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Of this issue of the Street Railway Journal 8250 *copies are printed. Total circulation for* 1907 *to date,* 73,650 *copies, an average of* 8183 *copies per week.*

Making Drawings of Shop "Kinks"

The great majority of electric railways are constantly using home-made contrivances in their repair shops, but in very few instances are there kept any drawings or dimensional sketches of these "kinks" and appliances. Local conditions create the demand for various handy contrivances, and often the man responsible for a clever idea in the shop has neither the time nor the drafting ability to prepare even a simple sketch of the device. It would seem that some one connected with the company, however, ought to be charged with the duty of making at least a rough sketch for the sake of having a complete equipment record if nothing more. Sometimes a photograph is even better for the purpose.

Master mechanics come and go, and so do the foremen of shop departments. Handy devices are usually rugged in character, but they wear out sooner or later and their replacement or improvement is much easier if a workable sketch of the device when new is on file. A contrivance full of merit—possibly some testing device with more or less complicated wiring—may give out some day long after the man responsible for it has left the company, and if a simple drawing of its essential parts is on file, there is less danger that a good idea will be lost. The saving of time when patterns and castings are required is well worth the trouble of making the sketch. A note book full of such drawings would be a mechanical treasure, and the exchange of small blue prints by visiting officials a source of mutual profit and lasting benefit.

Team Work in the Power House

The cost of labor per kilowatt-hour of output is an important division of power-house expenses, and its reduction to the minimum consistent with good service is admittedly desirable. Sometimes this means the payment of exceedingly moderate wages and the operation of long shifts; in other cases it signifies the encouragement of initiative on the part of employees in the plant, a genuine interest in the operating man's welfare and a desire to reward good work by the payment of bonuses for records in fuel economy, speedy repairs and minimum interruptions to service. Without attempting to specify desirable and undesirable wages—and the conditions of few plants are alike in this respect—it is none the less profitable to consider how team work in the power house can be insured.

The discussion of personal relationships is naturally a delicate matter, but it is certainly true that the men at work on different shifts must work in harmony with one another and with the wishes of the engineer in charge of the plant if the best results are to be secured. The chief engineer of a plant should have considerable executive ability and breadth of mind; he should be freed from the petty jealousies so common in shops where a low standard of esprit-de-corps prevails. Whenever it is possible, promotions should be made from within the plant, and when it is necessary to employ a new engineer from without, the advent of the new man should not be a pretext for letting all his friends come in and replace the old force, provided the latter is doing its work squarely. Men cannot always work together in perfect harmony; in such cases it is better to make a change in the shifts than to perpetuate discord.

Relatively to the whole number of employees, the forces in the power plants and sub-stations of an operating road are few in numbers, and it should therefore be much easier to watch their records and adjust their difficulties than in the case of car service men. Power plant operators are

thrown closely together in their work, and the personal equation makes more difference than in some other branches of the transportation industry. Given a management which is interested in the individual power house employee, which encourages him to become more valuable and better his condition, which listens patiently to his suggestions, and which endeavors to put itself in the place of the man behind the switchboard, stoker and throttle, the seed of co-operation is sown and team work becomes a direct probability. Of course, the power house attendant on his part must "make good"; poor material must either be strengthened or weeded out, and lack of interest in the company's welfare must be suitably condemned. Welfare work must not have a charitable aspect; it is better to begin at the pay envelope than to put the same money into a power house roof garden. On the other hand, uncomfortable lavatories, the absence of hot water for washing and pure cold water for drinking, the omission of lockers and other plain, every-day conveniences are negligences which ought not to be perpetuated. The root of the whole matter lies in the mutual appreciation of management and employees, in liberality on the one side and loyalty on the other.

The Ventilation of Repair Shops

The relation between the productive efficiency of a set of repair shop employees and the ventilation of the premises where they work cannot be expressed in other than general terms, but it is clear enough that a shop with a well-designed system of fresh air supply will make a better record in volume of work turned out than one in which no special attention has been given to ventilation. The best quality of work needs comfortable conditions for its execution, and fresh air is quite as desirable in the long run as good lighting.

Fortunately in street railway shops the employees are seldom crowded together to a degree which makes for unhealthy conditions. The character of the work is such that a large area is required for its proper conduct; trucks, motors, car bodies and the heavier equipment of electric railway service are all relatively bulky. At the same time there is a tendency for the air in the paint shop to become impregnated with volatile odors which should be carried outside the building, for the air in the machine and erecting shops to become saturated with the oily distillate which marks the continued use of machinery, and for the air of the blacksmith shop and brass foundry to hang heavy with smoke from the forges and the dust of the anvil. Although none of these conditions may be actively injurious to health, they all tend to vitiate the exhilarating effect of the air, and to slow down production in much the same way that a slight drop in voltage reduces the schedule speed on a line with insufficient feeder capacity.

The ventilation and the heating problems are tied so closely together in the modern repair shop that one cannot well be considered without the other. In climates where considerable artificial heating is needed to offset the cold weather outside the building the scheme of passing the air through a set of steam coils and delivering it to the various parts of the shop under the power of a motor or engine-driven fan is a thoroughly effective means of combined heating and ventilating. The cost of suitable ducts is not serious, and the control of the air supply is flexible and simple. A fair average allowance is 100 to 150 cu. ft. of space per linear foot of steam coil, according as exhaust or live steam is used in the latter, provided all the air is taken from out of doors. If practically all the air is returned from the building the amount of space per linear foot of pipe may run as high as 190 to 200 cu. ft. The larger the shop the smaller will be the radiation from the wall surface in proportion to the total contents. For figuring the size of fans, three or four changes per hour are about as many as are needed, even in a shop with a large number of employees.

It is seldom necessary to install a general system of exhaust ventilation in a railway machine shop if provision is made for the influx of plenty of out-of-door air. In the blacksmith shop and brass foundry special exhaust fans are well worth their cost. Recent wood-working shops for railway service have been quite generally equipped with fans and ducts for exhausting shavings and chips, sawdust and dirt from the machinery and carrying the debris away to be burned. The cost of power is so low on any well-managed street railway that no one should hesitate to experiment with improved ventilation facilities if the present conditions are inferior.

Fenders and Brakes

An attempt is made in the March number of one of the most sensational of the 15-cent popular monthlies to pillory all of the street railway companies of the country for an alleged disregard of safety appliances in the equipment of their cars. Foreign street railway companies are held up as exhibiting examples of what American companies should copy in this particular, especially so far as fenders and brakes are concerned. Statistics of the larger payments for accident claims in this country than abroad are quoted in defense of this claim. The article of course bears its own refutation on its face because the very much larger damage payments made by American companies and the far stricter accountability to which the courts hold American companies for accidents, to which we have frequently referred in these columns, make the question of the proper safety devices a very much more important one, both in theory and practice, in this country than abroad.

Now we believe thoroughly in the idea that in many respects American street railway companies can gain valuable hints on electric railway practice from what their confréres are accomplishing across the water, and for this reason we have given a great deal of space to describing foreign methods; but we believe that less can be learned from European practice in connection with fenders and brakes than in almost any other direction. The principal considerations in the selection of a proper fender are the average speed and weight of the car to be equipped, the condition of the pavement between the rails, the type of car and the traffic congestion on the street. The first determines the distance traveled by the car after braking and also the impact with which the fender strikes the person to be picked up; the second fixes the height at which the fender can be carried over the pavement; and the type of car, whether single or double-truck, settles to a large extent the type of fender, because with a teetering single-truck car the platform fender is obviously at much greater disadvantage than on a double-truck car. Finally, the congestion on the

street obviously also has a great deal to do with the possibility of using a platform fender which requires a clear space in front of the car of several feet instead of a wheel guard which is protected under the front platform from damage.

Now, in all of the points mentioned European street railway practice differs radically from that followed here. Considering first, speed, the rates in general use are very much lower than in this country. In Great Britain speeds are fixed by the Board of Trade upon the recommendation of its respective officers, and have regard to the circumstances affecting the several routes, such as grades, density of traffic, etc. Unless such circumstances are especially favorable a speed not exceeding 8 miles an hour is generally prescribed. Irrespective of the wishes of the inhabitants of any city, the street railway is bound to these rates of speed and managers of municipally owned systems are liable to prosecution upon the complaint of any citizen, if they exceed these rates, even if the excess is approved by the mayor and entire common council. A great deal is said in the article about the tremendous merits of the Liverpool fender. We do not wish to disparage this device, but in connection with this question of speed think it only fair to point out that up to within a comparatively short time the average speed of the electric cars in Liverpool was limited by the Board of Trade rules to 5.8 miles per hour.

Taking up the second point mentioned in connection with fenders, the pavements in European cities are kept in a much more level condition as a rule than in this country. This is due partly to the better municipal governments, partly to the lower price of ordinary labor and partly, no doubt, to the fact that, in the older cities especially, the sidewalks are so narrow that people habitually walk in the streets. Owing also to the narrow and crooked streets single-truck cars are the rule, not the exception as in this country.

We see, therefore, first, that each of the four considerations cited drives the European company to the use of a wheel guard rather than to a platform fender, and second, that the conditions so far as speed, weight and type of car employed, are so entirely different from those in this country as to afford no guide for the use of either appliance here. As a rule the European wheel guard is rather a crude affair, somewhat similar to that formerly used on cable cars in this country, though ample probably for the speeds and conditions under which it is used. The low accident records on the British roads are certainly not due, therefore, to the use of the Liverpool fender, as would be inferred from the article mentioned. In fact this fender is by no means accepted as essential or even desirable in its home, and the British Board of Trade, while not specifying any particular type of fender or life guard, says in its rules that it "prefers one of the trigger type," a form which in the magazine article is condemned as inadequate. In Germany practically all of the companies use simply the old cable wheel guard or track scraper, as it is called there, with the addition in some cases of a spring buffer on the front dash to cushion the shock of a blow.

The question of brakes is based largely upon the same conditions as those cited for fenders. With single-truck cars the rule, and traveling at speeds but slightly in excess of those used by horse cars, a very different type of brake is possible than under American conditions. It is somewhat of a coincidence, however, that the particular type of brake recommended in the magazine article was the one with which the car involved in the Highgate accident in London on June 25, 1906, was equipped, and in the official inquiry on that accident by Lieut. Col. Yorke, of the Board of Trade, the use of a brake whose operation depended upon the rotation of the wheels was practically condemned. The German types of electric brake, which are also commended in the article, are not unknown here. They have been tried extensively, particularly in the form of the disc brake, but have been abandoned, principally because of the load put upon the motors.

A great deal of stress is laid in the magazine article upon the alleged smaller percentage of accidents abroad both on a car-mile and passenger basis. But comparisons of the number of reported accidents are deceitful unless compiled upon the same basis. It is said, for instance, that in 1903 the number of fatal street railway casualties in London was only 10, but unless we know what accidents were attributed to the cars and what to contributory negligence on the part of the injured person, the comparison is valueless. The tendency abroad is to hold the individual much more strictly accountable than here. An instance is afforded in a case which we reported some time ago from Australia, where a man attempting to drive across an unprotected grade crossing was struck by a train and narrowly escaped with his life. but was haled to court and fined 20 shillings for obstructing travel. Many American accidents are undoubtedly due to the practice, common among passengers here but forbidden by law in most European countries, of getting off and on cars while they are in motion. Thus the New York State records show that during the year ending June 30, 1904, or that corresponding to the London year quoted above, this cause accounted for 23 of the 24 total number of fatalities to passengers in the State. Our laws do not hold the companies liable for accidents occurring from this cause but the number goes to swell the total. In the same way, of the entire fatalities that year to passengers, employees and others, only three, according to the Commissioners' report, were not caused by the individual's own misconduct or incaution. Yet the roads in New York State carried over four times the number of passengers transported by those in London during the corresponding period.

The concluding claim in the article, that street railway managers pay no regard to the safety of the public in the operation of their cars, is a gratuitous insult to the industry as a whole, and to the Boston, New York and Brooklyn companies which are mentioned in particular. There are none whose standing is higher in this country for broad-minded administration and lack of parsimonious dealing. American managers through State and national associations, as well as individually, are working in every way to better their service, and no subject attracts more attention at a convention than one on methods to reduce accidents. It necessarily must be so in a country where the negligence law is construed so strictly against the railway company as here, and any statement to the contrary is a perversion of facts. We prophecy that the attack will fall as flat as the others in which the same magazine has engaged in the past.

THE ELEVATED SHOPS AND TERMINALS OF THE BROOKLYN RAPID TRANSIT COMPANY—MANUFACTURING METHODS, STORAGE, EMPLOYEES AND ACCOUNTING AT EAST NEW YORK *

THE MACHINE TOOL DEPARTMENT

The machine tool department occupies the east bay or Gillen Place side of the lower floor of the main shop building, running parallel with the west bay taken up by the truck-overhauling shop. To take full advantage of the natural illumination, there are no partitions of any kind between the two shops. As the side of this building facing

Form N. S. 188 △ 250 Pads 10-5-6 O—85000

BROOKLYN RAPID TRANSIT SYSTEM

ORIGINAL

MACHINE SHOP ORDER NO.

..... 190

This work should be completed by..... 190

Signed: Charge to.....

Approved:

Head of Dept. Requiring Work Done.

Foregoing described work to be done at.....Shop

Do not write in this space)

Superintendent of Equipment.

Order sent to Shop.....

Sent to V. P. and G. M. for Approval.....

Sent to Comptroller for Approval.....

DIRECTIONS

This order must give a brief description of the work desired and should give enough information to enable one to promptly and properly furnish what is required. All four copies are to be sent to the Supt. of Equipment after approval of Head of Dept. requiring work done and the quadruplicate (pink sheet) will be returned with the number of order thereon when same is sent to the shop

FIG. 35.—MACHINE SHOP ORDER MADE OUT IN QUADRUPLICATE FOR MANUFACTURING WORK TO BE DONE AT THE EAST NEW YORK SHOPS FOR OTHER DEPARTMENTS

Gillen Place is made up almost entirely of windows, no better location could have been found for a department where so much machine tool work must be done. Along the full length of this side, facing the windows, there is a 3-in. hard maple work bench for the performance of minor machine work.

In this shop considerable manufacturing is done for other departments of the company besides that required in connection with the maintenance of the elevated rolling stock.

When another department of the company desires to have a job done by the machine shop, an order of the type shown in Fig. 35 is made out in quadruplicate on different colored sheets and sent to the superintendent of equipment's office where it is assigned a machine-shop order number. The original is retained in this office, the duplicate sent to the shop doing the work, the triplicate to the comptroller's office and the quadruplicate to the department ordering the work. For instance, the track department may desire to have tools sharpened, plates drilled and other work performed for which it has no machinery. If the work is of such a character that the proper charge account cannot be assigned in the shop, the comptroller's office is asked to decide that point. When the job is completed the same office also checks up the time spent as shown by the employees' time card. This procedure is the usual one, except for rush orders, in which case the work may be started on a telephone order as soon as the superintendent of equipment's office has assigned the proper number. This telephone order is followed by the regular written forms as confirmation.

All orders received by the machine shop are entered in a book containing columns for the order number, date, date received, signer, charge, foreman, material to be made up,

THE BROOKLYN HEIGHTS RAILROAD COMPANY ELEVATED DIVISION ..... SHOP

REPORT OF PRESSING ON OF NEW WHEELS OR RENEWAL OF STEEL TIRES

Wheel No	Tire No
Make of Wheel	Make of Tire
Wheel Fitted By	Tire Fitted By
Pressed On By	Outside Diameter
Tons Pressure	
Axle No.	
Make of Axle	
Diameter of Axle	
Fitted By	Date 190
Inspected By	

Foreman

FIG. 36.—REPORT OF PRESSING ON OF NEW WHEELS OR THE RENEWAL OF STEEL TIRES

THE BROOKLYN HEIGHTS RAILROAD COMPANY. ELEVATED DIVISION ..... SHOP

REPORT OF TURNING STEEL TIRED WHEELS

Wheel No

Received From ..... Shop 190

Reason For Turning

Measurement (Circumference) Before Turning

Measurement (Circumference) After Turning

Tire Loss (Calipered)

Work Done by ..... Date 190

Inspected by

Foreman

190	190	190
Date	Date	Date
No. of Wheel Scrapped	No. of Axle scrapped	No. of tire Scrapped

Reason for Scrapping

FIG. 37.—REPORT COVERING THE TURNING OF STEEL-TIRED WHEELS AND THE NUMBER OF WHEELS AND AXLES SCRAPPED

date completed and date delivered. The orders themselves are kept on two files, one for the completed jobs and the other for those still under way. If a requisition calls for work that must be divided among several foremen, copies of their part of the order are given to each so the order can be filled without loss of time.

The amount of wheel work done in this shop for this and other traffic divisions is very extensive so that careful records are essential. The two wheel forms shown in Figs. 36 and 37 are both for the elevated division. Fig. 36 is made out for pressing on new wheels or the renewal of steel tires, and Fig. 37 covers the turning of steel-tired wheels. It will be seen by examining these reports that they are capable of being developed into elaborate records of the cost, life and maintenance of wheels and axles. Such detail work is not done in the shops, however, but in the office of the superintendent of equipment. In connection with this outside work, the machine shop has a thrice-a-week

* See Street Railway Journal, Feb. 2 and 9, 1907.

delivery to other departments. Delivery cars are used on both surface and elevated divisions. All cars are specially constructed for this work and are fitted with derricks and other means for handling heavy materials.

The machinery installed in this shop, although very extensive in its scope, is new only in part, as many of the tools were formerly employed as belt-driven machines in older elevated railway shops. Some of these have been remodeled for motor-drive, while others are still running as belt-driven machines where the latter method of operation is better. This condition applies also to the tools in the mill room, as described elsewhere in this article.

The arrangement and driving of such a collection of tools as used in this installation required much preliminary study and a few changes after the plans were put into practice. For the sake of convenience all tool combinations driven from one countershaft are identified by a group letter, such as A, B, C, etc., and all the tools, whether group-driven or not, are assigned certain numbers. Records of all of these shop tools and motors are kept in the office of the superintendent of equipment. In the accompanying plan, Fig. 40, there are two groups, A and B, in this shop besides the independent driven tools. All of the motors throughout the shops are of Northern Electric manufacture unless otherwise mentioned.

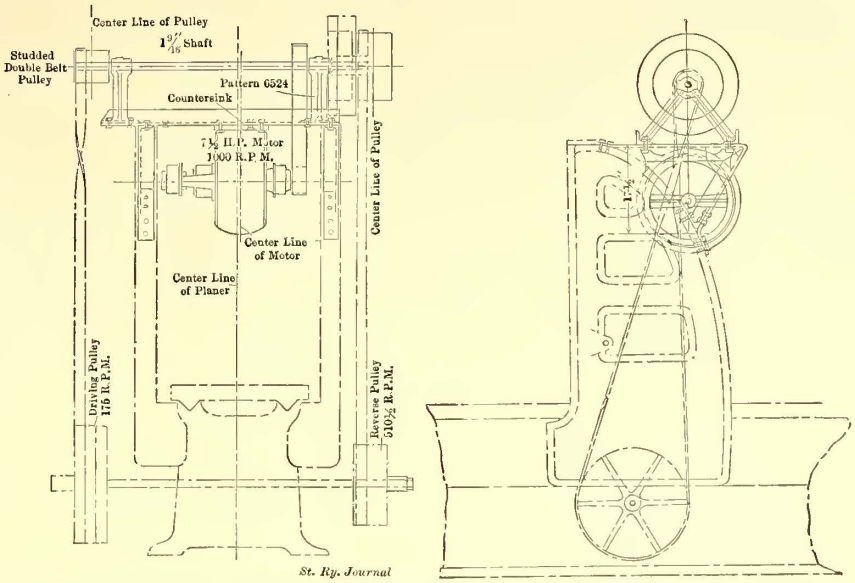


FIG. 39.—FRONT AND SIDE ELEVATIONS OF PLANER WITH REVISED DRIVE, ILLUSTRATING PARTICULARLY THE MANNER OF MOUNTING THE MOTOR OVER THE BED OF THE MACHINE

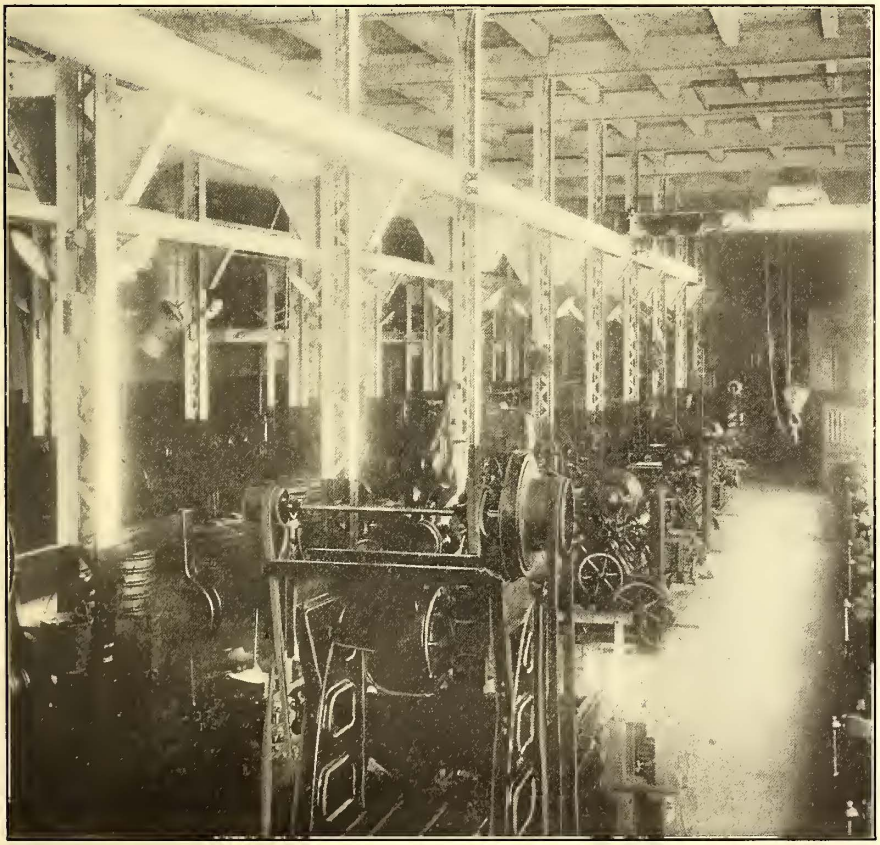


FIG. 38.—LOOKING DOWN ONE OF THE MACHINE SHOP BAYS ON THE GILLEN PLACE SIDE

The following tools were changed over from belt to independent motor drive: No. 1, Pond wheel lathe with a 15-hp motor; No. 3 and No. 4 Bement-Miles wheel lathes with 10-hp motors each; No. 11, L. W. Pond iron planer, 30-in. bed, and 12 ft. long, with a 7½-hp motor; No. 12, Perkins 22-in. engine lathe with a 2½-hp motor; No. 14, New Haven 36-in. lathe with a 5-hp motor; No. 15, McCabe double-spindle 26-in.-48-in. lathe with a 5-hp motor; No. 16, Bement-Miles 5-ft. radial drill with a 2½-hp motor. Of the tools in this group, the neat, compact method of installing the motor above the bed of the planer, as shown in Fig. 39, is of particular interest.

The other motor-driven tools consist of the following new machines: No. 2, Pond wheel lathe, driven by a 15-hp motor, which allows a greater clearance for an axle with the gear on than the older type; No. 5, a wheel grinder with 10-hp motor; No. 7, Putnam axle lathe with a 10-hp motor; No. 8, milling machines with a 2-hp motor; No. 9, 300-ton Putnam wheel press with a 7½-hp motor; No. 10, Putnam wheel borer with a 7½-hp motor; No. 13, Cincinnati shaper with a 3-hp motor.

Group A is located between the last of the stub tracks of the truck shop and the stock room. It comprises the following tools, all driven from one 20-hp, 800-r.-p.-m. motor: No. 6, Bement-Miles slotting machine; No. 17, Pond iron planer; No. 18, Niles 16-in. screw cutting lathe; No. 22, iron shaper; Nos. 25 and 26, Lodge & Davis 16 and 18-in. screw cutting lathes; No. 27, Lodge & Davis 16-in. screw-cutting lathe; No. 29, Place 32-in. drill press; No. 34, E. W. Bliss, No. 18 stamping machine; No. 35, Whitcomb punching machine; No. 40, Dwight slate 12-in. drill press; No. 41, Le Blond 16-in. engine lathe; and No. 42, American Tool & Machine Company's monitor lathe. To this group the following tools are being added: No. 43, Lodge & Shipley

20-in. combination engine and turret lathe; No. 44, Betts No. 2 horizontal boring mill for boring out air-brake cylinders; and No. 45, Bridgeford single-axle lathe.

Group B starts at a line coinciding with the southern end of the tool storage room and the Gillen Place side of the shop. It is driven by one 20-hp, 950-r.-p.-m. motor, and includes the following tools: No. 19, Garvin milling machine; No. 20, Greenfield universal grinding machine placed in the tool room; No. 23, L. & C. shop saw; No. 24, National double-head bolt-threading machine ⅜ in. to 1½ ins.; No. 30, Place 26-in. drill press; No. 31, Dwight slate 12-in. single spindle sensitive drill; No. 32, diamond double emery grinder; No. 36, Geo. L. Cumming 6-in. x 36-in. grindstone; No. 37, Barnes 25-in. drill press; No. 38, Snyder 20-in. drill press, and No. 39, Foote, Burt & Company three-spindle sensitive drill.

For conveying wheels or other heavy material to the machines two Cleveland cranes of two tons capacity each have been installed with a travel covering the east bay or machine shop and the bay adjoining the workshop. In addition to these, there is an I-beam trolley and a two-ton air hoist for transporting surface car wheels and other parts from the surface track running parallel with the Gillen Place side of the shop building. No provision is made in this shop for overhauling surface cars other than turning their wheels. At the present time 400 pairs of wheels and axles are being fitted up for the 100 new surface cars being equipped at the Thirty-Ninth Street elevated and surface shops. As the East New York shops now have the best facilities for this work it is not being done in the Fifty-Second Street shops as heretofore.

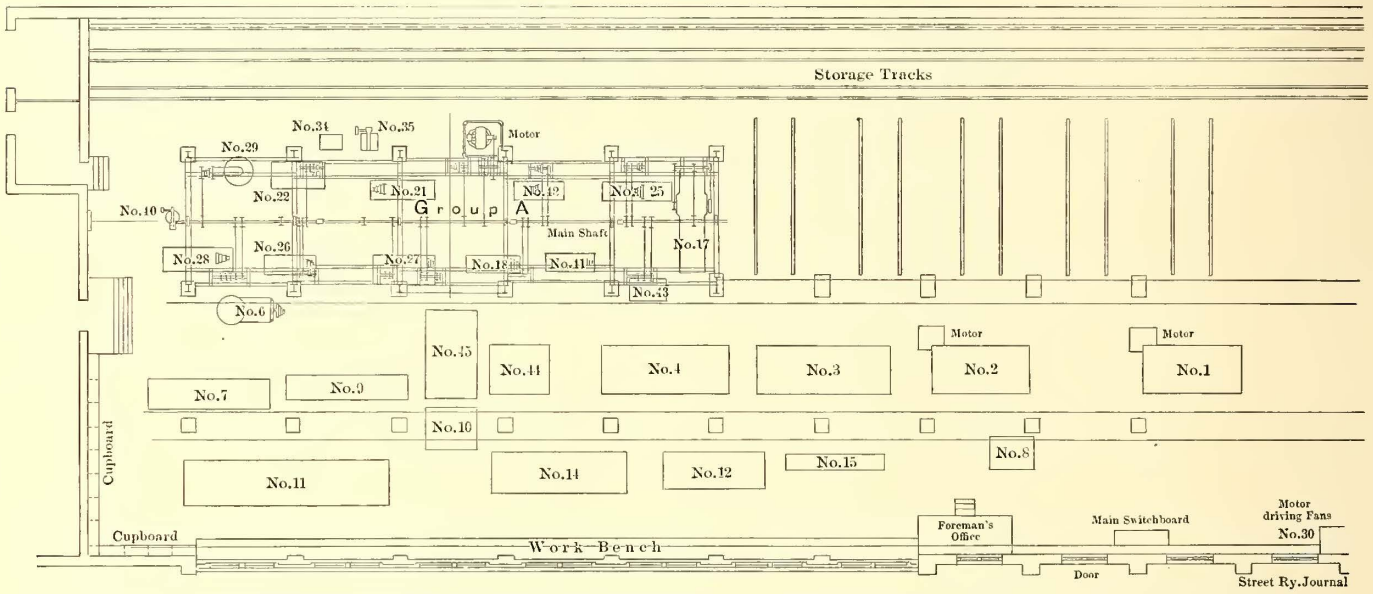


FIG. 40.—PLAN OF FIRST PART OF MACHINE AND TRUCK OVERHAULING SHOP, SHOWING ARRANGEMENTS FOR GROUP AND INDEPENDENT MACHINE DRIVE, STORAGE TRACKS, ETC.

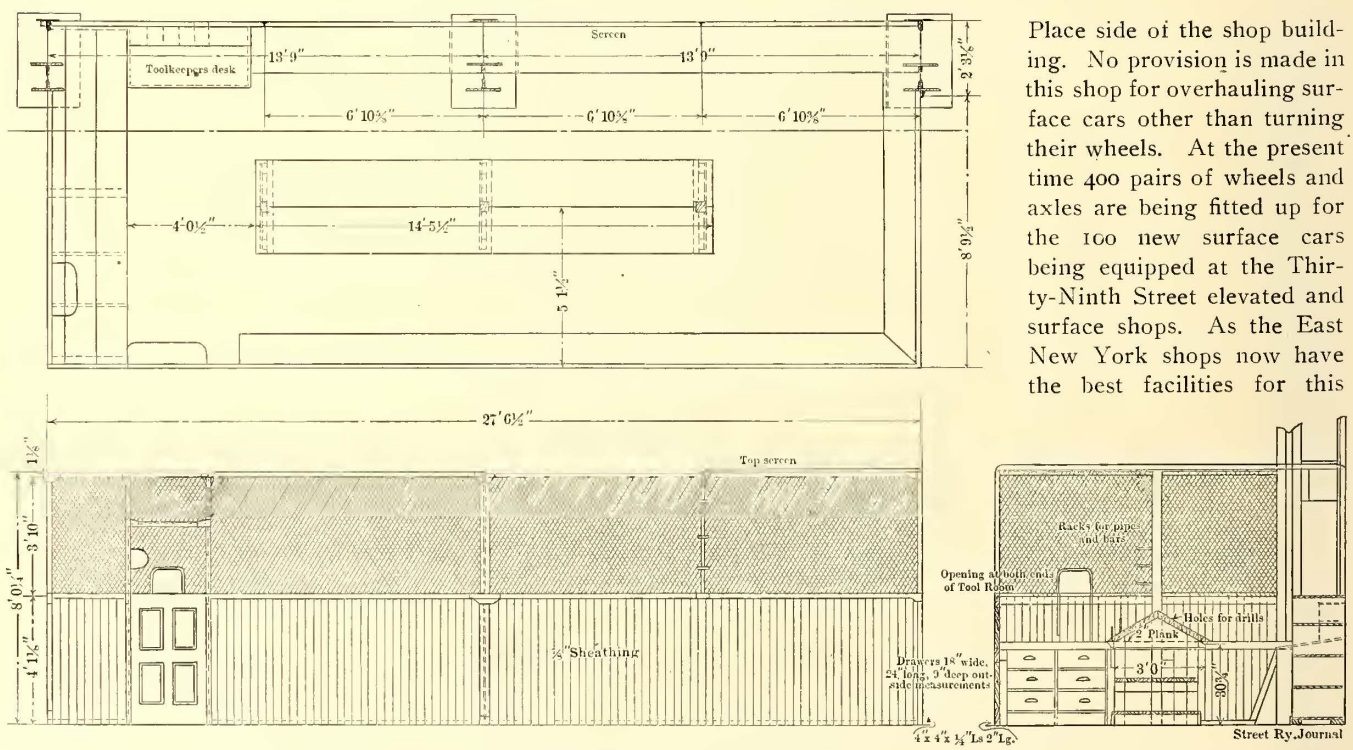


FIG. 41.—PLAN, ELEVATION AND PART SECTION OF THE TOOL ROOM

The main switchboard has been erected in the northeastern portion of the machine tool bay, made up of three black slate panels. On the middle panel are mounted in line the main switch, a 3000-amp. Cutter circuit breaker and a switch for the circuit-carrying current to all the first-floor motors.

Below these in another row are the switches for the second-floor motors, the inspection shed, the second-floor lights

and the first-floor lights. All of these switches except the main switch have Noark fuses. The other panels are composed almost entirely of small switches for the smaller lighting circuits leading to different parts of the building, fire-alarm system, etc.

THE TOOL ROOM

The tool room for storing all tools belonging to the company is located in the center of the lower shop floor between the overhauling and machine shops. It is 27 ft. 6½ ins. long and 8 ft. 9½ ins. wide. As noted in Fig. 41, the division walls are 4 ft. 1⅛ ins. high, but have in addition an expanded metal screen which makes the total height 8 ft. ¼ in. The room is furnished with the appropriate drawers, bins and pigeon holes; a center table 14 ft. 5½ ins. long, on which are receptacles for holding drills and the like in a vertical position; and the tool-keeper's desk, which is placed opposite the single entrance.

Every shop employee secures tools from this room through five small brass checks which carry the number assigned to him. Should he desire a sixth tool he must give up one of the five previously taken. The tool room is in charge of a machinist who is furnished with a universal grinder and vise to grind drills and keep other tools in repair. If there is not enough work of this kind to keep him busy, outside employment is given him. Hence the tool room is always in the charge of a reliable man without incurring the expense of employing some one with a lot of idle time on his hands. In addition to keeping the tools, this room is also used for storing jigs, templets and other standards of the company.

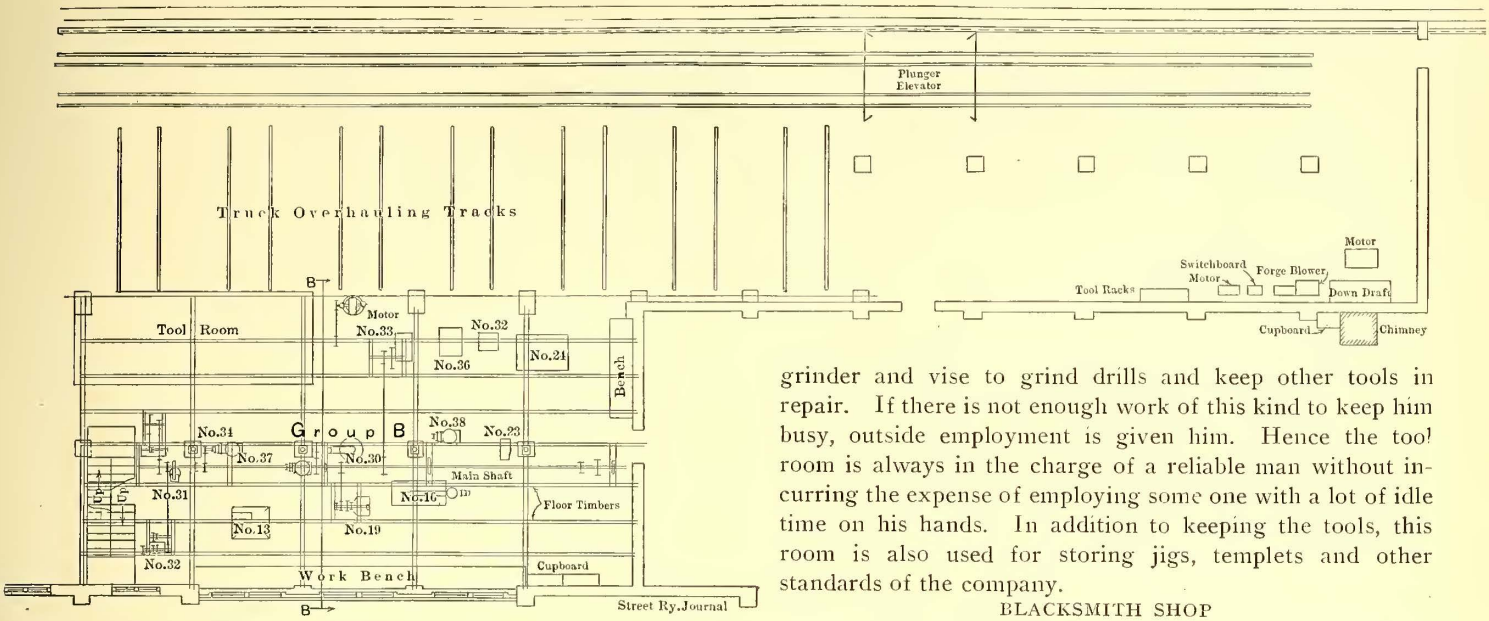


FIG. 40 (CONTINUED).—PLAN OF SECOND PART OF MACHINE AND TRUCK OVERHAULING SHOPS, SHOWING GROUP-DRIVEN TOOLS, TRUCK-OVERHAULING TRACKS, ELEVATOR, TOOL ROOM, ETC.

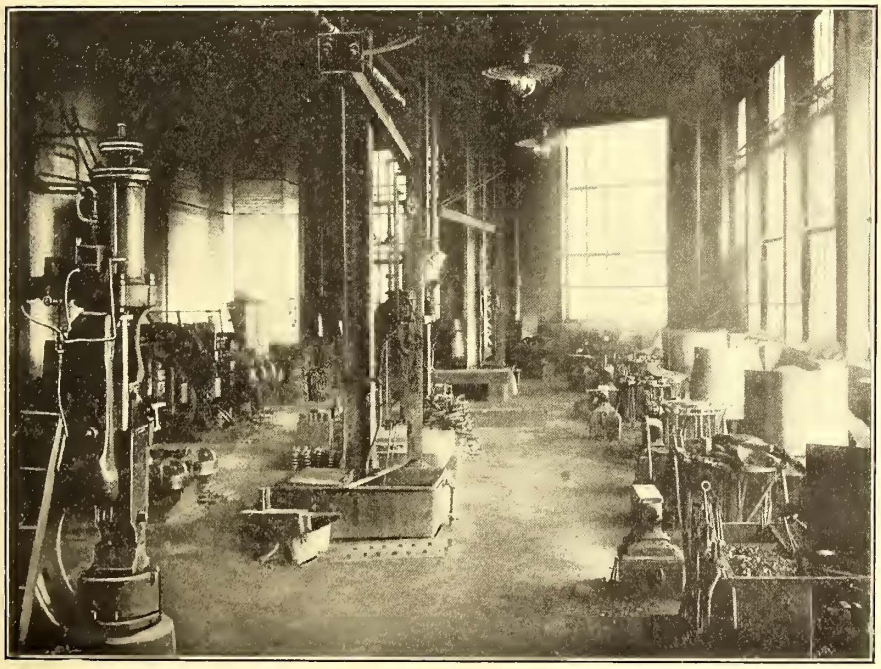


FIG. 42.—VIEW OF THE BLACKSMITH SHOP, SHOWING FORGES, TOOL TURRETS, ETC.

BLACKSMITH SHOP

The nature of the work done in the blacksmith shop covers all kinds of small forgings and bolts for the building, track, electrical and power house departments, as well as forgings for the repair and maintenance of elevated and surface cars.

The blacksmith shop forms a continuation of the bay occupied by the machine shop and extends to the end of the building, with a floor of a special New Jersey clay. It is separated from the other departments on this level by a brick fire wall.

The equipment of this shop embraces the following: Fourteen down-draft forges; 9-in. McDougal-Pond steam hammer (No. 78) and one 7-in. American steam hammer (No. 79), both operated by steam received from the rubbish incinerator plant; a Williams & White bulldozer (No. 77) driven by a 10-hp motor; a Hillis & Jones No. 3 punch and shear (No. 75) with 22-in. throat, driven by a 10-hp motor conveniently located on the top of the machine; a Hillis & Jones iron clamp (No. 80); and a 2-in. Acme bolt-heading and forging machine (No. 76). This last machine mentioned is fitted for several types of dies, which enables the operator to make any kind of forging up to 2 ins. diameter. Bolts can be made on this machine much cheaper than they could be bought. For heating the iron and steel in this machine the two oil furnaces mentioned later are used.

The exhaust fan in this shop is driven by a 12-hp Sprague direct-connected motor, and the blast fan is belt-driven by a 7½-hp Sprague motor. Both motors are operated from one switchboard having two starting boxes and one circuit

breaker. The pipes for this blower system are led through clay conduits under the floor. The fans and forges were installed by the New York Blower Company, of Bucyrus Ohio.

Two interesting features in connection with the forges are the separate coke boxes and revolving tool-rack turrets which were built in the company's shops. There are also two oil furnaces in the blacksmith shop; one of these is of the double-burner Buckeye type, 24-in. x 48-in.; the other

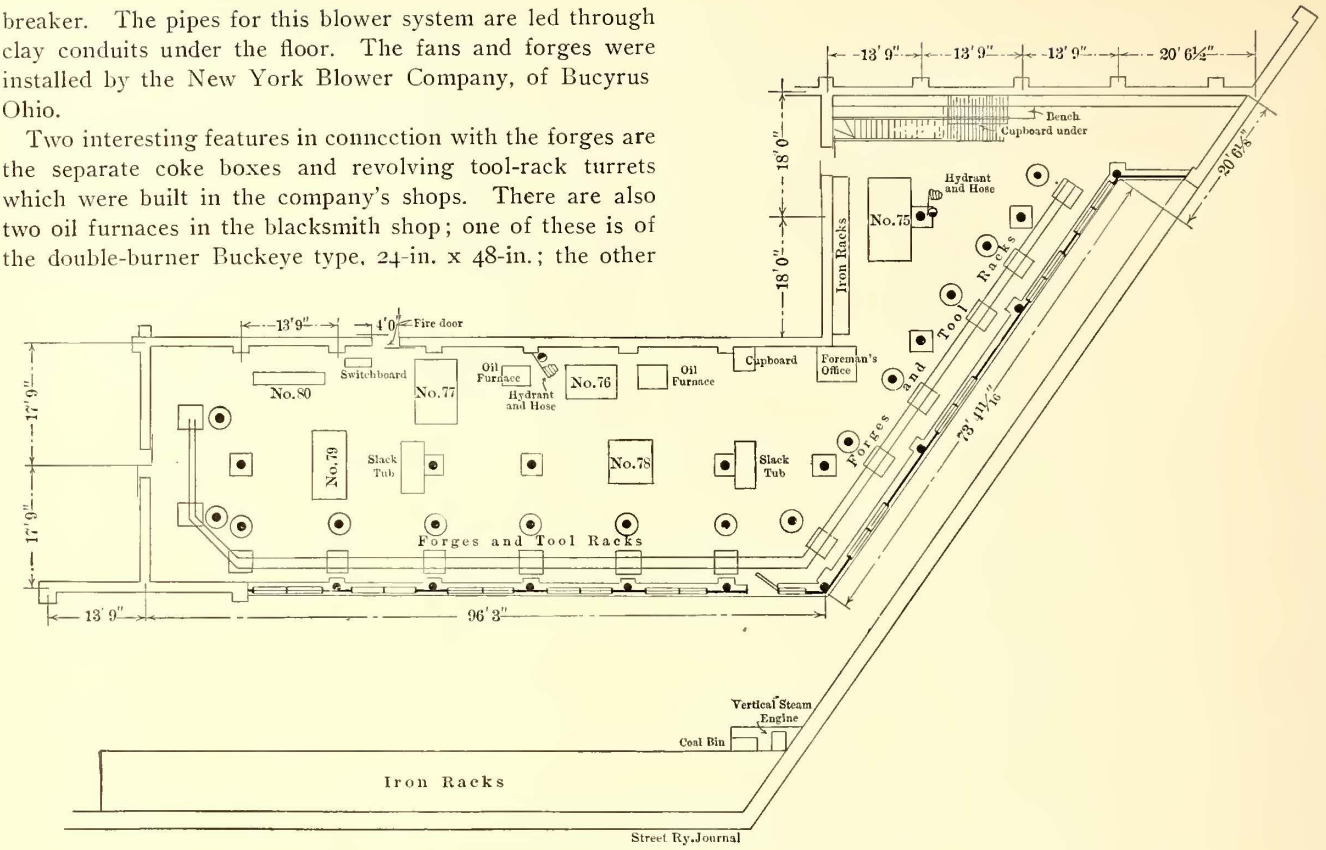


FIG. 43.—PLAN OF BLACKSMITH SHOP AND ADJACENT STORAGE YARD AT EAST NEW YORK

is a bolt furnace, also with double burners, constructed of fire brick and angle iron in the company's shops.

THE MILL ROOM

The mill room is located in the northeast part of the shop directly over the blacksmith room, and, like the latter, is separated from the rest of the shops on the same level by a brick wall. The principal work of the mill room is to manufacture car framing, carlines, window frames, doors and other classes of car woodwork. Considerable cabinet work, such as office furniture, etc., is also manufactured in this shop.

The mill machinery consists of several belt-driven machines divided into two groups, C and D. Group C is made up of the following tools: No. 49, Rogers 42-in. band saw; No. 54, Levi Houston 8-in. molding machine; No. 55, Fay & Egan post-boring machine; No. 57, a Greenley hollow chisel mortiser. There is also one emery wheel (No. 63) in this group directly outside of the mill room for grinding or facing snow brushes. Group D consists of the following:

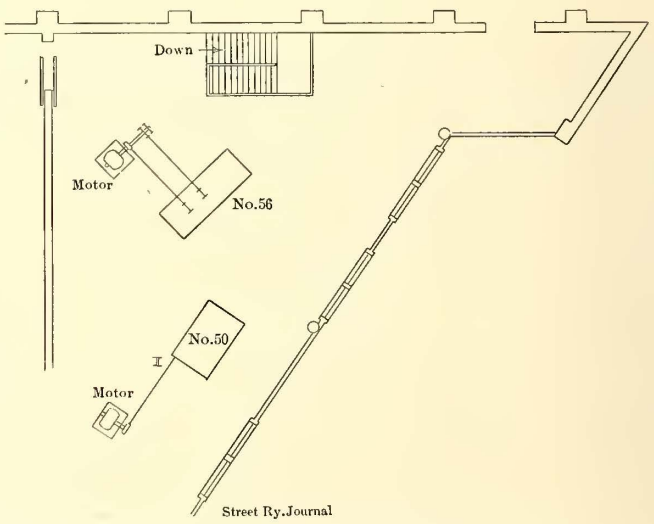


FIG. 44 (CONTINUED).—PLAN OF UPPER END OF MILL ROOM

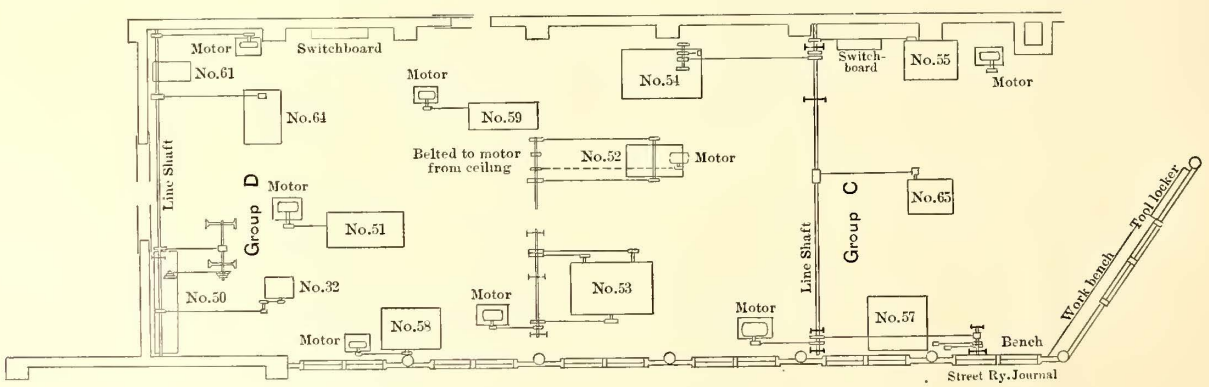


FIG. 44.—PLAN OF MILL ROOM, SHOWING LOCATION AND DRIVE OF WOODWORKING TOOLS

No. 48, an Atlantic 32-in. band saw; No. 60, an H. B. Smith wood-turning lathe; No. 61, Norton 30-in. grindstone; and No. 32, a small emery wheel grinder. This group is driven by a 7½-hp motor.

The independent motor-driven machines include: No. 50, Jos. Colladay 26-in. rip saw, belt-driven from 15-hp motor; No. 51, one Oliver rip and cross saw with 7½-hp belt-driven motor; No. 52, one Baxter & Whitney 26-in. planer driven by a 20-hp motor which is suspended from the ceiling to save space; No. 53, one Berlin Machine Works "Royal Invincible" sanding machine belt-driven by a 20-hp motor; No. 56, one double-spindle Prentice molding machine belt-driven by a 7½-hp motor; No. 58, one Levi Houston 7-in. tenoning machine belt-driven by a 3½-hp motor, and No. 59, one Prentice jointer belt-driven by a 3½-hp motor.

All of the motors are of Northern Electric manufacture and are furnished with dust-excluding shields. The exhauster system is operated by a 20-hp Crocker-Wheeler motor supported on wall brackets. This machine runs without intermission from 7. a. m. to 5:30 p. m., and at times up to 9:30 p. m. without the slightest trouble.

There are two 5-panel black slate switchboards in this room. Panel 1 of the first board contains the circuit breaker, switch and starting box for group C; panels 2, 3 and 4 the same apparatus for the planer, rip saw and molder; panel 5 a magnetic blow-out, circuit breaker, switch and starting box for a fan motor. On the second board, panel 1 contains a circuit-breaker switch and starting box for group D, and the remaining panels are similarly squipped for the saw, sander, tenoner and jointer.

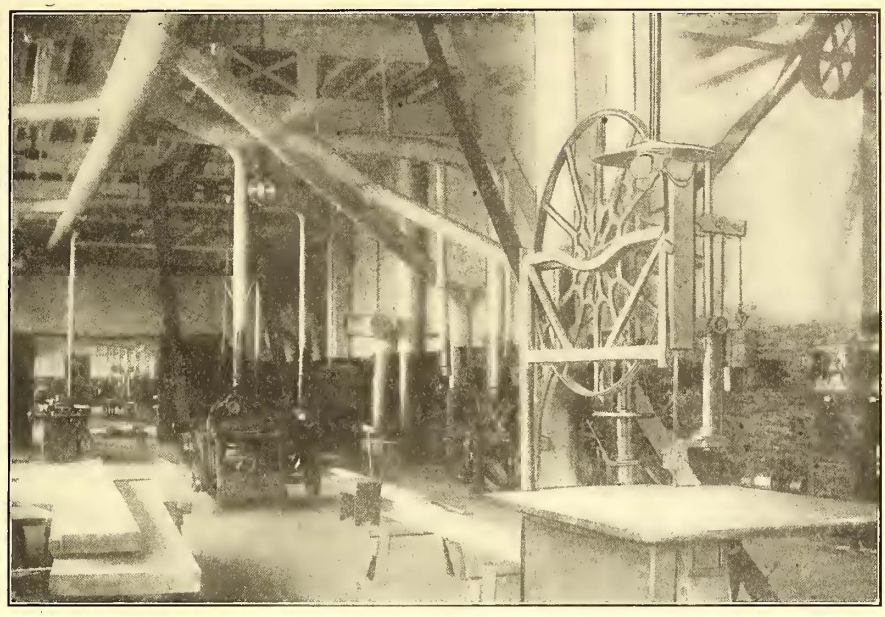


FIG. 45.—SCENE IN THE MILL ROOM, SHOWING EXHAUST PIPES FOR CARRYING OFF SHAVINGS

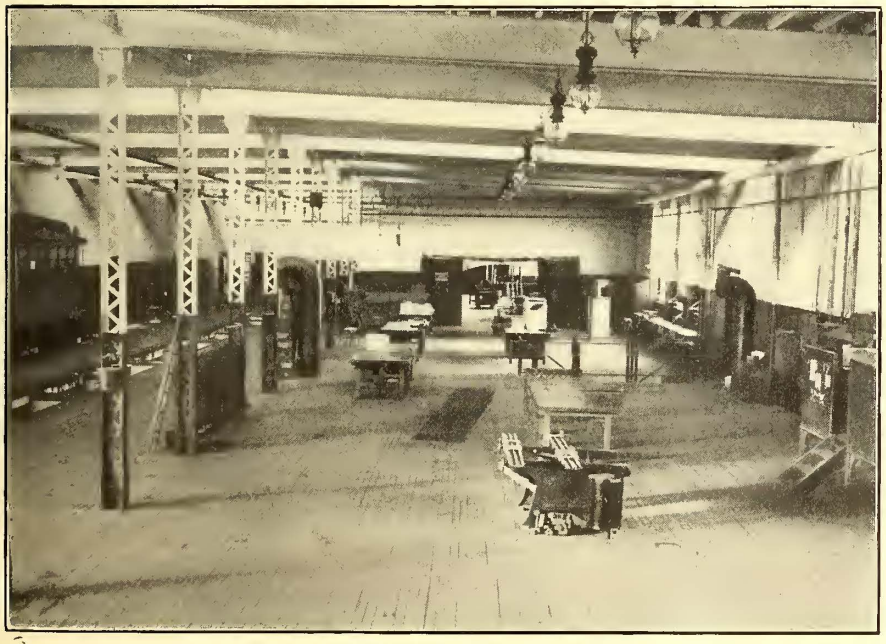


FIG. 46.—GENERAL VIEW OF THE CARPENTER SHOP

A notable feature of the equipment of this department is the exhaust system connected to each machine for drawing off all shavings, chips, dust, etc. This refuse is carried to a receptacle on the roof, from which it enters a chute leading to the yard, where the material is discharged into two covered carts holding 35 bushels each. These carts when full are pushed by hand across the street, where their contents are transferred to the incinerator.

CARPENTER SHOP

The carpenter shop is located on the second floor of the main shop building between the Gillen Place side and the two inspection tracks. In connection with the mill-room machinery this shop is capable of carrying out all kinds of repairs to car finish and miscellaneous cabinet work.

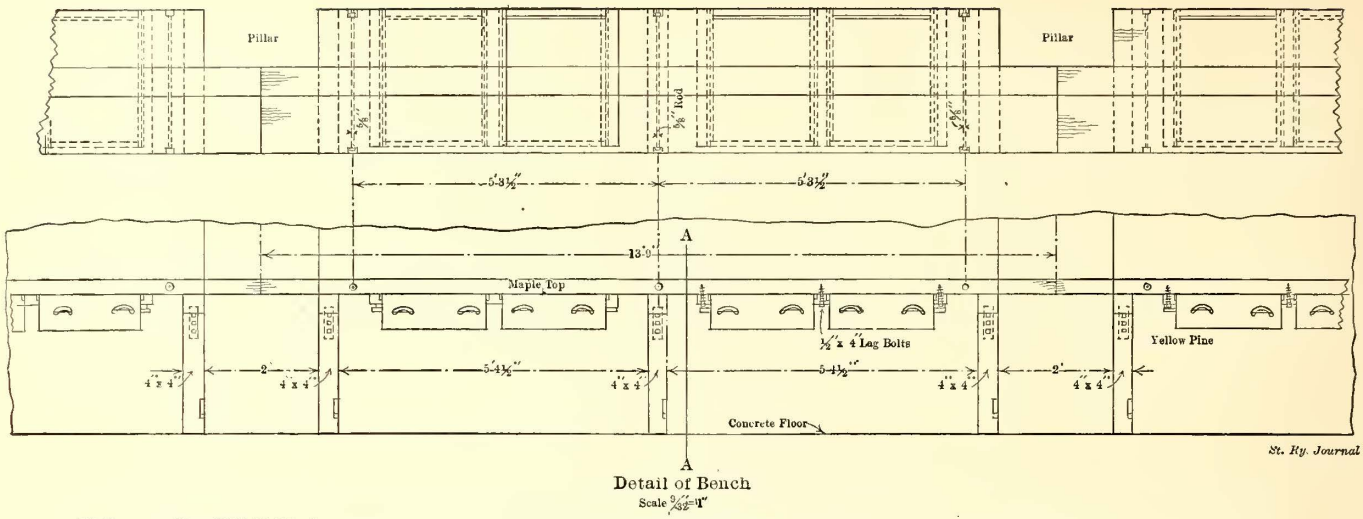
Through the center of this shop are placed seven cabinet-makers' benches, and along the entire length of the Gillen Place wall as far as the mill-room similar working benches are installed. These are made with hard maple tops 3 ins. thick, provided with through bolts which can be tightened from time to time to allow for shrinkage of the wood. All the benches have drawers for holding the carpenter tools, most of which belong to the men, and each of these drawers is furnished with a 1½-in. Yale padlock. Construction details of these benches will be found in Fig. 47.

BATTERY-CHARGING OUTFIT

Adjacent to the carpenter shop and just behind the elevators there is located a charging outfit for the batteries used in connection with the Westinghouse unit switch group train control, which is used on the elevated lines of the Brooklyn Rapid Transit Company. This consists of a lamp rack of one hundred 10-cp lamps arranged in groups with switches for cutting in 25, 50, 75 or 100 lamps, as different amperages are required. The cells of the storage batteries are of various Westinghouse types and are arranged in sets of seven to deliver 14 volts.

STORAGE BUILDINGS

A shop plant so extensive as the one in East New York naturally requires a large and varied assortment of supplies



Detail of Bench
Scale ⅜" = 1"

FIG. 47.—CONSTRUCTION DETAILS OF THE WORK BENCHES USED AT THE EAST NEW YORK SHOPS. A NOTEWORTHY FEATURE IS THE USE OF THE ⅝-IN. RODS TO ALLOW FOR SHRINKAGE OR SWELLING

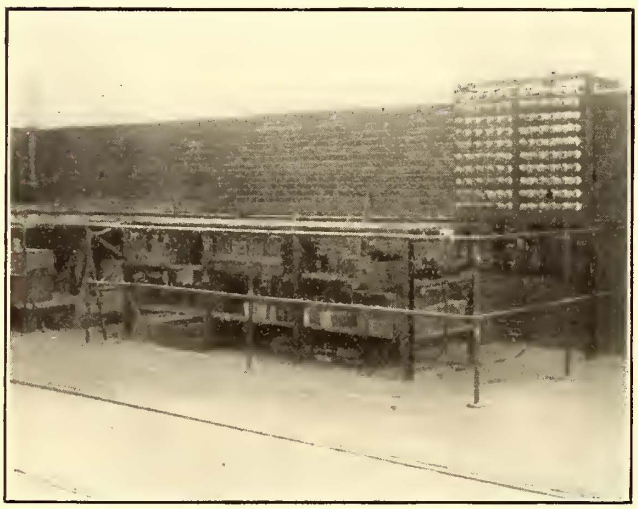


FIG. 48.—LAMP RACK FOR BATTERY TESTING

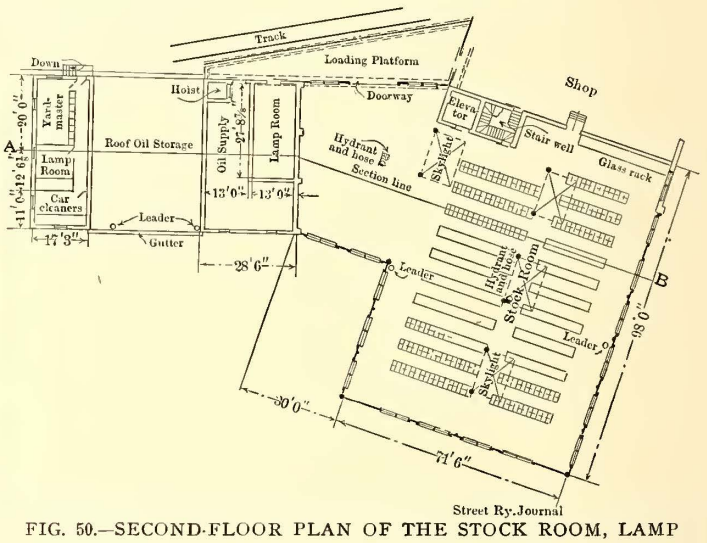
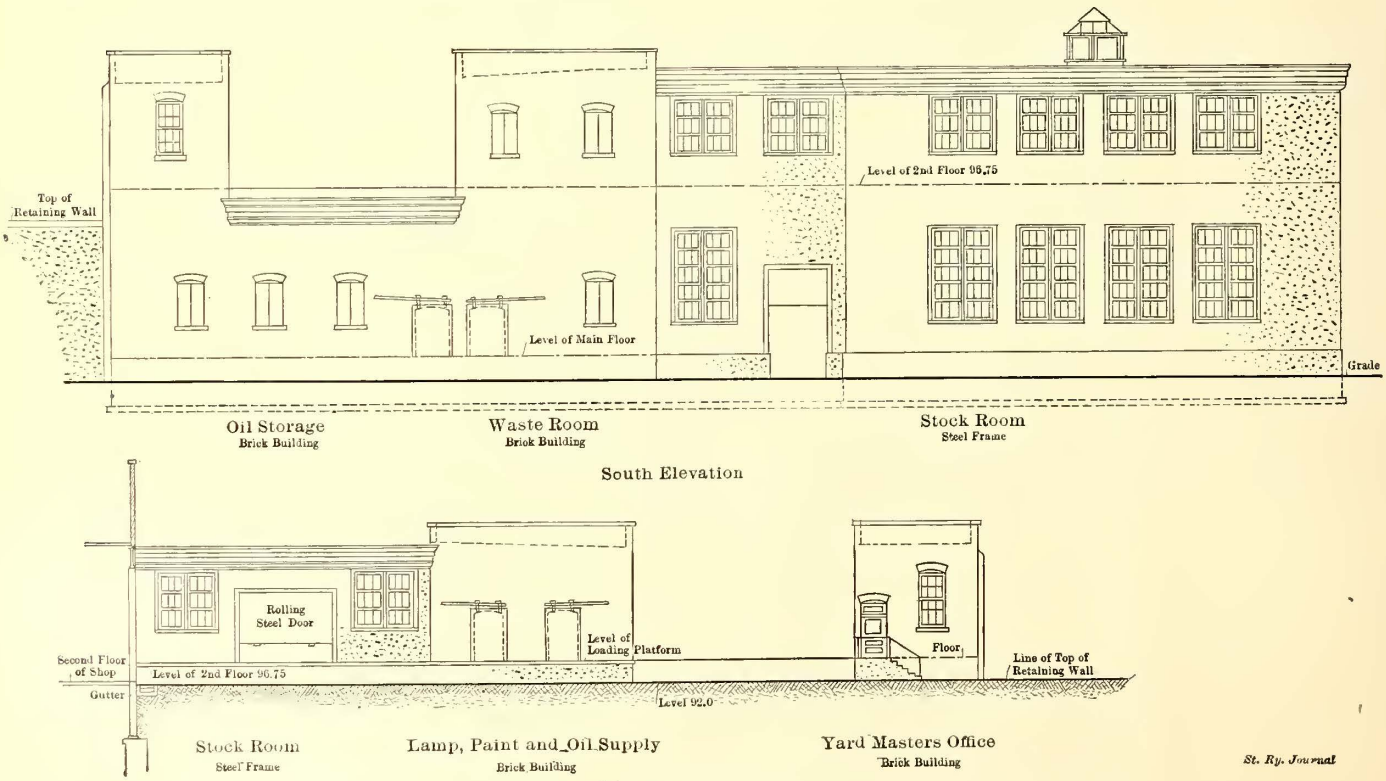


FIG. 50.—SECOND-FLOOR PLAN OF THE STOCK ROOM, LAMP ROOM, OIL STORAGE, YARD-MASTER'S OFFICE, ETC.



North Elevation

FIG. 49.—NORTH AND SOUTH ELEVATIONS OF THE STORAGE BUILDINGS AND YARD-MASTER'S OFFICE

both for manufacturing and because it is a distributing center. Hence a study of the best means for bringing material into the yards and distributing it afterward with the least labor is of considerable importance. Particular attention was given to two things, to have a stock room nearest to the shop using all or the greater part of its contents, and to isolate structures containing combustibles from other buildings as much as the conditions permitted.

THE B. H. R. R. CO. Storeroom Order 2075 Broadway Date 12-4 1906
Supplies chargeable to one account only to appear on same order. Book No 1563 Order No. 14
Quantity | Unit | DESCRIPTION | Price | Amount
Sold
Will not be received if account is not shown. Spoiled orders must be turned in. TOTAL
Foreman.
Account No ____ M. S. O. No. ____ Request No. ____ Authorization No ____

FIG. 52.—STOREROOM ORDER WHICH MUST CONTAIN THE NUMBER OF THE ACCOUNT TO WHICH MATERIAL SHOULD BE CHARGED

The main stock building which carries supplies for the elevated division, the track department and the signal department is located at the southern end of the shop forming a continuation of the building proper. It has two floors with offices for the storekeeper and his assistants. The floors of this building are raised about 3 ft. above the corresponding floors of the rest of the shop building, this arrangement making it easier to handle material to or from the surface and elevated tracks serving this part of the yard. The elevated track is a right-hand branch of the double Y entering the storage yard, and runs alongside a large platform just outside of the stock room. There are elevators in both this stock room and in the nearby paint and oil supply and lamp storage building. The surface track leads into a pocket on the lower floor, extending through the rolling doors of the stock room proper, the floor, as above

Form N. S. 160. ORIGINAL
THE BROOKLYN HEIGHTS R. R. CO.
Supplies Required at ____
Month of ____
Quantity On Hand | Quantity Required | DESCRIPTION OF ARTICLES | Amount
NOTE.—This form not for daily supplies. To be used for monthly ordering only.
Signature.

FIG. 53.—PART OF REGULAR TWICE-A-MONTH GENERAL REQUISITION SENT TO THE HEADQUARTERS OF THE COMPANY

Form N. S. 666.
BILL-HELD NOTICE No. ____
THE B. H. R. R. CO.
____ DEPARTMENT
Covered by Purchasing Department Bill Statement No. ____
TO COMPTROLLER.
Bill of ____ Dated ____
Amount ____ Order No. ____ Contract Dated ____
is held by this department for the following reasons: ____
Notice must be sent to the Comptroller on the fifth of each month for each bill for which approval cannot be given.
Head of Department.
This Form does not take the place of Bill-Held Notice, Form N. S. No. 229, to Purchasing Agent.

FIG. 54.—EXPLANATORY NOTICE SENT TO THE ACCOUNTING DEPARTMENT FROM SHOP USING PURCHASED MATERIAL WHEN INVOICES ARE NOT APPROVED IN THE USUAL TIME

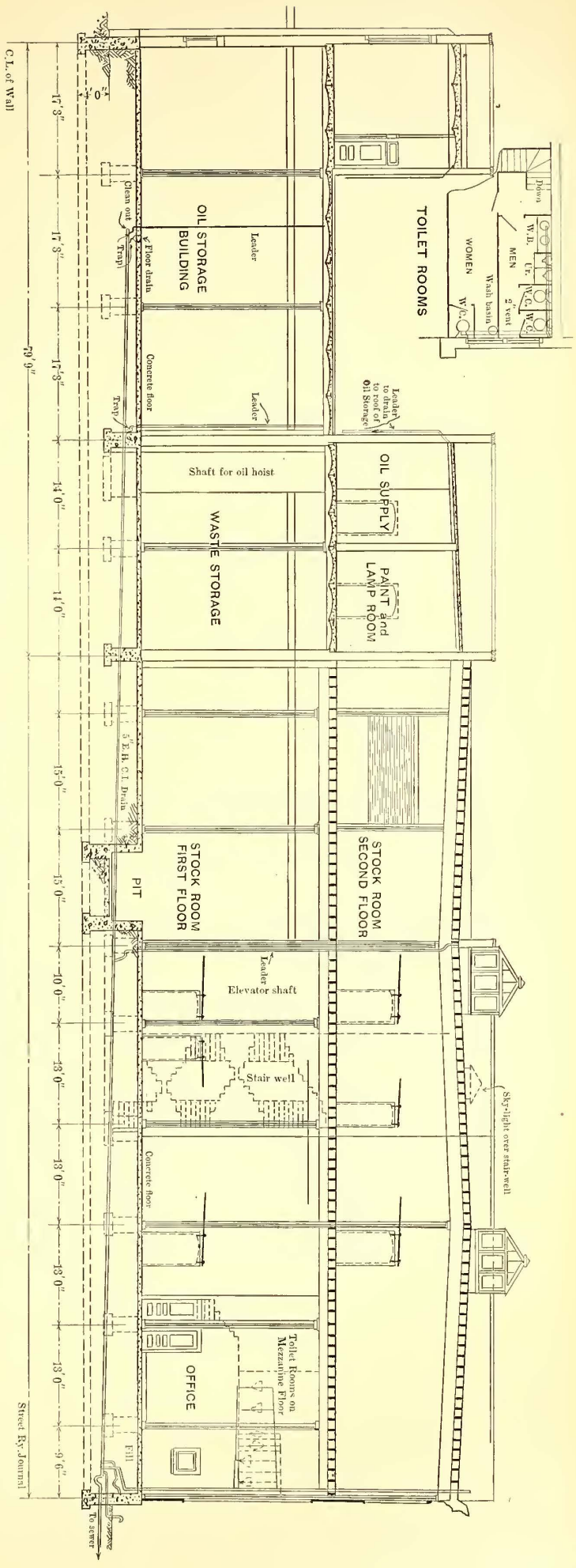


FIG. 51.—SECTION THROUGH THE OIL STORAGE BUILDING, WASTE STORAGE AND STOCK ROOMS

noted, being raised to the level of the platform of the supply cars.

The same surface track used for supplies to the main stock room is continued through the yard along Gillen Place, parallel with the shop building, terminating in front of the blacksmith shop. At this place are stored most of the supplies required for that shop. The iron racks are in a shed directly opposite this shop adjoining the coal bin. The latter contains a 3-hp steam engine which operates the crusher supplying pulverized coal for the forges. Steam for this engine is taken from the pipe supplying the steam hammers.

The fuel oil required for the furnaces in the blacksmith shop is stored in a 100-gallon tank buried at this point. Oil is supplied to this tank from barrels with the aid of a small chain hoist and crane which raises the barrel slightly to allow the oil to run into the pipes below the ground.

In connection with the storage methods in general it is interesting to note here that numerous metal lockers have been installed in different parts of the shop where small finished products can be kept. This avoids littering up the floors with loose pieces, besides making it much easier to keep record of manufactured material on hand.

Supplies from the stock rooms are ordered on the form reproduced in Fig. 52. An important feature of this form, which simplifies the accounting, is that it must be used only for supplies chargeable to one account. The order must be signed by the foreman of the department requiring the material.

The storekeeper orders his supplies about the 15th and 30th day of the month, using the

O—39534 N. S. 401

The B. H. R.R. CO. **REPORT OF UNSATISFACTORY SUPPLIES.**

DUPLICATE AT_____ DATE_____ 190__

QUANTITY	DESCRIPTION.

Received____ Date____ 190__ Book No.____ Order No.____

EXPLAIN ON NEXT LINES WHY UNSATISFACTORY

Signature.

COMPLAINT MUST BE SIGNED BY HEAD OF DEPT BEFORE SENDING TO PURCHASING AGENT.

Do not write or make any marks below.

Head of Department.

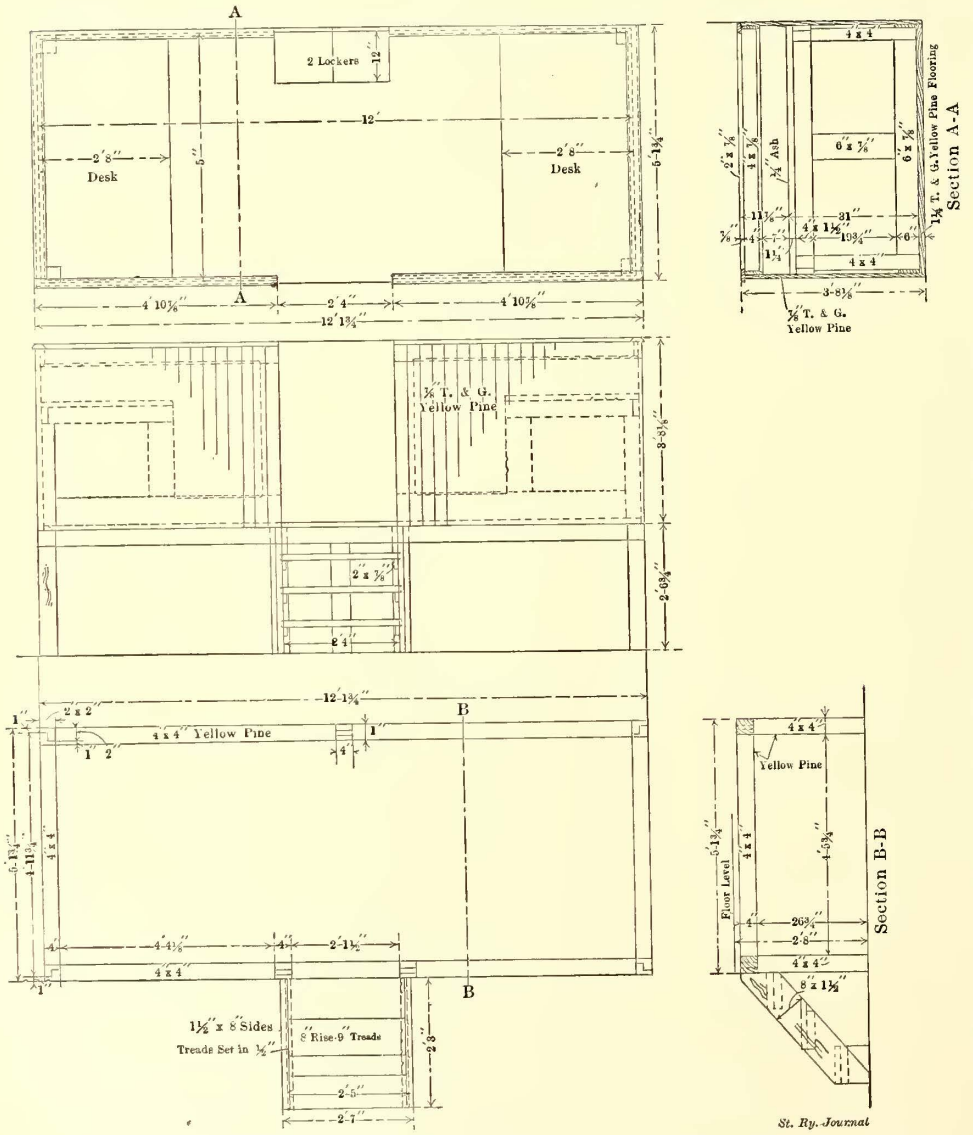
Return Order No.____

Make Report in Triplicate and send Original to Purchasing Agent. Duplicate to Head of Department and retain Triplicate

Purchasing Dept. No.____

ONLY ONE KIND OF SUPPLY MUST BE REPORTED ON SAME BLANK

FIG. 55.—REPORT OF UNSATISFACTORY SUPPLIES SENT TO THE PURCHASING AGENT BY SHOP FOREMAN



St. Ry. Journal

FIG. 60.—CONSTRUCTION DETAILS OF FOREMAN'S OBSERVATION OFFICES, PLACED IN THE SHOPS

Form N. S. 768 385M. 4-14-06. O—76608

THE BROOKLYN HEIGHTS R. R.

DAILY TIME CARD

Date____

No.____ Rate____

Name____

Occupation____

Auth. No.____ Req. No.____

	MORN.		NOON		NIGHT		EXTRA	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT

ACCT. NO.	DISTRIBUTION CLASS OF WORK	HRS.	AMOUNT

TOTAL TIME MADE____ HRS.

CORRECT

____

Foreman.

FIG. 58.—EMPLOYEE'S TIME CARD, INCLUDING DATA REGARDING CLASS OF WORK

form illustrated in Fig. 53. If ordered at any other time, he may use the same form but must mark it "Special."

Two interesting forms are those shown in Figs. 54 and 55. The latter is a report made out by the department foreman explaining to the purchasing agent why certain material is considered unsatisfactory; and the former is a "bill-held" notice sent to the comptroller on the 5th of each month explaining that specific bills have remained unapproved by the department ordering the material on account of high price, unsatisfactory supplies, etc.

In case the material needed to fill a certain order is found excessive, the surplus is turned in to the storekeeper with the

Form N. S. 341 — 50 Pads

DUPLICATE

The Brooklyn Heights Railroad Company

Department No._____ Date_____ 190__

OLD MATERIAL

Taken from_____ has this day been turned into Stock and Stored at _____

Numbered from_____ to_____ inclusive.

FULL DESCRIPTION	Item Number (Do Not Write in These Columns)	Price	VALUE

By _____

Employe.

Received and charged to "Old Material Account" for the month of_____ 190__

Statement No._____

Date_____ 190__ _____

General Storekeeper

TO BE MADE IN QUADRUPLICATE. Original, Duplicate and Triplicate to be sent to the General Storekeeper and Quadruplicate to be Retained by Department Reporting.

FIG. 57.—REPORT TURNED IN WHEN SENDING OLD MATERIAL TO THE GENERAL STOREKEEPER

L 225 — 20 M 2-3-06 O-73,382

ELEVATED LINES—B. H. R. R. CO.

Occupation .....
Name in full .....
Badge No. .....
Week ending ....., 1.....

	Days	Hours	Rate	Amount $	Amount c.
Friday					
Saturday					
Sunday					
Monday					
Tuesday					
Wednesday					
Thursday					
Total					

Fill in name and badge number (if any), the date and the amount earned each day, giving the total at end of week.

On pay day hand this card to paymaster, who will receive it and hold it as a receipt.

Each employee is required to show badge when presenting card for payment.

All employees, where possible, are required to receive their pay direct from the paymaster.

If the paymaster cannot be reached an entry must be made on the back of the card, stating to whom the pay shall be given; the reasons why the employee can not come in person, and the whole certified to by the immediate superior of the employee and receipted for by the person receiving the money.

FIG. 59.—DATA CONTAINED ON WEEKLY PAY CARD OF ELEVATED RAILWAY SHOP EMPLOYEES OF THE BROOKLYN RAPID TRANSIT COMPANY

B. R. T. UNUSED MATERIAL REPORT.

_____Dep't. Date_____190__

Material described below drawn from stock, or purchased, for work covered by respective Authorizations given below has been turned into stock at

DESCRIPTION:

CREDIT Autho.	Account	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	AMOUNT
TOTAL												
VALUE												

ORIGINAL

By _____

Foreman

Received and Charged to Stock, Month of_____ 190__
Statement No._____

_____

Storekeeper

TO BE MADE IN QUADRUPLICATE Original and Duplicate sent to Storekeeper. Triplicate to be retained by Employee making report. Original, when priced, to be forwarded to Comptroller. Quadruplicate to be forwarded to Head of Department.

FIG. 56.—DATA GIVEN ON BLANK FORM OF UNUSED MATERIAL REPORT

blank shown in Fig. 56, and the cost is credited to the proper account. Fig. 57 illustrates the form used for turning in and crediting old material such as scrap brass, copper, etc.

WASH ROOMS, TOILET, CLOTHES LOCKERS, ETC.

It is worth noting that in the East New York plant as much care has been taken for the comfort of the men as for the proper layout of the work that they are called upon to do. This fact is demonstrated by the lighting and heating of the buildings, as well as the commodious toilet and wash room, which in its comfortable arrangements is on par with the best work of manufacturing companies noted for their welfare work. This room is on the mezzanine floor directly above the machine shop, and is furnished with sixteen urinals, thirty-two toilets, sixty-four yellow porcelain wash basins with hot and cold water, and four shower baths,

sufficient for a total force of 400 men. There are also smaller toilets in the armature room, storehouse and offices.

Directly off the main toilet and wash room and under the office is a locker room which contains 480 expanded metal lockers for the shop men. The use of these fireproof metal lockers insures absolutely the privacy and safety of the employees' property; and as their contents can be observed from the outside it is difficult for any employees to store tools or other of the company's property.

This room is well lighted and has enough space outside the lockers to allow a considerable number of employees to use it as a lunch room. For the latter purpose, as well as to assist the men in dressing, benches are placed along the walls of the room.

EMPLOYEES AND SOCIAL FEATURES

For convenience of keeping cost of records all of the employees in this shop receive a number which indicates at once what class of work they perform. For instance, as an arbitrary illustration it may be assumed that all cabinet makers are numbered from 300 to 350, air-brake men 351 to 400, wire men 401 to 450, etc.

Every man is furnished with the company's standard time card as illustrated in Fig. 58, which must be placed in the time clock to be stamped when entering and leaving shops. This card is arranged for the account, authorization number, etc., under which the employee is working. The back of the card contains a line each for the employee's name and number. It is the rule for the shop men to receive ten hours' pay for eight hours work on holidays and for nine hours on Saturdays. The weekly pay card is illustrated in Fig. 59, together with the instructions regarding the collection of wages.

As noted in an earlier part of this article, the splendidly equipped clubhouse of the Brooklyn Rapid Transit Benefit Association is adjacent to the shops so that members can spend their free time in the reading room, gymnasium, pool parlor, etc. In addition to this, the Young Men's Christian Association provides some form of musical entertainment and religious discourse every Tuesday during the noon hour in the carpenter shop. The latter is best suited for the purpose on account of its large free area and its excellent lighting. This diversion is always interesting and is enjoyed by a large number of the men.

A novel practice for an electric railway shop is the installation of foreman's pulpits, that is placing his office on an elevated platform from which he can survey his shop to the best advantage. In this shop nearly all the department foremen are provided with platforms of the type shown in the drawing on page 360. The structure is about 3 ft. above the shop level and has three of its sides fully enclosed by walls 2 ft. 8 ins. high. As the pulpit is open at the top no extra ventilating means are required. The floor is 12 ft. long and 5 ft. wide, so there is sufficient room for a desk at each end, drawers, lockers and miscellaneous office material. The three steps leading to the platform are provided with Universal safety treads. These foreman's offices can, of course, be built for one desk only if desirable.

ACCOUNTING FOR LABOR AND MATERIAL

For the purpose of properly charging up all labor and material, every shop foreman is supplied with a schedule of operating expense accounts devised by Howard Abel, the comptroller of the company. Part of this schedule is shown herewith. It is tabulated in six columns covering the following points: The first column includes labor, material or both,

PART OF THE SCHEDULE OF OPERATING EXPENSES

Schedule No.					
	Surf.	Elev.	Bridge.	F. M. & E. A. R. T.	MAINTENANCE OF WAY AND STRUCTURE.
L.M.	288	588	888	1188	Motors—Miscellaneous.
L.M.	289	589	889	1189	Transfer of motors and equipment for other purposes than repairs.
L.M.	290	590	890	....	Electrical equipment of service cars and plows.
L.M.	291	591	891	1191	Air-brakes, including pumps and governors.
..	292	592	892	1192	
					Repairs and Renewals of Locomotives.
L.M.	...	593	...	1193	Boilers and fire-boxes.
L.M.	...	594	..	1194	Brake shoes.
L.M.	...	595	...	1195	Wheels, axles and journal brasses.
L.M.	...	596	...	1196	Springs.
L.M.	...	597	...	1197	Miscellaneous repairs.
L.M.	...	598	..	1198	Electric locomotives.
					Repairs and Renewals of Miscellaneous Equipment:
L.M.	299	599	899	1199	Plows, sweepers, sprinklers and
.	300	600	...	1200	brine cars.
					Repairs and Renewals of Track and Roadway:
M.	201	501	801	1101	Steel rails, girder or T.
M.	202	502	802	1102	Cross ties.
M.	203	503	803	1103	Guard rails.
M.	204	504	804	1104	Track-walk, slatting and rail filler.
M.	...	505	805	....	Frogs, switches and crossings.
M.	206	...	...	1106	Special work.
M.	207	507	807	1107	Spikes, bolts, splices and braces.
L.M.	208	508	808	1108	Paving and ballast.
L.M.	209	509	809	1109	Bridges and culverts.
M.	210	...	810	....	Sheaves and bearings.
L.M.	211	511	811	1111	Tools.
L.M.	212	512	812	1112	Foundations.
L.M.	213	513	813	1113	Structure repairs.
L.	214	514	814	1114	Hauling and distributing material.
L.M.	215	515	815	1115	Other expenses.
L.	216	516	816	1116	Labor.
L.M.	217	517	817	1117	Engineerng Dep't—Salaries and
..	218	518	818	1118	expenses.
					Repairs and Renewals of Electric Line:
M.	219	519	819	1119	Poles, span wires and fixtures.
M.	220	520	820	1120	Trolley wire.
M.	221	521	821	1121	Feeder and fixtures, overhead.
M.	222	522	822	1122	Feeder and fixtures, underground.
M.	223	...	...	....	Subways.
M.	224	524	824	1124	Bonding.
M.	...	525	825	....	Third rail and fixtures.
L.M.	226	...	...	1126	Stable expenses.
L.M.	227	527	827	1127	Tools and other expenses.
L.	228	528	828	1128	Labor.
L.	229	529	829	1129	Emergency crews.
L.M.	230	530	830	1130	Electric lighting—Repairs and renewals.
L.M.	231	531	831	1131	Repairs and renewals of telephone and telegraph lines, fixtures and instruments.
L.M.	232	532	832	1132	Engineering and superintendence—
..	233	533	833	1133	Salaries and expenses.
					Repairs and Renewals of Buildings and Fixtures:
L.M.	234	534	834	1134	Machine and car shops.
L.M.	235	535	835	1135	Depots.
L.M.	236	...	836	....	Power stations.
L.M.	237	537	837	1137	Switch towers, machinery and signals
L.M.	238	538	838	1138	Stations
L.M.	...	539	...	1139	Water and coaling stations.
L.M.	240	540	840	1140	Flag and track houses.
L.M.	241	541	841	1141	Miscellaneous buildings.
L.M.	242	...	...	1142	Docks and dock repairs.
L.M.	243	...	...	1143	Dredging.
L.M.	...	...	...	1144	Ash stations, cranes, derricks, bins and covers.
					MAINTENANCE OF EQUIPMENT.
					Repairs and Renewals of Steam Plant Electric Stations:
L.M.	245	...	845	....	Boilers.
L.M.	246	...	846	....	Piping.
L.M.	247	...	847	....	Economizers.
L.M.	248	...	848	....	Stokers.
L.M.	249	...	849	....	Forced draught apparatus.
L.M.	250	...	850	....	Engines and pumps.
L.M.	251	..	851	....	Condensers.
L.M.	252	...	852	....	Coal and ash handling machinery
L.M.	253	...	853	....	Other repairs.
L.M.	254	...	854	....	
					Repairs and Renewals of Electric Plant:
L.M.	255	...	855	....	High tension generators and exciters.
L.M.	256	...	856	....	Low tension generators.
L.M.	257	...	857	....	High tension switchboards and cables
L.M.	258	...	858	....	Low tension switchboards and cables.
L.M.	259	...	859	....	Rotary transformers.
L.M.	260	..	860	....	Static transformers and blowers.
L.M.	261	...	861	....	Boosters.
L.M.	262	...	862	....	Storage batteries
L.M.	263	...	863	....	Other repairs.
					Repairs and Renewals of Passenger Cars:
L.M.	268	568	868	1168	Bodies.
L.M.	269	569	869	1169	Painting and varnishing.
L.M.	270	570	870	1170	Trucks, hand brakes and brake rigging.

PART OF THE SCHEDULE OF OPERATING EXPENSES—Cont.

Schedule No.					MAINTENANCE OF WAY AND STRUCTURE.
	Surf.	Elev.	Bridge.	F. M. & E. A. R. T.	
L.M.	271	571	871	1171	Wheels and axles.
L.M.	272	572	872	1172	Journal brasses.
L.M.	273	573	873	1173	Brake shoes.
L.M.	274	574	874	1174	Transfer of trucks for purposes other than repairs.
L.M.	275	575	875	1175	Fenders.
L.M.	276	576	876	....	Fare registers.
L.M.	277	577	877	....	Grips and grip fixtures.
..	278	578	878	1178	
					REPAIRS AND RENEWALS OF ELECTRICAL EQUIPMENT OF CARS:
L.M.	279	579	879	1179	Trolley stands, poles, trolley contact shoes and beams.
L.M.	280	580	880	1180	Car-heaters and lights (switches, fuse-blocks and wiring).
L.M.	281	581	881	1181	Armatures.
L.M.	282	582	882	1182	Commutators.
L.M.	283	583	883	1183	Fields.
L.M.	284	584	884	1184	Electrical car control.
L.M.	285	585	885	1185	Gears, pinions and gear cases (car motors).
L.M.	286	586	886	1186	Motor bearings.
L.M.	287	587	887	1187	Brush holders.

as the case may be; the second for work in the surface department, numbered from 201 up; the third for work on the elevated division, numbered from 501 up; the fourth for work on the bridge division, from 801 up; the fifth for work on mail and express cars and for the American Railways Traffic Company, numbered from 1101 up; the sixth and last column gives a description of the labor performed. The simplicity of this system is such that there can be little hesitation regarding the proper account against which a charge should be made, but in case of doubt the right number is specified by the comptroller.

It will be noted that there are several blank squares under some of the headings. These omissions are due to the fact that certain kinds of charges do not come up in every department. For instance, no charges appear against No 1176, covering fare registers, because there are none in the service in the American Railways and Traffic Company's department. The figures "76" do appear, however, on all the passenger divisions.

INSTALLATION AND CONNECTION OF GRID RESISTANCES

BY HENRY SCHLEGEL

The article by the writer on "Grid Starting Coils" in the STREET RAILWAY JOURNAL for Oct. 6 attracted such attention and comment that a few hints on the installation and connection of grid resistances may prove of value to some of the readers of this paper.

If we assume that we have a set of grid resistance frames well selected and correctly made, the next chance for fault and confusion is in their installation and connection—and faulty installation often begets faulty connection. The frames should be placed well away from the car floor, well away from the water and slush to be thrown by the car wheels, and well clear of all brake parts. By the latter I mean under all conditions, that is, whether the brakes are applied or released, whether the car is light or loaded, and whether it is in a curve or on straight rail or on no rail at all, and in all these cases allowance must be made for extreme travel of brake rods and chains due to neglect, slack and wear.

Secondary considerations in the location of the resistances are (a) that the frames shall be so placed that the heat of one frame shall not blow through the others when the car is in motion; (b) that the frames shall be located in the same order on all cars, and (c) that the individual placing of frames be such that the minimum length of jumper will connect the correct end of one frame to the correct end of the frame next to it. With conditions b and c observed, the right or wrong disposal of a frame can be judged at a glance.

The height above the rails and the space available under different car bodies varies so in amount and disposition that no rigid rule can apply to all. On modern grid frames the length of the legs is such that the resistance metal is held a safe distance from the asbestos lined car floor even when the legs are lagged or bolted directly to the car floor, provided a proper selection of grids prevents excessive heating; but this direct connection of frames to car floor, especially by through bolts, is to be avoided, because in event of defective grid-to-frame insulation or of a frame picking up wire in the street—and this often occurs—the through bolts become charged and create in the car floor above a charged area ready to shock a passenger making contact with it and a grounded area at the same time. The safest method of suspension is by means of the hangers supported at points where their fastening bolts will not be within reach of passengers' feet inside the car. A good method and place of suspension, where such is practicable, is to use hangers of L section which extend on either side of the short-circuit line of the car, the resistance frames being placed lengthwise along the shorter center line. This arrangement has the advantage that the sides of all frames are exposed to the direct windage due to motion and the hangers are supported from the sides where the liability to cause shock is the least. On cars with center-hung brake lever, the frames must be dropped as low as permissible and the brake rigging allowed to work between the top of the hanger and the bottom of the car. A wood or fiber guard should then be placed above the hangers on both ends to prevent any contact between the sway bar and the hanger.

Assuming that the frames have been so assembled and the sectioning so proportioned that all car wires must be brought down to the same side of the frames, care must be taken that all frames are installed with their connecting sides toward the same hanger iron. If this is not done, not only will some of the car wires have to cross over or under the frame, but a long jumper will have to be used instead of a short one, thereby making the connections appear confusing. Where the manner of assembling has not been thus standardized, it will in all cases pay to do so. The turning of a coil end for end would then become detectable at once, and this is a mighty good feature, especially on frames composed of two or more different kinds of grid. The effect of getting such a frame end for end is to put high-resistance grids of low current capacity where low-resistance grids of high current capacity should be, with the final result that the car will notch in jerks and the abused frame will give trouble. Measurement of the total resistance of the starting coil will not reveal this condition, because unless the jumpers are so run as to cut out some grids the total resistance will measure normal. The wiremen should be made to understand that jumpers between frames should be so run that current entering at one end of the starting coil must traverse every grid of every frame before leaving at the other.

The above points by no means include all of the irregularities encountered in the careless assembly, installation and connection of grid starting coils, but are sufficient to emphasize the importance of using a stand grid, assembled in a standard frame and installed and connected according to standard methods.

SHOP PRACTICE AND SHOP DEVICES AT MEMPHIS

When the Memphis Street Railway was acquired by its present owners, about two years ago, the shop department underwent a complete reorganization. New features of practice were introduced and many original devices for facilitating work were gotten up. The changes resulted in a great reduction in the maintenance expenses, and many of the devices developed might to advantage be introduced into other shops. Through the courtesy of President T. H. Tutwiler this publication is able to give an account of the work in the shop for the last two years.

On assuming charge, A. D. McWhorter, master mechanic of the shops, began at once to systematize the inspection of cars. This portion of the car-house work was regarded as having such influence on the cost of maintenance that Mr. McWhorter took personal charge of the inspection for a period in order to get the system into working order, and he now gives it a great deal of attention. Because of the limited number of extra cars it is necessary to do all of the inspection at night. About 33 men are employed in caring for 168 cars. The distinguishing feature of the system is that each man or squad of men is delegated to do a certain portion of the work on all of the cars. Each inspector is given an inspection card, a duplicate of which is reproduced. On this he is required to check the particular parts which he is required to inspect and the numbers of the cars inspected. This enables any faulty work on any car to be easily traced back to the man at fault. One squad of men inspects the trucks, brakes, wheels and motors. Another examines the brushes and lubricates the motors. One man is responsible for the condition of the fenders alone, while another has charge of the trolleys. The car body, including the grab handles and the signs, is cared for by a separate squad. One man inspects all of the controllers and one squad takes care of all of the air apparatus. The careful manner in which the inspection work is carried out is no doubt due in part to the fact that whenever faulty inspection is the cause of an accident or whenever faulty inspection is discovered, the man at fault may be ascertained by reference to the inspection cards. He is then either dismissed or dealt with in such a manner that he is not likely to repeat the offense. This is especially true with regard to armature clearance, and it is a very rare instance for an armature to get down on the pole pieces.

CAR CLEANING

In addition to the nightly cleaning of the interior and of the windows, the exterior of the car is washed off every third night with Phœnix car washer and cold water. The interior is washed thoroughly every two weeks. The floors and seats of the summer cars are blown out with air every night just before being run into the shop, air being obtained from the compressor plant in the shop. About one minute is required per car, and the adoption of air for this work has enabled the cleaning force to be cut to one-third its former number.

CARE OF HEADLIGHTS

Arc headlights are used on the cars and are turned out only when the cars are on Main Street. In order to care for the 140 arc lights used, a separate building measuring 25 ft. x 40 ft. has been constructed. In summer this building is also used to store the 600 pairs of vestibule doors which are removed from the cars during the summer season. The headlights are collected from most of the cars as they come in at night. Those from the other cars are set off at a central point down town and brought to the shop on a work car. Each day the reflectors of the headlights are cleaned, the globes wiped out, and new carbons are put in and the light is then tested. The work requires one man's time continuously.

FRONT VIEW OF SHOPS AND OFFICE OF THE MEMPHIS STREET RAILWAY

OVERHAULING MOTORS

The thorough nightly inspection to which the cars are subjected is regarded as the chief cause for the relatively small number of armatures lost. The method of overhauling motors, however, has its effect. The decrease in armature troubles may be judged from the fact that where seven winders were formerly employed, two men and a boy now do all the winding, including the manufacture of the armature and field coils for almost twice the former number of cars. Motors are overhauled by inspection rather than by mileage, and as much of the work as it is possible to do on the car-house floor is done there rather than under the car. Motors of the GE-800 type are removed from the truck bodily and are gone over on the car-house floor. With other types the lower half of the shells are set out.

It is considered that on the car-house floor there is better opportunity to get at the fields, and the better light makes it possible to see defects which would otherwise be overlooked. As a rule motors are given a thorough inspection every time bearings are renewed or armatures changed.

REPORT OF WINDING ROOM.

Month of October, 1906.

Number of men.....

	G. E. 800.	G. E. 1000.	G. E. 80.	G. E. 67.	G.E. 57.	AA-1 Comp.	AA-4 Comp.	Total
Armatures brought into winding room	69	3	..	10	56	..	2	140
Armatures for mechanical trouble	58	3	..	10	56	..	2	129
Armatures for electrical trouble	5	..	..	..	..	..	..	5
Armatures for inspection	13	..	..	..	..	..	..	13
Armatures wound	3	..	..	..	1	..	..	4
Armatures O. K. in stock	18	47	..	4	3	1	1	31
Commutators renewed	5	..	..	..	..	..	..	5
Commutators turned	54	3	..	6	14	..	1	78
Field coils O. K. in stock	188	14	..	72	4	..	..	272
Field coils wound	84	..	..	..	..	..	..	84
Field coils repaired	..	9	..	..	4	..	4	17
Field coils used	26	..	..	..	4	..	4	34

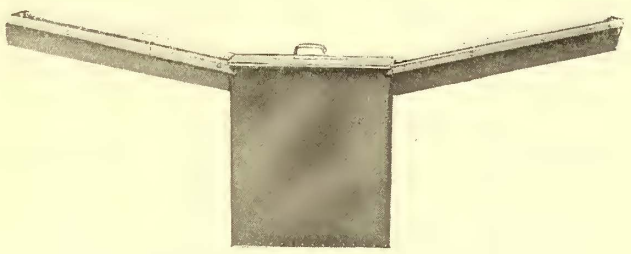
REMARKS: Wound—34 K-2 controller magnets.
Repaired—8 K-2 controller magnets.
Wound—5 electric switch solenoids.

.....Foreman.

The lower half of the shell is cleaned out thoroughly, the fields are examined and repainted, and the armatures are taken into the winding room, where they are blown out and inspected.

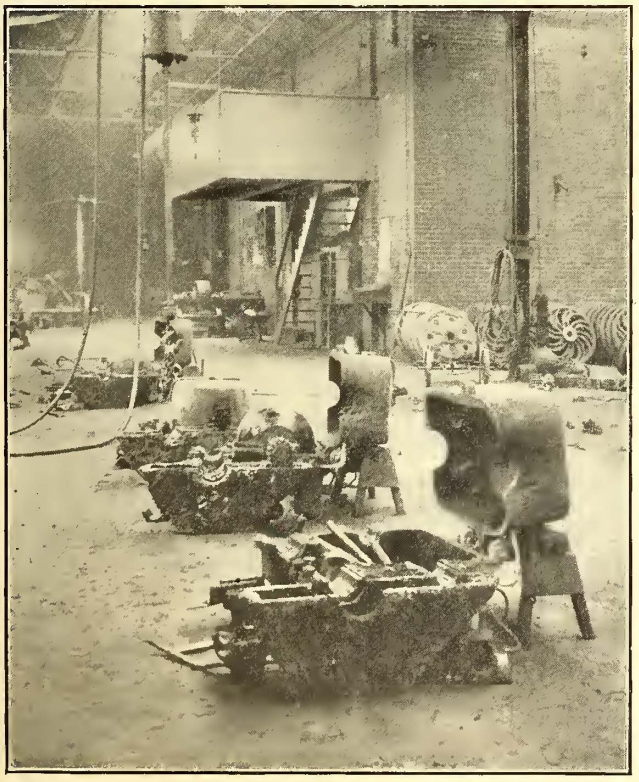
WINDING-ROOM METHODS

The small amount of trouble experienced with defective armatures may be observed by reference to the winding-room report for the month of October, 1906. This shows that only four armatures were rewound during the month. For one year, as has been stated, the record was 76 armatures rewound, and during this year, 1906, 1318 were inspected. The form of winding-room report is in itself worthy of a notice. It shows at a glance the work done in the winding room during the month, and also the number of armatures and field coils on hand. It is made out each month by the foreman of the winding room and is forwarded by him to the office of the master mechanic. This report also shows that the winding department is much ahead in its work. At the rate they were used during the month for which the report was made the 31 armatures and the 272 field coils on hand would enable the department to discontinue winding for several months. Coils are usually wound on shop orders for large numbers. The itemized cost on an order for 79 field coils is given to show the material entering into a field. This also shows a very small labor cost per field. The fillers used in the fields are of asbestos and all splices are covered with mica.

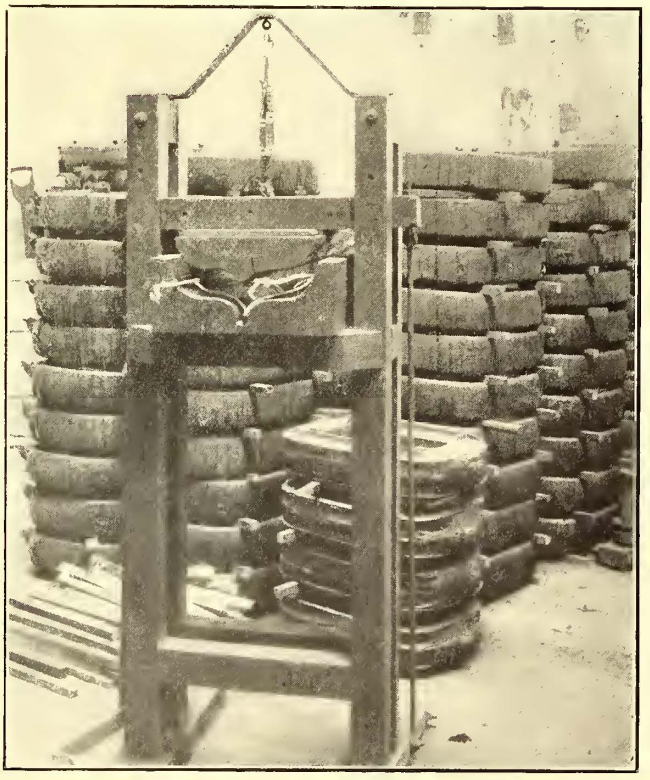


DRIP CAN WITH EXTENDING SPOUTS USED IN THE WINDING ROOM

All of the armature coils for the GE-800, GE-1000 and GE-67 motors are wound in the armature room. After being wound on the usual forms they are dipped in standard varnish and then taped with white linen tape. The operator of the taping machine tapes them at the rate of about twenty per hour. After being taped they are dipped in M. I. C. compound, and after drying and being baked they

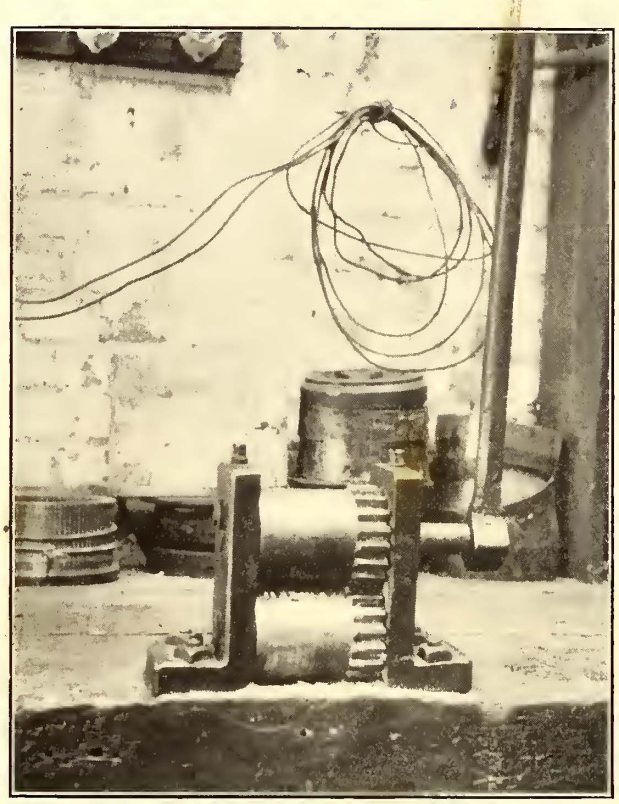


MOTORS LAID OUT FOR OVERHAULING



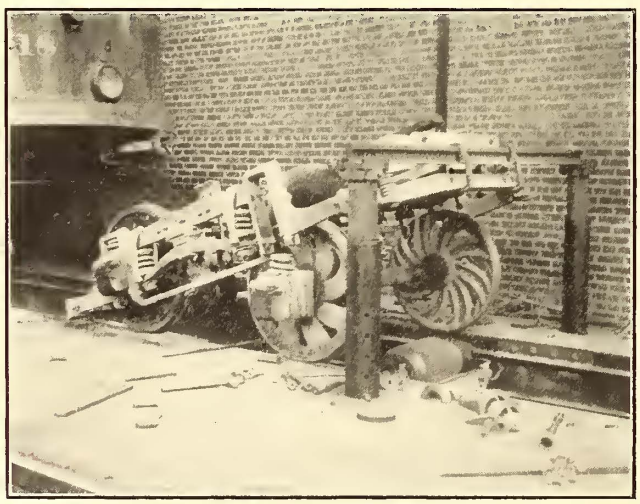
PRESS FOR SHAPING COILS; ALSO SHOWING THE MANNER OF STORING THEM

are pressed in shape in the press shown in an accompanying illustration. This press, which is operated by a foot lever so shapes the coils that very little pounding is necessary in winding the armatures. Incidentally, the reproduction of the press shows the manner of stacking fields in the wind-



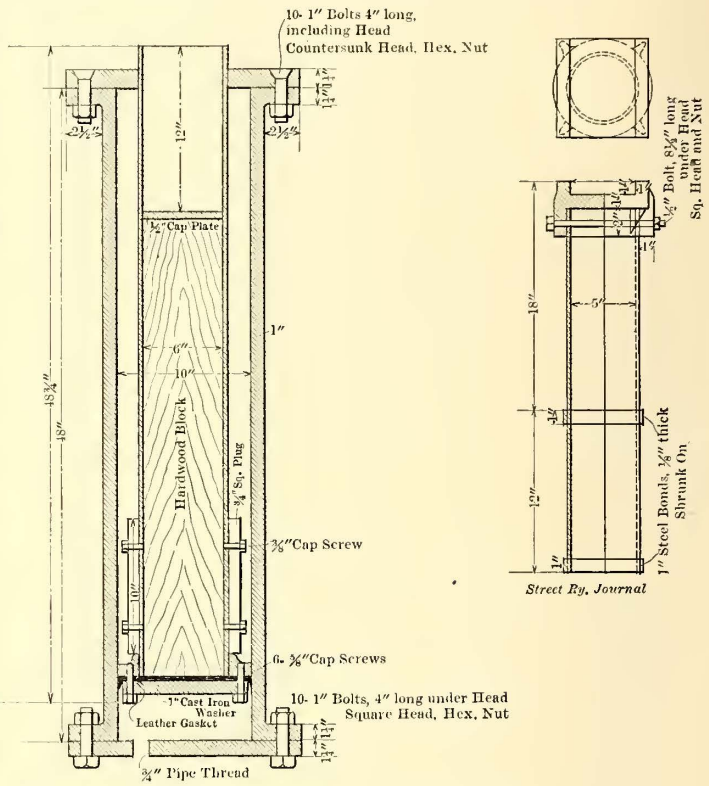
COIL FLATTENER USED IN THE WINDING ROOM

ing room. Another reproduction shows a drip can which results in a considerable saving in dripping varnish. Field and armature coils while drying are suspended above the troughs on either side of the central can and all the drip runs into the can. The two cans of this type in use are



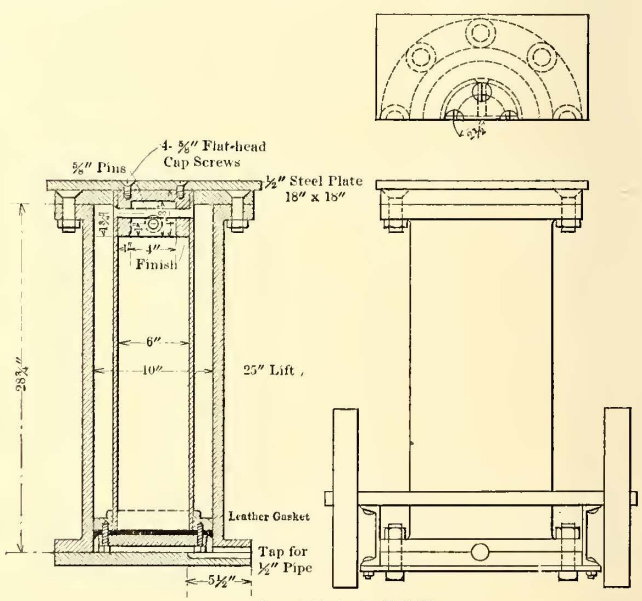
RAISING A TRUCK TO CHANGE THE WHEELS

made of No. 22 galvanized iron reinforced at the top of the troughs by small galvanized angle-irons measuring about 1 in. x 1 in. x ⅛ in. A special device for flattening the leads of GE-800 armature coils has been found to save considerable annoyance. The rolls which were made from two pieces of an old axle are placed at such a distance apart that when an armature lead is rolled between them it is flattened out to a thickness which causes them to fit snugly in the slots of the commutator bars. In winding GE-1000 coils, the coil is changed somewhat from the standard form. Instead of bringing one lead out in the center it is carried out directly from the slot as is customary with



CONSTRUCTION DETAILS OF AIR LIFT

the coils of more modern machines. The throw of the leads is not changed, the short leads being brought up to the same segment. This results in a shortened lead on one



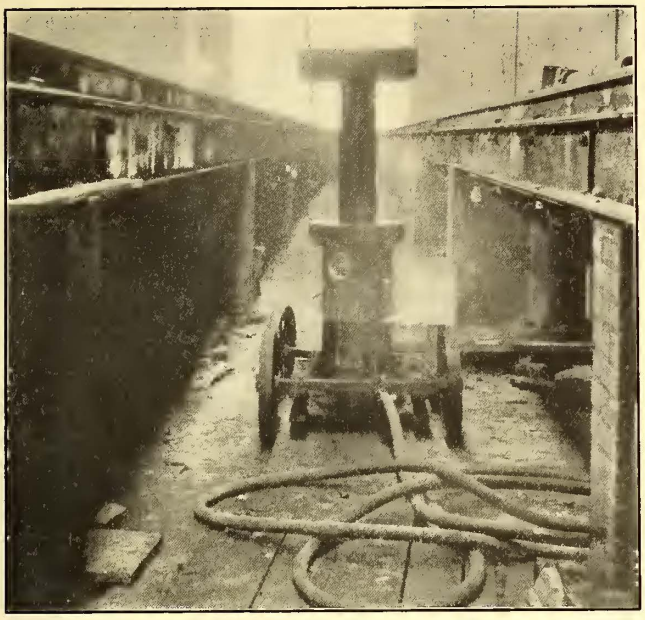
SKETCH OF AIR LIFT

end with a consequent saving in wire, and in addition the smaller amount of wire in the leads makes the head of the armature less bulky.

PNEUMATIC HOISTS AND LIFTS

The shop is well provided with air lifts and hoists, all of which with the exception of casting the parts, were made

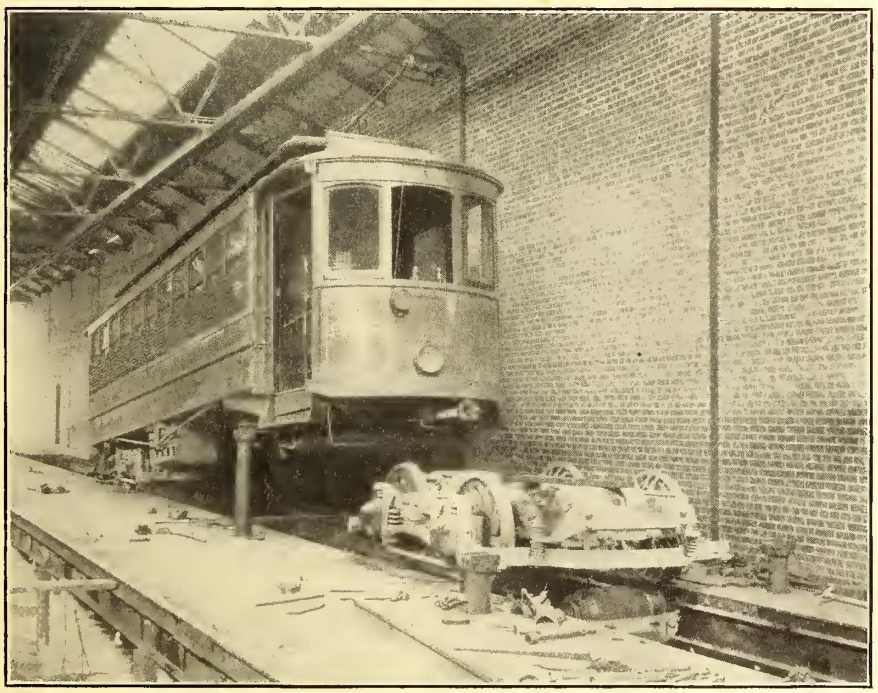
in the shops. Air is furnished by a compressor of 200 cu. ft. capacity per minute, the automatic control of which is provided with a device for throwing the load off the compressor while it is getting up to speed. A tank above the compressor measuring 5 ft. x 18 ft. furnishes storage



PIT-JACK MOUNTED ON A FOUR-WHEEL TRUCK

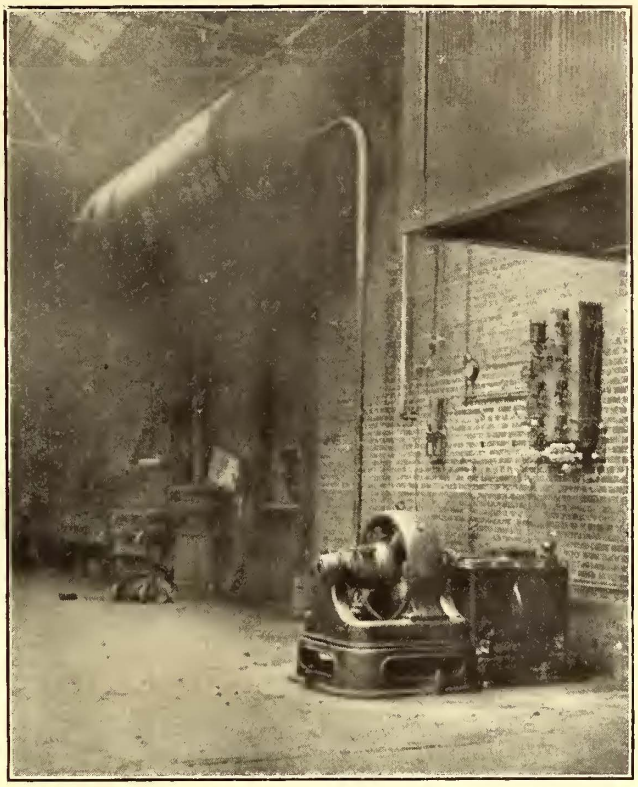
capacity. From this tank pipes lead to all portions of the shops.

Of the pneumatic hoists, probably the most interesting are the car hoists which were designed by Mr. McWhorter. Two of the reproductions from photographs show these in use and the details of their design may be gotten from an



RAISING ONE END OF THE CAR-BODY WITH TWO OF THE CAR HOISTS

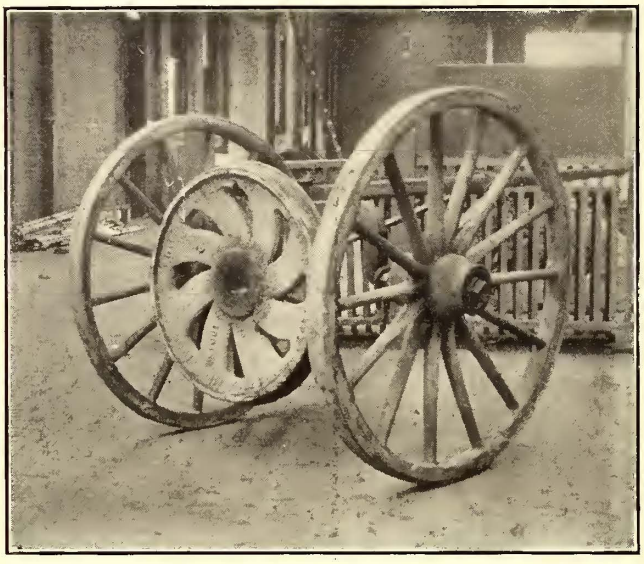
accompanying drawing. The four hoists, which are placed at a distance apart that permits them to be employed to lift a single or double-truck car body off the trucks are identical in design. The cast-iron cylinders are 10 ins. in diameter and are of such a length as to allow the piston to travel about 34 ins. The piston rod is hollow and is filled to within 12 ins. of the top with a hardwood block capped with a ½-in. steel plate. At intervals of about 3 ins. for



AIR COMPRESSOR AND STORAGE TANK USED IN MEMPHIS

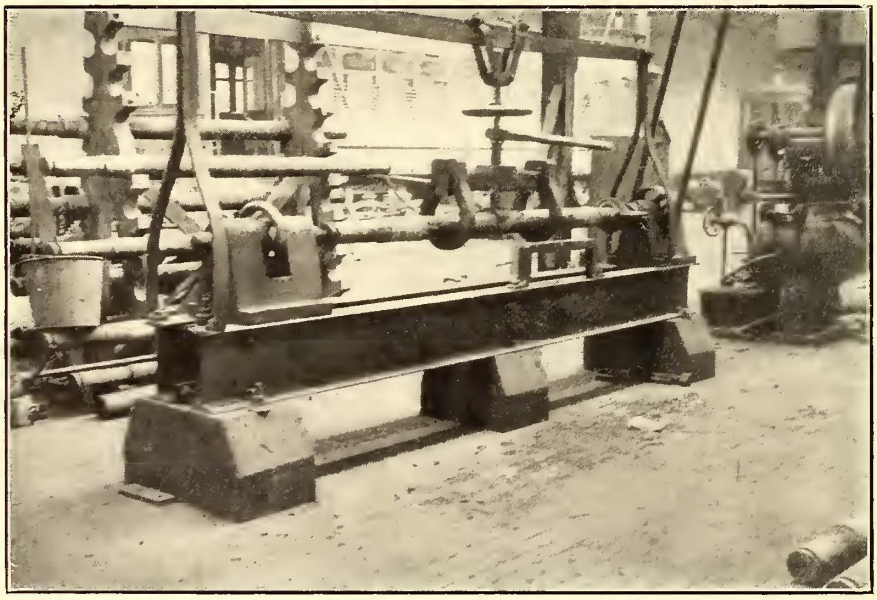
almost its full length it is drilled with 1-in. holes, as shown in the reproductions, and into which pins are inserted when the piston is to be held in one position. The load on the hoist is carried by a hollow head about 28 ins. long which is placed in the piston and rests on the wood filler. This head is capped with a casting which takes the base of a standard section rail. Two hoists opposite each other are piped in sets, but there is no mechanical connection between any of them. A straight air engineer valve with a three-way cock alongside the wall near the hoists permits the two sets to be controlled independently. When the hoists are not in use, the heads are withdrawn and the piston is allowed to drop below the floor level. When the cylinder is down and the round disc shown in one of the reproductions is placed in the hole in the upper cylinder head the floor presents a smooth surface. At the present time the hoists are operated by air. The elasticity of the air, however, sometimes causes them to move unsteadily and the system will be so piped that water will be forced into the cylinders. The pits are equipped with two 12-in. and one 10-in. air lifts of a design shown in one of the drawings. In many features these are similar to the car hoists. The head of the piston rod is capped by an 18-in. x 18-in. x ½-in. steel plate. The cylinders which have a travel of 25 ins. are controlled by a straight air engineer's valve at

the side of the cylinder. The lifts are mounted on trucks with four wheels having flat treads. Air is led to the cylinders through armored hose from the pipe outlets in the pit walls. For handling heavy parts around the machinery in the machine shop and in different portions of the shops several jib cranes and overhead tramways provided with pneumatic hoists made in the shops are used.



TRUCK FOR CARRYING WHEELS AND MOTORS ABOUT THE SHOP

A two-wheel cart of rather odd design is also used for carrying wheels and motors about the shop. It is made with wagon wheels of the usual type. Motors are handled by hooking the handles over a hook on the end of the long handle of the cart, and wheels are carried as shown in the illustration.



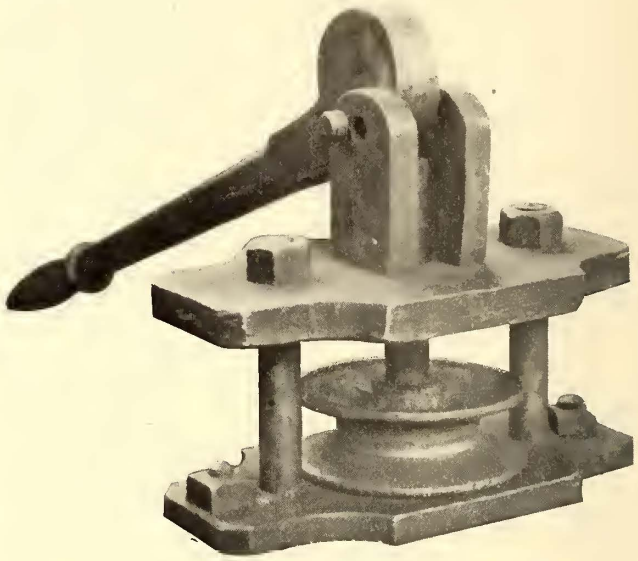
APPARATUS FOR STRAIGHTENING BENT AXLES AND SHAFTS

CHANGING WHEELS AND ARMATURES

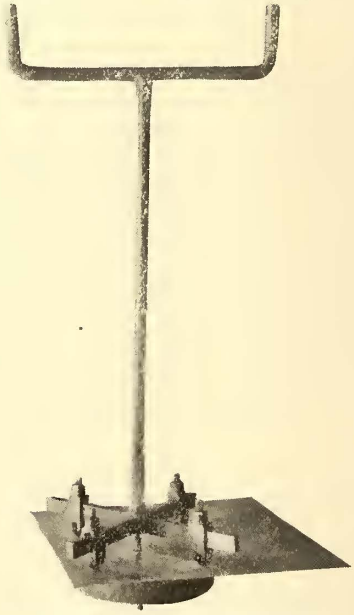
The method of removing wheels and armatures from double trucks is well shown by the two illustrations of the car hoist. Where the two pairs of a single-truck motor are to be removed both motors are dropped with the use of one pit hoist. One motor is dropped to rest on projecting shelves bolted to the bottom of the I-beams under the pit rails and the hoist is then utilized to drop the other motor.

SOME SPECIAL SHOP DEVICES

The work of straightening axles and shafts is very much facilitated and the possible injury to lathes avoided by the use of the special device illustrated. The bed is made of two 10-in. I-beams. The head stock is stationary and is belted to run at about 40 r. p. m. A trolley above the bed supports a very powerful "jim-crow." In very cold weather or when the bends are very bad the armature shafts or axles are heated before attempts are made to straighten them, but in warm weather small bends are corrected without heating. Armature shafts are straightened by the use of a bar for which a U bolted to one of the I-beams serves as a fulcrum.



DEVICE FOR PUSHING OUT TROLLEY BUSHINGS



DEVICE WITH WHICH HEADLIGHT HOLES ARE CUT IN DASHES

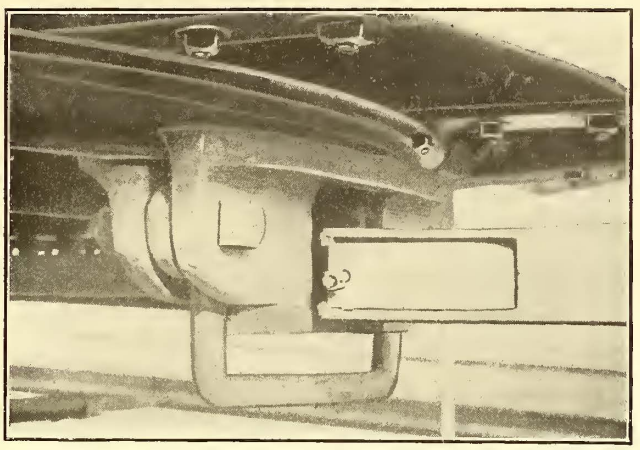
A device for cutting headlight holes in the dashes of cars has saved many times its cost. The work of rebuilding the cars, which has just been completed, necessitated 440 holes being made in dashes of No. 14 gage iron. The devices consist of a long rod with a ladle handle at one end and four radiating arms near the other. The end beyond these

arms is threaded for a nut which holds in place an iron ring of about the diameter of the hole to be bored. When the handle is turned the adjustable cutters on the cross-arms, and which are made from pipe-cutter wheels, cut a circle of any desired diameter up to 17 ins. The friction of the nut on the rear side of the dash keeps the wheels drawn up to about the proper tension. With the device two men can cut a hole in No. 14 gage iron in about twenty minutes. The cross-arm for the handles of such a device should be about 48 ins. long. In boring 440 holes four sets of No. 1 pipe-cutter wheels were worn out.

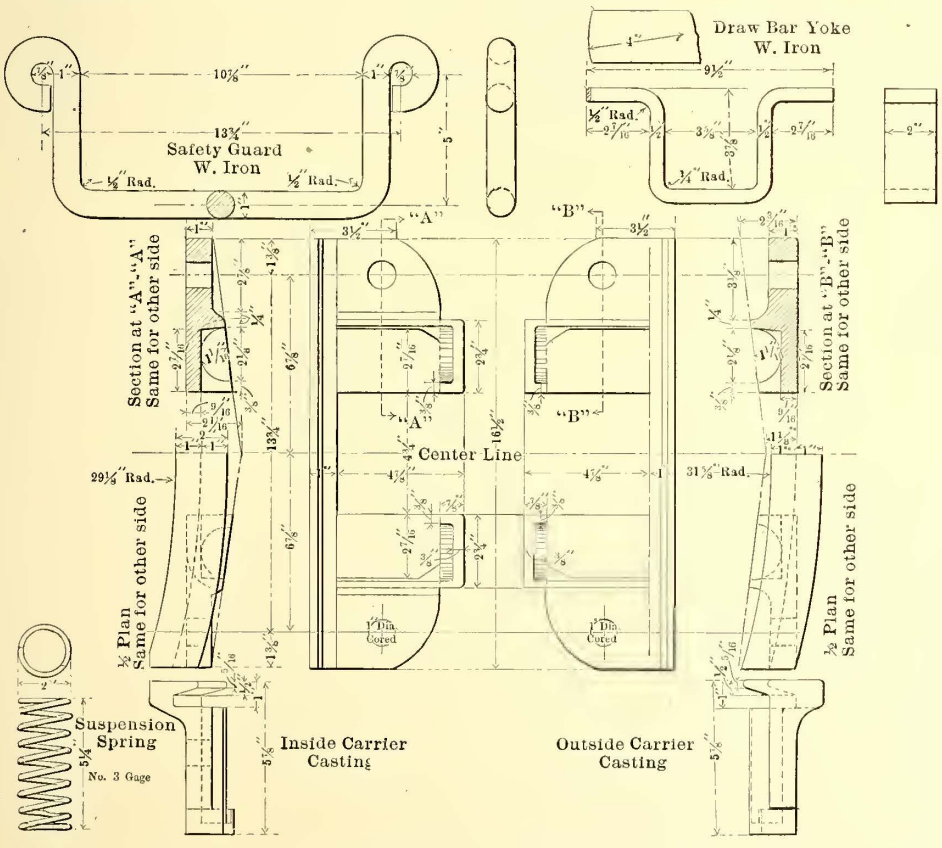
Instead of pounding trolley bushings out in the usual manner, a device for removing them by the throw of a lever has been made. The end of the lever carries an eccentric, and this acts with considerable force on a plunger which pushes the bushing out of the wheel and through a hole in the bench. One of the illustrations shows the brass armor fastened on the air hose jumpers between cars at points where the jumpers would be worn by chafing on the car bumpers. These, which are about 6 ins. long and ⅛ in. thick, are made slightly curved to correspond with the curvature of the hose when coupled. They have been the means of lengthening the life of the hose considerably.

DRAW-BAR CARRIER

Several of the reproductions show the drawbar carrier designed by Mr. McWhorter for use in connection with Van Dorn drawbars. The details of this device are given in a separate drawing. The outside and inside carrier castings are bolted together and suspended from a circular I-beam bolted to the platform timbers. The carrier castings contain seats for coil springs on either side of the drawbar opening. The drawbar is supported on a yoke the two ends of which rest on a coil of springs. A safety guard of 1-in. wrought-iron is provided to support the drawhead in the event of the yoke breaking. The springs are of such a length that the drawhead has a movement of 3 ins. above and 3 ins. below its normal position. A weight of about 200 lbs. is required to force the drawbar down to the lowest point of travel. When the drawbar is not in use the two springs push a wrought-iron plate up against the under side of the supporting I-beam with sufficient pressure to keep the bar from swinging on the beam as the car lurches. One advantage in the use of the carrier is that the drawbar heads instead of becoming worn on the top face are held up in such a manner that the wear is distributed over the whole face. The wide range of vertical travel of the bar is also an advantage, and especially so where the tracks are uneven. The carrier, moreover, always holds the drawbar level, and this adds considerably to the appearance of the car.



DRAW-BAR CARRIER, WITH WHICH THE MEMPHIS CARS ARE BEING EQUIPPED



St. Ry. Journal

DETAILS OF DRAFT RIGGING OF SEMI-CONVERTIBLE CARS

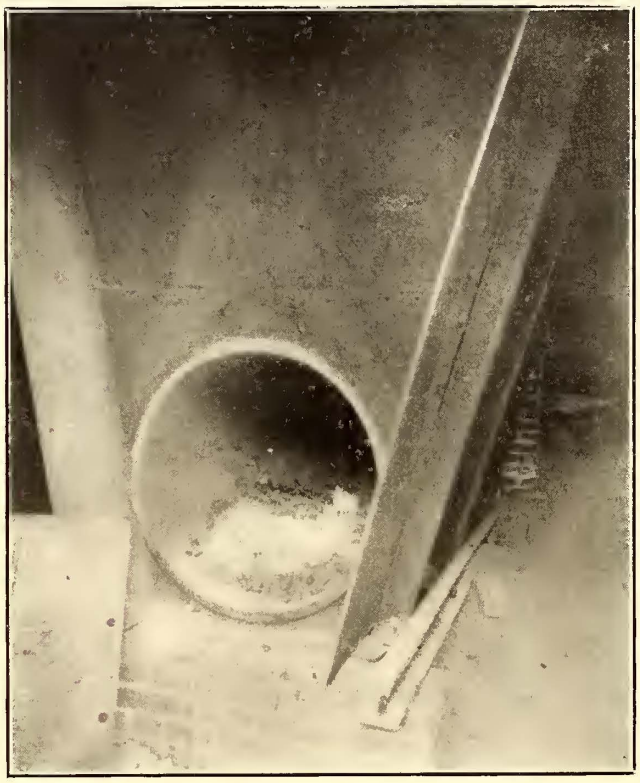
A SHOP WATER-COOLER

The Memphis Street Railway uses in its shops a home-made water cooler which is very simple in construction, comparatively cheap, and which requires very little ice. It consists of a wood box measuring 3 ft. x 3 ft. x 4 ft., well insulated to prevent the passage of heat, and having in the bottom a coil of ½-in. galvanized pipe. One end of the coil terminates in a faucet while the other is connected to the water supply. The ice, which is put into the box through a door in the rear, rests on the pipes and cools the water in them. The water from the melted ice surrounds the pipes and is heated to the temperature of the water in them. The vacant space in the box may be used by the men for keeping milk and other foods cool.

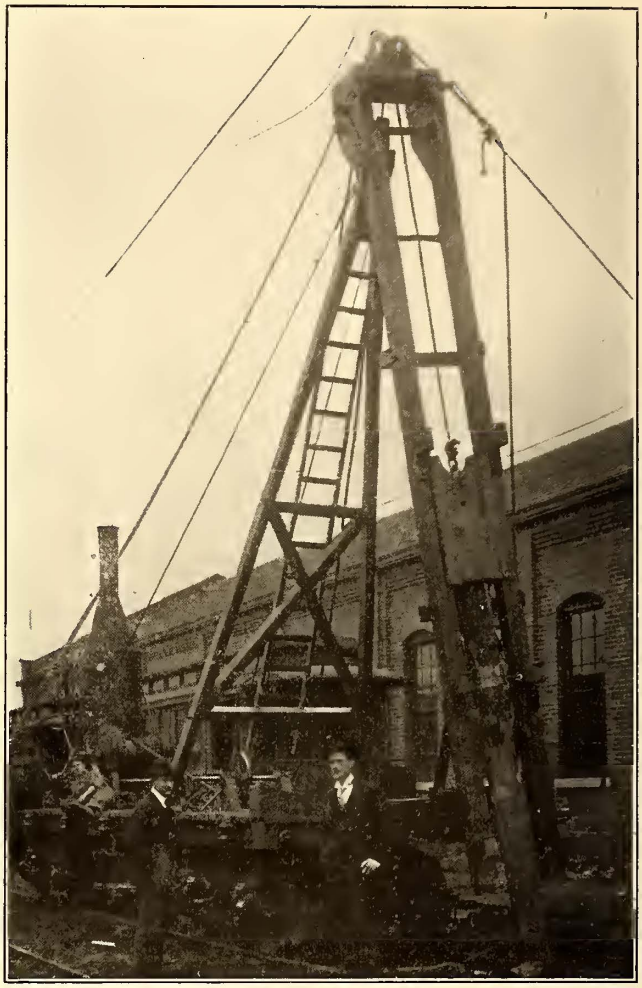
A UNIQUE SAND-DRYER

A novel sand dryer of sufficient capacity for a city road

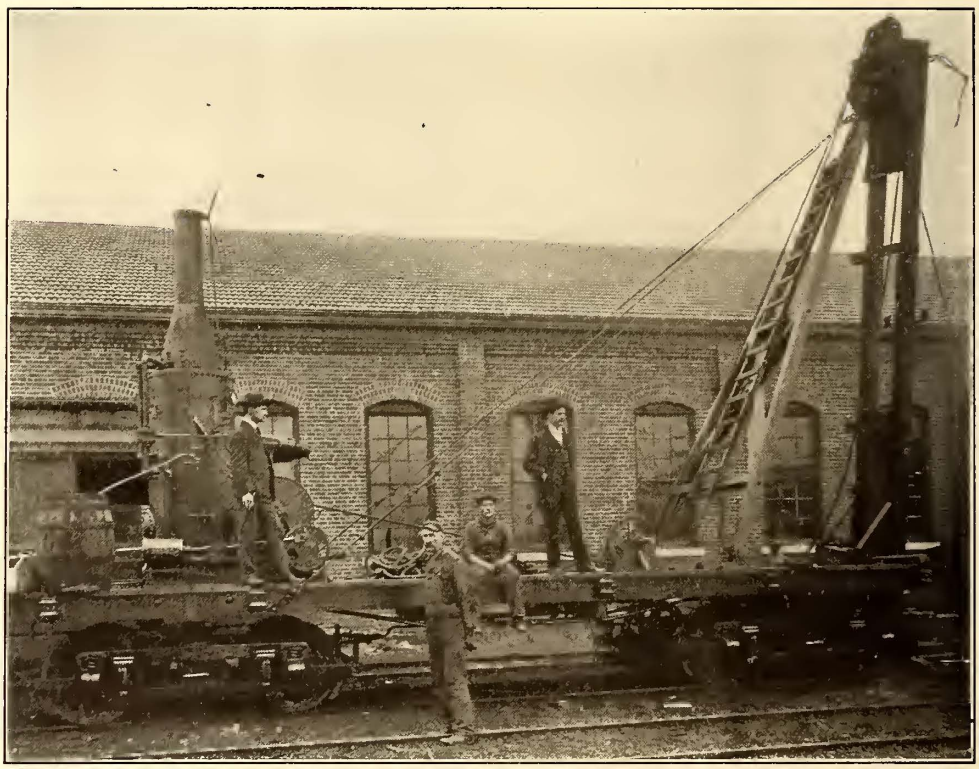
operating 150 cars is used by the Memphis Street Railway Company. The dryer is built in one side of a sand house near the shops. Around a 30-in. cast-iron water main, which serves as a furnace and which rests on brick piers has been built a hopper of 5-16-in. steel plates. The hopper, which is 6 ft. wide at the top, has a capacity of about 7 cu. yds. Between the pipe and the side sheets of the hopper a ½-in. space has been left through which the dry sand falls. The rear end of the water pipe is built into a brick chimney, and to prevent a too vigorous draft, bafflers have been placed in this end of the pipe. Sand obtained from the bottom of the Mississippi River is bought from sand companies and is thrown directly from the wagons into the hopper. Trash, old cross ties, or any available wood is thrown into the furnace and then the fire is almost allowed to take care of itself. The dryer has a capacity of about 1 cu. yd. of sand per hour. It was built by A. D. McWhorter, master mechanic of the system.



SAND-DRYER MADE OF A CAST-IRON PIPE



PENDULUM PILE DRIVER, SHOWING ANGLE AT WHICH PILES CAN BE DRIVEN



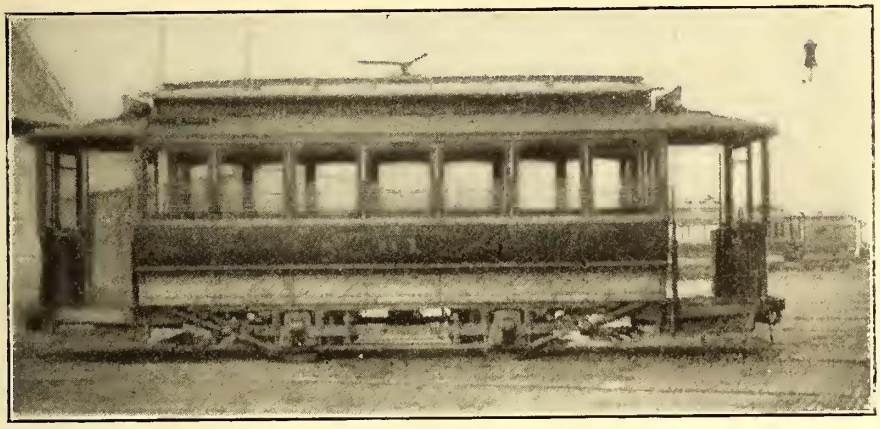
PENDULUM PILE DRIVER BUILT IN MEMPHIS STREET RAILWAY SHOPS

PENDULUM PILE DRIVER

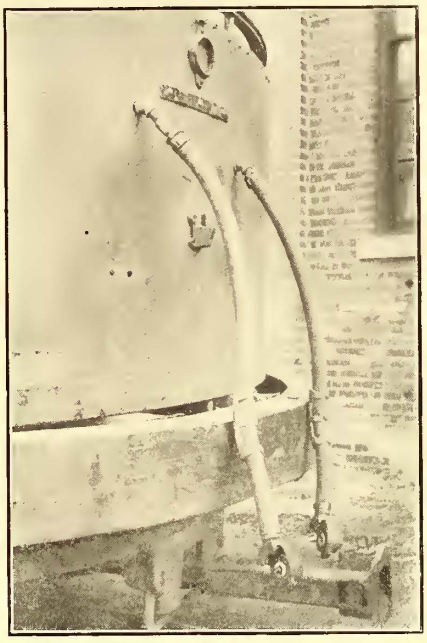
The Memphis Street Railway has just completed a pile driver with 2000-lb. hammer for use on the system, which will drive a pile at any angle up to 10 degs. on either side of a vertical position. The driver was designed by A. D. McWhorter, master mechanic of the system, and was built in the shops of the company under his supervision. It is

constructed on a flat car 32 ft. long and 8 ft. wide. When the driver is not needed for any considerable period of time it can be removed from the car and the car used for other purposes.

The leads or guides for the hammer are 22 ft. high, of 4-in. x 6-in. pine, with 2-in. x 6-in. oak runners for the hammer, and extend over the end of the car to within 18 ins. of the rail. They are supported in such a manner that while the top part is held stationary the lower ends may be swung over a radius block extending the full width of the car. The radius block is practically free from weight, as all of this is carried by braces and cables behind. A 5½-in. x 8-in. duplex steam hoisting engine mounted on the rear end of the car furnishes power to operate the hammer. Although only one drum is required for the operation of the pile driver, the engine is of double-drum type. When the pile driver is not in use the engine will be removed from the car and used in construction work when both drums will be required.



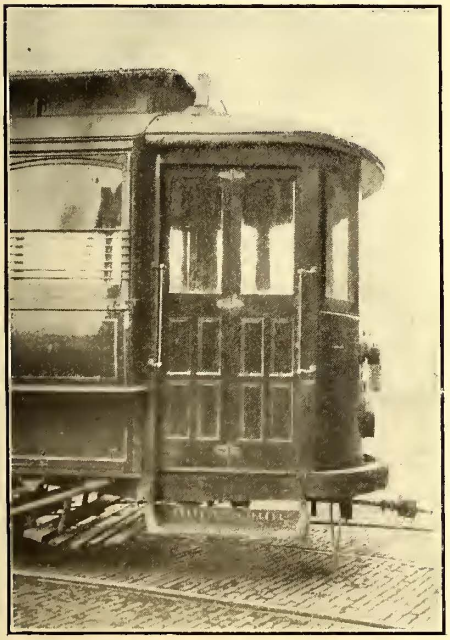
SINGLE-TRUCK CAR BEFORE OVERHAULING



BRASS LUGS ON THE JUMPERS FOR PROTECTION FROM ABRASION

CARPENTER SHOP

In a period of about eighteen months 139 cars were completely overhauled and rebuilt in the carpenter shop. The work included building closed vestibules on both ends of the cars of the type shown in one of the illustrations. In all 95 cars were equipped with these vestibules. It is the practice in the carpenter shop to keep in stock posts, doors, sash and other parts of the cars most frequently damaged so that injured cars can be gotten out of the shops quickly. All parts of vestibules are kept in stock and a vestibule can be put on a car in about three-quarters of a day. To facilitate rebuilding the cars about $5,000 was spent for woodworking machinery, and the carpenter shop is now fully equipped with frizzer, mortising machines, planers and other tools, all driven by a 35-hp motor.

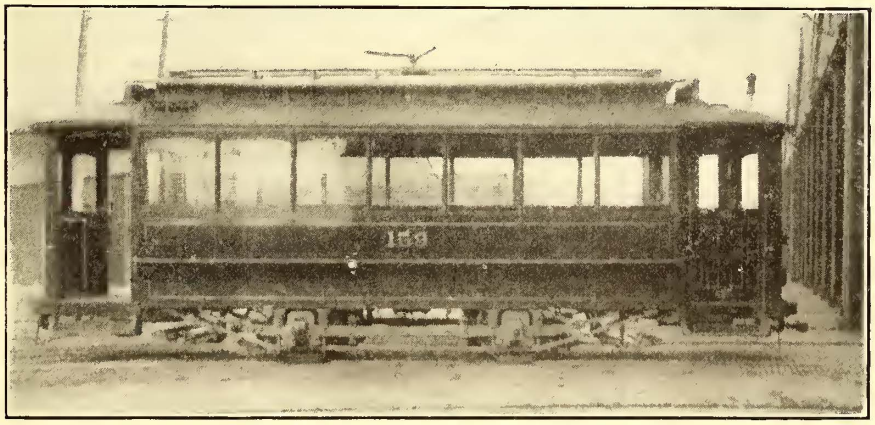


STANDARD TYPE OF VESTIBULE

PAINTING

One bay of the shop which contains three tracks, and which is well heated and lighted, is utilized as a paint shop. The under side of the tile roof has been plastered and given a coat of plaster of paris to keep out dust and to prevent the radiation of heat through the roof.

All parts of the exterior of the car, including the trucks, are painted the same shade of green. The reason for adopting the solid color is that the painting can be done somewhat cheaper and quicker and it is considered that it gives a better appearance to the car. No scrolls or decorations are used and the striping and lettering is very simple, as is shown by the reproduction of the overhauled car. From forty to fifty cars are completely repainted every year. The year after being painted it is the practice to give them one coat of body color by cutting it in around the stripping and lettering, and one coat of varnish is put on top of this.



MEMPHIS CAR AFTER OVERHAULING

The second year the car bodies are given two coats of body color and two coats of varnish. This process costs about $20 per car per year. With this method it is believed that a car can be kept out about six years before it will be necessary to remove the old paint and repaint them. The practice of "cutting in" one coat or color is preferred to retouching the car, because the latter method gives a more or less spotted appearance and it is believed that "cutting in" can be done at a very little additional cost.

Form 105—500—3 '05.

MEMPHIS STREET RAILWAY CO.

SHOP ORDER No. 96. DUPLICATE.

Issued.....190.... To be Completed.....190....

WORK TO BE DONE (state very fully) .....

.....

.....

.....

.....

.....

SUPERINTENDENT.

Date Completed.....190.... FOREMAN.

NOTE.—All labor and material used in the work called for in this order must be reported by the Order number and to no other account. The Original will be posted upon the bulletin board at the shops, and remain until the completion of the work. The Duplicate will be sent to the Auditor. The Shop Order tag bearing same number will be attached to the work for identification. All scraps removed from the work should be accounted for and reported, under this number, to the Auditor. Immediately upon completion of the work the Original will be taken from the bulletin board and sent to the Superintendent by the Foreman.

Charge to Account.....

Total Labor - - - - $..... Final Account.....

" Material - - - .....

Total - - - - - $.....

Less Scrap - - - - - .....

Net Cost - - - - $.....

SECRETARY.

SHOP ORDER FORM 105

Form 222—P P. Co. 6492

MEMPHIS STREET RAILWAY CO.

Daily Time Report.

Name..... **Date**.....190...

Occupation..... **Total Time**.....

	HOURS		HOURS	CAR PAINTING	HOURS
Motors 57s....		Power House, Mchl...		Car No..	
67s....		Power House, Elec....		Car No.	
800....		Fenders.....		Car No.	
Arm. Repairs.....		Car Body Repairs.....			
Field Repairs.....		Truck Repairs.....		MISCELLANEOUS	
Controllers.....		Brakes.....		Sweeping.....	
Car Wiring.....		"Air" Equipment.....		Sand Drying.....	
Inspecting E E....		Wheels and Axles....		Trail Car Coupler....	
Headlights.....		Track Work.....		Car Shifting.....	
Trolleys.....		Line Work.....		Car Cleaner.....	
Work Cars.....		Building & Fixtures..			
Shop Tools.....		Oiling Journals.....			

MISCELLANEOUS WORK	HOURS
Shop Order No.	
.....	
.....	
.....	

DAILY TIME REPORT

SHOP ACCOUNTING

Special jobs in the shop are done on shop orders and all labor and material are charged to them. The orders are made out in triplicate. The original is turned over to the foreman of the department in which the work is to be done, and he posts it on the bulletin board of his department. The duplicate which is sent to the auditor has on the back

RECAPITULATION.

Period.	Labor Charge.		Material Charge.		Scrap Credit.		Net Cost.	
Total.....								

BACK OF FORM 105

Form 241. 10m-7-06. S.C.T.&Co.

THE MEMPHIS STREET RAILWAY COMPANY.

DAILY REPORT OF CARS AND EQUIPMENT INSPECTED.

Day of week..... Date.....

Parts Inspected.	Day Inspected.	Car Numbers.						
Trucks, truck bolts, other parts.....	Daily	1	131	175	322	366	510	554
Brakes.....	"	2	132	176	323	367	511	555
Brake chains.....	"	9	133	177	324	368	512	556
Wheels and axles.....	"	10	134	178	325	369	513	557
Sand boxes.....	"	11	135	179	326	370	514	558
Floor gongs.....	"	12	136	180	327	371	515	559
Motors, bolts, gear cases....	"	13	137	181	328	372	516	560
Armature clearance.....	"	14	138	182	329	373	517	561
Motor leads.....	"	20	139	183	330	374	518	562
Carbon brushes.....	"	21	140	184	331	375	519	563
Brush holders.....	"	22	141	185	332	376	520	564
Lubrication.....	"	23	142	186	333	377	521	565
Trolley wheels, poles, base.	"	24	143	187	334	378	522	566
Trolley rope.....	"	100	144	188	335	379	523	567
Grab handles.....	"	101	145	189	336	380	524	568
Steps.....	"	102	146	190	337	381	525	569
Gates.....	"	103	147	191	338	382	526	570
Doors.....	"	104	148	192	339	383	527	571
Seats.....	"	105	149	193	340	384	528	700
Fenders.....	"	106	150	194	341	385	529	701
Registers.....	"	107	151	195	342	386	530	702
Bell cords and straps.....	"	108	152	196	343	387	531	703
Glass.....	"	109	153	197	344	388	532	704
Air compressors, lubrication	Mondays	110	154	198	345	389	533	705
Air governors.....	"	111	155	199	346	390	534	706
Outside journals, lubrication	Saturdays	112	156	200	347	391	535	707
Signs.....	Daily	113	157	201	348	392	536	708
Trolley catchers.....	"	114	158	202	349	393	537	709
Headlight glass.....	"	115	159	306	350	394	538	710
Controllers.....	"	116	160	307	351	395	539	711
Air valves.....	"	117	161	308	352	396	540	712
Air pressure gages.....	"	118	162	309	353	397	541	713
Lamp circuits.....	"	119	163	310	354	398	542	714
Heaters.....	"	120	164	311	355	399	543	715
Circuit breakers.....	"	121	165	312	356	500	544	716
Push buttons.....	"	122	166	313	357	501	545	717
Cars washed—inside.....	"	123	167	314	358	502	546	718
Cars washed—outside.....	"	124	168	315	359	503	547	719
		125	169	316	360	504	548	720
		126	170	317	361	505	549	
		127	171	318	362	506	550	
		128	172	319	363	507	551	
		129	173	320	364	508	552	
		130	174	321	365	509	553	

The car parts and apparatus as above checked have this day been inspected and are in good order.

.....Inspector.

.....Foreman.

NOTE.—Each employe is required to check the parts and apparatus which he is designated to inspect and numbers of cars inspected, by running line through same. No two inspectors will report on the same blank form.

DAILY REPORT OF CARS AND EQUIPMENT INSPECTED

columns for the labor charges, material charges, scrap credit and total cost, and the actual cost of the work after being obtained by the auditing department is entered on the duplicate. At the time the order is made out the master mechanic notifies all of the foremen interested in the work and others by letter that the order has been issued, and he also gives them any special instructions as to charging material and labor to it. When the first work on the order is started, a tag of heavy manila paper measuring 4 ins. x 9 ins., and bearing the number of the shop order, is at-

Form 106. 507-3-05

MEMPHIS STREET RAILWAY CO.

SHOP ORDER.

No. 96

Attach this to the work and keep it there until completed, then return to the Foreman

SHOP ORDER TAG

tached to the work. The return of this tag to the office is an evidence that the order has been completed and that costs upon it may be computed.

In one instance ninety-five sets of vestibules were built on a single shop order. All field coils are wound on shop orders, and in order to keep the maintenance charges correct they are turned back into the storeroom and the cost is charged up to the storeroom department.

TIME CARD

With the exception of painting, no attempt is made to keep records of the cost of maintenance of each car. The workman's time card is gotten up with the idea of distributing the charges to different parts of the work on all of the cars. However, the charges on the different types of motors are kept separate, with a view of determining the relative cost of maintenance of the old and the new types. The shop time cards are of heavy manila paper and measure 4½ ins. x 6½ ins. The shop practice has been established and for the most part the devices have been designed by Mr. McWhorter since he assumed charge of the shops in March, 1905. In the work he has been assisted by R. G. Stewart, general foreman of the shops.

THE STREET RAILWAYS OF NEW HAMPSHIRE FOR THE YEAR

The electric railroad corporations making returns to the Railroad Commissioners of New Hampshire for 1906 are the same as in 1905, except that the Atlantic Shore Line, in which the Portsmouth, Dover & York was merged Feb. 1, 1906, reports for the last five months of the year. This new corporation has 71 miles of road in Maine and only 3 in New Hampshire, from Main Street, in Dover, to the Elliot bridge, but the great bulk of its traffic is to and from Dover and Portsmouth and the York beaches, and might properly be classed as New Hampshire business In making comparisons, however, the board has eliminated this and confines itself to roads entirely within the State. Taken together these roads make a better exhibit than ever before. The winter of 1905-06 was a favorable one and there was an increased volume of business in the following summer, which partially appears in the returns for the year ending June 3. The companies operated 221 miles of line with 243 miles of track, practically the same as in the preceding year. This, with the appurtenant property, represents an investment of about six and a half million dollars, four millions in stock and two and one-half millions in bonds. Their gross receipts in 1906 were $1,055,488.39, as against $977,-919.95 in 1905, and their operating expenses were $870,-892.21, against $815,845.94. In 1906 they collected 24,606,-611 five-cent fares, against 18,880,742 in 1905. Nine of them showed a divisible income of $145,342.73, and six of them reported deficits amounting to $66,758.76, while a year previous only seven returned a divisible income aggregating $103,325.07, and eight deficits amounting to $95,993.21. The principal statistics of the companies reporting are given in the table on this page.

STREET RAILWAY STATISTICS OF NEW HAMPSHIRE FOR THE YEAR 1906

	Length of Road.	Miles of Track.	Stock.	Bonds.	Current Liabilities.	Gross Income.	Operating Expenses.	Fixed Charges.	Deficit or Divisible Income.	Number Five-Cent Fares.
Atlantic Shore Line*	73.91	77.91	$3,000,000.00	$1,871,000.00	$49,477.84	$183,504.28	$108,556.71	$60,176.38	‡$14,771.19	2,496,562
Berlin	7.50	7.75	110,000.00	105,000.00	.....	44,654.19	35,366.08	7,595.34	‡1,692.77	871,142
Chester & Derry	7.75	7.75	50,000.00	50,000.00	7,678.50	14,667.65	9,813.17	2,918.70	‡1,935.78	253,205
Claremont	7.32	7.98	260,000.00	180,000.00	122,180.11	29,288.36	23,759.87	5,783.12	§254.63	358,505
Concord & Manchester	27.88	30.22	250,000.00	473,000.00	.....	147,459.80	122,336.31	2,356.42	‡22,767.07	2,782,827
Dover, Somersworth & Rochester	17.00	17.74	375,000.00	300,000.00	31,625.00	91,882.26	60,453.88	24,449.86	‡6,978.52	1,803,080
Exeter, Hampton & Amesbury	20.72	21.60	360,000.00	225,000.00	116,838.88	52,496.07	48,682.82	22,720.66	§18,907.41	870,948
Haverhill, Plaistow & Newton	8.15	8.47	225,000.00	145,000.00	21,750.00	33,041.76	25,379.94	7,632.70	‡29.12	652,096
Hudson, Pelham & Salem	27.30	30.21	475,000.00	365,000.00	153,858.93	94,147.04	84,487.36	22,916.55	§13,256.87	1,843,845
Keene	8.34	8.58	220,000.00	80,000.00	65,447.78	26,529.53	20,472.92	7,115.59	§1,058.98	524,301
Laconia	8.36	8.87	140,000.00	130,000.00	11,500.00	30,493.35	20,336.85	10,011.11	‡145.39	593,207
Manchester	28.65	37.23	944,500.00	.....	163,861.11	313,013.20	243,998.05	9,693.91	‡59,321.24	6,102,659
Nashua	14.16	15.52	325,000.00	150,000.00	34,746.19	78,602.59	56,622.60	8,405.76	‡13,574.23	1,506,162
Portsmouth	18.10	19.25	.....	.....	.....	65,083.29	91,561.57	.....	§26,478.28	1,284,901
Portsmouth, Dover & York†	36.97	38.51	650,000.00	710,000.00	19,311.58	103,512.67	58,188.94	21,866.90	‡23,456.83	1,989,632
Portsmouth & Exeter	11.98	12.23	185,000.00	145,000.00	35,400.30	19,812.86	19,283.20	7,332.25	§6,802.59	390,349
Seabrook & Hampton Beach	5.53	5.80	65,000.00	45,000.00	18,750.00	14,316.44	8,337.59	5,308.26	‡670.59	283,190
Springfield	2.25	.....	12,000.00	.....	.....	.....	.....	.....	.....	.....
	331.87	355.62	$7,646,500.00	$4,974,000.00	$1,112,426.22	$1,342,505.34	$1,037,637.86	$226,283.51	.....	$24,606,611

* Includes Portsmouth, Dover & York for five months, from Feb. 1, 1906.
† For seven months ending Jan. 31, 1906.
‡ Divisible income.
§ Deficit.

Divisible Income	$145,342.73
Deficits	66,758.76
Excess of Income	$78,583.97

Without doubt the question of switching charges made against the interurban roads by the Toledo Railway & Terminal Company will be brought before the State Railroad Commission. It is claimed that steam roads are charged $1 per car for switching, while the interurbans are charged $3 per car for the same service. This charge is made for transferring cars from the steam railroads to the interurban electric railways or from one interurban railway to another.

FUNERAL CAR SERVICE AT BALTIMORE

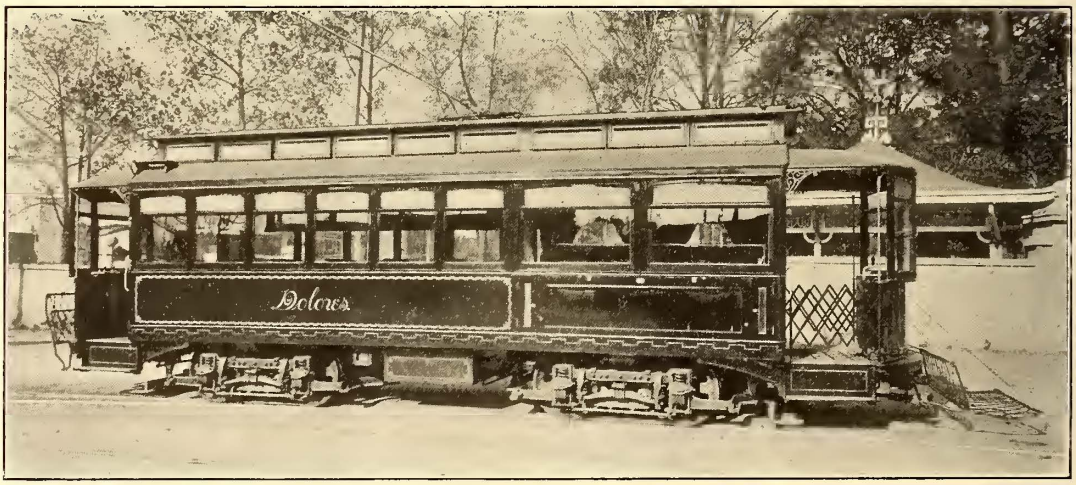
For the past six years the United Railways & Electric Company, of Baltimore, has conducted a trolley funeral service with its funeral car "Dolores." This car was put in commission Oct. 1, 1900, and as practically all of the city and suburban cemeteries of Baltimore are reached by some line of the company's system, the car has proved very popular. Last summer it was thoroughly overhauled and refitted. This work included mounting the car on new trucks and equipping it with four Westinghouse No. 49 motors.

FOLDING BIER FOR CARRYING CASKET

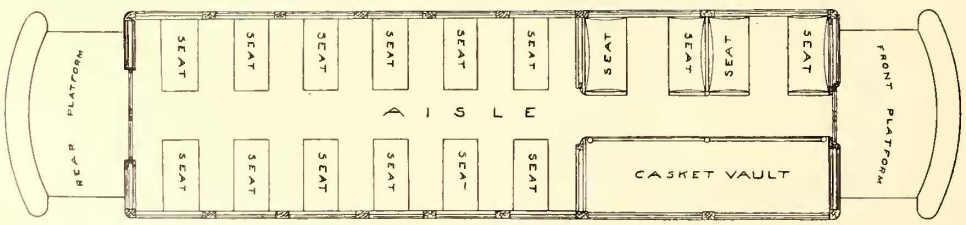
END VIEW OF FUNERAL CAR

No difficulty has been experienced through the car blocking the track at the time of a funeral. If the house is on a street on which there are tracks, the arrival of the car in front of the house is timed so that it will be there at the close of the ceremonies. If it is not on a street on which there are tracks, the folding bier shown on this page is used. This bier consists of a light carriage with pneumatic tired wheels, mounted on an axle which can be folded under the bier when not in use. The bier is purposely made low so that when the casket is placed upon it and it is pushed forward by the pallbearers the appearance is not unlike that if the casket were being carried. As the tracks reach practically every portion of the city the transportation on this folding bier is rarely more than a city block. The bier may also be used for the conveyance of the casket from the car through the cemetery if desired.

The car itself is divided into two compartments which are separated by portieres. The smaller, or forward compartment, contains the receptacle in which the casket is carried, and also seats for eight passengers. The receptacle for the casket extends the entire length of one side of the forward compartment and is of cherry paneling lined with black cloth; it is tastefully draped. To insert the casket the outside panel, which is of thick plate glass, is swung outward, exposing a sliding slab which is held in place by a bolt



SIDE VIEW OF FUNERAL CAR



PLAN OF FUNERAL CAR

Nickel pegs hold the casket in place so that it will not jolt around. The slab runs on roller bearings. The top of the casket compartment is level with the window sills, and upon it the floral contributions are placed, where they are visible not only to the occupants of the car but through the windows from the street. The larger compartment has twelve crosswise seats which accommodate two passengers each, thus giving the

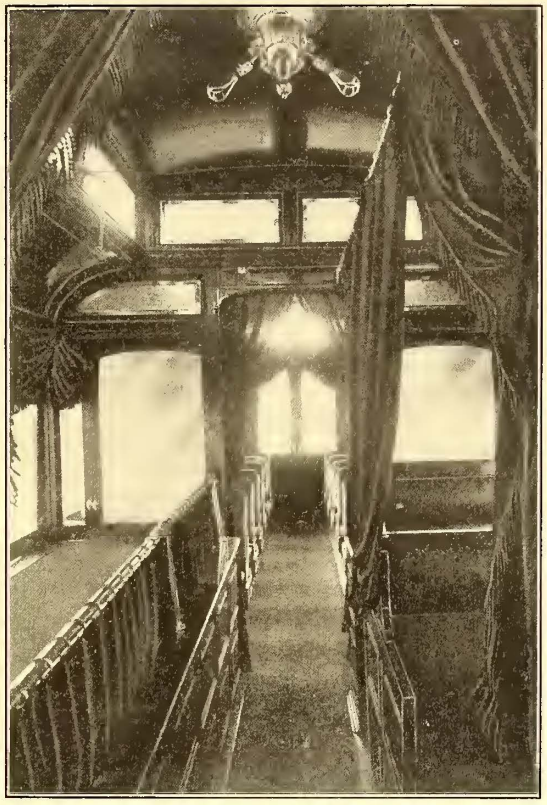
car a total seating capacity of thirty-two persons.

The interiors of both compartments are finished in hard wood, are comfortably furnished and present an attractive appearance. The seats are upholstered in leather; the windows and doors are draped with black curtains and the aisle is carpeted. A system of ventilation keeps the car cool during the summer months, while in the winter it is warmed by electric heaters.

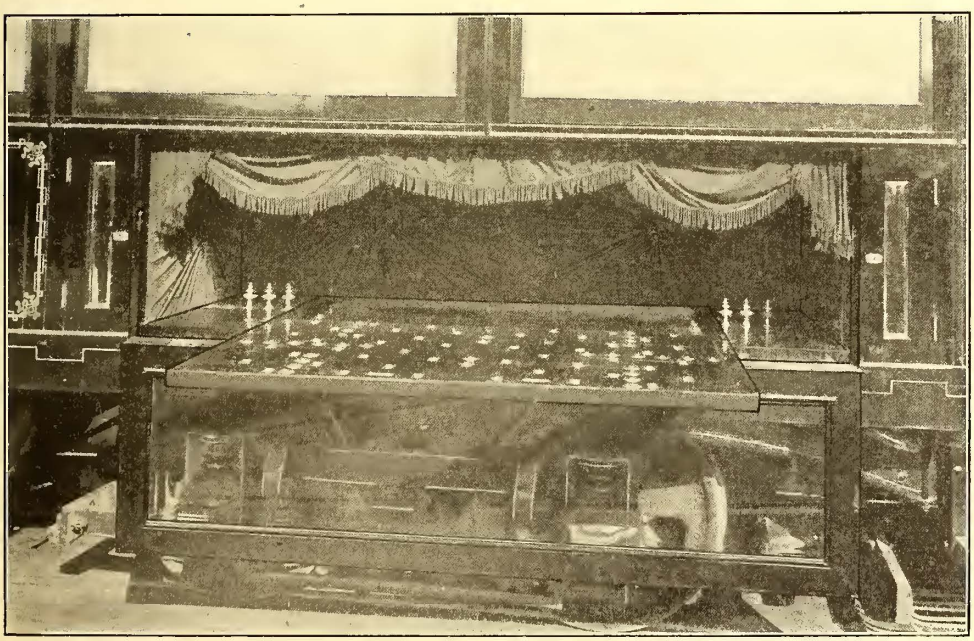
The "Dolores" is in charge of a special crew, thoroughly acquainted with the requirements of its special use, who know how to render all possible assistance looking to the comfort and convenience of those who use the car.

The charges for the car to cemeteries within the city limits of Baltimore are $20, and for service outside the city limits from $2 to $15 additional, depending on the distance to be traveled.

REAR COMPARTMENT



FORWARD COMPARTMENT



RECEPTACLE FOR CASKET, WITH SLIDING SLAB AND FRONT PANEL LOWERED

IMPROVEMENTS BY THE ROANOKE (VA.) RAILWAY & ELECTRIC COMPANY

The Roanoke Railway & Electric Company, of Roanoke, Va., has just announced that it will build a power house to cost $225,000, on property recently purchased in Norfolk from the Norfolk & Western Railway Company. The plant will be 90 ft. x 140 ft. floor area, and will be designed so that it can be extended from time to time to suit the requirements of the service. The building will be reinforced concrete construction. The initial equipment will consist of four 500-hp boilers and one 1500-kw turbo-generator and two 500-kw turbo-generators. In connection with the announcement of its plans for the building of this new station, the company calls attention to the arrangements made at the annual meeting in December for the expenditure of $108,000 for general improvements such as new cars, double tracking and rebuilding some of its line, and increasing the capacity of its car house. An order has already been placed for 72-lb. 6-in. T-rail for double tracking in the paved streets, and also for two double-truck Brill convertible and two double-truck Brill semi-convertible cars, each of which will be equipped with four GE-80 motors. These cars are to be delivered to the company by May 1, 1907.

THE BOW TROLLEY AND THE WHEEL

BY AN AMERICAN ENGINEER

The correspondence columns of the Street Railway Journal for Jan. 19 and Feb. 9, 1907, contain two letters which present opposite but interesting views of the relative merits of the sliding bow and wheel trolley. During the writer's visits to Europe, and especially to Germany, he has tried to get at the real merits of the sliding bow, and perhaps

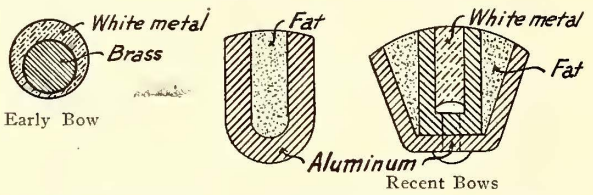


FIG. 1.—SECTIONS OF DIFFERENT TYPES OF BOWS

some further comparison with the wheel trolley may be of interest.

One point of inferiority of the bow appears to be the limited amount of current it can collect. But this disadvantage can be somewhat overcome at points where large currents are needed by adding another trolley wire beside the first, so that the bow presses automatically up against two conductors instead of one. This is impossible with the ordinary wheel trolley but is of considerable value on grades and curves. This practice of doubling of the trolley wire is followed on the western division of the Amsterdam-Haarlem electric railway in Holland, where the line is most distant from the power house. Another disadvantage laid to the sliding bow is the relatively short life of some of the aluminum contact strips. One recent type was found to have a life of only about 5000 miles, and cost about $1 for renewals. But in another city the life has frequently been as great as 25,000 car-miles. This corresponds to an average mileage per 1 cent of cost for about 69 car-miles, or 48 car-miles if maintenance is included. To compensate for any real disadvantage in this respect, there is the smaller wear on the trolley wire, especially on curves. With a new wire, the only immediate wear appears to be a slight flat on the under side, but even this has sometimes been found hardly measurable after a year's service. The average loss in diameter in Dresden after the first four years' use was about 4 per cent, and wires in both Dresden and Budapest have now been up for over twelve years. The well-known zig-zagging of the wire distributes the wear over the width of the bow. With an 8-mm wire, the flat has been found to reach a width of about 3 mm and then widen but slowly. As the top of the bow is flat, it would have about 3 mm in contact with the trolley wire.

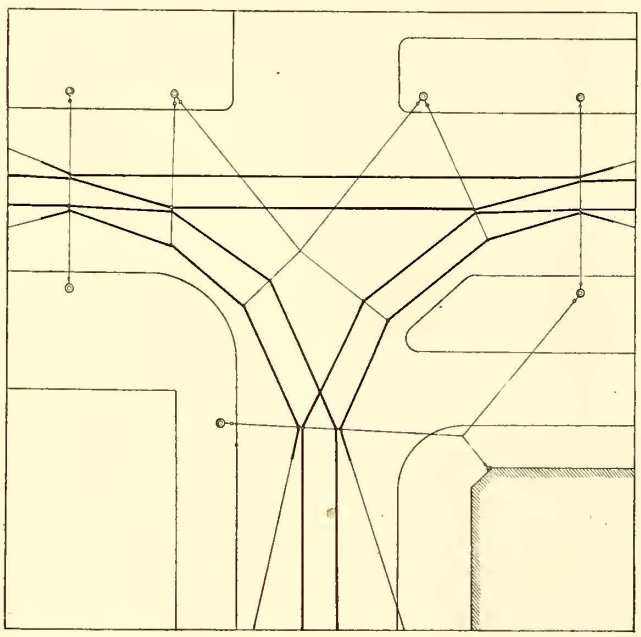


FIG. 2.—OVERHEAD WIRING FOR SLIDING BOW, DRESDEN

The writer rather expected to find the bow noisier than the wheel, because a scraping contact would seem likely to produce more vibration than a rolling one. The contrary appeared to be the case, though the earlier types of bow were said to have been noisy. The contact strip of the bow has a groove filled with grease (Fig. 1), or the under side of the trolley wire instead may be lubricated. This latter practice is said to facilitate the removal of ice from the wire in winter.

The light pressure of the ordinary sliding bow against the wire, as low as 8 lbs., is obviously a disadvantage at high speeds. But it will be remembered that in the Zossen trials a type of bow was devised with which vanes balanced the wind pressure, and only about 6 lbs. pull on the springs was needed to maintain a satisfactory contact at the highest speeds.

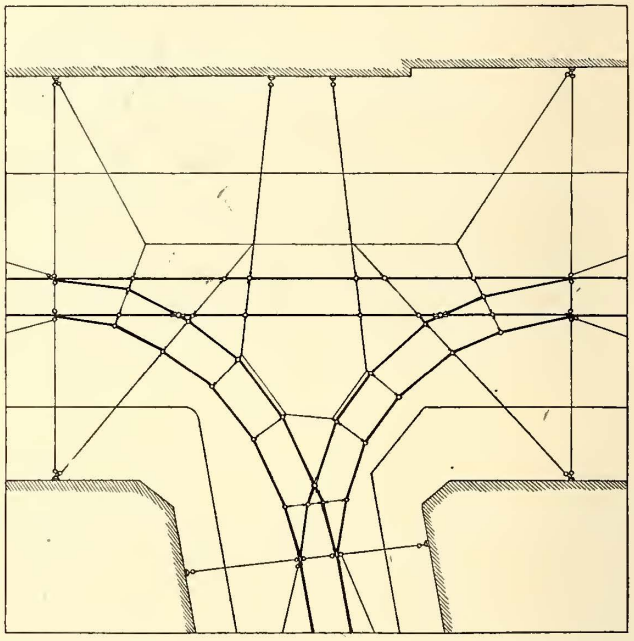


FIG. 3.—OVERHEAD WIRING FOR TROLLEY WHEEL, BERLIN

What impressed the writer most with the value of the sliding bow was the opinion of the chief engineer of one of the largest and best managed street railway companies in Europe, a company that is now using the wheel trolley, who said emphatically that he would use the bow if he could equip his system over again.

The width of the contact piece, which may be about 48 ins., allows a simplification of overhead work at curves and junctions, as illustrated in two accompanying plans of actual wiring for the bow and for the wheel (Figs. 2 and 3). It will be noted that, under the similar conditions, the trolley wire for the bow requires suspension at only fourteen points instead of thirty-eight; that the three frogs and six switches are unnecessary; and that the total length of span wire used is 512 ft. for the bow and 899 ft. for the wheel trolley system. Some allowance must be made with

the latter, however, on account of the fact that in the example the wires are attached to buildings and not poles.

One interesting advantage of the bow is seen in Berlin on a street where two companies operate cars over the same tracks with wholly different trolley wires and power supply. To keep the two sets of wires distinct at every

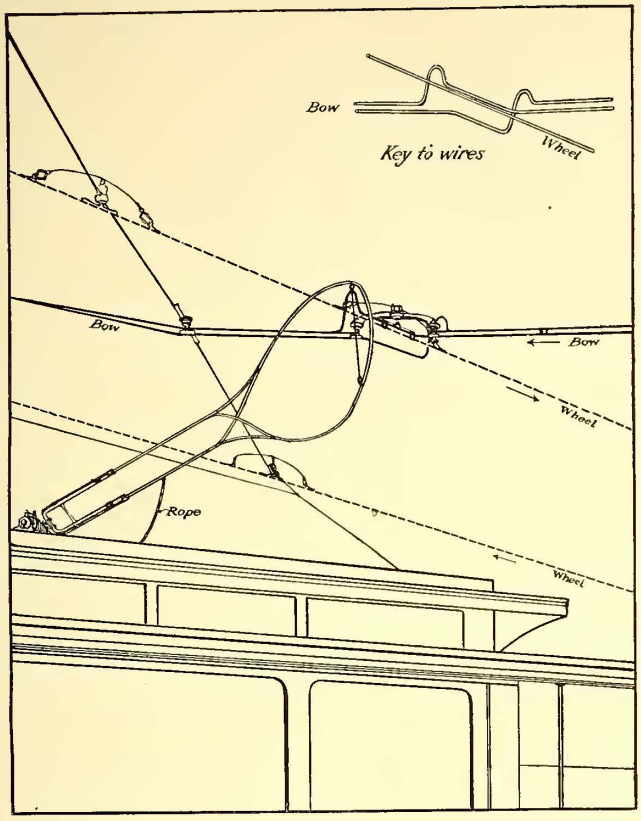


FIG. 4.—WIRES FOR WHEEL AND BOW ALONG SOME TRACKS IN BERLIN

point would seem almost impossible, but was accomplished in Berlin by suspending the wires for the bow system below those for the wheel, though done from the same span wires. Where the bow has to pass across the path of the wheel, its wire leaves a gap for the latter, but is

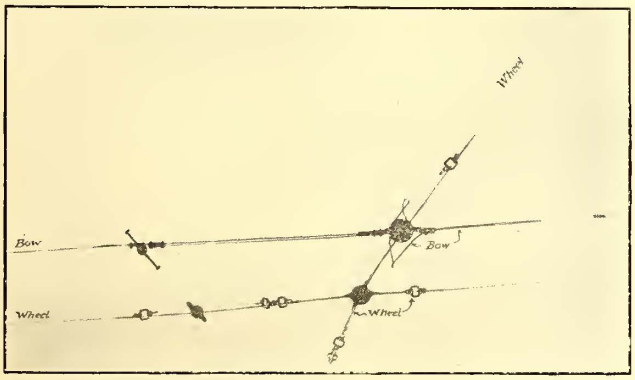


FIG. 5.—WIRES FOR WHEEL AND BOW (FROM BELOW)

diverted alongside so as to cause the wide contact piece to be kept always at the same level. (Figs. 4 and 5).

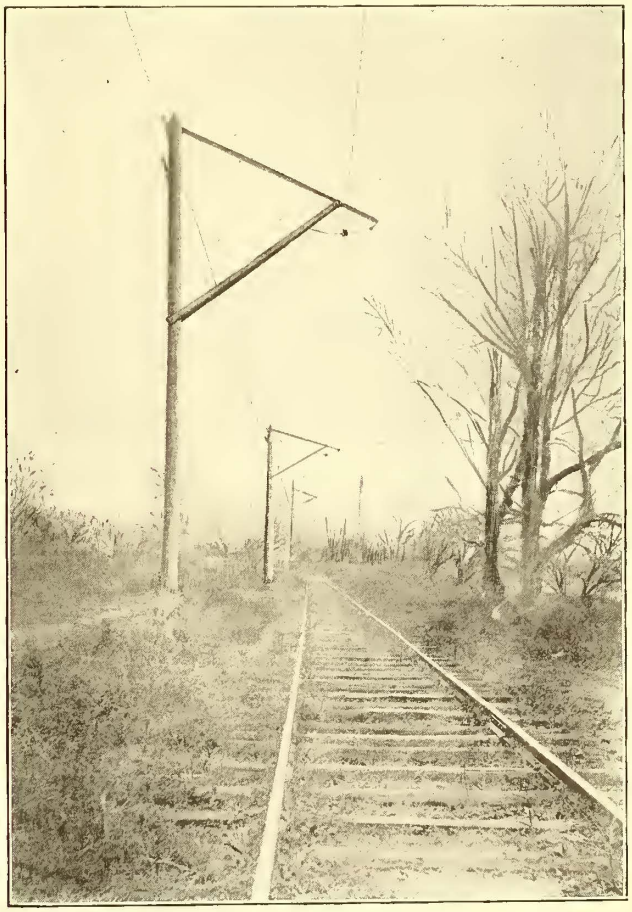
Municipal authorities on the Continent have laid great stress on the simpler appearance of the overhead work. It is interesting to note that in the report of Mr. Barclay Parsons advocating overhead wires in San Francisco, and printed in the STREET RAILWAY JOURNAL for Jan. 6, 1906, every photograph published illustrated construction on sliding bow street railway systems.

For bridging over gaps in third rails, or in connection with conduit systems, the bow would have the advantage of striking and leaving the trolley wire without shock or attention from the conductor.

The writer cannot help feeling that the bow is really better, for ordinary street cars at least, than the wheel trolley, and that the almost universal use of the latter in the United States, England and France must be ascribed to some other cause than a superiority which does not seem to exist. The fact that the use of the bow has not spread may be due simply to the reason that the collector must be suited to existing overhead work on old lines, and that a new type cannot be put on all new cars as easily as a truck. Probably it is too late for the bow to be tried now except for single-phase lines, and perhaps the pantograph type of collector may prove better than the bow, especially for high-speed work.

A HOME-MADE TROLLEY BRACKET

The electric railway systems in the Southwest frequently experience delay in receiving shipments, and as a conse-



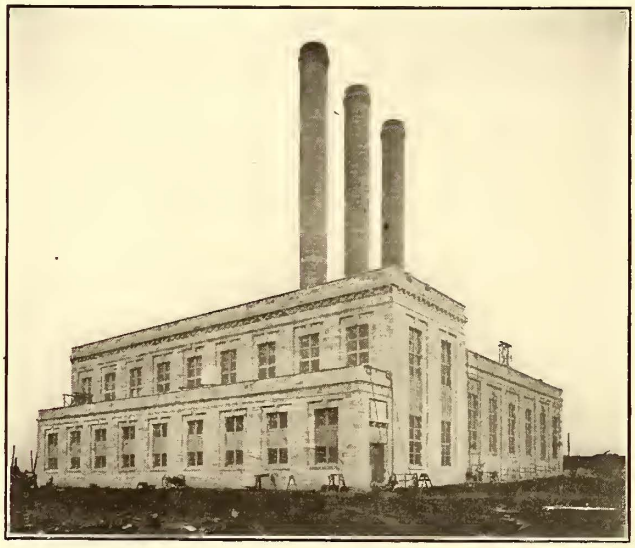
HOME-MADE BRACKET ON A SPUR OF MUSKOGEE ELECTRIC TRACTION COMPANY

quence managers are often compelled to exercise considerable ingenuity to avoid inconvenience when required material is not at hand. The accompanying illustration shows a home-made trolley bracket in use on a spur of the Muskogee Electric Traction Company, Muskogee, Indian Territory. Credit for the design is due to Ira L. Reeves, formerly president of the system. The upper portion consists of a single arm of wood bolted to the pole. Two lower braces extend from the upper arm to each side of the pole.

THE NEW TURBINE PLANT AND SUB-STATIONS OF THE POTOMAC ELECTRIC POWER COMPANY, WASHINGTON, D. C.

A large steam turbine plant of advanced design has just been completed for the Potomac Electric Power Company, of Washington, D. C., by the J. G. White Company, of New York. It was built for the purpose of supplying power for railway purposes in the city of Washington, as well as current for light and power. The plant is located in Bennings, D. C., on the eastern branch of the Anacosta River. The work was carried out under the direct supervision of L. E. Sinclair, general superintendent of the Potomac Electric Power Company.

The layout of the building is similar to many of the modern prominent turbine generator stations. The boiler room is at right angles to the generating room, while the switching apparatus is located in an annex, running along the entire length of the generating room. The boiler room,



TURBINE POWER STATION OF THE POTOMAC ELECTRIC POWER COMPANY, WASHINGTON

which is 164 ft. long x 180 ft. wide, is arranged to accommodate four rows of boilers, thus forming two firing aisles. At present there are installed sixteen boilers, while space is provided for eight more. There are three stacks (one for every eight boilers), and two suspended steel coal bunkers with a capacity of 650 tons each. The boiler house is provided with a basement 14 ft. high, the floor of which is flush with the main generating room floor. It contains, besides the coal and ash-handling plant, a repair shop, storeroom and a locker and toilet room. Of more importance, however, is the machinery in the boiler room basement. Here are installed two exciter units, the boiler feed pumps, oil pumps and two house pumps, as well as the oil filtering tanks and testing tanks. The space occupied by this machinery is separated from the rest of the basement by a hollow concrete block wall, thus forming an extension of the main generating room floor. This is possible owing to the fact that the division wall between the generating room and the boiler room does not start from the main operating room floor, but some 14 ft. above, and is carried on I-beams.

The generating room, which is 164 ft. long x 45 ft. wide, has been laid out to accommodate three 5000-kw and two 2000-kw turbines. At present only two 5000-kw and two 2000-kw turbines are to be installed. The annex for the switching compartments, offices, etc., is 15 ft. wide x 164 ft. long.

Owing to the condition of the soil, it was found necessary to drive piles for the greater part of the footings for the engine room walls, columns, etc. These piles are of the Raymond concrete system and are from 30 ft. to 40 ft. long, while the condition of the turbine foundation itself, owing to their depth, did not require any piling. This was due to the peculiar arrangement of the condensing water intake and condensing water discharge tunnels running directly through the turbine foundations, as will be seen by the accompanying illustrations. This arrangement materially reduces the amount of concrete necessary for the foundations, and at the same time gives a most satisfactory arrangement for obtaining the circulating water. Both the intake and discharge tunnels have an area of 40 sq. ft. each.

The footing of the turbine foundations is calculated for a bearing power at 1.8 tons per sq. ft. of soil. To prevent uneven settlement between the different turbines, old rails have been embedded in the concrete of the tunnel throughout the length of the building. As the entire building covers an area of 29,520 sq. ft., and the normal output of the plant is 19,000 kw, 1.52 sq. ft. is taken up per kilowatt. The structural steel required for the building amounts to about 800 tons.

Up to the basement floor all wall and column footings are made of concrete, while the superstructure consists of a self-supporting steel skeleton frame. The walls are of hollow concrete blocks, self-supporting, with the exception of a few of the lighter walls. These hollow concrete blocks were made by the Lake Stone Company, of Washington, D. C., and are of a uniform size, being 3 ft. x 1 ft. x 1 ft. However, there are some specially designed blocks, such as were required by the door and window lintels and sills. Some of the lintels have a span of 12 ft. and are reinforced by ¾-in. rods; in fact, all lintels are reinforced. The pilasters and cornices of the building are well designed and the architectural features of the entire structure give a pleasing appearance and harmonize with the tall chimneys, also made of concrete.

The coal is brought to the plant on railroad cars and is stored in the yard or dumped into pockets at the side of the boiler rooms, crushed and then delivered to the top of the bunkers in the boiler room by bucket conveyors. From here the coal is distributed into bunkers by two belt conveyors of a capacity of 40 tons per hour each. Ashes may be removed either by railroad cars or by teams. The ashes are collected in reinforced concrete hoppers suspended under the boilers, from where they are removed on an industrial railway and dumped into a receiving hopper feeding the bucket conveyors, to store the same in ash hoppers arranged between the coal bunkers and the end wall of the boiler room. These hoppers are made of reinforced concrete and have a storage capacity of approximately 50 cu yds. each.

EQUIPMENT

Sixteen boilers are now installed, arranged in four rows with every two boilers forming one battery. All boilers are of the Babcock & Wilcox make, with a heating surface of 6040 sq. ft. They are designed for 175 lbs. working pressure and are equipped with superheaters of 1180 sq. ft. heating surface, capable of superheating the steam to 150 degs. The boilers are provided with Roney stokers, each with a grate area of 11.8 sq. ft. The fronts of the boilers are faced with white enamel brick.

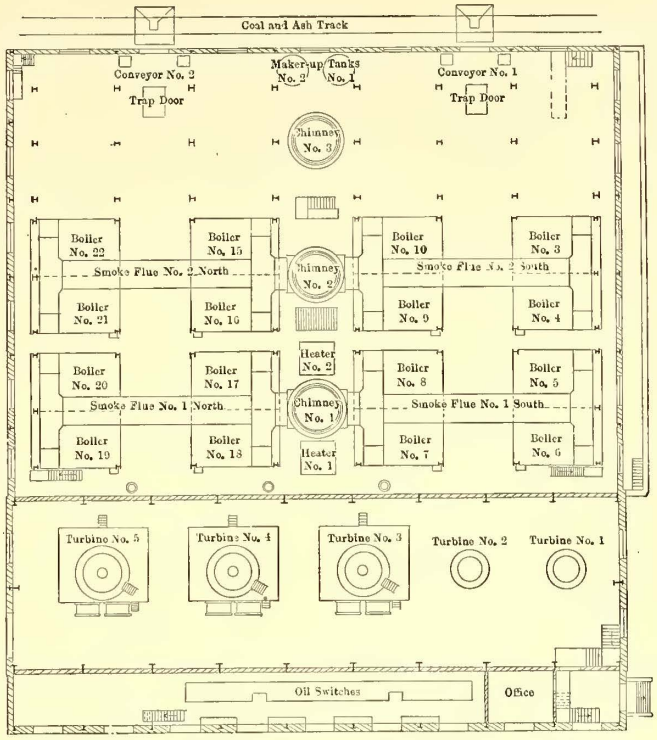
The flue connections are made on the top of the boilers;

four boilers joining in one breeching to give two breechings for each chimney. Each boiler is provided with a hand damper, while the four main flues are equipped with dampers operated by two automatic regulators.

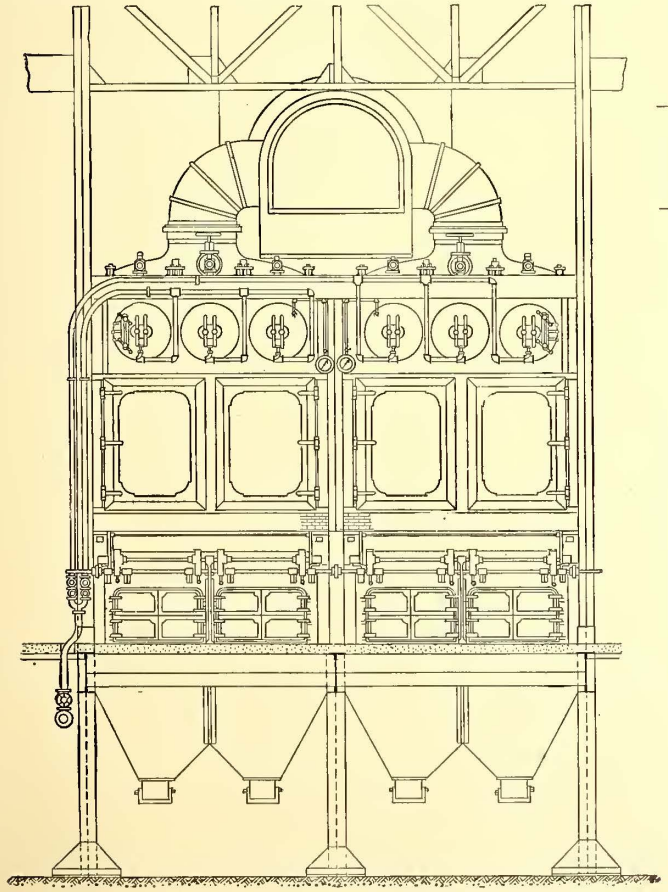
The chimneys are of the Weber concrete steel type. They are 200 ft. in height above the basement floor; 183 ft. in height above the grates; 163 ft. in height above the flue openings, and an internal diameter of 12 ft. One of the three chimneys is reserved for the eight boilers to be installed later.

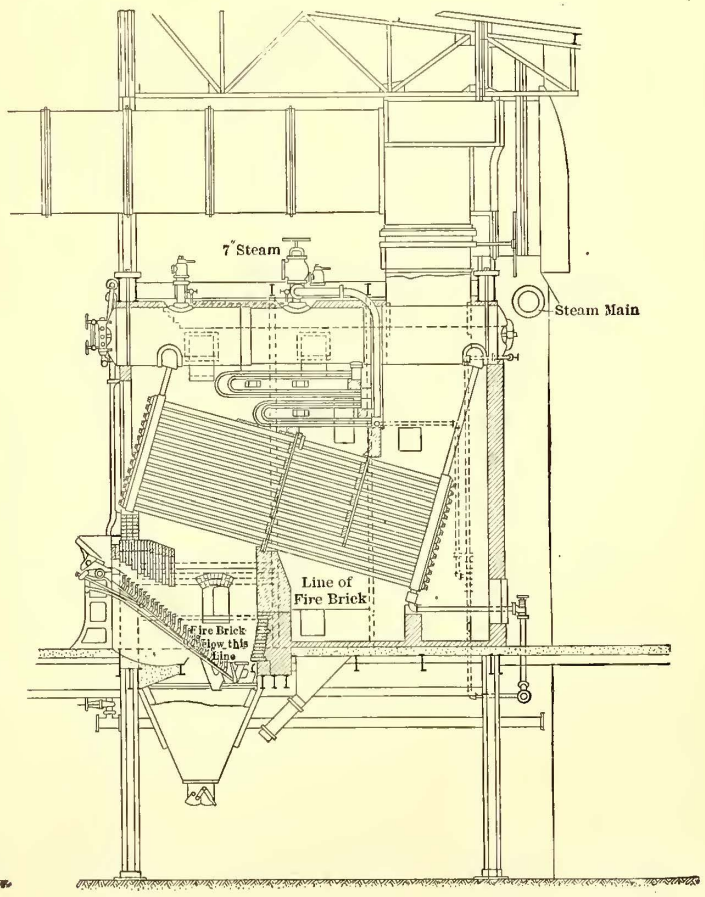
Between the boilers and the chimneys two Warren Webster open feed-water heaters are installed, each capable of heating 200,000 lbs. of boiler feed water from 80 degs. to 205 degs. F. per hour. To make up the loss caused by leakage, etc., two make-up tanks have been installed in the boiler room, each with a storage capacity of 25,000 lbs. of water. For this purpose two house pumps are installed.

The boiler feed water is supplied by two horizontal duplex pumps, 16 ins. x 10¼ ins. x 16 ins. An additional pump will be installed with the full equipment of the plant. These pumps work upon a 6-in. header ring system from where the branches lead to the boilers. The arrangement is such that either pump may supply water to any of the boilers. Branch connections to the boilers are so centrally located that the water tender may operate the valves of eight boilers from practically one point. All steam leads from the boilers are 7 ins. in diameter, which are connected to the main header system by means of flexible bends, as will be seen in the accompanying illustration. The largest size of this header is 15 ins. O. D. Pipes are all made of steel with the exception of fittings, which are of semi-steel. All pipes have been provided with the loose-type flange, known as the Van Stone flange. From the header the branches lead to the turbines, the sizes of which are as follows: 10-in. pipe to the 2000-kw turbines and a 12-in. pipe to the 5000-kw turbines. The 12-in. pipes were chosen because of the use of superheated steam, which enables a greater velocity than saturated steam. As the turbines operate with 17 lbs. steam per kilowatt, and the volume of superheated steam, at 150 degs., is practically 30 per cent greater than that of saturated steam



PLAN OF POWER STATION

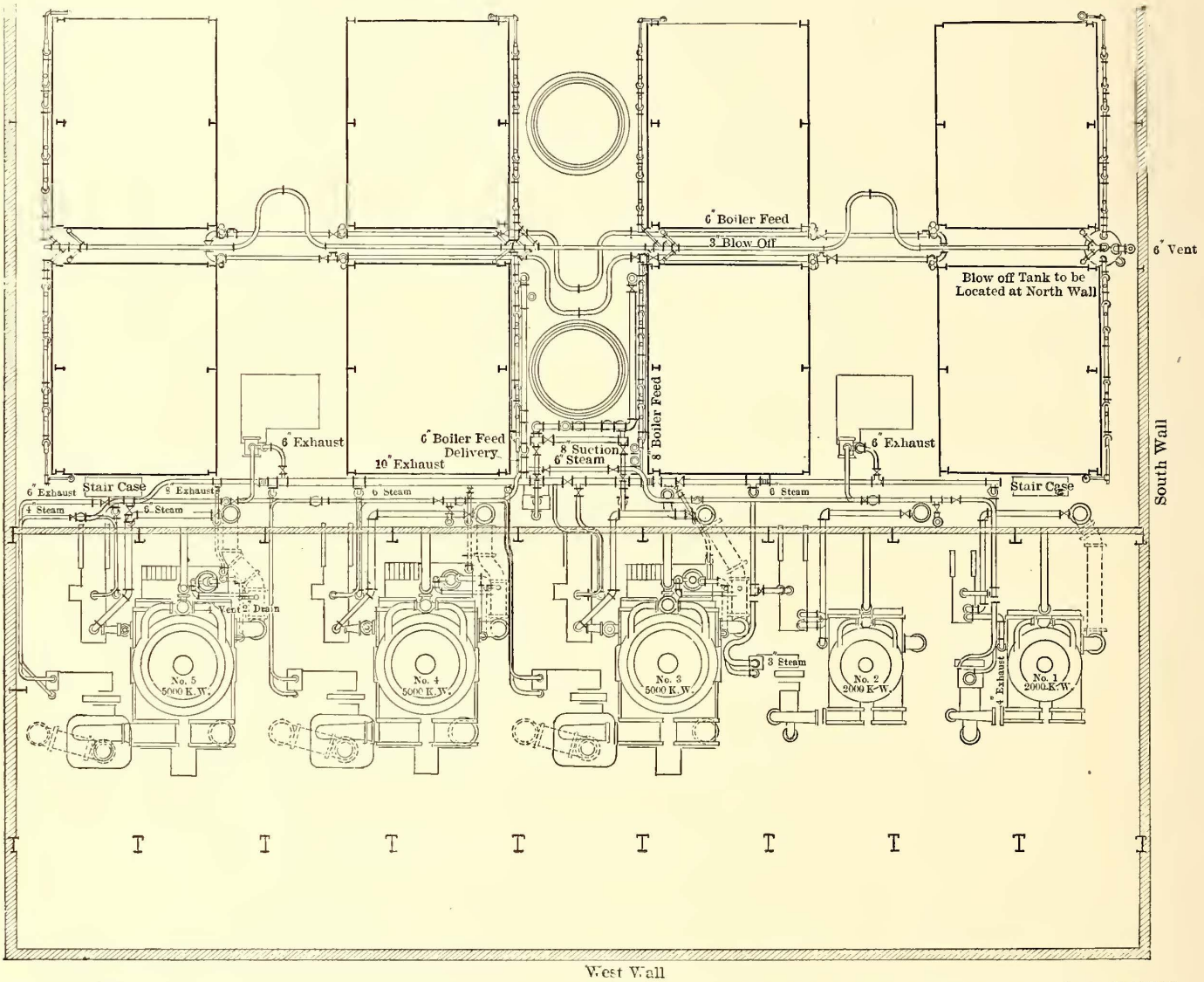




FRONT ELEVATION AND CROSS-SECTION OF BOILER

at the same pressure (175 lbs.), the velocity in the steam pipes will be approximately 7800 ft. per minute.

No separators have been installed in the pipe line, but provision is made to drain the entire system, for which purpose four 1¼-in. traps have been located in the basement of the boiler room. The return of water is fed into the feed-water heater. A separate 6-in. steam header has been installed in the basement for the auxiliary machinery. This header runs the entire length of the plant and draws its steam at three points from the main header by means of 6-in. connections. This auxiliary header is also provided with a drip system of two ¾-in. traps. All steam piping, is covered with 85 per cent magnesia.



PLAN OF THE MAIN STEAM PIPING IN THE TURBINE POWER STATION OF THE POTOMAC ELECTRIC POWER COMPANY

The turbines are of the Curtis base-condenser type, the two 2000-kw units being four-stage and the 5000 units five-stage. The alternators are four-pole, 25-cycle, and designed for 6600 volts. The turbines run at 750 r. p. m. The first turbine installed was one 5000-kw unit, which has been in operation since the early part of December. The cooling surface of the condensers of these 5000-kw turbines is 20,000 sq. ft. The circulating water is drawn by a 24-in. steam-driven centrifugal pump. The vacuum pumps are of the rotative single-stage type, also steam driven. The hot-well pumps, located in the hot-well pits, 5 ft. 9 ins. below the main operating room floor, are vertical, two-stage, centrifugal pumps, and are the only pumps motor-driven. The auxiliary machinery is so grouped around one main turbo-generator as to form the most compact unit system.

The 2000-kw turbines to be installed are now in operation in the company's existing power plants. One of these units was exhibited by the General Electric Company at the World's Fair, St. Louis. It is provided with a base-condenser, while the other unit has a separate condenser, but will, however, be re-designed for base-condenser type, to have the entire plant equipment uniform. The auxiliary machinery of these turbines, such as the circulating water pumps, hot-well pumps, etc., will be taken out of the existing plant. Only one of the dry vacuum pumps will be replaced.

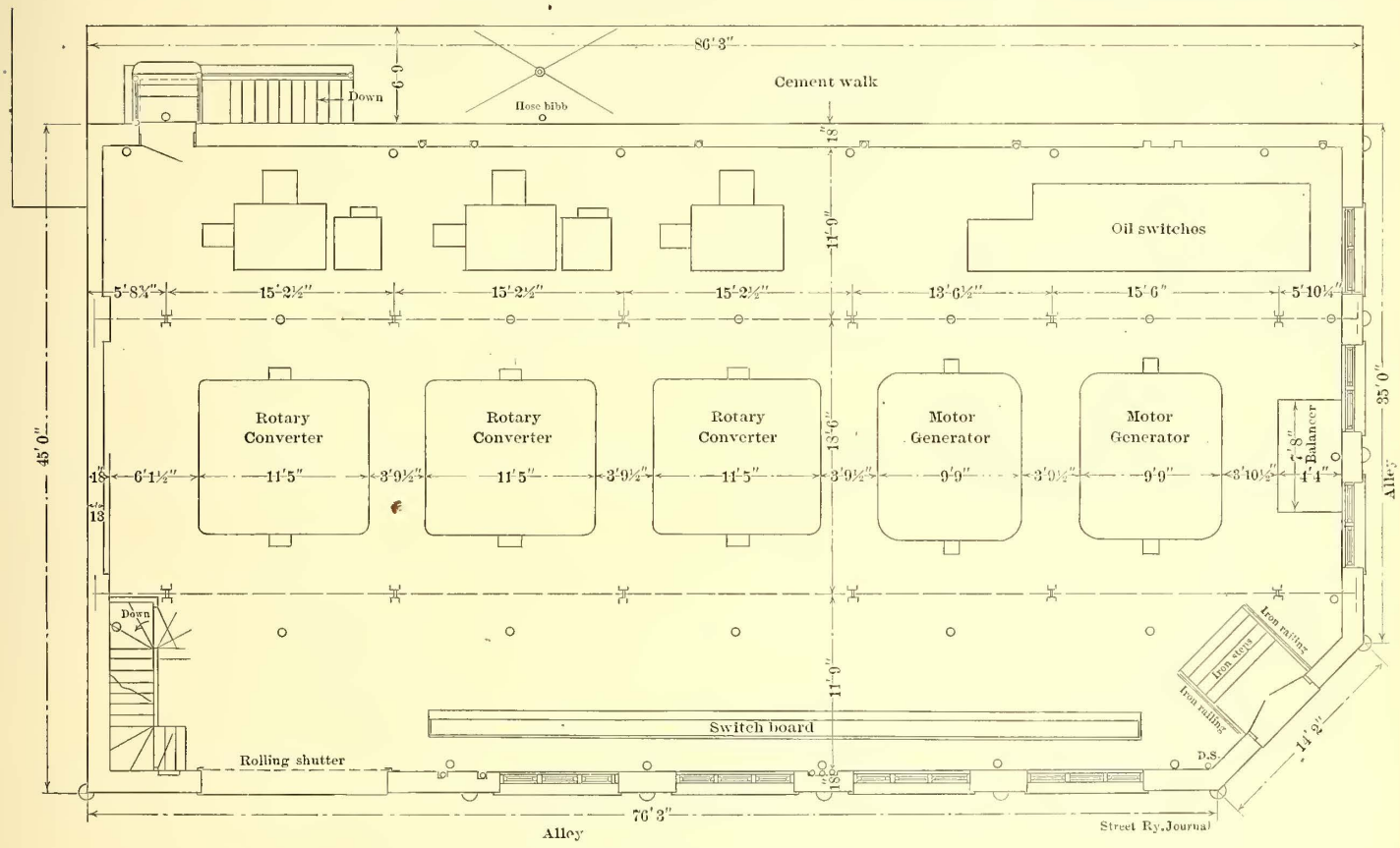
The atmospheric exhaust pipe leads to a tunnel under the generating room floor into the boiler house, where the riser extends through the roof. The exhaust pipes, which are 24 ins. in diameter on the 5000-kw units, are provided with a relief valve. The hot-well pumps discharge into a common header leading to the two heaters. The discharge from the hot-well pump is provided with a gate valve and a check valve, so should one pump fail to work the water of the other pump may not enter the pump in operation. The suction of the vacuum pump is provided with an angle globe valve, hence in emergencies the turbine may operate on an atmospheric exhaust line, while the pump is being repaired.

The discharge of the dry air pumps is connected to the exhaust risers above the relief valve. The exhaust of all auxiliary machinery discharges into one common header connected to the open feed-water heaters.

There are three step-bearing pumps to supply oil to the turbines; arrangement is made for another pump of this kind. The return oil is brought to a collecting tank, from whence it is drawn by an auxiliary oil pump and pumped into a 1600-gallon oil-filtrating storage tank.

The two 100-kw., 125-volt engine-driven exciters are of sufficient capacity to supply the necessary current for the entire plant. These exciter units are located, as previously stated, in the basement of the boiler room.

The switching room is 15 ft. wide and runs the entire length of the generating room. This annex is three stories. The first floor is flush with the generating room floor, containing the man-holes for the generator leads and the outgoing cables. The latter are arranged in double tile ducts on the side of the wall, from whence they lead underground to the various sub-stations. Here are also the generator field rheostats, while at one end is located a toilet room. Some 9 ft. 5 ins. above the floor is a gallery containing the oil switches. The oil switches control the generators and the outgoing feeders, together with two bus-sectionalizing switches. These switches are of the cellular type, each pole being mounted in a separate concrete compartment, arranged in one row. Directly back of these cells are the bus-bar compartments. The static discharges and disconnecting switches are between the bus-bar compartments and the wall. The switches are in brick compartments. The second gallery, which is above the former, contains the switchboards. The generator switchboard is made up of five panels (one for future use) each, while the exciter switchboard is made up of two panels, each 16 ins. wide. The feeder switchboard is made up of nine panels, each 16 ins. wide. Three of these panels are for future equipment. The switchboards are made of black enameled slate of dull finish, supported by a pipe framework and containing all controlling switches, indicating lamps, instruments, etc. The entire switching compartments are separated from the main generating room by a division provided at the upper switchboard gallery with large openings to overlook the generating room.



FIRST-FLOOR PLAN OF SUB-STATION NO. 10

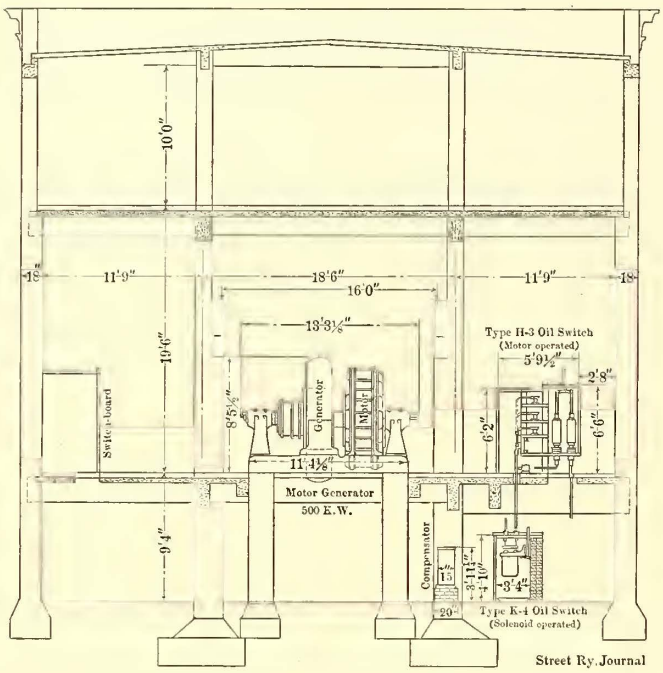
THE SUB-STATIONS

In addition to the main station the Potomac Electric Power Company has erected four new sub-stations to take care of the increasing low-tension lighting, railway and 2400-volt lighting loads. Taken in order these sub-stations are: Sub-stations No. 2, No. 10, No. 11 and No. 12.

Sub-station No. 2 is located at No. 450 Washington Street N. W., adjoining the old sub-station No. 2. It is 100 ft. long, 14 ft. 8 ins. wide, and one story high. The building is of steel, brick and reinforced concrete for roof and floors. This station is designed for 6000-kw capacity, and we have installed at the present time two 1000-kw rotary converters with two 1100-kw three-phase transformers. These transformers are equipped with dial switches to vary the voltage on the direct-current side of the rotary transformers. This station, which is to be the principal sub-station, contains several type-H-3 oil switches for automatic remote control. The current is brought from the main power station and is distributed to other small sub-stations through the switches mentioned. One type-H switch controls the apparatus in the sub-station, while the oil switches that control each rotary separately are of the K-4 non-automatic type, it being assumed that in case of any trouble inside of the station the H-type switch will protect the sub-station as well as prevent any of the other lines being disturbed. This sta-

tion is also furnished with a large-size three-wire lighting switchboard connected to a storage battery in the adjoining building, and which can be used either on the railway or lighting bus.

Next in order is sub-station No. 10, located in the alley between H and I, Fourteenth and Fifteenth Streets N. W. It is 86 ft. long, 45 ft. wide and two stories high. This



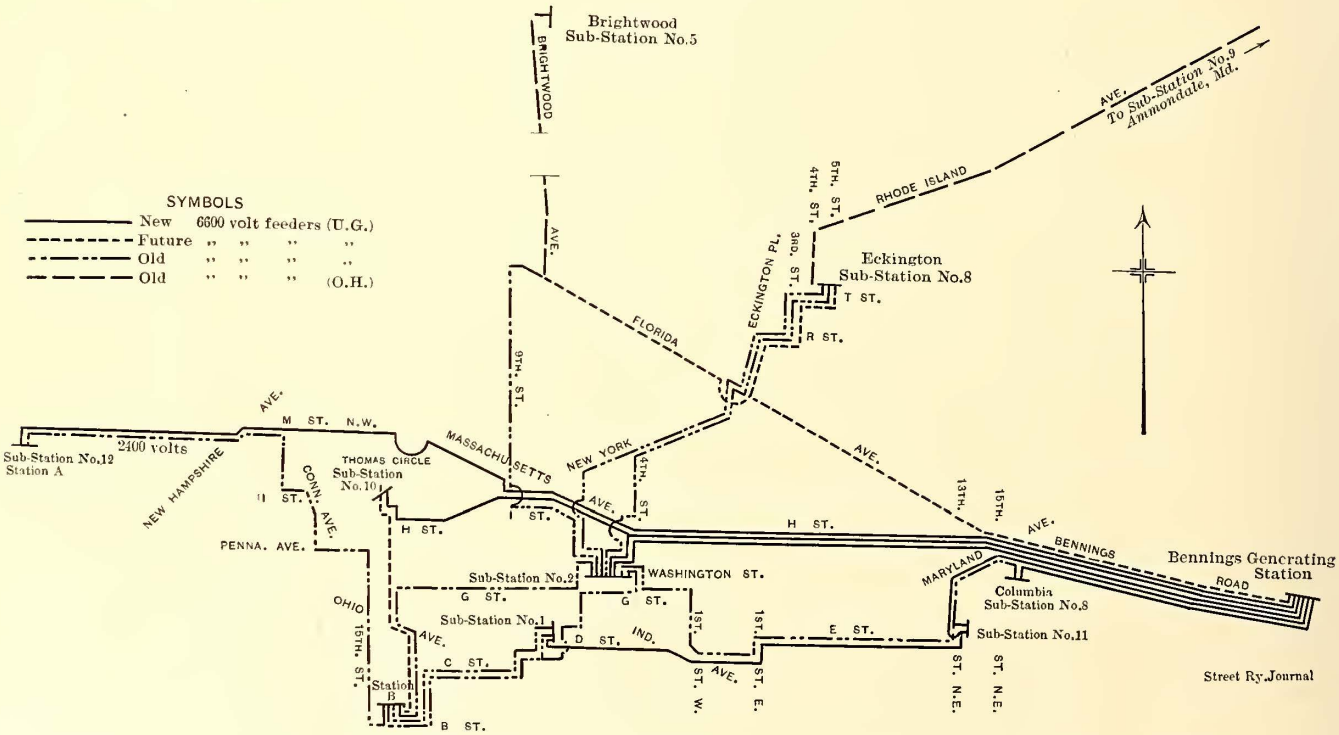
SECTION OF SUB-STATION NO. 10, WASHINGTON

of 75 kw. This station is provided with an air duct and the foundations are laid out so that either rotary transformers or motor generators can be installed.

The second story is laid out for a storage battery of 250 cells. Attention was given to the floor of the battery room to insure it being practically acid proof. It is designed to drain both ways of the building so that it can be washed down at any time. The floor is built of acid-proof brick laid in boiling pitch with ⅜-in. joints which were filled with hot pitch. This room is well ventilated and lighted, with practically no metal to be attacked by fumes, and is separated from the end cell switch rooms and other rooms by cement partitions. The controlling apparatus is of the same type as is used at sub-station No. 2 except that the motor-generator sets are started through compensators.

Sub-station No. 11 is located at Thirteenth and D Streets N. E. This building was remodeled from an old office building into the present sub-station. It is 80 ft. long, 30 ft. wide and one story high. This station is designed for three 500-kw rotaries and to be used entirely for railway work, and feeds into the ends of four roads whose extreme easterly lines are in the vicinity of this sub-station. This apparatus is controlled by type-H-3 automatic, remote-control oil switches. The rotaries are started up from the a. c. end through taps that have been brought out from the transformer for that purpose.

Sub-station No. 12 is located in the old steam power station at Thirty-Third and K Streets N. W. The apparatus is located in the northwest corner of the building, consisting of two 500-kw rotaries for railway work and one 500-kw frequency-changer set, from 6600 volts to 2400 volts for alternating-current lighting in that territory. It is be-



MAP SHOWING LOCATION OF POWER STATION, SUB-STATIONS AND ARRANGEMENT OF HIGH-TENSION FEEDERS

building, with the exception of the brick walls, is built of concrete. A 10-ton traveling crane on concrete girders is provided for handling apparatus. This station is designed for 5000-kw lighting capacity to feed into the Edison three-wire system, and is equipped with two 500-kw induction motor generator sets and also a balancer set with a capacity

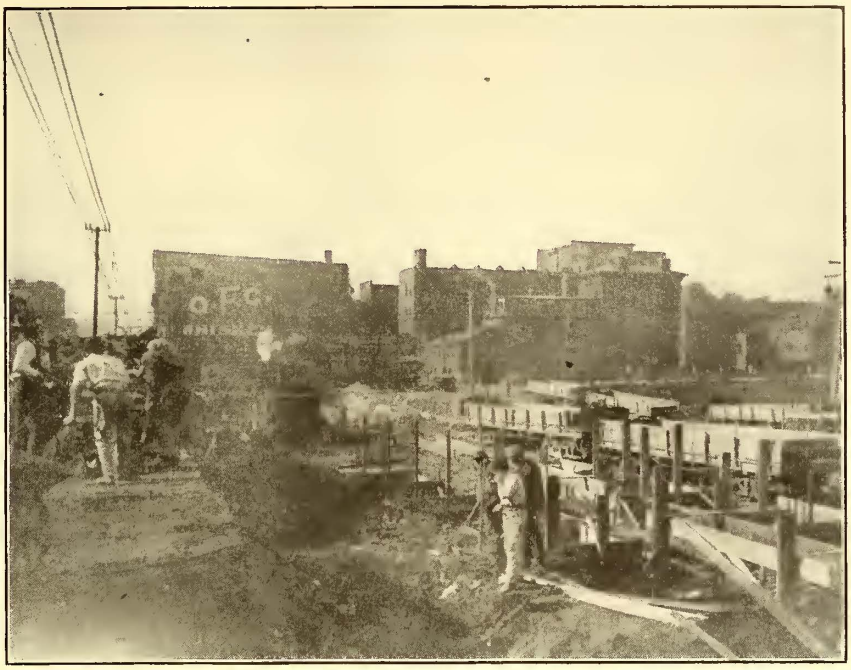
lieved that in case anything happens to this sub-station the steam station can be gotten under steam at very short notice. Men familiar with the steam service are to be retained.

At the Fourteenth and B Streets plant one 1000-kw frequency-changer set has been installed for the purpose of supplying the 2400-volt commercial lighting.

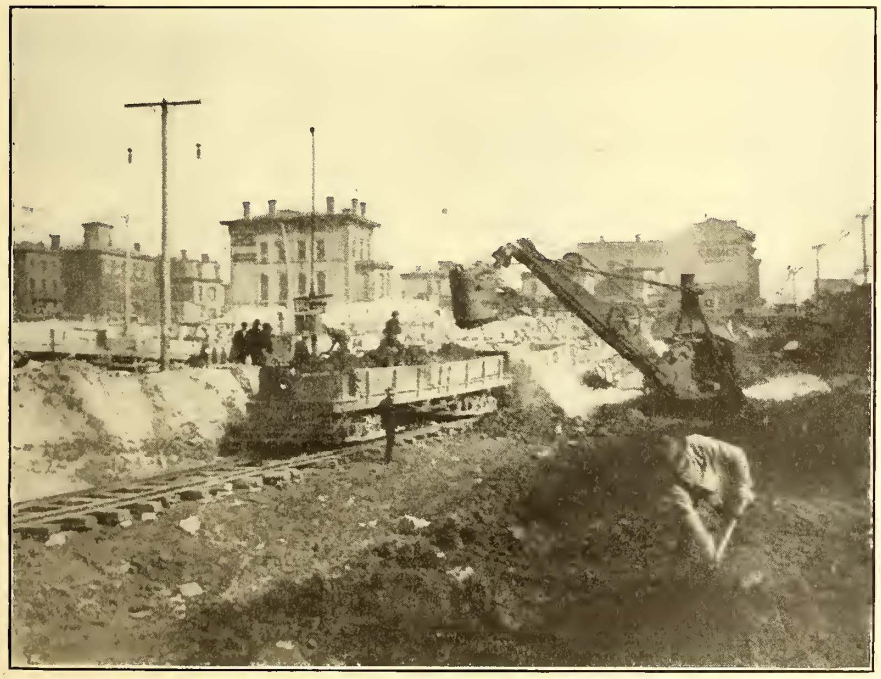
HANDLING DIRT FROM EXCAVATIONS IN ST. LOUIS

The accompanying views from photographs show some work of handling dust from a building excavation by the United Railways Company, of St. Louis. The excavation covered a city block and is bounded by Seventeenth, Olive, Eighteenth and Locust Streets. The building being erected on this block will be of concrete and eight stories high. The site was previously occupied by some old residences and stone buildings, some of which were situated upon an elevation at least 10 ft. above the street level.

The contractors, James Black Masonry and Construction Company, rented a standard railway 1¼-yd. steam shovel and at night hauled it to the scene of the work over the street railway tracks, although these tracks are 4-ft. 10-in. gage. Permission was granted by the city for a switch into the lot, and several tracks were laid across it and a trolley wire was strung into the lot for a distance of 100 ft. A lead wire attached to the trolley and the motor car permitted operation of trains to any point in the property. The tracks were moved as required by the progress of the shore. The dirt was hauled from the excavation by two-car trains, each car holding approximately 20 cu. yds. The amount excavated was about 80,000 cu. yds. Work was started in September and was completed during the first part of November. Day and night crews were employed and the work progressed steadily.



VIEW OF EXCAVATION, LOOKING WEST FROM SEVENTEENTH STREET



STEAM SHOVEL AT WORK FILLING ELECTRIC CARS

The excavated material was hauled about 2½ miles and dumped into an abandoned quarry in the north part of the city, at Twenty-Second and Angelica Streets. This quarry, which is the property of the railway company, has for some time been used as a dump for the dirt excavated in the process of reconstructing the city tracks. Unloading the material excavated from the building block was accomplished manually, a force being at work continuously. Several of these quarries have been filled during the past summer and the ground values greatly increased thereby.

Eighteenth street, the route over which the dirt trains passed from the excavation, is the route of three car lines, and the traffic is very heavy. Although dirt trains were continually running over the same track, passenger cars were not blocked to any extent.

Some objection was raised by team owners to this method of disposing of dirt on account of the business it took away from them, and the circuit attorney has been called upon by those who insist that the company exceeded its charter rights, to bring suit against the company. However, it is not likely anything serious will result from this proceeding. The condition of the streets around the property was remarkably clean. A comparison with the wagon method is afforded by a walk of two blocks, where an excavation has been made for the Ely-Walker Dry Goods Company. The pavement is a sea of mud continually and the police are constantly arresting team owners.

One of the accompanying engravings shows the shovel in the act of dumping a bucket of dirt into the car. The other is a general view looking west from Seventeenth Street, showing the switch into the property from the Eighteenth Street tracks of the United Railways Company.

The Marion, Bluffton & Eastern Traction Company has been admitted to membership in the Central Electric Railway Association. The mileage over which the interchangeable coupons are good is now nearly 2300 miles.

REPAIRING BY THERMIT AT DAVENPORT, IA.

An account was published in the Street Railway Journal for Dec. 22, 1906, of the methods followed in the shops of the Montreal Street Railway Company in repairing broken motor castings by thermit. Another company which employed thermit extensively for this purpose is the Tri-City Railway Company, of Davenport, Ia., and Moline and Rock Island, Ill. This company has also used thermit for repairing broken truck frames and for machine welds, but the work on motor casings has constituted the greater part of the application of thermit in Davenport. The part of the motor cases found to be most frequently broken is the lug through which the bolts to secure bearing cap to frame pass. The illustrations presented herewith will give a clear idea of the method of making the weld.

Fig. 1 shows the motor frame with the broken lug. The first step in the process is to clean the frame of all grease and dirt which may be on it. It is then heated to a cherry red in the forge fire, after which it receives a thorough cleaning with a wire brush to remove any remaining dirt. It is then ready for welding. In Fig. 2 motor frame and molds used in making the weld are shown together. These parts are dried by the fire until all moisture is removed. The molds are made half and half of brick clay and sand and are made from a pattern of the same shape as the

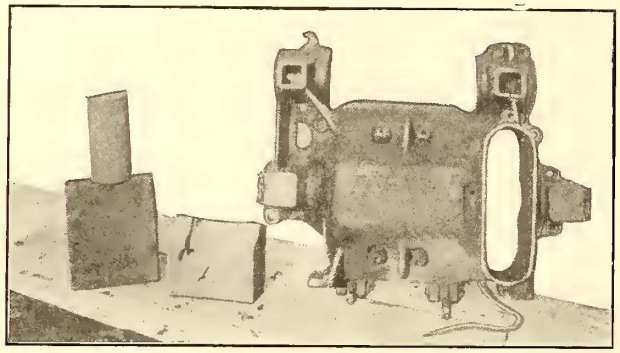


FIG. 1.—MOTOR FRAME WITH BROKEN LUG

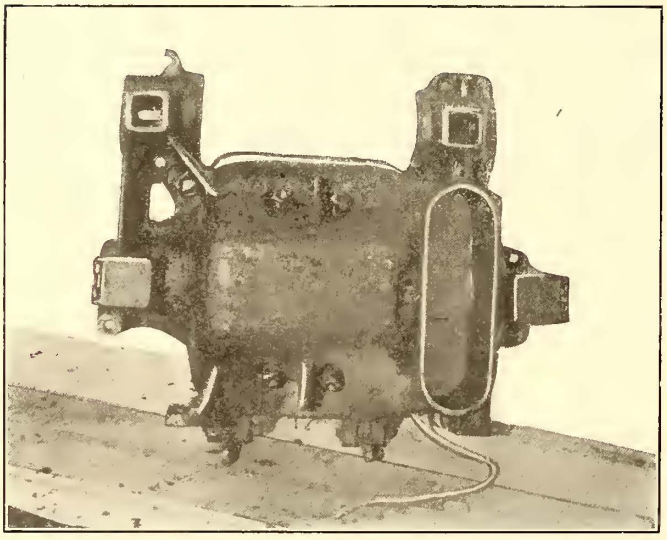


FIG. 2.—MOTOR FRAMES AND MOLD FOR WELDING

FIG. 5.—READY TO TOUCH OFF THE MIXTURE

FIG. 3.—PLACING THE MOLD ON THE MOTOR BEFORE WELDING

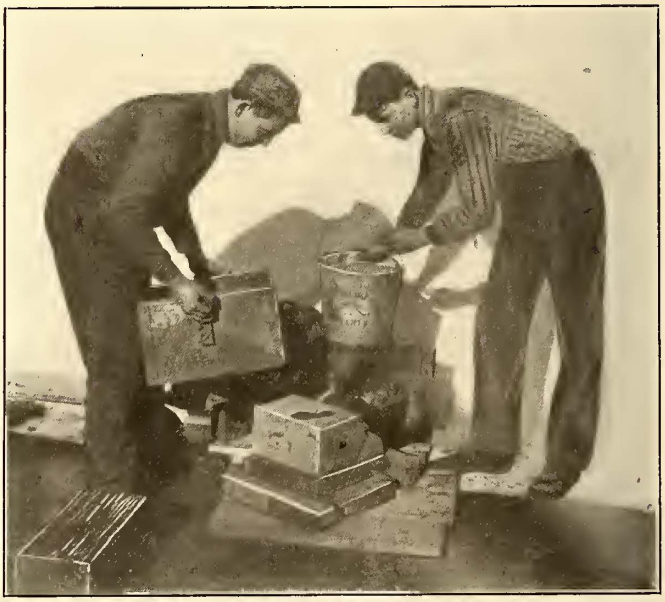


FIG. 4.—PLACING THE COVER AROUND THE MOLD

original casting. Fig. 3 shows a workman placing the mold on the motor in position for the weld.

Fig. 4 illustrates the next stage in the process, which is that of placing the cover around the mold. This cover is used to hold the sand required to stop the fine cracks in the mold; otherwise thermit when in the fluid state would escape through the small openings, and the use of the sand has been found desirable for this purpose. Fig. 5 shows the cover and surrounding case of sand, the crucible in place and the workmen ready to touch off the mixture with a red-hot iron. The man at the right holds the cover of the crucible to drop over it as soon as the reaction commences. Fig. 6 shows the finished weld as it comes from the mold and with the gates still clinging to the casing.

FIG. 6.—THE FINISHED WELD

About seventy of these welds have been made by the company to date, with only a very small percentage of failures. These failures consist of four fractures of which three proved to have been caused by a flaw in the casting while one was a clean break. The company has found as a result of experiment that the addition of about ½ per cent of nickel thermit makes a tougher weld, and is now using nickel thermit for this purpose.

The amount of thermit compound required in an average weld is 15 lbs., and the total cost of an average weld is about $12, not counting machine work, which will run about $2 per weld additional.

This paper is indebted to James F. Lardner, general manager of the Tri-City Railway Company, for the information and photographs presented in this article.

THE SELECTION OF WOODEN POLES

BY H. S. STOUT

The highest electrical, mechanical and civil engineering talent is being devoted to the design of track, rolling stock and power stations for electric railway systems, but the subject of wooden poles seems to have been largely neglected by the engineering profession. In buying poles, purchasing agents often follow a different policy than in selecting cars or other parts of the equipment. Beauty seems to be the only criterion, while in all others the desiderata are strength and durability.

There are only a few woods accepted in this country for electric pole lines, viz: cedar, both Northern and Western; cypress and chestnut. These woods are used principally because they contain more tannin, the preservative of all vegetation, than any others which are commercially available.

The first question in comparing poles of these materials is, then, which possesses the most preservative or tannin, and which contains it in the most insoluble state; in other words, which carries the tannin protected against moisture, which is its solvent? The second question is that of tensile strength when new and when in partly rotted condition.

Cedar has been used for pole lines perhaps more extensively than any other wood, and has been found very desirable for this purpose, but in a great many localities its high reputation has been established simply because other woods have not been tried. Moreover, the Northern cedar, which is far better for poles than any other cedar growing, is becoming scarcer every year and necessarily higher in price.

Chestnut is a wood that grows practically all over the Eastern United States, but its home is especially in the Appalachian chain of mountains in the Southeast. This wood has not had the same opportunities to be tested as cedar. It might be also well to say that the farther south the chestnut is cut the larger is the percentage of tannin or preservative in it and the tougher is the protecting ring or fiber which protects the heart against moisture.

The existence of tannin and its preservative qualities can be substantiated from any chemical source. If this is the case, then it is the strength of fiber or ring growth in the wood which will determine the toughness of the wood and its maximum resistance to moisture.

All trees are made up of annual growths, or rings, as can be seen by looking on the end of a piece of timber. All the tannin cells are between these layers, and those directly exposed to moisture are dissolved with comparative ease. Now the layer or growth in the chestnut, or what might be called a covering to the tannin cells, is tougher by 100 per cent than the layers of any other wood which carries the same amount of preservative or tannin. and will absorb less moisture than any other wood of its class. This being the case, it is reasonable to believe that the life of this piece of timber must necessarily be longer than the other.

Another advantage of chestnut is its tough growth as a resistant to vibration. This is an important feature in electrical work. It takes very little wind, if steady, to cause vibration in a pole line, and chestnut contains in its tough fiber a larger resistance to this vibration than any other wood used for the purpose. A chestnut pole when new will stand 23 per cent to 25 per cent more tension than any other timber used for poles, that is, it takes that much more to protect it, and when poles are rotted at the base, as is the case with all of them, the chestnut when rotted down to 6 ins. or 7 ins. diameter will stand at least 100 per cent more than any other wood.

Many companies have sustained losses in pole lines on account of the pole being burnt off at the ground, especially at a point where lines are parallel to steam railroads which are continually setting fire to the dry grass along the track. Chestnut resists fire a great deal better than any other material that is used for poles.

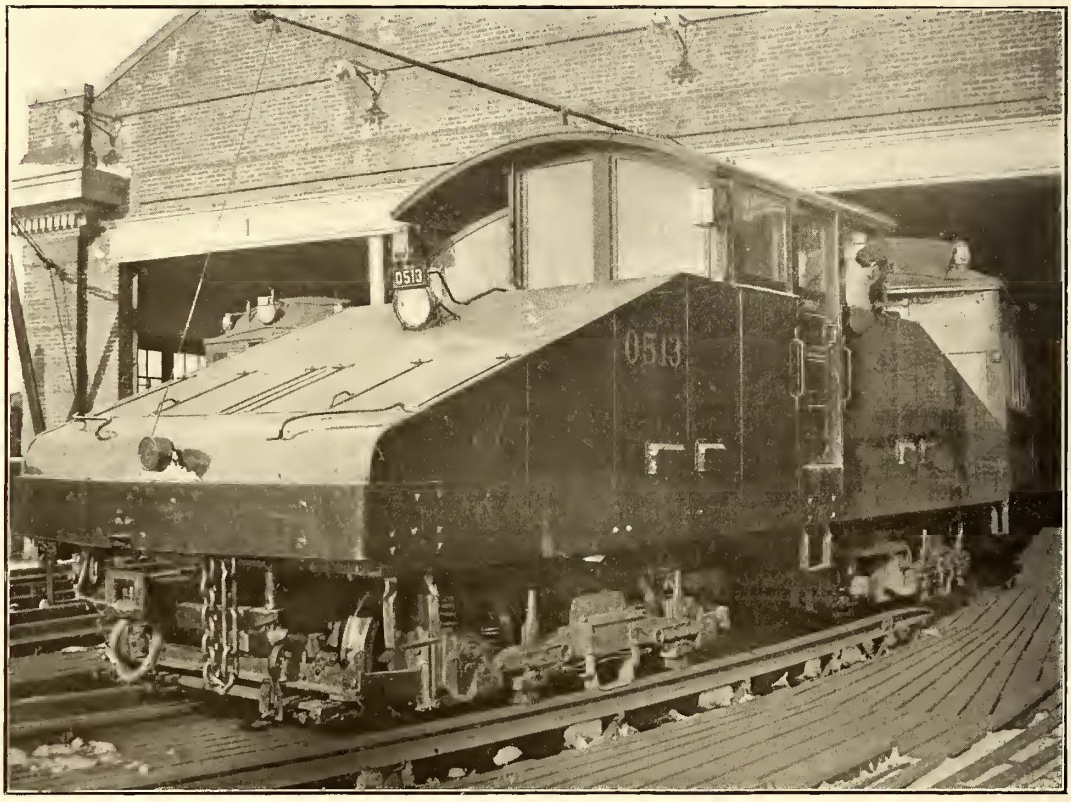
Cypress is also being used in some places on account of its straightness; so is the Western or Idaho cedar, but it will be easily ascertained that neither of these woods compare with the other for life or strength.

An objection at times urged against chestnut is that it is not quite as straight as the other woods, but it is possible to set a very pretty line out of chestnut poles. The writer has seen lines that were made up of what he would term very crooked poles, but were so set that an even effect was produced.

NEW ELECTRIC LOCOMOTIVE OF THE BOSTON ELEVATED RAILWAY COMPANY

Two electric locomotives have recently been designed by the Boston Elevated Railway Company for heavy yard and general haulage service on the elevated division. One of these machines has already been completed and placed at work in the Sullivan Square terminal yard, and the second is in process of construction. Both locomotives, when the second is completed, will have been manufactured in the company's own shops, and in detailed design the two are practically duplicates. One machine will probably be used exclusively in yard work, while the other will be employed in the haulage of materials, flat cars, box cars or other rolling stock in connection with the work of the road department.

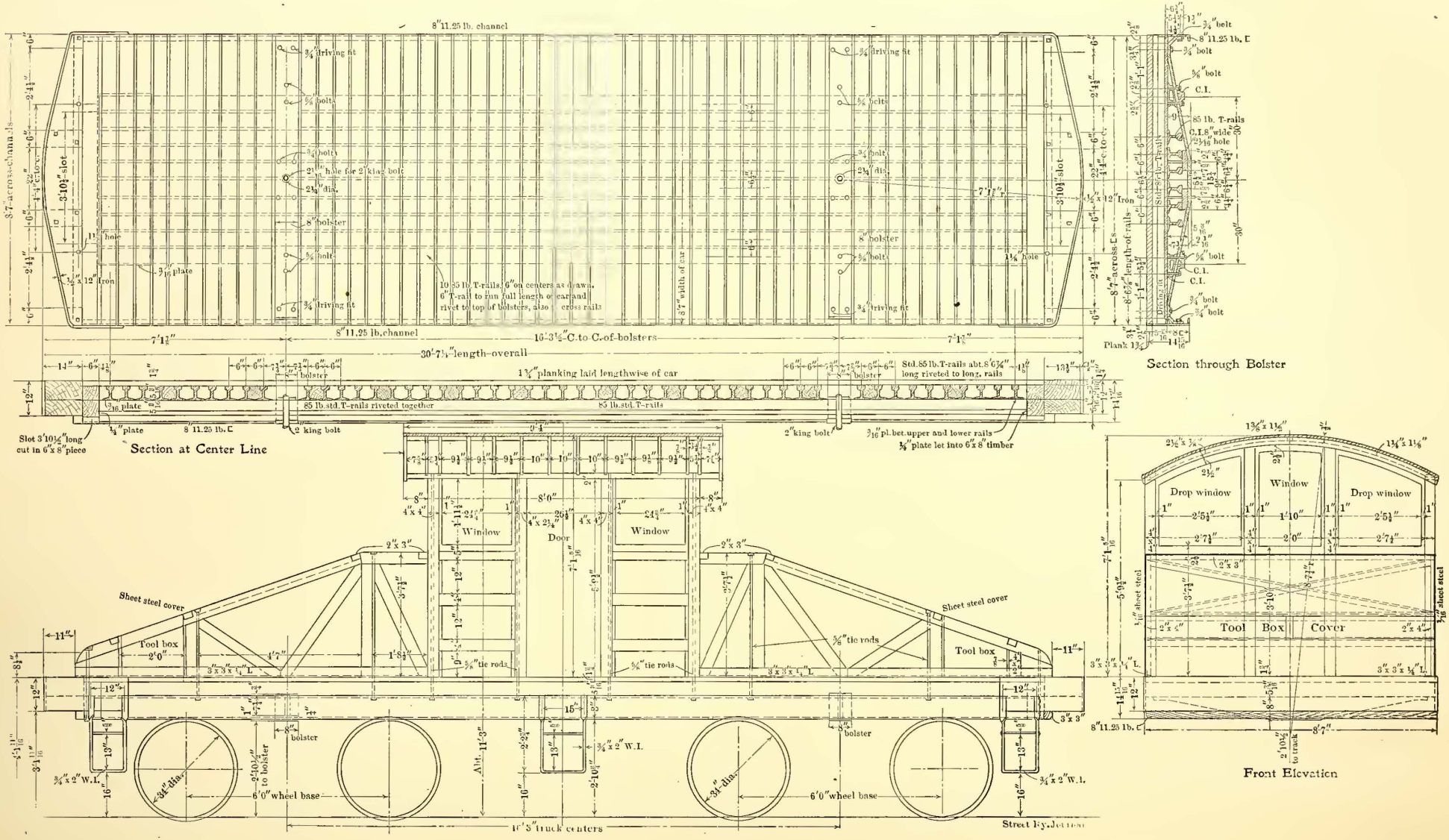
As is shown in the accompanying illustrations, each locomotive is 30 ft. 7¼ ins. over all and 8 ft. 7 ins. wide. The height of the top of the cab from the rail is 11 ft. 3 ins. The locomotives were designed to pass through the subway as readily as a standard elevated car, and each weighs, complete, 77,000 lbs. The floor is 4 ft. 1 11-16 ins. high above the rails. In general design the locomotives conform to the usual arrangement of a central cab and body with sloping ends on each side of the cab supported on a heavy underframe, the latter being carried upon two four-wheel trucks. The strengthening of the underframe, however, was accomplished in this case by the novel method, shown in the illustrations, of using a horizontal lattice work of longitudinal and transverse steel rails riveted together in place of the castings which have sometimes been employed for the purpose of geting sufficient dead weight in electric locomotives. Both cross and longitudinal rails are of T section, weighing 85 lbs. per yard. There are ten longitudinal rails in the bottom framing, spaced 6 ins. apart on centers, and fifty-one cross rails 6 ins. apart on centers. Six of the longitudinal rails run the entire length of the car, and these are riveted to the tops of the bolsters as well as to the cross rails. The longitudinal rails are inverted as they pass through the framing. On top of the cross rails is laid a floor of 1¾-in. planking which extends the entire inside length of the locomotive. The bolsters are each 8 ins. wide and the center pins are 2 ins. in diameter, spaced 16 ft. 3½ ins. apart on centers. At the sides and ends of the locomotive the framing consists of 8-in. 11.25-lb. channel irons. Filler blocks of wood are wedged in at intervals between the cross rails to serve as nailing strips for the flooring.



ELECTRIC LOCOMOTIVE USED BY THE BOSTON ELEVATED RAILWAY

The motor equipment of the locomotives is in each case four G. E. 73's, geared for a maximum speed of about 12 m. p. h. As 100 per cent of the weight of the machine is on the drivers the maximum possible tractive effort without slippage of the wheels on 20 per cent adhesion would be about 15,000 lbs. The trucks are each similar to the motor trucks used under the cars of the elevated division, having 34-in. steel-tired wheels, a 6-ft. wheel base, and being 16 ft. 3½ ins. apart on centers. The control is type 17 multiple unit. The contactors are mounted in a fireproof compartment in the center of the cab, which is about 8 ft. long. The master controllers are mounted in diagonally opposite corners of the cab, and are arranged for right-hand operation of the locomotive, facing each end. The reverser, circuit breaker, fuse box and rheostats are installed under the sloping end at one side of the cab, and the main reservoir cylinders, air compressor and governor are installed under the opposite sloping end. The wooden flooring is fire-proofed by sheet tin in the compartment which holds the control apparatus. Minor control switches and fuses are mounted in a special asbestos lined compartment at one end of the cab, and a single-pole, double-throw switch is installed to connect the main motor circuit either with the trolley pole with which the locomotive is provided or with the circuit of the four third-rail shoes. The air brakes are of the new Westinghouse electro-pneumatic type with graduated release and quick recharge features.

Arc headlights and electrically-lighted markers are provided, and part of the space at each end of the locomotive housing is given up for tool-box purposes. Special ventilators are installed in the sides of the housing, and both end and center steps are attached to the frame. A full set of steel sleet brushes of the company's standard adjustable type has been attached to the trucks. The motors are inside-hung. Van Dorn drawbars were used, as on the regular elevated cars of the system.



PLAN, ELEVATIONS AND SECTIONS, SHOWING THE CONSTRUCTION DETAILS OF THE BOSTON ELEVATED RAILWAY COMPANY'S ELECTRIC LOCOMOTIVE

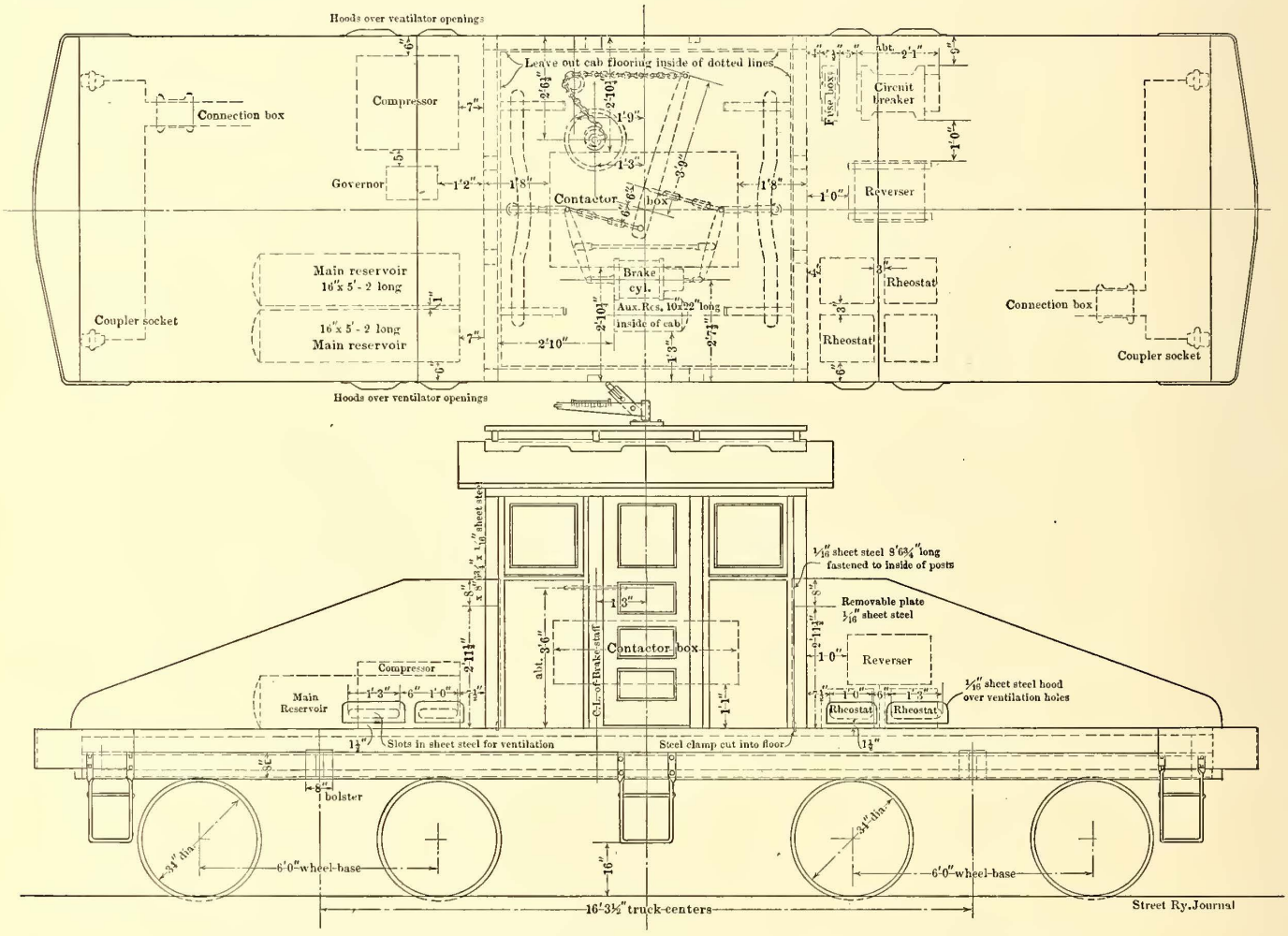
The principal work of the first of the two locomotives consists in shifting cars in and out of the northern division of the Sullivan Square shops for the purpose of wheel grinding or truck changing. About forty-eight pairs of wheels are ground daily, and the locomotive is constantly at work transferring cars to and from the special track in the shops which is served by an elevator connecting with the machine shop on the ground floor. Ever since electric train operation began in Boston it has been necessary to shift dead cars by a passenger car withdrawn from service. On this car the facilities for looking back at the rear of the train were not good, and safe movements could not be made without considerable delay in signaling. In the case of the locomotive the driver can readily see all that is happening at the end of the train, and the control is graduated so that the locomotive can be moved an inch at a time if desired. Eleven elevated cars weighing about 33 tons each have been hauled at one time by the new locomotive without the least difficulty.

A NEW BOAT FOR THE KEY ROUTE

The new Key Route ferryboat "Claremont" has been completed by the Union Iron Works and will soon enter the regular ferry service. She is a duplicate of the "San Francisco," but unlike that vessel is a product throughout of San Francisco firms, while the "San Francisco's" engines were made in the East. The "Claremont" has engines of 1800 hp, and is expected to make a trial speed of nearly 18 knots an hour. She is 200 ft. long, with a beam of 58 ft and draws about 14 ft. of water, and carries 2000 passengers.

RESEARCH FELLOWSHIPS IN ENGINEERING AVAILABLE AT THE UNIVERSITY OF ILLINOIS

The University of Illinois has extended and strengthened the field of its graduate work in engineering by recently establishing ten research fellowships in the engineering experiment station. These fellowships have an annual value of $500, and are open to graduates of approved universities and technical schools, both American and foreign. They must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the master's degree will be granted. Preference will be given to men who have had some experience in practical engineering work outside of college. The appointments will be made upon the recommendation of the station staff of the engineering experiment station, and upon the approval of the faculty of the graduate school and the president of the university.



PLAN AND ELEVATION OF BOSTON LOCOMOTIVE, SHOWING ARRANGEMENT OF THE APPARATUS

With the first day of March came the closing of the prize trolley trip story contest which has been conducted the past few months by the passenger department of the Boston & Northern and Old Colony Street Railway Companies. Prizes of $25, $15 and $10 were offered for the best stories of the best trips taken by the contestant on either of these systems. This inducement caused many people to send in some very entertaining descriptions of trips they have taken which will live in the memories of the writers as especially enjoyable and attractive.

DUTIES AND DISCIPLINE OF SUPERINTENDENTS

BY G. E. MILLER
Superintendent Union Electric Company, Dubuque, Ia.

So many papers have been written in the past about the "Discipline of Employees" that it may not be amiss to leave the beaten path, take to the woods, and write about the duties and discipline of superintendents.

The first thing to be remembered is that, while you are an important personage, you are not the only berry on the bush, as there are over nineteen hundred street railways, with superintendents and assistants, operated in the United States alone, and working on each system there are men who are competent and willing to take your place should you drop off when the bush is shaken.

As to the public, be courteous and honorable in all your dealings with them—they are the nickel givers. Pay attention to complaints and investigate each one. Keep the cars clean, well ventilated and on schedule time. Adopt schedules that can be depended upon, and the public will soon be educated to wait for the cars. In making engagements, keep them—to the minute. Do not get hot under the collar when things go wrong, but control your temper and wait until you get to your office and then—saw wood. The Sage of "Trolley Talk" hits the nail on the head when he says:

> It's easy enough to be pleasant,
> When life goes along like a song;
> But the man worth while is the one with a smile
> When everything goes dead wrong.

Study every phase of the transportation problem and make your preparations ahead of time for the days on which travel will be exceptionally heavy. While cold chills are occasionally sent up and down the back by urgent hurry-up calls to move large crowds, it should act as a good, wholesome stimulant towards your best endeavors and resources to accomplish successfully the demands that are made upon you.

The rowdy element should be handled firmly and all violations of the law should be prosecuted vigorously. Do not allow cheap politicians, saloon keepers, forgotten parents or relatives to persuade you that "they are such good boys" and that you cannot or dare not arrest them. A few good fines, with some healthy exercise on the rock pile thrown in, and publicity in the newspapers, have a quickening effect in checking the inclination of others to be mean and quarrelsome on the cars and company property. The lesson is very seldom forgotten.

Now as to employees: In dealing with subordinate officers and employees be firm, but fair. Keep in close touch with them and see that all of your desires are carried out faithfully. Do not attempt to do all the work yourself, but surround yourself with good assistants. Never hire cheap men for responsible positions, as they are always the most expensive. Let all the men look alike to you and show no favoritism. Write and date all important orders, retaining a duplicate. These books can be purchased in convenient pocket sizes and are invaluable to your success. Check and correct all signs of discord at once. Be ready to consider grievances and afford the necessary relief if they are legitimate. Never correct before others.

Meet with your employees once a month and eliminate the Quaker meeting idea and let them do some of the talking. You will be surprised at the many good and valuable suggestions that are offered. Continually keep before their minds and discuss with them that "Safety to passengers is the first consideration, "How to avoid accidents," "How to take care of accidents," "To report all accidents no matter how trivial," "Courtesy to passengers," "The care of children and the aged," "Delays," "Fares and transfers," "When, where and how to eject passengers," "The use and abuse of the controllers," and if you have steep grades, "How to handle the cars safely." Prepare a list of the number of complaints, delays and accidents during the month and read it to them at a meeting, and it will surely set their thinkers going.

In discharging an employee never allow your personal feelings to interfere with your duties. Consider well all the facts of the case, look up and study his record, and then show him the justice of your decision.

The Manager: In your business relations with the manager, report to him only such things that are necessary to a successful management. Do not waste his time and try his patience by reciting all the trivial things that happen during the day or try to convince him what a nice, good, faithful, hard-working sort of a fellow you are. He has troubles of his own and not all of his dreams are sweet, but you can rest assured he knows all about your case and the number of complaints from patrons, the discipline of employees, the receipts and expenditures of your department speak volumes for themselves. Attend strictly to your own business. When advice is wanted he generally knows where to get it, and should you be consulted for some of it, give him the best at your command.

While suggestions from directors, stockholders or the public are always welcome for improvements in the service, orders must only be taken from the manager and then implicitly obeyed. If they are red hot and straight from the shoulder, handle them carefully, cool them off and season them properly with thought before passing them along the line of subordinates. You are the keystone of the arch, with the public and employees on one side and the manager and directors on the other.

Gain and hold the friendship of the newspaper reporters, but let the manager only give them the news or accounts of new or difficult undertakings. Many extensions and improvements have been lost or delayed by a premature disclosure of the intentions of the management by an overzealous superintendent. Never abuse the confidence placed in you.

In conclusion: Learn to say "Yes" or "No."

Be willing to learn. Do not "know it all."

Sleep losers are poor business mixers.

Accidents are open bung-holes to the dividend barrels.

Subscribe for and read the trade journals and papers. They keep you next to all the latest ideas and improvements.

Pomposity, stiffneckism, or sour face cult are sadly out of place in your business; they are the cause of comment, foster resentment and—your retirement.

Your confidential clerk, or some one in authority, should know at all times where you can be reached by 'phone or messenger. This is very important at times.

Good superintendents are always in demand and not much difficulty is experienced in securing positions. Dreamers hot-air artists, fire eaters, and slick pen pushers are very often placed in these responsible positions, but it is not long before a "want" adv. is placed in the trade journals and the move is made to the next temporary stopping place.

NOTES ON SPEED-TIME CURVES

New York, Feb. 23, 1907.

Editors Street Railway Journal:

In the Street Railway Journal of Feb. 9, 1907 (Vol. XXIX, pp. 244-248), I find an article entitled "Notes on Speed-Time Curves," by Mr. Tracy W. Simpson. I would like to supplement his notes by a few notes bearing upon the actual *evolution* of the methods outlined in his article.

Mr. Simpson, while admitting that these methods are, in reality, those first made public by me in my A. I. E. E. paper, in 1902, calls attention to certain presumed innovations ("several differences of procedure") in the use of these methods. Mr. Simpson's statement conveys—quite unintentionally, I have no doubt—a misleading impression in regard to the *novelty* of these "differences of procedure," and also, in regard to the *utility* of some of them, especially the slide-rule method of obtaining the time-values.

One of these novelties is in use, for the ordinate values, in Mr. Simpson's Fig. 1 ("general speed-tractive-effort curve") of a scale of "pounds of tractive effort" instead of "equivalent accelerations." The following extract from my discussion of the A. I. E. E. paper of Mr. F. W. Carter, on "Predetermination in Railway Work" (Niagara Falls, 1903, see A. I. E. E. Trans. XXII., 1903, p. 165) is of interest, since the solid line graphs in Fig. 9 of Mr. Carter's paper are the prototypes of the solid line graphs in Fig. 1 of Mr. Simpson's article:

The solid-line curve in Fig. 9 is one which gives gross tractive efforts as a function of the speed. The author uses the ordinates for tractive efforts per motor in pounds. The abscissae indicate speeds. In my paper I also use abscissae for speeds, and I use the same ordinate *values*, but they are plotted according to a different *scale*. I call them acceleration coefficients. Now, the acceleration coefficient is, as is easily shown, nothing more than the tractive effort multiplied by a reduction factor, which we know to be 91.1. This factor (which we may here call F) includes the coefficients necessary to change weights from pounds into tons, to convert speeds from feet per second into miles per hour, and to take into consideration the gravity value or measure of acceleration, thus,

$$F = \frac{5280 \times 2000}{3600 \times 32.2} = 91.1$$

Consequently, if, without changing the curve, we change the scale in the ratio of 91.1 to 1 in either of the two curves they become identical in mathematical character. They both have the same meaning; that is to say, the solid-line curve in Fig. 9 of this paper has precisely the same significance as curve *M* in Fig. 9 of my paper. They both express the force which is available per motor for producing acceleration. What is still more remarkable is that the solid-line curve at the bottom of Fig. 9 of this paper is identical with the curve *R* in Fig. 9 of my paper. It is the curve of train resistance expressed in terms of equivalent acceleration. The dotted line curve, which is the curve of net acceleration factors, is also exactly the same as the curve *N* in Fig. 9 of my paper.

In my earlier work with speed-time curves (prior to 1901), I had myself used these same "force-velocity" ("F-V") graphs (like Fig. 1 of Mr. Simpson's article, or Fig. 9 of Mr. Carter's paper), instead of the "acceleration-time" ("A-T") graphs, such as are used in the "Charts of Coefficients." This was the way which suggested itself first, seeing that the motor characteristic curves furnished by the manufacturers of railway motors give the horizontal tractive effort values in pounds per ton. In those days we not unfrequently measured or expressed acceleration in terms of the tractive effort in pounds per ton producing it. In due time, I became convinced that train acceleration was most conveniently as well as most logically expressed in *acceleration units*, such as the "mile-per-hour-per-second." There is no more logic in expressing acceleration in terms of equivalent tractive forces than in terms of equivalent grades. Finding, then, that the "acceleration-factor" (which is

$F = 91.1$, when $g = 32.2$, or $F = 91.3$, when $g = 32.16$),

always entered into every calculation related to train acceleration, I looked about for a way of getting rid of this factor at the outset. I saw that this could be done by changing the scale of ordinates of the "force-velocity" ("F-V") graph, or by using, instead of it, the "acceleration-velocity" ("A-V") graph, whereby the forces either *producing* or *opposing* acceleration could be expressed in terms of equivalent accelerations. I soon found that one could thus obtain a more logical and direct relation between acceleration, velocity and time, because we then have

$$dt = \frac{1}{a}\, dv \text{ instead of}$$

$$dt = \left(\frac{1}{91.3}\right)\frac{1}{a}\, dv = .01095\,\frac{1}{a}\, dv.$$

From this to the "theorem of accelerations" (given in "Appendix B" of my paper) was but a simple step. The idea of the *reciprocals* was suggested by the constant appearance of the acceleration value (a) as a reciprocal $\left(\frac{1}{a}\right)$ in the preceding equation. At first I calculated these reciprocals by the slide rule, or else obtained them from a table of reciprocals. It was not long before I realized that those values could be very conveniently used in the form of "reciprocal" curves.

The "chart" method outlined in my A. I. E. E. paper was completely worked out by the end of August, 1901. Since that time I have myself always found it preferable to use, for the graphs of the forces concerned in acceleration, scales of ordinates, expressing "*equivalent accelerations.*" At the same time, in my lectures on electric train movement, at different technical schools in the last four years, I have always pointed out carefully and even emphasized the fact that these forces can be also expressed in equivalent *tractive-force* units, or in *grade percentage* units. I recommend the students to show *all three* of these scales of ordinates on each "chart of coefficients." The following quotations from the mimeographed syllabus of my lectures on Electric Train-Movement, at the Brooklyn Polytechnic Institute (1905-1906), are of interest as evidence:

(Lecture No. 13, syll., pp. 8-9).

It is also possible to transform equations (50) in such manner as to express the force corresponding to "grades" and to "acceleration" in terms of the "train resistance," "*fi*," or more properly in terms of an "equivalent tractive force."

In such a case the equivalent "resistances" would not be resistances capable of absorbing or consuming energy, but they would have to be resistances comparable to the resistance produced by "reactance" in an electric circuit. (See A. I. E. E., XIV., p. 910.) Equation (51), in reality, represents such a condition, since, as we have already seen (equation 41), all that is necessary to transform accelerations into tractive efforts *per ton* is to multiply the acceleration *coefficient a* by the acceleration *factor* 91.3. It would also be possible to express all the forces in terms of "equivalent *grades*," of which one kind, corresponding to the "intrinsic" resistance, would be proportional to the force-factor of an amount of potential energy which would have to be regarded as "non-recoverable."

The equivalent acceleration method is the theoretically preferable and most logical method, as will be seen presently. The equivalent tractive effort method may be used advantageously to supplement it as will be seen.

The same statements are, in substance, to be also found in the syllabus of the course of lectures just given (1906-1907).

In the same lecture it is shown that the ordinary curve of train-resistance in pounds per ton as a function of the

train-velocity represents, by a scale of ordinates 91.3 times greater, a "loss" of acceleration.

(Lecture No. 13, syll., p. 12):

"Intrinsic" Accelerations.—The term "intrinsic" acceleration is a convenient one to designate the acceleration "loss" (a') due to train resistance, because it suggests the nature of this loss. from the values of f_i, obtained by some train resistance formula, the values of the "intrinsic" acceleration may be calculated by the formula

$$a' = a_i = \frac{f_i}{91.3} = .01096\ f_i \qquad (51)$$

Table XII. contains the values for f_i obtained by train-resistance formula No. 34, and the values of a_i obtained by formula (51) for cars of 25 tons, 35 tons and 45 tons total weight, in trains of 1 to 5 cars.

The following extract is also of interest:

(Lecture No. 14, syll., pp. 10-11):

Since there is, both in the curves and in the tables, a speed value for every tractive effort value, it follows that we can, from these simultaneous values plot a curve of tractive effort F as a function of the velocity (V), (i. e., the F-V curve); and, by analogy with the train-resistance curve, it is evident that the same curve would also represent "equivalent accelerations," by reference to another scale, 91.3 times larger. Such a curve would not be exactly what we want, however, because it would represent the equivalent acceleration for a total train weight of only *one ton* per motor. What we need to know is the total acceleration *per ton of total train weight.* We must, therefore, before plotting the tractive force values (or their equivalent acceleration, a_t), *divide* the total tractive effort per motor by the number of *tons* per motor. If M = number of motors per train, and if F_t = the total tractive force exerted by each motor, at any instant, then the total tractive effort *per train* will be $F_T = MF_t$. The total tractive effort *per ton* of train (when W = total weight in tons will be

$$f_t = \frac{MF_t}{W} = \frac{F_t}{(W/M)} = \frac{F_t}{w} \qquad (A)$$

where $w = \frac{W}{M}$ = total train weight *per motor.*

The equivalent acceleration *per ton* of train will be

$$a_t = \frac{f_t}{91.3} = .0195\ f_t = .0195\ \frac{F_t}{w}. \qquad (B)$$

The values of f_t depend upon the motor characteristic curves, as already seen. The quantity w will depend on the train and its load.

The quality a_t is, in reality, what might be termed the "gross acceleration" *per ton* of train weight, and the "actual" acceleration, as we shall find, could also be called the "net" acceleration.

In this lecture reference is made to tables giving, by way of illustrative examples for the students, the "equivalent" acceleration values for various train units and for various motor equipments. Every student is also given a "sample" chart of coefficients, reproduced from Fig. 9 of my paper, and containing, in addition, *eight* graphs of "gross" accelerations by motor efforts and *three* graphs of acceleration losses by train resistance. This shows that the idea of putting several curves on one chart is not as new as might be supposed from Mr. Simpson's statement. The novelty of plotting the graphs for all the gear ratios of one motor on the same sheet, as is done in Mr. Simpson's Fig. 1, is "anticipated" in the following language:

(Lecture No. 15, syll., p. 3):

The engineer must be prepared to expect, therefore, that many different "combinations" of cars and of motor equipments may have to be "studied," and that a large number of different kinds of service-run diagrams may have to be predetermined in the course of the detailed study of a project. Consequently, it is likely that many a_t and a_i curves will have to be used on "Charts of Coefficients." It is advisable, for reasons already given, to plot only a few curves on each sheet. It is advisable to plot on any chart sheet the a_t curves corresponding to one kind of motor equipment only for different gear ratios. Such charts when once made up are useful for other cases where the same motor equipment, gear ratios, etc., are applicable.

It is obvious that the chart of reciprocals does not need to be duplicated, since the same chart may be used with all charts of coefficient *whose scales of acceleration coefficients are the same.*

In the latter part of 1902, the idea occurred to me to prepare and publish a chart of coefficients for every railway motor, showing the curves for every gear ratio used or likely to be used for this motor. I prepared a large number of "blank" charts for this purpose and actually began the task of making these charts. This task was, after a time, abandoned, partly from lack of time, but, principally, because I foresaw the possibility of developing analytical methods which would supersede all "point-to-point" methods. An extended reference to such analytical methods will be found in my discussion of Mr. Carter's paper (see A. I. E. E. Trans. XXII., 1903, pp. 165-174). I am still at work on such a method which would, possibly, have been perfected and made public before now, had it been possible to give the problem the uninterrupted thought and study which this solution requires.

We now come to the slide-rule method of finding time-values. Here, again, there was evolution. Being addicted to the use of slide-rules to a "notorious" extent, it was quite natural that I should begin that way. I did so; and I used the slide-rule method until the happy thought of the reciprocals came to me, whereupon I quickly found by actual trial that I could save time, eye-sight and nervous energy by using a chart of reciprocals and a pair of dividers, instead of a slide-rule, even though my slide-rule was one having a logarithmic scale 1 m. long, and giving three figures even at the end of the scale. I have had occasion several times to astonish some of my colleagues by the rapidity and quality (precision) of the work which can be done by the Mailloux Chart Method. In every case, I have found that those who objected to it or found fault with it, had not, in reality actually tried it. They had, usually, only read of it. If they had made or procured a chart of reciprocals and had actually done some work with it, they would have found what a remarkable labor and brain-saving "tool" it is. They shirked, however, the task of preparing such a chart, even though the work (which is not, after all, so gigantic), has to be done only once, since *only one* chart of reciprocals is needed for *any number* of charts of coefficients, provided the same scale of values are used on all the charts of coefficients.

One of the most enthusiastic converts to this chart method is a prominent electrical engineer, who attended my lectures last year and there, for the first time, got in touch with the method and saw, by practical demonstration in the class, what it could really do. The method never fails to appeal to the students the moment they begin to do actual work with it in the class-room.

The calculation method (either with or without a slide-rule) is useful at certain points, notably when the time-values to be found are those corresponding to velocity increments, which are not round numbers or numbers for which a curve of reciprocals is available. The chart method, when used with proportional dividers, enables the correction for rotational kinetic energy to be made in a very simple and accurate manner. With the slide-rule either one more "setting" is required or else an *addition* has to be made separately, before using the rule, as indicated by the sum $(W + W_1)$ in Mr. Simpson's equation.

Prof. Freudenberger's method is of considerable theoretical interest, but, unfortunately, not of great practical utility, for reasons which are given in my discussion of Mr. Carter's paper, already mentioned.

C. O. MAILLOUX.

TWO NEW TYPES OF REGISTERS

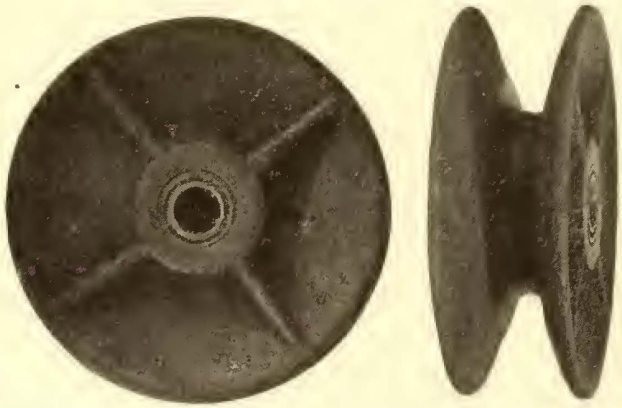
The Recording Fare Register Company, of New Haven, Conn., announces two new types of fare registers, the F and G, for which very strong claims are made. The machines are full geared and contain very few parts, the aim being the elimination of springs and small parts. The cases are of seamless drawn cartridge brass, finished in antique copper, and the face dials are of steel enameled in any color desired. Both the trip and the total figures are very large and plain. The "set-back" is automatic, the knob returning to position instantly upon canceling the trip or changing the direction indicator. Type G is a recording register and furnishes a printed record showing the number of the register, the number of trips, the direction of the trip, and the total statement at the end of each trip. Type F is of exactly the same construction as Type G with the exception that the recording feature is omitted. Both of these machines can be supplied with a "not set" indicator, which requires an extra push of the knob to unlock the register after canceling the trip or changing the direction. This enables the conductor to lock his register so no fares can be rung up during his absence from the car.

REGISTER FACE

A LONG-LIFE TROLLEY WHEEL

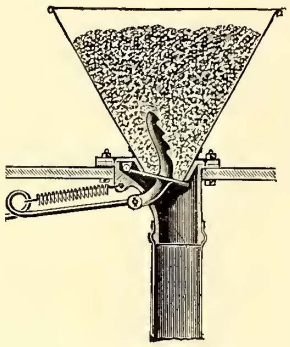
In an article on the Keystone trolley wheel, published on page 42 of the Street Railway Journal for July 7, 1906, reference was made to the fact that it had been adopted as standard by the Stark Electric Railway Company, of Alliance, Ohio. In connection with this it may, therefore, be of interest to publish the accompanying reproduction of one of these wheels after it had run over 10,000 miles on this company's lines. The wheel was placed in service on Sept. 17, 1906, and ran up to and including Nov. 26, averaging 146 miles per day, or 10,220 miles in all.

While a reproduction made from a photograph can give no fair idea of the excellent present condition of the wheel, it may be said from personal inspection that the wheel certainly showed very little wear for this mileage, nor did it exhibit any evidence of sparking, despite the severe current-collecting conditions in high-speed interurban service. As noted in the article mentioned, this wheel, which was made by the Keystone Steel Company, of Sebring, Ohio, is not of copper or brass, but consists of a secret composition whose base is iron. It is claimed, nevertheless, that for all practical purposes the conductivity is equal to that of the more expensive metals and that the wheel wears out less rapidly.


COMPOSITION TROLLEY WHEEL AFTER 10,000 MILES OF SERVICE ON AN OHIO INTERURBAN LINE

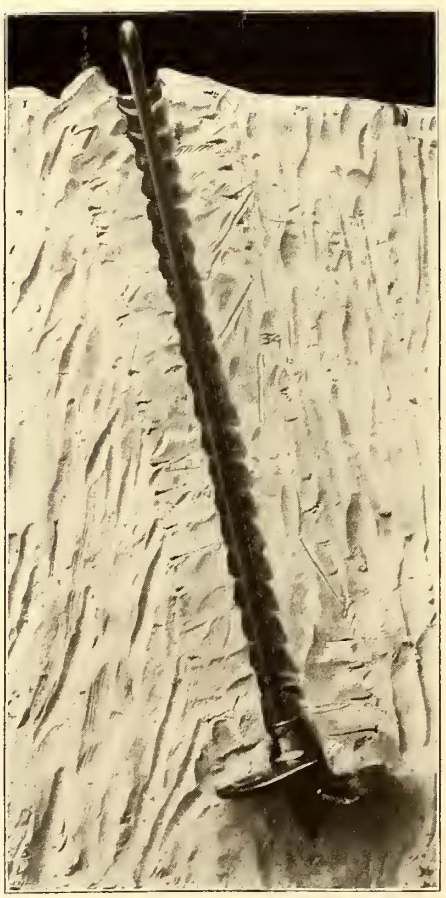
A SIMPLE SAND BOX

A sand box with swinging valve, serrated knife and lever to which the pulling rod is attached, all in one piece, is being manufactured by the De Witt Sand Box Company, of Troy, N. Y., and is known as the Simplex box. In this box the valve is so arranged that the vent cannot be held open by anything in the sand, any foreign matter reaching the vent at the time of closing the valve being forced either out or in. It is said for this box that moisture from below is positively excluded, the lugs on which the valve swings being embedded in a way that insures an almost perfect junction. The box is said to feed very quickly. Slight pressure will give all the sand necessary for an ordinary stop.


SAND-BOX AND OPERATING MECHANISM

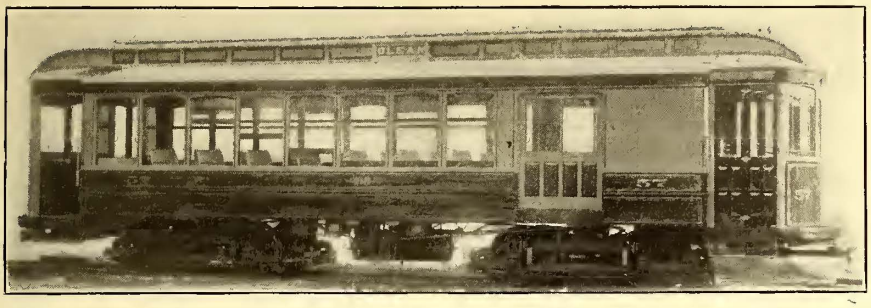
TESTS OF GUY ANCHORS

Seventy-odd tests of different sizes of Stombaugh guy anchors made by Prof. Carpenter, of Cornell University, recently with the aid of a dynamometer established the strain for a 5-in. anchor at 12,500 lbs.; a 6-in., 15,000 lbs.; an 8-in., 20,000 lbs.; a 10-in., 25,000 lbs., and a 12-in., 30,000 lbs. The illustration herewith of a 12-in. anchor, from which half of the clay into which it was screwed was carefully dug away, shows very clearly the application of the device. The place is very plain where the helix or screw of the anchor passed through the clay, but the solid clay was not disturbed, the anchor leaving practically no trace of where it went in. At the recent electrical show in Chicago the manufacturers of the Stombaugh anchor, W. N. Matthews & Brother, of St. Louis, had on exhibition a Stombaugh anchor in a large box of modeling clay, in which the cuts of the helix were opened up to show the path of the anchor. In this instance modeling clay was used because it held its shape.

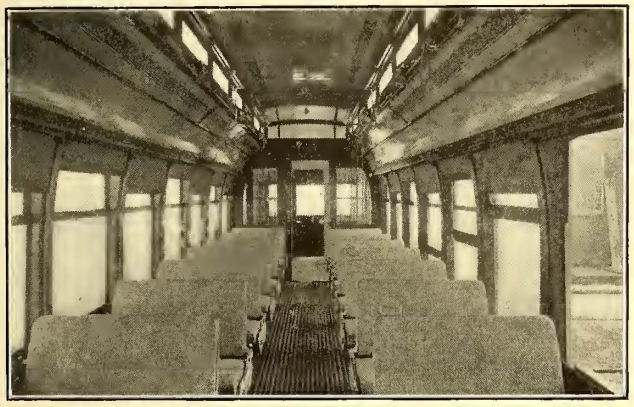

ANCHOR IN CLAY

COMBINATION CARS FOR OLEAN, N. Y.

The Western New York & Pennsylvania Traction Company has recently purchased from the J. G. Brill Company six combination cars of the grooveless-post semi-convertible type (patented), three of them being of the passenger and baggage type shown in the illustration, the remainder having passenger and smoking compartments. The company, which is now operating about 60 miles of electric road, 50 miles of which are interurban, includes the Olean Street Railway, the Olean, Rock City & Bradford Railway, and the Bradford Street Railway.



EXTERIOR OF THE OLEAN CAR



INTERIOR OF OLEAN CAR

Following are the chief dimensions of the new rolling stock, which apply to both types of cars: Length over end panels, 31 ft. 8 ins.; over crown pieces and vestibules, 41 ft. 1 in.; width over sills, including sheathing, 8 ft. ½ in.; over posts at belt, 8 ft. 4 ins.; sweep of posts, 1¾ ins.; centers of posts, 2 ft. 8 ins.; size of side sills, 4¾ ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, ⅜ in. x 12 ins.; thickness of corner posts, 3⅝ ins.; side posts, 3¼ ins. All of the cars are equipped with the No. 27-E1 trucks with 6-ft. wheel base. These trucks have solid forged side frames and have the manufacturer's type of brake hanger known as the "Noiseless." Four motors of 40-hp capacity each were installed on each car. The interiors are finished in mahogany, inlaid. The partitions dividing the smoking and passenger departments have windows on each side. The baggage compartments are 9 ft. 2 ins. long and have the regular equipment; the smoking compartments occupy the space of three windows. The cars are equipped with spring cane seats which have push-over backs and are of the Brill type.

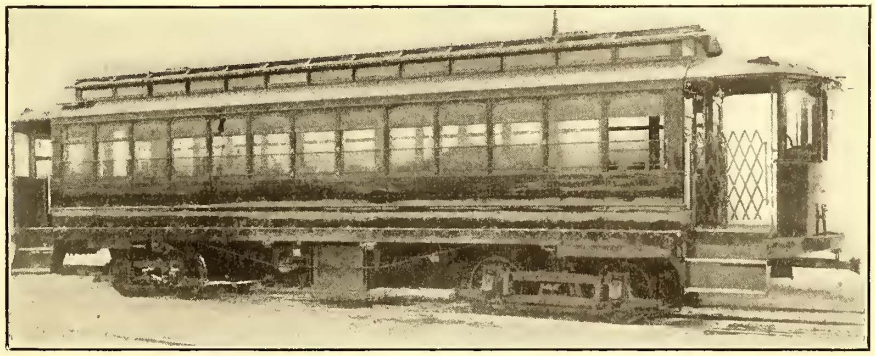
INTERESTING CARS FOR PENSACOLA

The Pensacola Electric Company, which is under the management of Stone & Webster, connects Pensacola, Warrington and Fort Barrancas. It has a trackage of 25 miles and operates about fifty cars, some of which were recently supplied by the J. G. Brill Company, of Philadelphia.

The new cars have flush platforms with two steps at each side, as the cars are intended for mixed conditions of city and interurban service, necessitating high-speed trucks, which carry the body too high to admit of single steps with drop platforms. The car in the photograph was temporarily mounted on trucks which were at hand for photographing; these trucks were later replaced by the Brill No. 27-E1, which is in standard use on the system. Brill portable vestibules and folding gates are provided for the platforms.

INTERIOR OF PENSACOLA CAR

The window system is of the stationary upper sash and lower drop sash type. The interiors are finished in cherry with birch veneer ceilings. Spring cane upholstered seats with push-over backs are of Brill make, as are also other specialties with which the cars are equipped. The chief dimensions follow: Length over end panels, 36 ft.; over crown pieces, 46 ft.; width over sills, including sheathing, 8 ft. 5½ ins.; size of sie sills, 4 ins. x 8¾ ins., plated with ⅜-in. x 15-in. steel; center sills, 4½ ins. x 5½ ins.; end sills, 5¼ ins. x 6⅞ ins.



EXTERIOR OF PENSACOLA CAR

The Columbus, Marion & Delaware Railway Company is building a freight station on North Main Street, Marion.

LONDON LETTER

(From Our Regular Correspondent.)

The fact that the London County Council elections take place within the next few weeks has brought the whole London tramway situation into somewhat undue prominence, the two parties, the Progressive and the Moderates, making the most contradictory statements regarding the results of the tramways. In the daily papers columns upon columns have been appearing, some from outside writers, but some also from the pens of the chairman and the ex-chairman of the tramways committees of the London County Council, and were it not for the fact that most of these are written for electioneering purposes, they would be valuable contributions to the economics of tramway management. Naturally the Moderates accuse the present London County Council of extravagant management and lavish expenditure in connection with the tramways, but the statements are so mixed up with the extravagant electioneering propaganda that the truth is not easily arrived at. The fact remains above all else, however, that London has been extremely backward in providing herself with tramways, and that, notwithstanding the huge expenditure, the area of London is not yet one-half equipped. From that point of view alone, the Progressives, so far as the tramways are concerned, are worthy of all encouragement, and though the London County Council may have put down a system of tramways involving the conduit construction, which necessarily has made the cost very great, still in the central portions of London it would have been impossible to get the consent of the various boroughs to a proposition for overhead equipment. Even now, after the experience of several years in the outlying districts where they are endeavoring to electrify the tramways, these districts will not give their consent to overhead construction, so that the County Council have a difficult task to satisfy all. In the writer's opinion mistakes were certainly made in putting down in the outlying districts so much underground conduit, but that should be no reason why such boroughs as Islington or Bow should now insist upon conduit construction being put through their boroughs from an aesthetic point of view. How it would be possible for well-constructed overhead system to spoil the aspect of the streets in these districts it is difficult to imagine, and the objections from these outlying boroughs are simply of an obstructive character and petty in the extreme. Meantime the work of the London County Council on new tramway schemes is making excellent progress. A very useful connection has just been made at the south end of Westminister Bridge, by which the Embankment tramways are now available for all of the cars operating on the route from St. Thomas' Hospital, southward by way of Battersea and Wandsworth. The Council has decided to commence at once the electrification of the South London horse tramways recently acquired by it, and the first part to be electrified is that between Brixton Road and Vauxhall, the old tramway depot in the Stockwell Road being converted into a sub-station. The Council has also decided to invite tenders for the construction of the tramways from Grove Vale to Newlands, by way of Peckham Rye, giving a direct service from this district to the bridges. The conduit system on this line will be adopted, particularly in view of the adjacency of the Greenwich Observatory. While mentioning this observatory, it is interesting to note that the two committees appointed some time ago are working in entire harmony, and a solution of the difficulty is within sight. Other important electrification schemes have been decided for various routes from Greenwich to Lewisham and for connecting links in that vicinity and for certain portions of that line the overhead system will be used. It is also proposed to construct a line of tramways across Putney Bridge, so that it may link up the Middlesex County Council's tramways at Harlesden with Shepherds Bush, Hammersmith and the south of London. The electrification of the tramways in the Islington district are at present, however, being held up, as the Islington Borough Council has refused its sanction to the electrification of the tramways by the overhead system. The London County Council has decided that it will apply to the Board of Trade for approval of an overhead installation, pointing out that this system would effect a saving of £40,000. All the schemes of the London County Council which have been submitted by the highways committee amount to a total length to be electrified in the immediate future of over 30 miles, and involving an expenditure of about half a million pounds. The highways committee is also carefully considering the matter of half-penny fares, and is recommending the adoption of these fares on the northern section of tramways, similar to that which is already in operation on the southern tramways. It is pointed out that during the past year on the southern electric tramways over sixty-one million people took advantage of the half-penny fares, which is one-third of the total number carried.

At Bristol, a few days ago, a conviction was secured against two colliers for refusing to go on top of a car instead of inside when they were asked to go outside by the conductor. It appears that the car was a workmen's car, but these colliers came direct from their work at the pit's mouth, and in the opinion of the conductor their clothes were in such a condition that they might soil or injure the cushions or other passengers' clothing. In the court, the company was careful to explain that it was not objecting in any way to colliers in themselves, but did object to any passenger going inside a car with his clothing in such a condition as would make it disagreeable for anyone else to sit next him. The Bench decided in favor of the company and fined each of the colliers the sum of 25 shillings. By the way, the Bristol Tramways & Carriage Company has had a most successful year, its profit for 1906 being over £90,000, a little more than £5,000 more than the previous year. After paying all interest and putting an adequate sum to depreciation in reserve, the company is able to pay 9 per cent on the ordinary shares for the year. The most interesting point about last year's work, however, has perhaps been the company's experiment with motor omnibuses, though nothing very definite is published in the annual report about the working, further than the proof of their ability to carry a large volume of traffic. These experiments have naturally been in the way of using these motor omnibuses in outlying districts, where the tramway lines did not reach, as feeders to the system. Though no figures are given in the report as to their working expenses, the general statement is made that the percentage of working expenses is necessarily high.

The Dublin Tramway Company continues in its successful career, the amount available for distribution in dividends during the past half year being £51,704, which is more than £2,000 over that of the corresponding period the previous year. Substantial amounts have also been placed to reserve and renewals, and a large amount has been placed to their maintenance account. Several important improvements have been made during the past year, and a number of new cars have been put on various routes. The company is also doing excellent work in providing a number of cottages for the use of its own employees and the first lot of twelve erected have been completed and immediately occupied. This housing accommodation has been provided near the depots so that the employees will be able to reside near where they begin and end their day's work.

The Corporation of Manchester has had a rather curious experience during the past month as regards the extensions to its valuable tramway system. One would have thought that the tramways had found favor in the sight of all Manchester residents, but it would appear that recently when it was proposed to extend these tramways through certain streets there arose considerable opposition, so strong in fact that the Corporation was compelled to resort to a poll of the inhabitants to find out whether its bill in Parliament to go on with these extensions was to be proceeded with or not, costing Manchester for this experience something like £2,000. Needless to say, however, the result of the poll was entirely favorable to the Corporation; in the first place the ballot cast being a very small one, and the result being overwhelmingly in favor of the tramway extensions. The reason for so small a proportion of the electors voting, only about 10 per cent having been induced to go to the polls, may be that the extensions proposed are really connecting-links from already existing routes, and the objections naturally came from people who thought they would be disturbed by tramways in these streets. A great portion, therefore, of the electors were sufficiently apathetic in the matter not to vote, but fortunately for the Corporation, sufficient voted to defeat the opposition. The result also goes to show how local opposition can be easily defeated when it comes to a question of benefiting a whole city.

Despite the report of the deputation of the Edinburgh Tramways committee, who had the satisfaction of visiting a number of cities for the purpose of deciding on the best method of providing an extension of Edinburgh's tramways, and despite the report from its own expert and all sorts of advice from electrical engineers representing various systems of electric tramway construction, the members of the tramways committee of Edinburgh

Town Council have now committed themselves once more to the cable system for the extension of the tramways of the Gilmore Place routes, the other extensions before the committee being rejected. Thus the whole question of the Edinburgh tramways has been once more postponed as no one thinks for a single moment that the cabling of the Gilmore Place route will solve the problem. Naturally the decision has given rise to a great deal of comment, even by the most conservative of Edinburgh citizens. The cable system does not fill the necessities of the case and many of the inhabitants of the city who have traveled much are quite willing to admit that even Princes Street, which is the great show street of Edinburgh, would not be ruined by an installation of the overhead system. As far as the other streets of the city are concerned, I do not know that anyone has ever claimed any special beauty for them, and they are certainly not any better than the streets of any other city, and many of them are a good deal less beautiful. It certainly would be quite possible to make a combined overhead and either underground or surface contact system, and this Edinburgh will surely be compelled to do in the years to come.

The report of the work of the Glasgow Corporation Tramways for the past six months by Mr. Dalrymple, the general manager, contains some interesting information. Firstly, it is pointed out that more electric plant will be required at Pinkston power station, which was opened in 1901, and is at present equipped with four vertical engines of 2500-kw capacity each, besides two smaller auxiliary engines. The demand on the plant has steadily increased, so that as 75 per cent of the plant is in use at one time, there is really no standby-engine in case of accident. He now advises the committee to advertise for two turbo-alternator sets of 3000-kw capacity each, together with the necessary boilers. Mr. Dalrymple also makes a report on the question of double-bogie cars and has come to the conclusion, after experiments, that for Glasgow conditions the present single-truck car is more useful. He believes in having a larger number of comparatively small cars rather than a smaller number of larger cars; the smaller cars are safer on the curves, weigh very much less and only cost about three-fifths of the large double-bogie cars and can be run more frequently with better results.

An extension of the car system of the Lanarkshire Tramways Company from Cambuslang to Blantyre opens up a possibility that would hardly have been thought of some years ago. The rails of the Glasgow Corporation Tramways already extend to Cambuslang, a distance of about 15 miles, and with the new section now opened, the whole systems of the Lanarkshire Tramways Company and the Glasgow Corporation are now connected, making a direct open stretch of about 28 miles from the furthest point of the company's system to the most westerly point of the Glasgow tramways. Another interesting point in connection with this is that the Dumbartonshire Tramways Company is about to lay down a line from Dalmuir to Balloch, and this system also joins the Glasgow Corporation Tramways, so that when this link is completed, by means of the Glasgow Corporation Tramways and the tramways of the two above mentioned companies, it will be possible to journey a distance of about 40 miles from the heart of the busy coal region in Lanarkshire to the beautiful scenery on the banks of Loch Lomond. Blantyre is also interesting as the birthplace of Dr. Livingstone, while the tramways in the Lanarkshire coal-field district also pursue a route which has many picturesque and historical associations. The battle of Bothwell Bridge was fought in the immediate vicinity and the battle of Langside not far away. Hamilton Palace is also in the immediate vicinity and the Falls of Clyde.

It is reported from Macclesfield that Parliamentary powers are likely to be sought for the construction of a light railway from Sheffield, via Tideswell, Buxton, past the famous "Cat and Fiddle" Inn, to Macclesfield, then proceeding to Knutsford, and thence to Warrington. It is stated that a survey has been made, and that already many influential public men in the districts to be served have given their hearty support to the undertaking.

By a resolution adopted by a small majority, the shareholders in the Torquay Motor Omnibus Company agreed to sell their eight omnibuses and accessories to the Harrogate Road Car Company, and voluntarily to wind up the company. The step is taken, not because the omnibuses have not paid, but because electric tramways are about to begin running in the town, and their competition is feared. The shareholders will receive back the whole of their capital and a bonus also.

The total receipts for 1906 of the Leeds Corporation Tramways were £318,234, or an increase of £17,612 as compared with 1905. This is equivalent to an expenditure in tram fares of 13s. 11¼d. per head of the city's population, as compared with 13s. 2d. in the previous year. The number of passengers carried was 71,750,330, as against 67,314,334 in 1905. This is equal to carrying the entire population of the city 157 times during the year. The receipts per car-mile were 10.57d., an increase of .30d. over the previous year.

The Light Railway Commissioners have approved the application of the Llandudno & Colwyn Bay Tramway Construction Company for powers to carry a light railway through the town. Three years ago a partial scheme for the outskirts was passed, and now the promoters sought powers to tap the main business thoroughfares, supported by the District Council. The tramways will not run on Sundays.

At the London, Brighton & South Coast Railway Company's meeting, the figures of 1906 were compared with those of 1903, when the tramways of South London first began to compete with the railway. A diminution of over 6,000,000 in the number of passengers carried was shown, the second class alone showing a falling off of nearly 25 per cent. Comparing the half year with the corresponding period of 1905, there was a decrease of over 1,000,000 passengers, and on the whole year nearly a million and a half, mainly in the suburban and short-distance traffic. The additional rail motor services established by the company had resulted in about 1,000,000 passengers being carried, as compared with 130,000 in 1905. As the cost of running a motor train was about one-third of that of an ordinary train, additional cars were to be built and more of the small engines converted for those services. A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

Early in the year a strike occurred on the system of the Tramway Sud of Paris, which affected the service on a number of lines on the southern side of Paris. The Tramway Sud is perhaps the most important of all the lines in the French metropolis, and the suspension of its service caused very great inconvenience to thousands of Parisians. The whole of the operating force, to the number of 1600, ceased work, and there was almost immediately a total suspension of the service on the lines of the company, which not only include some 20 miles within Paris but also extend from the city to various suburban districts. The cause of the strike was the new law relating to weekly rest for workmen and employees, which went into force late in 1906, and immediately became the cause of heated discussion and disputes in many trades and industries. Tramway companies were included among the other commercial interests affected, and legal cases were not slow to appear in view of the rather lax wording of the law. It was apparently left to the local authorities to decide whether the tramways and interurban railways in their districts came under the new law. In one case at least, that of Brest, the magistrates decided that the tramways of that town came under the same category as railways, and to this class of industry the obligatory clauses regarding the weekly day of rest do not apply, although the employees must be compensated by a rotation holiday, which need not necessarily fall on Sunday. Previous to the passing of the new law the Tramway Sud had allowed its drivers, conductors and other employees two whole days holiday per month with pay. There was nothing obligatory about this. The new law obliges the employer to allow four days rest per month, which was duly done, but the company protested against the payment of wages on these four days, while the men claimed that full pay should be given. It will be seen that the company, in continuing the payment on two days, paid what is equivalent to four half days' wages, beyond which it flatly refused to go. Hence the strike. The lines of the system have been completely shut down for weeks. Attempts have been made to run a certain number of tramcars by means of new men, but the municipal regulations on this point are severe and strictly applied, and progress along these lines has been slow. A motion was made in the Municipal Councillor's meeting to annul the company's franchise, but matters have not gone so far as to warrant such a measure. At the present time everything is at a complete deadlock, and the attitude of the men is only equaled by the firmness of the company, which declared that it positively cannot afford to allow the men full pay for the four days rest imposed by the new law.

CHICAGO TRACTION QUESTION IN POLITICS

The contest for the nomination for Mayor of Chicago on the Democratic ticket between ex-Mayor Harrison, who favors the street railway franchise ordinances passed recently by the City Council, and Mayor Dunne, who opposes the ordinances and contends for municipal ownership, terminated in the selection of Mayor Dunne, upon a platform almost entirely devoted to the traction question, which denounces the present traction ordinances and declares for municipal ownership. The platform in part reads:

The Democratic party is unalterably pledged to municipal ownership of all public ulitities, to the end that service for the whole people rather than profit for a few shall result from the operation of public necessities.

In the course of these negotiations (those to secure immediate rehabilitation of the lines) the traction companies, backed by the stock-jobbing interests of New York and Chicago, made unreasonable demands upon the city and finally secured from the Council, over the veto of Mayor Dunne, ordinances that are so drawn as to make municipal ownership practically impossible.

These ordinances are now before the people on referendum, and should be voted down. Pretending on their face to provide for municipal ownership, they are, in fact, private franchises for twenty years or more.

Much was conceded by the administration during the negotiations for the ordinances, with a view of making a peaceful settlement, enabling the city to municipalize at any time upon reasonable notice. These concessions were reasonable if that object could have been accomplished, but, under these ordinances as submitted to the people, municipal ownership is practically impossible. For this reason the Democratic party condemns the ordinances and urges the people to defeat them at the polls.

The Democratic party irrevocably pledges itself and its candidates to the principle of the referendum. Whatever may be the will of the people as expressed at the polls must be executed faithfully by their representatives. Should these ordinances be approved by the people, notwithstanding their dangerous character, we must have public officials who will steadfastly guard the people's rights therein. If, however, these ordinances are defeated by the people we must have public officials who will prevent the enactment of other franchise ordinances. In the event of the defeat of the ordinances at the polls the city should assert its right under the eminent domain act and condemn these properties in the courts. Pending the condemnation of the property and rights of the companies the city should not enter into any further negotiations except for the purpose of temporary occupancy of the streets under licenses revocable at any time at the will o the city.

We reiterate our demand for home rule in Chicago on matters of local concern, and insist that all citizens should have the largest measure of personal liberty that may be compatible with peace and good government.

We oppose the granting of any further franchises or privileges to the Union loop. This loop has become a tremendous obstacle against the development of the city and should be removed from our streets as soon as this can be legally accomplished.

The Republican mayorality platform, it is reported, will approve the traction ordinance. Chairman James Reddick, of the Republican county committee, after a meeting of the committee, is quoted as saying:

The committee was of one mind concerning the traction ordinances. It is possible that there are some sections that could be improved, but the committee believes that on the whole they are the best measures that can be secured by the city from the traction companies. They represent the best judgment of the Council committee on transportation and nearly all the members of the Council, and with that approval the committee feels that it should go on record in their favor. The committee believes that it is time that the traction question should be taken out of Chicago politics forever.

With this purpose of indorsing the ordinances in view, Aldermen Milton J. Foreman and Bennett were appointed members of the committee as having led the fight in favor of the measures, both in the Council committee and on the floor of the Council.

The most likely candidates for Mayor on the Republican ticket are Postmaster Busse and Alexander H. Revell, both business men.

What was known as the "three-pronged petition," which was one of the petitions circulated recently to secure a referendum vote on the traction ordinances, has been declared illegal by the Board of Election Commissioners.

Various organizations throughout the city are passing resolutions favoring the passage of the traction ordinances at the April election. A joint committee of the Chicago Commercial Association and the Chicago Real Estate Board, appointed in the interests of the ordinances, has engaged a secretary, will rent down-town headquarters, and has sent out a letter asking all non-political organizations to send delegates to a meeting to be held Feb. 26. The name of the present organization is the Citizens' Non-Partisan Traction Settlement Committee.

Plans for the reorganization of the Union Traction Company into the Chicago Railways Company, with authority to accept the traction ordinances now pending, are being formulated in New York. The reorganization program, it is said, will be submitted to Prof. John C. Gray, of Harvard University, and Judge Grosscup, receiver of the road.

TEXAS LEGISLATURE GRANTS RIGHT OF EMINENT DOMAIN

The Texas Legislature has passed a bill giving interurban electric railway companies the right of eminent domain. The bill was drawn especially in the interest of the proposed interurban electric railway that is about to be built between Houston and Galveston by Stone & Webster, of Boston. It is stated that this line will now be built without further delay. It will be 51 miles long, with a branch line to one or more pleasure resorts on Galveston Bay.

NEW YORK SUBWAY CONTRACTS APPROVED

The original contract for the Lexington Avenue subway was approved last week by the New York Rapid Transit Commission without any of the modifications asked for by the Interborough Company, which had objected to the "burden of proof" clause allowing the Commission to order increases in rolling stock and changes in the stations, and to go into court to enforce its orders, the burden of proof that such orders were unreasonable being placed upon the operating contractor. The contract as approved carried the section provided that the bidder should state to what lines transfers would be issued. The issue of transfers was not mandatory, however, but was to be a factor to be taken into consideration in the awarding of bids. So far as the transit commission is concerned the matter of the Lexington Avenue contract is settled. It must next go to the Board of Estimate. It provides for the cut and cover method of excavation on Broadway.

The matter of the Behr mono-railroad to Coney Island from Atlantic Avenue, also came up. Mr. Orr brought the matter up by saying that he had received a letter from Mr. Behr asking that the Commission recede from its former position.

"He promises that he will get the consent of the abutting property owners," said Mr. Orr, "that he will get the capital, and that he will build the road without aid from the city in a year's time. The route he plans does not interfere with any of ours. If the people want it and the city does not have to pay anything I think we should consider it."

"I think so, too," said Charles S. Smith, "if the company is willing to pay a reasonable price for a franchise and will carry people from New York to Coney Island for a single 5-cent fare."

It was finally decided that the committee on contracts should determine whether Mr. Behr was able to carry out the project and had sufficient backing.

Controller Metz thought that the Fourth Avenue, Brooklyn, subway should be delayed until the Third Avenue and Bronx to Coney Island line, known as the Tri-Borough route, should be in shape. Then more bids would be obtained than by advertising the Fourth Avenue route separately. This was agreed upon. Engineer Rice stated that he would have the complete specifications ready in six weeks, and the specifications for the Seventh and Eighth Avenues routes in three weeks.

The Commission voted to pay the bills for the work of ventilating the subway, on the ground that the installation was construction work.

President Bryan, of the Interborough Rapid Transit Company, has written to the Rapid Transit Commission intimating that his company will shortly send in a demand for payment for the extra work done in the construction of the present subway. While the tunnel was building, and since its completion also, the Commission has ordered additions to the original plans and certain modifications, the extra cost of which are estimated by Chief Engineer Rice at about $5,000,000 The largest item in the bill will be for the building of the conduits for electrical wires.

CHICAGO & MILWAUKEE TERMINAL PLANS CHANGED

The Chicago terminal station of the Chicago & Milwaukee Railway Company will be located at Second and Wells Streets, the company having secured a ninety-nine-year lease of the property on the northwest corner of those two streets. An ordinance granting the company the right to lay its tracks from the north end of the Sixth Street viaduct northeasterly to Fifth Street, thence north to Wells Street, thence east to West Water Street and on Second Street from Wells Street to Grand Avenue has been submitted to the Common Council. It had been supposed that the terminal station of the company would be located in the vicinity of Sixth and Wells Streets, but the fact that the curves on the original route at the corners of St. Paul Avenue, Sixth and Seventh Streets are too sharp to permit the operation of the large cars, the company, through its president, A. C. Frost, desires to change the route. The company also asks the right to build the tracks on 12-ft. centers instead of 11-ft. centers, which, it is believed, will make a better and safer construction. This will increase the paving 1 ft. in width. Mr. Frost has asked the Council to extend the time in which to complete the road until Oct. 1 of this year. Under the ordinance, the company is obliged to complete the construction work by Aug. 27, but Mr. Frost declares there is a great deal of heavy construction work to do just south of Milwaukee, and this may cause some delay. He promises to take advantage of the extension of time only if it becomes necessary. The ordinance relating to the change in the route was referred to the committees on judiciary and railroads, and will be reported to the Council at an early date.

STEEL TIES BELIEVED TO HAVE BEEN PARTIALLY RESPONSIBLE FOR PENNSYLVANIA WRECK

As a result of the investigation of the wreck of the Pennsylvania Railroad's Chicago flyer, near Mineral Point, Friday, Feb. 22, the committee appointed by the Pennsylvania Railroad Company to investigate the cause has issued a report, in which it says:

"We are unable to account definitely for the cause of the accident, but the best reason for it that we can advance is that at the point where the derailment occurred some foreign material became wedged between the flange of the left rear tender truck wheel and the inside rail.

"We are of the opinion, on account of the lack of positive evidence as to the cause of this derailment, and on account of the fact that the damage subsequent to the derailment was more serious than would have been the case with wooden ties, that the remaining steel ties should be removed."

ORGANIZATION IN PENNSYLVANIA

The electric railway interests of Pennsylvania propose to look after their interests systematically, and have formed a temporary street railway association, with W. E. Harrington, president of the Pottsville Union Traction Company and manager of the Eastern Pennsylvania Railway Company, as chairman, and have retained Ex-Attorney-General Hampton L. Carson, of Philadelphia, to advise the association on all legal points connected with legislation now under consideration or in process of enactment. The electric railway interests favor the introduction of a bill covering the subjects of eminent domain, freight transportation and the right to absorb railroad companies.

PEORIA & PEKIN TERMINAL PROPERTY SOLD

The Peoria & Pekin Terminal Railway was recently sold at receivers' sale to John S. Stevens for $600,000, Mr. Stevens representing the stockholders of the newly organized Peoria Terminal Railway Company, the officers of which are: T. A. Greer, president; W. J. Conzelman, vice-president; W. J. Jack, secretary; Frederick H. Smith, treasurer. This sale insures a close alliance of the property with the Rock Island & Alton Railroad. In connection with the sale a number of important improvements are rumored, the first of which is said to be an effort to gain another entrance into the heart of Peoria. At present the Terminal Company is operating into Peoria over the Central Railway Company's lines, but the contract with the latter company is said not to be entirely satisfactory to either of the parties to the agreement.

LEGISLATION IN IOWA

The present session of the General Assembly of Iowa has witnessed the introduction of about 400 bills, about sixty of which affect the railroads. Fifteen of the sixty relate to the lowering of passenger rates, and vary as to rates from 3 to 2 cents per mile.

The interurban interests as well as the steam railroads of the State made a determined fight before the railroad committees in the two houses against the low-fare bills, the representatives of the steam lines declaring that the business within the State did not justify the lowering of the passenger rates, and the representatives of the interurban lines declaring that the lowering of the rate on the steam lines would drive the interurbans out of business, as it would make the steam lines more of competitors than ever; that this would make Eastern capitalists hesitate before investing in interurban projects, and as a result the building of interurban lines would be retarded. Despite these arguments a bill was reported before the House for passage and passed. This bill provides for a straight 2-cent fare rate on all steam railroads with normal gross earnings of $4,000 per mile or over; 2½ cents per mile for railroads with gross earnings of $3,000 and not over $4,000 per mile; and 3 cents per mile for railroads with gross earnings of less than $3,000 per mile. Before the bill went to the Senate committee the steam railroad interests made a proposition to sell family mileage books for 500 miles and over at the rate of 2 cents per mile, and then to make a flat rate of 2½ cents per mile on all steam railroads in the State regardless of class. It is believed, however, the Senate committee will report the House bill for passage.

It is also believed that a reciprocal demurrage act will be passed, and that acts to increase the powers of the Railroad Commission to fix freight rates and establish joint rates between interurbans and steam railroads will pass. The anti-pass act of one year ago will be so amended as to conform to the national law on that subject. The interurban interests are supporting the joint rate act, and hearings on this subject were set for Feb. 26.

Several acts requiring street and interurban railroads to vestibule their cars have been introduced.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION

The annual meeting of the electrical committee of the Underwriters' National Electric Association will be held at the rooms of the New York Board of Fire Underwriters in New York, on March 27 and 28, for the purpose of making changes and additions to the national electric code. As is well known, it has always been the endeavor of the electrical committee to make only such changes in the code as are made necessary by progress in the art, or such as have been shown by some field experience to be necessary to safeguard against hazard, since changes in the code, even if necessary, cause more or less confusion and trouble. It will be remembered that at the last meeting of the electrical committee in December, 1905, there were submitted matters of such importance as to require further consideration before action was taken. These various matters were referred to sub-committees, by whom they were considered during the past year, and their reports will be considered by the full committee and finally brought before the general meeting in New York for action. The following committee reports will be considered: Committee on rules for signaling system; committee on slow-burning, weather-proof wire; committee on wiring and equipment of street railway property, including rolling stock; committee on double and single-pole switches; committee on variable-speed motors; committee on theatre wiring; committee on construction and installation of rheostats; committee on series lamps; committee on insulating joints; committee on outlet boxes; committee on metal mouldings; committee on laboratory report in condulets; committee on rule 13A; committee on omitting fuses in neutral of three-wire systems, and committee on electric signs. There are also a number of suggested changes in the rules to be given consideration, as well as a number of miscellaneous suggestions.

INCREASE IN CAPITAL PROPOSED FOR DENVER TO BE USED FOR IMPROVEMENTS

At the Denver City Tramway Company's annual meeting, to be held Feb. 19, the capital stock will be increased from $5,000,000 to $20,000,000, and a new bond issue of $20,000,000 authorized. The money will be used mainly for the construction of 70 miles of new track, the extending and improving of two viaducts, and the erection of new shops and car houses. The courts recently decided that the company legally acquired a new twenty-year franchise over certain streets. The franchise was attacked, but found valid. It does not seem probable that there will be any further litigation in connection with the matter. Part of the money will be used to continue the construction of the Denver, Northwestern & Pacific Railway, building from Denver to Salt Lake City. David H. Moffat and William G. Evans, head officers of the Tramway Company, are in New York City completing arrangements for the financial reorganization of the company.

HAVANA ELECTRIC MEETING POSTPONED—REPORT OF CHANGES IN THE COMPANY

The annual meeting of the Havana Electric Railway Company, operating the electric railways in Havana, Cuba, which was to have been held in New Jersey, Tuesday, Feb. 26, was postponed until March 6. This postponement, it was reported, was at the request of certain stockholders of the company, presumably for the purpose of allowing more time for the adjustment of the company's affairs. From unofficial reports it would seem that differences as regards policy have developed between the Cuban interests on one side and the Canadian and American interests on the other side, who control the property. It was even reported that General Manager Greenwood had tendered his resignation to the company, his connection to cease May 1, and that Edwin Hanson, the president of the company, would also retire from the company. William Hanson, of Montreal, the brother of the president, however, discounted the statement regarding the retirement of the president. As regards Mr. Greenwood's resignation from the company nothing of a definite nature could be obtained.

DES MOINES COMPANY'S FRANCHISE UPHELD

Judge Smith McPherson, in a decision filed in the Federal Court, Wednesday, Feb. 22, holds that the Des Moines City Railway Company had a franchise in the city of Des Moines, that the old Turner franchise granted Dr. Turner in 1866 is still in force and effect, but that the monopoly feature of that franchise expired in 1898, and enjoins the city of Des Moines from tearing up the tracks of the street car company as the Council so voted last fall.

The decision is the first one upon the merits of the case in the litigation brought to test the validity of the franchise of the Des Moines City Railway. Under quo warranto proceedings the Civic League, through Robert Fullerton et al., went into the District Court of Polk County and secured from Judges Howe and Brennan a decision that they, as relators, had a right to appear in such proceedings to test the validity of the Turner franchise as to its perpetuity. This decision of the District Court was appealed to the Supreme Court of Iowa and affirmed, which in effect sent the case back to the District Court of Polk County on its merits for trial. There has as yet been no trial. The City Railway asked for a rehearing in the Supreme Court, and this motion is still before the Supreme Court. If upon rehearing the Supreme Court still holds that the original decision of Judges Howe and Brennan is good law the case will come up in the District Court of Polk County on its merits. In all of the legal sparring in Polk County and the Supreme Court of Iowa there has been no evidence taken or argument made as to the merits of the City Railway's claim, hence no decision upon this point. This may still be taken up in the District Court. The decision of Judge McPherson is the first where the facts were all taken into consideration.

CONSOLIDATION PROPOSED IN BUENOS AYRES

The London financial papers announce the organization of a strong Belgian and German syndicate which proposes to consolidate two or all of the tramway undertakings of Buenos Ayres. These number no less than eight different companies. Seven of these are British, the eighth being a small company, with Argentine capital and control. The British companies are: Anglo-Argentine Tramways Company, capital £2,900,000; B.A. & Belgrano, capital £850,000; Buenos Ayres Electric Tramways, capital £250,000; B.A. Grand National Tramways, capital £1,075,000; B.A. Lacroze Tramways, capital £2,000,000; B.A. New Tramways, capital £216,000; B.A. Port & City Tramways. capital £200,000; total, £7,491,000. This is exclusive of debentures, which bring up the total to considerably over £8,000,000, or about $40,000,000.

ACCOUNTANTS QUESTION BOX

Frank R. Henry, auditor, United Railways Company of St. Louis, has been appointed editor of "Question Box" of the Accountants' Association this year, and requests that members should send their questions promptly to him. In writing the questions illustrations may be used if they will make the question clearer.

The executive committee has decided to follow a slightly different course this year in connection with the Question Box than that employed formerly. The following is the plan adopted for this year:

1. All "questions" are to be "edited" before being submitted to the members.
2. All "answers" are to be "edited" before being printed and sent out to the members.
3. Only such questions and answers as are of general interest, or upon which additional information is desired are to be taken up in the convention.

ANNUAL REPORT OF THE LOUISVILLE RAILWAY

The Louisville Railway Company has issued its annual report for the year ended Dec. 31, 1906. The income account compares as follows:

	1906	1905
Gross receipts	$2,523,343	$2,298,619
Operating expenses and taxes	1,563,314	1,422,953
Net earnings	$960,029	$875,666
Other income	69,653	57,201
Total income	$1,029,682	$932,867
Fixed charges	350,271	351,500
Surplus	$679,411	$581,367
Dividends	596,706	501,706
Surplus	$82,705	$79,661
Charged off for depreciation, etc.	70,000	65,000
Surplus for year	$12,705	$14,661

The condensed balance sheet as of Dec. 31, 1906, is as follows:

ASSETS	
Securities owned (including interurban lines)	$1,264,605
Bills and accounts receivable	118,572
Material, supplies, live stock, etc	193,922
Cash	310,426
Real estate and buildings	958,249
Machinery and car equipment	1,940,739
Permanent way, franchise, etc	10,838,856
Total	$15,625,370
LIABILITIES	
Capital stock paid in	$7,456,500
Bonded debt outstanding	6,999,300
Funds for taxes and insurance	114,530
Interest and dividends accrued	325,829
Pay rolls and accounts payable	80,450
Profit and loss account	648,761
Total	$15,625,370

TOKIO UNDERGROUND RAILWAY

"The Bulletin Commercial" has received from the Belgian legation in Tokio particulars of a scheme to construct across Tokio an underground railway. The distance is about 12 miles, and the cost is estimated as low as $625,000 a mile. A company is to be formed with a capital of $7,500,000. It is expected that a uniform fare of 2½ cents will produce a dividend of 8 1-5 per cent. The Electric Tramway Company, of Tokio, has asked for sanction to extend its system by the construction of an addition of 60 miles.

NEW ENGLAND STREET RAILWAY CLUB MEETING

The February meeting of the New England Street Railway Club will be held at the American House, Boston, Thursday evening, Feb. 28. Dinner will be served at 7 o'clock, and at 8 o'clock the regular business meeting will be held, after which Prof. A. S. Richey, of the electric railway engineering department, Worcester Polytechnic Institute, will give a lecture on "Electric Car Testing."

CINCINNATI, COVINGTON & NEWPORT PROPERTIES LEASED

The Columbia Company has closed a lease for the properties of the Cincinnati, Newport & Covington Light & Traction Company for a period of ninety-nine years and has agreed to deposit $1,250,000 in cash or bonds in Cincinnati banks to insure the agreement being carried out. It is also stipulated that the stockholders of the old company may acquire bonds of the new company in the ratio at par of two to one, and with each amount of bonds thus subscribed for an equal amount of the Columbia Company's stock shall be given. President Ernst is to be retained as the head of the properties. The Cincinnati, Newport & Covington Light & Traction Company controls the light and traction business in Newport, Covington, Dayton, Bellevue, Ludlow, West Covington, Bromley, Fort Thomas and Latonia, and some other lines have been planned which the new company will probably build. The Columbia Company is having some trouble in acquiring the two artificial gas companies in Cleveland on account of an injunction suit one of the stockholders of the Peoples' Gas Light Company has brought, and also because of the uncertainty as to the offer of furnishing natural gas instead of artificial. While it is understood that an agreement has been reached by which the properties will be acquired by purchase, many of the details will have to be worked out.

Some of the improvements that have been decided upon are the extension of the Lewisburg line to Erlanger, extension of the Monmouth Street line from Evergreen Cemetery to Fort Thomas, new line over a new bridge over the Licking River from the new Andrews steel mill at Finchtown back of Wallace Woods down into Covington, $100,000 in new rolling stock and the erection of sub-stations and new mains when natural gas is substituted for artificial. The amount to be expended for these improvements and extensions is $884,000.

UNOFFICIAL STATEMENT OF TERMS OF CONNECTICUT RAILWAY & LIGHTING-CONSOLIDATED DEAL

While the terms of the lease of the Connecticut Railway & Lighting Company's property to the Consolidated Railway Company are still withheld from publication, having been given out only in confidential form, a statement issued in New Haven gives the following particulars, which are, of course, open to inaccuracies and the aforesaid possibility of change:

"The preferred stock which, Aug. 1, 1906, was 60,228 shares of $100 each, is to be raised to 81,429 shares by the issue of 21,201 shares, representing cumulative dividends upon the preferred stock, first to be issued in the form of scrip. Of this amount the United Gas Improvement Company, of Philadelphia, will have about three-fourths. Provision is made for payment of $4 a share a year in quarterly dividends on the preferred stock (by its terms a 5 per cent stock, at least, originally) the common stock coming in for the same amount of dividends, provided the $10 assessment is met, and the payments by the lessee company justify it. Attached to the agreement is the lease by the Consolidated Railway Company of the Railway & Lighting Company. This provides for a first payment beginning Aug. 1, 1906, of $975,000, rising to $1,400,000 on Aug. 1, 1914, to be made in quarterly payments except the sums required for fixed charges. The total amount to be paid into the treasury by the lessee company for interest and sinking fund is $673,882, the sinking fund being one-half of 1 per cent upon the bonded debt of the lessor company outstanding, which is $12,491,378, and in addition an underlying bonded debt of $209,000 of the old Connecticut Lighting & Power Company, and $706,000 of the Derby Street Railway Company. The total annual payment to the sinking funds are $62,445 a year up to the 1st day of July, 1980. The lease is made for 999 years.

"Earnings for years ending June 30:

Year	Gross	Net	Other Inc.	Taxes	Interest	Bal. Sur.
1905-06.....	$1,682,740	$747,989	$328,293	$104,483	$584,848	$385,951
1904-05.....	1,420,094	582,477	207,390	92,865	556,422	140,580

"Of the other 'other income,' $327,351 in 1905–06 and $206,737 in 1904–05 was from the gas and electric departments."

AN IMPORTANT CANADIAN CONSOLIDATION

At the annual meeting of the shareholders of the Cataract Power Company, held at Hamilton, the announcement was made that the Cataract Company had been absorbed by the Dominion Power & Transmission Company, which was incorporated a few weeks ago with an authorized capital of $25,000,000. Increase of business and the need for the extension of existing plants of the Cataract Company and the acquisition of other enterprises made it necessary that additional capital be secured, and the organization of a new company was the plan decided on to reach the desired end. As soon as the Dominion Company was organized and incorporated a controlling interest in the Cataract Company was turned over to it. The balance of the stock will likely be transferred in the very near future. The Cataract Company will continue in existence as an operating company, but its stock will be mainly held by the Dominion Company.

The stock of the new company is divided into three classes—preferred, limited preferred and common. The preference stock, by the terms of the Dominion Company's charter, will pay dividends for three years at 6 per cent, and afterwards at 7 per cent per annum. The limited preferred stock will be preferred stock for five years only, after which it will become common stock. The preferred stock of the Cataract Company was taken over by the new company on an equal basis, one share of preferred stock in the Dominion Company being given for one share of preferred in the Cataract Company. The holders of common stock in the Cataract Company shared somewhat better, however. For every share of Cataract common three shares of limited preferred were given by the Dominion Company.

Just what the company intends to do with the roads now controlled by the Cataract Company is unknown. From one source it was learned that the new company had in contemplation the building of electric lines from Windsor to Niagara Falls, and so reach Buffalo.

The Hamilton Street Railway Company, although its stock is held by people who are prominently connected with the Cataract Company, has been operated separately, and will continue as an entirely independent concern.

THE PROPOSED NORWICH-HARTFORD LINE

The petition signed by Costello Lippitt, of Norwich, and others and presented to the General Assembly of Connecticut, as previously noted in the STREET RAILWAY JOURNAL, requests a charter with the right to construct an electric railway to connect Norwich and Hartford, extending through the borough of Colchester and the villages of Yantic, Fitchville, Bozrahville, West Chester, Marlboro, Marlboro Mills, East Glastonbury and Addison. In addition the rights are sought to develop water power to generate electricity and to sell electricity for lighting or power.

The route of the proposed road will have easy grades, and will be more than 10 miles shorter than the distance by the steam railroads through Willimantic, that route being 49 miles. About midway the proposed line crosses the Air Line division of the New York, New Haven & Hartford Railroad, a branch of which division enters Colchester. More than 25 miles of the

central portion of the line, however, are remote from any carrying facilities except these mentioned. The distance to Norwich from Colchester by the highways is 15 miles, and by railroads 31 miles, with two changes of cars and only three trains per day. The distance to Hartford by highway from Colchester is 23 miles, and by the railroad, via Middletown, it is 41 miles, with four trains a day. Via Willimantic the distance is 49 miles, with three trains, the earliest arriving at Hartford at 11 a. m.

Hartford is now connected by electric lines with all the cities and important villages of the fertile and prosperous Connecticut Valley, and Norwich is connected by interurban lines with New London, Westerly and intervening towns, and upon the completion of lines now under construction will be connected with all points of the ocean shore of Rhode Island and Eastern Connecticut, and the proposed line would link the groups of railways at either end. The population of Hartford is more than 200,000, and that of Norwich as a center more than 50,000. George E. Manning, of Yantic, is in charge of the affairs of the company.

THE NEW YORK CENTRAL ACCIDENT

The Coroner's inquest as to the causes of the accident on the New York Central Railroad on Feb. 16, when five cars drawn by two electric locomotives were derailed on a 3-deg. curve near Bronx Park, has been continued this week. The testimony showed that the heads of the spikes on the east side, or outside, of the spread rail were sheared off, and that the rail was elevated for a speed of about 46 m. p. h. Prof. E. B. Lovell, adjunct professor of civil engineering at Columbia University, stated his belief that the spreading of the rails was caused by the excessive weight and speed of the wrecked train, which he said might cause the shearing of the spikes. This was denied by other experts.

ELECTRIC MOTORS AND HEAVY ELECTRIC TRACTION DISCUSSED AT MEETING OF WESTERN RAILWAY CLUB, CHICAGO

At the regular meeting of the Western Railway Club, held at the Auditorium Hotel, Chicago, Feb. 19, James Lyman, Western manager of the engineering department of the General Electric Company, presented a paper, illustrated with experimental apparatus and stereopticon views on the development of the railway motor, motor control systems and the adaptability of the electric motor for heavy traction.

After calling attention to the fundamental principles upon which the operation of the electric motor depends slides were presented showing early types of railway motors and those of the New York Central locomotives. In speaking of the efficiency of motors, Mr. Lyman said that when running free the distribution of the losses were approximately: Copper losses, 4 per cent; iron losses, 6 per cent; gear and bearing losses, 10 per cent; total, 20 per cent. During acceleration they were: Copper losses, 10 per cent; iron losses, 2 per cent; gear and bearing losses, 5 per cent; total, 17 per cent.

The treatment of controllers was rather fundamental in its character, being intended particularly for the steam railway men not at all familiar with them. With regard to the substitution of the electric for the steam locomotive for suburban service and when traffic was congested, Mr. Lyman gave the following advantages for the electric locomotive: (1) From 50 to 100 per cent increased train capacity with the same track facilities, because of increased tractive effort, length of train limited only by station facilities, and operation of locomotives in either direction. In one case being investigated in the West with an investment in electrical equipment of about 30 per cent of the cost of double-tracking a road, the capacity for handling trains will be doubled. (2) Convenience, cleanliness and general comfort of passengers. (3) Safety. (4) Economy of operation. (5) Increased speed at which the electric locomotive can maintain its maximum tractive effort. (6) Ability to maintain higher speeds with safety. In this conection he said that experimental motors were now being designed for express service with a maintained maximum speed of 90 m. p. h.

In the discussion which followed the paper, C. F. Street, of the Westinghouse Electric & Manufacturing Company, said he did not think as did some enthusiastic electrical engineers, that the steam locomotive had seen its day. He said that in Mr. Stillwell's recent paper regarding the subject, Mr. Stillwell was very particular to say that it must not be considered practical or desirable to make substitution in all cases, but that each individual case must be threshed out and solved as an individual problem.

Prof. Woodworth, of the Lewis Institute, Chicago, thought the question of change to electricity as a motive power largely depended on capacity. Where a steam road had reached its capacity it was of advantage to electrify.

M. K. Barnum, assistant to the second vice-president of the Chicago, Burlington & Quincy Railroad, said the question of failures was important, and that in the electric locomotive it appeared that a large percentage of the causes for failure present in the steam locomotive was eliminated. Another feature which appealed to him was the adaptability of electric traction to roads through mountainous regions, where power could be generated by electricity. He said he understood the question had been discussed by one or two of the railroads crossing the Rocky Mountains, and it had resolved itself into the question of how much business they had to transact.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED FEBRUARY 12, 1907.

832,575. Automatic Switch; Albert N. Bradley, Washington, Ind. App. filed Dec. 20, 1905. Provides a safety device to prevent the closing of an automatic time-switch in the event that a train is entering or leaving the siding at the expiration of the time limit.

843,625. Power Brake; Louis Pfingst, Boston, Mass. App. filed Nov. 19, 1904. The brake spindle is rotated by a solenoid to put on or take off the brakes.

843,641. Automatic Switch Operating Mechanism; Cisco R. Traxler, Winston Salem, N. C. App. filed April 28, 1906. Provides a switch-operating rail and an abutment rail and a swinging shoe suspended from the car and adapted to pass between the switch rail and the abutment rail.

843,701. Automatic Air Brake Coupling for Railway Cars; Frank H. Rutherford, Chicago, Ill. App. filed June 13, 1906. An automatic coupler for air brakes, comprising a longitudinally movable coupling head having a limited swiveled movement oblique to the line of draft, and a longitudinally reciprocal plunger normally pressing forward against the rear end of the coupler head.

843,703. Railway Signal System; Alfred L. Ruthven, Topeka, Kan. App. filed April 20, 1906. A special third rail is provided between the track rails, which is deflected at intervals so as to exert a cam guide action to throw a switch on the car in addition to its function of establishing a signal circuit. The purpose is to provide a block signal system.

843,739. Electric Insulator; Frederick A. Feigert, Shelbyville, Ind. App. filed March 19, 1906. Has a saddle on its upper surface for a messenger cable and a hanger depending therefrom to support the trolley.

843,749. Brake Control System; Laurence A. Hawkins, Schenectady, N. Y. App. filed Oct. 8, 1904. Each car of the train is equipped with a pneumatic brake system controlled by a local engineer's valve, which is operated by an electrical pilot circuit extending throughout the train.

843,758. Air Brake System; George Macloskie, Schenectady, N. Y. App. filed June 22, 1906. Two brake cylinders on a car and means for automatically releasing the pressure in one cylinder upon the admission of pressure to the other.

843,761. Trolley Retriever; Francis M. Miller, Arcadia, Ind. App. filed April 22, 1905. When the wheel leaves the wire a winding drum is operated through sprocket and gear connection with one of the car wheels to retrieve the trolley pole.

843,788. Electric Locomotive; Asa F. Batchelder, Schenectady, N. Y. App. filed Dec. 11, 1905. Bearing members journaled upon the driving axle and supporting the locomotive frame, a motor having an armature revolubly supported by the bearing members and a driving connection between said armature and axle.

843,844. Third-Rail Insulator; Robert N. Redmayne, Newcastle-on-Tyne, England. App. filed March 12, 1906. An insulating block having over-hanging ledges on all sides so as to shed dampness and moisture and keep the insulator dry.

843,879. Tongue Switch; Edward Bradbury Entwisle, Johnstown, Pa. App. filed April 11, 1906. Comprises a body structure having a depressed floor portion forming the bed for the body of the tongue, and a rearwardly and downwardly diverging portion forming the bed for the heel of the tongue.

843,896. Slot Switch; Clarence C. Korns, Johnstown, Pa. App. filed April 11, 1906. A slot-switch tongue supported on a sector provided with projections to shift the tongue.

843,897. Adjustable Guard Rail Fastener; Clarence C. Korns, Johnstown, Pa. App. filed April 11, 1906. An adjustable rail chock having a plurality of wedge members provided with wedge-shaped frictionally-interlocking tongue and groove connections.

843,918. Railway Rail Joint; James C. Wallace, Denver, Col. App. filed Jan. 26, 1906. A rail joint comprising a device open at both extremities to receive the rail ends, the device being provided on one side with a removable angle-plate of a length equal to the length of one of the rail ends inclosed by the joint.

84,116. Amusement Device; August Francovich, Paris, France. App. filed Feb. 10, 1906. A gravity railroad comprising suspended bicycle mechanism provided with a propeller whereby the speed may be increased.

844,133. Passenger Car; Walter A. Jacobs, Adamant, Vt. App. filed Feb. 27, 1906. Comprises seats movably connected to the body and adapted to be arranged transversely of or longitudinally of the body, a portion of said seats being arranged directly beneath the other of said seats when in longitudinal engagement.

844,209. Railway Switch; George E. Stewart, East St. Louis, Ill. App. filed Oct. 23, 1906. Details.

844,224. Car Seat; Joseph A. Wolle, Philadelphia, Pa. App. filed Sept. 14, 1905. Details of construction of a back-to-back car seat.

PERSONAL MENTION

MR. FRANCIS H. ELY, M. E., formerly chief engineer of the Union Railway Company, of New York, has become associated with Mr. Harold P. Brown, of New York, manufacturer of plastic rail bonds.

MR. JAMES McCABE, formerly in charge of the turnpike line of the Public Service Corporation of New Jersey, between Newark and Jersey City, has been appointed division superintendent in charge of the Elizabeth lines, succeeding Mr. F. C. Southard.

MR. JAMES A. ROBERTSON has been appointed division superintendent of the South Side lines of the Georgia Railway & Electric Company. Mr. Robertson has been in the employ of the company twenty-five years, starting in as a driver in the old horse car days.

MR. A. A. HOEHN has resigned as superintendent of the San Jose & Santa Clara Street Railway Company, of San Jose, Cal., and the office has been abolished. Mr. Hoehn, it is announced, will engage in business for himself in San Jose, of which place he is a native.

MR. CLYDE M. GRAVES has been appointed general manager of the Coeur d'Alene & Spokane Railway Company, of Spokane, Wash., to succeed Mr. R. F. Blackwell, resigned. Mr. Graves will also continue in his present position as general manager of the Spokane Traction Company.

MR. BION J. ARNOLD, of Chicago, has been retained by the city of Toronto, Can., to give expert advice on the traction situation there. The street railway company in that city is operating under a franchise ordinance and under certain regulations imposed by the municipality. There is a misunderstanding between the company and the city, and Mr. Arnold has been asked to interpret the conditions of the agreement.

MR. WILLIAM FOSTER, JR., one of the builders of the Sixth and Second Avenue elevated railroads of New York, is dead, aged 83 years. In 1874 Mr. Foster became interested with Dr. Gilbert, Mr. William R. Garrison and others in the project of establishing elevated railroads. They received from the State a charter for the Sixth and Second Avenue lines, and in 1879, while the roads were in progress of construction, Mr. Jay Gould and Mr. Russell Sage bought out their interest.

MR. J. W. SMITH, whose appointment as general manager of the City & Elm Grove Railroad Company, of Wheeling, W. Va., to succeed Mr. L. S. Kirker was noted recently in the STREET RAILWAY JOURNAL, formerly was with the Schuylkill Railway Company, of Girardville, Pa., from which company he resigned to assume charge of the City & Elm Grove Railroad Company. Mr. Smith was connected with the Electric Traction Company, of Philadelphia, in 1893 and 1894 as one of the engineers on construction work, and not as manager as previously stated in these columns.

MR. DAVID S. PLUME, of Waterbury, Conn., vice-president and director of the Connecticut Railway & Lighting Company, is dead. Mr. Plume was long identified with manufacturing and commercial interests at Waturbury and throughout Connecticut, and was one of the original owners of the Waterbury horse railroad and later was president of the Waterbury Traction Company. At the time of his death Mr. Plume was treasurer of the Plume & Atwood Manufacturing Company and the American Ring Company, besides being president of the Colonial Trust Company, president of the Thomaston National Bank and a director in a number of other corporations.

COL. MICHAEL HURLEY, a prominent electric railway contractor, died very suddenly at his home in Trenton, N. J., on Feb. 20, from acute indigestion. Col. Hurley was born in Ireland fifty-seven years ago, coming to this country at the age of 3 years, since which he had been a resident of Trenton. He was in the Civil War, and for many years was prominently connected with the National Guard of New Jersey. He also held a number of political positions in the Democratic ranks, being minority leader in the City Council at the time of his death. Col. Hurley was the first contractor to lay a brick pavement in the city of Trenton, and he built part of the Trenton, Lawrenceville & Princeton Railroad, the Yardley, Morrisville & Trenton Street Railway, the Camden & Trenton Railway from Bordentown to Trenton, and other pieces of road in different sections of the country.

AS A STEP IN THE PERFECTION of the organization of its electric railway properties the Delaware & Hudson Railroad is extending the jurisdiction of several of the officials of the steam road over the traction properties. Mr. J. White Sprong, purchasing agent of the Delaware & Hudson, will at once become the purchasing head of the United Traction and Hudson Valley lines. Beginning March 1, Mr. Axel Eckstrom, the consulting electrical engineer of the Delaware & Hudson, will assume charge of all mechanical and electrical work connected with all traction operations of the steam road. Mr. Eckstrom will have the title of general electrical and mechanical superintendent of the traction department. Beginning also on March 1 the traffic officials of the Delaware & Hudson, both in the passenger and freight departments, will have the entire supervision of the traffic of the associated traction properties controlled by the road. This will extend over the electric railway lines the jurisdiction of the newly-appointed general traffic manager, Mr. William J. Mullin, and his assistants, Mr. Paul Wadsworth and Mr. J. W. Burdick.

MR. ROBERT C. BROWN, the managing director of the Mexico Electric Tramways, Ltd., who is now acting as general manager of the company, owing to the resignation of Mr. W. W. Wheatly, as recently announced in the STREET RAILWAY JOURNAL, will, it is said, remain in Mexico for about six months, irrespective of what course is taken regarding the appointment of a successor to Mr. Wheatly. A number of changes have already been announced in the personnel of the company. Mr. W. H. Bellamy, who has been superintendent of the first division, with headquarters at the kiosko, in the Zocalo, has been transferred to the office of the general superintendent at Indianilla, where he will assist General Superintendent J. A. Peirce in the operation of trains. Mr. A. B. Wells, who has been superintendent of the second division, has been made superintendent of the first division, to succeed Mr. Bellamy. Mr. H. J. Peters, who has been chief dispatcher, has been transferred to division No. 2, where he will be superintendent, succeeding Mr. Wells. Mr. M. L. Masteller, who has been general freight and passenger agent, retains this position, but he adds to his duties the charge of the funeral service of the company, with headquarters at Indianilla, succeeding in the funeral service Mr. J. H. Gaffney, who has resigned. Mr. E. J. Peirce, former night foreman at Indianilla, has been placed in charge of the Indianilla car houses as chief dispatcher.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1 m., Dec., '06	141,709	82,277	59,432	41,012	18,420
	1 " " '05	129,806	81,622	48,184	39,641	8,543
	12 " " '06	1,703,340	1,006,842	696,498	483,174	213,324
	12 " " '05	1,552,970	898,830	654,140	471,503	182,637
BINGHAMTON, N. Y. Binghamton Railway Co.	1 m., Dec., '06	24,523	11,901	12,622	7,731	4,892
	1 " " '05	22,465	11,808	10,657	7,261	3,396
	6 " " '06	163,002	83,289	79,712	46,287	33,426
	6 " " '05	153,536	75,734	77,803	43,389	34,414
CHAMPAIGN, ILL. Illinois Traction Co.	1 m., Jan. '07	280,039	*165,694	114,345	.....	.....
	1 " " '06	237,048	*126,689	110,359	.....	.....
CHARLESTON, S. C. Charleston Consolidated Ry., Gas & Elec. Co.	1 m., Jan., '07	55,334	37,727	17,607	13,349	4,258
	1 " " '06	53,513	35,095	18,419	13,117	5,302
	11 " " '07	601,913	379,365	222,548	143,698	78,850
	11 " " '06	564,170	339,985	224,186	144,333	79,852
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co.	1 m., Dec., '06	100,547	56,913	43,634	26,186	17,448
	1 " " '05	91,308	51,126	40,181	24,450	15,731
	6 " " '06	700,090	363,801	336,289	156,695	179,594
	6 " " '05	632,193	324,792	307,401	146,643	160,758
Chicago & Milwaukee Elec. R.R. Co.	1 m., Jan., '07	62,632	33,492	29,140	.....	.....
	1 " " '06	43,443	22,694	20,750	.....	.....
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1 m., Dec., '06	20,155	9,949	10,206	7,192	3,015
	1 " " '05	19,841	10,144	9,698	6,799	2,899
	12 " " '06	271,100	143,993	127,107	83,939	43,168
	12 " " '05	245,089	141,270	103,819	80,830	22,989
Cleveland & Southwestern Traction Co.	1 m., Jan., '07	49,558	29,604	19,954	.....	.....
	1 " " '06	46,567	27,550	19,018	.....	.....
Lake Shore Electric	1 m., Dec., '06	64,592	39,452	25,140	20,200	4,940
	1 " " '05	66,558	34,758	31,799	20,404	11,395
	12 " " '06	866,970	476,258	390,712	254,198	136,514
	12 " " '05	788,268	428,588	359,680	244,850	114,830
DALLAS, TEX. Dallas Elec. Corp'n.	1 m., Dec., '06	89,439	*72,159	17,280	16,255	1,055
	1 " " '05	84,735	*49,511	35,224	15,250	19,974
	12 " " '06	1,023,136	*699,143	323,993	185,646	138,347
	12 " " '05	934,707	*572,228	362,478	182,668	179,811
DULUTH, MINN. Duluth St. Ry. Co.	1 m., Dec., '06	66,590	41,621	24,969	16,727	8,242
	1 " " '05	61,090	28,737	32,353	17,429	14,924
	12 " " '06	768,875	418,820	350,054	261,892	88,162
	12 " " '05	663,424	368,049	295,374	268,278	27,096
EL PASO, TEX. El Paso Electric Co.	1 m., Dec., '06	41,575	*31,004	10,572	4,188	6,384
	1 " " '05	28,104	*18,640	9,464	3,803	5,661
	12 " " '06	391,656	*276,403	115,253	47,216	68,037
	12 " " '05	288,943	*190,561	98,382	43,327	55,056
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1 m., Dec., '06	101,380	57,897	43,482	.....	.....
	1 " " '05	87,327	50,329	36,998	.....	.....
	12 " " '06	1,109,193	676,846	432,347	.....	.....
	12 " " '05	949,498	580,832	368,665	.....	.....
FT. WORTH, TEX. Northern Texas Tr. Co	1 m., Dec., '06	78,750	*47,202	31,548	9,273	22,275
	1 " " '05	57,296	*35,758	21,538	9,938	11,601
	12 " " '06	854,136	*547,151	306,984	118,632	188,353
	12 " " '05	661,037	*391,863	269,174	118,127	151,047
GALVESTON, TEX. Galveston Elec. Co.	1 m., Dec., '06	27,258	*17,571	9,686	4,167	5,519
	1 " " '05	22,602	*14,061	8,541	4,167	4,374
	12 " " '06	315,135	*191,480	123,655	50,000	73,655
	12 " " '05	268,321	*181,398	86,923	43,333	43,590
HANCOCK, MICH. Houghton County St. Ry Co.	1 m., Dec., '06	19,973	*12,326	7,647	3,956	3,691
	1 " " '05	16,853	*12,139	4,713	3,786	927
	12 " " '06	229,245	*146,255	82,989	46,977	36,013
	12 " " '05	167,067	*168,643	†1,576	43,658	†45,234
HOUSTON, TEX. Houston Electric Co.	1 m., Dec., '06	54,118	*32,873	21,244	7,792	13,453
	1 " " '05	46,413	*29,794	16,619	8,749	7,871
	12 " " '06	591,351	*379,746	211,605	93,319	118,286
	12 " " '05	517,315	*313,525	203,791	105,504	98,286
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1 m., Dec., '06	499,632	244,103	255,529	147,892	107,637
	1 " " '05	447,798	211,183	236,615	138,438	98,177
	7 " " '06	3,372,621	1,658,723	1,713,898	1,017,616	696,283
	7 " " '05	3,044,039	1,474,581	1,569,458	958,897	610,561
MANILA, P. I. Manila Elec. R.R. & Ltg. Corp., Ry. Dept. All Depts.	1 m., Dec., '06	46,500	23,250	23,250	.....	.....
	12 " " '06	513,801	267,674	246,127	.....	.....
	1 " " '06	85,300	42,233	43,067	.....	.....
	12 " " '06	909,080	464,623	444,457	.....	.....
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1 m., Jan., '07	309,508	163,078	146,429	94,050	52,380
	1 " " '06	278,152	139,617	138,534	84,217	54,318
Milwaukee Lt., Ht. & Tr. Co.	1 m., Jan., '07	53,536	27,824	25,711	30,190	†4,479
	1 " " '06	44,915	19,842	25,073	21,737	3,336
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Dec., '06	495,092	222,924	272,168	.....	.....
	1 " " '05	438,375	157,697	280,677	.....	.....
	12 " " '06	5,644,988	2,625,379	3,019,609	1,137,427	1882182
	12 " " '05	4,759,262	2,119,145	2,640,117	1,050,797	1589320
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., Dec., '06	266,953	185,571	81,382	39,122	42,260
	1 " " '05	236,946	161,995	74,950	22,611	52,340
	3 " " '06	812,036	516,433	295,603	119,008	176,595
	3 " " '05	719,369	457,304	262,066	65,747	196,318
NEW YORK, N. Y. New York City Ry. Co	3 m., Dec., '06	4,823,744	2,559,657	2,264,087	2,871,807	†607720
	3 " " '05	4,767,831	2,471,462	2,296,369	2,812,000	†515631
	12 " " '06	18,808,977	9,558,287	9,250,690	11,347,788	†2097098
	12 " " '05	18,281,714	9,651,324	8,630,390	11,185,658	†2555268
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1 m., Dec., '06	137,273	83,632	53,641	.....	.....
	1 " " '05	126,627	72,506	54,121	.....	.....
	12 " " '06	1,513,846	926,646	587,200	.....	.....
	12 " " '05	1,386,713	829,012	557,701	.....	.....
PHILADELPHIA, PA. American Rys. Co.	1 m., Jan., '07	210,731	.....	.....	.....	.....
	1 " " '06	200,438	.....	.....	.....	.....
	7 " " '07	1,701,447	.....	.....	.....	.....
	7 " " '06	1,559,657	.....	.....	.....	.....
PLYMOUTH, MASS. Brockton & Plymouth St. Ry. Co.	1 m., Dec., '06	6,944	*5,336	1,608	1,802	†194
	1 " " '05	6,278	*4,891	1,387	1,792	†404
	12 " " '06	111,775	*70,894	40,881	21,855	19,026
	12 " " '05	102,143	*70,665	31,478	21,291	10,187
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., Jan., '07	826,337	*577,870	248,467	231,541	16,926
	1 " " '06	781,788	*491,368	290,420	232,055	58,365
SAVANNAH, GA. Savannah Electric Co.	1 m., Dec., '06	48,656	*32,836	15,820	11,300	4,520
	1 " " '05	54,146	*37,525	16,621	10,904	5,717
	12 " " '06	611,215	*379,046	232,169	134,461	97,708
	12 " " '05	586,236	*348,027	238,209	127,694	110,515
TAMPA, FLA. Tampa Elec. Co.	1 m., Dec., '06	41,161	*28,967	12,194	681	11,513
	1 " " '05	37,353	*20,830	16,523	953	15,570
	12 " " '06	469,222	*279,958	189,264	1,423	187,841
	12 " " '05	411,763	*237,153	174,610	21,766	152,844
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co.	1 m., Dec., '06	83,271	*43,854	39,417	14,041	25,376
	1 " " '05	61,063	*39,678	21,385	10,988	10,398
	12 " " '06	823,163	*468,873	354,290	160,211	194,078
	12 " " '05	629,760	*414,518	215,243	122,418	92,825
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Dec., '06	186,848	*94,573	92,275	42,800	49,475
	1 " " '05	175,745	*84,698	91,047	42,461	48,586
	12 " " '06	2,047,610	*1,071,773	975,837	509,607	466,230
	12 " " '05	1,913,456	*972,994	940,462	510,307	430,155