for safety, this does not enter into the question, since very few injuries are ever inflicted on persons or property by wheel failures on city streets.

It would seem, then, that a careful analysis of the whole subject will demonstrate that, considered from the two-fold standpoint of actual cash saving and convenience and reliability for service, it will be a paying proposition for a city road with heavy cars and frequent service, and where land values are high, to use a steel wheel; and that this will hold all of the way down the line, though with a probable decrease of actual and probable saving as we approach conditions in which the work is done by a light car hauled by horses.

TUNNELING IN NEW ORLEANS

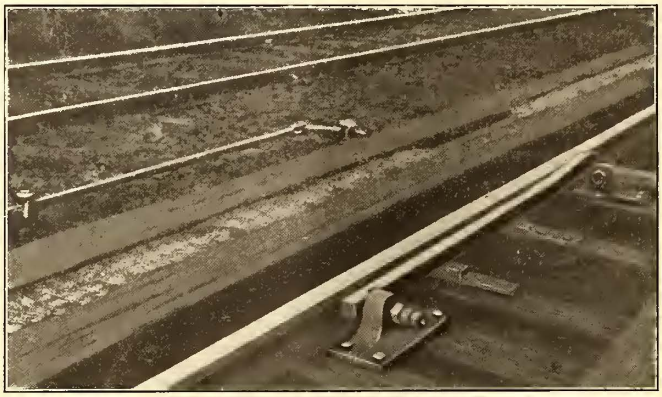
A novel piece of engineering work is being done by Sanderson & Porter in the construction of the big water main for the Claiborne power house of the New Orleans Railway & Light Company at Elysian Fields and North Peters Streets. Heretofore in New Orleans the openings for the large water pipes have been dug down from the surface of the earth; in this instance the engineers are tunneling through the ground from the power house, straight to the river. The water main is 7 ft. 9 ins. in diameter, and is being constructed as fast as the tunneling progresses. The tunnel will be about 280 ft. long; its depth at the power house will be about 15 ft., from which it will incline to a greater depth as it reaches the river. The digging through the earth is done by six cutters attached to jacks which are driven by hydraulic pressure. These jacks uphold a shield which is forced through the ground dug out by the cutters and holds the walls of the tunnel in place. As fast as the shield is forced along the space is taken by the sides of the pipe, which are built up in sections and securely riveted.

The second annual picnic of the employees of the United Railway Company, of St. Louis, was given Aug. 30 and 31 at Creve Coeur Lake. One-half of the employees attended the first day and the other half the second day. There was a barbecue, baseball games and athletic games of all kinds.

DEVICE FOR STOPPING CARS ON GRADES

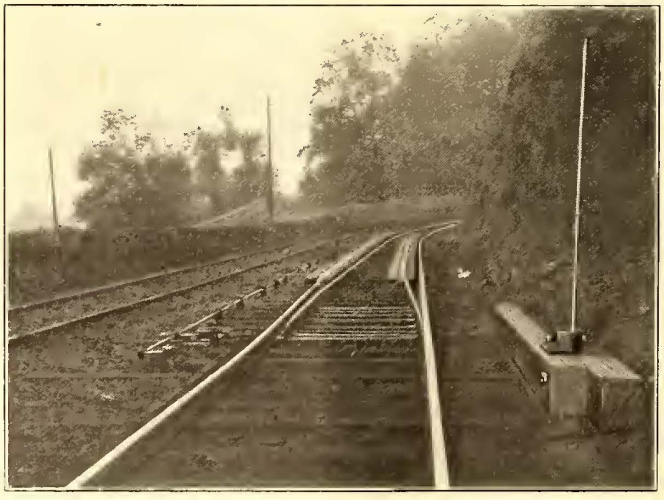
The New Jersey & Hudson River Railway & Ferry Company operates a number of lines in Northern New Jersey and connects with a ferry line running to West 129th Street, Manhattan. In climbing the sides of the Palisades the tracks take a zigzag course up the face of the cliff and ascend at an average grade of about 7 per cent.

As a precautionary measure in order to avoid any possibility of accident should a car run away, the company some



LEVER FOR AUTOMATICALLY RESETTING SWITCH TO SANDED TRACK—NEW JERSEY & HUDSON RIVER RAILWAY

time ago installed on all of the steepest grades a simple and ingenious stopping device which will be understood from the illustrations. This consists of a switch or siding track the rails of which are always covered with a layer of sand. The switch point at the entrance to this sanded track is always open to the main line, so that should a car get beyond the control of the motorman it would necessarily take the switch and run into the sanded track, thereby coming to a stop



ENTRANCE TO SANDED TRACK FOR STOPPING RUN-AWAY CARS—NEW JERSEY & HUDSON RIVER RAILWAY

automatically. The rails of the sanded track are laid close to the rails of the main-line track, so that there is no danger of derailing the car while it is taking the switch. The retarding effect desired is secured by building a trough about each rail of the switch track and filling this trough with sand to a height of 2½ ins. above the head of the rail. The trough is formed by spiking to the ties 6-in. x 6-in. timbers along each side of the rail, the trough being about 5 ins. wide.

Through the courtesy of F. W. Bacon, general manager of the company, the results are here given of a series of tests made to demonstrate the efficiency of the arrangement in stopping runaway cars. The sand track on which the tests were made is located on a 7 per cent grade and the approach to the sand track for a distance of 1500 ft. is also on a 7 per cent grade. The sand track has a switch at the lower end, so that cars which pass into the sand track can be brought back on to the main running rails without backing out. The sand track proper, that is, the section of the siding or second track that is covered by sand, is 180 ft. long, and the sand is generally damp.

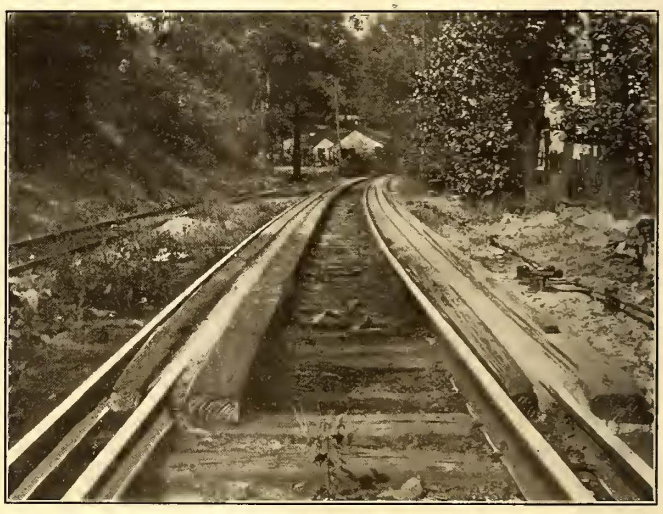
The results of the tests were as follows:

No. of Test	Speed M. P. H. Entering Sand Track	Depth of Sand Over Head of Rail	Distance Car Ran	Remarks
No. 1	14.5	2½ ins.	80 ft.	Free rolling
No. 2	19.5	2½ ins.	180 ft.	Front truck left track when leaving sanded section, after slight application of air brakes
No. 3	15.	80 ft. of ½ in. 40 ft. of 2½ ins.	120 ft.	Free rolling
No. 4	23.	80 ft. of 1 in. 100 ft. of 2½ ins.	180 ft.	Brakes set and wheels slid on last 40 ft. of test, leaving a coating of sand ¼ in. deep on rail.

In test No. 2 the forward truck left the rail at the lower end of the sand track, due to the packing of the sand under the wheel. It was found that where the sand was used to a depth of 2½ ins. over the head of the rail the wheels were lifted by the sand from 1 in. to 1¼ ins. above the head of the rail. In this test the front wheels had traveled off of the lines of the rail at the lower end of the switch where the siding entered the main line and had dropped to the ties. The car was still moving slowly after the application of the air brake when it left the track.

In tests No. 3 and No. 4 the sand of the first 80 ft. of the siding was reduced respectively to ½ in and 1 in. in depth over the rail.

In test No. 4 the car entered the track at a speed of 23 miles



SANDED TRACK AT SIDE OF MAIN LINE TRACKS FOR STOPPING RUN-AWAY CARS—NEW JERSEY & HUDSON RIVER RAILWAY

per hour and ran the 80 ft. through 1 in. of sand and 60 ft. through 2½ ins. of sand, free rolling, without brakes applied, and then slid 40 ft. after an emergency application of the air brakes had been made. The car finally came to a stop with the front trucks just inside the sanded section.

It is interesting to note that in the heavily sanded section of track, when emergency application of the air brake was made the car threw most of the sand out of the trough, leaving a compact layer of sand about ¼ in. thick over the head of the rail. In tests Nos. 2 and 4, both trucks of the car were on the

sanded section when the car came to a stop. The car used in making the test was one of the company's standard closed cars with M. C. B. trucks and 33-in. east wheels. The weight of the car complete was 22 tons.

From the foregoing tests the conclusions are reached that the sanded track will stop an ordinary passenger car running 17 miles per hour, free rolling, without any application of the brakes, within a distance of approximately 150 ft.

In practice the company requires its conductors when a car is descending the heavy grades to ride on the front platform with the motorman and to hold themselves in readiness to take charge of the car in case of emergency. As the switches are always left open to the sanded sidings it is necessary for the car to come to a dead stop at these points, and the conductor is required to get off and throw the switch for the main line. An auxiliary feature of the device is an automatic tripping mechanism whereby the car, after passing the switch, automatically resets the switch point for the siding, so that any car that does not come to a stop at the switch will always enter the sanded track. This tripping device consists of a lever near one of the rails of the main track and so arranged that when the car passes it is depressed by the flange of the wheel and releases the switch point, thereby setting the switch for the sanded siding.

This arrangement has proven very effective on the New Jersey & Hudson River system, and it is believed the idea contains a suggestion for any road that is compelled to operate over severe grades.

CORRESPONDENCE

RAIL CORRUGATIONS

New York, Aug. 27, 1906.

Editors Street Railway Journal:

If a further contribution to the discussion in your paper regarding the matter of rail corrugations is in order, I would call attention to a pamphlet issued recently by the Tramways and Light Railways Association of Great Britain, containing a resume of a number of guesses in regard to the matter.

Your editorials in the issue of July 21, and the letter in the issue of Aug. 11 set forth some of the hypotheses that have been advanced to account for the phenomenon. The vibratory and the slipping theories might account for the work but, as stated by your correspondent, no systematic investigations have yet been made to ascertain just what causes are always present in the production of the corrugations.

Evidently weight of rolling stock is an important factor in the development, since, as one writer has pointed out, we do not find any evidence of corrugations on tracks over which horse cars only are run, nor do they seem to have appeared on the early electric roads until the weight of the cars had been brought up to nearly the present proportions. On steam roads there has always been a corrugation at the ends of the rails, and the indentation on the receiving rail of a double-track road is usually quite sufficient to indicate the directions of the traffic regardless of the position of the rail in other respects. It is at this point that the rail has been subjected to an exceptional pressure that manifests itself in the indentation of the rail. That electric roads are alone in the production of corrugations is far from the fact, as has already been pointed out, so that it does not seem probable that the results are due entirely, if at all, to the use of the electric methods of propulsion.

In one of the papers referred to, it is suggested that, "as a current of electricity will flow along the lines of least resistance, and the presence of any undue accumulation of either ingredient of the metal must interfere with the uniform conductivity at that particular part of the rail, and when the wheel through which the current is passing comes in contact with a surface segregation, a local heating is set up, and any consequent softening, however inappreciable, would form the nucleus of a hollow, which, with the chilled tires now in use, would very soon be hammered into considerable proportions."

This would be very well to account for the vagaries of the phenomena, but cannot be accepted intact when we find that the corrugations appear at such regular intervals for one or more rail lengths. Segregation is not spotty but occurs in localized places. Further than this the ordinary segregation does not manifest itself in that part of the ingot that is rolled into the head of the rail but in the web, so that, while there may be alternate hard and soft spots in the head of the rail, these can hardly be attributed to segregation. Up to the present no extensive investigation has been made, as far as any published statements go, that really warrant this assertion that there are alternating hard and soft places in the heads of the rails, and it seems that it is at least worth investigating, considering that the expense for the work would be so small.

Continuing the review of this paper, the statement that "corrugations are only found on electric railways where check rails are applied on super-elevated curves" will not hold water, for they certainly are found elsewhere. Hence the conclusion that has been derived from this misstatement also falls to the ground, namely, that it is due to the skidding of the outside wheel in trying to keep up with the inner one on the curve which has the tendency to run ahead.

In the case of a certain loose wheel that was exploited and somewhat widely introduced on steam and street railways about twenty-five years ago, the wheels were carried on a sleeve that was itself loose on an interior and rigid axle. It was found that the cramping of the flange of the front wheel on the outside of the curve against the sleeve bound the latter so tightly to itself that it turned back in the hub of the wheel on the inside of the curve. If we acknowledge that this same cramping occurs in the case of the rigid wheel and axle, then it is evident that the inside wheel must do the slipping and the corrugations should occur on the inside of the curve. It seems to be absurd that an axle driven by a motor, where the whole tendency of the bottom of the wheel is to move backward on the rail, should actually slip ahead in order to catch up with its mate, and it is difficult to see how wear of treads and flanges, extraordinary as they may appear, can be made to account for this still more extraordinary slip.

The present difficulty seems to be that we have a little knowledge on the subject, and "A little knowledge is a dangerous thing." In this, as in all of the experiences of railroad life and the use of materials, the first results of any investigation are a prolific crop of contradictions, or rather apparent contradictions. Things do not work the same in every place because the conditions of the working are not the same, and as it has already been remarked, a judicious selection of the data obtained from these preliminary observations can be made to prove any point that may be desired. So with this we can prove anything you like.

The vibration and the slipping theories seem to cover the case pretty thoroughly, but it would not be at all scientific to tie to these and then try to procure data to prove the point, for that could be very easily done. Meanwhile it is respectfully suggested that some corrugated rails of different makes and rollings be obtained, and that they be carefully tested for hardness to ascertain whether there is really anything in the theory of alternating hard and soft spots in the head of the rail.

Finally, attention is again called to the fact of the unmistakeable evidence that some at least of the hollow places that appear in the heads of rails used on steam roads are due to the slipping of the driving wheels under the influence of the large pistons and high steam pressure that are used.

Engineer.

THE "EVERYBODY BUSY" PRINCIPLE

Aug. 27, 1906.

Editors Street Railway Journal:

Your editorial on the "Everybody Busy" principle is splendid, and I feel that it is just the hint needed by a good many roads that I have seen, especially small city lines and both large and small interurban roads. The men on the large city railways are all busy as it is, but those on the smaller ones are not. It is as you say, a good man will not object to being given something to do during his idle minutes, as he finds it quite an assistance in passing his time away. On the other hand, many a good man is spoiled by idleness, as idleness surely breeds discontent. Moreover, a man who has several odd little things to do finds his work always interesting. I do not believe in having low-priced men to look and care for electrical equipment, for as a rule they neglect the little things until it is too late. A great many managers will claim that everybody is busy (when they are around), but one who is experienced in shop methods can see a good many things that would escape the observation of some managers. I would like to see the "Everybody Busy" principle in force in all places, as everyone is then more at ease, but it should not be allowed to interfere with tidiness. I would like to see other articles on this principle from time to time, and know it would be a good thing if the first article would impress all as it has me.

Master Mechanic.

SIGNAL EQUIPMENT FOR THE PHILADELPHIA & WESTERN

The General Railway Signal Company has been awarded the contract for the complete automatic block signal equipment for the Philadelphia & Western Railroad. This road runs from the terminus of the Philadelphia subway elevated structure, parallel to the Pennsylvania Railroad main line, due west for 12 miles. The road is double track, but the right of way provides for four tracks eventually. Signals will be spaced 1¾ miles apart, and all will be provided with an overlap of about 2000 ft. Experience on steam roads has shown that track circuits operated by gravity batteries cannot be successfully maintained where the blocks exceed a mile in length. The reason for this is that excessive leakage between the rails makes demands on the battery beyond its capacity, owing to its high internal resistance, and where blocks have been required exceeding one mile in length, it has been necessary to cut the section, thus adding materially to the cost of the installation.

With the system to be installed on the Philadelphia & Western Railway an alternating current is used to supply the track circuits, and inasmuch as the transformers used for this purpose have an unlimited amount of power back of them, it has been found possible where alternating-current track circuits are used to operate blocks three miles in length, without cutting the sections. It is often desirable in interurban roads operating on say five to ten minutes' headway, to extend the length of the blocks from 1½ miles to 2 or even 3 miles in length, and this is made possible by the development of this alternating-current system. If the system were limited to short sections, as on steam roads, the cost of cutting these sections, involving the use of additional reactance bonds, etc., would in a way be prohibitive. The two-rail system will be employed; that is, both of the traffic rails will be available for the return of the propulsion current.

The alternating current for the operation of the signal system will be obtained from transformers in the main generating station, stepping down from 19,000 to 2300 volts. This current is carried by special transmission line the entire length of the road, and at signal locations this 2300-volt current will be further reduced to 50 volts, which in turn will operate the track circuits, signal motors, signal lamps, relays, etc. Since the main transmission line of the road is 25 cycles, the signal apparatus will also be operated at 25 cycles, the same as is being done by the General Railway Signal Company in its installation of the New York Central & Hudson River Railroad electric zone installation.

METHODS FOR PREVENTING DECAY OF WOOD

Secretary George W. Hotchkiss, of the American Forest Congress, has compiled authoritative statistics showing the annual consumption of lumber in the United States to range between 46,000,000,000 and 50,000,000,000 ft. This is food for thought. Wood preservation is not among the new arts, and the primitive charring of wood showed results that induced inventive minds to endeavor improvement in this method. In 1838 Mr. Bethel patented a process in England which specified: "All timber to be treated shall be exposed in the air until fully seasoned." To-day there is not one wood-preserving plant in Europe resorting to steaming to hasten seasoning. Mr. Burnett also patented his process in 1838, and the cheapness of his process induced many to favor it. Practical results very much favored Bethelization, as it became known, and Europe now has no more Burnettizing plants. This latter method has, however, been considerably improved upon by means of injecting a certain amount of insoluble matter into the wood already lightly treated by the old process, and resulted in the newer processes such as the Hasselmann, Rueping and Allardyce methods.

In 1869 Dr. Avenarius, a German chemist of note, made a preparation combining the essential qualities of the two processes, which was then tested out on vineyard posts and proved of such great value that it was placed on the market in 1875 under the name of "Carbolineum," which was later changed to "Avenarius Carbolineum." Dr. Avenarius' idea of a reliable preservative for the vineyard regions of Germany soon spread, however, as its merits became known, and to-day his invention is known in every civilized country. The simplicity of the application which was essential to its success has made the preparation so widely known to-day. Dr. Herzenstein, the noted Russian engineer, in reporting to the International Railway Congress, showed 87 European railroads using a wood preservative, the methods employed being Avenarius Carbolineum, creosoting and chloride of zinc treatment. This method consists of deeply penetrating the wood with a self-impregnating oil of heavy specific gravity, which on account of its chemical ingredients will prevent rot and decay. The American representatives for this material are Carbolineum Wood Preserving Company, of No. 349 West Broadway, New York.

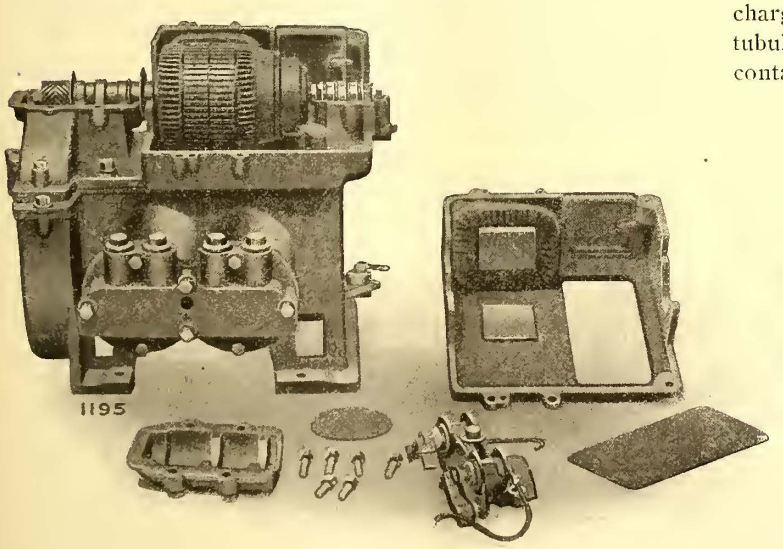
A. F. Schoepf, division superintendent of the Indiana, Columbus & Eastern, met with a peculiar accident a short time ago. He was riding on the front vestibule with the motorman when there was a crash and a broken window and Mr. Schoepf suffered a severe cut on the head. A dead owl was found on the fender, the bird having flown directly at the car.

A NEW TYPE OF AIR COMPRESSOR FOR ELECTRIC CAR SERVICE

One of the first undertakings of the engineering department of the National Brake & Electric Company after the organization of the company last spring was the design of a new type of air compressor for use in connection with air brake apparatus on electric cars. A thorough knowledge of the requirements of a compressor for such work enabled the engineers to embody in the design of the new machine many original features intended to overcome the defects of older types of compressors. A consideration of the conduction of heat to the motor from the crank chamber, of the protection of the motor from dust and dirt, of the accessibility of parts for repairs, and of the external appearance of the machine has resulted in a compressor of the type shown in the accompanying illustrations.

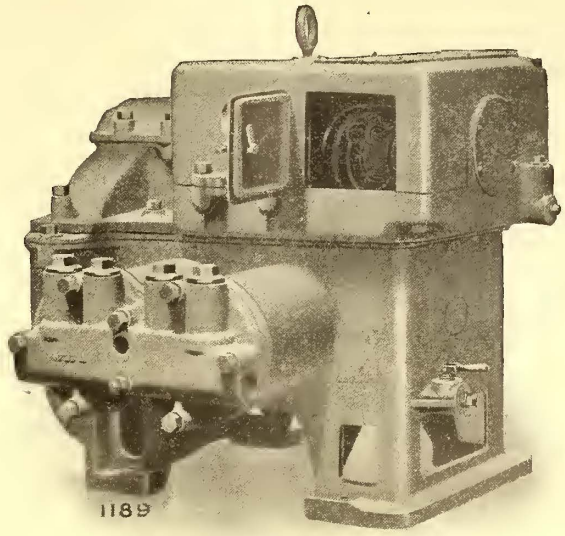
To prevent the heat generated in the cylinders from passing into the motor, the compressor proper and the motor are built as two distinct units. Although the motor is mounted above the crank chamber, it has an independent base and an air space of ½ inch intervenes between the base of the motor and the crank chamber cover. The motor is of the 4-pole, consequent-pole type with fields and armature wound in series. The compressor is of the two-cylinder, single-action type with trunk pistons, and is driven by a herring-bone gear and pinion.

The motor itself is completely enclosed. Hinged doors and removable covers give access to the commutators and brushes. The accessibility of the parts of the motor for repairs may be seen from one of the illustrations which shows the top portion of the motor casing and one of the fields removed. To remove an armature it is necessary only to remove this top portion of the motor casing, together with the bearing caps at either end of the armature shaft. The illustration referred to also shows the liberal size of the brush holder insulators. The grounding of brush holders of compressor motors through the accumulation of oil and dust on the brush holder insulators has heretofore been a source of much annoyance and expense. The proper insulation of the brush holders was given particular attention in the design of the new machine, and the insulators are of such dimensions as to give a leakage surface of about 1¼ ins. The brush holders are provided with an improved spring tension easily and accurately adjusted and which gives a constant tension on the brushes over a wide range.



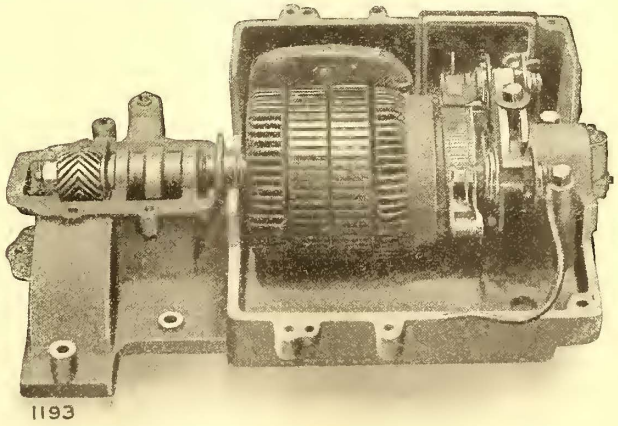
PARTIAL DISSEMBLY OF THE AIR COMPRESSOR, ILLUSTRATING ITS SIMPLICITY AND ACCESSIBILITY

The lower half of the motor magnet frame, the housings for the armature bearings and the cover for the top half of the gear are all formed by one steel casting. This design assures of all parts being kept in perfect alignment. The design of the base of the motor and of the crank case permits the removal of the crank and pistons of the compressor with the least amount of inconvenience. After the cover has been removed from the crank case, the crank may be taken out for repairs without removing the gear from it. The connecting rod head, instead of being loose, is connected to the body of the rod by means of a hinge and hinged eye bolt. This arrangement has the advantage that there is only one bolt to slacken or adjust.



TYPE A-4 COMPRESSOR, COMPLETE

The efficiency and life of the pump and gearing is materially increased by a third bearing for the crank shaft. This bearing, placed at the center of the shaft, steadies it and supports it at its weakest point. The suction and discharge valves are interchangeable and are of cold-drawn tubular steel and are seated by gravity. All of the valves are contained in one head, the discharge valves being in the center and the suction valves on either side. The design of the head is such that the suction and discharge pipes may be screwed directly into it, there being no necessity for elbows or other fittings.



LOWER HALF OF MOTOR, SHOWING ALSO THE HERRING-BONE GEARING

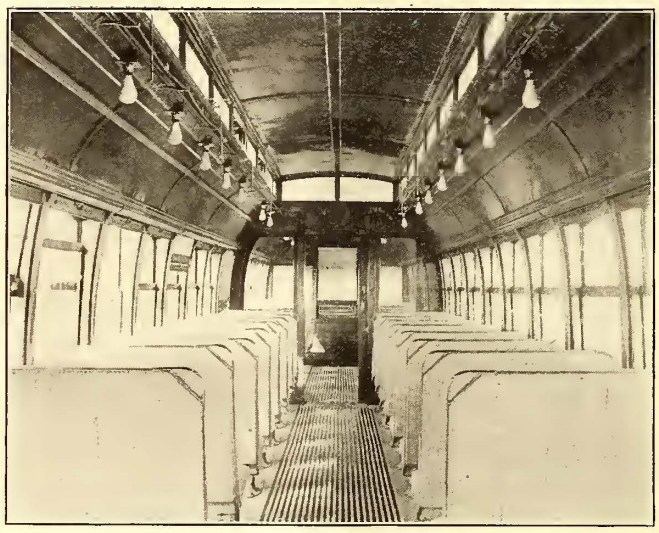
The working parts of the compressor are oiled by splash lubrication. The gear and crank move in a bath of oil contained in the crank case. The oil holes for filling the crank

case as well as the oil drain holes have been arranged conveniently and sightly. The tendency to force the oil vapor and oil out of the crank chamber into the motor bearing and armature has been avoided by providing vent holes in the crank chamber. An oil thrower on the armature shaft between the pinion bearing and the motor casing prevents oil from the bearings finding its way into the armature and fields. A minor point in the design of the compressor, but one that will appeal to the repair man, is that all the cap screws and bolt heads are of one standard size, obviating the necessity of more than one wrench in repair work.

As the compressor is designed to be hung under the car without an enclosing box, it was necessary to give some consideration to its external appearance. Projecting parts have been avoided as much as possible with the idea of improving the appearance. This new type is built in six sizes, the capacity of each size being 11, 16, 20, 27, 35 and 50 cu. ft. of free air per minute.

FINE INTERURBAN CARS FOR KANSAS CITY-WESTERN RAILWAY

The car illustrated is one of four built by the American Car Company for operation on the Kansas City-Western

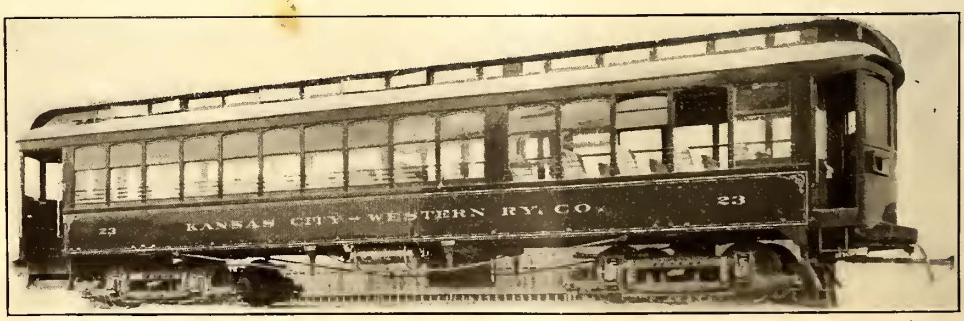


INTERIOR OF PASSENGER CAR FOR THE KANSAS CITY-WESTERN RAILWAY COMPANY

Railway, which runs between Kansas City and Fort Leavenworth, and is of the combination passenger and smoking type. Each car is equipped with four 75-hp motors, enabling a very fast schedule to be maintained. The power house is about half way between the two termini at the town of Walcott, where the company also has a car house, in the immediate vicinity of Walcott Lake, from which the water supply is obtained. The line, which skirts the river for the entire run from Kansas City to Fort Leavenworth, traverses a remarkably beautiful country, and many interesting places are passed en route, those of chief interest, perhaps, being the Soldiers' Home, south of Leavenworth, and Fort Leavenworth, just north of Leavenworth. The grounds of the home cover 640 acres, and a more pleasing site for such an institution could not have been chosen. Fort Leavenworth is also noteworthy, due to its having the most important as well as attractive military reservation in the United States. The grounds extend over 12,000 acres intersected by driveways, buildings and parade grounds. The fort has been greatly added to in recent years by improvements costing several millions of dollars. The terminus of the railway company's system is located in the very center of the post. Aside from the purely military features to be found at Fort Leavenworth, two great prisons, occupying seventeen acres, are maintained by the government, and the cars will take visitors within a few feet of the prison gates. The village of Lansing, also reached by the company's lines, is situated in a great fruit growing country and is of considerable interest owing to the presence of the Kansas State Penitentiary, unique on account of having within its walls a large coal mine which is mined by convict labor through the winter for the purpose of supplying State institutions with coal. Brickmaking supplants that industry during the summer. There are five coal mines in the vicinity in addition to this one.

The new cars seat sixty passengers—forty in the passenger compartment and twenty in the smoking compartment. The seats are of Brill manufacture and have stationary backs with head rolls. Cherry constitutes the interior finish, with ceilings of sheet steel painted and neatly decorated. In the corners of the passenger compartment are longitudinal seats occupying the space of two windows each; the rest of the seats all face forward, and as the cars are only to be operated in one direction, the front platform is arranged for a motorman's compartment and is accessible only by one door at the side. The rear platform is of the usual dimensions and is of the dropped type; the entrance steps are covered with trap doors when the folding doors are closed. The semi-convertible window system is of the Brill type, and four-barred window guards extend from end to end of the car. A substantial bottom framing is employed which consists of 6-in. I-beam center sills with pine fillers and 4-in. x 7¾-in. side sills with 15-in. x ⅜-in. sill plates in the side to which the bases of the posts are screwed; double-trussed needle beams with malleable iron truss rod struts under trusses anchored at the ends of the body bolsters give additional support to the center of the car. No. 27-E1½ trucks are used under all of the cars and have solid forged frames and noiseless brake hangers; the trucks have a wheel base of 6 ft.; wheel diameter is 33 ins.; axle diameter, 5½ ins.

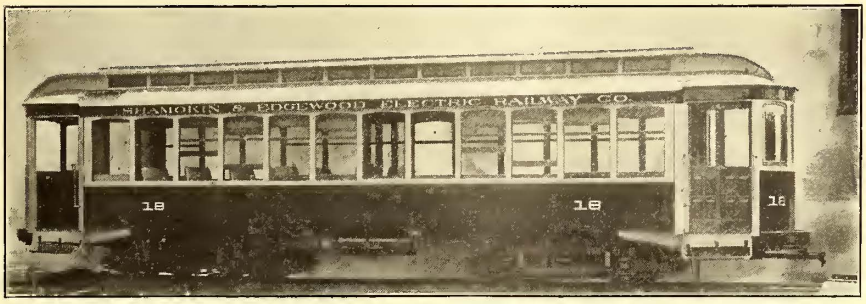
The dimensions of the cars are as follows: Length over the corner posts, 42 ft. 4 ins., and over the vestibule sheathing 50 ft. 4 ins.; length of the smoking compartment, 14 ft. 6 ins.; width over the side sheathing, 8 ft. 6 ins.; centers of the posts, 2 ft. 8 ins.; height from the floor to the ceiling, 8 ft. 5¾ ins.; height from the track to the under side of the sills, 3 ft. 2¼ ins.; height from the under side of the sills over the trolley board, 9 ft. 6⅞ ins.; from the track to the lower platform step, 15¼ ins.; height of the riders, 11½ ins. The weight of a car and trucks without motors is 35,000 lbs.



ONE OF THE NEW CARS FOR THE KANSAS CITY-WESTERN RAILWAY COMPANY

COMBINATION CARS FOR THE SHAMOKIN MINING DISTRICT

The lines of the Shamokin & Edgewood Electric Railway run through the heart of the anthracite coal region of Pennsylvania, and it would be hard to find country of a more beautiful or varied character than that met with on the run from Shamokin to Treverton, a distance of 8 miles. Throughout the entire journey the country is exceedingly hilly, the grades averaging 3 per cent. On reaching the level after a climb for about 3½ miles, descent is made into a second valley where the grade is about the same. The railway company now operates 23 miles of track, but there is a strong probability of the lines being extended to Sunbury, 18 miles from Shamokin, in the near future.

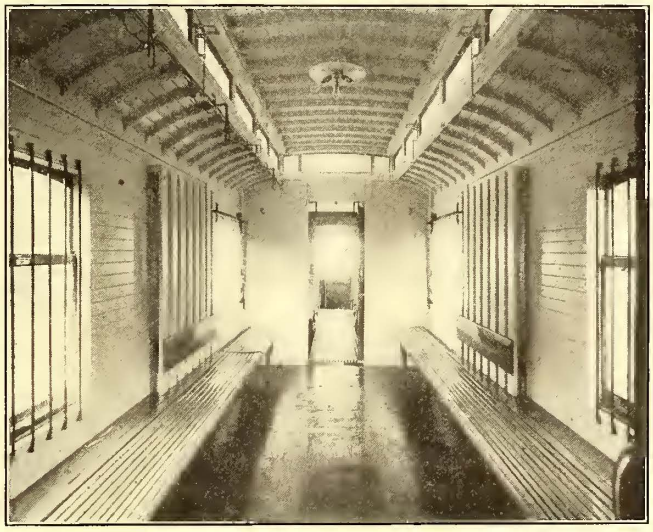


STANDARD PASSENGER CAR FOR THE SHAMOKIN & EDGEWOOD ELECTRIC RAILWAY COMPANY

The feature of the cars illustrated, which were built by the J. G. Brill Company, is the large smoking compartment in the combination passenger and smoking car and the equally large compartment for baggage in the other type of car shown, these compartments in each case occupying one-half the entire length of the car. This is due to the fact that the passengers handled consist largely of miners, and in the case of the baggage compartment with its commodious folding seats this can be equally well adapted as a smoking or miners' compartment. The chief features of the car interiors are clearly shown in the illustrations and need not be mentioned. In both cars the car builders' grooveless post semi-convertible window system is employed, and the trucks are of the 27-E1 type with a wheel base of 6 ft.; the wheels are 33 ins. in diameter; axle diameter, 4½ ins.. Four 40-hp motors were installed on each car.

The following are the chief dimensions which apply to both types of cars: Length over the end panels, 33 ft. 4 ins., and over the crown pieces and the vestibules, 43 ft. 4 ins.; width over the sills and the sheathing, 8 ft. 6 ins.; distance between the centers of posts, 2 ft. 8 ins.; side sill size, 4 ft. x 7¾ ins.; size of the end sills, 5¼ ins. x 6⅞ ins.; sill plates, ⅜ in. x 15 ins.; thickness of the corner posts, 3⅝ ins.; thickness of the side posts, 3¼ ins. Among the specialties are "Dumpit" sand boxes, "Dedenda" alarm gongs, signal bells, and angle-iron bumpers.

SMOKING COMPARTMENT OF PASSENGER CAR



BAGGAGE COMPARTMENT WITH BENCHES FOR PASSENGERS

COMBINATION PASSENGER AND BAGGAGE CAR FOR THE SHAMOKIN & EDGEWOOD ELECTRIC RAILWAY COMPANY

The Toledo Railways & Light Company is building in its shops in Toledo a very fine special car which will be used during the summer months for tours around Toledo, and during the fall and winter months for special parties and excursions either on the city lines or over the interurban lines radiating from Toledo. The car is of the heavy interurban type, designed for high speed, and is luxuriously fitted up with chair seats, smoking compartment, buffet service, etc. General Manager L. E. Beilstein, of the company, will name the car at the time of the Columbus convention of the American Street and Interurban Railroad Association, when with a party of associates and friends he will travel to the convention over the interurban lines by way of Findlay, Lima, Troy and Springfield.

FINANCIAL INTELLIGENCE

Wall Street, Sept. 5, 1906.

The Money Market

There has been a decided change in the local monetary situation during the past week, a combination of unfavorably influences sending rates for both call and time accommodations to unusually high levels for this season of the year. Money on call loaned as low as 5 per cent early in the week, but toward the close the rate worked up to 40 per cent, the highest quotation recorded for demand money at this season of the year since September, 1890: Time accommodations also ruled decidedly strong, charges for all maturities extending from sixty days to six months, commanding 6 per cent, plus commission of ¼ and ½ per cent, bringing the total charges to the borrower up to 7½ per cent in some instances. Mercantile paper reflected the advance in money rates, very little paper being negotiated at less than 6½ per cent for the very best names. The principal factor in bringing about the high rates included the extremely low bank reserves and the increasing demand for money at the principal inland cities, both for general business and for crop moving purposes. The outflow of money from New York during the past week has assumed rather large proportions, and the advance in the rate of New York Exchange at Chicago to 40 cents discount indicates an increasing demand for money at that center. The active speculation in stocks also calls for considerable money. The accumulation of money by the Government continues, the statement of receipts and expenditures for the month of August showing total receipts of $56,007,596, and the expenditures $47,848,449, leaving a surplus of $8,155,157 for the month. The high rates for money resulted in liberal offerings of finance bills by international banking houses, the proceeds of which were made available for market purposes. In fact, the proceeds derived from the sale of these bills constituted the principal supply of money during the week, local bankers being practically out of the market so far as time accommodations were concerned. The heavy offerings of finance and stock bills in the exchange market resulted in a sharp fall in demand sterling exchange to 4.8285, a rate that under ordinary conditions would have resulted in a liberal import movement of gold from Europe. As a matter of fact, however, very little gold was obtained by local bankers abroad, both the Bank of England and the Bank of France advancing their selling prices of the yellow metal in order to keep their gold holdings intact as far as possible. This action on the part of the leading institutions in Europe restricts the efforts of New York bankers to secure gold abroad in the open market, and unless rates of exchange go low enough to offset the restrictions referred to above, the prospects of obtaining relief from that source are not very promising at the present time. The engagement of gold for import for the week amounts to only $1,900,000, of which $1,000,000 was secured in the open market at London, and $900,000 in the open Paris market. Rumors of heavy engagements of gold in Australia were current, but up to the present time these engagements lacked confirmation. One very interesting point in the present situation is the probable effect of a money stringency on the enormous real estate speculation, which is in progress all over the country, and which has tied up an enormous amount of capital, and which has caused apprehension to some of the largest financial interests in the country. The situation is such as to call for relief of a practical kind, and it appears that the only source of such relief is the release of a large amount of money now tied up in the national treasury, and which could be put in circulation through deposits of public money in the national banks.

The bank statement of last Saturday showed that the clearing house banks lost $4,369,300 in cash, and that the surplus reserve was reduced $1,420,675, to $2,869,400, which total is the lowest of any corresponding period in the last seven years. In the corresponding week of last year the surplus was $5,489,875; in 1904, $47,503,400; in 1903, $17,296,975; in 1902, $4,097,050; in 1901, $6,915,875, and in 1900, $27,078,475.

Although the week was broken by the labor holiday the volume of trading averaged over one million shares each day, and the price movements were of a sensational character. The net changes show advances on many stocks ranging from 1 to 7 points, while other active issues showed losses of 1 to 3 points. Notwithstanding the large volume of business the trading was largely professional, but the public has begun to enter, and if the present pace can be maintained there would appear to be little doubt that the so-called big interests will succeed in distributing a very material line of stocks. One of the features of the week has been the disposition of certain large holders to convert securities into cash. The week's developments favored irregularity in the price movement, and included activity in and higher rates for money, the radical speech by Mr. Bryan, an unfavorable bank statement, and the sale of part of the Pennsylvania holdings of Baltimore & Ohio and Norfolk & Western to a prominent banking house, while, on the other hand, sterling exchange ruled weak, a small amount of gold was engaged for import, and it was semi-officially announced that the Great Northern ore deal has been practically concluded. The official statistics of copper metal also were counted on the bull side, the output for 1906 having been estimated at 1,230,000,000 lbs., and the consumption at 1,220,000,000 lbs., leaving a surplus at the end of the year of only 10,000,000 lbs., the greater part of which has already been sold. Rumors of a change of control of St. Paul in the interest of the Union Pacific, together with insistent talk of increased dividends on Atcheson, Norfolk & Western, Chesapeake & Ohio, and several other stocks stimulated bullish activity. The important check to public buying is the condition of the money market. Call money reached 40 per cent and time money was scarce at 6 per cent, and a commission of as much as one-half of 1 per cent. The demand for funds for crop-moving purposes is now active, and the available supply is likely to prove inadequate to meet legitimate demands and to provide for a bull speculation in stocks. The sensational developments in connection with the failure of the Real Estate Trust Company, of Philadelphia, had a bad sentimental effect. A political campaign is about to begin, in which the corporate interests will be openly attacked and socialistic and paternal policies will openly be advocated. While business conditions continue excellent and crop prospects are good, these are being, if they have not already been, discounted. Prices for stocks are high and will probably go higher, but it is time for conservatism and profit taking.

The local traction stocks have not been conspicuous, but Brooklyn Rapid Transit continues to receive good support as a result of the rebate system of fare put into effect.

At the close of the week the Secretary of the Treasury announced that, beginning on next Monday and until further notice, the Treasury will make deposits in national banks to facilitate gold imports. Bonds available for investment by savings banks in Massachusetts and New York will be accepted at 90 per cent as security pending the arrival of the gold. The actual engagement of the gold must precede the deposit, and the deposit must be paid as soon as the gold arrives.

Philadelphia

Very little activity developed in the local traction issues during the past week. The demand for these shares was not large, but in the absence of any pressure to sell, prices held decidedly firm. Interest centered largely in Philadelphia Rapid Transit, which was the leader in point of activity, upwards of 3000 shares changing hands at 28¾ to 29. Philadelphia Company common, after an early decline from 50 to 49, recovered to 49½, on transactions aggregating about 500 shares, while sales of the preferred were recorded at 49 and 48⅝. The directors of the company have decided to issue $3,240,000 of the $6,000,000 new common stock recently authorized, the rights being extended to holders of the preferred as well as the common stock. Stockholders are given the opportunity to subscribe to the new stock at par, to the extent of 9 per cent of their holdings at the close of business on Sept. 5. Ten per cent of the subscription price is payable on Sept. 21, and 90 per cent on Oct. 5. Philadelphia Traction was decidedly firm, 500 shares selling at 99⅛ and 99. Union Traction brought 64¾ and 64½ for odd lots aggregating 300 shares. American Railways sold at 53 ex. the dividend for 700 shares. It is expected that the company's gross earnings for the month of

August will show an increase of from $25,000 to $30,000 over the corresponding month of last year. The Scranton and Joliet systems are said to be showing very handsome increases. Other transactions included United Companies of New Jersey at 255 and 257, Lehigh Valley Traction at 12½, the preferred at 21⅞, and United Traction of Pittsburg preferred at 51.

Baltimore

Trading in tractions at Baltimore was extremely quiet during the past week, the bulk of the business being supplied by the United Railway issues. The free income bonds held steady, about $55,000 changing hands at 70⅛ to 69½ and back to 70, while $5,000 of the receipts, representing incomes deposited, brought 69⅛. The 4 per cent bonds sold at 91¾ and 92 for $13,000, and near the close an odd lot brought 89⅞. The refunding 5s sold to the extent of $31,000, at from 89 to 88⅝ and back to 88¾. Other transactions included 100 United Railway pooled stock at 15¼, $13,900 Maryland Trust Company income certificates at 69¾ and 70, 200 Norfolk Railway & Light stock at 17 and 18, $3,000 Norfolk Railway & Light 5s at 100, and $2,000 Washington City & Suburban 5s at 102¾.

Other Traction Securities

A further substantial rise in Chicago Union Traction preferred was the principal feature of the Chicago market during the past week. Opening at 16, the price rose to 18, and held all of the gain. About 1200 shares were dealt in. The advance was in sympathy with the upward movement in the stock on the New York Stock Exchange. There has been good buying of the stock in the Eastern market for several weeks past. The common stock was very quiet, but firm, several hundred shares changing hands at from 4¾ to 5. Other sales were: South Side Elevated at 98 and 97, West Chicago at 33, Metropolitan Elevated gold 4s at 92, and Northwestern Elevated 4s at 91. The Boston market was quiet, but decidedly strong. The principal trading was in Massachusetts Electric issues, about 500 of the common changing hands at 20¼ and 20, while a like amount of the preferred brought prices ranging from 70¼ to 71. Boston & Worcester common brought 35, and the preferred stock sold at 83¼ and 83. Boston Elevated changed hands at 149½ and 150. West End common sold at 96 and 96½, and the preferred at 108½ and 108.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Aug. 31.	Sept. 5.
American Railways	*53	52
Boston Elevated	150	150¼
Brooklyn Rapid Transit	75½	78⅛
Chicago City	160	160
Chicago Union Traction (common)	4⅞	5
Chicago Union Traction (preferred)	17¼	19¼
Cleveland Electric	70	—
Consolidated Traction of New Jersey	78	79
Detroit United	93¼	93¾
Interborough-Metropolitan, W. I.	38⅛	37¾
Interborough-Metropolitan (preferred), W. I.	78	78½
International Traction (common)	—	—
International Traction (preferred), 4s	—	—
Manhattan Railway	147	146
Massachusetts Electric Cos. (common)	19½	19½
Massachusetts Electric Cos. (preferred)	70½	70
Metropolitan Elevated, Chicago (common)	27	26
Metropolitan Elevated, Chicago (preferred)	66½	66½
Metropolitan Street	106	106
North American	93	91¾
North Jersey Street Railway	27	27
Philadelphia Company (common)	—	†49½
Philadelphia Rapid Transit	29	28
Philadelphia Traction	99	99
Public Service Corporation certificates	69½	69
Public Service Corporation 5 per cent notes	95	94½
South Side Elevated (Chicago)	96½	96½
Third Avenue	125	125
Twin City, Minneapolis (common)	115	114½
Union Traction (Philadelphia)	64¼	64½
West End (common)	—	—
West End (preferred)	—	—

* Ex dividend. † Ex rights.

Metals

The "Iron Age" says that the excitement in pig iron has quieted down somewhat, although the danger of a runaway market has not disappeared and is regarded in some quarters as imminent this fall, particularly in foundry iron. Some of the largest interests have reached their full converting capacity anyhow, and with them it is a question of supplying the finishing mills with steel rather than of feeding the steel plants with pig iron.

Copper metal rules decidedly strong. The demand for the metal, especially for electrolytic, is increasing, and prices of all grades are ⅛c. to ¼c. a pound above those of a week ago. Quotations are: Lake, 18⅞ to 19c.; electrolytic, 18⅝ to 18¾c.; castings, 18⅜ to 18½c.

THE BOSTON, LOWELL & LAWRENCE COMPANY

The Boston, Lowell & Lawrence Electric Railroad, another high-speed "interurban" electric road, has filed with the Board of Railroad Commissioners a petition for a certificate that public convenience and necessity require the building of a road through Somerville, Medford, Arlington, Lexington, Woburn, Billerica, Burlington and Tewksbury to Lowell, a distance of 22¾ miles. Like the Boston & Eastern road, it will run almost entirely upon private land, a short distance in Mystic Avenue, Somerville, being the only location in the highway. There are to be no grade crossings. The principal backer of the proposed road is Congressman Butler Ames, of the Fifth Massachusetts District, who petitioned the last general court for a special charter under which to build the road, but on account of a failure to file his petition within the specified time, the petition was not admitted by the committee on rules of the House, which referred it to the next general court. Subsequent to this the now famous "interurban" bill was enacted by both branches, under which promoters of such roads are obliged to go before the State Commssion and secure a certificate of exigency instead of getting a special charter from the Legislature.

TUCKER-ANTHONY—NORTHERN OHIO CONSOLIDATION

The plan for consolidating the Tucker-Anthony lines with the Northern Ohio Traction & Light Company will be consummated at a meeting of the stockholders of the latter company to be held Sept. 18. The lines to be merged are the Canton-Akron Railway Company, the Canton & New Philadelphia Traction Company and the Tuscarawas Traction Company. The stock of the Northern Ohio Traction & Light Company is to be increased from $7,500,000 to $10,000,000, of which $1,038,000 will be issued at this time to exchange share for share for the stock of the Canton-Akron Company. The balance of the financing will be carried out by the Canton-Akron Consolidated Railway Company, which was incorporated recently. This company is a consolidation of the three companies mentioned, and it has a capitalization of $2,500,000. It is the intention of this company also to issue the same amount of bonds bearing 5 per cent interest. Of these bonds, $535,000 will be exchanged for the existing preferred stock of the Canton-Akron Railway Company. About $600,000 will be required to retire outstanding bonds, and a percentage, probably $640,000, will be for future betterments. The Northern Ohio Traction & Light Company is to guarantee the interest on these bonds.

B. R. T. REPORT ISSUED

The annual report of the Brooklyn Rapid Transit Company for the year ended June 30 was issued Thursday morning, as the STREET RAILWAY JOURNAL went to press. It shows an increase of $2,139,883 on the gross earnings, which were $18,473,328 during 1906. There is also an increase of $1,502,376 on the net earnings, which totaled $8,031,950. The total income was $8,355,886, an increase of $1,574,176. The net income after taxes and fixed charges have been deducted is $2,742,952, an increase of $1,139,734. The net income is equal to 6.09 per cent on the capital stock of the company. Deducting charges for betterments and additions, there is left a surplus of $2,162,609, which is an increase over last year of $1,012,676. The percentage of operation to earnings is 56.62 per cent, for 1906, as compared with 60.02 per cent for 1905. An extended abstract of the report will be published in this paper next week.

THE SAN FRANCISCO STRIKE SITUATION—STRIKE DECLARED OFF

Coming as it does at a critical time, during reconstruction period in San Francisco, the strike of the employees of the United Railroads can not but be regarded as of serious import. The trouble between the company and its employees dates from the fire of April 18. The men claim to have been subjected to conditions that materially altered their mode of living and the expense thereof. The work became more exacting, due to a shortage of cars, over which the company had no control. Although the carmen's union and the United Railroads were under a contract till May, 1907, stipulating the present wages of 25 cents to 27½ cents an hour, they have asked for 37½ cents an hour, or $3 for an 8-hour day, maintaining that the present wage is inadequate and the working day too long.

The demands of the men were sent to the company on Aug. 18. The company requested that a decision be postponed until the arrival of President Calhoun, who at that time was in New York. Several communications passed between the corporation and the union, resulting in the ultimatum from the men demanding a definite reply to their demands by not later than Friday afternoon, Aug. 23. Late Friday night the company issued a letter fully setting forth its position, declaring that a decision in the matter could not be reached until Mr. Calhoun arrived, and requesting a postponement of the meeting of the union to take a strike vote from Saturday night, for which time it had been called, until after the conference between the officials and directors of the company.

The postponement was not agreed to, however, and after a protracted meeting late Saturday night, Aug. 24, the men voted to strike, although President Calhoun was due to arrive within 24 hours. This action on the part of the men is looked upon very unfavorably by the people, especially as they acted against the counsel of Mayor Schmitz, and also in violation of the arbitration agreement of the contract with the company.

President Calhoun has issued a statement to the people explaining in detail the standing of the company in the matter, and promising to use the utmost effort to resume service at the earliest practicable moment. He has also issued a statement to the men asking them to return to work pending an adjustment of the difficulties, but as the latter notice was addressed to the men, the union has refused to take any notice of it.

Meantime the business of San Francisco is being seriously hampered. Every vehicle, automobile and conveyance has been pressed into service. The business sections of the city being so widely scattered since the fire makes it extremely hard for the employer to get to work and for any retail business to be carried on. Carriages and trams are not to be had, and automobiles rent for $20 an hour.

The present strike is not the only labor trouble that the United Railroads has had since last April. In the early part of July the linemen of the United Railroads demanded an increase from the company, and when offered the choice of several compromises, struck, taking with them the inside electricians—station and shopmen, members of the Electrical Workers' Union. This strike has not been settled and is still on, although the company has replaced the men who went out and the strikers have, for the most part, secured work with other employers.

Less than a month ago the stationary engineers followed the lead of the linemen, quitting their work at 5 o'clock in the evening, just as the evening rush was beginning.

Shortly after that the trackworkers, employed in reconstruction and in the conversion of cable roads into trolley lines were formed into a union and quit work almost immediately thereafter.

An affiliation of seven unions whose members work for the United Railroads was recently organized, and the matter of a uniform working agreement taken under consideration. This has not been definitely settled yet, and the proposition remains in abeyance.

The first sign of activity from the carmen was the passing several weeks ago of resolutions addressed to the company requesting a speedy settlement of the differences with the linemen. The company replied that President Calhoun would consider the matter of their document upon his arrival.

A despatch from San Francisco, dated Wednesday, says that by a decision of the executive committee of the union the strike has been declared off, and that the men have all decided to return to their positions, prepared to resume operations on Thursday.

From the tone of the reports, it is indicated that the men realize that the whole affair was ill-advised, that the public and the press could not be counted on to uphold deliberate abrogation of contract in the face of the overtures made by the company, and more especially that the company was fully prepared to begin at once with new help a service equally as efficient as that which was given before the trouble. Although it is not stated definitely in the despatches that the question of an advance in wages will be arbitrated, it is indicated that this plan will be adopted to adjust the difference and settle the question as to whether or not, under the extraordinary conditions that prevail in the city, the remuneration for platform work is sufficient.

ELECTRIC RAILWAY PROJECTS IN WASHINGTON

Interest in electric railway matters in Washington is acute now, as a result of the many projects for new lines under way throughout the State. This is especially true of Spokane, where the City Council's time recently has been devoted to the consideration of applications for franchises for lines proposed to be built from that city into adjacent territory. The committee of the whole of the City Council by a vote of 6 to 1 has just recommended that the Council pass an ordinance granting a franchise to the Spokane-Pend d'Oreille Rapid Transit Company, which has right of way for a line from Spokane to Lake Pend d'Oreille, Idaho, 42 miles. The company will also build a spur line from Rathdrum to Spirit Lake, Idaho, 12 miles. W. S. McCrea, acting treasurer, announces that cars will be running to Hauser Junction in six months, and that the line will be completed to Lake Pend d'Oreille in a year.

Stockholders of the Lewiston & Southeastern Electric Railway Company have authorized the directors to issue first mortgage 5 per cent gold bonds to the amount of $3,000,000 on that corporation, and $2,000,000 on the Central Idaho Development Company, dated Aug. 1, 1905, and payable Aug. 1, 1936. The Scofield Company, of Philadelphia, has the contract to build 100 miles of line between Lewiston and Grangeville, Idaho. Work will begin the coming fall.

Surveyors of the Inland Empire Railway Company are in the field running locating lines between Moscow and Lewiston, Idaho, between which points the Spokane & Inland line will be pushed. The company is now clearing a site for its terminal building at Moscow. The company has just completed its line from Coeur d'Alene to Hayden Lake, 9 miles, and has four trams in operation. New equipment is being received from Philadelphia, the cars having an average speed of 37½ miles.

Charles P. Lund, executive officer of the Spokane, Cheney & Southern Electric Railway Company, announces that construction work will begin early in September on the line between Spokane and Cheney, Wash., 19 miles. The company will use the Washington Water Power Company's lines between Spokane and Hayford, 9 miles. The route from Hayford to Cheney is over low grades and has only a few curves. Detroit type motor cars will be used on the line.

A. W. Turner, of Davenport, Wash., announced in Spokane a few days ago that the Big Bend Transit Company, the line from Spokane into the Big Bend country, will be in operation the coming year. Ten miles of grade is ready for steel, and locating is being rushed to the Columbia River.

THE ATLANTA, GRIFFIN & MACON COMPANY INCORPORATED

A charter has been granted by the State to the Atlanta, Griffin & Macon Electric Railroad Company, which will operate an interurban electric railway from Atlanta to Macon. The company is incorporated for 101 years, with a capitalization of $100,000. The road will pass through the following towns: Forest, Jonesboro, Lovejoy, Hampton, Sunnyside, Griffin and Forsyth. It will intersect the following counties: Fulton, Clayton, Henry, Spalding, Pike, Monroe and Bibb. It will be 94 miles in length, not including spurs and turn-outs. According to its charter, the road will enter Atlanta over the following streets: Capitol Avenue over double tracks to Little Street, east along Little Street with single tracks to Fraser, to Rawson and Crew Street; also starting with single track at intersection of Little Street to Crew Street, to Trinity Avenue, joining the first line at Rawson Street, thence along Trinity Avenue with double track to Washington Street, to new Washington Street viaduct, to Gilmer Street, to Ivy Street, to Exchange Place and then to N. Pryor Street, where it will end. The incorporators are as follows: N. P. Pratt, W. A. Wimbish, Clifford L. Anderson, Edwin P. Ansley, Atlanta; W. J. Massee, J. T. Moore, Minter Wimberly, W. J. Kincaid, James M. Brawner, Seaton Grantland and N. B. Drewery, Griffin.

NEW ENGLAND STREET RAILWAY CLUB OUTING

The September outing of the New England Street Railway Club was scheduled for Thursday, Sept. 6, 1906. Arrangements were made for visiting the power plants of the Boston Elevated Railway Company and the gas plant of the New England Gas & Coke Company. The program issued by the secretary was as follows: The party will assemble at Sullivan Square, Charlestown, in school room of the Boston Elevated Railway Company, at 8:15. At 9:00 o'clock there will be a talk by Paul Winsor, president of the club, on "Gas Engines and Gas Plants." At 9:30, through the courtesy of the Boston Elevated Railway Company, special cars will be boarded for the Somerville power station, where an opportunity will be given the party to inspect the newly-installed gas plant. At 10:15 a. m. the party will leave the Somerville power station for the Medford power station, where another gas plant has recently been installed. At 11:15 a. m. they will leave the Medford power station for Everett, where the plant of the New England Gas & Coke Company will be inspected. At 12:30 p. m. special cars will be boarded for Revere Beach. Here a fish dinner will be served at 1:45. After dinner, through the courtesy of the Wonderland Company, the members will be admitted to the following attractions: "Shooting the Chutes," "Descent to Hell Gate," "The Fatal Wedding" and "Fighting the Flames."

POTTSVILLE COMPANY NOT AFFECTED BY REAL ESTATE FAILURE

It is said in Philadelphia that the suspension of the Real Estate Trust Company of Philadelphia will not seriously affect the Eastern Pennsylvania Railways Company. At the time of the suspension the Real Estate Trust Company held a trust fund in connection with the consolidation which was considerably under $100,000 in amount. This, however, will no more than temporarily inconvenience the Railways Company, because it is presumed that as soon as the trust funds are freed it will get its money. The latter was in a trust fund, and it was not an ordinary deposit. Aside from its relation as a trustee, the Real Estate Trust Company is stated to have no connection with the Eastern Pennsylvania Railways Company. The work of accomplishing the physical consolidation and improvement of the properties owned by the company will, therefore, not be interfered with.

TRAFFIC ARRANGEMENT CONTROVERSY AT TOLEDO

The Toledo, Port Clinton & Lakeside Railway Company and the Toledo Railways & Light Company are engaged in a controversy over a traffic arrangement for entrance of the cars of the former company into the city over the tracks of the latter. Heretofore the Port Clinton road entered Toledo over the Lake Shore Electric. Now it is building its own entrance to connect with the Starr Avenue line of the city company, but the traffic arrangement which the city company offers is not satisfactory. The terms offered are said to be a sliding scale beginning with 4 cents per city passenger and reducing to 2½ cents after a term of years. These terms are said to be unsatisfactory to the interurban company, which threatens to start condemnation proceedings for an independent entrance to the city.

CHICAGO TRACTION NOTES

As a consequence of the protest of Maurice F. Doty, city superintendent of transportation of Chicago, against the lack of brake connections between motor and trail cars, the use of trail cars will be discontinued as far as possible on the Madison Street and Milwaukee Avenue lines, recently equipped with the trolley. Double-truck cars will be used instead.

In order to hasten street improvements which have been held up because of the lack of rails of a special pattern specified by the city, the Commissioner of Public Works is endeavoring to secure such rails from the rolling mills. It is reported that his efforts have been rewarded by the discovery of 200 tons of rails of the desired section in Pittsburg.

The city superintendent of transportation is endeavoring to secure a special investigation by the grand jury of recent street car accidents. During the summer, is is reported, twenty-four persons have been killed, and 285 injured. As a means of lessening accidents the following recommendations are made by the superintendent:

The City Council should pass the schedule, fender wheel guards and overcrowding ordinances now before the transportation committee.

"Waiting for time," in the loop district should be prohibited.

The cars should stop on the near crossings only, in the loop district, or two cars should load and unload together at the far crossings during the rush hours.

Cars should be so routed as to run on the proper side of the street.

The companies should be compelled to furnish enough helpers at stub ends to prevent blockades by switching cars rapidly.

It should be made a penal offense for conductors to give the signal for motormen to start the car while a person is partly on or partly off the car.

The company should be compelled to broaden the curves so that the long cars will not block traffic, as at Madison and State Streets.

Steps should be taken to prevent cars being run by men who have been without proper sleep or rest.

The companies should be compelled to employ a sufficient number of track and car repairers and inspectors to keep the cars and tracks in proper condition.

The majority of the accidents in the last fifty days, according to a report made by the superintendent, were caused by passengers alighting and boarding moving cars, forty-six people having been injured in this way. Forty-five people were hurt in crossing before cars, and forty-five vehicles were struck by street cars. Cars starting before the passengers were safely on or off caused thirty-seven accidents, and fourteen accidents each were caused by improper fenders, sudden moving of cars, and people being struck by passing vehicles while on the footboard.

NEW PUBLICATIONS

"Handbook Relating to Bare and Insulated Wires and Cables." By Joseph W. March. Seventeenth edition. Standard Underground Cable Company, Pittsburg, Pa. Cloth, 228 pages, 3½ ins. x 7½ ins. Price, $1.

The mammoth manufacturing companies of to-day with their great staffs of specialists possess exceptional opportunities for bringing out valuable publications relating to their products. Some of the publications thus issued have become so favorably known that they are now standard books of reference despite their trade origin. Of a kind with these is the wire and cable handbook which the Standard Underground & Cable Company publishes from time to time and of which the seventeenth edition has been just issued. Owing to the great expense incurred in preparing this publication, free copies are being sent only to the customers of the company.

The new handbook differs from former ones in having a greater number of illustrations, numerous half-tones in place of line cuts, a very large amount of text relating to subject matter not previously touched upon, and in having all text relating to the same subject matter re-written, revised and brought up-to-date. The book, as a whole, is divided into six sections: Price list; telegraph code; description of products; working directions; testing directions, and general and electrical data.

The first section is almost entirely for use of customers and for persons contemplating the purchase of cable. The telegraph code is perhaps of little more general interest on account of the scarcity of telegraph codes covering such ground. The third section is devoted in large part to description of the company's own products, but in various places throughout the text there is information which applies to wires and cables in general.

The fourth division, namely, working directions, gives suggestions and instructions for the installation of conduit and cable systems, not only taking up the design, but also the details in connection with the actual installation. This section should be of great interest to engineers who are laying out conduit and cable systems as well as to those in charge of the construction. The fifth section discusses small conductor cables giving information relating to tests for open and cross-wires and for tests on insulation resistance and electrostatic capacity. It also treats of the usual tests on power and light cables.

The last section, namely, general and electrical data, has so much information of general nature included that it is rather difficult to pick out that which will prove of most general interest. The pages noted below, however, will give some idea of the nature of the contents.

On pages 173 to 176, inclusive, are data relating to size of conductors for single-phase and multiphase systems, including a table of reactances; on page 177, a table of charging currents; on page 178, a table of sparking distances giving the results of a long series of tests by Henry W. Fisher; on pages 180 and 181, a valu-

able table giving relative insulation resistances and the relative electrostatic capacities of cables of practically any size and insulation; on page 182, data relating to insulation resistance and electrostatic capacity of various mediums, with change of temperature; on pages 192, 193, 194 and 195, data relating to the current and energy carrying capacity of electric light and power cables, used in underground conduits, which should be of the very greatest service to engineers designing conduit and cable systems; on page 195, data concerning the inter-relation of capacity of multi-conductor cable; some very interesting information compiled from a number of different sources on the properties of lead which enters so largely into the manufacture of underground cable, and important facts on rubber; on pages 196 to 202, relative cost of underground and aerial construction.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED AUG. 28, 1906

829,390. Trolley Harp; Benjamin L. Dresser, Uxbridge, Mass. App. filed Sept. 14, 1905. The trolley harp is made in two parts bolted to one another and having an intermediate channel by which they are engaged upon the trolley pole. Spring detents are provided for locking them in such relation.

829,403. Finger Contact for Electric Controllers; Francis E. Imeson, Thornaby-on-Tees, England. App. filed April 3, 1906. The finger has a wheel or roller at its extremity, the periphery of which is engaged by a blade spring to make the electric contact. The rotation of the roller insures a new surface, and carbon tips are provided to take the arc.

829,416. Third-Rail Insulator; John J. McGill, Chicago, Ill. App. filed Dec. 14, 1905. A cylindrical vitreous block is beaded at each end to receive specially formed malleable castings which are bolted around the beaded portions to form the base and the rail support respectively.

829,418. Track Cleaner; William A. McNair, Detroit, Mich. App. filed Oct. 30, 1905. All of the cars are designed to be equipped with a snow plow hinged at its central portion so as to be capable of throwing all the snow to one side, or throwing it on both sides as desired.

829,446. Derailing Device; Owen J. Travis, Denver, Col. App. filed April 26, 1906. A flange plate is pivoted on a vertical axis adjacent to the rail so as to swing horizontally over the same when desired.

829,557. Motor Suspension; John E. Webster, Pittsburg, Pa. App. filed Jan. 3, 1906. An improvement in "nose" suspension for motors by means of which the usual projection on the motor frame is spring impelled downward against the cross beam to prevent any backlash.

829,606. Railway Signal; Robert J. Sheehy, New York, N. Y. App. filed May 5, 1903. A form of signal system having the usual insulated block sections, and so arranged that the proximity of trains, either approaching or following each other, is indicated for either direction of travel without the use of any electrical conductors between blocks except the rails upon which the trains run.

829,630. Switch; Roy V. Collins, New York, N. Y. App. filed July 13, 1903. A mechanical movement by which a switch point is positively moved, first in one direction and then in the other by successive actuations of a power solenoid. Has two specially slotted cam plates which co-operate with one another by movements in two directions.

829,641. Trolley Harp; David J. Etly, Pittsburg, Pa. App. filed Dec. 13, 1905. The trolley harp has a pair of spring plates projecting upward therefrom on either side of the trolley wheel so as to be depressible when passing guy wires, hangers, crossings, etc.

829,675. Street Car Fender; Ernist H. Schulze, Kansas City, Mo. App. filed Jan. 27, 1906. A supplemental fender is provided in the rear of the usual fender and normally held in raised position by a detent. When the main fender engages an object the supplemental fender is automatically dropped.

829,783. Block Signal System; Max R. Hanna, Schenectady, N. Y. App. filed March 10, 1905. Designed for use with signal systems where the power circuit is alternating and the signal circuit is direct current. In order to avoid disturbance of the signals by stray alternating currents, the patentee has small motors for signal relays, the poles of which are circumscribed by copper rings which act to choke off any flux produced by the alternating magnetomotive force from the power current, but which have no effect on the flux due to the signal current.

829,794. Controller; Hermann Lemp, Lynn, Mass. App. filed Dec. 18, 1905. The controller has a stop to limit its throw in either direction so that it will not be intentionally moved to braking relation, but a button on the handle is provided to make this stop ineffective when desired.

829,822. Trackless Trolley; Montraville M. Wood, Schenectady, N. Y. App. filed Feb. 23, 1905. The vehicles draw after them, by a flexible cord connection, small carriers which run on the trolley wire. When the two vehicles meet and pass one another the carriers are interchanged, so that no two carriers ever pass one another on a single wire.

829,842. Kinetic Solenoid; Benjamin F. Carpenter, Roselle Park, N. J. App. filed May 12, 1904. The power solenoid has a loose joint connection with the switch point so that the solenoid has a certain movement before the resistance is felt, and imparts a hammer blow to give greater efficiency.

829,845. Fluid Pressure System; Fred B. Corey, Schenectady, N. Y. App. filed Feb. 2, 1903. When the main switch is thrown by the automatic devices controlled by the reservoir pressure, a valve is opened admitting air to a special cylinder which actuates a starting rheostat for the motor.

829,861. Supplemental Car Step; Arthur F. Elkins, Ironton, Ohio. App. filed Dec. 13, 1905. The lower step is carried by the piston of a downwardly acting pneumatic cylinder.

829,864. Safety Indicator for Elevators and Traction Cars; Robert H. Gaylord, Pasadena, Cal. App. filed Sept. 29, 1905. In order to warn passengers against entering a car when the same is about to start, the patentee has semaphore signals at the gates which drop the instant the power current is turned on.

PERSONAL MENTION

MR. C. V. MILLS, formerly general manager of the Chester Traction Company, of Chester, Pa., has been appointed manager of the Union Electric Construction Company, of Philadelphia.

MR. JOHN N. AKAMAN, general passenger agent of the Public Service Corporation of New Jersey, has been appointed general superintendent of the South Jersey division of the company, with headquarters in Camden.

MR. ROBERT DITTENHAVER, of Toledo, formerly passenger and freight agent of the Toledo & Indiana Railway and later with the White Star Line, has been appointed auditor of the Ohio Central Traction Company, of Galion, Ohio, succeeding Mr. A. T. Long, who resigned on account of ill-health.

MR. THEODORE STEBBINS, formerly general manager of the Columbus, London & Springfield Railway Company, is to take an extensive trip in South America in the J. G. White interests. He will visit Jamaica, Colon, Panama, Lima, Lake Titicaca, La Paz, and probably also Santiago, Valparaiso and Buenos Ayres. He will be accompanied by Mrs. Stebbins, and expected to sail from New York on Sept. 7.

MR. M. F. WESTOVER, secretary of the General Electric Company, is interested in the organization of the Adirondack Murray Memorial Association, of which he has accepted the secretaryship. The objects of the association are the erection of a monument to the late Mr. Murray at his burial place, and in other ways to perpetuate his memory. Any one can become a member by the payment of a small fee.

MR. J. MANCHESTER HAYNES, for years identified with the business and political history of Maine, died Sept. 1, after a long illness, from a complication of diseases. He was sixty-seven years old. Mr. Haynes was president of the Augusta Trust Company, president and promoter of the Augusta, Gardiner & Hallowell Electric Railway, and a director of many other Maine companies. He was interested largely also in shipbuilding. In 1879 Mr. Haynes was president of the Maine Senate, and in 1882 he was Speaker of the House of Representatives. He was a delegate to the Republican National Convention which nominated Blaine and Logan in 1884. He leaves a widow and three children.