Street Railway Journal.

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THE SYSTEM OF THE STATEN ISLAND ELECTRIC RAILROAD COMPANY.

Staten Island is about thirteen miles in its longest dimension, comprises sixty-one square miles and is located in New York Bay at the west of the Narrows. Its nearest point is about five miles by water from the Battery, New York City. The northern and eastern shores are hilly and covered with residences, while the southern and western shores are flat. The Island has long been a favorable residential suburb of the great metropolis, especially for business men who have their offices below Fulton Street. It is well situated for residences, the bluffs commanding fine views of New York Harbor.

The total population of the island is about 70,000. Of this number probably three-quarters are contained in a strip a mile and a half deep extending along the northern shore to Fort Wadsworth. The rest of the Island is largely devoted to farming purposes. The cause of this distribution of population lies in the fact that the northern shore only has been provided with good transportation facilities to New York. A large part of the interior of the Island though suitable for residences has been practically inaccessible to the commuter.

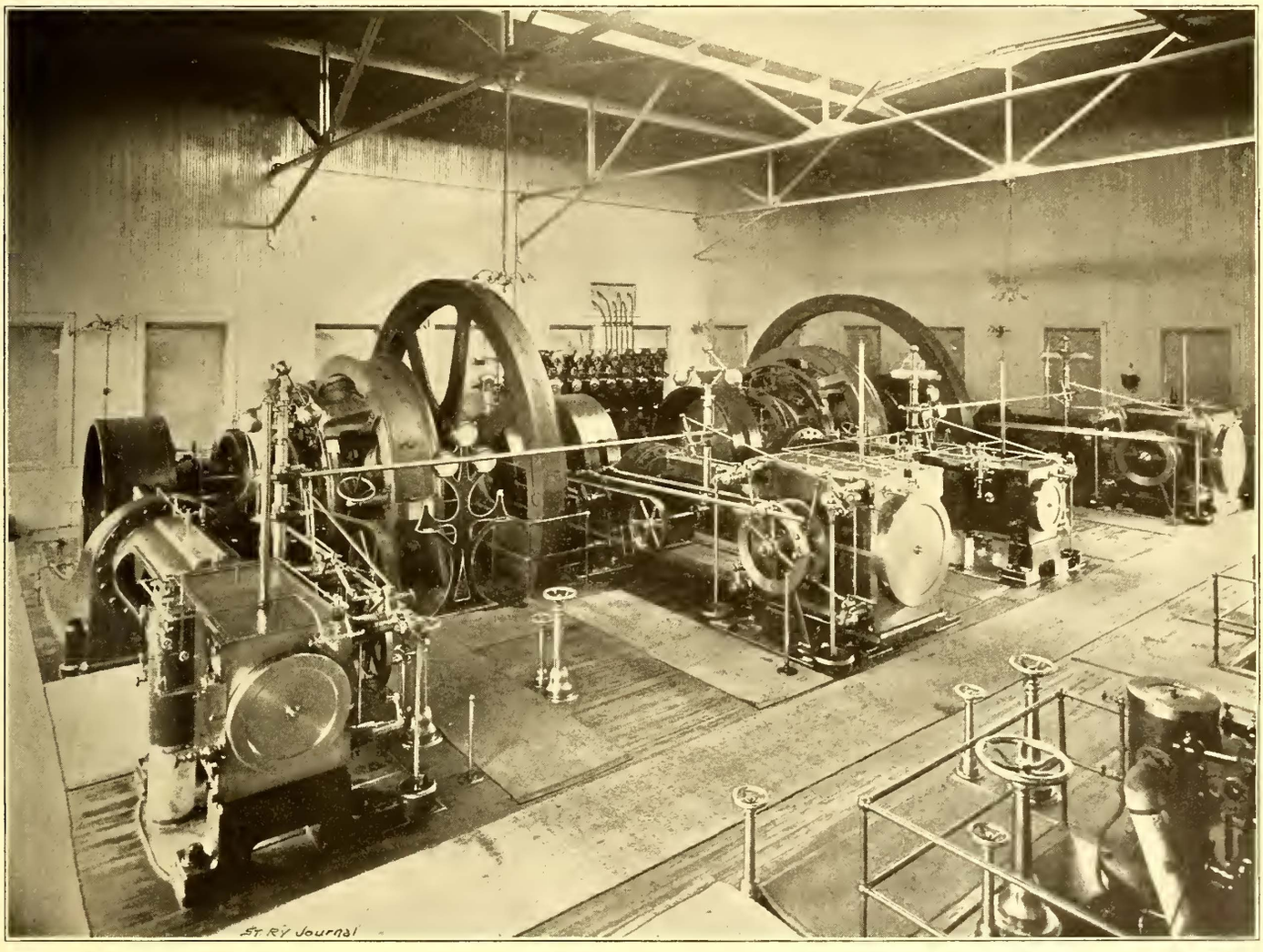


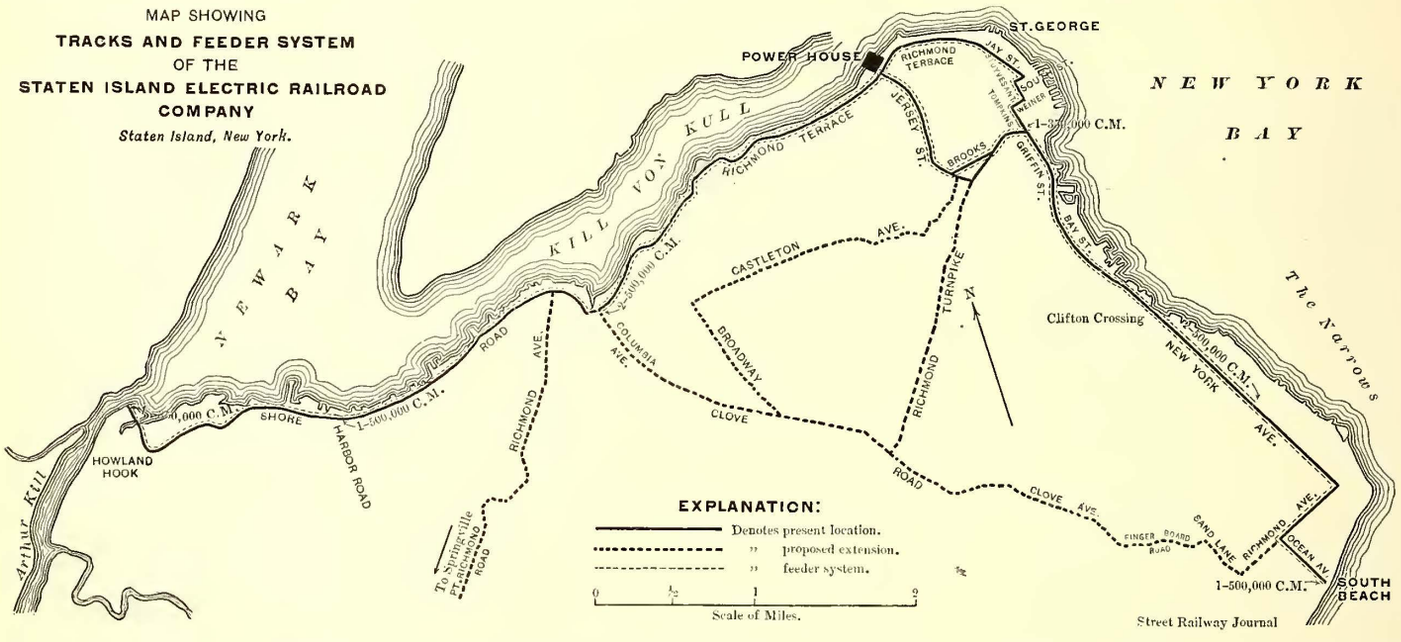
FIG. 1.—INTERIOR OF POWER STATION—STATEN ISLAND.

The deep water in the Kill von Kull has attracted to the northern shore a certain number of manufactories, and a few years ago extensive docks were built at St. George by the Baltimore & Ohio Railroad Company which now uses that place as its main Eastern freight terminal.

The proximity of Staten Island to New York and its sand beaches on the ocean side would naturally have sug-

gested the establishment along the southeastern shore of popular seaside resorts for summer excursions from New York. Somewhat strange to say, the advantages of Staten Island in this way were not recognized to any extent until a few years ago when South Beach was opened as an excursion ground. The number of visitors to this place has grown rapidly during the last ten years, owing largely to the fact that it could be reached from New York in about forty minutes and for ten cents. Thousands of excursionists from the city visit this place every Sunday during the summer and similar resorts are being developed along the shore to the south.

While the Sunday pleasure seekers in large numbers visit South Beach, an attraction to the more sober minded has been established in the western part of the island at Prohibition Park. This enterprise was started a few years ago by the proprietors of a well known religious book publishing house. Here has been built an extensive auditorium in which prominent lecturers give addresses during the summer on topics of current interest. Around the auditorium and in the park many residences and cottages have been built and the place has become a popular summer resort for many residents of the city.



MEANS OF TRANSPORTATION.

With the exception of a short electric road connecting Prohibition Park with Port Richmond, the transportation on the northern shore of the island was, up to within recently, carried on by the Staten Island Rapid Transit Railroad Company. This company operates a double track steam railroad line extending from the northwestern end of the island along the northern shore to South Beach. Trains connecting with boats from St. George to New York run on a headway of from fifteen to thirty minutes between 7 A. M. and 9 P. M. The stations are from one half mile to one mile apart and the fare charged from any station to New York is ten cents. The same company also operates a steam railroad connecting St. George, the landing of the New York boats, with Perth Amboy at the southwest point of the Island.

During the spring of 1895 however extensive franchises were secured along the northern shore and extending into the interior of the island, by the Thomas syndicate, and to operate these franchises the Staten Island Electric Railroad Company was organized. The lines now in operation parallel closely the tracks of the Staten Island Rapid Transit Railroad, and the extensions which will be built this summer will bring a large part of the interior of the island into close connection with the ferry landing at St. George. Among the franchises secured was that of the old Staten Island Belt line Company which had never been able to compete with the steam railroad, and over whose line a car was run only at long intervals to hold the franchise.

On the electric railway cars are now run at a headway of about five minutes, and it furnishes a good local service, something which the Rapid Transit Railroad with its stations at long distances apart was never able to give. In addition a terminus will be made at the ferry landing at St. George, and by a recent act the company will be able to offer a through fare of ten cents from any point to New York, the local fare remaining five cents. Among the other factors which will increase the traffic of the railway company will be the establishment in the near future of a ferry from Howland Hook to Elizabethport, by which through excursions can be run from the latter town to the ocean resorts on the southern shore.

When the St. George terminus of the road is completed the electric cars will enter the ferry house at an elevation of about twelve feet and will land their passengers on the second floor of the ferry house, so that they can pass directly to the upper deck of the ferryboats when the latter shall be fitted so that this can be done. In this way a grade crossing at this point with the Rapid Transit Railroad tracks will be avoided. The construction will involve the installation of a truss with 148 feet span, the contract for which has just been awarded to the Boston Bridge Company.

The franchises of the company embrace in all about fifty miles of track, of which eighteen miles are in operation at the present time. Construction was commenced last spring and the road was put in operation Dec. 20.

Messrs. Sheaff and Jaastad were engaged as engineers and the construction of the entire line has been carried out entirely by them.

THE power house of the company is on the water front at New Brighton, where there is a dock allowing coal to be received in unbroken cargoes. The station is an iron structure, 108 ft. × 60 ft., built so as to be practically fireproof, and arranged so that at any time one side can be taken down and an addition built to it without in any way interfering with the operation or construction of the present plant. The stack is of steel, self-supporting, with inside diameter of seven feet and 125 ft. high.

There are at present installed two horizontal, cross compound condensing Allis-Corliss engines, direct coupled to 400 k. w. generators. The cylinder dimensions of the

engines are 18 ins. and 34 ins. × 42 ins. and they run at a speed of 90 r. p. m. The shaft is 19 ins. diameter in center, and 16 ins. in journals. The weight of the fly-wheel is 50,000 lbs. The engines were built extra strong throughout for a working pressure of 150 lbs.

Each engine is connected to one independent vertical, fly-wheel condenser, and these condensers are so arranged that their steam cylinders come up through the floor, making them easy of access.

The steam pipes to the engines from the main are carried through the partition wall between the engine and boiler rooms, under the engine room floor to a Stratton separator located near the throttle valve on the engines. These pipes have also long copper bends. A safety stop valve has been placed between the separator and throttle. This valve will automatically shut off the steam supply to the engines in case they should commence to "race."

The piping at the engines is so arranged that either

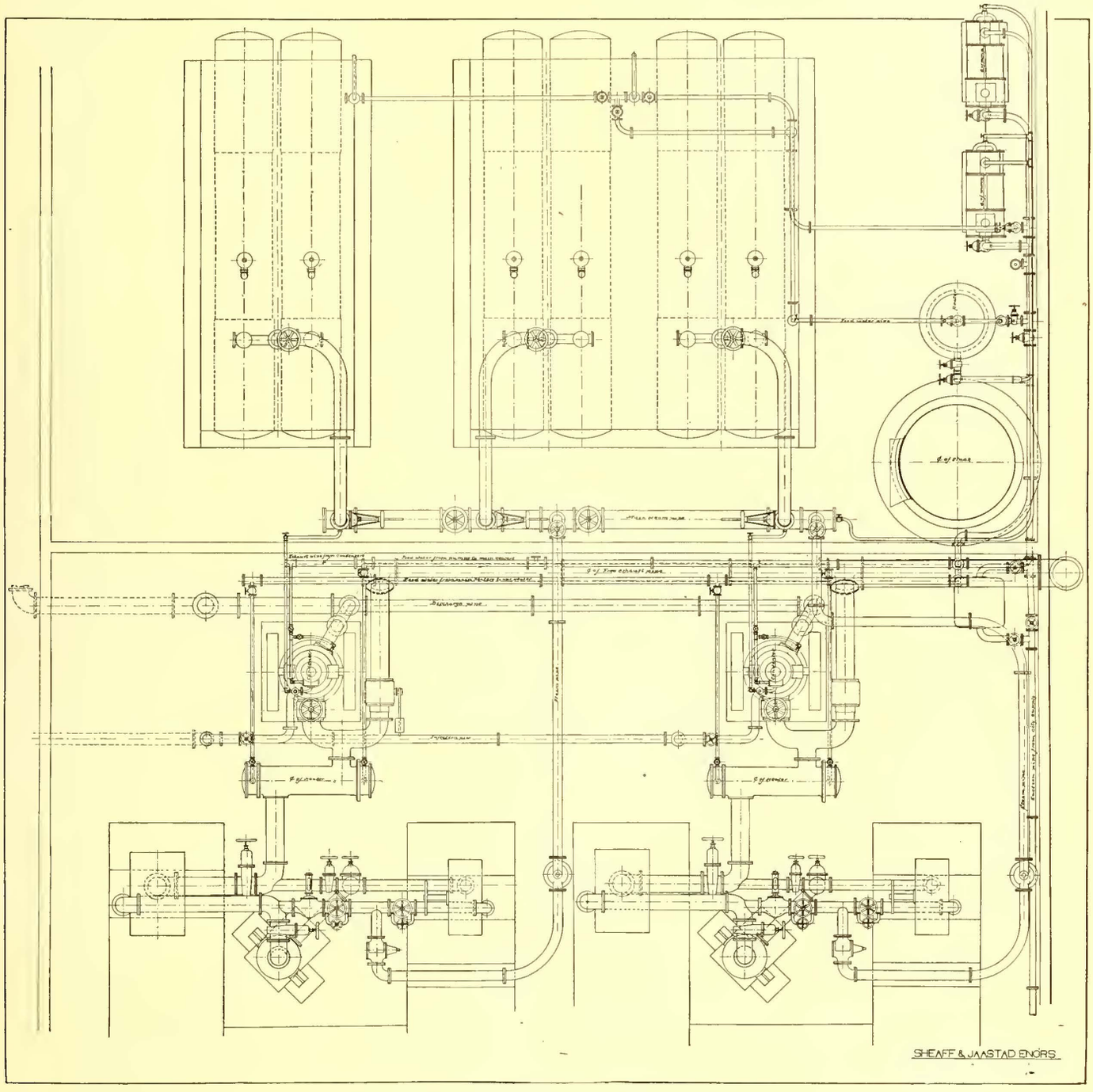


FIG. 3.—PLAN OF STATION, SHOWING PIPING.

The generators are the General Electric 400 k. w. multipolar, iron clad type with steel frame.

PIPING.

The piping has been installed with great care and is remarkable for its absence of vibration. The main in the boiler room is carried on adjustable rollers placed on pedestals, bolted down to solid masonry, back of boilers, and at such a height above boiler room floor that all valves can be operated by hand from the floor.

The headers from the boilers to the main have long, easy bends, so as to take care of the expansion, and at the same time retard the speed of the steam as little as possible.

side, high or low, can be run independent and condensing or non-condensing, if so desired.

The exhaust steam, after leaving the engines, passes through a heater into the condenser, or around the condenser into the free atmosphere, as the case may be, depending upon whether the station is running condensing or non-condensing.

The suction pipe to the condenser is fitted with a strainer, placed inside of the engine room in the basement. This is by-passed, and so arranged that it can easily be cleaned. The overflow from the condensers empties into the river.

The feedwater, which is city water, passes through

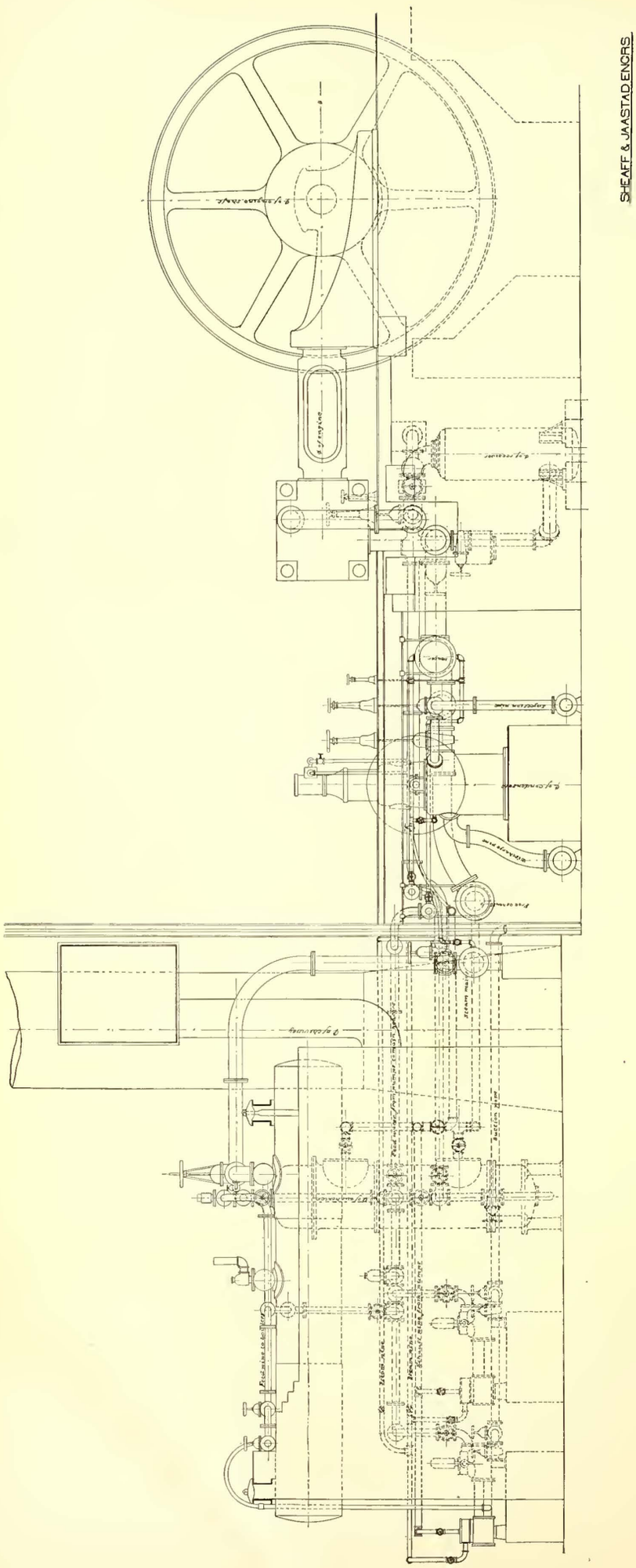


FIG. 4.—SECTION OF STATION, SHOWING PIPING.

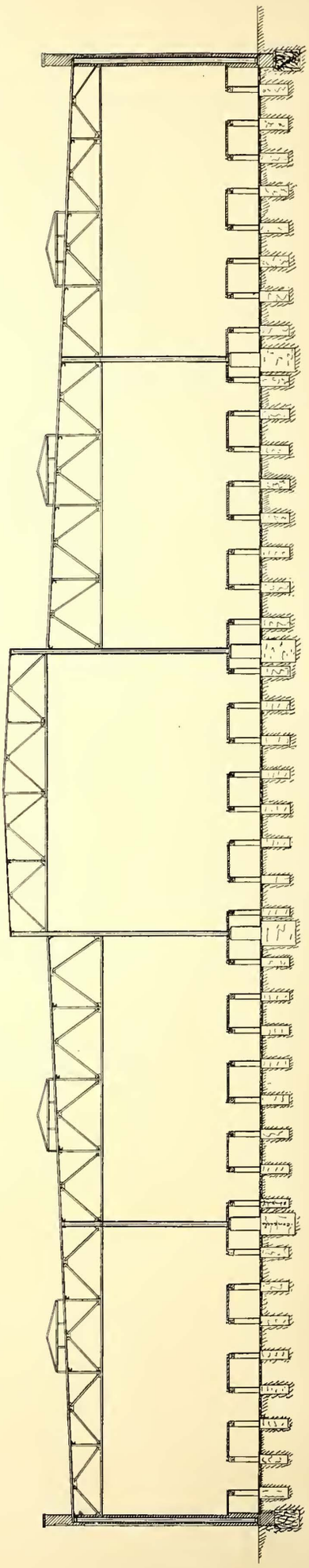


FIG. 5.—SECTION OF CAR HOUSE ON BROOKS STREET.

a meter to the pumps in the boiler room. From here it is pumped first through the primary heaters in the engine room, where it reaches a temperature of from 125 to 130 degs.; thence to the auxiliary heater in the boiler room, where the temperature rises to from 200 to 212 degs. The feedwater piping, as will be seen from Fig. 3, is so arranged that any or all primary heaters or the auxiliary heater can be cut out. The water can therefore pass directly from the primary heaters to the boilers, or it can pass directly through the auxiliary heater to the boilers, or, finally, it can pass directly from the feed pumps to the boilers as may be desired.

It must be noted that the plant is so piped that under no circumstances anything but a partial break down is possible, as all pipes are in duplicate with the exception of the main, which however is, by valves so divided into sections that if anything should happen to one of the sections, the rest can be operated.

All dips from piping, separators and receivers are carried back to the boilers by the Holly gravity return system.

All valves in the engine room basement can be operated from engine room floor, by long stems and valve stands bolted to the floor.

OILING SYSTEM.

The station is equipped throughout with an automatic lubricating system in which the oil is fed to all bearings under air pressure. Taps from the oil pipes are also led to the two gauge stands from which oil can be drawn at pleasure. The oil after leaving the bearings flows by gravity to a tank in the basement. From this tank it is passed through a filter and purified, then taken to the reservoir. All handling of oil is by compressed air. The system is considered economical, and the engine oil consumed does not average over half or three-quarters of a barrel per month.

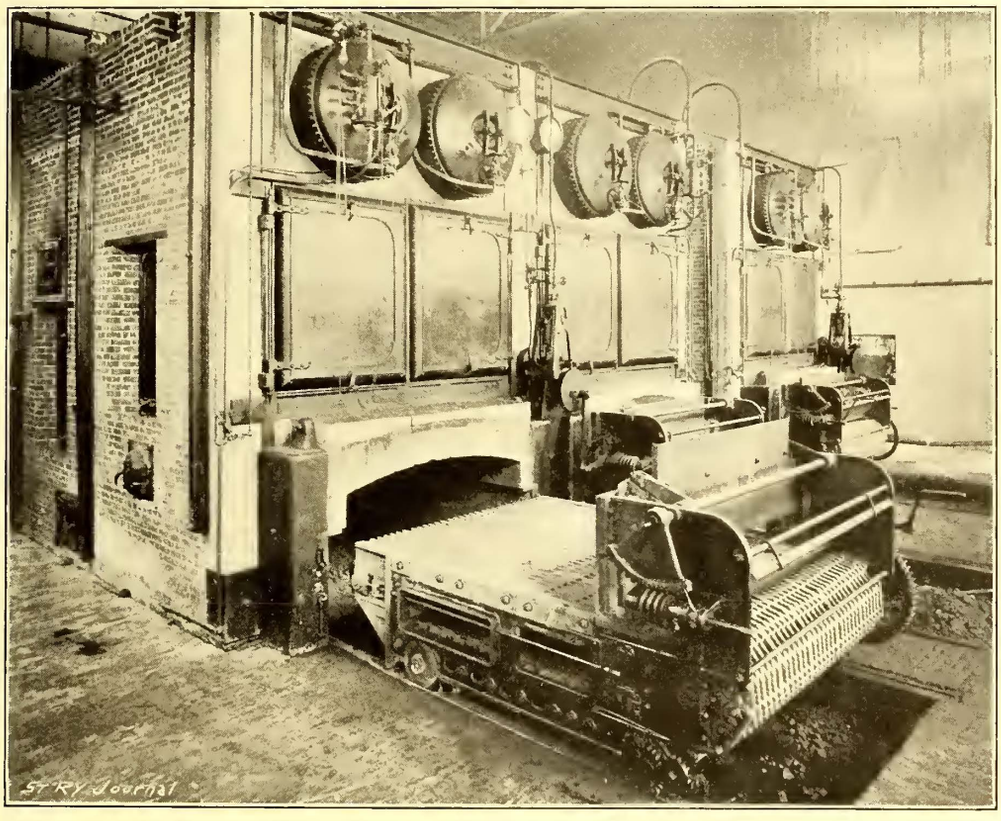


FIG. 6.—VIEW OF BOILERS, SHOWING ENDLESS CHAIN GRATE.

The air compressor is of the ordinary reciprocating type driven by steam, and also supplies air pressure for cleaning commutators, etc.

BOILERS, ETC.

The boilers are three in number, of the Babcock & Wilcox water tube type, each of a rated capacity of 250 h. p. Each is fitted with a B. & W. automatic stoker, which was fully described in the STREET RAILWAY JOURNAL for June, 1895. The grates are endless chains run over

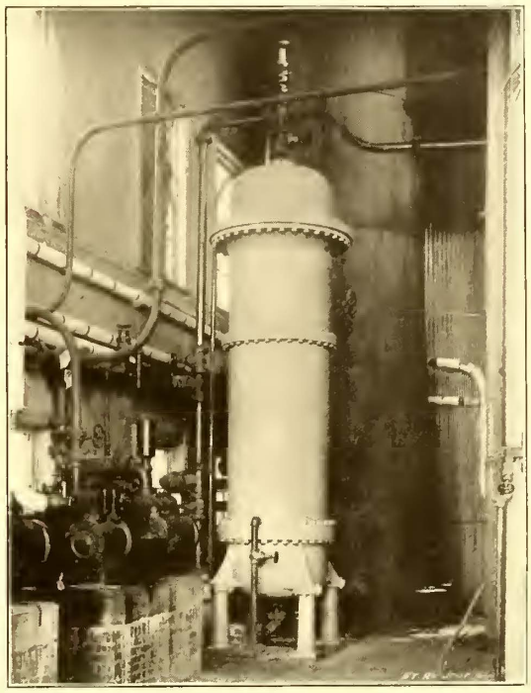


FIG. 7.—FEEDWATER HEATER.

sprockets at the front and rear. The chain is always driven in the same direction, but at a variable speed, depending on the thickness of the coal and the requirements of the steam. Propelling power is furnished by a small oscillating cylinder engine on the front of the boiler. The motion of the grate at the back throws the ashes into the pit. One great advantage of the device is that the grate does not move relatively to the coal. The entire grate frame is mounted on wheels which run on rails so that it can be hauled out from under the boilers when desired. The engraving shows one thus drawn out.

The fronts of boilers are laid with glazed brick, and present a very neat appearance.

In the boiler room are also two duplex feed pumps; each ample to handle the whole plant.

ROADBED CONSTRUCTION

The track is of the most rigid and substantial type. It is the opinion of the engineers and owners of the line that the roadbed is a most vital factor in the life of a railway and determined that it should be first class in every respect. No expense or pains were spared in its construction from the rails down to the smallest detail. As a result the line is certainly very smooth running and promises to have a long life.

Ten miles of rail were furnished by the Cambria Iron Company. It is a nine inch girder weighing ninety pounds

to the yard and laid in sixty foot lengths. The rest of the rail is the Johnson standard nine inch, eighty-four pound girder, in thirty foot lengths. All ties are of oak or chestnut and measure 6 ins. × 7 ins. × 7 ft. Johnson tie plates were used throughout and were placed on every third tie.

The joints are neither opposite nor staggered in the usual way, but are seven and one-half feet apart, measured in the direction of the rail. In making the joints the rails were butted close and were then connected by Wheeler rail joints of standard pattern, but made extra heavy for this work. The track is bonded with Chicago rail bonds, two No. 0000 bonds being used at each joint. No cross connections or supplementaries are used as the engineers believe that crossovers and the axles of cars themselves furnish all the cross connection necessary.

In excavating for the track, the earth was removed for a depth of four inches below the bottom of the tie. This space was then filled with gravel, and the ties and rails were put in place. Gravel was then filled in for a sufficient height for tamping and when this was done the track was surfaced and lined. Then more gravel was filled in until it was two inches above the top of the tie. The road was then macadamized with trap rock of the proper size and rolled with a steam roller.

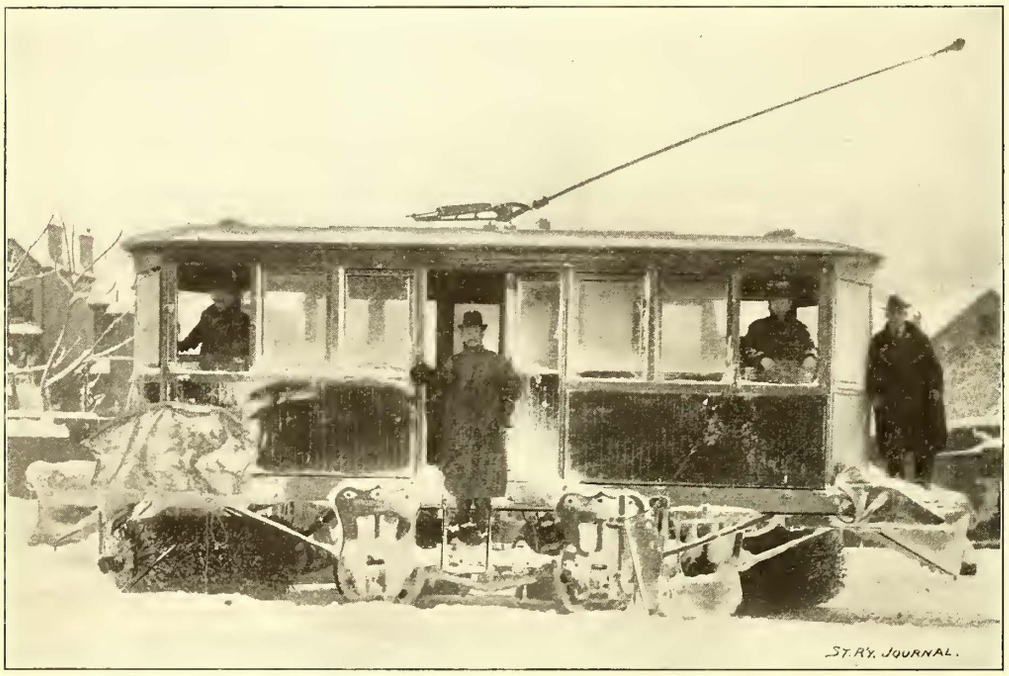


FIG. 8.—SNOW SWEEPER.

The minimum curve radius is forty feet, and the wheel base of the cars is seven feet six inches.

All special work is of the Johnson Company's guaranteed type. The most elaborate special work of the system is that at the entrance to the car house on Brooks Street. At this point a gauntlet switch is used to save the wear on the entrance curves of the cars passing on the main line. The number of tracks entering the car house is twenty. All of these tracks are led up to the car house sill with nine inch rail and all the special work is of the guaranteed form.

FERRY TERMINAL.

The natural slope of the ground toward the shore at St. George permits the cars to enter the second floor of the ferry house without ascending any grade. After leaving Jay Street they will run over a wooden trestle 271 ft. in length, then across a 148 ft. through pin connected truss, then over two plate girder bridges, 32 ft. 3 ins. span, to the ferry house. The station platforms, of which there will be four, serving three tracks, will be 150 ft. in length. There will be a grade on the pin bridge of 2.6 per cent.

The concentrated load of the cars and passengers on the track assumed for calculation was 11,000 lbs. on each axle of a double truck car. The wheel base of each truck was assumed as five feet, the distance between inside axles nine feet, and the distance between the rear axle of one car and the forward axle of the next car, eleven feet.

OVERHEAD CONSTRUCTION.

THE overhead work has been carefully laid out. Wooden poles painted a dark green are used throughout the line. The overhead line equipment was furnished by the General Electric Company and all trolley and insulator wire from the Roebling's works.

The general system of feeders is illustrated in the map on page 276. From the power station two feeders of 500,000 c. m. are led west to the junction of Richmond Terrace and Columbia Avenue. From this point one feeder of the same size is carried to Harbor Road, and from that point one 350,000 c. m. feeder to the western terminus of the line. From the power station south, two 500,000 c. m. feeders are led by Jersey Street, Brooks Street, Griffin Street and New York Avenue to the point indicated in the map, and from that point there is one 500,000 c. m. feeder to South Beach. From the power station east, one 350,000 c. m. feeder is carried around the outside of the loop and taps the two 500,000 c. m. feeders at the corner of Brooks and Griffin Streets.

ROLLING STOCK.

The road has now twenty-five closed cars and twenty-five open cars, all mounted on Peckham trucks, four sweepers, and one freight or ballast car. All car bodies are from the works of the Brill Company. The closed cars have a length of body of twenty feet and a length over vestibules of twenty-eight feet. They have monitor deck roof and are finished inside in polished oak. The platforms are fitted with removable vestibules with drop sash and the patent angle iron bumper and corner irons of the manufacturer, which have been described in recent issues of the Street Railway Journal. The seats and backs are spring upholstered and covered with woven rattan. The ceilings are of three-ply birch veneer handsomely decorated. The windows are of thick French glass with oak sash, and are fitted with spring roller curtains.

The open cars have nine seats and are fitted with iron bumpers like the closed cars. The freight car, which is equipped with four G. E. 800 motors and mounted on Brill trucks, is shown in Fig. 10 and one of the sweepers in Fig. 8.

Both closed and open cars are protected with Providence fenders and are equipped with G. E. 800 motors and K 2 controllers.

CAR HOUSES AND REPAIR SHOPS.

THE car house is located on Brooks Street, is 220 ft. front by 155 ft. depth, and has room for 100 cars. It is a skeleton steel structure, the trusses being supported on steel columns

between which there is a brick curtain wall twelve inches thick with four inch pilasters. Two eight inch brick walls carried the full depth of building, divide the interior into three different parts, thus reducing the rate of insurance as well as cost of heating since only part of the building needs to be heated at one time. The floor of the car house is two inch spruce planking matched and beaded and planed on top. The roof is two inch planking, matched and beaded and planed on the under side. It is spiked on to 4 in. × 6 in. hard pine rafters and covered with tar and gravel.

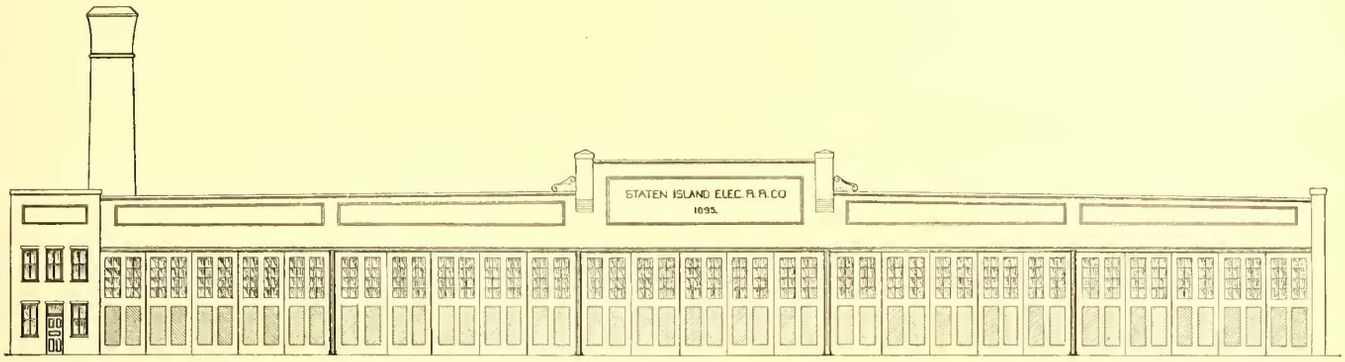


FIG. 9.—FRONT ELEVATION OF CAR HOUSE.

All tracks in the car house (twenty in all) enter the building from the street, thereby doing away with transfer tables or other devices for switching inside the building. Two switches are also placed between the two tracks in the street, so that a car can enter or leave building from either track.

The track timbers are 8 in. × 10 in. hard pine, supported by 8 in. × 8 in. hard pine posts, 10 ft. on centers. The posts are set on iron plates on concrete foundations and are securely braced together.

There is a 4 ft. 9 in. pit or basement under the entire building. It has concrete floor four inches in thickness drained toward a common center. This pit, or basement, is lighted throughout by small windows placed below the floor line and so arranged as to harmonize with the windows above.

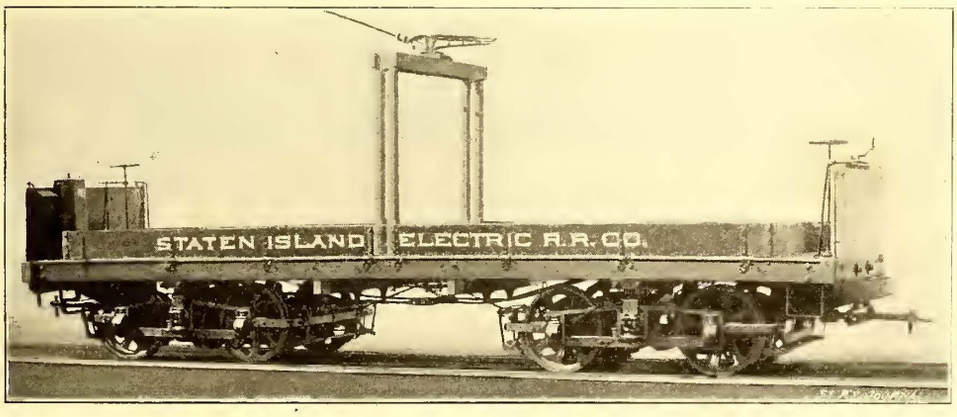


FIG. 10.—FREIGHT CAR.

The doors in front of the building are carried on rollers and so arranged that one slides back of the other, thereby giving free access to any track, or if so desired, to ten different tracks at one time. The trolley wire hangers above the car house doors, at the point where the trolley wires enter the building, are protected from the weather by cast iron hoods made fast to the brickwork.

The building is excellently lighted throughout. Besides having windows, sides and rear, there are a number of large skylights in the roof extending the full depth of building.

The boiler room for heating purposes and for supplying power to the repair shop is at the rear end of the building, and is fireproof throughout. Next to the boiler room is the machine and repair shop. This is furnished with all necessary tools and machinery for repairs of cars and motors. There is also a special paint shop and washroom.

The superintendent and receiver's office is on street at the left hand corner of building. Above this office is a waiting room for the conductors and motormen.

ORGANIZATION.—THE officers of the company are: President, G. B. M. Harvey; treasurer, G. G. Haven, Jr.; general manager, H. J. Quigg; engineers, Sheaff & Jaasted.

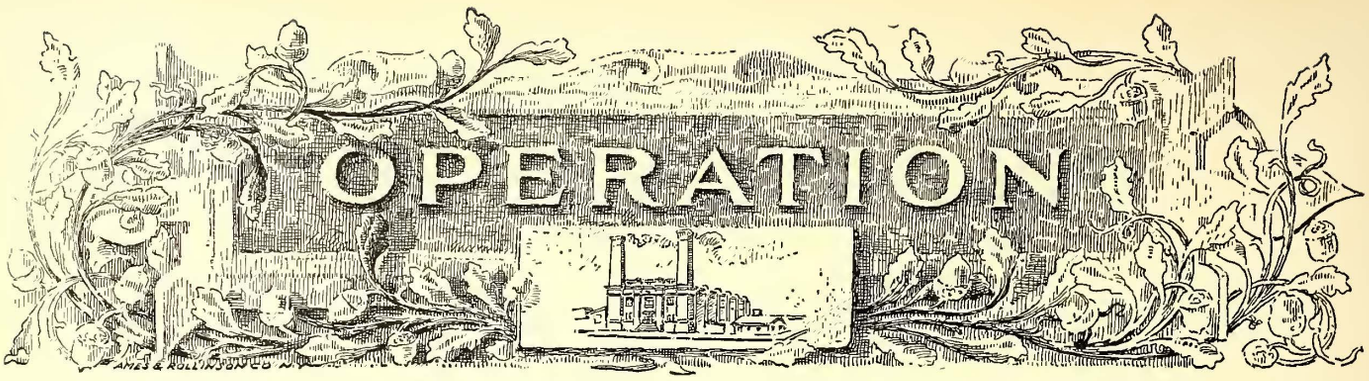
Projected Extensions in Chicago.

The Chicago City Railway Company is building some forty miles of new line, is relaying its Wabash Avenue line with sixty foot rails and is making very extensive additions to its Fifty-second Street power station. The Calumet Electric Street Railway Company and the Chicago General Street Railway Company are each building about fifteen miles of new track, and the North Chicago Electric Street Railway Company and the Ogden Street Railway Company, both belonging to the Yerkes system, are making important extensions. The Suburban Railway is also making good progress and expects to have its cars running to La Grange this season. The Englewood & Chicago Railway Company is busy upon its new equipment, of which full particulars are published elsewhere.

Considerably more work is contemplated in addition to that mentioned, but for which contracts have not as yet been placed. It is estimated that the electric traction work now contracted for and under progress will require an expenditure this year exceeding $15,000,000. The miles of track now operated are between 750 and 800, and within another year will not be far short of 1000. The number of cars used in this work at the present time is about 6000.

The different elevated railway companies are also planning important extensions and changes, so that the projected enterprises in the transportation line in the city will involve a large investment during the coming year.

THE London (Ont.) Street Railway Company is negotiating with the City Council for a contract to water the streets on which the street railway runs.



Studies in Economic Practice:—St. Paul-Minneapolis.

By C. B. Fairchild.

First Paper.—Maintenance, Wages and Shop Practice.

In the theoretical consideration of any subject, undue weight is often given to some points and insufficient regard to others, so that the results secured in practice are often quite different from those which were originally anticipated. For this reason a study of the practice followed by street railway companies which have been operating cars for a number of years, with the results secured by them in pursuing certain methods, should be of help in determining the best policy to follow under other somewhat similar circumstances. The conditions presented by the system of the Twin City Rapid Transit Company are such as make a study of its practice particularly interesting. It not only provides urban transportation in the two cities of Minneapolis and St. Paul, which have a combined population of about 400,000, but also connects the business centers of the two cities by an interurban line, which is one of the most prominent factors in the financial life of the entire system.

Thomas Lowry is president of the company, but the active management is entirely in the hands of C. G. Goodrich, vice-president, and his able assistants, among whom W. J. Hield bears the title of general manager.

The total street railway mileage in the system is 225, of which 6 are operated by cable power. The average number of cars in daily operation is 200, of which 45 are 44 ft. double truck cars, and are operated on the interurban line.

The following quotations from the president's annual report for 1895 will serve as a basis for a discussion of the practice of the operating department of the company: the gross passenger earnings for the year ending Dec. 31, 1895, were $1,964,772.65, a decrease of less than 1 per cent over 1894. The net earnings from operation were $1,009,319.

The proportion of total operating expenses to gross earnings for the entire year was 49.4 per cent and the cost of operation per car mile in 1895 was $.0819.

On the interurban line, where the cars make a run of 180 miles per day, the cost of operation to gross earnings during the last year was 33.15 per cent and the cost of operation per car mile (large cars) was $.1075.

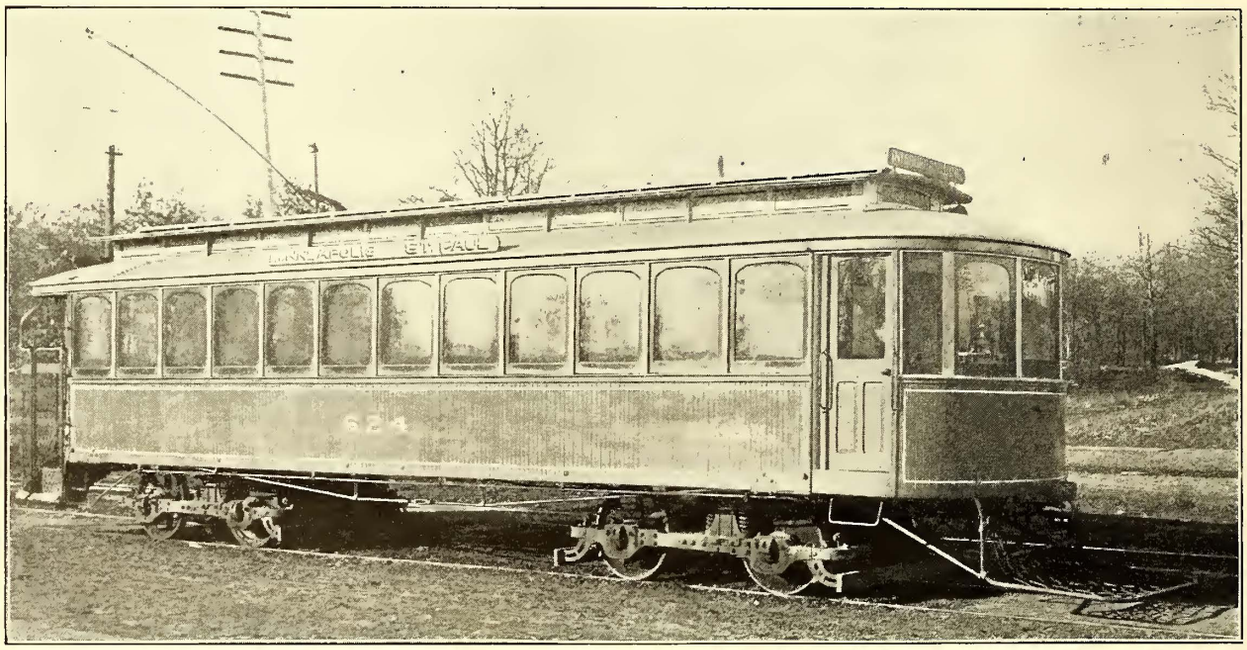


FIG. 1.—INTERURBAN CAR—TWIN CITY RAPID TRANSIT CO.

A comparative statement of the cost of operation for the years named was as follows:

	1893.	1894.	1895.
General expense	$94,281.09	$61,162.07	$56,934.02
Maintenance of equipment	180,831.40	103,349.91	81,815.63
Maintenance of way and structure.	98,930.65	66,606.77	58,069.49
Conduct's' and motormen's wages.	452,686.83	369,597.97	378,256.49
Inspect's' and trans. agts'. wages..	27,252.32	14,300.28	8,859.13
Conducting transportation, misc...	144,517.62	90,638.92	87,131.08
Cost of maint'ing power stations...	229,357.67	161,374.85	154,103.73
Machine shop expense	36,550.37	22,999.99	21,722.24
	$1,264,407.95	$890,030.76	$846,891.81

The cost of maintenance of equipment is subdivided as follows:

	1893.	1894.	1895.
Repairs to motors	$105,021.08	$66,054.79	$48,527.45
Repairs to car bodies	75,810.32	37,295.12	33,288.18
	$180,831.40	$103,349.91	$81,815.63

The decrease in gross receipts over the year before was due to the prevailing business depression.

As far as can be observed, the large decrease in the

operating expenses from year to year is legitimate, for the physical condition of the property appears to be first class.

A large reduction during the last two years has been secured in the salary account by the elimination of high priced heads of departments, including superintendent of repair shops, master mechanic, chief engineer, and electrical engineer. In place of the superintendent, a foreman is employed in the car shop at a moderate salary, who has a bench and does some of the finer work, such as pattern making, etc., while he oversees the other work.

In the body repair department twelve men are regularly employed, and each one is expected to operate the wood working tools, getting out such parts as his special work requires. The tools are operated from an electric motor so that they may be started and stopped at will. The equipment is kept thoroughly painted, the management believing that good and frequent painting is economical in the long run. In the paint shop there are thirteen men, only four of whom are termed skilled workmen. The others are young apprentices. In the iron shops a foreman is employed who supervises the iron working tools and lays out the work for the men. It is held that the shop work, which is largely of a routine nature, can be done by mechanics without specially close supervision.

The vice-president however makes it a point to visit the shops every morning, and so acquaints himself with the details of the work and the needs of the service.

The general manager visits the power station every morning, holding the engineers in charge responsible for the work, and so far has secured very gratifying results. Of course, due credit for the organization of the different departments is given to the men who have formerly held positions at the head of these departments.

MAINTENANCE OF EQUIPMENT.

Referring to the item of "Repairs of Motors," under "Maintenance of Equipment," it will be noted that the charge during 1893 was largely in excess of the other years. This was due to the fact that during this year the entire motor equipment was remodeled or rebuilt. This change, however, increased the efficiency of the motors, and largely reduced the cost of maintenance during the subsequent years. The company has 200 equipments of the Sprague double reduction motors, some S. R. G. and some W. P. motors. The remodeling lay in rewinding both armatures and fields after a plan suggested by long practice, and the substitution of large shafts with tapering fits for collars and commutators. In the W. P. 50 motors a second field coil which was placed in the lower part of the body or shell of the motor was added. A long hollow shaft was also substituted to bring the commutator outside of the case. These shafts are constructed from old axles, and are upset in the wheel press to provide a bulb or enlargement of the shaft. This swelling when bored out, allows of the leads being taken in through the shaft. They are then brought out at the end outside the bearing, where they are bent back and attached to the outer ends of the commutator bars. To prevent arcing between the brushes and yoke of brush holder, the forked ends of the yoke are enclosed entirely in a wooden block, by which means the formerly troublesome arcing has been almost entirely eliminated.

The motors have now all been so thoroughly made over that they are considered by the management to be fully as efficient as the more modern type of motors, and are said to require but little if any more repairs.

The reduced cost of labor and price of material aided largely in the reduction of expenses in 1895 over those of previous years.

MAINTENANCE OF WAY AND STRUCTURE.

Referring to the item "Maintenance of Way and Structures," the president's report says: "The decrease in this item is the result of our rail joint construction, begun in 1892, and continued vigorously through 1893. It was a special joint construction, put in our track where the traffic was the heaviest, and the results have been most satisfactory, lessening the expense not only of track, but also of rolling stock maintenance."

This joint which has been brought into prominence by the above paragraph is illustrated in Fig. 3, and is a home made affair. It is of three parts, a cast iron base six inches square and two malleable iron clamps three inches wide, but of an equal height, being relatively long enough to extend from the base to the under side of the head and tram of a girder rail. These clamps are so formed that the lower ends hook under the edge of an oval pedestal cast on the base. The clamps embrace the joint outside the regular splice bars, so that the ends of each rail meet above the middle of the clamps, which are held in place by a bolt through the foot of each part, the bolt passing under the base of the rail and occupying a channel formed in the pedestal.

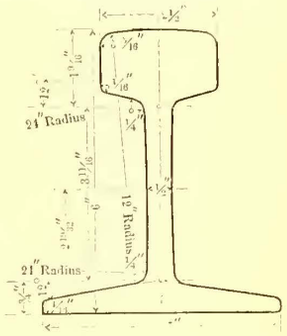


FIG. 2.—STANDARD RAIL.

The entire weight of the joint for a forty-five pound girder rail is sixteen pounds, and the cost including bolt and nuts is about fifty cents. In substituting these joints in tracks where three ties are employed under or near the joint with a stringer beneath them, the middle tie is removed and one of less thickness substituted, so that the base of the joint rests upon the middle tie.

Notwithstanding the excellent results had with these joints, they are not considered by the management as efficient as that of the Falk cast welded joint. A large number of the latter have been in service on some of the lines of this system for about a year, and have proven very satisfactory. Only a very few of them have broken during the past winter and the company has decided to employ this type of joint in repairs and renewal of joints on its city lines, a contract for a large number having been already closed.

The standard rail adopted for the city streets is an eighty pound T, of a modified design. The rail is six inches in height, with a five inch base, and the weight is distributed as follows:

Head,	43	per cent.
Web,	26	"
Base,	31	"
	100	"

Where asphalt paving, which is the prevailing paving in the city, is employed this rail is spiked directly to the

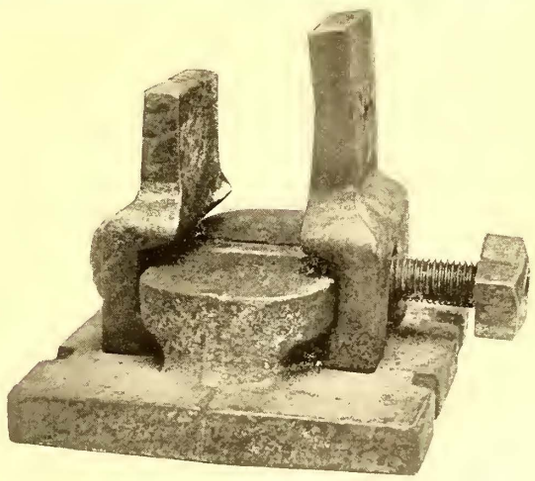


FIG. 3.—JOINT CONSTRUCTION.

ties. The latter are placed from three to four feet apart and are embedded in a concrete foundation, the concrete being tamped up solid to the base of the rail between the ties. In case different material is used for paving, the company has adopted the plan of using the same material between the rails as is employed on the sides of the street. This practice prevents in a measure wagon traffic seeking the tracks should the side paving become slippery.

On the interurban line a fifty pound T rail, with fishplates as in ordinary steam railway construction is used. There being no paving on this line, it is considered not practicable to employ a continuous rail, lest the effect of expansion and contraction be disastrous. At the only steam crossing of the interurban line the trolley cars use a single track only. This is a precautionary measure to prevent cars passing while crossing the steam tracks. The possible danger of one car obstructing the view of an approaching train, especially should the train after passing suddenly back up, is thus avoided.

The rails on the interurban line have now been in service a little more than six years, and are in a remarkably good condition, considering the service. In the opinion of the management, the heavy eight wheeled cars are not as hard on the rail joints as are the four wheeled cars, for it appears that the interurban track has stood up better than any portion of the system. With proper care the rails would seem to be good for ten years' additional service.

In this connection, it may be stated that the interurban cars are forty-four feet in length over all, and are mounted on double trucks, with thirty-three inch wheels, the leading wheel in each truck being of the steel tire type. The cars weigh empty 30,500 lbs., and are estimated to weigh with one hundred passengers, 43,600 lbs. The eighteen foot cars employed on the other sections of the system weigh from 14,000 to 15,000 lbs.

In the city of Minneapolis, center pole construction prevails, and to provide an elastic hanger for the trolley wire, a balance bar has been substituted in place of the rigid hangers formerly employed, at which the trolley wheel sparked badly in passing. The device, illustrated in Fig. 4, consists of a block of wood 12 ins. long by 1¼ ins. square. It has a hanger at each end which embraces the

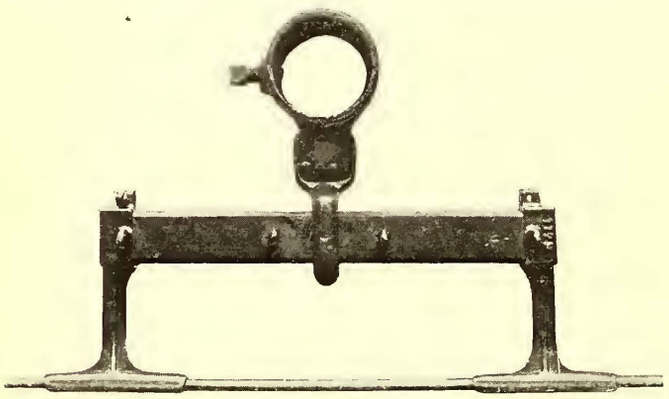


FIG. 4.—HANGER FOR BRACKET POLES.

trolley wire and is attached to the pole by means of a clevis. Cotter pins placed each side of the support allow of a slight end movement to the clevis. On the approach of the trolley wheel, the receiving end of the support tilts up slightly and so provides an elastic passage for the wheel. This construction is said to have resulted in a large saving in trolley wheel renewal and hangers.

CONDUCTORS' AND MOTORMEN'S WAGES.

The saving in "Conductors' and Motormen's Wages" was effected by a reduction in hourly payment. The rates now paid are sixteen cents an hour, except on the cable and interurban lines, on which the car men receive seventeen cents per hour. In this connection it may be stated that the company aims to secure as motormen on the interurban cars men weighing not less than 170 lbs.

INSPECTORS AND TRANSFER AGENTS.

The striking reduction over that of 1894 in this item of expense ($5400) was due to a change in the method of issuing transfers. Formerly agents were employed at central points whose duty it was to issue transfers to such passengers as wished to continue on other lines. This gave rise to a good deal of dissatisfaction, as frequently the passenger would be obliged to pass his desired point of transfer to secure a ticket, when he would have to walk back or move to another point. The management reasoned that it is always better to accommodate the public in all reasonable directions, and for this reason the agent system was abolished and transfers were put into the hands of the conductors to be issued at all connecting points. The change has resulted in the above saving and the number of transfers has not materially increased.

The conductors in receiving transfers ring them up the same as fares, and on their runs turn in their transfers each trip to an agent stationed on the street near the center of the loop. The cash fares are turned in only once a day. The orders require that transfers be rung up for the reason that it is much easier for inspectors to check up a car where all receipts are rung up than it is where an exception is made in case of transfer tickets.

The transfers on one or more of the lines are checked up every day in turn, to see if there is any abuse on the part of employes. So far, very little abuse has been detected, either on the part of the public or employes. This condition of affairs is doubtless due to the very close inspection instituted by the management.

In addition to accommodating the public in the matter of transfers, more attention than formerly is given to the accommodation of passengers in other directions, especially in providing more seating room and wider and more comfortable seats, and by keeping the cars up in the best shape possible, making them more attractive and pleasant. During the morning and evening hours on such days as the traffic is unusually large, trailers are employed, it being held that a conductor can better work two cars that are not crowded than one overcrowded.

Special attention is given to increasing the twelve o'clock dinner hour traffic by providing plenty of seating room and other accommodations so that merchants and others can conveniently and comfortably reach their homes for dinner.

REPAIR SHOPS.

The machine shop of the company is equipped with an unusually fine assortment of iron working tools, among which are two milling machines for gear and pinion cutting. The company thinks however of abandoning the practice of cutting its own pinions, but will continue to cut gears as formerly. There is also a very large lathe which may be employed for turning down the treads of flat wheels. In this operation a pair of wheels with axle is centered in the lathe. The tread is then caused to revolve in an opposite direction to an emery wheel which is driven very rapidly from the main shaft. The emery wheel is encased with a galvanized iron covering, and the wheel revolves in a galvanized iron vat containing water. The practice of grinding flat wheels is considered an advantage, but the same set of wheels is only ground down once.

Among the other useful machines employed is a magnetic separator for separating the steel and copper chips and filing. This is a small machine, with a magnetic cylinder, above which is a receiving hopper into which the turnings are poured. The valuable non-magnetic metals pass over a cylinder and fall into a receptacle, while the magnetic metals are carried further round and are brushed off into a separate receptacle by a revolving brush.

Railed off from the main shop is a tool room in which all the small tools are kept. These are checked out and in, as is the custom with large manufacturing establishments.

The company makes its own brass and bronze castings and trimmings, and for this purpose has a very good brass foundry, with modern equipment. It is estimated that the metals are remelted and put into useful product at a cost of about three cents per pound. Trolley wheels, cast bonds and trimmings of nearly every description are manufactured. The mixture for trolley wheels and some other castings is one part of tin and nine ounces of zinc to seven pounds of copper. There is also a bronzing and burnishing department in which car trimmings are cleaned, with all the usual appliances of a manufacturing establishment.

The power for operating the shop machinery is supplied by a seventy-five horse power bipolar motor. Provision is made for testing all repair motors, and numerous labor saving appliances are observed about the shop. It is also notable that the floors are kept in an exceptionally clean condition.

As a general thing the cars are taken into the shops every two weeks for inspection and such repairs on motors and trucks as may be necessary. In cleaning dismounted motors after the armature is removed, the fields are immersed by means of a trolley hoist in a large tank containing a hot solution of washing soda, which removes all grease and dirt and materially facilitates the cleaning of the motors.

The portion of the shop into which the cars are run for motor and truck repairs was formerly a roundhouse for the repair of the dummy engines employed on the suburban lines. The cars are placed in the different stalls of the roundhouse by means of an outside turntable, which is considered by the management a very convenient method of shifting cars in and about the shops.

Not including the trainmen and office employes there are regularly employed in the mechanical departments, including switchmen and curvemen, 125 men, distributed as follows:

12	men	in wood working shops.
13	"	" paint shop.
23	"	" machine shop proper.
6	"	" blacksmith shop proper.
4	"	" brass foundry.
14	"	" armature room.
23	"	" motor repairs.
2	"	" steam fitters, draughting room and stores.
28	"	" miscellaneous.

The large store rooms in connection with the shops were fully described in the STREET RAILWAY JOURNAL for February, 1893, and are managed about as stated there.

In making out a requisition for supplies, the foreman, or whoever makes the original order, sends same direct to the storekeeper and purchasing agent, who attaches a slip to the requisition, showing the cost of the article or articles, so that when the manager passes upon the requisition he is able to judge of the cost as well as the quantity. When the bill for the goods is received the same slip is attached to it, so that in approving the bill the manager can judge how near the estimate was made to the actual cost. By this practice the foremen of the different departments are taught to be conservative in making their requisitions, as frequently they might order a quantity of goods without regard to the cost. The practice also relieves the manager from a certain amount of guess work in auditing the orders.

The subject of accidents is one to which the company has given close attention, and the means adopted for prevention of casualties are so valuable and interesting that their description will form the subject of a separate article.

Wheel Notes.

THE hardness of the chilled tread is usually tested by a file or a sharp cold chisel and a hand hammer. Ultimately, some more certain and better means may be devised. Experiments have been made with emery blocks noting the time required for cutting through to the soft metal, but the apparatus is not in general use.

IN a recent letter a car wheel maker complains bitterly of the extremely low price of wheels at present, due to the competition of unscrupulous manufacturers, and says that in many of the car wheel works in the country "at least seventy-five per cent of the material used is made up of No. 3 mill or gray forge iron and the cheapest description of scrap, including malleable iron, plow points, burnt grate bars, etc., the whole going into the cupola accompanied by a certain proportion of ferro-manganese to add strength and chilling qualities to the mixture. The ferro-managnese, of course, fulfills its purpose in a measure, although the very small proportion added is not likely to become uniformly distributed throughout all the material."

A Study of the Causes Which Lead to Breakage of Gears and Pinions.

BY CHARLES F. UEBELACKER.

Second Paper.—Methods of Testing.

Of the four conditions to be met in practice by motor gears and pinions, viz., new gear against new pinion, new gear against old pinion, old gear against new pinion, and old gear against old pinion, the first was discussed in the last issue of the STREET RAILWAY JOURNAL. Of the three remaining, the most severe likely to occur in good practice would be that of a new pinion not very well cut, applied to an old gear, say, one whose teeth had worn down to about .125 in. at *a*, Fig. 1.

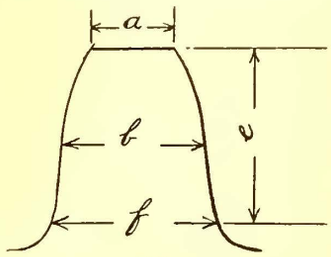


FIG 1.

Theoretically the teeth should wear off evenly over the entire depth of their working face, so that if our tooth which originally measured .271 in. at *a*, Fig. 1, now measures .125 in., it should now measure at *f* .395 in. instead of .591 in. as in the new gear. In actual practice this is not the case. The play in the bearings permits more or less movement of the centers and the result is a wear as shown in Fig. 2, which is a reproduction of a template of a partly worn gear. At *a* in Fig. 2 can be seen a decided ridge which marks the lowest point of the worn surface. Clearly the dimension of *f*, Fig. 1, has been reduced scarcely at all,

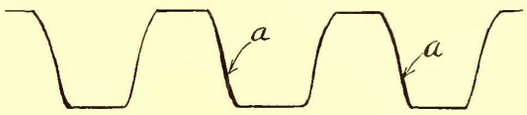


FIG 2.

and the worn tooth shown in Fig. 2, although reduced at the top from. 271 in. to .186 in., has scarcely suffered at all in strength. Farther wear of this same gear until the dimension *a*, Fig. 1, should be .125 in. would probably result in the other dimensions being altered to

$a = .125$ in.
$b = .377$ in.
$f = .356$ in.
$c = .445$ in.

Assuming the same conditions as for the new gear and substituting in the equation given last month we get

$$P = \frac{29370.}{.017} \times .178 = 29{,}600 \text{ lbs. per sq. in.},$$

or the strain in the portion of the section which has suffered reduction by wear is increased about fifty per cent as compared to new teeth, or if our metal (as stated above) has a breaking strain of 60,000 lbs. per square inch, we would still have a factor of safety of 2 in the extreme conditions secured.

Having then determined the strength which teeth should show, a simple test is desirable by which we may determine approximately whether any sample gear will fulfill the conditions. The wheel press offers us facilities for such a test, and very few roads are so placed that a press is not accessible.

Fig. 3 gives diagrammatic view of the arrangement of such a test. Here *f* is the yoke and *c* the plunger of the press. The half gear *b* has been securely strapped to the yoke *f*, and the third tooth *c* from the split has been shaped or chipped down so as to permit the flat bar *a* to be forced against the second tooth *g* at about the pitch line, a slip of metal *d* holds the point of the bar *a* in place and insures its striking the tooth at the proper height.

The wheel press can now be pumped up until the pressure begins to show on the gauge. The belt can then be thrown over on to the loose pulley and the flywheel turned by hand slowly enough so that the operator can

watch the rise in pressure and note the point at which the tooth fails, either by bending or breaking.

To determine what pressure a tooth should stand under this test we have only to return to our conclusion of 60,000 lbs. breaking strain per square inch, and substitute the proper amounts in the formula used before, which transposed to suit the present case would be

$$X = \frac{PI}{.331\,y} \text{ in which}$$

X = pressure as shown by gauge

.331 = distance from pitch line when pressure is applied to the weakest section *f* (Fig. 1)

P = 60,000 lbs.

I = Moment of inertia of cross section at weakest point *f* (Fig. 1.)

$$X = \frac{60{,}000 \times .06}{.331 \times .270} = 40{,}450 \text{ lbs.}$$

or as read by the ordinary gauge 20¼ tons.

If then a gear will stand 20¼ tons pressure applied at the pitch line, it should give a factor of safety of 2 under the most severe conditions. Should it be preferred however to raise the factor to 3, the pressure required

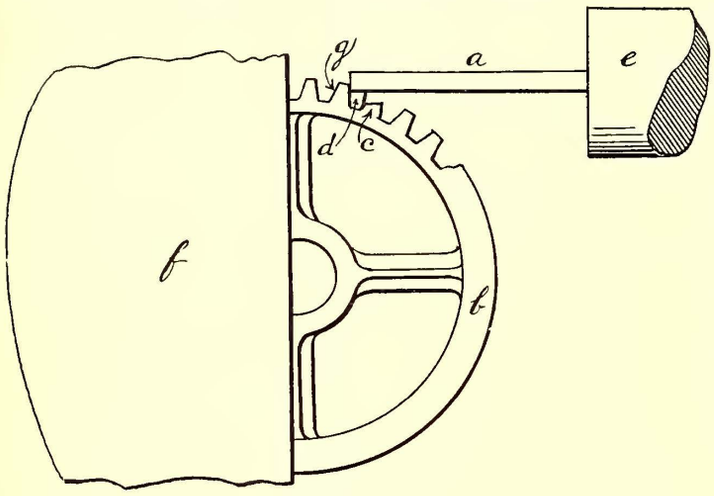


FIG. 3.

can be raised to thirty tons without exceeding the strength of many gears now on the market.

The following were the results of some tests such as described above.

(1)	Cast iron	gear,	tooth	broke	at	16 tons.
(2)	"	"	"	"	"	15 "
(3)	Mal.	"	"	"	"	37½ "
(4)	"	"	"	"	"	38 "
(5)	Steel	"	rim	"	"	40 "
(6)	"	"	"	"	"	40 "

These figures would indicate that either the malleable or steel gear had ample strength, but that the cast gear left considerable to be desired. Actual service fully bears out these deductions. Cast iron gears come in repeatedly with the corners of the teeth broken off and frequently with a whole tooth or series of teeth gone, while steel or malleable gears never break in this way.

The strength of a gear having been proved, the all-important question of its wearing quality comes up. The writer has never yet been able to find published any reliable figures of actual results in this line. His own measurement would point to an average of some ¾ of $\frac{1}{1000}$ in. per 100 car miles run or about one year's wear for steel gears. But the results of actual practice vary so widely that this figure is far from a satisfactory one to estimate on. A method for quick comparison of the wearing quality is necessary. It is not at all requisite that this should show the life of the gear, but only that it should indicate the comparative life of two different makers or materials. Working on this line a grinding test was arranged as shown in Fig. 4, where *a* is an emery wheel about eight inches diameter, *b* is a tooth cut from the wheel (shown in Fig. 6) fastened in the metal block *c* by the set screw *f*. The block *c* is held in position by a horizontal arm *d* pivoted at *e* to a fixed support.

In making the test the specimens are prepared so that their area *a* (Fig. 5) is the same. They are then secured in the block *c* (Fig. 4) and allowed to rest on the emery wheel

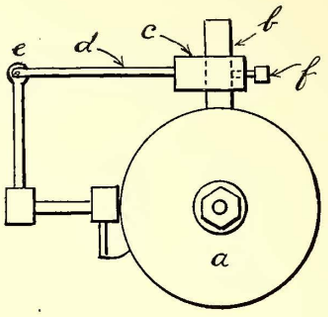


FIG. 4.

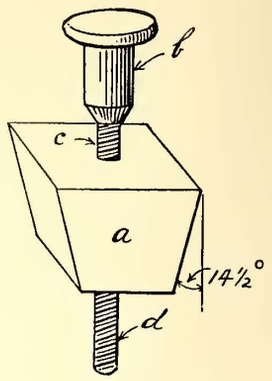


FIG. 5.

as it revolves until the end is true with the circumference. The length *b* (Fig. 6) of the test piece is then carefully determined and the emery wheel is allowed to make a given number of revolutions, the pressure being kept constant by the weight of the metal block *c* held to the test piece. The comparison of the lengths ground away from various test pieces should give us an idea of the comparative wearing qualities of the two gears. The results obtained by this method have not been as uniform as might be desired so far, and it has been found necessary to adopt several precautions, the necessity of which were not at first obvious. A few tests resulted as follows:

Wheel car borundum, freshly trued, circumference 23 ins., all results reduced to 1400 revolutions under test pieces.

1.	Cast iron	test	.141	in.	reduction.
2.	"	"	.121	"	"
3.	Mal.	"	.204	"	"
4.	"	"	.190	"	"
5.	Steel	"	.069	"	"

Actual results in the case of cars equipped at the same time with a steel gear on one motor and a cast iron gear

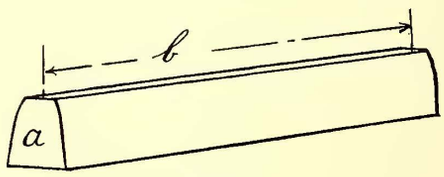


FIG. 6.

on the other, show the wear of the cast iron to be just about double that of the steel. This would be about what the results of the grinding test given above would lead us to expect.

One consideration remains in the selection of a gear, and that is workmanship. To make accurate measurement of bore, keyway and diameter, a set of plug gauges is all that is required, and it is very desirable that gears be frequently checked up with them, as small variations in these dimensions cause much trouble in fitting. The teeth can be roughly compared, of course, with a template fitted accurately to the space, but this gives no definite measure of the amount of variation.

A test frequently used in practice is to set the gear and pinion on short stubs at the proper centers and let a paper ribbon run through the teeth as they mesh. The ordinary clearance allowed being .015 in., paper .006 in. thick should run through without cutting. This test, like the template, gives no idea of the amount of variation and likewise takes for granted that the pitch circles are full size. The diameter of the pitch circle is not an easy thing to measure accurately however, and it is pretty safe to as-

sume that if the teeth show about the proper clearance when in mesh, the cutting is all right.

In order to determine the actual variation in the cutting, the writer got up the gauge shown in Fig. 5. In this *a* is a wedge each of whose two sides forms an angle of 14½ degs. with the axis of the micrometer screw, *d*, which is connected to the milled head *b* revolving around the barrel, *c*. The method of using is shown in Fig. 7. The micrometer screw, being run down to the bottom of the space, tells the length of the wedge that can drop in between the teeth. By a proper proportioning of the thread and the divisions on the milled head, the width of the wedge *e* (Fig. 7) can be read off directly in thousandths,

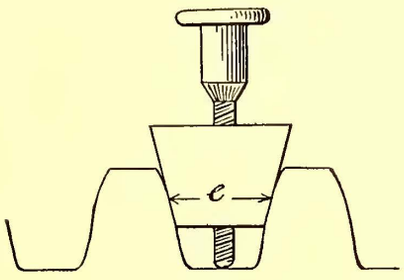


FIG. 7.

where it comes in contact with the faces of the teeth. Making the angle 14½ degs., brings the point of contact between the wedge and teeth at the pitch line. This gauge also gives a very handy method of determining the amount of wear on a gear in service.

To briefly sum up then, we have, first, determined the ordinary strain on the teeth, of sending a car up a not unusual grade (five per cent) and have found our pressure so great as to practically lose hope of any efficient lubrication.

Second, we have determined the probable strain of a sixty foot stop by reversing and have found that our metal should have a tensile strength of not less than 60,000 lbs. per square inch.

Third, tests have been suggested for quickly determining the suitableness of any given gear for work under the existing conditions.

Comparative Wheel Record.

The following wheel record is from a Western road and shows the comparative mileage made by 315 wheels from five different makers. The manufacturers, though five in number, are distributed over the country from the seaboard to the Mississippi River. They are graded from the best to the poorest.

The road has a T and girder rail track 105 miles in length, of which twenty-eight miles are laid on paved streets. The natural soil of the town is a sharp gravel. From this it may be seen that the service is of a pretty severe character.

The life of the wheels varied from 318 days to 201. In making the calculations the cost of changing has been placed at $5. The manager says this is a minimum figure for his road and the average on the smaller roads is likely to go above rather than below this figure.

Wheels O ran 2,293,350 miles, which has been taken as a basis for estimating what the other wheels could do.

The life of the wheels as shown by miles and time in service in columns No. 5 and in No. 10, varied greatly. From 45,000 miles down to 29,000 is a long gap, and what it costs is well illustrated in column 9, which shows what each make of wheels would have cost had the guarantee been the average of wheel maker O. Here it will be seen that the cost of the first wheel added to the cost of replacing it with the second one furnished free, is greater than the cost of the most expensive wheel of the whole lot.

The price obtained by maker O is nearly twice as large as one or two others, and yet his showing is best in nearly every case. This is a surpassing illustration of the value of a good wheel.

In column 8 we have the cost of making 2,293,350 miles with each of the different wheels based upon their average mileage. The figures are obtained by taking the number of wheels required to make the distance and then adding the cost of the extra changes. The latter figures are obtained by taking the extra wheels in column 6 at $5 each as the cost of changing. On this basis only one of the wheels prove cheaper than the expensive wheel.

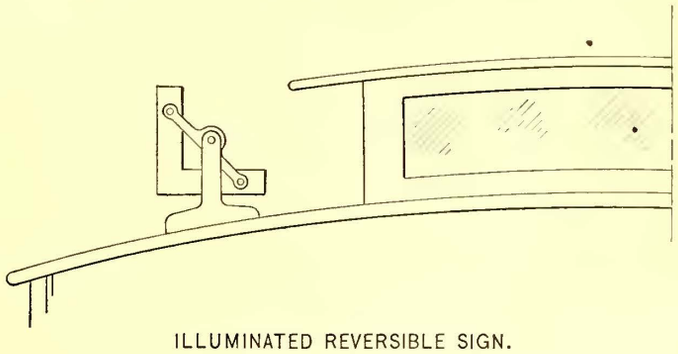
Make of wheel.	No. wheels used.	Price per wheel.	Cost of wheels used.	Average mileage.	No. of wheels to make the mileage of wheels O.	Extra wheels used to equal O.	Total cost to equal O.	Cost per wheel to make 45,000 miles each.	Days in service.
O	50	$8.10	$405.00	45,887	50	....	$405.00	$ 8.10	318
P	60	4.15	249.00	36,190	64	14	335.60	9.159	250
Q	25	6.20	135.00	35,520	65	15	473.00	11.20	246
R	44	3.40	237.60	29,490	79	29	413.60	8.40	205
S	136	4.60	625.20	29,388	79	29	508.40	9.60	201
1	2	3	4	5	6	7	8	9	10

It is easily understood from the figures that it does not pay to accept free of charge a new wheel of a short lived kind to take the place of one which has failed to make the required mileage. The cost of replacement is usually more than the wheel is worth. When rolling stock is run to its full capacity, there being no surplus, the advantage of long lived wheels is still greater. How much greater is difficult to put in figures. It depends on the daily earnings of each car and the consequent loss when one is off from the road.

The advantages of the Master Car Builders' plan of buying a wheel at a price based upon the mileage it makes is easily seen. The poor wheel is then handicapped as it deserves to be. On the other hand the wheel making the long run is paid for according to its superior value.

Illuminated Signs for Cars.

The Citizens' Street Railway Company, of Detroit, Mich., is employing, to distinguish the different routes of its cars, some very neat signs, which are useful for both day and night service. They are of wood with perforated



ILLUMINATED REVERSIBLE SIGN.

letters, the sign being painted black and the edges of the letters white, so that they can be read at a long distance in the day time. The signs are on the roofs in front of the ventilator windows, so that at night the lights from the interior of the car shine through the perforations, making the signs as readable as in the day time. Under the conditions existing on this line, reversible signs are not necessary, but if these were required, it would seem possible to construct such a sign, as shown by the accompanying sketch.

LETTERS AND HINTS FROM PRACTICAL MEN.

Operating Electric Cars Without Conductors.

Sioux City, Ia, Mar., 20, 1896.

Editors Street Railway Journal:

I have had a great many inquiries from managers of electric railways regarding the practicability of operating electric street railways without conductors. As a rule these queries come from the smaller roads which haul a limited number of passengers and which cannot very well afford to pay conductors. I have written to many roads for information on this point myself, and universally received the reply that it is entirely practicable and always advisable on roads hauling a limited number of people. A good motorman, with the farebox system, can successfully handle what might be considered a fair traffic. I am aware that many points can be argued against the practice, but where it has been allowed it has been found to give good satisfaction after a fair trial, and in most places where such an arrangement is advisable the patrons are sensible enough to appreciate the fact that the road is able to give a more frequent and a better service by saving the big expense of maintaining conductors. I am satisfied that many of the smaller roads could easily keep their heads above water and make a little profit in addition to making improvements from time to time, if they would only cut off the expense of conductors, operating their cars with one good man and the farebox system.

This is a question well worth serious consideration, and I will be glad to hear from other managers of street railways through the columns of your paper.

Yours truly,

I. B. Walker,

The Electrical Equipment of Cable Roads.

San Francisco, Mar. 17, 1896.

Editors Street Railway Journal:

Some of the cable engineers, including several abroad, do not seem to be able to understand why the Market Street Cable Railway Company of this city is replacing the cable by electricity upon some of its lines. If they had followed street railway events in this country more closely they would have learned that other cities have done the same; that the cable was abandoned for electricity at Grand Rapids, Mich., over three years ago; that the same was done in part if not in whole by the Denver Tramway Company, of Denver, Colo., over two years ago; that in a recent number of the Journal appeared an account of how the concrete cable tube was blasted out in St. Louis, Mo., to accommodate the ties for an electric road substitute; that the Piedmont road, of Oakland, Cal., was a financial failure until the cable was abandoned and electricity used instead; that the extensive Philadelphia cable lines have all been converted to trolley lines; that the Gilmor cable line in Baltimore has been electrically equipped; that a Los Angeles (Cal.) railway company has just finished converting all its cable lines to electricity; that it is proposed to combine all the street railways of Portland, Ore., into a single company and substitute electricity for cable throughout the city, using an auxiliary device on the one heavy grade; that a San Diego (Cal.) bankrupt cable road, costing originally $200,000, was recently sold for $17,000, and a change to electric traction decided on; and that the report has just come to hand that in Pittsburgh it has been decided to abandon cable plant and tracks costing $12,000,000, for equipment by electricity at a cost of $4,000,000. These bald facts ought to convince them that the cable is not entirely satisfactory even on negative testimony only, while there is no case on record where an electric road has been changed to a cable road.

Yours truly,

S. L. Foster.

Safety Switches.

Denver, Col., Mar. 20, 1886.

Editors Street Railway Journal:

To make a grade crossing absolutely safe is a problem that has puzzled the brains of many an engineer and as yet has never been satisfactorily solved. Various devices however have been invented to decrease and abate the dangers of such a crossing and one of especial merit has been in operation for the past three years at several points on the lines of the Denver Consolidated Tramway Company. This device consists of a pair of switches and blind curves, situated in the electric track at a point about seventy-five feet distant on either side of the railroad crossing, as shown in the illustration.

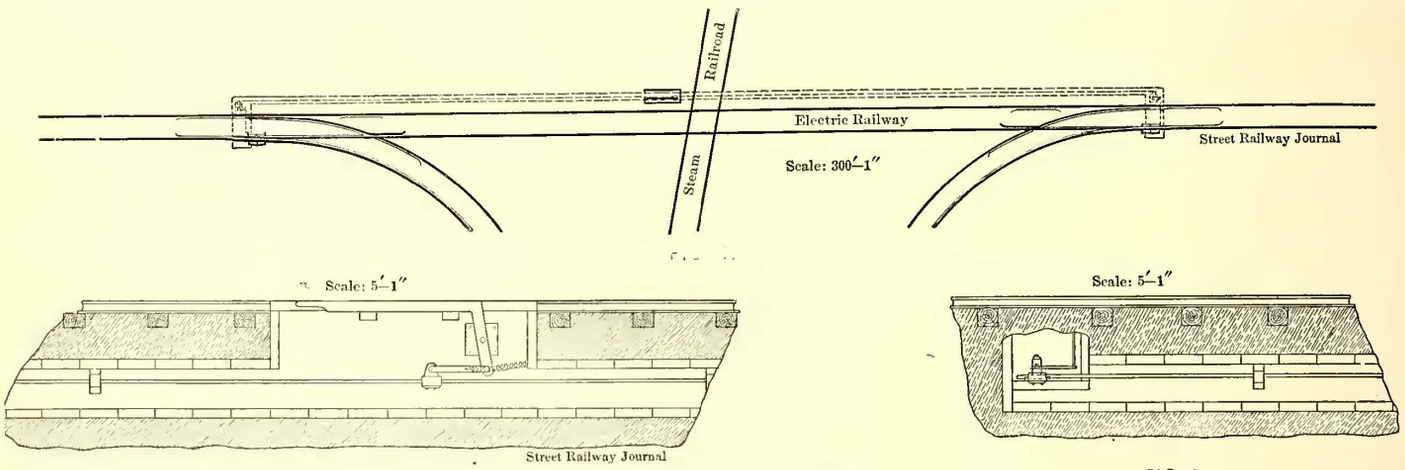


FIG. 2. SAFETY SWITCHES IN DENVER. FIG. 3.

The switch tongue is invariably set leading into the blind curve. It is impossible for a car to make the crossing unless it is stopped before reaching the point of switch. The conductor must then walk forward to a hand lever which operates the switches and by raising it throw both switches into the straight track. This hand lever is situated at a point on or near the crossing, possessing an unobstructed view of the various tracks.

The hand lever in operating the switches is raised to a height sufficient to allow the conductor to stand upright while the wheels of the car are passing over the switch tongue. As soon as the lever is released a spring below draws it back into former position and the switches are again set for the third curve.

The car passes out of the switch on the opposite side by direct pressure against the tongue, allowed for by means of a flat spring so constructed that the wheel flanges crowd through the switch which again automatically adjusts itself for the curve as soon as the car has passed.

Following is the automatic rigging in detail :

The hand lever is bent at an angle of about 100 degs. and is attached at the lower end to a connecting bar about two feet in length which is attached in turn to a clamp casting, setscrewed to a ¾ in. pipe which constitutes the rod. This rod is connected by means of a clamp casting to a bell crank opposite the center pin of either switch tongue. The bell crank is of cast iron with arms about one foot long and at an angle of 90 degs. The opposite arm of this crank is connected to a cross rod which connects with a slide holding the loose ends by two flat thirty-six inch springs. These springs are held in place at the opposite end by studs screwed into the switch casting and resting against the end of a second slide that runs through a cored aperture in the switch casting through which passes the center pin of the switch tongue. Lifting the hand lever two and a half or three feet slides the rod a distance of about eight inches, reversing the position of the bell cranks, bringing the opposite or idle spring to bear, thus opening the switch for the straight track.

Attached to the connecting bar is a coiled spring, and when the operator releases the hand lever this spring draws it back in place and resets the switches for the curve. The entire working of the rigging is so light that the spring adds but little to the power required to operate the hand lever.

The ¾ in. pipe or transverse rod is run through bearings three inches in width, placed one for each length of pipe or about sixteen feet apart. The space above the rod is enclosed in a plank box one foot square in the clear.

These safety switches have been in continual use for more than three years without repair. They require no oiling, except occasionally at the switch tongue and are working as well to-day as when first put into operation.

The object of these switches to a certain extent may be accomplished by much cheaper "derailing" devices, but the damage to car and loss of time is obviated by adopting this plan. Some such device could readily be applied to draw or pivot bridges, and worked automatically by the opening and closing of the bridge. Possibly such a plan would have prevented the late sad accident on the Cleveland Viaduct.

The details and general arrangement of these switches were worked out by Fred. Simmons, foreman of the construction shops of the Denver Consolidated Tramway Company. This company has recently equipped all its suburban railway crossings with the above switches.

JOHN A. BEELER.

Controllers.

CHICAGO, Apr. 2, 1896.

EDITORS STREET RAILWAY JOURNAL:

I fail to see wherein the modern series parallel controller economizes in current over the Sprague commutated type. Now my experience with the series parallel controller has been that when it was put in continued heavy service the resistance box (which is external) would get very warm, even hot, leaving the motors comparatively cool. The first steps cause a slow increase in speed until you come to parallel when the motors start off with a rush. The same thing occurs in the parallel combination. On the other hand, with the Sprague, where an internal resistance is used the increase in speed on each point remains the same. I have never seen the old Sprague motor so warm that you couldn't put your hand on it, but I have seen the resistance of the series parallel controller so hot that it was a case of hands off.

Do you not think that a motor of the commutative field type with a resistance point between each field combination to do away with the sudden impulse that always comes when the motor is worked up to speed rapidly, would give better satisfaction, everything considered, than any other arrangement? It certainly would give more running points, which would be quite an item, especially on interurban and elevated roads. A motor of this type would necessarily be more expensive to build, but considered from all points it seems to me it would be the cheapest in the long run. If there are objections to this I would place resistance enough in the first point so the motors cannot spin the wheels.

Now a point about controllers.

It seems to me that manufacturers are making a grave mistake in sending out controllers that can be turned either in series or parallel on a first point for the very reason that there is no motorman but can get his motors in parallel quick enough without any short cuts. I know of a road using controllers such as I have just spoken of and I find that a great many motormen use the parallel side only when crowded for time. This is expensive in more ways than one as you well know.

Yours truly,

PRACTICAL MAN.

Power Station Records.

OTTAWA ELECTRIC RAILWAY.

OTTAWA, ONT., Mar. 17, 1896.

EDITORS STREET RAILWAY JOURNAL:

The cost of the electrical horse power delivered at the bus bars of our station is about $0.015 per horse power per day. The cost of power per car mile is $0.00259. Our station is operated by water power.

Yours truly,

AHEARN & SOPER.

SAVANNAH, THUNDERBOLT & ISLE OF HOPE RAILWAY.

SAVANNAH, GA., Mar. 12, 1896.

EDITORS STREET RAILWAY JOURNAL:

In our power station which has a 325 h. p. engine and a daily horse power output of about 230 h. p. we are using at present about thirty gallons of cylinder oil and fifty gallons of engine oil per month. The makes employed are cylinder oil, Leonard & Ellis; engine and dynamo oil, Rucker & Company. The engine oil after passing through the bearings is strained and used over again.

We burn coal from the Chickamauga Coal & Iron Company, costing $2.35 per ton of 2240 lbs., delivered at the power house. We consume seven pounds per car mile.

In winter we run 16 ft. and 20 ft. closed cars, and in summer 25 ft. and 30 ft. open cars. Our road is mostly level. In the suburban districts we have several light 1½ per cent grades.

Yours truly,

J. H. JOHNSTON, President.

The general manager of an electric railway owning thirty miles of track writes us as follows:

We are using cylinder and engine oils furnished us by the Maloney Oil & Manufacturing Company. The engine oil, which is used on the engines and dynamos, is filtered and used over and over again.

We burn a mixture of rice coal, $1 buckwheat and culm, and taking a recent month as a sample, our figures are as follows:

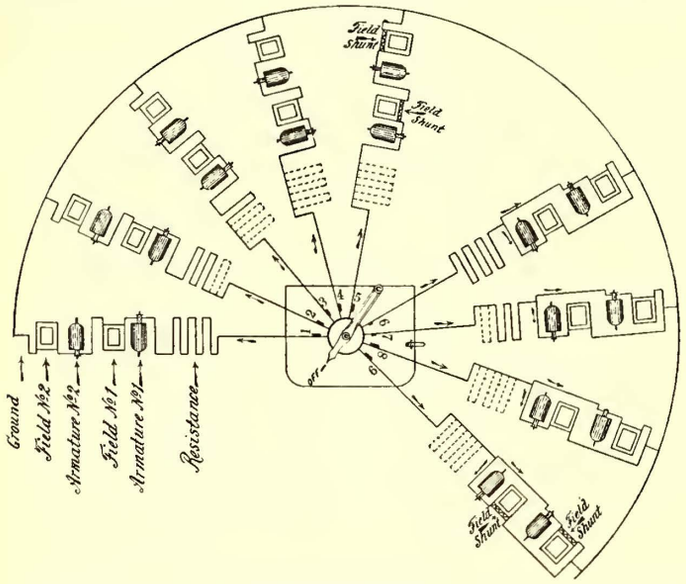
Number of cars run eighteen hours per day	33.74
" " miles run per year	124,634
" " " " " car per day	123.11
Cost of fuel per ton of 2000 lbs., delivered	$0.68
Number of pounds used	1,080,152
" " " per car mile	8.66
" " " " " per day	1,066
Cost per car mile	$0.00294

Our cars are eighteen and sixteen feet in length, about equally divided. The road is not level, having a very large number of long grades, some of them being as high as twelve per cent. The power plant is of 1200 h. p. capacity, equipped with simple Corliss engines and water tube boilers.

The quantity of oil used per month as shown by a statement covering six months, is 66.6 gals. of cylinder oil, and 230 gals. of engine oil.

A Novel Method of Showing Controller Diagram.

In the Milwaukee *Electric Railway Bulletin* of March appears a unique and excellent form of diagram showing the connections of the K2 controller. Mr. Wyman and his assistants have taken the greatest pains to train and instruct their motormen in every possible way which would serve to increase their efficiency and general intelligence. In the matter of controllers, "the right understanding of



1st Point. Current passes through three panels of resistance, through Armature No. 1, Field No. 1, thence through Armature No. 2, and Field No. 2 to the ground. This is called Running Motors in Series.
2d Point. Same as point No. 1, except that one-third of the resistance is cut out as shown by the dotted lines.
3d Point. Same as point No. 1, except that two-thirds of the resistance is cut out.
4th Point. Same as Point No. 1, except that all of the resistance is cut out.
5th Point. All resistance remains cut out and the fields are weakened by the use of a shunt coil, making this a safe and economical point to run on.
6th Point. Current passes through all three points of resistance, and then into Armatures No. 1 and 2 simultaneously, from them directly into the Fields No. 1 and 2, thence to the ground. This is called running Motors in parallel.
7th Point. Same as point No. 6, excepting that one-third of resistance is cut out as shown by dotted lines.
8th Point. Same as point No. 6, excepting that all resistance is cut out. This is the safe and economical point for high speed and heavy load.
9th Point. All resistance is cut out and the Fields are weakened by a shunt coil. Motors are still running in parallel. This point should never be used for heavy loads, and only when necessary to make up lost time.

CONTROLLER DIAGRAM DEVISED BY MILWAUKEE RAILWAY & LIGHT CO.

which lies at the very basis of the motorman's work," it was found impossible to get any diagram or sketch which would be sufficiently easy of comprehension, and it was finally determined to devise the form shown in the engraving, which is self explanatory to readers of the Journal. In an excellent article in the *Bulletin*, however, the different effects produced by passing the controller handle from point to point are carefully described, so that the comparatively non-technical motorman can easily comprehend the principles involved in the work which he does in handling the car.

Fare Regulations in Knoxville.

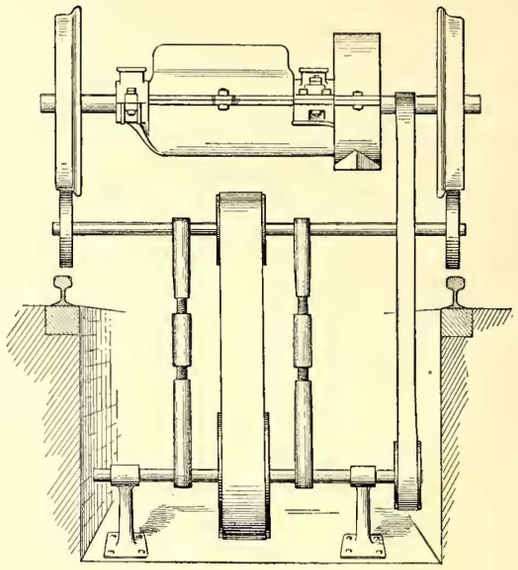
The Knoxville (Tenn.) Street Railway has commenced selling tickets in lots of twenty-five for $1, and in lots of six for twenty-five cents. Persons expecting a transfer must pay a cash fare of five cents. Persons paying cash fares and not desiring a transfer are given a rebate check. These checks if preserved and presented at the office of the company, in lots of fifty, will entitle the bearer to receive a book of six tickets. Half fare tickets are sold to school children and ministers.

The company offers encouragement to the conductor who sells the most tickets on the cars from now until December 25, 1896. The one with the best record in this way will be given $50; the one selling the second largest number gets $25, and the third largest $15. It is thought that this rule will encourage the selling of tickets generally by conductors when on and off duty.

Policemen are carried free when in full uniform only.

Wheel Grinding Machine.

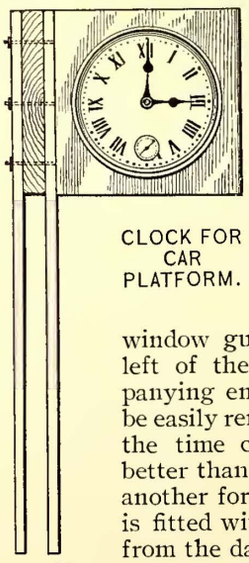
A novel method of grinding wheels without taking them from the truck or removing the truck from the car body, is in use in the car house of the Metropolitan Railroad Company, of Washington, D. C. The general ar-



WHEEL GRINDING MACHINE.

rangement is shown in the accompanying engraving. The car is first run over a pit, and the truck is jacked up so that the pair of wheels to be ground are raised five or six inches above the rails. The axle is then connected by belt to a jackshaft carried in journals fastened to the floor of the pit. On this jackshaft is mounted a second pulley of larger diameter than the first, by which it drives the emery wheel shaft. The two shafts are kept parallel by extension arms by which the belt connecting them can be kept taut.

The axle is, of course, revolved by the motor, and as will be seen, the portions of the emery wheels and car wheels in contact will revolve in opposite directions. It will also be noted that the former can be moved into and out of contact with the latter without varying the tension of any of the belts. The device was invented in the shops of the company, and the managers speak well of its performance.



CLOCK FOR CAR PLATFORM.

A Timekeeper on the Front Platform.

A good method of helping motormen to keep their cars on running time has been adopted on a number of the cars of the Union Traction Company, of Philadelphia. A small clock of the ordinary round face type with balance wheel is enclosed in a square wooden case and is attached by wooden strips to the window guard rails on the front platform at the left of the motorman, as shown in the accompanying engraving. This enables the clock to be easily removed to the other platform and keeps the time constantly before the motorman far better than if he depended upon his watch. In another form the wooden box holding the clock is fitted with hooks so that it can be supported from the dashboard.

The motormen are well pleased with the idea.

IT is said that in the long distance plants installed by the General Electric Company during 1895, over 1200 miles of copper wire for transmission purposes alone were used, amounting to practically 1,200,000 lbs. of copper.

Insulation of Underground Cables.

ST. LOUIS, MO., Apr. 21, 1896.

EDITORS STREET RAILWAY JOURNAL:

I have been very much interested by the article in your April number by R. W. Conant, entitled "The Design of Testing Stations for Street Railways."

Mr. Conant has given us an unbiased recital of experience with underground electric feeder cables that will undoubtedly result in a very large saving in future installations to those who carefully read and consider his statements.

In the following letter, I shall differ somewhat in deductions from those made by Mr. Conant, but his statement of facts I regard as unassailable, and it is with grateful heart that I thank the writer for stating in detail, and with the most positive evidence of collateral facts, truths that have long been suspected, but as often denied by one interest as asserted by their opponents.

It would seem from Mr. Conant's article that the West End Street Railway, of Boston, in March, 1895, installed "132,000 ft. of paper and fibre insulated 500,000 c. m. lead covered underground cable." It would seem that the selection was made (to a certain extent at least) because of a "peculiar advantage" which an "absorbent insulation" has over non-absorbent insulations, of giving warning of a developing fault.

It would seem however, that such "absorbent insulation" does not present any "peculiar advantage" of ease of location of a fault; but that such a cable, when discovered to be faulty, must be handled much as in the case of non-absorbent cables, that is, must be cut in manholes, tested section by section, until the faulty length is located. This must then be drawn out of its duct and be replaced by a new length.

Mr. Conant very naively tells us that the lengths installed and drawn out are somewhere about 400 ft., and that "the number of cuts which it is necessary to make in locating a fault in a mile of cable, averages seven to ten." Mr. Conant finally tells us that eleven faults have been detected and located during the first year's service in this underground system.

Now let us look at these facts as they present themselves to one experienced in underground cable work. We will do the subject no serious injustice if we assume these cables as averaging a mile in length; they are probably longer. We have eleven faults located by means of ten cuts each, a total of 110 cuts made in the cables during the year. Wherever a cut is made the ends must be securely sealed up to prevent the hygroscopic action of the "absorbent insulation" from carrying moisture back into the cable for a dozen feet from the cut. We have 220 seals therefore to make. Meanwhile we have had testing connections to make and unmake to every one of the 121 isolated sections. Now having located the eleven faulty sections, each 400 ft. in length, we draw out and replace just 4400 ft. of cable and go to work to connect up again the 110 joints, retest the cables and put them into service if showing fair insulation.

I do not propose to go into a dissertation on the relative merits of paper and fibre ("absorbent insulation") and rubber cables. I simply ask every practical business man to compare this record of weekly tests, an expensive underground repair gang, ever present and at work, elaborate nursing of cables by an expensive testing department, three per cent of cable pulled out the first year, and a testing and repair gang that I estimate costs $10,000 per annum, with a record made by a rubber insulated cable on another electric railway, where 280,000 ft., were installed a year ago; not one fault has been detected, not a single special underground repair man is maintained in the service of the railway company, and the cost of testing has been purely nominal.

This comparative record moreover is not unique. In other large systems that I can mention, the especial make of rubber cable just referred to has given the same perfectly satisfactory service, without a fault, defect or blow-out and without expensive nursing; while alongside, part of the same system in one instance, just the supervision, coddling, withdrawal and repair described by Mr. Conant, is continually going on to cables with the "absorbent insulation."

I venture to say that it was a matter of first cost only, not any "peculiar advantage of the absorbent insulation" that determined the West End Street Railway to the purchase of paper and fibre cable. At a fair estimate, the saving in first cost under the cost of rubber insulated cable was less than $15,000. Perhaps it is a good business principle to cut $15,000 on first cost, and then expend $10,000 annually in maintenance, but the most of us have not been brought up in that belief.

Before I close it may be pertinent to suggest that if we are to replace three per cent of our underground cables during the first year, when defects are slight and simply those of manufacture and of installation, what shall we expect after electrolytic action, which we cannot avoid, begins its ravages, pits the lead sheath, and admits the moisture of the duct and of the manhole to the "absorbent insulation" with its "peculiar advantage in the detection of faults?" Seven nights per week will not suffice for the work of the testing department. Yet these cables must be tested once a week as Mr. Conant gives us as at least one instance of a cable that at a given date tested up to his standard for service, and then fell to zero within ten days after.

Yours truly,

E. J. SPENCER.

Freight, Mail, Express and Baggage Service.

In an attempt to find out the experience of street railway companies with freight, mail express and baggage service, a series of questions was recently sent out to the cable and electric roads of the United States. From 119 replies received up to this time the following information has been obtained. Seventy-four companies give no such service whatever; 6 of them however consider a freight service profitable, 2 unprofitable and the remainder express no opinion; 4 consider a mail service profitable, 2 unprofitable, and the remainder express no opinion. The franchises of 21 of these companies permit such a service either in whole or in part, while those of 16 do not, and by the remainder no information is given. One road out of the 74 intends to undertake a mail service, 4 an express business and 8 both a mail and express business. The remainder either state positively that they will not enter on such a service or that no such plan is under consideration at present. 45 roads out of the 119 carry on a service of this character. A brief abstract follows of the replies received from these roads.

The Chester (Pa. Traction Company is about making a contract to carry the mails from Chester to Media, 6¼ miles. No special mail cars will be furnished. "There is very small profit, the main consideration being the accommodation to the public." No other kind of service is contemplated.

The Omaha (Neb.) Street Railway Company carries mails under contract with the Government. It does not provide special mail cars, does not consider the work profitable, does no express business and is not intending to do so.

The Eau Claire (Wis.) Street Railway, Light & Power Company carries express and baggage in limited amounts, but without any special cars. It considers that the work is profitable under certain conditions to the extent of twenty per cent on the necessary investment, but will not increase facilities. Mails are not carried.

The Conway (Mass.) Electric Street Railway Company operates six cars attached to passenger cars as trailers and one combination car for passengers, baggage, express and mail. The company depends largely upon its freight business for the support of the road. It carries United States mail under contract with the Government and expects to make extensions to the road which will increase its freight business. It considers the mail service moderately profitable in connection with its other business, as there is no addition in investment necessary in this particular case.

The Miami Valley Railway Company, of Piqua, O., carries mail, freight and baggage, and has one special car for the purpose used as a trail car. It considers that there is about twenty-five per cent profit in its freight and baggage service. It carries the mails under contract with the Government on its regular cars and considers this work profitable, as there is no additional expense required, the regular men attending to the mails.

The Cleveland (O.) City Railway Company, carries mail pouches on the front platform of its regular cars on certain lines under contract with the Government, and considers total receipts from this work clear gain as there is no additional expense involved.

The Northampton (Mass.) Street Railway Company, carries a closed mail pouch twice a day on one line and runs a combination passenger and post office car on another line. It does not consider the special car profitable (emphatically). It has applied to the legislature for an amendment to its charter permitting it to carry on a freight and express business, thinking that this would be profitable on its particular road to the extent of perhaps twenty five per cent.

The Mt. Adams & Eden Park Inclined Railway Company, of Cincinnati, O., carries mail sacks on front platform of baggage cars between two local sub post offices and considers this work profitable as there is no extra investment or expense required. No extensions are contemplated.

The Ithaca (N. Y.) Transfer Company, which is allied to the Ithaca Street Railway Company, operates one baggage and mail car over the latter's lines, which earns about $7000 per annum. The service is considered profitable to the extent of about twenty-five per cent. but the mail service under the existing contract is not thought profitable.

The McKeesport (Pa.), Duquesne & Wilmerding Railway Company operates one independent freight car, which also carries mail, and has a contract with the Adams Express Company. It does not consider its freight business very profitable, saying that the profits depend entirely on circumstances. Its mail service "promotes discipline, requires small extra work and results in small profit." Most lines are too short for much profit in business of this character.

The Rockland (Me.), Thomaston & Camden Street Railway Company operates a combination passenger, mail, express and baggage car, a special freight car equipped with 100 h. p. motors, and two flat trail cars giving a service between Rockland and Camden. It also carries the mails. With reference to this service its treasurer, George E. Macomber, says, "We have done this class of business for several years, and it is gradually increasing, but unless the conditions under which the road is operated are very favorable and there is little opportunity for competition, my impression is that there is not a great margin of profit. One reason is I think people are looking to have a street road carry freight and other merchandise on the same low basis which they charge for passengers, which cannot be done on account of the extra amount of labor involved in loading and unloading. I should say unless the conditions are all favorable there will not be much in it."

The Akron (O.), Bedford & Cleveland Railroad Company is organized under the railroad laws and has all their privileges, but is operated by electricity. It commenced in November last an express service between Akron and Bedford under a contract with the American Express Company, operating a combination express and passenger car. It is unable to extend the business at present owing to lack of suitable terminal facilities in Cleveland. It is too early as yet to determine the measure of profit, but the company will make an effort to secure this business as soon as it has a good chance and is able to give a quick service.

The Elmira (N. Y.) & Horseheads Railway Company operates a special transfer car for passengers during the day, and a baggage wagon for the transfer of baggage is also operated under the name of the general manager. It considers this work profitable to the extent of about ten per cent. The company intends to put on a special car for express service between Horseheads and Elmira. It does not carry mail and does not consider a mail service profitable, except as some safeguard in case of strikes.

The Galt (Ont.), Preston & Hespeler Electric Railway Company does a general freight business over a roadbed nine miles in length capable of carrying the Canadian Pacific Railway Company's freight cars, the transfer of which by a Baldwin light locomotive and an electric motor car is an important source of revenue. The road has sidings into a number of factories and foundries on the way and carries coal, pig iron, wheat, wool and manufactured goods. The locomotive is run at night only. Its own freight equipment consists of two special combination cars. During the last half of 1895 the company carried 5000 tons of freight and a large quantity of express and baggage. It considers this work profitable to the extent of fifteen to twenty per cent. Mails are not carried as yet, but the company is in negotiation with the Dominion Government and thinks a mail service would be profitable.

The Oxford Lake Line, of Anniston, Ala., operates one flat car as trailer and makes trips on special contracts only when a profit can be seen. It is trying to secure a mail contract.

The Oakland (Cal.), San Leandro & Haywards Electric Railway Company, a full description of whose peculiar freight service was given in the STREET RAILWAY JOURNAL for August, 1895, has discontinued this service stating that after a careful experiment it has been decided impracticable to continue it. The company carries mails on regular cars and does not consider the mail service profitable in itself at the compensation allowed by the Government.

The Owosso (Mich.) & Corunna Traction Company operates a number of combination cars with baggage compartment for trunks and baggage, used also as a smoking room and to the great satisfaction of the public. Mails are not carried. No statement as to the profits is made.

The Cincinnati (O.), Newport & Covington Railway Company has been carrying mails on all its lines since May 7, 1894, and also takes freight cars from the C. & O. R. R. to Fort Thomas by means of a locomotive formerly used in the construction of the Fort Thomas line, which is seven miles in length. The company nets about twenty-five per cent of the gross freight business. Mails are carried on regular cars, and the mail service is considered as profitable as in the operation of cars for the handling of passengers. There is no present intention of increasing the mail and express business.

The Citizens' Street Railroad Company, of Memphis, Tenn., operates one special express car as a trailer and says that the work "does not amount to much." Mails are carried on regular cars to a number of sub post offices and "what little we get out of it is gain." The company expects to increase its mail contracts.

The Negaunee (Mich.) & Ishpeming Electric Street Railway Company carries some express matter on its regular cars and has some extra flat cars which are used for car load lots under special contracts. It does not consider this work profitable, but merely carries it on as an accommodation. "If the amount carried is sufficient to warrant the putting on of an extra crew it ought to pay as well as ordinary cars." Mails are not carried and there is no intention of increasing this service.

The Mobile (Ala.) & Spring Hill Railway Company operates one freight car as a trailer, which makes one trip per day. Mails are carried on regular cars twice a day. The freight service is not profitable to any extent, but the mail service is considered so. There is no intention to increase.

The Cedar Rapids (Ia.) & Marion City Railway Company operates one regular and an occasional trail car for freight only. The gross earnings for 1895 from this traffic alone were $3234. The work is considered fairly profitable to the extent of "at least twenty-five per cent on the cost of the equipment used in that service." Mails are not carried.

The Cortland (N. Y.) & Homer Traction Company operates one electric express car as a locomotive and the regular freight cars of the steam railroads coming into Cortland as trailers between Cortland and McGrawville, a distance of five miles. The cars carry from Cortland coal, lime, feed, etc., and bring back hay and produce. The work is considered profitable, but the company has not been carrying it long enough to determine the measure of profit. Mails are carried on regular cars and this service is considered only indirectly profitable in cases of strike or of threatened injunction by property owners. A steady increase in the freight business is expected.

The Tri-City Railway Company, of Davenport, Ia., carries baggage and mail bags on regular cars and considers the work profitable.

The Omaha (Neb.) & Council Bluffs Railway & Bridge Company carries mails on regular cars and gives no opinion on profits.

The Butte (Mont.) Consolidated Railway Company is just commencing to haul ore on four cars of twelve tons capacity, each especially built for the service and equipped with two fifteen horse power Sprague double reduction motors. The heaviest grades with load are three per cent, though the empty cars will have a ten per cent grade. It is expected that the service will be profitable, but nothing can yet be said. The company's franchises permit work of this kind on one three mile line only built especially for the hauling of ore.

The Ottawa (Ont.) Electric Railway Company operates three special mail cars between the post office and all mail trains. The Canadian Government supplies messengers who have charge of the mails. The Government pays the company $4,000 per annum for this work and the company is asking an increase on this price.

The Hamilton (Ont.), Grimsby & Beamsville Electric Railway Company, operates an eighteen mile line, described in the STREET RAILWAY JOURNAL Souvenir, 1895, page 37. Trips are run every hour. The road runs through a farming and vineyard country. The company operates one motor freight car with three twelve foot trailers, one combination passenger and freight motor car, and also carries a large number of packages, baskets of fruit, etc., on its regular passenger cars. The line is in competition throughout its whole length with a steam trunk road. During the year ending Dec. 31, 1895, the company carried about 2,000 tons of freight, not including milk. Mails are carried on regular cars for a portion of the route, and the mail contract will probably be extended. Concerning the general character of the enterprise the company writes: "We believe there is a large profit in working this branch of suburban and interurban railway business. The first month we were in business we only carried five tons of freight, but finally reached as high as 200 tons in one month. During the greater portion of the first month referred to we were not in a position to handle freight as it ought to be handled, having no freight house and no horse and wagon to go after and deliver freight. Our rates are a little less than the trunk line which runs parallel with ours, the whole distance touching at the same points, but shippers prefer to do business with us in consequence of the more frequent service and more prompt delivery."

The company's report for 1895 showed gross earnings (passenger and frelght) of $33,988 and net earnings of $7,297, as a return on a capitalization of $110,000 capital stock and of $55,000 funded debt. The earnings from freight appear to have been about $3,500.

The Hartford (Conn.) & West Hartford Street Railway Company is carrying express, baggage, freight and mail between Hartford and three suburban towns, and operates two combination electric cars for this service. All branches of the work are considered profitable and the business will be increased as far as possible.

The Consolidated Railway & Light Company, of New Westminster, B. C., operates one combination freight and passenger car between the cities of Vancouver and New Westminster, a distance of thirteen miles. Express, baggage and mails are carried on regular passenger cars. This entire service is considered profitable to the extent of about twenty-five per cent and the company is endeavoring to increase it.

LEGAL NOTES AND COMMENTS.*

EDITED BY J. ASPINWALL HODGE, JR., AND GEORGE L. SHEARER,
OF THE NEW YORK BAR.

The Law of Negligence, with Some Statistics.

John Brooks Leavitt, of the New York bar, has during the past year contributed a work on the law of negligence which is unique. Its full title will be found in the column devoted to book reviews.

In a word, Mr. Leavitt has sought to photograph in outline and silhouette all the decisions, upon this particular subject, rendered by a single court of last resort covering a period of seventy-five years. He has, naturally, selected the Court of Appeals of New York, where he finds about 1300 cases. These he first condenses, writing short, concise and logical head notes of his own; he next gives in each case a very short statement of the facts culled not only from the opinion, but from the record; and finally he gives the amount of the verdict, which is not generally to to be found in the reports—an omission, it seems to the writer, which should not occur in the official reports of any case.

In the second division he seeks to codify the law as set forth in these decisions. In this part of his work there would seem to be somewhat needless repetition, but it is of supreme importance as an index to the decisions codified, and is a most useful and convenient help to the lawyer.

In the last division of his book he classifies the decisions in such a way as to tempt the reader to spend a considerable amount of time in gleaning from it statistics which are at once interesting, suggestive and instructive, especially to the lawyer, the loss adjuster or the officer of street or steam railways. Space prevents a review and criticism of the work, and only our conclusions after a careful study of it can be stated.

The author has, certainly, pursued a most admirable method of treatment of this particular subject in this state where the decisions have been so numerous, but it remains to be seen whether other subjects, or even this subject in a state where the decisions are less numerous, can be treated effectively along these lines. In an instant, with this book on his desk, a lawyer or a loss adjuster can learn, for example, from the table of cases classified according to verdicts, the amount of the verdicts that have been rendered for the loss of a limb, for the services of a wife or for the death of a child; while the lawyer at the trial can in a very few seconds produce the leading case or the case most analagous to his own, or to any particular phase of his own, which is presented, and from the court of last resort. If a book is thus useful, a minute criticism of it seems almost out of place.

With the aid of Mr. Leavitt's work and of the classifications of cases which he has given us, together with some examination of the reports and the record of cases in the Court of Appeals, we have gathered some statistics which may prove of interest to our readers.

STATISTICS OF NEGLIGENCE CASES.

Between 1820 and 1840 there were but a bare dozen decisions on the law of negligence in our highest court, and this record was only increased by eighty-eight from 1840 to 1860, while between 1860 and 1880 there were six hundred opinions rendered and within a score or so of that number during the next fifteen years.

The decade between 1850 and 1860 saw the first case against a steam railroad argued in the Court of Appeals (a cattle case in 1850), the first street car case (a collision with an Eighth Avenue car in 1856), the first case, by an employee (1851), and the first by a passenger (1854) against a steam railroad company, the first death case (1856) and the first case by a pedestrian (1858) against a street railway company. These street car cases are the only ones reported prior to 1860.

Prior to 1840 there is not an average of a case a year in the Court of Appeals; during the fifteen years preceding 1895 the average is thirty-seven a year, and during the three years from 1892 to 1895 the average is fifty.

Besides these interesting statistics, showing the remarkable and growing fecundity of the reports in negligence cases during recent years there are other facts and figures to be gleaned without very much difficulty from Mr. Leavitt's admirable condensation, classification, codification and indices.

All of the above figures, as well as those to follow, to be understood, need some explanation. They do not include all of the cases of negligence brought or tried, or even all passed upon, by an appellate court.

With cases settled, of judgments paid or compromised, before appeal or after decision by the general term (the intermediate appellate tribunal in New York State), this work and our statistics do not deal. But this by no means robs them of their suggestiveness.

There are also a large number of cases which have been decided by the Court of Appeals, which are not included in cases reviewed in Mr. Leavitt's work. They are the cases which have been affirmed, but without opinion. An examination of the reports and the records for a single year reveals upwards of sixty of such cases treating of the law of negligence, and it is probable that the number of cases actually passed upon by the court during the last fifteen years, instead of being something less than six hundred, is considerably more than twice that number.

Remembering these limitations, and speaking only of cases in which the court has rendered an opinion, we are startled to notice, that out of thirty pedestrians run over by street cars twenty were children and ten were adults, while of sixty-six run over by railroad locomotives only twelve were children.

The total number of street railway cases is			96
	of steam	" " "	458
	of stage coach	" "	4
of ferry, steamship, steamboat, etc.		" "	99

Mr. Leavitt by going to the printed records of the cases procures data which the official reporter in our opinion should supply. He gives us the amount of the verdict rendered in each case, and he has also classified the verdicts showing what verdicts have been rendered for death, for the loss of an arm, for injury to the spine, etc.

In view of the numerous deaths of children by street car accidents, it may be interesting to note that the average verdict for a child's death in the twenty cases reviewed by the Court of Appeals is $2000, the highest being $5000 and the lowest $120. When it is remembered that the defendant, who is generally the appellant in these cases, is far more apt to settle a case which has resulted in a low verdict and to appeal the case in which a high verdict has been obtained, we can safely say that the average verdict obtained is probably very much less than $2000. The average verdict for the loss of life of a man in the 145 cases reviewed by the Court of Appeals is $3350; and, in the twenty cases of the death of women is $3300. In forty-nine cases out of 145 the jury have given the full limit of $5000 for the death of men, and in four cases out of twenty for the death of women. Now that the $5000 limit has been removed the average will climb up.

*Communications relating to this department may be addressed to the editors, No. 32 Nassau Street, New York.

The following figures may be useful to a loss adjuster, when a claim for a ridiculously large amount is presented or a threat that a preposterous verdict will be obtained. *Out of the 1300 negligence cases in the Court of Appeals, only sixty-five resulted in verdicts of over $5000, and of these but twenty-eight were for sums in excess of $10,000, only three of them were over $20,000 and the only one over $25,000 was one for $42,500 which was reversed.*

If from the above figures are deducted all the cases wherein the judgments were reversed by the court, the number of large verdicts which have been sustained will be found to be very small indeed compared to the great number of cases passed upon by our highest tribunal.

Did time and space permit, it would be interesting to compare the average verdict of the past ten years with the average verdict of each of the previous decades. The growth in the size of the verdict would appear to be almost as surprising as the growth in the number of cases.

Out of the ninety-six street car cases fifty-eight are New York City cases, thirty-one are Brooklyn cases and only seven are from the other cities of the state. In only two of these seven did the court affirm judgments, and in neither case did the verdict exceed $1000.

In all that has been said we have not included in street car cases elevated railroad cases. There have been but eighteen in the Court of Appeals, seventeen of them being passed upon between 1885 and 1895. The average verdict in the eleven cases in which the judgments were affirmed is $3540, while the average verdict in the seven judgments reversed was $5678.

Space prevents a multiplication of these figures. If some reader is sufficiently interested in the subject let him figure on similar problems with Mr. Leavitt's book before him and give us the result of his labors. An exhaustive examination of the negligence cases tried before New York City juries, or even of all those passed upon by the General Term of the first department, would be a valuable contribution to this subject.

LIABILITY FOR NEGLIGENCE.

OHIO.—Act May 4, 1891 (88 Ohio Laws 582), provides that before a street car shall cross a railroad track at grade it shall be stopped, and that some employe of the company shall go ahead and ascertain whether the way is clear, and that the car shall not proceed until signaled to do so by the employe, or until the way is clear. *Held*, that when there is but one employe operating the car it is his duty to stop the car and go ahead to ascertain whether the way is clear, before driving the car over the crossing.—(Cincinnati St. Ry. Co. v. Murray's Adm'x, 42 N. E. Rep. 596.)

PENNSYLVANIA.—In an action for injuries to a child, caused by a street car, where there is testimony that the motorman, at the time of the accident, failed to see plaintiff because he was looking in another direction, at persons assembled at the side of the street, and there is no question of contributory negligence, the case cannot be withdrawn from the jury.—(Harkins v. Pittsburgh, A. & M. Tr. Co., 33 At. Rep. 1045.)

U. S. COURT.—In an action for injuries caused by a movement of a street car while plaintiff was trying to enter thereon, where witnesses testified that at the time plaintiff endeavored to board the car, which was in motion, they got on without difficulty, it was error to refuse to charge that plaintiff could not recover if the injury was occasioned by the want of ordinary care and prudence on his part, and to refuse to instruct the jury what was meant by ordinary care.—(Quincy Horse Railway & Carrying Co. v. Schultz, 71 Fed. Rep. 487.)

IOWA.—In an action against a street railway company for personal injuries received in being thrown from a street car, evidence that defendant paid plaintiff $1.50 and received a receipt discharging it from liability, and that the conductor of the car from which the plaintiff fell did not know for what corporation he was working, is insufficient to show that the car was operated by defendant, where defendant's manager testified that the car belonged to another corporation, of which he was also manager; the two corporations being operated under an arrangement that the total operating expenses of both should be apportioned between them in proportion to the number of cars run by each, the earnings from the lines being kept separate.—(Anderson v. Des Moines St. R. Co., 66 N. W. Rep. 64.)

NEW YORK.—In an action for the death of a child killed by a street car, all of plaintiff's witnesses testified that the car was going fast, and that the boy was first knocked down by the horses, but their testimony was conflicting. Defendant's witnesses testified that the car was going slowly; that the boy ran from the curb, and fell under the car, and was run over by a back wheel. Their testimony was consistent, and most of them were disinterested. *Held*, that it was error to submit the question of defendant's negligence to the jury.—(Goldschmidt v. Metropolitan Cross Town Ry. Co., 37 N. Y. Supp. 299.)

NEW YORK.—Where there is evidence, in an action against a street railway company for personal injuries received in a collision with defendant's cable car, that plaintiff, who attempted to cross defendant's tracks when the car was eighty feet distant, motioned the car to stop, and whipped up his horse to clear the track, and that no attempt was made to slacken the speed of the car, which was approaching at the speed of seven miles an hour, the question whether defendant was negligent is for the jury.—(Reilly v. 3d. Ave. R. Co., 34 N. Y. Supp. 593.

MISSOURI.—Recovery for injury to one who tries, by hurrying, to cross a street car track ahead of an approaching car, and is struck by it before he can get across, is barred by reason of his contributory negligence, though the motorman may be negligent in not stopping the car.—(Watson v. Mound City St. Ry., 34 S. W. Rep. 573.)

MISSOURI.—Plaintiff was a passenger on one of defendant's summer street cars. Defendant's driver acted also as conductor. A fellow passenger inadvertently threw a lighted match on plaintiff's dress, which blazed up suddenly. The driver immediately stopped the car, but before he could render any assistance to plaintiff she had left the car from the rear door, and was severely burned before the flames were extinguished. *Held*, that defendant was not chargeable with negligence.—(Sullivan v. Jefferson Ave. Ry., 34 S. W. Rep. 566.)

OHIO.—The introduction of new forms of vehicles and of new motive power on street railways has not impaired the right of the foot passenger to safe passage at street crossings.

When a street railway company operating a double track road discharges a passenger at a street crossing, having reason to know that such passenger, in order to reach his destination, must cross its tracks, it is the duty of such company to regard the rights of the passenger while on the crossing, and to so control the speed of cars on its tracks, and give such warning of their approach as will reasonably protect the passenger from injury. Omission of such duty is negligence.—(Cincinnati St. Ry. Co. v. Snell, 43 N. E. Rep. 207. See also Van Natta v. People's St. Ry., Elec. L. & P. Co., 34 S. W. Rep. 505.)

NEW YORK.—Evidence that a boy nine years old, starting to run across a narrow street in the middle of a block, at a point where there was at least one team, when "it was a little dark," fell on a horse car track, and received injuries from the horses of an approaching car; that at the time he fell the horses were twenty-five or fifty feet from him, leaving, as the same witnesses testified, but a second or a tenth of a second for the car to reach him after he fell, with evidence that the driver was looking to one side, and did not see the boy, and that a car can be stopped in about five feet after application of the brake, is not sufficient to go to the jury on the question of negligence or freedom from negligence. Williams, J., dissenting.—(Bello v. Met. St. Ry., 37 N. Y. Supp. 969.)

NEW YORK.—Negligence on the part of those in charge of a cable car cannot be inferred merely from the fact that as plaintiff was about to take his seat he was thrown to the floor by the sudden starting of the car, there being no evidence that any unnecessary or unusual force was applied by the gripman.—(Black v. 3d Ave. R. Co., 37 N. Y. Supp. 830.)

CHARTERS, FRANCHISES, ORDINANCES, ETC.

TEXAS.—The old Dallas city charter (Act 1885) made a street railway company liable for paving portions of the street between its tracks. The ordinance of 1887, granting plaintiff's assignor its franchise, provided that such assignor was to pay "the cost of improving the space between the rails." The new charter (Act 1889) provided that "all contracts" for street improvements "now outstanding" should be paid for, and the assessment therefore levied under its provisions, and made railroads liable, as before, for paving the space between its tracks. Plaintiff in 1891 placed a new track on a street already paved and paid for under the old charter, by authority of an ordinance granting it such right, subject to conditions of its franchise, and, at its own expense, relaid the pavement between the tracks. *Held*, that plaintiff was not liable to the city for the cost of the original pavement between its tracks.—(City of Dallas v. Dallas Con. St. Ry., 33 S. W. Rep. 757.)

TENNESSEE.—The franchise of a street railway company to operate its road and use the streets of a city is derived from the legislature through its charter, and not from the municipal corporation, though the consent of the latter be required to the exercise of its authority. Such franchises upon acceptance by the company, becomes a contract, inviolable and irrevocable; and the consent of the municipality, when once given, cannot, in the absence of a statute authorizing its withdrawal be withdrawn, either as to streets actually occupied or as to streets included within the general plan of the company's routes, which it intends in good faith to complete.—(Africa v. Board of Aldermen of Knoxville et al., 70 Fed. Rep. 729.)

OHIO.—In the extension of a street railway over streets not occupied by any road, under the provisions of sections 3437-3443, Revised Statutes, inclusive, the consents of the owners of more than one-half of the feet front of the lots or lands abutting on each street to be occupied by such extension are requisite.—(Mt. Auburn Cable Ry. Co. v. Neare, 42 N. E. Rep. 768.)

Progress of Electric Traction Abroad.

In a recent interview with a representative of the STREET RAILWAY JOURNAL, Captain Eugene Griffin, first vice-president of the General Electric Company, said:

"Considerable progress has been made on the Continent in the introduction of electricity for street railway and for lighting purposes. Despite the pioneer work of the old German companies, the Thomson-Houston system has a remarkable lead over other systems in number of roads as well as number of cars equipped.

"The objections urged against overhead wires on the Continent have been largely overcome. The overhead system is in use in the Public Square in Milan, immediately in front of the famous cathedral. Many of the principal streets in Hamburg, Bremen, Havre, Rome, Brussels, and other cities are occupied by tramways operated by the overhead system. Overhead lines are now being constructed in Berlin, in Leipsic and other large continental cities.

"Very little has been done in the way of underground conduits. Some miles of conduit are now being constructed in Brussels to operate in connection with the overhead system, although the latter is and has been for some time actually in use on some of the principal boulevards of the city.

"The Union Elektricitäts-Gesellschaft, which owns the Thomson-Houston rights in Central Europe, has secured ample financial assistance by forming a syndicate of German banks, consisting of the Disconto Gesellschaft, the Dresdener Bank, Bleichroeder, Born & Busche, Bank für Handel und Industrie, and Ludwig Loewe & Company. This syndicate organized a stock company called The Company for Electrical Undertakings with a capital stock of M15,000,000. This company purchased and owns two-thirds of the Union Company.

"Similar companies for electrical undertakings have been organized in Belgium, Switzerland, Austria and Hungary, one-half the stock of each of these companies being owned by the German company, and the other half being taken by the prominent local banks. The total capital of the banks which are associated in these companies for electrical undertakings is M974,000,000. The German company has been so successful that it became necessary to increase its capital, and M15,000,000 additional were issued, making a total of M30,000,000. The second M15,000,000 were offered to the public at 136. There were 12,000 individual subscriptions aggregating M560,000,000, and over M100,000,000 were subscribed on the basis of pooling the stock for six months so as to withhold it from the market. The official allotment provided as follows:

"'With reference to the allotment of subscriptions for the shares of the company for electrical undertakings, it has been resolved that, for shares not pooled, subscriptions up to M100,000 get nothing. Subscriptions from M100,000 to M200,000 are allowed one share; from M200,000 to M300,000 two shares, but no one subscriber is allowed more than ten shares. The method of allotment for pooled shares has been left to the discretion of the various banks receiving subscriptions, but no one subscriber to pooled shares is to have allotted to him more than twenty shares.'

"These figures indicate the general feeling of the German investing public in reference to electrical enterprises. Unfortunately for us the patriotic regard of the Germans for Fatherland has led to the construction of a fine factory for the German Thomson-Houston Company, and 'German money for German industry' is the rule.

"The French Thomson-Houston Company has also constructed a first class electrical factory in the suburbs of Paris and is doing a large and profitable business.

"The development in England is less pronounced and most of the English companies have failed to show any great financial success. The overhead system has recently been introduced in Bristol and Dublin. In Leeds, the Highways Committee recommended to the City Council that a mile or so of one of the principal streets should be provided with underground conductors. The City Council rejected the recommendation and referred the report back to the Highways Committee. It was understood that a recommendation for all overhead wires would be satisfactory.

"The Bristol road, installed last October by the British Thomson-Houston Company, has satisfied the Board of Trade as to their ability to meet its rules, and this road has been so successful from an operating as well as from a commercial standpoint that the local company has placed additional orders with the British Thomson-Houston Company, and proposes to electrically equip its entire system as soon as the necessary rights can be secured. The electric railway is very popular with the people of Bristol, and there will be no opposition to the extension of the overhead system throughout the entire city.

"The Dublin installation is somewhat unique in this—that the power house is placed at one end of the line, and in order to comply with the rules of the Board of Trade, it is necessary to divide the line into sections and use an alternating power transmission system, converting the current from alternating to direct, and reducing its potential to feed into each section for the operation of the cars by direct current in the normal way. This road is about ready for operation at the present time.

"There has been in England, for some time past, a decided movement towards the municipalization of street railways and lighting companies. Municipalization is generally advocated by the Liberals, and opposed by the Conservatives. The Conservatives being now strongly intrenched in power and, more particularly, having many of their prominent men in high municipal positions, as mayors of many of the large cities, there has been a distinct reaction on this subject, and it is probable that there will be much less progress made in the direction of extending the power of municipalities to do lighting and railway work in the next five years than there has been in the last.

"In Glasgow and some other cities where the municipality owns and operates the tramways, the financial success of such operations has not been pronounced. We know from our experience in this country that it is quite common for municipalities, in reporting the cost of operating lighting plants or street railway plants, to overlook many important items, such as rent, depreciation, street repairs, etc., to take no account of the loss which the municipality may sustain in receiving no rentals from private corporations which they might otherwise receive without investment, and in many other ways to fail to make a showing comparable with the showing that would be made by a private corporation if operating such lighting plant or tramways. It is, therefore, sometimes difficult to tell just how successful or unsuccessful municipal ownership and operation has been from a financial standpoint, but the above statement is based on the best information I could obtain.

"One of the great obstacles to the development of the electric railway in England is the fact that all street railway charters provide specifically for operation by animal power, and in order to introduce electricity it is necessary not only to obtain the consent of the municipalities, but also to secure from Parliament a modification of the charter. This takes time and costs money. Another difficulty is the fact that a majority of the franchises provide that the municipality shall have the right to purchase at the expiration of a fixed period—generally twenty-one years—from the date of the franchise. These franchises are now expiring and, of course, until some determination is had, no corporation can afford to make any great expenditures for changing the motive power. In such cases, the municipality must exercise its right to purchase and then equip the road electrically, or the municipality must decide that it does not want to purchase and approve a further lease for twenty-one years with the right to use electricity.

"A very earnest effort is being made to so modify the laws as to sanction the general use of electricity, subject to the consent of the municipal authorities, or in other words, to pass a general act changing the provision as to the use of animal power in the charters to permit the use of any form of mechanical power."

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Special effort will be made to answer promptly, and without charge, any reasonable request for information which may be received from our readers and advertisers, answers being given through the columns of the JOURNAL *when of general interest, otherwise by letter.*

Street railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our Directory, our Financial Supplement, or our news columns.

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Havemeyer Building, 26 Cortlandt St., New York.

WITH the approach of summer the best method of increasing pleasure traffic will naturally occupy the attention of many street railway managers. The fact that this is a growing department of the street railway business is shown by the interest in the subject of parks and other pleasure resorts and by the increasing number of street railway companies which are establishing parks of their own. The unanimity with which railway companies which have established parks regard their investment as profitable would perhaps be surprising to a person who had not carefully followed recent developments. But the fact is that electricity has wrought a revolution in this department of the transportation business as in others, for, by their higher speed, the electric cars have made distant resorts more accessible and the trips more enjoyable than when animal power was used. In most cities where the experiment has been tried by the transportation companies of giving entertainments at parks, the investment has proved profitable. Where this was not the case, the trouble has usually been either that too expensive or too frequent entertainments were attempted, or that the tastes of the public were not carefully studied. The latter is an important point. It has been found that an entertainment which is popular in one city has failed in another. Fireworks form a very desirable and effective method of entertainment, and very striking results can be secured in this line at a low cost. Where the park contains or fronts upon a lake or river, electric storage launches, charged from the trolley current, supply another popular attraction. By studying the desires of its patrons a company can soon learn their preferences, and can select its entertainments to suit them.

THE proposed plan of leasing the cable railway on the Brooklyn Bridge to existing transportation companies in New York and Brooklyn will, if consummated, form an interesting chapter in the history of municipal control of railways. The proposition is that the tracks on the bridge be connected with the elevated railway systems in both cities, so that the companies operating these separate systems can run their trains across the bridge and land through passengers in each case at the further bridge terminus. No further through business is contemplated, so that the trains of none of the companies will run over the structure of another company. The fares for transportation across the bridge alone will remain as they are at present, the through fares are to be fixed at five cents, and the rental paid to the bridge authorities for the use of the structure is to be the average net receipts of the bridge railway during the last three years. The proposition is said to have been agreed to by both bridge trustees and officials of the railway companies concerned and the former are now before the New York Legislature asking power to carry out the plan. There have been many propositions advanced for the municipal control of railway corporations, but this is the first instance in this country since the early days of railroading, so far as we are aware, of the leasing of a railway which for a number of years has been under municipal control, to a private railway corporation. During the time in which the line has been in operation, the trustees and management of the Brooklyn Bridge have been the objects of more than the usual amount of public abuse on account of delays and alleged mistakes in construction and service. The traffic during this time has been enormous and has greatly overtaxed the carrying capacity of the road, while the terminal facilities have been seriously inadequate to the needs of the line, and it is doubtful whether even the best private management could have done any better under the circumstances. But the fact that the present management has not been able to satisfy everybody is interesting as showing that municipal control will not be a great panacea for all the ills of local transportation, as is so often claimed. The public would undoubtedly be benefited in the way of reduced fares by a consummation of the proposed plan, as a great majority of the passengers on the bridge now pay both elevated and bridge fares. The rental has been attacked by a number of persons and by the public press as being too low, in view of possible future increase of traffic with the increase of population. It must be remembered, however, that there is now but one East River bridge, whereas during the next ten years, one or two more may be built, while four or five are not an impossibility before the end of the next two or

three decades. The only feature in the proposed plan to which objection could be made is that no provision is made for the surface railway companies. Many of the present passengers on the surface lines cross the bridge, and these companies are as much interested in carrying through passengers to and from New York and Brooklyn as are the elevated railroad companies. If they are not given equal facilities with their elevated neighbors a considerable amount of their traffic might be diverted to the elevated lines, and this is doubtless the object most clearly in the minds of the elevated railway managements.

DURING the last winter, bills were introduced in the legislatures of a number of states to compel all the street railway companies in those states to equip their electric cars with vestibules. Similar laws are already in force in certain states. A demand that a street railway company shall protect its motormen from storms and cold weather by the use of vestibules might seem at first sight to be a reasonable one. If the vestibule accomplished what is claimed for it by its advocates there would probably be little objection to its use from the railway companies on account of increased expense. But experience has shown that it is not an unmixed blessing, so that while there are many companies which have adopted vestibules voluntarily and would not remove them, they have certain objections which our legislators might well bear in mind. In view of the fact that injustice is often produced in the compulsory adoption of vestibules, it is well to enumerate a few of the disadvantages attending their use, as given by some practical street railway managers. If the window in front of the motorman is kept closed it is apt to become frosted over or covered with snow during stormy weather so as to interfere with the view of the motorman, thus tending to increase accidents. On the other hand, if it is kept open, the chance of the motorman catching cold is considerably greater than if he were standing upon an open platform, because he receives the full force of the wind against his chest, while the warmth of the vestibule makes it uncomfortable for him to protect himself by clothing as thoroughly as if he were standing in the open air. Even when it is possible to operate a car with the front sash closed, the motorman must open it to turn every tongue switch which is pointed in the wrong direction, and if the vestibule is at all warm he will be more apt to suffer in doing this than if there was no protection and he was well wrapped up. If passengers enter and leave the car by the front as well as the rear platform and the side doors to the vestibule are kept open, the latter will be swept by a side draft as well. From a mechanical standpoint also, the addition of the extra weight of a vestibule at the extreme ends of a car is an undesirable one, and the entire question is one which can be well left to the discretion of the railway company, instead of being made the subject of legislative enactment.

THE annual report of the General Electric Company is as clear, frank and intelligible as can reasonably be expected from a manufacturing corporation. Every item in the balance sheet and profit and loss account is carefully explained. During the year ending Jan. 31, 1896, the company earned $13,736,708 gross, of which $10,521,921 was expended in manufacturing and depreciation accounts, $1,899,641 for general expenses, legal expenses and taxes, and $437,500 for interest, leaving $877,645 applicable to reduction of the deficiency. The company has visible assets including factories, real estate, cash, inventories and work in progress amounting to $9,982,543, securities, notes and accounts receivable in treasury valued, apparently conservatively, at $12,063,455, and patents and franchises valued at $8,000,000. This last named item is the one most frequently criticised in the balance sheets of manufacturing companies, but we find some light upon the question of the true value of the company's patents in the profit and loss account. Here there is an item of $585,609 derived from royalties and sundry profits, while the difference between manufacturing cost of goods sold and prices obtained amounts to $2,859,842, or over twenty per cent margin, in spite of the low prices at which electrical apparatus has been sold during the past year. If we can assume that the company earns from royalties and "monopoly profits" at least $800,000 a year more than would be the case were it not in possession of the immense number of early patents which it owns (and for which it has actually paid doubtless, many millions of dollars) the item of $8,000,000 is fully justified, for out of this $800,000 of special profits enough can be set aside each year to provide for the expiration of the patents at their maturity, while still leaving a reasonable return upon the $8,000,000. On the liabilities side of the balance sheet we find the capital stock, $34,712,000, about $500,000 of current liabilities, which any corporation of this magnitude must necessarily have on its books, and $8,750,000 of five per cent debentures, which represents practically the entire indebtedness, and the interest upon which is nearly taken care of by the dividends and interest received by the company from the stocks and bonds in its treasury. The best point about the balance sheet is the entire absence of a floating debt, and when it is stated in addition that the company's name has not been once used during the year either as a maker of a note or even as the endorser of the business paper obtained in settlement of its accounts, the financial strength of the company is the more evident. Another evidence of the conservative way in which the company's business is conducted is the statement that over $11,000,000, or nearly eighty-four per cent of the total collections made during the year have been secured in cash, less than fifteen per cent in notes and but two per cent in securities, while over ninety-three per cent of the sales made during the year provided for payment in cash in sixty days. The company's deficiency of nearly $14,000,000 will probably be wiped out during the next year by a reduction of the capital stock, and it will then be in a position to return to a dividend paying basis.

A Question of Profits.

For some time past we have suspected that the profits possible to be derived by street railway companies from freight, baggage, express and mail service have been exaggerated by over sanguine promoters and managers. Capital for not a few new enterprises, particularly for interurban work, has been obtained upon the representation that the freight and express business alone would carry the enterprise or would add so materially to the passenger traffic as to make the investment profitable. From a large number of replies to a circular letter of inquiry sent out by us a few weeks ago concerning this traffic, and which are published in another column, we find substantial

grounds for our suspicion. In the vast majority of cases the profits shown by any separately conducted freight, express or mail business are pronounced insignificant or negative. It is worth while to inquire into this question a little to determine why this is so, and under what conditions, if any, a profitable service can be established.

Consider first a freight service pure and simple involving the carriage of merchandise in bulk. Within city limits there is rarely a field for such service whether given by steam or electricity. Municipalities do not, will not and should not ordinarily give up the use of streets to the tracks, switches and—in the case of electricity—the overhead structure necessary for a purely freight service between factories and shipping points. We sometimes find, it is true, terminal or belt railways connecting the factories in the outskirts of a city with its general railroad freight stations, but here electricity has no proper field, and cannot, in all probability, effect material economies.

Suppose, now, that an electric railway operating between two manufacturing towns twenty miles apart, with one or two manufacturing towns on its line, should institute a freight service. We cannot presuppose the absence of competition, for these towns would not have grown to be manufacturing places of any consequence had shipping facilities been lacking. In nearly every case the competition would be between steam railroads, but a few cases have been found, though not, we think, involving distances greater than five or six miles, where for special reasons, shipment by wagons only was possible prior to the advent of the electric railway. Now, the electric railway under the conditions named is nearly always at a serious disadvantage with a steam line, inasmuch as the latter is but a feeder to a general railroad system, and rates can be made, therefore, which if met by the electric railway, would mean an actual loss for the short haul only. This part of the question does not need further comment. The question of electric haulage of freight in competition with drays for distances of twenty miles or less involves more difficulties, but it is safe to say that no electric line of this character should be built unless the passenger traffic alone would be sufficient to carry the investment so that the freight business would be an additional source of revenue, if on the closest investigation it were found to be, in fact, a profit earner. Horses are cheap in these days, while the interest on the investment necessary for building switches into each factory along the line and the expenses of operating a freight service are such that the total quantity of freight to be transported per day *for 365 days in the year* must be large if a freight service is to be in itself profitable.

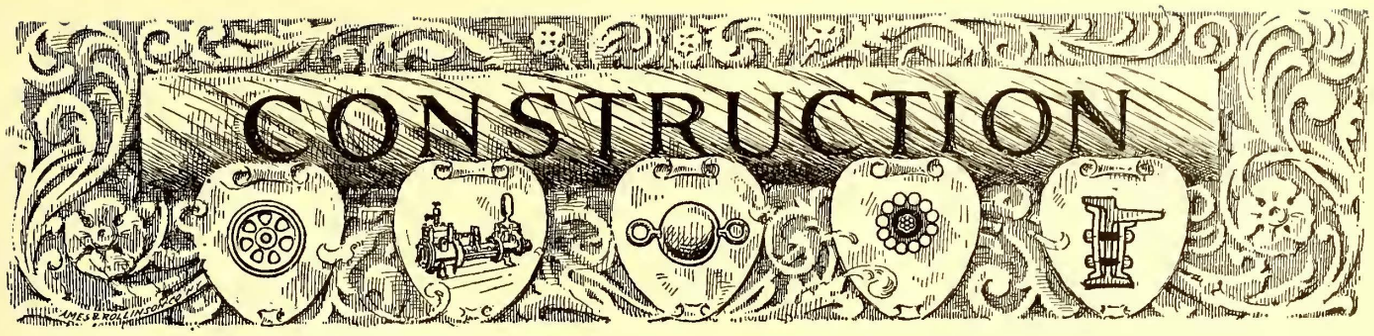
It is the express service which has taken such hold upon the imagination of street railway managers in their desire to increase the profits of their properties. Here, again, we have, nominally at least, two fields of effort, one the city itself with its suburbs reached by street railway lines, and another the cities and towns along an interurban line. The first field is extremely limited and cannot, we believe, be occupied to any advantage by a street railway company unless under the most peculiar and unusual circumstances. The difficulty lies, of course, in the collection of parcels from the sender and their delivery at the house or office of the recipient. A wagon service seems absolutely necessary for such a business and the question really is, therefore, Is there sufficient advantage in transporting by electric cars a large number of bundles from a point in the heart of the city to a point in the suburbs, transfer to depots or wagons to be made at both terminals? The answer must almost inevitably be negative.

Now, on interurban lines up to fifteen or twenty miles in length there is sometimes a chance for profit in an express and baggage service, provided that parcels can be carried in regular passenger or combination cars without serious loss of passenger room—in other words, if the service can be so handled that whatever is obtained from it is clear profit and no extra expenses are involved. We have ridden on a good many combination cars where the freight and express compartment was from one-third to one-half the capacity of the car, and we have yet to find a single case where anything like the full capacity of this compartment was utilized except as a lounging or a smoking room. As a matter of fact, the cases are very rare where there is a sufficient parcel traffic between one large city or town and several dependent townships to warrant a service at all commensurate in frequency with that required in passenger traffic. Of course, questions of profit in a service even of this character are seriously complicated if terminal delivery by messenger or wagon is necessary. This can sometimes be avoided by the sending out of postal cards notifying consignees that parcels are waiting for them at the company's station, but ordinarily it will be found that there is then too little inducement for the separate shipment of parcels and "shoppers" will carry their own parcels home in preference to paying any extra charges. As to the question of separate express cars, this is in almost every case an absurdity.

Some months ago there was described in the Journal an interesting express service given between San Francisco and two suburban towns, San Leandro and Haywards, the latter eighteen miles from the Oakland water front. Here express wagons were loaded up in San Francisco, ferried to Oakland, loaded upon electric cars and sent, one to Haywards and the other to San Leandro, where horses were attached and their loads delivered. The wagons were then loaded up for the return trip to San Francisco. Express matter for intermediate points was left at different places along the line and delivered by agents. One round trip was made per day. This service involves, perhaps, the ideal arrangement for the particular conditions met with, but it has been abandoned as unprofitable.

The opinions given by our correspondents as to mail service are almost, though not quite unanimous in stating that the service is unprofitable when given in separate postal cars, but profitable to the extent of the entire receipts when closed pouches can be carried on the front platforms of regular passenger cars. In other words, the Government does not pay, and we presume does not intend to pay more than merely enough to cover the absolute cost of the service, leaving the profit to a company that incidental advantage arising from the ability to obtain an undisputed right of way in case of labor difficulties. This is an important advantage, however, and one which will generally warrant a company in obtaining a mail contract entirely apart from the question of money profit.

Summing up the foregoing discussion we believe that a city and suburban street railway company will rarely or never be able to add materially to its net income by giving a freight, express or baggage service, and that the most rigid investigation of the field of effort should be made by the managers of an interurban line before undertaking such a service, as it offers in most cases little inducement.



Electric Conduit Construction in Washington.

The electric conduit system on Ninth Street, Washington, of the Metropolitan Railroad Company, the construction of which has been described in the STREET RAILWAY JOURNAL by the engineer of the company, A. N. Connett, has operated very satisfactorily during the last winter, in which several severe snowstorms visited Washington. The company is so well satisfied with the system that it is equipping its F Street line, 12½ miles long, with the same conduit, as rapidly as possible. About two-thirds of this is now completed. The Ninth Street line, now in operation, is 7¾ miles long. The success of the service is shown by the fact that an additional section of about 7000 ft. of similar conduit is also being laid in Washington by another company, the Washington, Alexandria & Mt. Vernon Railway Company.

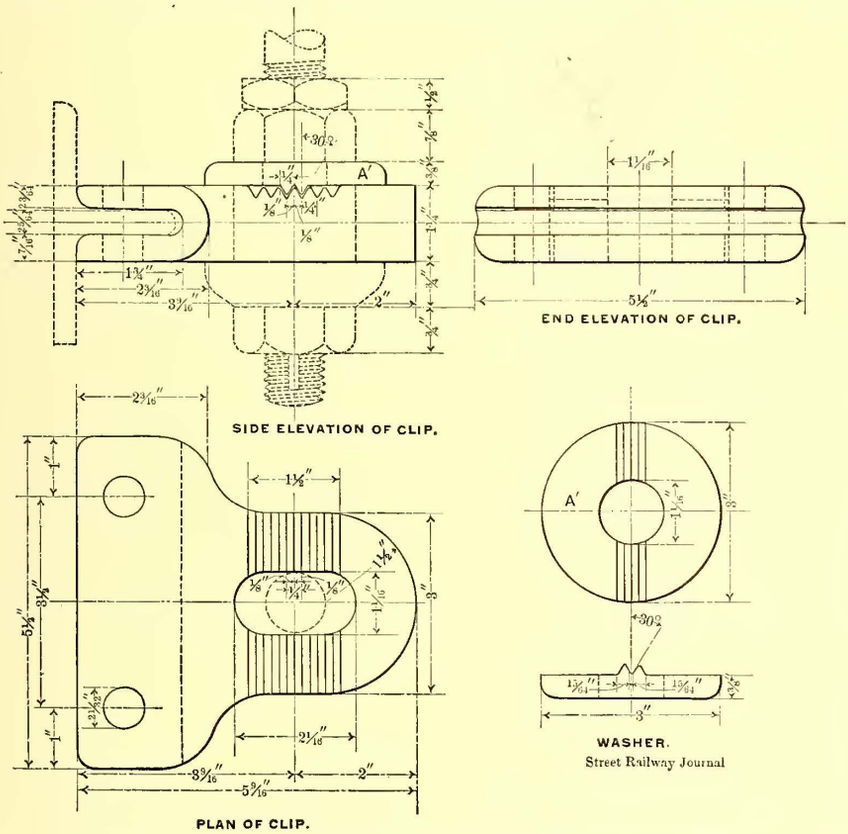
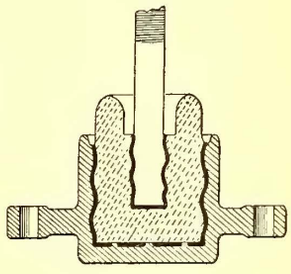


FIG. 1.—NEW CLIP AND EAR FOR UNDERGROUND CONDUIT.

A portion of the line of the Metropolitan Railroad Company is upon very low ground, and it was upon this section that trouble was anticipated, if any should occur. Though provision was made for draining this as well as the other sections, as well as possible, the downfall of rain has been so heavy that the sewers could not carry the water off and a portion of the line has been flooded. Under such circumstances the voltage on the section on which this occurs can be reduced at the station by means of a water rheostat from 500 volts to 300 volts or less. The cars are then able to run, though, of course, at a greatly reduced speed. The electrical leakage during such times has been from 300 to 550 amperes. The maximum average leakage on the negative side with the positive side grounded is one ampere for the length of the entire line, a low figure considering that in this distance there are some 6500 insulators.

One of the most interesting facts noticed in connection with the operation of this line has been the remarkable difference between the insulation resistance between conductor and ground of the positive and negative sides of the circuit. This varies on the positive for each section, as shown by Mr. Connett in the JOURNAL for February, from 6000 to 8000 ohms on a wet day to from 25,000 to 36,000 ohms on a dry day. The negative conductor under similar conditions shows an insulation resistance of from 300 to 400 ohms and from 700 to 1000 ohms. This leakage cannot be due to difference in the construction of the circuits, because when the polarity of the conductors is reversed, the high insulation remains a characteristic of the positive and the lower insulation of the negative conductor. The real cause has not yet been determined, but it may be that it can be explained by the theory of a deposition on the negative insulators due to electrolytic action.

The company has made a few slight changes in the construction of insulators since their description in the STREET RAILWAY JOURNAL. These changes have been of a mechanical nature and designed to facilitate adjustments and construction. One of these is a change in the clip, illustrated in Fig. 1. This improvement lies in the use of a toothed washer which engages with corresponding teeth cast in the malleable iron clip. Formerly liners were used to adjust the position of the clip in the con-



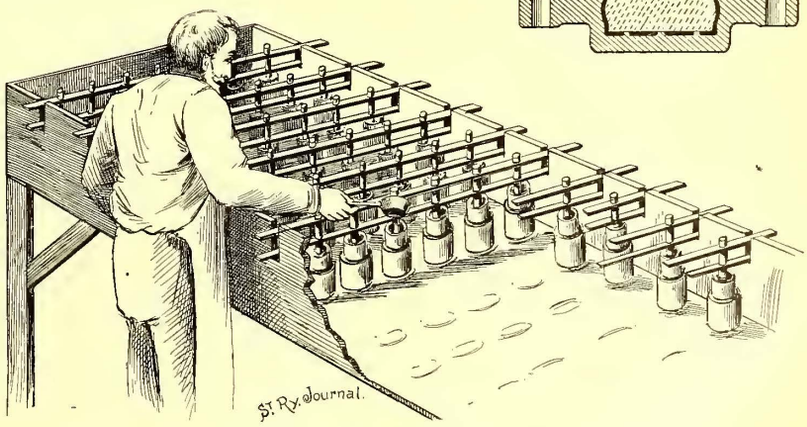


FIG. 2.—METHOD OF ASSEMBLING INSULATORS.

duit, but these are now avoided by the construction shown in the engraving.

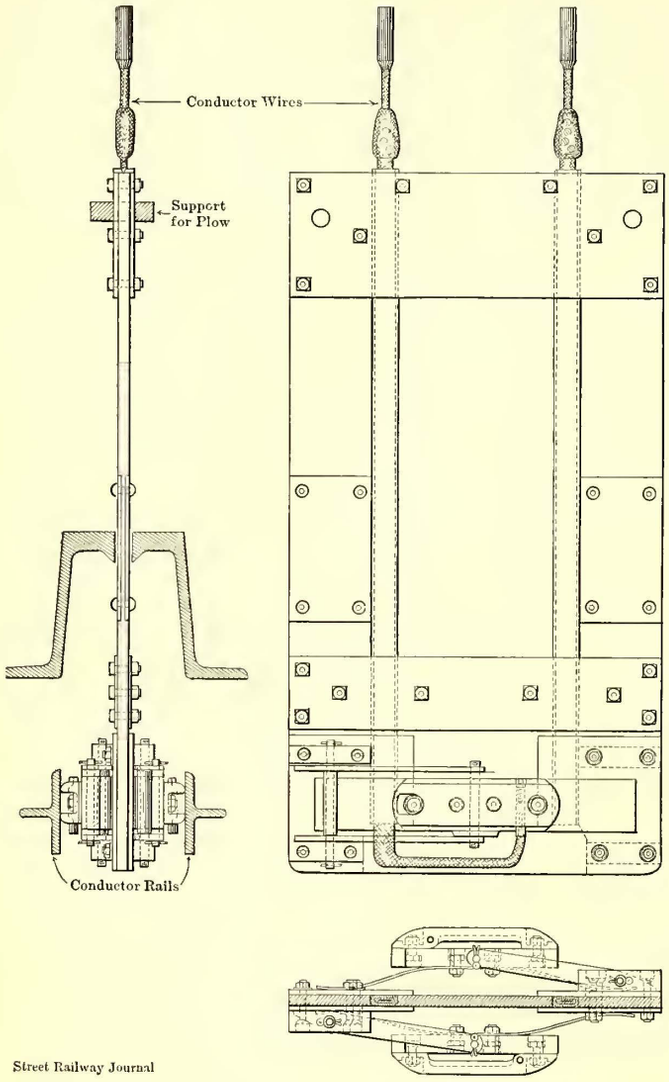


FIG. 3.—PLOW—METROPOLITAN STREET RAILROAD.

All insulators are assembled in the car houses of the company. A sketch of the room where this is performed is given in Fig. 2, with a section of one of the insulators.

As will be remembered the insulator is a porcelain cup holding by cement a shank and being held with cement in a cast iron cup. A small piece of wood is first cemented to the base of the porcelain cup which is then set into the iron cup and liquid cement poured around it. The method of aligning the iron shank is shown in the engraving. The cups are placed in long boxes in rows of six each, each box containing from forty-eight to eighty-four or more insulators. The shanks are then passed through light wooden frames. There are at right angles to the sides of the box and hold the shank upright. After the cement, which is poured in a liquid form, has hardened, the light wooden frames are slipped off the shanks and the insulators removed.

At the power station which is at the terminus of its line, the company has three Providence Corliss engines with cylinder dimensions 17½ ins. and 32 ins. × 48 ins., each direct connected to a G. E. 300 k. w. generator. The boiler room contains three Campbell & Zell boilers and Snow pumps. A jet condenser is used.

A specially interesting feature of the station is the switchboard which is of the General Electric panel type, but changed in a number of particulars to adapt it to the peculiar conditions presented by the road. The generator and feeder panels are similar to those of an ordinary board, but the negative switches are all on a separate board at the left of the other panels. On the center panel are ten lamps. These can be connected in two circuits of five lamps each between each bus bar and the ground, giving a fair idea of the insulation resistance of each circuit. Each lamp is arranged so that it can be short circuited if desired, or all ten lamps can be thrown in series between the two bus bars. The higher insulation resistance of the positive side of the system is clearly shown when both bus bars are connected to ground through five lamps each. Those on the positive side burn nearly up to full candle power, while none of those on the negative shows any signs of being red until one, two or three lamps have been short circuited.

At the right of the switchboard is a separate panel, controlling the operation of the water rheostat to which reference has already been made. By means of switches in the rear of the board this rheostat can be thrown in series with any one or more of the feeders. The rheostat is below the station floor and contains two large iron plates each about 4 ft. × 5 ft. One of these is immersed in a wooden tank and the other is so arranged that it can be lowered into this tank from the station floor by means of a crank and windlass. The plates are kept apart at a distance of thirty inches on a horizontal line. The tank is set on porcelain insulators so that it is not grounded. Salt water is used as an electrolyte.

The car house is a handsome structure adjoining the station and embodies a number of novel features necessary on account of the use of dependent plows. Near the entrance of the storage part of the house is a pit transfer table and along the sides of this pit are conductors against which shoes connected with the conductors on the table press, so that the table conductors are always alive. The cars for storage are run from this transfer table back into the car house on one track, which is equipped with conductors, to a transfer table in the rear where they are shunted to one of a number of storage tracks not equipped with conductors. These storage tracks are all on a slight grade sloping from the rear of the house so that any car can be

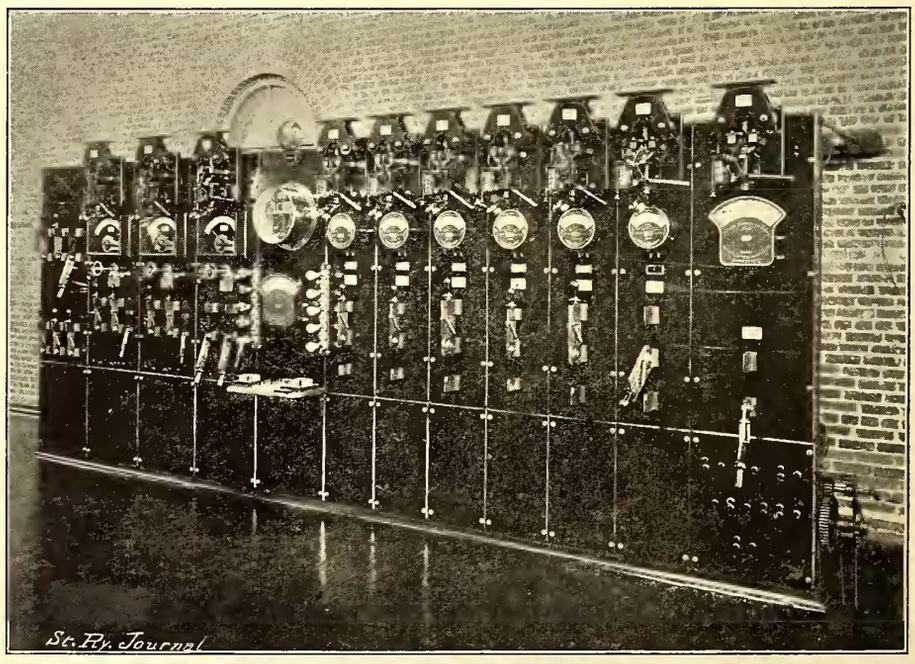


FIG. 4.—SWITCHBOARD—METROPOLITAN STREET RAILROAD.

run without power to the transfer table near the front of the house where the conductors are alive.

The cars of the company are of a standard length of sixteen feet and are run in trains of two each, the forward car only being equipped with motors. The motors and open trailers on the Ninth Street line were built by the J. G. Brill Company and the closed trailers by the American Car Company; they are very handsomely finished, are electrically heated and are lighted with ten lamps each. All motor cars are mounted on Brill trucks. On the P Street line American cars and Peckham trucks will be used.

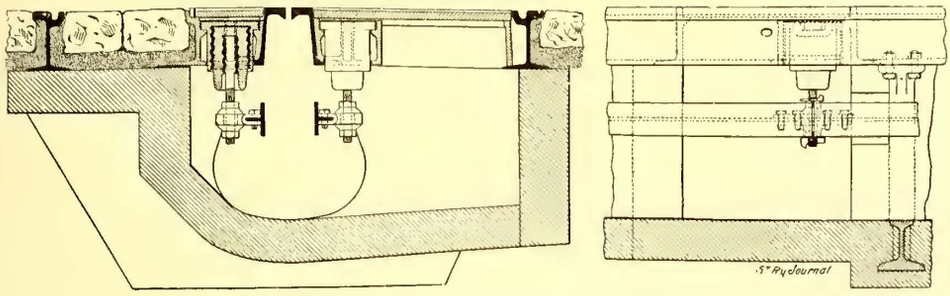


FIG. 5.—CROSS AND LONGITUDINAL SECTION OF CONDUIT AT INSULATOR.

A table was given last month of the expenses of the power station for January, 1896, including the cost of power necessary to heat and light the cars.

High Speed Line Between Washington and Mount Vernon.

The Washington, Alexandria & Mount Vernon Electric Railway Company, which has been in operation for some time and which connects with a ferry from Washington, has nearly completed its tracks to the corner of Fourteenth Street and Pennsylvania Avenue, Washington. The line will cross the Potomac over Long Bridge and will have in the city of Washington about 1½ miles of track equipped with an electric conduit. In this construction, which is being put in by E. Saxton, the methods adopted by the Metropolitan Railroad Company, of Washington, which have been described in the STREET RAILWAY JOURNAL, will be closely followed. The entire line when finished, which will be in the course of a few weeks, will comprise about nineteen miles of track.

Steam railroad construction has been closely followed in track and rolling stock, and the company is billing through freight. The track is laid with standard Pennsylvania Railroad T rail on ties spaced fourteen to the rail length. There will be in all thirty-six cars, of which five will be freight trail cars and one freight motor car. The latter is similar to an ordinary freight box car and will haul the freight cars billed to points along the road which it receives from the steam railroads. The passenger cars will run in trains of three or four each and a speed of from forty to fifty miles an hour will be attained. The motors are of the General Electric 2000 type and both passenger cars and trucks have been supplied by the J. G. Brill Company.

Each car is equipped with a double trolley, one for each direction of running. The form of the trolley is similar to that in ordinary use, except that it is made heavier, and the trolley wheel has a broad square groove with flaring edges. The object of making the groove in this shape has been to prevent any possible jamming which might occur in a groove of but little greater section than the trolley wire. The latter is a No. 0000 and is held in a malleable iron clip which fits into slots milled into each side of the wire giving a smooth under-running surface. The jaws of the clip are first screwed together and the ends of the screws are then beaded over to prevent loosening.

An improvement has been made in the method of attaching the plow to the cars by which no time will be required in changing from the overhead to the underground system. The improvement lies in an ingenious method of attachment whereby the plow automatically locks or unlocks itself from the car truck when the car passes the point where the change is made. The voltage in the city will be 220 and in the country 550 to 600. This will allow a wide variation of slow speeds in the city and high speeds in the suburbs.

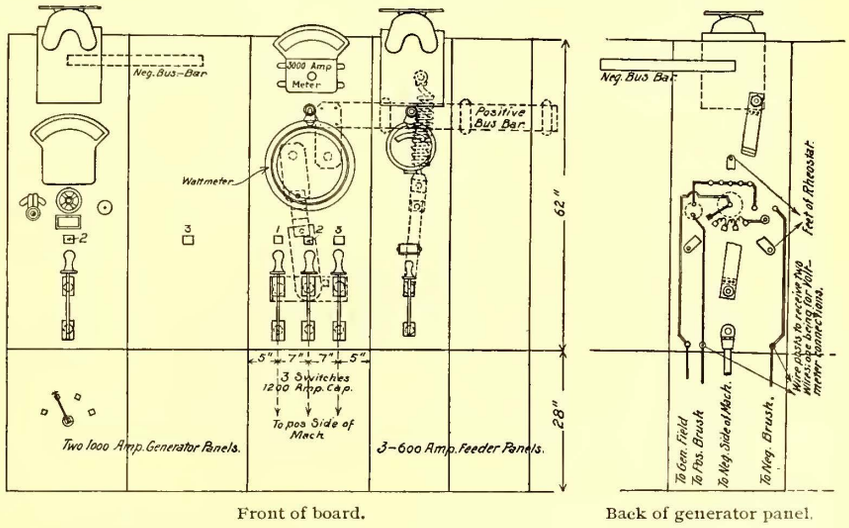
The line is a single track with turnouts, but two overhead trolley wires will be used to avoid overhead switches.

The company will have two power stations, one at Four Mile Run, the other at New Alexandria. Each will contain two simple condensing engines, with cylinder dimensions thirty-two inches and forty-eight inches, direct connected to General Electric 500 k. w. generators. If the company should desire to increase the capacity of the station later a high pressure cylinder twenty inches in diameter can be added to each of these engines. The boilers are of the return tubular type 18 ft. × 72 ins.

The switchboard is of somewhat novel construction, the principal feature being the location at opposite ends of the switchboard of the positive and negative switches and bus bars. The object of separating as far as possible the two bus bars is to prevent any possible short circuiting at the rear of the board. Elevations of the board are shown in the accompanying engraving.

Elevated Railroad Construction in Chicago.

There is great activity in electric elevated railway construction at the present time in Chicago. The Northwestern Elevated and the Union Elevated loop are both making rapid progress with construction. Both will be operated electrically. The latter will be a double track elevated system practically belting the downtown business section of the city for the purpose of accommodating the trains of the elevated systems. This will enable each of the lines to land and pick up passengers throughout the entire section bounded by the loop. The length of the loop will be between 2½ and 3 miles. The north or Lake Street side is already completed, the structural work on the eastern or Wabash Avenue side is about completed and is in progress on the Fifth Avenue or western side.



Front of board. Back of generator panel.

SWITCHBOARD OF WASHINGTON, ALEXANDRIA & MT. VERNON RAILWAY.

Novel Seashore Electric Railway.

A very novel attraction for a seaside resort has recently been built at Brighton, England. It is an electric railway three miles in length, the track of which is exposed on the sands at low tide, but at high tide is submerged to a depth of fifteen feet.

The line commences at the eastern end of the electric railway at Brighton and extends to the village of Rottingdean, where a small pier has been erected for the cars to run alongside. At the Brighton end of the line is an iron jetty with waiting rooms and offices. The coast is bold for the entire distance with chalk cliffs varying from sixty to 120 ft. in height. As the track is laid at a considerable distance from the shore, a fine view of these is obtained.

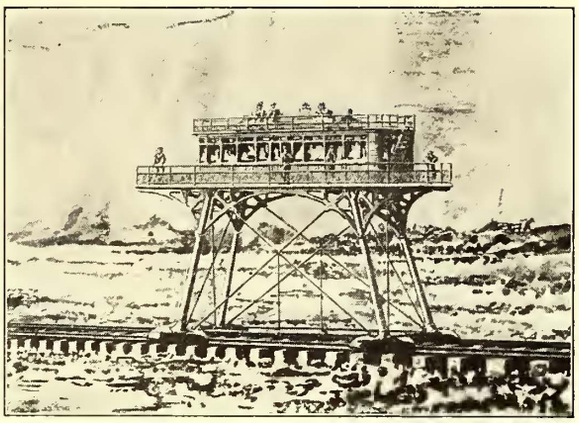


FIG. 1.—CAR AT LOW TIDE.

The rails are laid on concrete block spaced about three feet apart and mortised into the sound rock. The height of the blocks, of course, varies with the irregularities of the shore. A shifting sand of very moderate depth covers the rock in places, but the rails have been laid sufficiently high to prevent any trouble from accumulations on the rails. The steepest grade is 1 to 300, and the radius of curves 2640 ft.

The line consists of four rails weighing fifty-four pounds per yard and laid as two tracks of 2 ft. 8½ ins. in gauge. The outer rails are spaced about eighteen feet apart, this being rendered necessary to give the required stability to the cars. The rails are secured by steel clips and bolts, the latter being embedded in concrete. Oak blocks, through which the bolts pass, are placed between the rails and the concrete blocks. Tie rods are used every ten feet on straight track and every five feet on the curves. Heavy angle fishplates are used for the rail joints. Although the most violent gales experienced for many years occurred during the winter of 1894-95, no damage whatever was done to the permanent way, so the fact that it possesses ample strength to resist the force of the sea has been demonstrated in a satisfactory manner, and no accumulation of seaweed, etc., has taken place at any time.

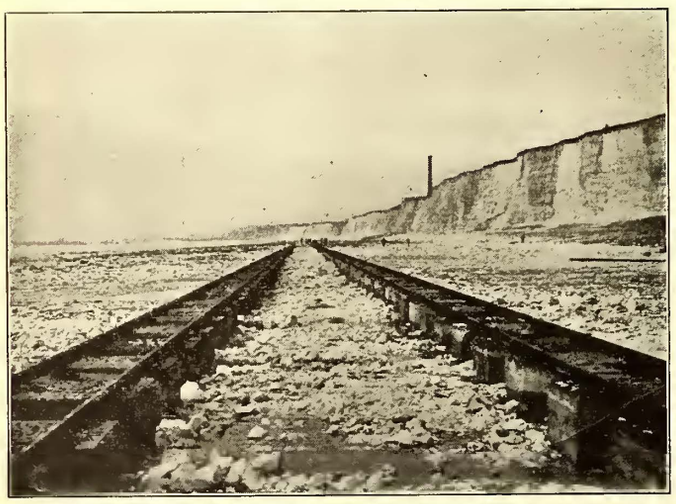


FIG. 3.—TRACK ON BEACH.

The car is mounted on sixteen wheels, thirty-three inches in diameter, and carries the passengers at a height of twenty-four feet above the level of the rails. The four main legs are tubes of drawn steel eleven inches in diameter. At the bottom of each leg is placed a bogie truck having four wheels. The outside of the bogie is shaped like an inverted double-ended boat to facilitate its passage through the water, and also to remove any obstructions from the rails. The four bogies are firmly held together by steel tubular struts. The wheel base is about twenty-eight feet and the effective gauge eighteen feet, giving great stability.

The tops of the main legs are firmly built into lattice girder work carrying the deck, and the whole structure is firmly secured by cross ties, and is of great strength, although offering but a small surface to the force of the waves. The main deck appurtenances and erections are carried out exactly as if for a steam yacht. The deck measures 50 ft. × 22 ft., and is surrounded by iron railings with wooden top rail and wire netting.

An ample supply of seats with reversible backs is provided to enable passengers to face the direction in which the car is going. The center space of the deck is occupied by the saloon, 12 ft. × 25 ft., with plate glass windows. The total accommodation is for 100 to 150 passengers.

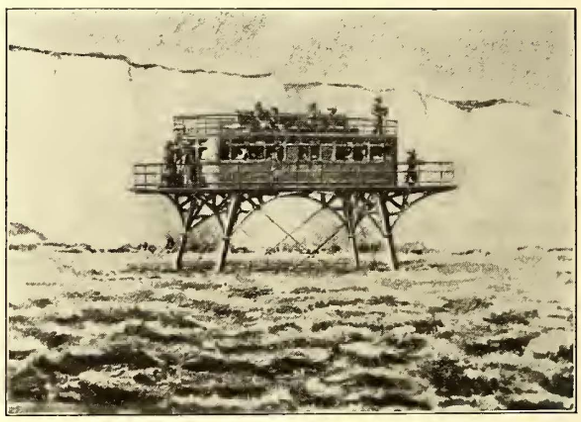


FIG. 2.—CAR AT HIGH TIDE.

As the journey is short and will be undertaken more for the sea air than for quickly making the trip the speed will be kept between six and eight miles an hour.

The driving machinery consists of two thirty horse power electric motors placed vertically immediately over two of the main legs, one on each side of the car. The shafting is carried down inside and communicates with toothed gearing which actuates the wheels. The brakes are worked by rods passing down the remaining two legs.

The current at 500 volts will be conveyed to the car by means of a trolley pole and overhead wire, provided the consent of the Corporation of Brighton be obtained for the portion within the Borough.

St. Geo. Moore, of Westminster, is engineer, in conjunction with Magnus Volk, and all work is being carried out under the supervision of the latter.

The Recording Wattmeter in Railway Practice.

By Caryl D. Haskins.

When recording electricity meters were first placed at the disposal of electric illuminating companies it was probably not anticipated that they could find any field of usefulness in connection with railways. Even the illuminating companies associated meters only with the measurement of light delivered, and among even the most advanced,

there was grave question whether a contract system would not be the preferable basis for general operation.

The common use of meters for the measurement of output from the central station did not follow with any great rapidity the establishment of meter systems for the measurement of input. This was due to two general errors of judgment. First, the producers of electricity had not yet come to realize that frequent periodic readings of station ammeter and voltmeter failed to give them a reliable check on their output, and second, to a quite general impression that recording meters in very large units must essentially be inaccurate.

The earliest recording meters too, registered in the ampere hour unit; a unit perhaps sufficiently good for early practice in connection with input measurements, but distinctly unsatisfactory for use with output measurements, destined to be checked back against horse power hours, engine efficiencies and consumption of coal and water.

The introduction of the Thomson recording wattmeter in 1889 and the rapid spread of the use of the watt hour as a charge basis for power delivered, which necessarily followed it, speedily led to the introduction in a few pioneer stations, of station or switchboard meters for the measurement of the output from a single unit. This speedily developed the fact that frequent ampere and voltmeter readings did not necessarily represent the actual foot-pound hours of energy generated, and the manufacturers of the Thomson recording wattmeter were not slow to realize that a new field of usefulness for the meter was existent. This led to the rapid development of large capacity instruments and it was after the development of the early larger sizes that the first suggestion of the application of meters to railway circuits was made. The rapid increase in the size of generating units necessitated the designing of larger and larger output meters, and it speedily became evident that these large meters were just as accurate and reliable within their proper ranges as were the smaller instruments.

The 600 ampere meter was at first considered a maximum size, but early necessity led to the development of a 1200 ampere size, the largest meter which could be conveniently manufactured in the then existing type. This meter for a time fully met the demands of the market, but with the growth of individual units, demands speedily began to be made for single meters whose capacities should range well into the thousands of amperes. These demands resulted in the form G type of recording meter which has been well described in the February number of the STREET RAILWAY JOURNAL.

The successful application of the Thomson recording wattmeter to the measurement of station output suggested that the meter could doubtless be put in such form as to withstand the constant vibration and jolting, incident to its use in a moving street car, thus meeting the needs of street railway companies not only in connection with their generating plant, but also with their car equipments. Such a meter was accordingly developed, notwithstanding the fact that what appeared to be unsurmountable difficulties had to be overcome to protect the meter from detrimental vibration.

The Thomson recording wattmeter being now very commonly in use in connection with street railway work, it is but natural that street railway engineers should be interested to know in detail those factors which go to make the meter which they use advantageous to them, accurate in its indications and reliable for steady use.

The principle and indeed general design of the Thomson recording wattmeter, as used in street railway practice, are the same as in those lines of meters which have been designed for lighting purposes, the capacities however being generally greater in the case of switchboard instruments and the mountings and methods of support radically different in the portable instrument designed for use on moving cars.

These meters are, as their name indicates, true wattmeters, i. e., rotating mechanisms in which the speed of rotation in connection with direct current is proportionate to the amount of current being delivered multiplied by the pressure at which it is delivered. The field coils of the Thomson recording wattmeter are in series with the current to be measured, and, since there is no iron in the fields, the field strength is directly proportional to the amount of current being delivered through them.

The armature, which is of the Siemens drum type and without iron, is connected across the line. It is itself of high resistance, and is in series with a dead resistance which makes it in substance a voltmeter. The armature strength therefore is directly proportional to the pressure on the line, and the torque of the meter is therefore directly proportional to the watts delivered through the meter.

The speed of the meter is obviously directly proportional to the torque, and the damping or retarding mechanism, which consists of a copper disk upon the main shaft rotating between the poles of permanent magnets, retards proportionately with the speed. The theory of the meter is therefore directly proportional and correct throughout.

The connections, as above described, can be clearly followed by referring to Fig. 1, which shows diagrammatically the general arrangement of circuits within the meter.

The commonest cause of error in all recording instruments is friction, which is, of course, unavoidable, and which would detrimentally affect the accuracy of the Thomson recording wattmeter were it not properly compensated. This would be especially true at light loads where friction represents a considerable proportion of the work done by the meter.

By referring to diagram 1 however it will be noted that the connection of the armature is made on the load side of the field coils, and it will be further noted that the armature current passes first through a fine shunt-

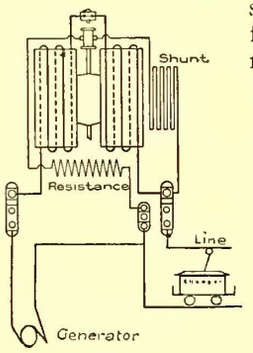


FIG. 1.

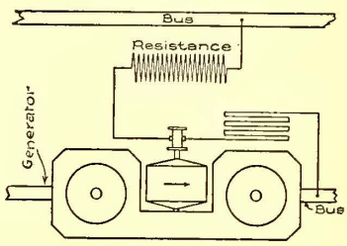


FIG. 2.

field winding, thence through the armature and resistance, back to the other side of the line. Thus, in addition to the field strength, due to current passing through the fields to the load, there is an additional and constant field strength, due to the armature current which flows through the main field coils and shunt field coil in uniform quantity, irrespective of the load which may be on the meter. The object of this extra or shunt field is to balance friction, which, is of course, of nearly uniform value. The strength of the shunt field is carefully proportioned to almost absolutely balance the effect of friction, holding the meter mechanism in the position of almost perfect equilibrium. Thus the meter is prepared to start at an accurate speed, even upon low loads, the retarding influence of friction being canceled.

It should not be assumed that the friction in a recording meter of this type is large. It is in reality very small, although it is none the less important that it should be properly neutralized.

The entire weight of the moving mechanism, which is small, is carried at the lower end of the shaft by a cup shaped sapphire jewel. As the shaft point is carefully rounded in shape and as the jewel has a glass surface, the friction at this point is obviously very small, whilst the breaking of the jewel from shock or jar is prevented by the manner in which it is mounted in its carrying screw, the jewel itself being set in a movable piston, which is in its turn supported upon a spring, making the lower bearing a flexible instead of a fixed support.

The type of meter, the connections of which are shown in diagram No. 1, is the standard form for the smaller switchboard meters used in railway practice, ranging from

capacities of 100 to 1200 amperes. Capacities in excess of this are made in what is termed the form G type. This instrument is diagrammatically illustrated in Fig. 2 and has been well shown in perspective in the STREET RAILWAY JOURNAL for February.

In meters of the form G type the field consists of a solid copper forging making about one-half turn total. This field block is carried on two studs of proper size, also of forged copper, which form at once the electrical connections and the mechanical supports of the meter. These studs pass through the switchboard and are connected to the bus bar which is cut off between them. The form G meters, like all others of their type, are strictly series instruments.

The armature resistance of the form G meter is placed in a separate cage, installed wherever convenient behind the board.

The portable Thomson recording wattmeter has standard arrangement of fields, armature and disk, mounted upon a skeleton frame. This frame is carried between two networks of Para rubber cord, woven into hammocks, one above and one below the meter. The instrument is thus floated within its carrying case and may be used in a moving street car even over the roughest roads with safety, all violent shocks being absorbed in the rubber. These portable meters are provided with a special thumbscrew for lifting the shaft off the jewel during transportation or shipment, and a sensitive and accurate meter is thus insured even after comparatively rough usage and a thorough shaking up.

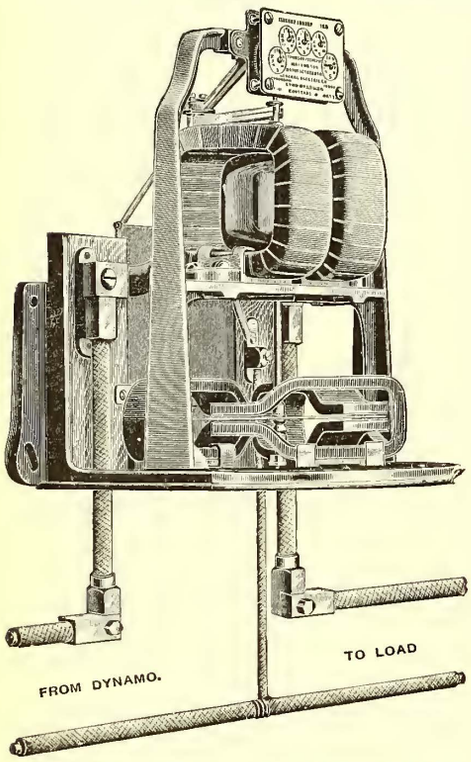


FIG. 3.—WATTMETER WITH CASE REMOVED.

The street railway engineer is to-day, by reason of the recording meters which have been designed for his especial use, in a position to tell absolutely what he produces and how he distributes his product. A switchboard equipped with a recording meter upon each unit or upon each feeder, gives him an absolute check upon the efficiency of engines and generators, the working value of his boilers, the care of his firemen, and if he is sure of all the foregoing factors, even upon the steaming value of his coal. The meters tell him too, if they are upon his feeders, just how the energy generated during the day has been distributed among his various lines and enable him to figure with absoluteness the horse power hours per car day on each of his circuits, and even watt hours per passenger carried. The portable meter enables him at any time to test the efficiency and power consumption of every car, and the power required for each car to carry it at various speeds over every section of the road. In other words, it puts within his reach a means of ascertaining the value of the greater part of those factors, the neglect or care of which goes to make a road profitable or unprofitable.

THE Binghamton (N. Y.) Railroad Company will lay out a new park on the Susquehanna River near Hooper.

A Resume of the Opposite Joint Discussion.

BY JAMES A. EMERY.

A study of the recent contributions on the question of breaking joints or laying them opposite is apt to leave the candid street railway man in a condition of prejudice, doubt or indifference. We have heard good and successful engineers speak with equal positiveness on each side of the question; and now who will venture to say that one is right and the other very much wrong? The subject is certainly worthy of consideration. The jointless track is yet in its infancy and is likely never to get beyond city roads, in paved streets and under heavy traffic. Scores of miles of suburban track are going down every year and a person ought to be able to know if one way is really better than the other, or if there is really no practical difference.

If the track is in good condition cars will ride equally well whether one joint or the other is used. Will the rail wear out equally fast in each case? It is well known that joints go down as the result of a thousand small blows, strains and deflection. Now do the joints get harder blows when opposite than when broken? It is hard to see how they get a doubly severe blow. Each joint gets its own load and the shock is in no way increased on each because both are in play at once. It may be conceived that a rigid truck would hold up one wheel. But we must remember that the deflections which cause the downfall of joints are very small indeed, so that such an action becomes a practical absurdity. It is quite likely that two joints will batter down a tie more than one. This is a valid argument against opposite joints when they are supported, but amounts to less when they are suspended. The instance where, with broken joints, the reflex action of the springs has mashed down the opposite rail just beyond the joint, is very curious and interesting, but there is no reason why the same action should not occur with opposite joints and such is actually the case. It must then be admitted that as far as wear of track goes the relation of joints is a very doubtful factor and a street railway man would better look to the ballast under, and the design and workmanship of the joints, before ascribing his bad track to it.

The effects on the car are more evident, therefore more important. When the track wears, opposite joints do give the motors doubly severe shocks and broken joints do twist the trucks and gears. The question is, Which damage costs the more? The answer is not forthcoming. When a road shall lay two lines of track exactly alike, but with differently arranged joints, and shall run the same cars always on each line, and shall keep an accurate repair account, then we can say something definite. Probably that the difference is small.

The riding of cars is a somewhat important commercial consideration, for low joints are an exceeding annoyance, however arranged. Opposite joints make the car pitch or "teeter," and broken joints give it a synthetic rocking motion. Either is disagreeable and it is hard to say which is worse.

Minor considerations such as cost of laying and cost of repairing favor opposite joints. Ties may be spaced a little more economically with opposite joints. But these cost arguments, slight as they are, are not valid if there is really an advantage the other way. Cross bonding may be done more effectively with opposite joints.

Summing up then the discussion we may say that track will wear equally, however the joints are placed, except that one tie may suffer from holding up two joints. Car repairs are unknown quantities. The riding of the car is pretty bad either way. And lastly, other things being equal, opposite joints have some advantage in construction. These are not very decisive conclusions from which to form an opinion. The proposition to break joints by ten feet is a good one, being a compromise, but especially as it destroys the rocking motion which uniformly broken joints give.

Pursuant of the compromise idea it would seem advisable to bring the joints closer together than ten feet, so

that we can get the advantages of economical tie spacing and cross bonding. This distance might be the tie rod spacing, but would best be from three to four feet. The ties should be spaced two feet on centers at the joints. This gives all the advantages that opposite joints may have and avoids the double blow on one tie and the car, as well as the pitching motion. It has all the advantages of evenly broken joints and avoids the rocking or vibration which they give. The tie rod holes would not come equidistant from the ends of the rail, but that would hardly be an objection.

It is surely no disgrace to try to evade the question by thus adopting a compromise, and in view of the disparity of all our evidence it is a reasonable idea.

Signals on Electric Railways.

For ordinary service on streets the speeds attained on electric roads are not yet so high that any system of block signals, similar to that used on steam roads for preventing rear end collisions, is necessary. The distance in which with present appliances an electric car can be stopped when running at full speed is so short that the judgment of the motorman can be depended upon to prevent accidents. The conditions on high speed suburban and interurban roads approximate those on steam railways, and will be considered later, but for the great majority of roads where the speed does not exceed twenty-five miles per hour, and is usually much less, the uses of signaling devices can be grouped under the following four heads:

First. The protection of cars at grade crossings with steam railways or high speed electric lines.

Second. The protection at drawbridge crossings.

Third. The establishment of blocks on single track roads between turnouts.

Fourth. The communication between the cars and the power station or emergency stations for relief in case of accidents or for despatching.

The latter, while not protective in its purposes as are the others, may well be considered with them, as in some ways the devices for this purpose can be combined with those under the third head.

HIGHWAY AND DRAWBRIDGE SIGNALS.

Under the first and second heads belong as well the many devices which are employed on highways for protecting vehicular traffic. The weight and speed of street cars together with the contingency that any mechanical motive power employed may possibly fail when the car is on the steam railroad tracks make advisable additional safeguards to those usually employed for ordinary vehicles. The simplest method conceivable is the employment of a flagman who is warned of the approach of a train by the whistle and signals to the coming car whether it is safe to pass the crossing. Where a flagman is not employed and other safeguards are not used this duty should be performed by the conductor.

Experience has shown however that faithfulness cannot always be relied upon, and that where this duty is left to the conductor it may not be performed, but the chance may be taken of hearing the train without leaving the car. For this reason the derailing switch was devised. This normally keeps the street railway track open. To set it so that the car can pass the crossing, the conductor must go forward to the steam railroad tracks and move the lever actuating the switch tongue. The operating lever can be placed either on the opposite side of the railroad tracks or between the latter. Where a flagman is employed, the derailing switch is usually operated by him.

The derailing device when properly operated provides for the safe approach of the street car, but is contingent upon two assumptions for its proper working. One of these is that the switch will not be set by the flagman or conductor if a train is approaching and hence the method is dependent upon the fidelity and judgment of the employe in the discharge of his duties. It also supposes that after the switch is passed, the car will cross the steam tracks in a short time, before a steam train which was so far away when the derailing switch was moved that it could not be heard, should reach the crossing. If the power should fail or the street car jump the track at the crossing, it might be struck by a steam train before the latter could be warned of the danger. These reasons have dictated the establishment at a number of crossings of interlocking signaling devices similar to those in use at the grade crossings of two steam lines. As their application is comparatively new and as their arrangement may not be generally understood, a short description of a typical device of this kind, that of the National Switch & Signal Company, may prove of interest.

In the crossing illustrated the switches and signals are arranged to be set by the conductor on the street railway line. If a flagman is employed the arrangement is somewhat similar, but with the addition of a signal tower in which the flagman is stationed.

The diagram on the next page illustrates a crossing of a single track street railway with the two main tracks of the steam railroad at the same level. The regular high semaphore signals 1, 2, 7 and 8 are placed on the steam railroad. The home signals 2 and 7 are located about 300 ft. in advance of crossing and the distant signals 1 and 8 are from 1200 ft. to 1500 ft. in advance of the home signals.

The street railway is provided with two derails numbered 5 and two dwarf semaphore signals numbered 3. These signals and derails are connected by wire and pipe to levers grouped at a central point in a signal tower, all as shown in the diagram. The method of operation is then as follows: the normal position of signals 1, 2, 7 and 8 is at clear, as shown by broken lines, the levers in the tower being reversed, giving right of way for trains on the steam railroad. The normal position of signals 3 on street railway is at danger; with derails 5 open the cars on the street railway cannot now reach the crossing. The levers operating these signals and derails are all locked in position by a system of dogs and bars similar to those used in interlocking steam railroad signals. The object sought is, of course, to provide against any carelessness or neglect on the part of the conductor of the motor car who will have charge of the manipulation of the levers. It is consequently desirable to arrange the interlocking mechanism so that the conductor cannot change the position of the signals numbered 2 or 7 after a train on the steam road has passed either signals 1 or 8. Unless this protection is provided, he might change the signals 2 and 7 immediately in front of a fast approaching train, and, in consequence, cause a collision, as the distance between home signals 2 and 7 and the crossings is not sufficient in which to stop a train which has passed the home signal at speed.

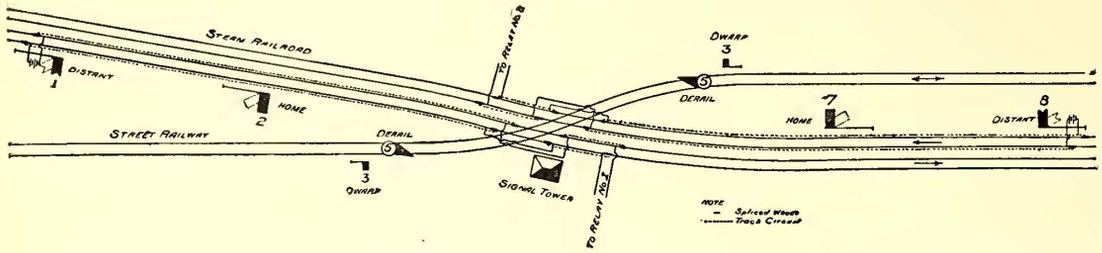
Let us now consider the conditions under which an electric car can pass the crossing, assuming there is no train between 1 and 8. To do this the conductor must first set the danger signals 8, 7, 1 and 2 before the derailing switches 5 can be set. The act of moving these levers automatically locks the door of the signal house in a closed position. This prevents the conductor leaving the signal house until the electric car has passed the crossing and the switches and signals returned to their original position.

In some cases an automatic cut-out, cutting off current in the trolley line for a distance of some hundred feet from the crossing and scotch blocks which block the track are used as additional precautions. Where a flagman or signalman is employed to guard the crossing the arrangement is very similar to that described, the signal man operating all switches and signals and closing and opening as well highway gates.

Where a signal tower is not used a cut-out can be introduced in the circuit of the electric railway at a point beyond the crossing. This should be so arranged that it will remain open except when the steam railroad signals are at clear. In this way the conductor will be obliged to return the steam signals to their normal position before proceeding on his route.

PROTECTION AT DRAWBRIDGES.

Most if not all the conditions covering the protection of grade crossings, belong as well to the protection of drawbridges. Here the movement of the draw can be utilized to operate the signals, and if deemed advisable to open the trolley circuit so as to cut off the current. As the car usually approaches the draw on an up grade, a condition which does not as often apply to grade crossings of steam roads, this device would seem to be particularly applicable.



PLAN OF STREET AND STEAM RAILWAY CROSSING PROTECTED BY INTERLOCKING SIGNALS.

BLOCKS ON SINGLE TRACK ROADS BETWEEN TURNOUTS.

In the consideration of this question the results sought are somewhat similar to those secured by the block system on steam railroads, though under different conditions. Timetables cannot always be followed so closely that set rules can be set down as to the time that an electric car on a single track road should wait at a turnout for the car coming in the opposite direction. For this reason it is very necessary, especially on long roads with an extended single track system, that some provision should be made for communicating between turnouts. The same conditions exist where a single track is used for a short distance on a double track road, as for instance, at curves where the width of the street does not admit of the location of two tracks.

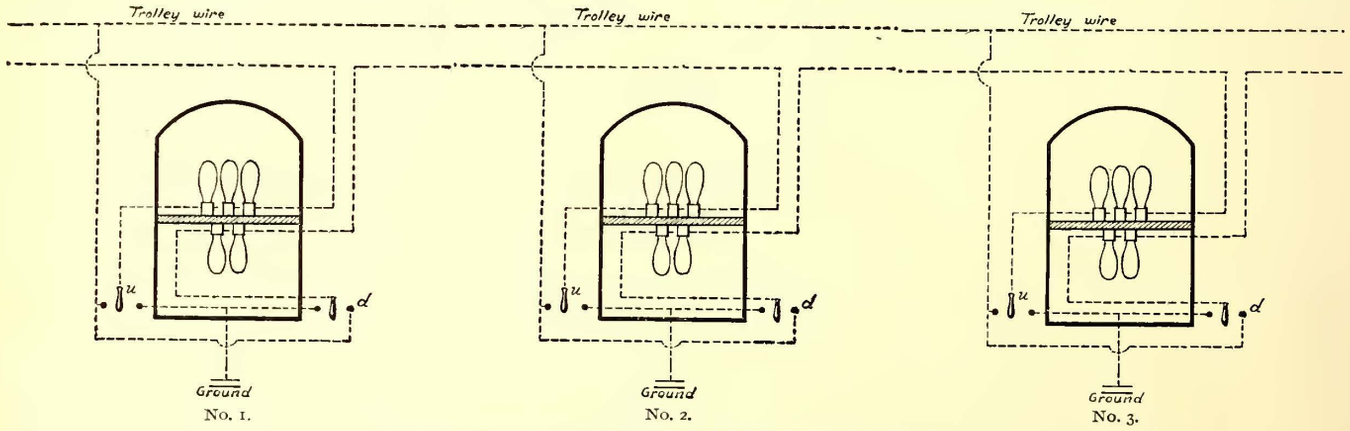
The elaborate devices employed for street railway block systems is not here necessary because as a stop is usually made at turnouts when the approaching car is not in sight any mechanism can be operated by the conductor. A simple method of accomplishing the result sought has been put upon the market and is shown in the accompanying engraving.

Signal boxes divided into two compartments are placed at each turnout. The three lamps shown in the upper half of one box are connected with the two in the lower half of the following box, etc., by a wire carried on the trolley poles. Each box has two double pole switches, one in each circuit, by which the lamp terminal can be connected to either trolley line or ground, as shown. The position of the two switches on a circuit between two turnouts upon which there are no cars is either both to ground or both to trolley. In either case there would be no light in the lamps. Assuming now that a car, after waiting at turnout 3 a certain length of time, decides to go to turnout 2 and await the appaoaching car there. The conductor throws a set of lamps in circuit by turning the switch *u* in box 3 from one pole to the other. This will light the two lower lamps in the turnout at 3 and the three upper lamps at 2. Upon reaching turnout 2 the lamps are extinguished by throwing switch *d* at 2 from one pole to the other, leaving the system ready for use by the next car going in either direction. The conductor of the car going the other way would turn the lamps on by switch *d* and off by switch *u*.

The operation of the system is then as follows: The conductor on a car going from 3 to 2 upon reaching the turnout looks at the upper half of the box. If the lamps are burning he will understand that another car is on the single track either on its way to the next switch or else approaching. If the car is on its way to the next switch and too far ahead to allow him to follow he should wait until the extinguishment of the lamps in the upper part of the box shows that the turnout has been reached and the section of track is clear. The cars going from 3 to 1 are therefore blocked by the lamps burning in the upper part of the box and from 1 to 3 by those burning in the lower part of the box. A dark box indicates everything clear. In the system as installed, the boxes are usually so arranged that the light of each group of lamps can only be seen by the cars coming in the direction to be blocked by it.

In another system a vane disk signal at one turnout is operated by a momentary current in a special circuit from the preceding turnout and the operation of the signal is proved by a return signal. In still another the signal switch is not operated by hand, but through a contact device so arranged on an overhead frog that the pressure of the flanges of the trolley wheel closes the circuit.

The use of telephones in connection with these signals will prove very convenient as providing a means of communication between two turnouts, and as the cost is but little, their installation is advisable.



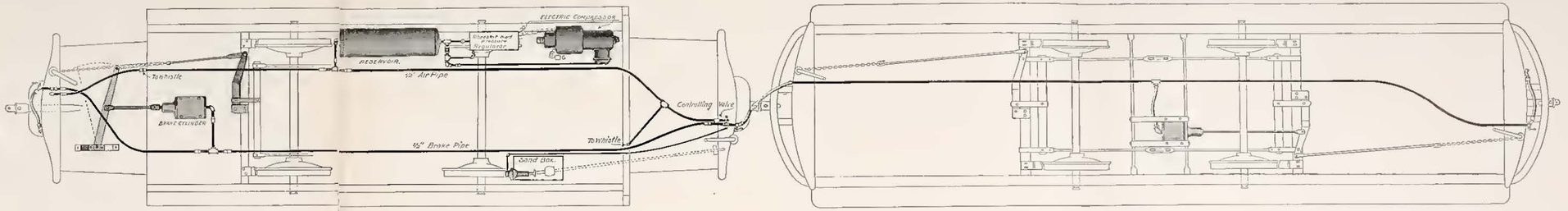
BLOCK SIGNAL SYSTEM FOR SINGLE TRACK ROADS.

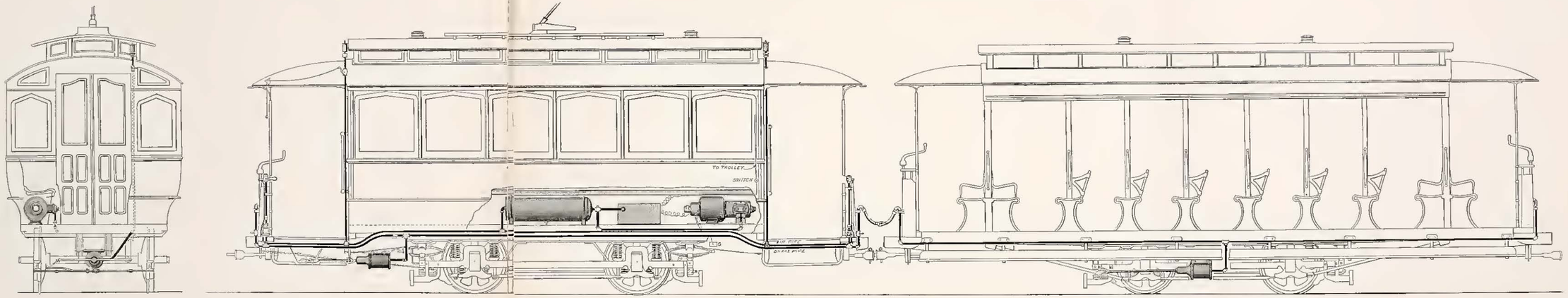
DESPATCHING SYSTEMS.

Where telephones are used they can be connected with the main office. All the conductors will then receive their instructions upon passing at turnouts from a despatcher. The latter can thus control the operation of the entire line and know the location of each car. If the turnouts are frequent this method, of course, involves some delay.

The telephone system will however be found very convenient in case the conductor wishes to notify the main office or emergency station of any accident or the necessity of repairing any part of the line. Where the turnouts are not very numerous all can be connected on the same circuit and a code adopted for indicating each station.

THE ELECTRIC COMPRESSOR.





PLAN AND ELEVATION, SHOWING THE AIR BRAKE EQUIPMENT FOR STREET CARS,
MANUFACTURED BY
THE STANDARD AIR BRAKE COMPANY.

SCIENCE · ENGINEERING · INVENTION ·

Three Phase Electric Railway at Lugano.

In a recent issue of the *Elektrotechnische Zeitschrift* the following description is given of the application in Lugano of the three phase alternating current to electric railway work.

The polyphase system as compared with the continuous current has some advantages as well as disadvantages for electric railway service. The chief argument which has been raised against it is that two overhead wires are required whether the two or three phase system is used. When this objection is analyzed, however, it will be found that it is not very important. The same poles, brackets, span wires, etc., are required with one as with two overhead wires and since the weight of two wires will be not appreciably greater than when a single trolley wire is used, the overhead parts need not be much, if any, heavier. At the crossovers and curves where the overhead system would naturally be complicated, current need be taken from only one wire, as it is well known that polyphase motors when once in synchronous revolution will operate as single phase motors and the second circuit can be open.

The use of the polyphase system with two trolley wires, on the other hand, has the advantage that two trolley poles are used, and it is extremely unlikely that at curves or any other points both should leave their wires at the same time. Another advantage lies in the fact that there is but little arcing between the trolley wire and wheel so that the wear on the trolley wire will be less than with the continuous current.

The chief advantages of the use of the alternating current for street railways are however as follows: with reduced cost of feeders and less potential drop, it is possible to operate much longer lines, while if a continuous current transformer is used an attendant is required and the cost of installation is very much higher. The construction of the motor is simple and there are no commutators to occasion trouble. The general assumption that a polyphase motor cannot compete in torque with continuous current motors of the same weight is no longer true; on the contrary, with like weight the alternating current motor has the greater starting torque since, in such motors, the induction in the iron with a normal current is much lower than with the continuous current motor, and in consequence the torque for a short time should be very much higher. To regulate their speed a resistance is used in the armature circuit of polyphase motors by which any variation in speed desired can be secured. The speed of the motor with the resistance cut out is constant and independent of the load, consequently in ascending grades the speed will be maintained, and in descending grades the cars cannot run away. Further, the alternating current system has this important advantage that in descending grades the motor acts as a dynamo pumping current into the line.

The first line in Europe equipped with the three phase system is in Lugano. This is an attractive town on Lake Lugano on one of the beautiful Italian lakes at the foot of the Alps, near the Swiss frontier. Work was commenced by the firm of Brown, Boveri & Company in 1895. Power is taken from a waterfall seven and a half miles from Lugano. This fall already supplies power for the electric lighting of the city on the alternating system, the power for the San Salvatore Mountain Railway, and for industrial uses.

At the power station is one 300 h. p. turbine direct connected with flexible coupling to a 150 h. p. three-phase generator. The voltage of the latter is 5000, the period 40, and the number of revolutions 600 per minute. The arrangement of the generator is such that the armature remains stationary and only the iron part of the field magnets rotates. The pole pieces are not set opposite each other, but are staggered. As a result the armature windings are common to both armature cores, that is, they go through both halves of the armature and each half does not require a special winding.

The current is carried to Lugano on three copper wires .2 in. in thickness and is led in Lugano to a transformer station at about the middle of the railway system. Later, when the line is extended, transformers will be located at other points. The transformer reduces the potential to 500 volts. The length of the railway is a little over three miles. It has a number of long grades of three per cent and for three short distances as high as six per cent. The two overhead wires have a diameter of .24 in. and are separated about ten inches apart. The rails are bonded in the usual way, but without a supplementary.

The rolling stock consists of four cars each capable of holding twenty-four passengers. Each car is equipped with one twenty-five horse power motor which is geared to one axle. The normal speed is about nine miles per hour. Each car carries two trolley poles, one set about three feet behind the other. The resistance is connected to the rotating part of the motor through three contact rings. There is a controller on each platform, where are also hand brake, cut-out, etc.

In case the line should be extended outside of the city and on these suburban parts a higher speed should be desired, this can be secured through a special arrangement by which the number of poles of the motor can be reduced, in which case the speed will, of course, be increased. The same effect can be secured by using a higher frequency on such sections. Where there are heavy grades to surmount the current in the motors can be increased by such a change in the winding as will increase the field intensity of the motors. An increase in the power of the motor can also naturally be secured in such places by an increase in potential which can be obtained by a special transformer for such a section. If at such points it is desired to operate with a lower power consumption this can easily be done by using on such sections a current of lower frequency or by connections by which the number of poles will be increased.

The first tests made of the line were in December, 1895, and were very satisfactory. No trouble was experienced in the neighboring telephone system through induction, and the steepest grades, those of six per cent, were mounted with ease.

The Problem of Braking Street Railway Cars.

The difficulties of applying mechanical or power brakes to street railway cars are somewhat serious though by no means insuperable. When a street railway manager finds his accident account assuming large proportions and determines that something better than hand brakes must be adopted, he naturally turns to the domain of steam railroading in order to find what has been accomplished in power braking with high speed, heavy train work. He finds that air brakes are there used to the exclusion of all others, because of the flexibility of the system, its instantaneousness in action and the ease with which it can be controlled. He naturally asks himself why air brakes have not been more generally used on street railways and finds the answer in the fact that it costs money to construct a good air brake system, and that such a system cannot be sold for the price of an ordinary brake handle and chain. If he goes still further and tries to balance interest on an investment in air brakes for the cars on his road against the annual saving in legal expenses and damages he soon finds that the accident end of the balance tremendously outweighs the air brake investment end.

The integral features of an air brake system for street cars are the following:

1. The air compressor is an air pump used for maintaining the necessary pressure in
2. The reservoir, from which is drawn the air necessary for use in
3. The brake cylinder, which acts directly through a system of compound levers upon
4. The brake beams and shoes.
5. The controlling valves, which are in charge of the motorman or gripman, and which regulate the flow of air between the air reservoir and the brake cylinder.
6. The gauges, which indicate to the motorman the pressure in the air reservoir.
7. The automatic valves between the air compressor and the air reservoir, which serve to cut out the compressor when the pressure in the reservoir is at a predetermined maximum and to cut it in when the pressure falls below a predetermined minimum.

All these elements in an air brake system require careful proportioning, good workmanship and ingenuity in design and construction. There is however but one serious mechanical difficulty met with in designing a perfectly operating street railway air brake system, and that is the difficulty of obtaining such a motive power for the compressor that the latter can be run with certainty, without waste of energy and without undue wear in the working parts. The original cost of the system must also be reasonably low and this last named difficulty has been the most serious of all and one which

has caused most of the difficulties with street railway air brakes in time past where attempts have been made to "produce something for nothing."

The most natural place to go for the motive power necessary for a compressor is the car axle, since this is kept in revolution by the general motive power of a car. The difficulty here however is that there is frequently too little space upon the axle for a properly designed compressor. Moreover, with high speed cars the axle revolves so rapidly that it is difficult to work a compressor without undue wear except by the use of gears, and there is generally too narrow a space in electric cars between motors and wheels to permit the use of power transmitting devices other than an eccentric. Nevertheless, the axle compressor has been the one hitherto most generally used in street railway air braking and is understood to be successful for cars running at speeds not exceeding sixteen to eighteen miles per hour.

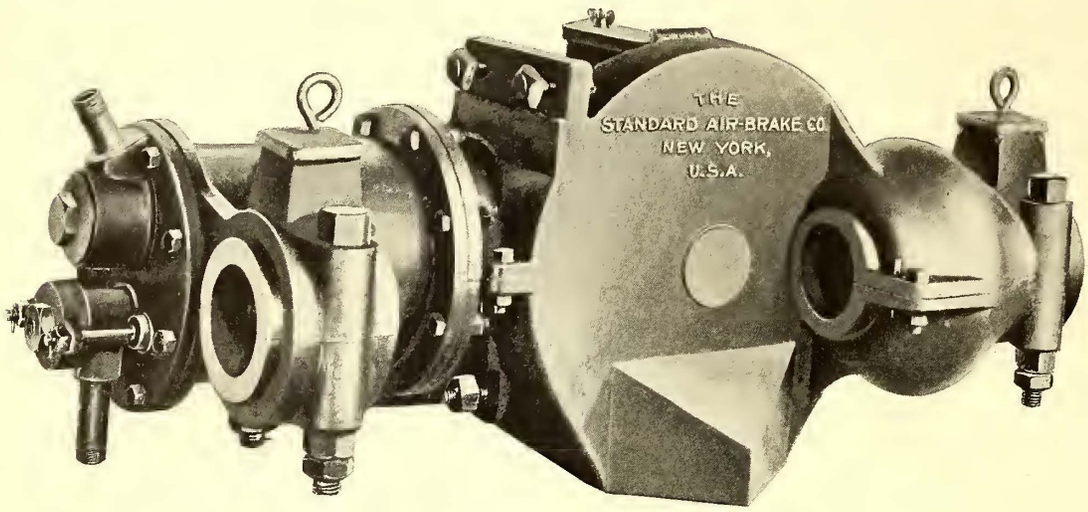


FIG. 1.—GEARED COMPRESSOR.

On double truck, or eight car wheels, the problem is simplified, for here it is possible to put a geared compressor on the free axle and thereby produce as low a compressor speed as is desirable, and this geared compressor type has a considerable field in interurban work.

For very high speed, four wheel motor cars the axle cannot be depended upon as a motive power. Some independent power must be provided.

The new electric compressor system of the Standard Air Brake Company—which is the pioneer and has been for many years almost the only worker in this field—is designed to meet this particular need, and is adapted at the same time, in the various sizes in which it will be manufactured, to fulfill every air brake function on electric cars and trains of all sizes and for all speeds. The compressor (Fig. 2) consists of a small slow speed motor wound for 500 volts, and carrying on its extended axle two cranks at 180 degrees to each other which work the pistons of twin compressor cylinders. The motor and cylinders are all enclosed in a strong iron casing and the entire compressor is so small that it can be easily carried under the seat of a car. An exceedingly novel and ingenious automatic regulator, enclosed in a separate box, controls the operation of the motor and performs the following functions:

1. It starts the motor gradually through a resistance which is cut out of circuit when the motor has reached full speed.

2. If the supply of current is lost through the coming off of the trolley or by accident at the power station, thereby stopping the motor, the regulator again puts the starting resistance in series with the armature.

3. When the current is again obtained the compressor motor is started up through its resistance.

4. When the pressure in the reservoir reaches its predetermined maximum the motor is cut out of circuit and stops, thus preventing a waste of power, and the starting resistance is again placed in circuit with the armature.

5. When the pressure in the reservoir falls to the predetermined minimum the motor is started up through its resistance.

6. The motor will continue to operate whether the car is in motion or at rest if the air pressure in the reservoir is between maximum and minimum.

The regulator is mechanical rather than electrical and is therefore positive in its action. It has been most carefully designed and is one of the integral features of the company's electric compressor system. It is intended to start and stop the motor with a variation in the main reservoir of from five to eight pounds.

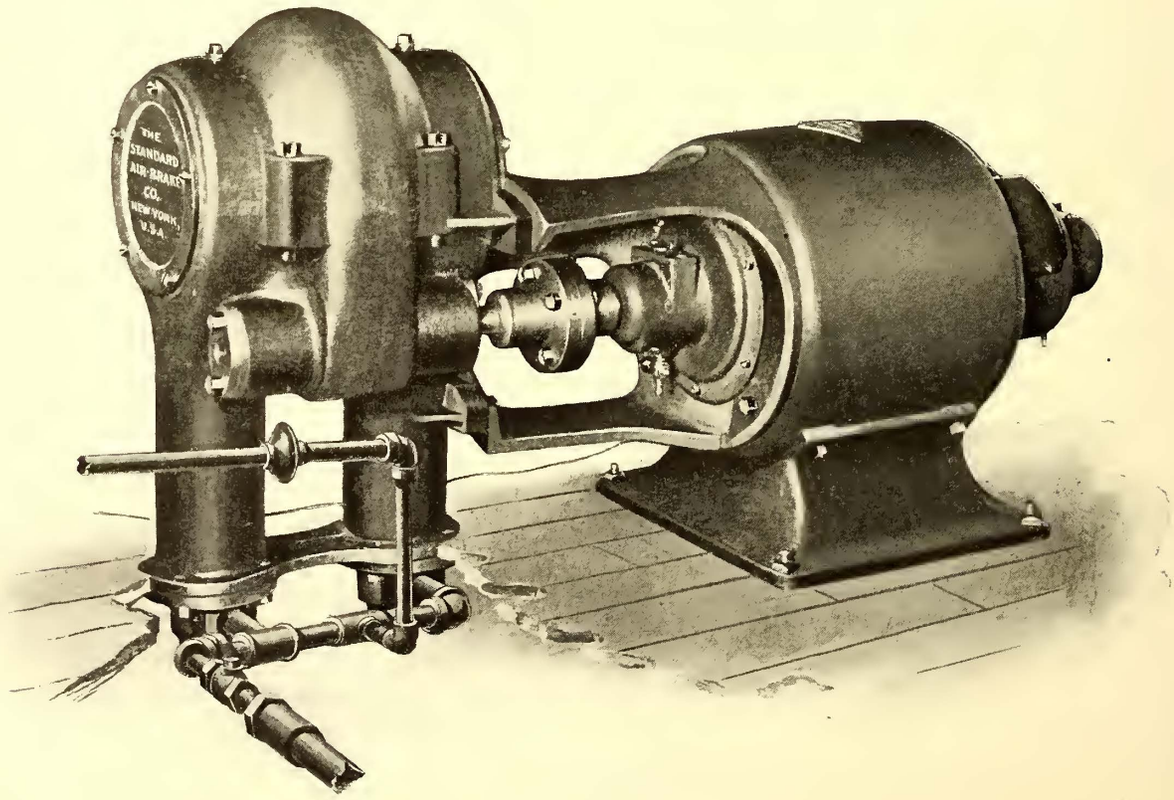


FIG. 2.—ELECTRIC COMPRESSOR.

This electric compressor will be built in three sizes, 1 h. p., 2 h. p. and 3 h. p. The 1 h. p. compressor will be of sufficient capacity for city work, where frequent stops are necessary, with motor and one or two trail cars, or with a double truck motor and double truck trail car. The larger sizes are for high speed work and heavy trains.

In laying out the remainder of the apparatus and piping for this electric compressor system the company has had the advantage of its wide experience with its other air brake systems (which will be referred to presently) and the result is great simplicity, as will be

seen from the inset between pages 306 and 307, on which is shown a complete air brake equipment for motor and trail car. The compressor and regulator box are, as before stated, placed under the seat of the car. The reservoir carries about fifty pounds pressure. The brake cylinder is seven inches in diameter and the piston travels five to six inches in the operation of the brakes. By means of a hollow piston rod there is no opposition offered by the air brake apparatus to the use of the regular hand brakes whenever the latter are needed. There is an air muffler to deaden the sound of the exhaust. A small though important detail is found in the way in which the motor and trail car hose is joined. The hose used in connecting up railroad trains frequently breaks off near the point of connection, but in this case it is reinforced for some distance away from the nozzle so that the curve which it assumes is not *sharp*, but *long*. There is a special coupling used by the company for this trailer connection.

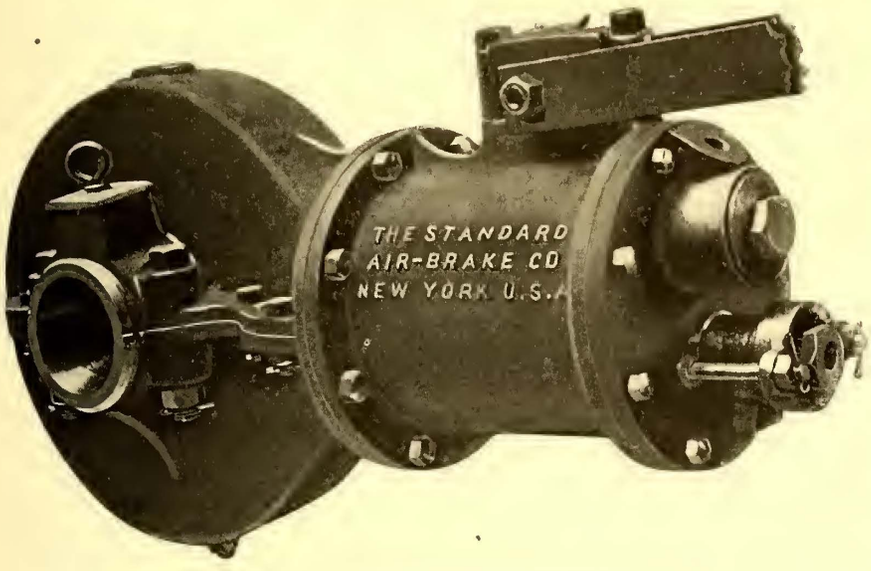


FIG. 3.—AXLE COMPRESSOR.

The inset shows the new form of controlling apparatus in which pipes are dispensed with on the platform. The controlling valve alone is visible and occupies a space of 7 ins. × 3 ins. × 6 ins. It may be placed on top of the platform or under it and is operated by the controlling staff, which in turn is covered by a shield. On top of this staff is the admirable controlling handle recently devised by the company. The handle is detached and a new interlocking device which appears under the gauge makes it impossible for a careless motorman to leave the valve in the wrong position when changing to the other end of the car. The handle must be inserted and withdrawn at one particular place. Directly above the controlling handle is the waterproof gauge fitted with specially strong glass to resist accidental or malicious injury.

The company's axle driven compressor is illustrated in Fig. 3. All the working parts are completely enclosed with hoods which are carried through the center of the axle boxes. Suction and discharge valves are placed in the valve chest, cast in the cylinder head and closed with caps. The governing chest is made in two parts, the base being attached to the cylinder head and the top screwed into this, thus closing down upon the diaphragm and forming an air partition between these two parts. The under side of the governing piston rests upon this diaphragm over the opening connecting the head of the governing piston where it enters the opening in the valve chest under the suction valve. When the desired pressure is reached in the reservoir it opens the regulator valve and admits air into the governing chest under the diaphragm so as to force the governing piston up. This lifts the suction valve from its seat and supplies the air cylinder with air so that the compressor can move in free air and do no work until, by the application of the air to the brake cylinder the pressure is again reduced. The regulator then acts, releasing the air confined under the diaphragm. The governing piston falls and the valve is reseated and the compressor begins again to pump into the reservoir. Each stop brings down the registered pressure in the reservoir by only one or two pounds and the capacity of the reservoir is therefore claimed to be ample for all requirements.

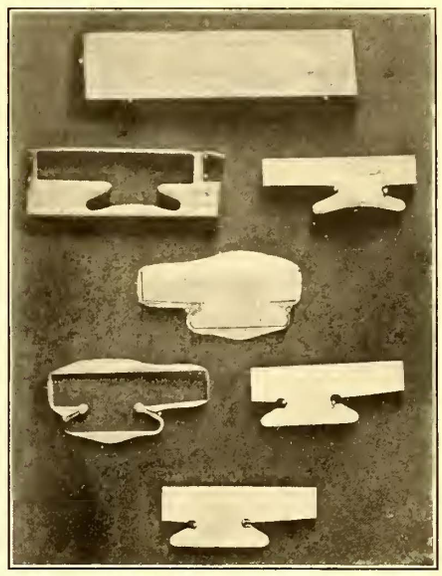
In Fig. 1 is shown the company's geared type of axle driven compressor for attachment to either free axle of an eight wheeled car. A sectional view was shown in the STREET RAILWAY JOURNAL, January, 1896, p. 66. Its operation is practically the same as that of the type just described operated by an eccentric. This compressor is flexibly supported upon the truck so as to prevent excessive jarring of the mechanism. Of the three systems described the electric compressor system is, of course, the most desirable from every point of view, its only disadvantage being a somewhat greater first cost than that of the other types.

THE Hamilton Radial Electric Railway Company (Hamilton, Ont.) has awarded the contract for the construction of its Beach line to W. P. Chapman. Work will be begun at once.

Drop Forged Commutator Segments.

There has recently appeared upon the market a new make of drop forged commutator segments, manufactured by the Forest City Electric Company makers of the "Roll Drop" segments. The engraving on this page shows the successive stages in this new process from the bar copper to the finished segment.

The process is similar in all essential features to the general process of drop forging, but is especially designed for the making of commutator segments of copper. Commencing with a bar of lake copper, the operation of blanking, forging hot, trimming and forging cold, is accomplished by the use of special machinery with an entirely new type of combination steel dies. These dies are made extremely hard and durable, especially to turn out a finished product that is perfectly uniform, flat and true to gauge and angle.



DROP FORGED COMMUTATOR SEGMENTS.

The process as designed and used, it is claimed, does not infringe in any way the well known patents on drop forged commutator segments.

Self Cooling Condensers.

From an electrical standpoint the most desirable location for a power station is as near the center of electrical distribution as possible. Any variation from this position will entail an added expense for feeders. At the same time the laws of economical steam generation require the location of the station as near as possible to a source of cheap water supply, which can be used for condensing. As a result, very few stations can be so located as to take advantage of both of these conditions. For those stations which must be placed at some distance from an abundant water supply, the Worthington self cooling condenser is claimed to be particularly desirable. This condenser depends for its effectiveness upon the capacity of atmospheric air to absorb and carry off heat and moisture. Broadly considered the air becomes the condensing medium instead of cold water as ordinarily employed, and as a condensing medium air is much more desirable than salt or brackish waters, as it exerts no corrosive effect upon air pumps and connections.

Either the jet or surface condenser can be employed. With the former, the exhaust steam from the engine comes into direct contact with a certain amount of water drawn from a tank and is condensed. The water formed by the condensation and the heat liberated therefrom are added to the circulating water. This heated water is then discharged by the condenser pump to the top of a tower. This tower is filled with short lengths of cylindrical tiling over which the water trickles in falling to the base. The tiles are so arranged as to break joints and present a broad surface over which the water spreads in thin films. A current of air driven by a fan is forced up through this tiling. By this process the water is rapidly cooled, partly by direct contact with the air, but principally by evaporation, so that when it reaches the base of the tower it is sufficiently cool to be returned to the suction tank. It is then used over again for condensing purposes. Of course a certain amount of water is lost by evaporation, but this amount, it is estimated, will be considerably less than the amount of water gained through condensation of the steam, so that no water other than the feed supply is required for the operation of the system.

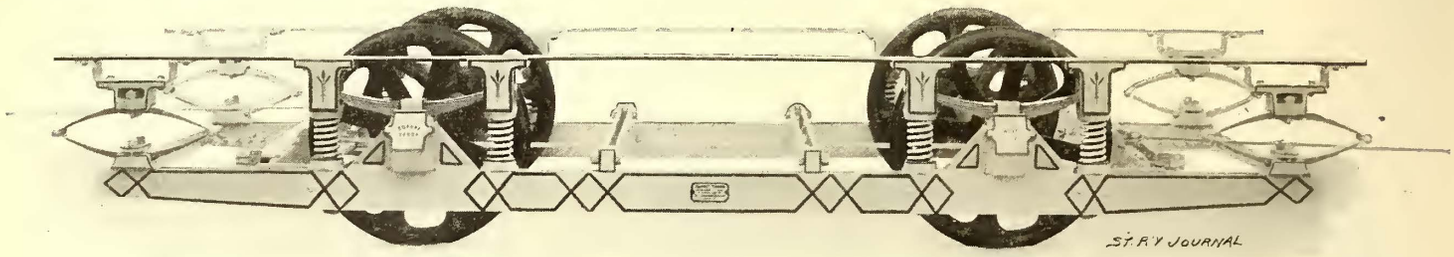
The condenser has been in successful operation in several well known plants and is being installed in the new power station of the Metropolitan Railroad Company, of Washington, and in that of the Chicago & Englewood Railway.

THE Fort Wayne & Belle Isle Railway Company (Detroit, Mich.) has contracted for 700 tons of new rails.

New Truck.

The accompanying engraving shows the style C Du Pont truck recently brought out by the Johnson Company. The truck differs in a number of particulars from either of the former trucks manufactured by the same company. It is built especially for high speed and is claimed to be free from oscillation and easy on rail and car.

As will be seen the weight of the car over the wheels is supported on spiral springs which rest on the side bars. These in turn are carried on the half elliptical springs resting on the boxes. The total spring base for a single truck car is from sixteen to twenty feet, measured from the centers of the end elliptical springs. If other support is desired spring truss rods can be used. The truck has few parts which means few repairs, and the side bars are continuous and free from bolts.



DU PONT TRUCK, STYLE C.

The truck department of the Johnson Company is in operation day and night to fill orders now booked. Among the companies using the truck are the following: Atlanta Consolidated Railway Company, Richmond Railway Company, Buffalo Railway Company, Commonwealth Avenue Railway Company, of Boston, Columbus Consolidated Railway Company.

Large Feedwater Heater and Purifier.

The engravings below present two views of a feedwater heater and purifier furnished the recently completed Philadelphia Bourse by the Kensington Engine Works. It has attracted considerable attention from all who have inspected the machinery used in the building, as it is probably one of the largest of the kind ever built. The heater is sixty inches in diameter with shell fourteen feet high over all, and has exhaust steam inlets and outlets sixteen inches in diameter. It has 350 sq. ft. of heating surface and heats the feedwater in the boiler supply to 206 degs. by the exhaust steam from the electric light engines and pumps, while also purifying it. It is of the reservoir return tubular type, and has a capacity of 1250 gals.

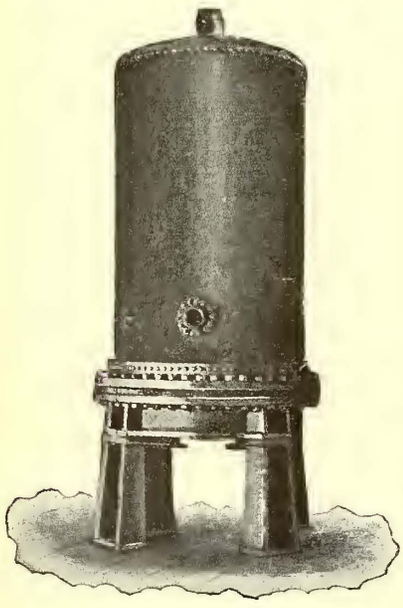


FIG 1.—HEATER.

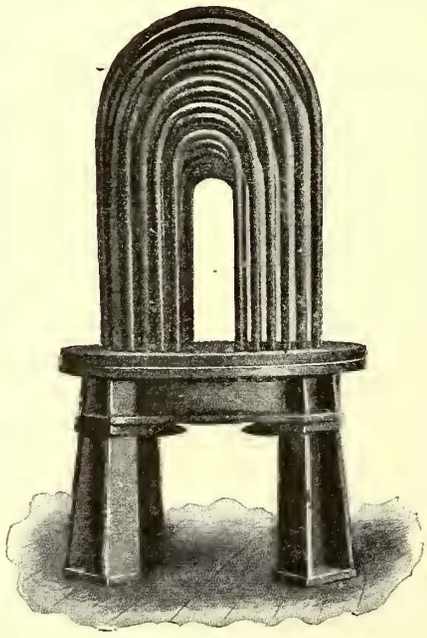


FIG. 2—HEATER WITH CASE REMOVED.

While the general construction of this heater is largely explained by the engravings, a few words regarding the details are of interest. There is first a cast iron base with projecting flanges on the top and suitable flanged nozzles on the bottom for the ingress and egress of the steam. Projections properly ribbed and braced provide for the reception and bolting to of the four cast iron legs which support the heater at a suitable height from the floor. Resting upon the top flange of the bottom casting is the tube head made of semi-steel, similar to that used by the Cramps in guns. This head is convex in order to better withstand and resist the pressure required to force the water into the boiler, 125 lbs. per square inch.

The tubes, which are of seamless brass and therefore free from corrosion and very durable, are securely expanded into the tube head, and when so done the tubes and tube head become practically one piece or part of the apparatus. The shell, which is of wrought steel ½ in. thick, is designed to enclose the tubes and at the bottom end has a strong cast ring securely riveted to it, with projecting flange corresponding in diameter to the flange of the bottom casting and tube head. The bolt holes of all three are identical in the matter of spacing and pitch circle, and all three parts of the heater are firmly bolted together.

Feedwater enters and leaves the heater by a 4½ in. pipe and all impure deposit is blown out through a 3 in. mud blow at the bottom, while the impurities which float on the surface are removed through a 2½ in. surface blow.

Automatic Danger Stop for Engines.

The accompanying illustrations show a novel apparatus for instantly stopping engines in case of accident, which has recently been installed by the North Hudson County Railway Company, of Hoboken, N. J. It is the invention of that company's chief engineer, A. T. Bonta, and is being put on the market by the Bonta Manufacturing Company. The device is operated automatically by the machinery or by hand from any desired part of a building. The automatic portion is arranged so that the breaking of a belt, the lifting of a lap on a driving belt or the increase of speed in an engine or other piece of machinery, will automatically close valves admitting steam to the engine.

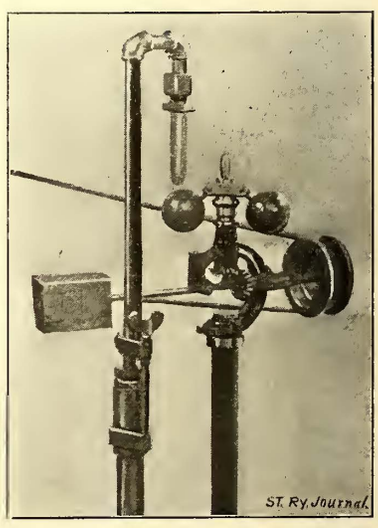


FIG. 1.—AUTOMATIC DANGER STOP.

The apparatus consists of an air pump, a small reservoir for compressed air and pipes leading to the various pieces of apparatus which are to be controlled, and to places from which it may be desirable to control the machinery by hand. The pressure carried is forty-five pounds per inch. When this pressure is reached the pump automatically stops and the only work done afterwards is to supply the leakage.

The valve in the steam pipe which supplies the engine is of the butterfly pattern. It is held closed by a balance weight attached to its stem. When the engine is in operation this valve is held open against the action of the counterpoise by the pressure of air against the bottom of the piston which operates a sector working in a gear upon the valve stem. A rubber diaphragm gives motion to the piston.

A view of this apparatus is shown in Fig. 2. Two pipes enter the diaphragm case, one bringing a pressure of air and the other leading to the automatic apparatus. Air is admitted under the diaphragm through a hole $\frac{1}{32}$ in. in diameter. The exhaust pipe is ¾ in. When in normal condition the supply of air beneath the diaphragm holds the piston up and the valve open. If for any reason the safety device operates the ¾ in. pipe is opened, the air is exhausted beneath the diaphragm faster than it can be supplied by the small opening, the diaphragm falls and the valve closes. Opening a small valve in this pipe by hand produces the same result.

The same construction is adapted so that the apparatus is applicable to a number of engines or machines, so that one may be closed without interfering with the operation of the others. The flow of air through the small opening is so small that the pressure in the main pipe does not fall.

Fig. 1 shows the automatic apparatus. This consists of an auxiliary governor belted in this case to the engine shaft, and a brass pipe working in a stuffing box so as to be easily adjusted to any height. This pipe is closed at the end by a small glass tube like an ordinary test tube, but much thinner than the ordinary tubes. The movable brass U-tube is adjusted so as to carry the glass end a very short distance above the normal position in which the governor balls revolve. Any dangerous increase in the speed lifts the balls high enough to break the tube. The air pressure is thus at once relieved and the valve to which this particular tube is connected closes, cutting off steam.

Over each main belt tubes are carried out in a T shape, and glasses are inserted, two directly over the belt, but two or three inches distant from it, and two at the edge of the pulley or flywheel. These are connected with the automatic device as in the previous case. If a lap on the belt raises one or both of the center tubes will necessarily be broken and the engine stop. If for any cause the belt runs off one of the side tubes will yield and the engine be stopped.

Where jet condensers are in use it is very necessary to break the vacuum at the same instant that steam is cut off from the engine in order to prevent a back flow of water to the cylinder. This is accomplished by placing a vacuum valve on the exhaust pipe which is operated by a weight in a manner similar to that used upon the butterfly steam valve. When the steam is being shut off from the engine the vacuum valve is being opened.

One supply pipe answers for as many engines as desirable, each engine connection being made by a T. It is possible to stop not only one, but all of the engines simultaneously if it is so desired by opening the main air pipe. A secondary reservoir is used to break the circuit of a dynamo where different engines drive dynamos feeding the same circuit, thus cutting off every possible source of power by a single movement. Valves to allow the escape of air from engine pipes and so operate the steam valve by hand are usually placed at the engineer's desk, in the dynamo room, if this is separate from the engine room, and in any other positions from which it may be desirable to shut down the machinery. One feature of great advantage in the system is that it must be in working order or the machinery will not run. If for any cause it becomes inoperative attention becomes necessary in order to keep the machinery going.

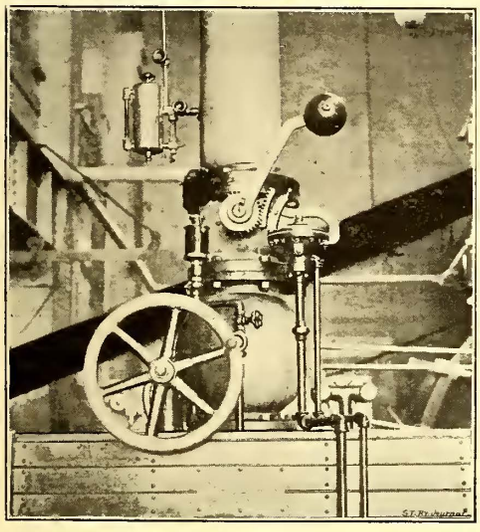


FIG. 2.—VALVE IN STEAM PIPE.

In view of the numerous accidents recorded during the last year or two in electric light and power stations as well as in manufactories of various kinds, no argument is needed in regard to the desirability of an automatic means for shutting off steam when the engine begins to race. The feature of being able to close any number of valves at a distance from the operator is one that has a wide range of usefulness in boiler rooms and many other locations.

Improvements in Gears.

One of the earliest electric railway supply companies to make a specialty of railway gears, was the R. D. Nuttall Company, and a history of its practice follows closely the development of the railway gear. When railways were first put into operation the importance of well built gears was not fully realized and the early manufacturers endeavored to produce as cheap a gear as possible. In consequence, cast iron was the material generally used for this purpose. Experience has shown that better material is necessary and in this search for a desirable gear the Nuttall Company has been active in studying the needs and requirements of the conditions.

A few years since the company experimented with malleable iron. The results were not satisfactory at first, but with the aid of a local malleable company whose product the company now controls, a composition was produced which, it is claimed, stands all the practical tests of steel with a wear superior to that of steel. The manufacturers have made several tests in which the teeth have been bent over with great pressure without breaking, showing the toughness of the material.

Sprinkler With Forty Foot Spread.

The use of road sprinklers on electric railways is increasing rapidly so that any new device in this line is of interest. The sprinkler shown, which is manufactured by the Taunton Locomotive

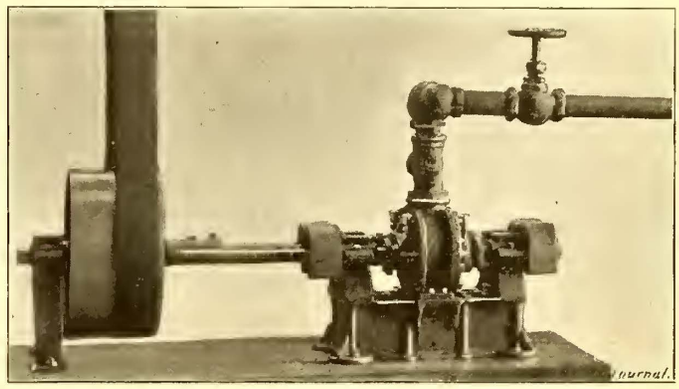


FIG. 1.—PUMP FOR SPRINKLER.

Works, is equipped with a device which permits a forty foot spread on each side of the sprinkler without the use of a spinnaker, which is inconvenient in crowded streets. Briefly, the improvement consists in the use of a rotary pump which will throw the spray to the extreme distance given, while the spray between the two extreme distances is taken from the tank direct. The pump can be driven either by an electric motor or by a sprocket chain to one of the axles. In either case a by-pass is provided so that if the pump is shut off quickly the water may be returned to the tank while the pump is in motion. The nozzle connected with the pump has a swinging joint so that the water can be thrown in any direction.

FIG. 2.—SPRINKLER WITH 40 FOOT SPREAD.

The standard tank supplied is of three-sixteenths inch steel, hot riveted. Where a spread of thirty feet is desired without pump, the top of the tank is mounted twelve feet above the rail, when the force of gravity is sufficient to give the spread desired. The standard size is 2700 gals., but the tanks are manufactured in capacities from 3400 gals. down, as desired. In the view shown the cab is removed, but the usual construction is to cover the tank so that the car presents very nearly the appearance of a box car.

IT is reported that the system of the Norwalk Tramway Company (Norwalk, Conn.) has been sold to Thomas E. Waller, of New London, Conn., representing a company of New York capitalists, who intend to extend the road to Westport, Darien and New Canaan and to double track the main line.

Extensive Car Wheel Works.

A great deal about the structure of wheels and hence their probable wear in service can be learned by a trip through a large wheel foundry. One of the largest, as well as one of the most interesting wheel foundries in the country, is that of the Griffin Wheel Company, of Chicago. This company has also works in Detroit, Denver and St. Paul. The Chicago plant has a capacity of 850 wheels per day. That at Detroit can turn out 300 wheels per day, the Denver plant 200, and the St. Paul works 300, making a total daily output of 1650 wheels.

The Chicago Company is at present casting about 100 wheels per day for street car service. The works in that city comprise a number of large buildings. The main foundry is 400 ft. × 320 ft. and connects directly with the charging and cupola room, which measures 60 ft. × 350 ft. The machine shop is 75 ft. × 140 ft., and the engine and boiler house occupy a space of 60 ft. × 75 ft. The power for the works is supplied by two compound engines of 550 h. p. and 450 h. p. each. One is an Allis-Corliss, and the other was built by M. C. Bullock. A peculiar feature of the latter is the use of a piston rod extending through the rear of the cylinder as a piston rod for an air compressor. This supplies compressed air for the thirty-five cranes in the moulding shop, air for the cupola, etc. The other buildings are a laboratory, which is 36 ft. × 60 ft., a building 40 ft. × 75 ft., for the gannister crusher and grinder for sea coal, and two sand sheds, one 200 ft. × 300 ft. and the other 600 ft. × 400 ft. One of these shops appears in Fig. 4, which also shows part of the stockyard and old wheels used for scrap.

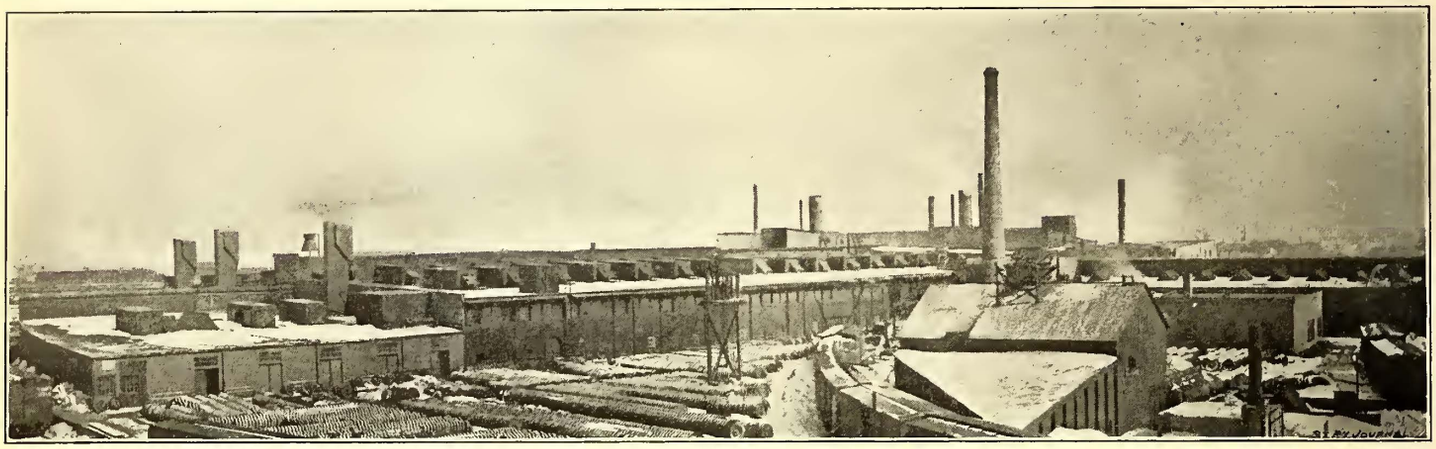


FIG. 1.—VIEW OF CAR WHEEL WORKS.

The yards contain about two miles of side track and have direct switches to the Chicago, Milwaukee & St. Paul Railroad and also to the Chicago & Northwestern Railroad. The area now enclosed is about fifteen acres, and this will undoubtedly have to be extended before long to include land now unoccupied which belongs to the company.

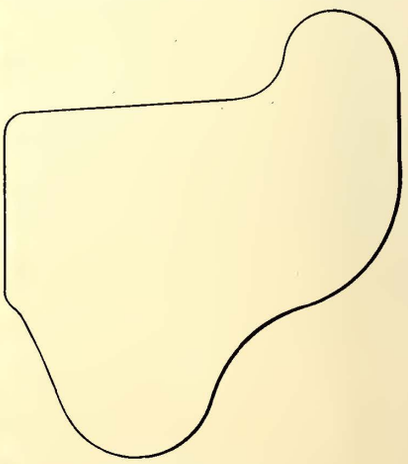
During working hours the moulding room presents a most busy appearance. One peculiarly effective and economical piece of machinery in use here is the pneumatic crane. By this two men can handle moulds and wheels to great advantage.

Fig. 2 is a view of the annealing pits and cranes by which they are filled. These pits take up a space nearly 350 ft. in width. On the left they open directly into the cleaning sheds. On the other side, the elevated railways, which are used not only for handling wheels, but for conveying the ladles, lead down between the different floors of the casting house.

From the wheel pits the wheels go directly through the sand blast cleaning machine into the cleaning room. This sand blast machine is shown in Fig. 6. Externally it appears like a small box set against the wall, with sliding doors on each side, into which the wheels, from the wheel pit can be rolled. While enclosed in the box a sand blast is brought to bear upon each side of the wheel and the latter in an incredibly short space of time is cleaned from scale and adhering sand. The boxes and chutes seen on each side are those used for the blast and for catching and elevating the sand for supplying the blast. Fig. 5 gives a view of the core room. The man in the foreground is in the act of sweeping a core. Behind him is the great carriage on which cores are run into one of the ovens, and from it the large size of the ovens may be seen. The corner of a similar carriage or rack is shown at the right hand of the picture. Fig. 7 shows the interior of the machine shop where much of the special work of the establishment is performed and where the company has unusual facilities for boring and fitting wheels and turning up axles.

The arrangement of the works for handling iron is peculiarly effective. There are two large cupolas, each capable of melting iron for 425 wheels per day. They are placed in a separate cupola house where the charging and rough work is carried on by itself. The advantage of having them in a separate house has been shown by the fact that the cupola room has once been burned out without disturbing the moulding building. These cupolas discharge into great tilting ladles, each of which delivers contents into the foundry.

FIG. 2.—PIT ROOM.



(two-thirds size.)

FIG. 3.—STANDARD SECTION.

There are two very important features in the system employed in the works which go very largely toward producing perfect wheels. One of these is the large ladle by means of which a uniformity of metal is secured. The second is the use of a bottom pouring ladle, invented and patented by H. H. Fisher, superintendent of machinery. By this only clean iron is allowed to enter the mould, sand, slag and impurities generally rising to the surface. A rough idea of the plug and the method by which this desirable feature is secured can be given.

In the bottom of the ladle there is a hole lined with graphite and closed by a specially prepared plug of the same material. This plug is carried on the end of an iron rod which is protected from the action of the molten iron by a covering of fire clay. An arm coming from a lever worked outside of the ladle serves to raise and lower the plug. This opens and closes the opening in the bottom of the ladle and thus controls the flow of metal. The desirability of bottom pouring had been recognized by founders for years, but the difficulties in the way of accomplishing it in a simple and mechanical fashion have been so great that very few foundries have ever succeeded in using bottom pouring ladles. The obstacles in the way of their use have been the difficulty of finding a material which would withstand the extreme heat and cutting effect of the iron and, at the same time, to quickly and accurately close the ladle when the mould was full so as to prevent the waste of iron. These are all overcome by Mr. Fisher's invention.

To have clean iron flowing into the mould is not however sufficient to guarantee freedom from sand washes and the collection of dirt on the way from the ladle through the gates into the mould. In the Griffin foundry clean iron in the mould is obtained by a device at once ingenious and simple. When the iron comes from the ladle it drops into a bowl or feeding head the bottom of which is formed by a hard disk moulded of dry sand. This disk is prepared in precisely the same way as a core would be, and is perforated by ten 1¼ in. holes. This strong dry sand plate resists completely the tendency to wash and the iron is delivered into the moulds clean. The resulting wheels by their freedom from dirt and sand show pretty clearly the advantages of these improvements in casting.

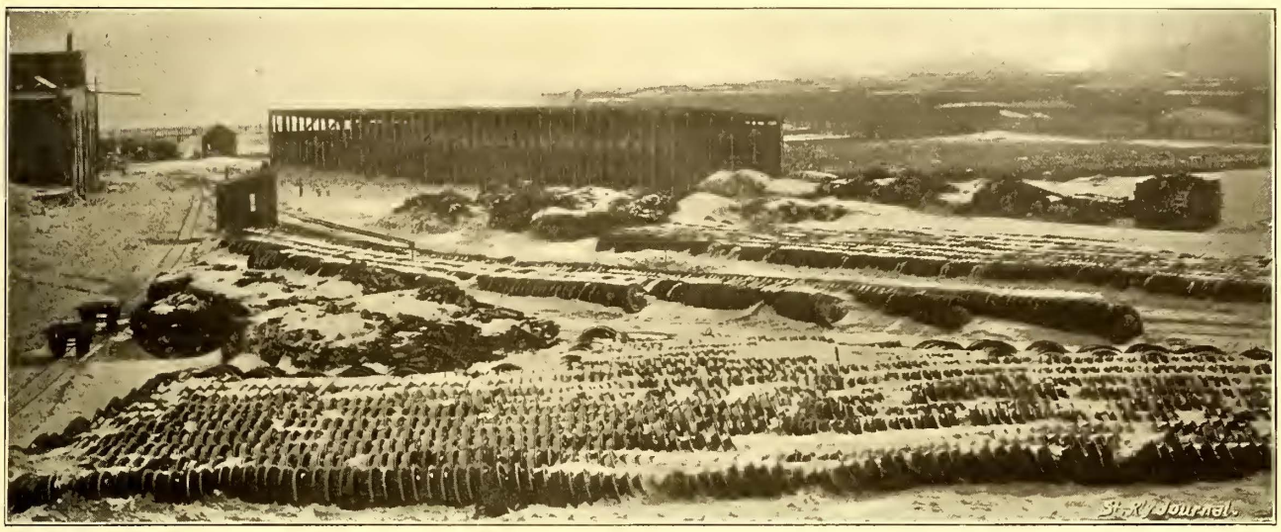


FIG. 4.—WHEEL YARD.

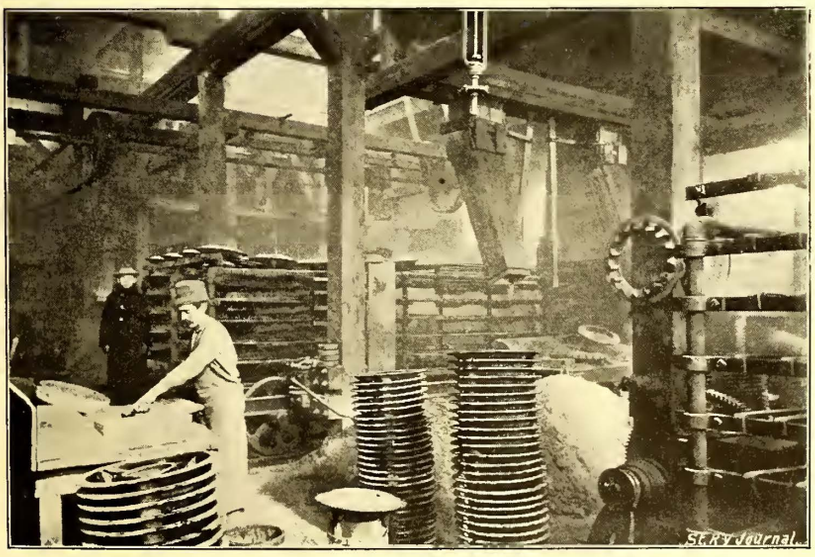


FIG. 5.—CORE ROOM.

The perfection of a car wheel is not however altogether dependent upon the facilities for casting, the size of the foundry or its capacity for melting iron. A complete knowledge of both physical and chemical qualities of the iron are also necessary. The Griffin Company in order to produce a first class wheel analyzes its iron for silica, manganese, carbon, sulphur, phosphorus and iron, and divides the carbon into three forms, graphitic or non-metallic, carbide and hardening carbon. Old wheels which must be extensively used in any foundry are most carefully graded by their fracture. When a lot of wheels of any particular make are received they are carefully analyzed so that it may be known not only from analysis but from the physical character of all the iron used what may be expected from it in the cupola.

As both iron and wheels are subjected to analysis, the cupolas are also charged by analysis. With these means to an end, the company makes the end sought the obtaining of a wheel which will give the maximum wear with strength enough for the service to which it is subjected. In a street railway wheel hardness is the keynote to the wearing qualities, while strength, of course, is of primary importance up to the point of safety in carrying the load. When this has been reached it becomes of no importance whatever, hence the absolute strength per square inch of iron is not an essential feature. The standard section is shown in Fig. 3. In thirty-three inch wheels the company considers that the weight for a motor car should be from 380 to 400 lbs. according to the width of the tread. This enables

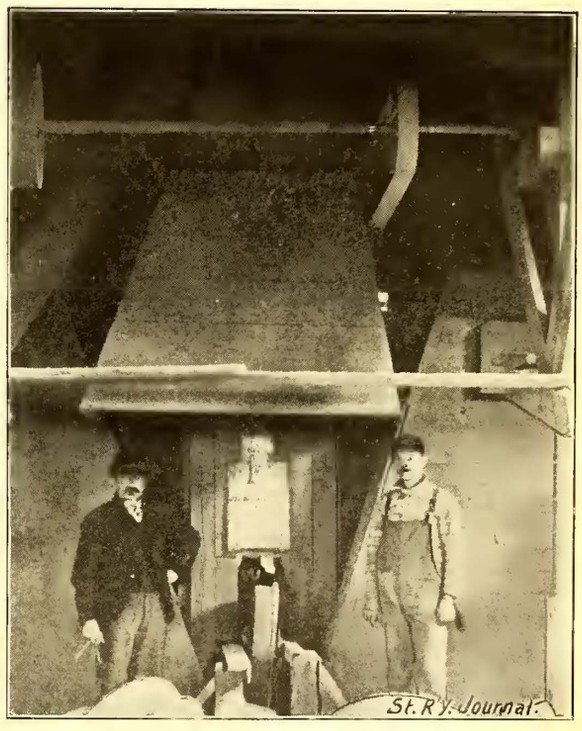


FIG. 6.—CLEANING WHEELS BY SAND BLAST.

depth of chill to be obtained by the use of hard iron, while a sufficient quantity of metal can be used to obtain all the strength necessary. On such wheels, the company gives a guarantee that all wheels shall make 40,000 miles under fair usage. This means however that wheels broken in collision and skidded by careless motormen shall not be charged against them. This is only a fair condition often overlooked in keeping wheel records.

The conditions under which wheels are made have much to do with their durability and strength. Not only must the quality of the

iron be known, but the time of the heat (by the moulder's record for the day), the condition of the metal at the time of pouring, the weather, the distance from the mould to the furnace, and even the position of the mould relative to the doors, etc., are all matters that should be known. They all have their influence on the quality of the wheel. For example, it is found that a wheel may show a deep hard chill, the chill appearing perfect to the eye; the iron will be chemically all right, and yet the wheel is found to be brittle. Investigation of the causes would show that such a wheel might have been poured when the iron was too cold. As a case in point, a thirty inch wheel showed a chill of $1\frac{1}{16}$ ins. It was of good metal as shown by analysis, and was hard and round. Such a wheel except for certain indications would have been considered absolutely perfect, but it was found to be brittle and investigation developed the fact that the metal was too cold when it went into the mould. The moral of such things as this is that the superintendent must to a considerable degree depend upon his wheel maker for a perfect wheel. Judging the quality by its performance, specifications of the quality of iron is of little use, since the famous Salisbury iron might be so handled as to make a wheel of but insignificant wearing qualities.

These facts lead the company to exercise a remarkable degree of care over every individual wheel that leaves its establishment. The company's wheel records are commenced each day by giving each moulder a list of the wheels which he shall make and the numbers which he shall put upon them. The charges for the cupolas are also determined in advance and moulds for test pieces made so that the quality of iron going into each wheel is not only decided in advance, but means taken to know whether the result desired has been attained. When the work is done, each wheel is inspected, calipered, and a record made which shows who made it, when it was poured, from what heat, its chemical composition, its physical condition and the part of the charge from which it was taken. There are also numerous other facts connected with the wheel, all having a bearing upon its durability, strength and form, which are carefully recorded and with a systematic regularity which makes it practically impossible to have any one wheel escape. Penalties for the workman who makes mistakes eliminate to a large extent imperfections.

Every individual wheel which has left the foundry, and there are 1,250,000 of these wheels now in service, can be identified, and all the information about its manufacture obtained from the record books. A still further record is kept in a graphic way in one of the rooms which enables the managers to note the changing chemical and physical aspects of the output, and to correct any tendency to error before it has time to make its appearance as an actual quality in the wheels.

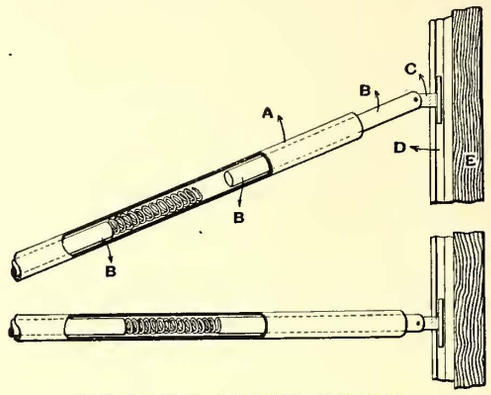
FIG. 7.—MACHINE SHOP—GRIFFIN WHEEL WORKS.

In general the company aims to give a product about 100 per cent stronger than the specifications call for. For example, if the physical tests demand 8 blows of the 140 lb. drop, a wheel is aimed at which will resist 16. But it is not desirable to go too far in this direction, for the strong tough irons are soft and invariably produce for street car work a wheel giving a less mileage than a harder one.

In connection with the company's records and the constant scrutiny which is given them, mention must be made of the peculiar and very happy system upon which the works are run. They may be said to be carried on by an executive commission. Each of the departments at the works has a special head. At the main office there is a board of management. There is no one man who holds the office usually termed that of a superintendent, and neither the works nor the business are dependent upon any one man for their operation. The superintendents report direct to the executive committee and in this way there is a daily consensus of opinion, and at this board meeting all business connected with the departments is transacted. This idea of a consensus of opinion in carrying on the work is carried out by entirely rejecting all verbal instructions. The action of the board is all reported in shorthand and the managers or superintendents receive all their orders in writing. Verbal instructions, to use the slang of the day, "don't go." The system of records and blackboard reporting is such that the successful operation of each one of the departments makes itself apparent even to those who are not specially expert. And the system is so nicely adjusted that the daily results of the departments show in an almost graphic manner.

Adjustable Curtain Fixture.

In the accompanying engraving a new type of curtain fixture, manufactured by the Brussels Tapestry Company, is illustrated. The engraving shows sections of the tube A, at the bottom of the curtain leather. The rods B are of such a size as to readily slide inside of the tube A in which they fit snugly. At their outer ends are pivoted the guides C, which slide in a groove D, cut in the casing stock or in a double rabbeted groove fastened to it. At the inside ends of the rods B is a spring, the tension of which is so arranged as to press the guides C against the casing E with sufficient force to assist the roller to hold the curtain at any desired height and prevent rattling. The force required to do this is very slight, and the tension of the spring roller at the top will always keep the curtain in its natural position.



ADJUSTABLE CURTAIN FIXTURE.

If the curtain is pushed up by taking hold of the tube A, near the end, it will cause the fixture to assume the position shown in the upper diagram. The tension of the spring is then automatically released, and when the hold on the rod is released it will immediately assume its normal position. All parts are of metal and practically indestructible. As the arrangement is simple, the fixture should not get out of order.

Although placed on the market for only a few months, the company has received orders from a number of the principal steam railroads and from a number of street railway lines.

A Turbine Governor.

The Stilwell-Bierce & Smith-Vaile Company, which has done so much in developing the horizontal type of turbines and adapting them to the requirements of electrical generators, has recently brought out the new governing device called the Giesler. It is claimed to keep the speed of the wheels constant to within one per cent.

After experimenting in every direction, the manufacturers of this governor finally decided that a form in which the governor acts upon the valves through the medium of electricity was decidedly the most desirable in every way. With this machine the slightest variation in speed is properly multiplied to any desired extent. This enables the governor to open or close the water wheel gate long before ordinary governor balls would show any sign of moving. The governor can be arranged to fully open or close the water wheel gate in from 3 to 15 seconds, according to the requirements of the situation.

The makers are enabled to use very small balls in this governor as the latter is relieved of all work whatever, such for instance as lifting a valve against pressure, lifting a pawl or moving a slide. The balls and their attachments are finely balanced and their movements magnified so that a slight variation in centrifugal action will at once manifest itself by opening or closing the water wheel gate as required.

National Air Brake.

The accompanying engravings illustrate a new type of air brake for street railways invented by Geo. S. Lee, and put upon the market by the National Air Brake Company, of which Mr. Lee is general manager. The service is expressly for street railway cars, and possesses a number of features designed to reduce wear of parts and simplify operative methods. Descriptive of the system, Fig. 1 shows

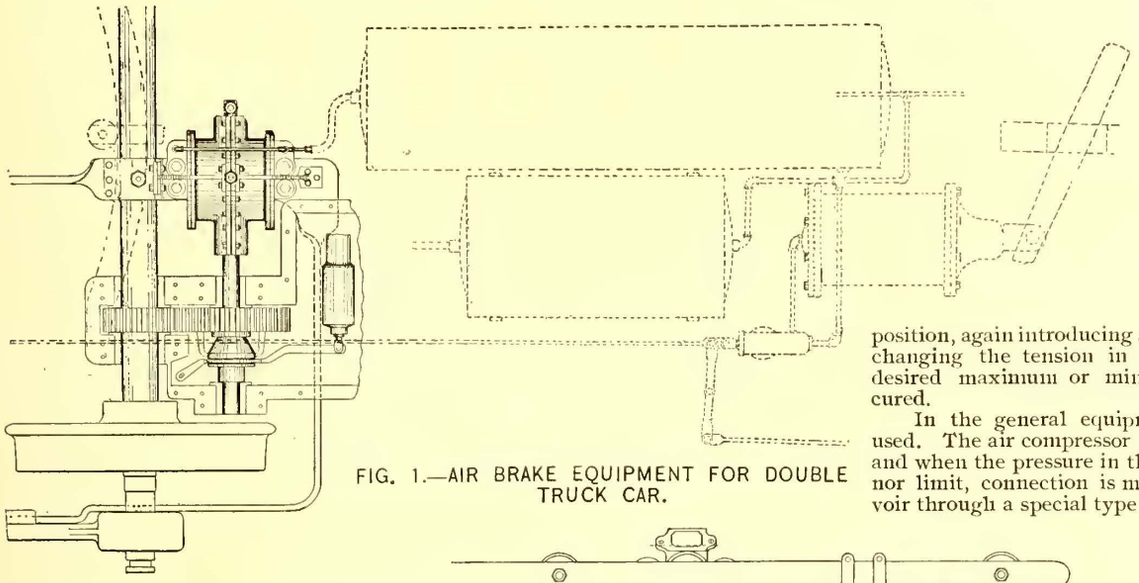


FIG. 1.—AIR BRAKE EQUIPMENT FOR DOUBLE TRUCK CAR.

the manner of attaching the compressor to a double truck car, and Fig. 2 that employed with a single truck car.

One of the principal features of the invention is that by which the compressor is stopped when a predetermined maximum air pressure is accumulated in the reservoirs, and again resumes operation when the air pressure in the storage reservoirs has fallen by usage to a certain predetermined minimum amount. By this means the wear on all of the active parts is reduced to a minimum. The manufacturers estimate that with the greatest number of brake applications the activity of the machinery in service will not be more than about ten per cent of the running car time, and taking the average number of stops required in the ordinary city street, not more than five per cent. This should mean a long life to the equipment.

The compressor is operated from the axle by gearing. A pinion placed upon the axle gears into one of a larger diameter on a countershaft. Inclosed in the larger gear is a clutch, the shipping lever of which is thrown in and out of service by an automatic governor, ingenious in construction and illustrated in Fig. 3. The lever actuating the clutch is moved by a plunger in cylinder *A*, operated by two air ports shown at side and bottom, the whole being connected to one of the pressure reservoirs. In starting the car, the plunger in cylinder *A* is firmly held down by air pressure passing through the passage *H* and held on the upper side of the piston head. When the pressure in the cylinders has reached the predetermined minimum amount (say thirty pounds), the plunger *g* is raised, cutting off the air pressure in cylinder *A* and allowing the air pressure above the piston to escape through opening, *i*. The plunger is not raised however there being no pressure below it. When the air pressure increases to another predetermined amount (say fifty pounds maximum), the plunger in cylinder *C* is pushed back, opening the ports beneath the plunger in cylinder *A* and forcing it upwards. This operates the lever governing the clutch, stopping the action of the compressor. When the pressure in the reservoirs has dropped below fifty pounds, plunger *C* falls to its original position, but the clutch is not thrown into operation until the thirty pound minimum limit is reached, when g drops back to its original position, again introducing a back pressure in *A*. By changing the tension in the valve springs, any desired maximum or minimum limit can be secured.

In the general equipment two reservoirs are used. The air compressor discharges into the first, and when the pressure in this has reached the governor limit, connection is made with a second reservoir through a special type of graduating valve illustrated in Fig. 4. The second reservoir acts as a storage and is not connected with the pumping-in reservoir until braking pressure above the minimum limit is gained in the larger. The graduating valve then opens and the second reservoir, as well as any others, even those on trail cars, are charged to a predetermined maximum pressure. A return is made from one to the other so that continued usage of the air in the reservoirs can be obtained. The object of using the small pumping-in reservoir is that at starting the car from the barn air sufficient for braking purposes can be obtained before the car has traveled twice its length. This graduating valve is so arranged that the air pressure in the reservoirs can never go above the maximum limit; thus a safety attachment is provided.

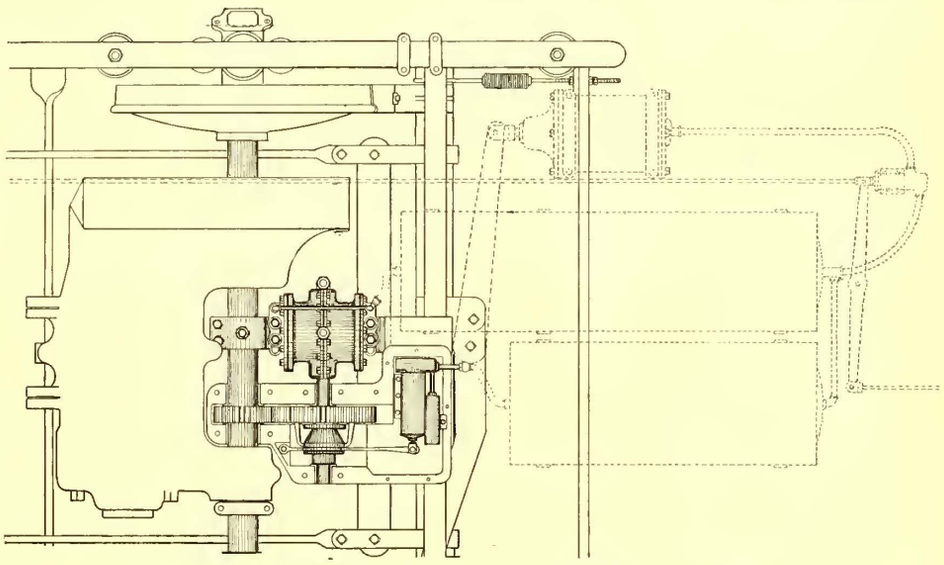


FIG. 2.—AIR BRAKE EQUIPMENT FOR SINGLE TRUCK CAR.

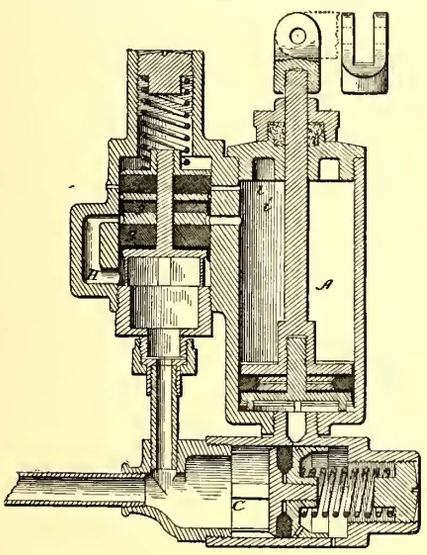


FIG. 3.—SECTION OF AUTOMATIC GOVERNOR FOR COMPRESSOR.

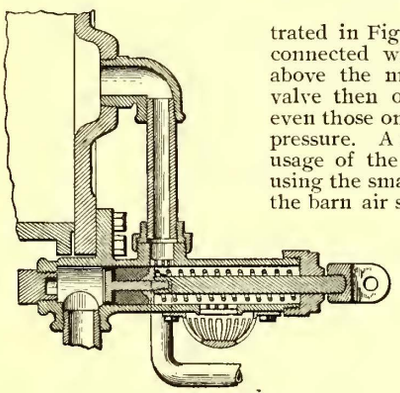


FIG. 4.—SECTION OF GRADUATING VALVE.

The service valve admitting air to the brake or jam cylinder is connected to each platform by a rod. This is actuated by the brake handle staff used for operating the ordinary hand brake. As this adds no new apparatus to the platform, it simplifies the work of the motorman. The hand brake is allowed to remain in position with its chain attached to the ordinary brake staff, so that if an accident occurs to the air brake equipment additional turning of the same handle used for the air brake will set the hand brake.

A special recording indicator is in full view of the motorman, showing him at all times the air pressure in the reservoirs.

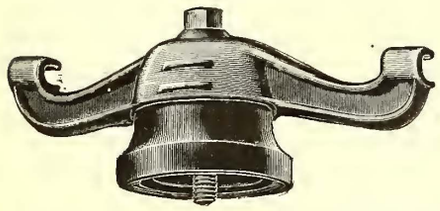
Among other special advantages claimed for the National air brake are the small amount of piping required, no pipes being led to the platforms, and automatic lubrication of all parts subject to wear.

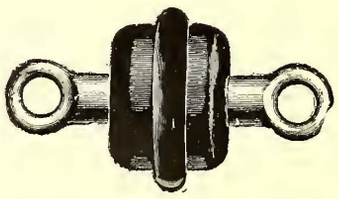
On single truck cars where lack of room prevents the use of the arrangement shown, the equipment is somewhat different. A novel mechanical movement accomplishing the same results as a flexible shaft, connects the compressor with the geared shaft so that the

former can be placed at any angle up to 90 degs. with the latter. Although the National Air Brake Company has been organized but a short time, it has equipped a number of cars with its apparatus.

Overhead Line Material.

Some views of the overhead line material of the W. T. C. Macallen Company, which have not been published in the STREET RAILWAY JOURNAL, are given herewith. This company was incorporated in 1892 and its line appliances are manufactured under the patents granted to its treasurer and general manager, Louis McCarthy, who with G. W. Prouty has developed the business to its present extensive proportions. The patents owned by the company embrace broadly an insulator comprising a metal bell or case with an interior supporting piece insulated from the metal by sheets of mica, and the whole firmly compressed together and imbedded in a mass of insulating compound. These insulators were at once applied to the insulation of gas and electric fixtures, the underwriters throughout the country insisting upon their use. This insulator has so completely revolutionized the construction of insulating joints that no board of underwriters in the United States will now accept anything but a mica joint.





FIGS. 1 AND 2.—BELL AND STRAIN INSULATORS.

FIG. 3.
BELL SECTION.

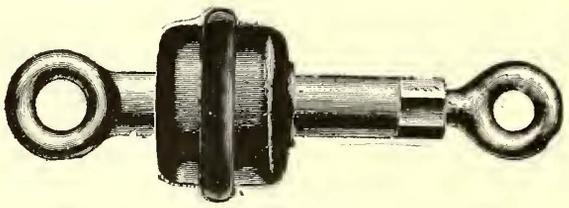


FIG. 4.—INSULATED TURNBUCKLE.

FIG. 5.—BOLT.

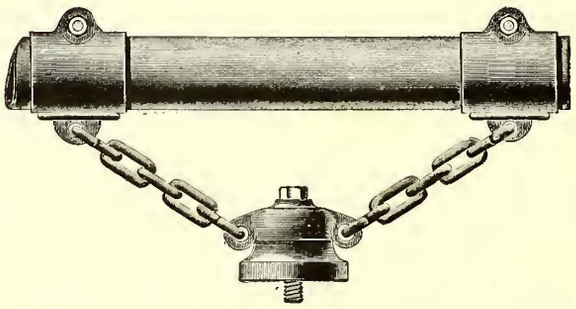


FIG. 6.—DOUBLE CHAIN BRACKET SUSPENSION.

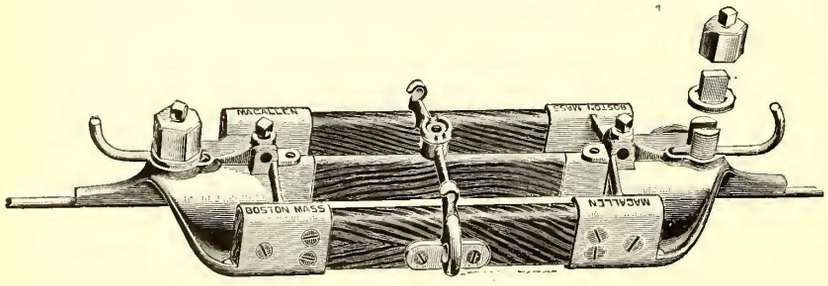


FIG. 7.—STRAIGHT RUN CIRCUIT BREAKER.

Figs. 1, 2, 3 and 4 illustrate some of the different hangers and pull-offs with section of the bell showing the arrangement of the sheet mica. This company also manufactures the "West End" forms, the insulated part of which is shown in Fig 5.

Fig. 7 illustrates the straight run circuit breaker. Some of the advantages of this type of circuit breakers are, that the trolley wheel can pass under it at full speed, while the shear at the ends is such that the trolley will be thrown to one side should the car approach with the trolley off, the clamp device shown for holding the end of the trolley wire, and the ease with which the center bar or runner can be removed, and a new one inserted in its place. This is done without disturbing any of the trolley wire connections by removing the two screws shown in the engraving.

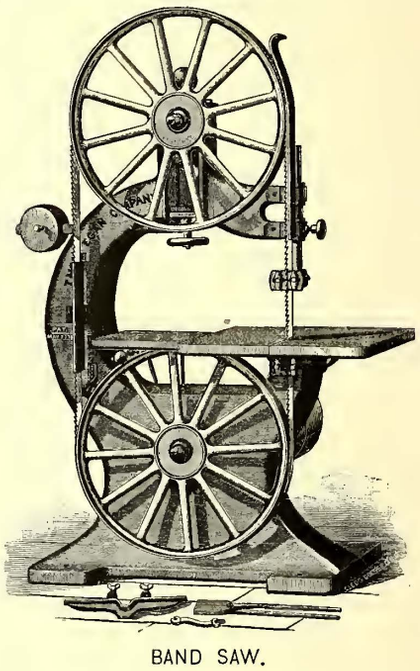
Fig. 6 illustrates the double chain bracket suspension manufactured by this company. It is novel in design, and so entirely different from any other form of bracket hanger ever before designed that it is worthy of consideration. Its motion is absolutely universal, there being absolutely no strain on the trolley wire excepting its own weight, and the means by which this motion is obtained is simplicity itself.

The Macallen Company has an especially prepared compound from which these goods are manufactured. Practical use, as well as tests, it is claimed, has proved this material to have strength, durability and waterproof and insulating qualities of a high order.

Band Saw.

The band saw illustrated herewith is manufactured by the Egan Company and is designed for general work. It has many new features and points of advantage especially in the complete manner it is fitted up. The frame is cast in one piece, and is cored out, or, in other words, is hollow. This adds materially to the strength, without increasing the weight. The wheels are large in diameter, and the greatest care has been taken to get a perfect wheel. A pure gum covering is placed around each wheel and is ground true; and so perfect is the process for putting on this gum, that during the years the company has been making band saws, not one band has ever come off, until worn out, if properly handled.

The table can be instantly angled to any point, and the blade will run true to center of cut. The upper box or wheel is angled, so as to lead the saw to any path, by a hand wheel, and the saddle and the box are raised and lowered by a main screw. The weight, for giving the proper tension to the saw, is adjustable, is very simple, and can be instantly changed to give more or less tension according to width of saw and density of work to be done.



BAND SAW.

The saw is fitted with a guide that will run narrow or wide blades with equal facility. The adjustable steel plate at the back gives the saw a full bearing and support, the plate being reversible. The side guides are adjustable to the width and thickness of blade. The shifter, for shifting belt and stopping the saw, is very quick and effective. The patent guide raises and lowers with guide bar, to adjust itself to thick and thin lumber, and will take in twelve inches under guide.

THE Warren Electric Company, of Chicago, will exhibit at the approaching electrical exhibition two of its induction type of alternators with stationary armature coils and single stationary field coil. The exhibit will include a 45 k. w. and a 60 k. w. machine. The 60 k. w. will be run to provide alternating current at 110 volts direct from the machine without transformers, for use in lighting portions of the building and for driving a single phase self-starting alternating current motor, and for operating wattmeters, etc. The 45 k. w. machine will not be run regularly, but will be on exhibition partly unassembled. The exhibit will be under the charge of Messrs. Wendell & McDuffie, agents in New York City for the Warren Electric Company.

THE Mountain Park Land Company, proprietor of the Johnston Drive Mountain House (Plainfield, N. J.), will build an electric railway from the Mountain House to the lines of the Plainfield Street Railway Company. Two cars will be used. Silas D. Drake, of Elizabeth, N. J., is secretary, and Joseph T. Vail, of Plainfield, is treasurer of the company.

Fireworks as a Park Attraction.

The value of the establishment of parks as promoters of traffic is getting to be more generally recognized by street railway managers. Those whose lines have served parks, either of their own or established by the public, have found that with the use of electric cars the number of pleasure seekers among their patrons has greatly increased. In many cities it has even been found profitable to give at the parks at stated intervals, entertainments to which either an admissson fee is charged or the patrons of the company have been allowed free admittance. In the latter case, the increased traffic induced by the entertainment has been depended upon to defray the expenses.

It has been estimated that there are at least 100 companies which have established parks of their own for the single purpose of increasing their passenger business. Some of these have been very elaborate, such for instance as that of the Toledo Electric Railway, of Toledo, O., which has built an extensive casino at a cost of $65,000 on the shores of Lake Erie, in a large park owned by it. Another company which has gone largely into the development of parks is the Detroit Railway Company, of Detroit, Mich. The extensive spectacular show given at this company's park last summer was illustrated and described in the STREET RAILWAY JOURNAL for January, 1896. The contract for giving this entertainment was taken in toto by Pain, the well known New York specialist at such entertainments, and met with such success that after the time contracted for between him and the railway company the entertainment was by mutual consent extended. As the park was in the outskirts of the city and the only means of access was by the electric cars of the Detroit Railway Company, the latter enjoyed a phenomenal patronage during the time in which the entertainment was being glven. The performance was presented at Boulevard Park, a resort of about five acres owned by the company, where a grand stand seating 8000 persons was erected.

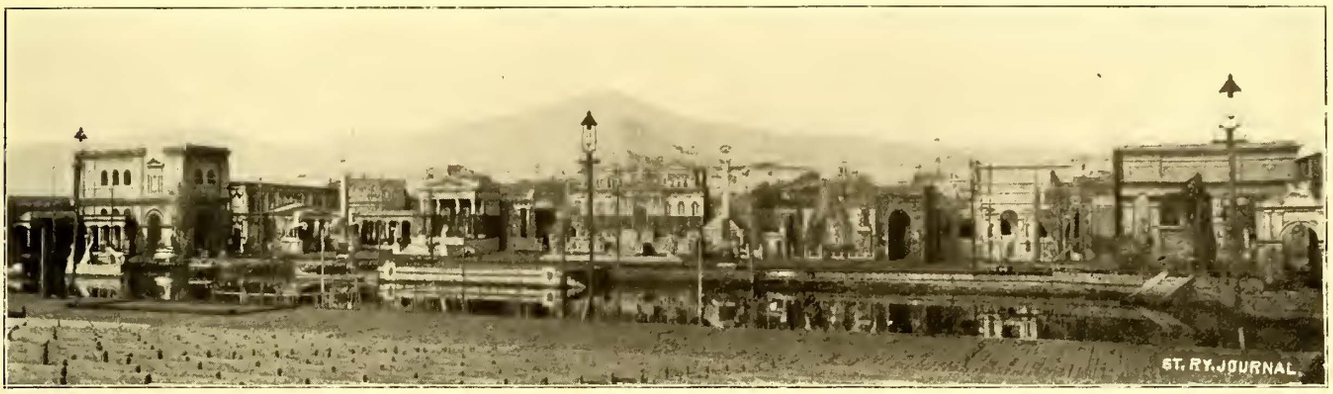


FIG. 1.—SCENE REPRESENTING LAST DAYS OF POMPEII.

The adaptability of fireworks for amusements of this character, and the proximity of the season in which street railway managers having parks will have to consider the question of entertainments, is the reason for the publication of the accompanying engravings showing what can be accomplished in spectacular entertainments.

Fig. 1 illustrates the stage of a pyro-spectacle entertainment to represent the destruction of Pompeii, devised by Pain; Fig. 2, a similar entertainment representing the bombardment of a Chinese town during the recent war between China and Japan; Fig. 3, the Carnival of Venice.

The Pain Pyro-Spectacle Company, from whose entertainments the accompanying photographs were taken, was the introducer and originator of these amusements. In fact, it may be said here that this company probably leads all others in the extent of entertainments of this character, and that the science of pyrotechnics has been carried to a far higher point in this country than in any other.

The subjects usually selected for these spectacles are historical in character and are remarkably correct in historical detail, although, of course, the question of best possible effect is carefully studied. The object, as given by the manufacturer, is that an attempt is made, not only to amuse, but to impress a series of lessons on the mind that few readers are able to draw from history or other reading. In fact, probably no more vivid way of appreciating the appearance of a bombarded city, except by actually being present, is possible than by attendance at one of these spectacles, nor could one derive from books such a vivid idea of the appearance of the grand canal at Venice by night than by being present at this spectacle.

A good idea of the character and variety of the entertainments presented will be obtained from a consideration of the titles of the different amusements which have been produced and presented with success by Pain, some of which are illustrated herewith. They include the following: the Last Days of Pompeii, The Siege of Sebastopol, Capture of Vera Cruz, Storming of Pekin, Fall of Vicksburg, Lalla Rookh, Carnival of Venice, Paris from Empire to Republic, and Japan and China. In addition to the above, two others are now in process of preparation. One will be entitled Cuba; the other will be a spectacular play having as a subject the renowned East Indian city of Benares.

The general plan of the entertainment as shown is a carefully drawn and painted background representing the subject illustrated. In the foreground the parts making up the picture are real, heightening the illusion presented by the background. So carefully is the natural blended with the representation that it is usually impossible at a short distance to determine exactly where one begins and the other ends.

FIG. 3.—SCENE FROM CARNIVAL OF VENICE.

In the foreground is a stage, whereon the actors appear. The play, which is pantomimic in character, is usually so arranged as to embody athletic contests, pageants, races, ballets and other spectacular features, with a pyrotechnic finale.

In the foreground is usually also a pond or lake, secured by scooping out the narural earth to a depth of a few feet. The seating capacity of the entertainment ground can, of course, be of any size desired. That of the Detroit Railway Company was 10,000. Some or all of these can be protected from the weather if desired, but it is usually found desirable to build a shelter over only a few of them, leaving the others in the open air. Of course the pyrotechnic part of the exhibition is depended upon to produce the principal spectacular effect. This part of the entertainment must necessarily be in the hands of skilled experts. Great care is taken that no mistake is made, and especially that no danger of premature explosion is run through carelessness. The materials are all prepared and assembled at the company's works in New York, and all the various precau-

tions which experience has taught for reducing the possible danger of explosion are taken by the manufacturers.

The principal actors in the theatrical part of the entertainment, as well as the acrobatic and athletic exhibitors in the large entertainments, are provided by the Pain Pyro-Spectacle Company, which also cares for and manages the entire entertainment, relieving the railway company from all responsibility in this line. In addition to the leading actors, the principal lesser parts are generally filled by the company and these include from 200 to 300 employes and supernumeraries, usually engaged on the grounds. The costumes and properties for these actors, with the music scores for the band, etc., are also all furnished by the entertainment company.

The following statement is given of what is usually supplied by the railway company in an entertainment of this character: grounds, 300 ft. × 450 ft., suitably enclosed, a plain uncovered grand stand, with a seating capacity of from 5000 to 10,000 persons, a narrow strip of ground scooped out for a lake and filled with water, necessary lumber for creating the framework for the scenery, dressing rooms and workshops, advertising, and help, such as ticket sellers, ticket takers, ushers, band and lights. On the other hand, the amusement company takes the contract for furnishing the following: the entire plant or picture with all scenic effects, erected and placed in position,

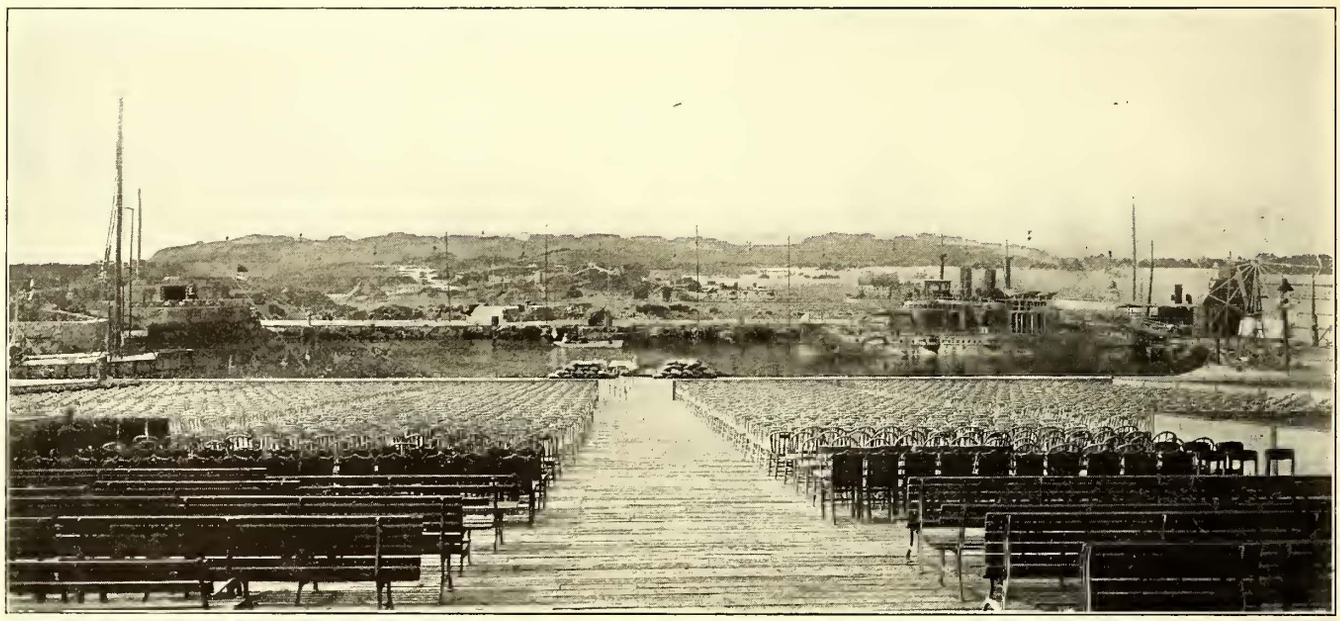


FIG. 2.—SCENE FROM CHINA AND JAPAN.

cast, chorus, specialties, supernumeraries, firemen and operators, numbering in all from 200 to 350 performers, costumes, properties and effects, pyrotechnics for the production, together with a certain number of hand bills, etc.

The company has made a specialty of these out of door exhibits for the last ten years, and its entertainments have been given at all of the principal popular resorts in this country. Those who visited the World's Fair at Chicago in 1893 will remember the magnificent displays given by the company at Jackson Park. Realizing the extent to which street railway companies have within the last few years embarked in the entertainment business, the company is making a specialty of providing entertainments suitable for street railway parks.

The National Electrical Exposition.

On May 4 the National Electrical Exposition will be opened in New York. It will be held in the large Exhibition Building at the corner of Forty-Third Street and Lexington Avenue. According to present indications it will be the largest purely electrical exhibition which has ever been held in this country, and in the number of exhibitors and articles shown will exceed that in Electricity Building at the World's Fair. The exhibit will remain open for about a month.

At present over 200 exhibitors have applied for space, and a good idea of the size of the exhibits will be gained when it is stated that the Exposition managers have been obliged to install 600 h. p. of boilers and engines in addition to the 600 h. p. already in the building. Power will be transmitted to the different exhibits by electric motors. In the center of the hall will be a model of Niagara Falls in which every feature will be reproduced in miniature. It is intended to supply the power for operating this model from the power plant at Niagara Falls. The Loan and Historical exhibit will be particularly complete and will include many objects of interest which have not been heretofore shown in public. C. E. Stump is the active manager of the exposition.

Insurance Against Accidents.

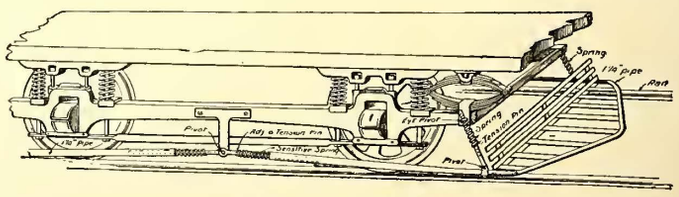
Street railway managers have at last organized a mutual company for the purpose of caring for their accident losses. A mutual organization has been a much talked of necessity, but no one cared to devote the time necessary to the organization of a company until a few weeks ago, when a number of managers in New York and Pennsylvania organized the Electric Mutual Casualty Association, with home office at Scranton, Pa. The Association is directly under the supervision of the insurance commissioner of that state.

The associated managers state that no large and hazardous roads are admitted to membership; only well managed roads with a good record respecting casualties are accepted. The expenses of the management will be less than seven per cent of the premium receipts, while stock companies average more than sixty per cent. The rate charged for insurance by the Association is two per cent of the traffic receipts, and the entire liability of any member is limited to three per cent additional. The management being in the hands of the roads themselves, and every one having at heart the welfare of the organization, success, it would seem, should crown the efforts of its promoters.

The president of the Association is Horace E. Hand, president of the Ithaca Street Railway Company and Cortland-Homer Traction Company; vice-president, W. B. Rockwell, treasurer and general manager of the Middletown-Goshen Traction Company and Staten Island-Midland Railroad; treasurer, Geo. M. Halstead, of the Delaware, Lackawanna & Western Railroad; secretary, Newton Jackson. According to the statements of the Association the legal board consists of the best legal talent in Pennsylvania, and the services of skillful adjusters and detectives have been engaged.

A New Truck Fender.

The accompanying engraving represents a new automatic truck fender now being manufactured by the R. A. Crawford Manufacturing Company for a large road in the West. It is called the United



NEW TRUCK FENDER.

truck fender and has the well known Crawford patented spring action construction, which is used in all the various types of fenders made by this company.

This fender is designed to prevent a person getting under either the front wheels or the rear wheels at side of car. It is carried very close and drops automatically to the track, conforming to any unevenness by reason of the two spring yielding vertical arms.

STREET RAILWAY NEWS

Third Annual Convention of the Texas Street Railway Association.

Mention was made in the last issue of the STREET RAILWAY JOURNAL of the Third Annual Convention of the Texas Street Railway Association held in Galveston, Mar. 18. The following is a summary of the discussions on the different topics considered.

FARES.—Whether the use of tickets of any sort should be advised; if a reduced ticket, in what form, and how handled and sold. Only one railway represented sold reduced fares, and none sold children's tickets. The Dallas roads require full fare for all children except babes in arms; others, all children occupying seats.

EMPLOYES.—The question of whether time was wasted and accidents added to by not using conductors. The cost of a conductor is $547.50 per year; the general length of time of employment is twelve hours, and the average pay $1.55 per day. Some pay by the hour, some by the day and some by the month.

It was generally conceded to be a good plan to increase the pay after certain length of service. One road works its men four days and they are then off one day; another two days, and off one, except for relieving times. Other roads use three men to two cars, one man being a swing run man.

Considerable discussion was held as to what are repairs and what are properly expenses. Mr. Hayward, of Houston, submitted a blank specification which was generally approved.

POWER.—Only three roads could give definite figures on the cost of power per mile; they were .0177 cents, .0144 cents .014 cents. The latter was with hired power. Considerable discussion was had as to the amount of training a man should have in order to save power, and the sort of training.

ELECTROLYSIS.—Several instances were given of supposed destruction by electrolytic action. In few of the cases could this be definitely traced. It was the general opinion that heavier bond wires were desirable. Messrs. Hayward, Urie, Hendricks and Wakefield, all gave instances of trouble; in one case a six inch condensing pipe had been perforated, but was afterwards encased in the tunnel, and so far no bad results had been noticed. In another case water pipes had been badly damaged, but no main pipes. In another, service pipes only had been damaged, and the water superintendent advised connecting to the water pipes direct. In another city the water superintendent refused to allow such connection. In one city the electrician had recommended that they encase the service pipes in vitrified clay sewer pipes. Some discussion was had upon the plastic bond. Mr. Young, of Galveston, advised its use, and maintained that it was not affected by the up and down movement of the rails that it joins.

REPAIRS OF TRACK.—Messrs. Hayward, Drake and Hendricks advocated the heaviest rail possible. Mr. Wakefield inquired if the investment would not soon reach a point where a heavy rail would cease to be economical. In reply Mr. Hayward stated that the difference in cost at the present price of rail, between thirty-five pounds and seventy-five pounds, would be $1700 per mile only, plus about ten per cent for labor and handling.

Opinion was general that the T rail was proper except where paving blocks were used; and the opinion of the majority was that even then the T rail could be so blocked as to prevent trouble.

The president said: "I think the city authorities in general are rapidly coming to the opinion that the T rail has not the objections that have been formerly urged against it.

Mr. Hayward cited a case where T rail was specified for macadamized streets and said: "It costs from ten to fifteen per cent less than girder, especially when the difference in the cost of fittings, connections, etc., is considered."

Mr. Sinclair: "The salt air in Galveston corrodes our rails rapidly, no matter what the weight, but we find that the labor of keeping up the joints of light rail is enormous."

Mr. Drake: "We find that the difference between the twenty-five pound and the sixty pound rail is more than saved in truck and car body repair account."

Mr. Hendricks suggested that a quicker stop could be made on heavy rails than on light; he advised ties close together.

OVERHEAD WIRES.—A figure eight form of trolley wire was talked of and a cut shown.

Mr. Hendricks: "I saw this in the midst of a sleet storm, and it did not seem to be affected by the extra weight more than other wires. Because of the fastening, arcing and consequent pitting of the trolley wire will be prevented at the ears.

The general opinion was however that a No. 0 hard drawn copper was standard.

MOTORS.—The average life of an armature had been found by Messrs. Hendricks and Wakefield to be two years. Mr. Sinclair, of Galveston, had found the life to be one year.

Mr. Drake said: "Our armature man showed me where armatures had become crystallized, probably by heat or overload." It was the general opinion that overload was the principal cause of the destruction of armatures.

POWER.—The price of coal was variously stated to be $3.65, $2.50 and $4.10 in front of boilers. The mileage of the cars per day was from 100 to 180 per day. Nut and slack coal mixed was used, excepting in one case where Arkansas was used.

CAR BODIES.—One member had built new and repaired several car bodies, but did not advise the building of new cars by railway companies.

INSURANCE.—The discussion under this head covered a wide range. Briefly, the insurance companies were charging from 2 per cent to 3½ per cent on frame power house buildings. On brick car houses the premium was 1¼ per cent.

Mr. Drake suggested the organization of the Texas Street Railway Mutual Insurance Company; that ten per cent of the gross earnings of each line, together with the regular insurance charges, according to Board rates, be paid into the treasury annually and that a certain percentage be kept in reserve. Until a corporation could be regularly organized under the laws of the state all payments would have to be upon honor. A permanent committee on insurance was appointed, as follows: Carl F. Drake, of Austin, chairman; H. C. Chase, of Houston City Railway Company, J. L. Sale, of Dallas, and the president and secretary of the Association.

CAR WHEELS.—Various makes and styles of car wheels were discussed pro and con, and there seemed to be no unanimity of opinion. It was conceded that the cost of the wheel was not the principal item in wheel expense, but the cost of taking them off and putting them on and the taking of the cars out of service. It was therefore argued that the best wheel possible should be obtained. It was found that the soft cast shoe was generally used and recommended, though some had the cast shoe with wrought plugs.

TIES.—The cost of ties was found to run from twenty-five to fifty-five cents delivered. Cypress, long leaf pine and oak were the woods generally employed. The cypress for damp soil was found to have long life, but the other woods, it was thought, should be treated. In treating ties Mr. Drake urged that the ends should not be covered or painted as that would prevent the sap from running out in the process of curing, and fermentation and internal decay would result. A white oak tie was thought to be the best.

LITIGATION AND ACCIDENTS.—The cost ran from $500 to $2500 per annum, exclusive of attorneys' fees which average about $1200. It is the general opinion that about seventy-five per cent of the amount of claims paid were unjust and the judgments were brought about by the general hostile feeling against corporations and a controversion of the facts by the plaintiffs.

METHODS OF INCREASING REVENUE.—The discussion under this head covered a very wide range. One instance was given where an $80,000 park had brought in $30,000 per annum in increased revenue, at a small additional expense. Another instance was cited of a park for negroes, which cost about $3500 and paid for itself many times during the season.

Mr. Hayward stated that he had found it absolutely necessary to study the people closely before presenting them an attraction.

In a general discussion it was found that while one attraction (a band) had been successful in one place, in another it was an absolute failure. It was found that people will not pay both a fare and admission to any appreciable extent.

Mr. Drake, of Austin: "We tried to give good entertainments and charge a small admission, but found they were not patronized; we then gave very ordinary entertainments free, and had to turn people away."

Mr. Drake believed in an amusement circuit. Mr. Hendricks found that a negro park paid, and that band concerts took very well.

Mr. Wakefield: "We find that in Dallas the factory man is the one who patronizes the cheaper entertainments, and we have not enough of this class to make it pay. Wealthier people want attractions that cost more than the increase in business warrants."

Mr. Urie: "We find it profitable to keep in with the baseball people; they are well patronized in Galveston."

On the question of appointing a committee on summer attractions no action was taken.

Exhibits at St. Louis Meeting A. S. R. A.

The committee appointed some time ago to look after the exhibits at the St. Louis meeting of the American Street Railway Association is issuing a circular which will be sent out within a few days, containing an announcement to the effect that the convention headquarters for both the sessions and the exhibits will be in the Convention Hall now building for the Republican National Convention. This building is 260 ft. × 180 ft., and for the Street Railway Convention a space of eighty feet will be partitioned off at one end for the convention sessions, and the remainder, consisting of a space 180 ft. square, will be devoted to the exhibits. A plan of the building will be sent out with the circular and intending exhibitors will be requested to notify Mr. Baumhoff, the chairman of the Committee of Exhibits, by Aug. 1, how much space they will require. Every facility will be accorded the exhibitors including current at 550 volts supplied from the street railway lines. There will be no means of ingress or exit to the session room except through the portion of the building devoted to exhibits, and exhibitors are thus assured of more attention, perhaps, than they have ever before received at conventions.

The following sub-committees have been appointed to take care of the details of the St. Louis meeting. The chairman of the general committee is Robert McCulloch.

The Committee on Ways and Means: P. C. Maffitt, president Missouri Railroad Company.

Committee on Entertainment and Banquet: Henry Scullin, vice-president Union Depot Railroad Company.

Committee on Exhibits: George W. Baumhoff, general manager Lindell Railway Company.

Committee on Hotels and Halls: J. S. Minary, general manager Southern Electric Railroad Company.

Committee on Information Bureau: Robert Lehman, secretary and treasurer St. Louis & Suburban Railroad Company.

Street Railway Mileage and Equipment in Chicago.

The following table shows the number of miles of track and the number of cars operated in the city of Chicago by the different street railway companies, divided according to motive power. This table has been prepared with great care from latest information received direct from the companies' officials.

The large electric railway mileage is particularly remarkable, when it is remembered that on Jan. 1, 1893, there were hardly 100 miles of electric railway track in Chicago:

Mileage.	Cable.	Elec.	Horse.	Steam.	Miles of Track. Total.	Cars.
Chicago City Ry. Co	35	118	10		163	1,785
West Chicago St. R. R. Co	31	122	48		202	2,000
North Chicago St. R. R. Co	17	81	2		100	874
Chicago General Ry. Co.		16			16	32
South Chicago City Ry. Co		35			35	91
Cicero & Proviso Ry. Co		50			50	87
Calumet Elec. St. Ry. Co		54			54	186
Chicago & Jefferson Urban Transit Co		5			5	
Chicago North Shore St. Ry. Co.		17			17	25
Chicago Elec. Transit Co		12			12	40
North Chicago Elec. Ry. Co.		16			16	20
North Side Elec. Ry. Co		4			4	
Ogden St. Ry. Co		15			15	
Lake Street Elevated R. R. Co.		14			14	125
Metropolitan West Side Elevated Ry. Co		33			33	155
Chicago South Side Rapid Transit R. R. Co				19	19	180
The Suburban R. R. Co.		5			5	24
Total	83	597	51	19	760	5,624

Under contract and in process of construction in addition to above about 160 miles of electric.

Charles Denby, U. S. Minister to China, states in a recent report to the Secretary of State that an extensive franchise for railroad construction in China has recently been awarded. The line will be operated by steam, will be seventy miles in length and will probably be built by Chinese capital.

San Francisco Notes.

On Apr. 1 the extension of the Pasadena & Los Angeles Railway from Los Angeles to Santa Monica was formally opened. This line is nineteen miles long and is equipped with forty foot closed cars furnished with double trucks. A speed of thirty miles an hour is frequently reached on the long stretches between Los Angeles and Santa Monica. There are already two steam lines running, that of the Southern Pacific and that of the Santa Fe and there is a heavy excursion travel between the two places on Sundays and holidays. On the day of the opening the nineteen miles was covered in one hour and a quarter including stops at all way stations.

The store house of the Market Street Railway Company, in San Francisco, is located in the center of its large system of roads. The machine and electrical repair shops are here also. All the hauling has heretofore been done by teams, but recently the company has decided to equip an electric car as a freight car to displace these teams. The electric lines go near almost all the power and car

ELECTRIC FREIGHT CAR—SAN FRANCISCO.

houses and for the past month this car has been handling the work of collecting and distributing supplies and repair work. The car is equipped with two twenty-five horse power motors and series parallel controllers. The enclosed section is reserved for armatures and other electrical parts that would be damaged by rain. The open portion is used for wheels, axles, brake shoes, barrels of oil, etc. The illustration shows its general features clearly.

In the latter part of March the extension of the Mt. Lowe Scenic Line from Echo Mountains three miles further toward Mt. Wilson's summit was started. This line extends now from Pasadena, Cal., up to Altadena where the power house is located and then up six and seven per cent grades to the base of an incline about a mile long and containing a grade of from forty-eight to sixty-eight per cent. The top of this incline has been heretofore the terminus of the line. It has now been extended three miles further at a uniform rise of seven per cent. The scenery along the route of this mountain road is unsurpassed anywhere and the trip is a very popular one with tourists. The power for the road is furnished by generators run by gas engines. The gas comes up from Pasadena, six miles distant, and the plant forms a case of long distance transmission of power of a character whose advantages are not as fully appreciated by Americans generally as they are in Europe. This transmission of energy in the form of gas is said to be much more efficient than any other. During a recent discussion at a meeting of the Institution of Civil Engineers, of England, it was shown that 3000 h. p. could be transmitted in the form of gas for 1 h. p. or with a loss of but $\frac{1}{30}$ of one per cent and that the cost for gas mains as against electric mains required to transmit the same power was as one is to twenty.

After numerous delays and several postponements the San Francisco & San Mateo Railway, of San Francisco, was sold Apr. 11, to the highest bidder. When the road defaulted on the interest payments on the bonds, a receiver was sought for and appointed by the Superior Court by whom the sale was later ordered. The road was bonded for $1,100,000, and is said to have cost $925,000. Claims have been allowed by the Court amounting to $175,000. The road sold for $300,000, thus leaving the bondholders a prospect of 11¼c. on the dollar. The purchasers were J. A. Buck and N. Ohlandt, heavy holders of bonds, and are thought to be backed by Spreckles the sugar king, who has of late been investing so much money in San Francisco. The stockholders yet have a year in which to redeem the road however, so that no radical changes will be made at present.

On the same day, Apr. 11, another receiver's sale took place in Victoria, B. C., when the Victoria Electric Railway & Lighting Company was sold to F. S. Barnard, of the Consolidated Electric Railway & Lighting Company, of Vancouver, for $340,000. The only other bidder was C. A. Holland, representing the bondholders who ordered the sale. The road cost but $500,000 originally, when prices for everything were high.

S. L. F.

Construction Notes.

Cleveland, O.—The Wooster, Medina & Cleveland Electric Railway Company has been granted a franchise by the County Commissioners to construct its line on the Wooster pike. Among those interested are C. V. Hard, of Wooster, O.; R. T. McDowell, of Medina, O., and Joseph Roof, of Cleveland.

Danville, Va.—The Danville & Riverside Railway Company, recently incorporated, has elected the following officers and directors: President, T. B. Fitzgerald; directors, F. X. Burton, J. H. Schoolfield, J. G. Penn, B. F. Jefferson, John N. Wyllie, J. E. Schoolfield, R. I. Anderson, R. A. Schoolfield and C. G. Holland. Work on the road will be commenced at once.

Dundee, Mich.—The Monroe, Dundee & Lake Erie Electric Railway Company has been incorporated with W. H. Cowles, president; W. H. Johnson, vice-president; Vincent Field, treasurer; G. L. Strong, secretary; Oscar B. Marx, auditor. Other incorporators are: A. B. Bragdon, Geo. A. Marr, H. H. Hatch, A. T. Knowson and F. H. Humfrey. The company will build an electric railway from Monroe to Dundee. Capital stock, $400,000.

Erie, Pa.—An electric railway is to be built from Erie to North East, Pa. F. G. & G. R. Sikes, contractors and engineers, of Buffalo, N. Y., have the contract for building the line.

Hagerstow , Md.—Christian W. Lynch, William Jennings and John A. Herman, the principal stockholders of the Hagerstown Railway Company, have been awarded the contract for constructing and equipping the lines of that company.

Jersey City, N. J.—The North Bergen Railway Company has been incorporated by Geo. L. Lecord, John C. Payne and George Sanderson, of Jersey City; John V. Bacot, of West Orange, N. J.; Wm. S. Bacot, of East Orange, N. J., and Albert S. Wall, of Orange, N. J., to construct a railway in Hudson County. Capital stock, $10,000.

Kansas City, Mo.—The Citizens' Street Railway Company has been incorporated by New York, Philadelphia, Chicago and Kansas City capitalists to build and operate electric railways in Kansas City. The conduit electric system will be used instead of the overhead system. Capital stock, $1,000,000. J. C. Shaffer, president of the company, has been in Kansas City to apply for franchises. It is the intention of the company to buy the systems of the new Brooklyn Avenue Railway Company and the North East Street Railway Company.

Meriden, Conn.—It is reported that the New York, New Haven & Hartford Railroad Company will make extensive experiments in the different methods of operating electric railways, the object being to determine the relative merits of third rail construction and the trolley construction, and also to determine which construction will give the greatest efficiency in the matter of speed. If satisfactory results are obtained from these experiments, it is probable that the company will equip with electricity several of its lines which have a large amount of local traffic. Among these are the thirty mile Meriden branch, connecting Waterbury, Meriden and Cromwell, the line between Hartford and Meriden and the line between Meriden and New Britain. Power houses will be erected at Meriden, as this is the center of these three lines.

Moncton, N. B.—The Moncton Street Railway, Heat & Power Company has been incorporated to build an electric railway in Moncton and Lewisville. Capital stock, $100,000. Among those interested are J. & C. Harris, of Moncton.

New Brunswick, N. J.—The Pennsylvania Railroad Company is considering the practicability of equipping with electricity its single track branch line running from New Brunswick to East Millstone.

Oakland, Cal.—A franchise has been granted to the Oakland & Livermore Valley Railway Company and construction will be commenced in a short time. E. P. Vandercook, of Oakland, is general manager.

Portland, Me.—The City Council of Westbrook has granted a franchise to the Portland Extension Railroad Company to build its line toward Gorham. Among those interested are William G. Davis and Chas. F. Libbey, of Portland, and Edward A. Newman, of Deering, Me.

Royal Oak, Mich.—The Oakland Railway Company has secured a franchise to extend its lines from Woodward Avenue west on the ten mile road to Farmington and Southfield. Among those interested are F. A. Baker, Chas. A. Dean and W. H. Elliott, of Detroit, and Nelson E. Springstein, of Royal Oak.

St. Elmo, Ill.—The Western Equipment & Transit Company has been incorporated by B. F. Johnson, P. M. Johnson, C. M. Fraught and R. Kelly, of St. Elmo. Capital stock, $100,000.

St. Paul, Minn.—C. J. Buell, Joseph Elsinger, Gov. McGill and W. M. Liggett, of St. Anthony Park, a suburb of St. Paul, are the promoters of an electric railway from St. Paul to St. Anthony and Como Parks.

Seattle, Wash.—The Third Street & Suburban Railway Company, recently incorporated, has applied for a franchise to construct and operate an electric railway in the city of Seattle.

Turners Falls, Mass.—The directors of the Greenfield & Turners Falls Street Railway Company have accepted the franchise granted by the Selectmen to extend their lines from Lake Pleasant to Montague Center.

Toledo, O.—The Toledo & Maumee Valley Railway Company will extend its lines to Bowling Green, through the towns of Waterville and Tontogany.

Important Western Contracts.

The Walker Company has made during the past month a number of large contracts by which its apparatus will be put in service on some of the most important street railways of the country. The selection of its apparatus by these corporations is an exceedingly strong testimonial to the merits of the company's dynamos and motors.

The Chicago City Railway Company will install six 800 k. w. Walker rope driven generators, having placed an order with the company in the latter part of April. These generators are said to be the largest belt or rope driven generators in the world. To give an idea of their size it may be said that the rope wheel which drives them is about eight feet in diameter and has an eight foot face. The generators run at 220 r. p. m. Two of these machines will be driven from one 2500 h. p. cross compound engine. This order was placed by the Chicago City Railway Company after a most thorough examination of all generators now in the market, and the results of the Walker Company's 800 k. w. generators in Detroit, concerning which Mr. Everett, of the Detroit Railway Company, is most enthusiastic were largely instrumental in the final disposition of the order.

The Metropolitan Street Railway Company, of Kansas City, Mo., has also placed an order with the Walker Company for a 1200 k. w. generator to be coupled direct to an Allis tandem compound engine.

The company has received, during the last ten days, an order for the equipment with motors, controllers and generators of the Chicago & Englewood Railway Company, which is the first large storage battery road in the world. The batteries will be charged from the central station containing four large direct coupled Walker generators, and both these and the motors were selected by the purchasers because of their high efficiency and excellent design.

A large number of motors and complete car equipments have also been ordered of the Walker Company during the month by the Union Railway Company, of New York City, the Second Avenue Traction Company, of Pittsburgh, the Pittsburgh, Crafton & Mansfield Street Railroad Company, the Newburgh (N. Y.) Electric Railway Company, the Rapid Railway Company, of Detroit, and C. E. Loss & Company, of Chicago.

The large orders received by the company for heavy generators and motors have made it necessary to refuse the general machine work business which it has hitherto been possible to carry on in its finely equipped shops, and little more of this will be done in future, the entire shops being given over to the production of electrical apparatus.

Heavily Overloaded Generators.

W. S. Davis, electrical engineer of the Detroit (Mich.) Railway Company, in a letter to the Walker Company a short time ago spoke as follows regarding the work which the Walker 400 and 800 k. w. generators in use in his power station were performing. "Early in the winter when we were extremely short of power and had but the two 400 k. w. machines available, on several occasions we ran these machines for upwards of ten hours with a fifty per cent overload with absolutely no sparking or other injurious effects. On one occasion we carried 1400 amperes at 550 volts on each of these machines for four hours, in a heavy snow storm. So great was the output at this time, that the insulation was melted from the cables running from the generators to the switchboard. The area of said cables was 1,500,000 c. m. We have not yet had occasion to overload the large machines to this extent, but we have every reason to believe from their present operating that they would act equally well under similar circumstances.

"These four generators have now been running upwards of two months without the removing of a single brush and with absolutely no repairs to the commutator or other parts with the exception of ordinary cleaning. With a full load on, these machines are absolutely sparkless, and the fact of our placing with you an order for two more of the 800 k. w. generators is sufficient proof that we are thoroughly satisfied with your apparatus. Owing to the liberal brush contact on commutator one unusual result is obtained, namely, that the commutator is the coolest, of any of the working parts of the machine after a long and heavy run."

This is certainly a fine showing and one of which any manufacturer has reason to be proud.

The Storage Battery in Chicago.

The storage battery will shortly be given an opportunity under fair conditions to prove whether or not it is capable of handling cars practically and economically on an extensive street railway system. The Englewood & Chicago Electric Railway Company, of Chicago, has placed contracts for the construction and equipment of a large portion of its contemplated line which will embrace about sixty miles of track when completed. All of this it is expected to have in operation this season. The cars of this road are to be equipped and operated exclusively by storage batteries. It will be the most extensive and thorough equipment of the kind ever made, and will naturally attract unusual attention. G. H. Condict, chief engineer of

the company, has charge of the entire construction and equipment of the line, and in connection with B. J. Arnold as consulting engineer is carefully planning every detail for its successful operation.

The work of construction is being pushed with all possible despatch, C. E. Loss & Company has the contract for the track work and Henry Lewis & Company for the rails. The Walker Manufacturing Company will furnish the electrical equipment embracing four 250 k. w. Walker generators, and twenty-three fifty horse power car equipments and controllers. The engines will be the Willans patent build and will be upright, condensing and triple expansion. The Arnold system of connecting engines and generators will be used. Heine boilers and Worthington pumps and cooling tower have been contracted for. Forty cars have been ordered from the St. Louis Car Company, using Dupont single trucks. The batteries will be of the Electric Storage Battery Company, type L. Seventy-two cells will be used on each car and will be arranged to commute their connections as follows: four parallel; two parallel and two series, and four series. The weight will be about 5400 lbs.; the output will be about 400 ampere hours per cell, and it is estimated that these will give sufficient power to make a speed of twenty-five miles per hour.

The batteries will be on the car trucks where they can be quickly removed and replaced from the pits in the power station, over which the cars will be run when a change of battery is necessary.

General Electric-Westinghouse Patent Arrangements.

It is reported that a board of arbitration has been selected by the managements of the General Electric and Westinghouse Companies to undertake the solution of all problems arising in connection with the recent patent arrangement between the General Electric and Westinghouse Companies. This board of arbitration consists of Pres. Charles A. Coffin and Gen. Counsel F. P. Fish, of the General Electric Company, Pres. George Westinghouse and Paul D. Cravath, of the Westinghouse Company, and E. B. Thomas, president of the New York, Lake Erie & Western Railroad Company, who is said to have consented to act as the fifth member of the committee.

A New Firm.

Macartney, McElroy & Company, is the title of a new firm of contractors and engineers with headquarters in New York. The firm was organized last month and has already been awarded the contract for track construction for extensive improvements of the Meriden (Conn.) electric railway projected by the owners of the line, the New York, New Haven & Hartford Railroad Company.

Mr. McElroy is a native of Bridgeport, Conn., and a graduate of Stevens Institute of Technology in 1887, taking the highest honors in that year. He is a practical machinist and toolmaker, and has served an apprenticeship in Boston, Providence and other cities. After graduation he associated himself with the United Gas Improvement Company, of Philadelphia, of whose works in Omaha, Neb., he was assistant superintendent. Later he went to Cuba where, as mechanical engineer, he had charge of the machinery of a large sugar plantation. Returning to this country, he entered the employ of the Field Engineering Company just as that company was beginning the construction of the Buffalo street railway system. He was engaged on the plans of this and most of the other plants erected by this company during its existence and after its dissolution he was appointed constructing engineer for the Bridgeport Traction Company. After the completion of this system he designed and built the power station and car house for the Brunswick Traction Company, of New Brunswick, N. J., and also superintended the construction of the overhead work and feeder system, completing the work in January last.

Mr. Macartney, the other member of the firm, has been engaged in engineering work for a number of years and has supervised the construction of a number of roads for Murry A. Verner, of Pittsburgh, one being in Norfolk, Va. He has recently represented the Ohio Brass Company in New York.

Personals.

Mr. Henry C. Payne, vice-president of the Milwaukee Street Railway Company, has returned from his trip to Europe and is now devoting his attention to the interests of the Milwaukee system.

Mr. W. T. M. Mottram, of San Antonio, Tex., died last month, Mr. Mottram was one of the pioneer electrical engineers in Texas. and for a number of years represented in that state the Sprague Electric Railway & Motor Company, and afterwards the Edison interests.

Mr. H. C. Spaulding, formerly of the Knowles Steam Pump Works, has been appointed New England manager for the Electric Construction Company, which is the manufacturer of the Manhattan incandescent arc lamp, and also represents in New England the Siemens & Halske Electric Company.

Mr. J. H. Van der Veer has been appointed superintendent of motor department of the Brooklyn Heights Railroad Company in place of J. F. Whittlesey, who has been made chief engineer. Mr. Vander Veer is well known in electric railway circles, having been general manager of the Scranton (Pa.) Electric Railway Company.

Mr. Erich Rathenau, of the Allgemeine Elektricitats-Gesellschaft, who has recently been traveling in this country inspecting the recent installations here, sailed for Germany last month. While in this country, Mr. Rathenau contributed to the *Elektrotechnische Zeitschrift* an interesting series of articles on notable American electrical installations.

Mr. Scott F. Hazelrigg has been recently appointed superintendent of the Seashore Electric Railway Company, of Asbury Park, N. J. Mr. Hazelrigg began his street railway experience as a driver with the Citizens' Street Railway Company, of Indianapolis, in 1881. He was afterwards appointed road officer, and when the first motor equipment was installed on that road was placed in charge of the repair shops. Later he acted as purchasing agent of the company. In the spring of 1893 he resigned his position and became associated with the electric railway at Asbury Park, and later, in January, 1894, accepted the position of superintendent of the Youngstown (O.) Street Railway Company.

Mr. Edgar C. Seebohm, the representative sent to South Africa by J. A. Fay & Egan Company, the manufacturers of wood working machinery, had a close call recently at Johnannesburg where he was sent to install some machinery for his company. The column of his company's band mill which he was passing through the Custom House was thought by the Boers to be a large cannon or some sort of a machine gun. They wanted to confiscate it and Mr. Seebohm says that it took any amount of talking to convince them that it was a part of a band mill. They are even now a little skeptical as to its being what he claims, and ride past every hour or so to watch the progress made in its erection.

Mr. Charles N. Black, who has just been appointed manager of the Walker Company's recently acquired New Haven factory, has had a valuable technical experience and training. He was a graduate in 1888 in the regular course at Princeton, receiving his degree of A. B., and for the next two years studied electrical engineering under Professor Brackett in the same university, securing his degree of E. E. in 1890. Soon after this he entered the shops of the Brush Electric Company, of Cleveland, at a salary of $1 per day, in order to get the practical machine shop experience which he felt would be necessary for his future plans. After eight or ten months spent in various departments of the work, he obtained the position of chief draughtsman, which he held for a little over a year, gaining in this way a great deal of exceedingly valuable technical experience. He was then appointed foreman of the testing department, and about eight months later became superintendent of construction of the Short Electric Railway Company, with whom he remained until the spring of 1893, when he returned to the Brush Company as its assistant superintendent. During the next two years he designed and developed a new line of large arc light dynamos, ranging from 80 to 125 lights capacity, and these have achieved great popularity in lighting circles. In 1895 he was promoted to the position of superintendent and chief electrician, but owing to severe illness which lasted several months, he was obliged to give up these duties and to devote his time solely to the technical work of the company. His new connection commenced on Apr. 1, and the Walker Company's New Haven factory is expected to be in operation at an early date.

CHARLES N. BLACK.

Captain Eugene Griffin.

Capt. Eugene Griffin, first vice-president of the General Electric Company, who has just returned to this country after a prolonged investigation of the business situation abroad, has had an interesting and remarkable military, professional and business career. He was graduated from West Point in 1875, and was at once appointed second lieutenant of engineers in the United States Army, and was assigned to duty at the Engineering School of Application at Willets Point, where he remained until 1877. During the next two or three years he was in charge of a party of engineers in the United States Geographical Survey in Colorado, New Mexico, Arizona and Texas, and in 1879-80, in which last year he was promoted to the first lieutenancy, he was in charge of the surveys of Governor's, Ellis, Bedloe's and David's Islands, in New York Harbor.

From 1881 to 1883 he was adjutant and quartermaster of the battalion of engineers and instructor in photography, and from 1883 to 1885 was assistant professor of civil and military engineering and the art of war at West Point. In 1885-6 he became aid-de-camp to Major-General W. S. Hancock and chief engineer of the military division of the Atlantic and department of the East. From 1886 to

1888 he was assistant engineer commissioner of the District of Columbia, having charge under the commission of pavements, country roads and all matters relating to electric lighting, telegraph and telephone companies in the City of Washington. In 1887 he was promoted to be captain in the corps of engineers and resigned his commission on Oct. 5, 1889, in order to take charge of the railway

CAPTAIN EUGENE GRIFFIN.

department of the Thomson-Houston Electric Company, which he organized in 1888. In 1891 he became second vice president of the Thomson-Houston Electric Company, and in 1893 held also the office of president of the Thomson-Houston International Electric Company, which has since been consolidated with the General Electric Company.

Captain Griffin is a member of the American Societies of Mechanical and Electrical Engineers, and is one of the best business men in the United States because of his prominent connection with a company which has been intimately associated with the development of electric lighting and railway service in this country. He now resides in in Albany, New York.

Obituary.

WM. S. BEATTY.

The many friends of Wm. S. Beatty, of the Pittsburgh office of the General Electric Company will be pained to learn of his death, Apr. 7, in New Orleans. Mr. Beatty was obliged to give up his work some weeks before, on account of failing health and to seek a more congenial climate in Florida, and later in Arizona. Finding no improvement however he was on his way home, but on reaching New Orleans was unable to proceed further. Mr. Beatty was a comparatively young man for the position he filled and had marked abilities which gave great promise for a brilliant future. His agreeable and obliging manners made him friends everywhere, and his sudden death comes as a great shock to them all.

Among the Car Builders.

The Brownell Car Company is making for the Baltimore Traction Company seventy-five cars, twenty-nine feet nine inches over all. They are nine bench motor cars on Bemis trucks with Westinghouse motors. The plated sills have metal panels of new and improved form at the seat ends, with side steps which fold. They have spring roller curtains of duck with Acme fixtures. The cars seat forty-five persons.

Fifteen cars with convertible bodies are building for the Cincinnati, Newport & Covington road. These are twenty-five feet long, have center aisles and Brownell folding and reversible seats. This seat is a decided novelty, and on a road where a large number of passengers have to be discharged quickly at the end of the line they present many advantages, since when the passengers are standing, the whole seat folds up in such a way as to occupy a space of but six inches in thickness. This practically gives the passenger the whole of the floor space and reduces the obstruction to leaving the seats to a minimum. The sashes are high, with two lights, and have a panel below the windows. In summer a wire screen crosses the whole length of the car preventing passengers from putting their arms or heads outs. The car is finished in cherry and has Acme fixtures to the curtains. The truck is the Brownell 2 E with extended spring base. The cars are wired for both double and single trolley, the first for use in Cincinnati, and the latter for the other portion of the line. These Covington cars are very handsome in style, being in green and cream color. Mr. Jenkins, the superintendent of the road, considers these cars, all things considered, to be better adapted to the heavy summer resort traffic which he has to carry than any which he has yet tried. They are pleasant for the passengers, carry a large number comfortably seated, have good standing room, are safe in case of accident, and at the ends of the line when the crowds are handled can discharge their passengers with the greatest speed.

Some of our Eastern builders would be surprised at the method of putting on and material used in the roof. The roof itself is a single piece of three-ply veneer and the side or lower decks are also in single pieces. The strength and stiffness thus imparted to the roof of the car is very material. The only objection which has so far been urged or suggested has been the effect of water, but as veneer ceilings have been carried in cars for years without damage from water and in almost the same position, this may be dismissed as of no importance, especially in view of the fact that roofs of this kind stand so well. The roofs are covered with canvas and well painted, and if ordinary attention is paid to them they will remain perfectly tight for years. Being in a single piece and greatly stiffening the roof, the danger of cracking the canvas or injuring the paint is considerably reduced, so there is little to be feared.

The Laclede Car Company is building 10 cars for the Pittsburgh & West End Passenger Railway and 28 for the Second Avenue Traction Company, of Pittsburgh. The motor cars have five reversible and four stationary seats, and are 28 ft. 7 ins. over all. They have vestibule fronts with three drop sash. The front is round with No. 14 steel dash, paneled with ash on the inside. The bodies are 6 ft. 8 ins. over the side sills. The sills themselves are respectively 5 ins. and 6 ins. in depth, with uniform thickness of 3¼ ins. The outside sills are plated with ½ in. × 7 in. steel. The steps are the full length of the car. They have slide guard rails out to the end of the cab. This is a somewhat unusual but very good feature. The platform timbers are 2¾ ins. × 11 ins., and the timber is covered with ¼ in. × 5 in. iron. The end platform timber is 22 ins. wide and projects forward to the vestibule 6½ ins. It will be noted that these cars have vestibules, but not bulkheads. There is merely a spindle back between the stationary seats. The cars are finished throughout with selected white ash. They have striped duck curtains on Hartshorn rollers which come down to the floor, effectually closing the car.

Fourteen of the twenty-eight trail cars have a nine foot wheel base, while the motors have but seven feet six inches. The bodies of all these cars are interchangeable. Twenty-four are to be on Lord Baltimore trucks. Fourteen of the trail cars are on on the Baltimore standard trail car gear. Both motors and trailers have high trussings and Westinghouse No. 38 motors. Robinson sand boxes by Victor Knight & Company, of Cincinnati, four on each car under the end seats, are used. The ceilings are of birdseye maple made by the Frost Veneer Seating Company. There are ten lamps and candle bracket lamps at each end of the car.

The Laclede Company is also building twenty ten bench cars for the Baltimore City Railway Company, These cars have very wide monitors and Adams & Westlake Acme curtains. One of the benches faces on the platform. They are furnished with sand boxes, have panels of wood at the end of the seats, two windows in the ends and double posts on each side of the windows.

Thirty closed cars are building for the Fort Pitt Railway, of Pittsburgh. These have three-ply white wood roofs in single pieces. The frame is entirely of ash, except the sills, which are of oak and yellow pine.

One hundred open cars are building for the Cincinnati Street Railway Company and eight for the Mt. Adams & Eden Park Railway. These are 30 ft. 6 ins. over all, have seven reversible 30 in. seats, spaced 30 ins. centers. There are also two stationary seats at the bulkheads. The 2 ft. 3 in. platforms are closed by gates on all four corners. This is the Cincinnati standard. They have Hartshorn roller curtains with automatic curtain replacers designed by John Kilgour, the president of the road. There are electric buttons on every post. Three Robinson sand boxes are on each car. The reason for the odd number is that the cars run in only one direction. They are furnished with electric lights only, finished in cherry and ash, with birdseye maple ceilings and have signal lights on the roof. They are mounted on McGuire trucks and have G. E. 1200 motors. In addition to a powerful brake on the truck they have the Bayard-Kilgour emergency brake.

Twenty cars are building for Peoria. These have center aisles and side steps. The bulkheads have two drop sashes with curtains in the center opening and mirrors over the end seats. Ten have six cross seats and ten have five cross seats with four stationary. The curtains are by Adams & Westlake and come to within 9 ins. of the floor. Half of them are 28 ft. 3 ins. over all and half 25 ft. 9 ins. The bodies are 19 ft. 10 ins. and 17 ft. 4 ins. in length, and the total width over the steps is 7 ft. 6 ins. They are mounted on McGuire trucks.

The Laclede Car Company has also received an order for 50 nine-bench open cars from the Consolidated Traction Company, of Jersey City. The cars will be of the Traction Company's standard style and finish.

The street car department of the Barney & Smith Car Company, is building three closed motor and eight open trail cars for the Rapid Railway Company, of Detroit. They have Wheeler cross seats. The closed cars are 31 ft. 6 ins. long and 41 ft. over the platforms. There are two motors placed on the inside axles of the truck, the make not yet decided upon. This location of the motors is chosen so as not to interfere with the framing. There are three steps to these cars, with two risers. The vestibules are large and have steam car hoods. There are folding doors on each side of the platform which is the full width of the car. The eight open trail cars are 39 ft. 10 ins. over all, have 26 benches, 13 on a side, with a center aisle. The bulkhead has

a single sliding door. These cars have straight sides and are convertible into closed cars for winter use. In summer the panels are filled with wire netting. The sash and sheathing panels fit in the same spaces as the netting panels and have strips for covering the joints which complete the finish of the car.

Thirty open motor bodies are building for the City & Suburban Railway of Baltimore, 20 ft. 8 ins. long in the body and 30 ft. 1 in. aver all. Width over the sills is 6 ft. 9¼ ins. The finish is of cherry and ash with wood blinds. The bulkhead has 3 glass lights. There are seven reversible and two stationary seats; the curtains have Adams & Westlake fixtures.

Four open motor cars are building for the Mahoning Valley Electric Railway, 36 ft. over platforms. They are without bulkheads, but have an octagonal end or vestibule with sash. They are 7 ft. 4 ins. wide over the posts, 6 ft. 4 ins. at the sills, and are 8 ft. 4 ins. high from sill to roof. These are finished with a steam car hood. The seats are reversible and there are Burrowes fixtures for the curtains.

Three open cars are building for Marion, Ind., with the Barney & Smith Company's class A truck. The length of the car will be 28 ft. 5 ins. over all. There are nine reversible Barney & Smith seats. Burrowes curtains will be used. There are also 4 open trail cars for the same road. These have 15 ft. 10 in. bodies and are 24 ft. over the platforms. There are four reversible seats and four stationary. These cars have a three-sash bulkhead.

One closed car body for the Elwood (Ind.) Street Railway is building. The body is 16 ft. long and the width 7 ft. 3 ins., the total length 22 ft. 6 ins., width at the sills 6 ft. 2 ins., and the height 8 ft. 3 ins. The car is finished in oak, has open platforms and folding gates. It is mounted on a four wheel Barney & Smith class A truck with a G. E. 800 motor.

Two rather novel cars are building for the Los Angeles (Cal.) Traction Company. The design is a combination open and closed car, 38 ft. 6 ins. over all with a 33 ft. body. It might be best described as being composed of two open cars with a box car between them. In the center is a compartment with four windows and longitudinal seats. The ends are like those of ordinary open cars and have two reversible cross seats with aisle in center and one stationary seat. The car is 7 ft. 4 ins. in width over the guard rails and 6 ft. 2 ins. at the sills; total height 8 ft. 4 ins. from the sills. The finish is cherry. The windows and doors have polished French plate glass. There are four folding gates on the two platforms. The doors are double automatic and the open ends are furnished with a removable rail. At the sills all the posts in the open ends have malleable iron brackets on both sides. This car is mounted on double trucks.

The firm is also building a single motor car for the only horse road now running in Dayton, the Wayne Avenue Street Railway Company. The car is 18 ft. body, 26 ft. over all, five windows on a side, and with one end vestibule. Curtains for the windows have automatic fixtures. This car is for experimental purposes and contains many novel features. It is understood that it will have a gasoline motor of some kind.

The American Car Company is building a number of open cars for Windsor, Can., and three are now in the shop. They have double trucks and have sixteen benches, of which six are reversible, are 7 ft. 6 ins. wide and 30 ft. over all.

Ninety-six cars are building for the Missouri Railway Company of St. Louis, and are nearly finished. They are 8 ft. 6 ins. wide, are 20 ft. in body length and 28 ft. over all, and have cross seats 33 ins. wide with a 20 in. aisle. They are finished with white enameled ceilings. The body is trussed beneath the sill, rather an unusual feature. The cars are lighted with Pintsch gas, the holders being placed under the platforms.

One hundred and sixty cars are building for the Metropolitan Railroad of Washington, D. C. The company also has orders from Oswego, N. Y., Buffalo, Philadelphia, Hot Springs, Ark., Union Railroad Company of New York City, Southern Electric Railway Company of St. Louis, and Fall River, Mass. They are building in all at the present time under these orders about 425 cars.

The company is bringing out an extended wheel base, sixteen foot steel frame truck of a very satisfactory design. Experts looking over say that if the rules and past experience hold good it should be both easy riding and durable and ought to be very easy on the car body. Judging from construction it would seem that the body would be entirely relieved from strains arising from irregularities of track.

At the Pullman shops thirty open single truck bodies are building for the Chicago City Railway Company. Ten open cars are building for Toledo, and the company is rebuilding a number of cars that were smashed in transportation to the St. Charles Street Railway in New Orleans. An order has been received for 34 cars for the Pasadena & Pacific Railway of Los Angeles, Cal., of four different styles. There be will 6 motor cars, 8 semi-closed cars, 8 combination open and closed motor cars and 12 trailers. All of these cars have Hale & Kilburn 91½ Walkover seats and Acme curtains. The side sills come to the ends of the platforms and are plated with ½ × 7 in. steel. An order has come from the General Power & Quick Transit Company of South Bend, Ind. Two motor cars have been shipped. The trail cars are on double McGuire trucks. They are 8 ft. 4 ins. over the posts and have side seats. The length is 26 ft. 6 ins. The vestibules are remarkable for their great width which is 6 ft. 6 ins. In the motor and trail cars Baker heaters are placed on these platforms. They seat 44 passengers and have large standing room. The ceiling is three-ply white wood finished in cream color. The platform has a wide door at the outer edge and a drop to cover the steps when the doors are shut. The cars have Gothic windows, Acme curtains and drop sash. These cars are all straight sided. They are very handsome and will be comfortable for passengers and employes.

The John Stephenson Company, Ltd., has recently delivered the final lot of 360 of its elegant cars for the Metropolitan Traction Company, covering its cable lines on Broadway, and branches on Columbus and Lexington Avenues, and also the underground electric lines on Lenox and Lexington Avenues. It is now building a lot of open cars for the same service. The Stephenson Company has also within the last year shipped 250 open and closed cars to the Detroit Citizens' Street Railway Company, and a number of closed cars for the Nassau Railroad Company, of Brooklyn. In addition to these a large number of cars have been shipped to domestic and foreign points.

AMONG THE MANUFACTURERS.

The Okonite Company has moved its New York offices to the Postal Telegraph Building, 253 Broadway, where it has secured a handsome suite of offices.

The Q. & C. Company, of Chicago, has moved its New York office to Rooms 20, 21 and 22, on the 20th floor of the American Surety Building, No. 100 Broadway, New York.

The Consolidated Car Heating Company, of Albany, N. Y., states that it has not entered into any combination with any other electric heating companies and that it has no intention of so doing.

The George F. Blake Manufacturing Company, of New York, supplied an entire outfit of Blake pumps, including fire pumps, feed pumps, etc., to the new battleship, "Iowa," launched from Cramp's shipyard in March.

Ahearn & Soper, of Ottawa, Can., have completed arrangements by which they will have charge of the exclusive sale of the Westinghouse Electric & Manufacturing Company's apparatus in the Dominion of Canada.

The Link-Belt Engineering Company, of Nicetown, Pa., writes us that a preliminary injunction in the suit of the Ewart Manufacturing Company vs. J. Henry Mitchell has recently been granted, restraining the defendant from making an infringement of the patented chain cable of the plaintiff.

The Simonds Manufacturing Company, of Pittsburgh, has added to its list of representatives E. H. Van Vleet. Mr. Van Vleet has located at No. 15 Cortlandt Street, New York, where he will be pleased to see his friends. This company is about to add new machinery which will more than double its present output of gears and other railway material.

Henry R. Worthington, of New York, manufacturer of steam pumps, has published a very attractive line of circulars. They are a series of maps of the different states printed in colors and enclosed in a pasteboard cover presenting views of the principal types of Worthington pumps and a statement in regard to the business of the Worthington Company.

The George F. Blake Manufacturing Company, of New York, informs us that the new U. S. Battleship "Massachusetts" is equipped with an entire outfit of Blake pumps, including independent vertical twin air pumps for the main condensers, fire pumps, bilge pumps, water service pumps and feed pumps. The guns and turrets are also operated by means of Blake hydraulic pressure pumps built especially for the purpose.

The Hoppes Manufacturing Company, of Springfield, O., has recently brought out a new catalogue descriptive of its well known live steam feedwater heater and purifier. This heater, as is well known, belongs to the open type and has given excellent results in practice. In the catalogue the company publishes a list of some of the persons using the device, showing that the heater has been adopted in many sections of the country.

Watson & Stillman, of New York, have some little time been at work upon a lot of hydraulic machinery for the new American Pulley Works, of Philadelphia. This company is to manufacture a new all sheet steel pulley, in which the hub, spokes and rims are all made of thin sheet steel. Watson & Stillman have also received an order for the building of fifteen draw benches for bicycle tube manufacture, each of which will have a stroke of eighteen feet.

C. S. Van Nuis, of New York, has recently published a handsome pamphlet relating to his well known lightning arrester, a description of which has been published in the STREET RAILWAY JOURNAL. The arrester is compact and is claimed to be well adapted for both car, line and station use. Mr. Van Nuis correctly says that fuses are cheaper than armatures and, as experience in electric railway operation has shown, the lightning arrester forms an important equipment of every line.

The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., reports that although the season has scarcely opened, the demand for Wurts' lightning arresters bids fair to be phenomenal. How popular this lightning arrester has become, and how well it has proved its efficiency, may be gathered from the fact that during 1894 the Westinghouse company sold 9000 arresters, and in 1895 12,000, while every indication for the present year promises to double the sales of last year.

Reed & McKibbin, the well-known electric street railway contractors who have been located for a number of years at 80 Broadway, have leased a large suite of offices in the handsome new building at 30 Broad Street, corner of Exchange Place, Broad and New Streets. Reed & McKibbin are owners of a number of street railways, and

have recently purchased control of a well known steam railroad in New York State, which they intend to extend during the year, making it a system of considerable importance.

The Stever Rail Joint Company, of Canton, O., reports the outlook as very promising for a large business this season. Those who have used this joint for from three to five years confirm the company's statement that it is as strong as or stronger than the rail itself and there is no question as to its durability, it being guaranteed to last the life of the rail. This joint was installed on a large number of street railways last year and it is generally stated that the joint is everywhere giving excellent satisfaction.

Edward P. Sharp, of Buffalo, N. Y., is one of the best known representative supply men in western New York and the neighboring district. He represents the American Mica Company, the Taunton Locomotive Works, the Partridge Carbon Company, the R. D. Nuttall Company and other manufacturers prominent in the street railway line. Mr. Sharp also does an excellent business in second hand electrical apparatus, and has on hand a number of S. R. G. and W. P. motors, with rheostats, G. E. 800 ring armatures, gravity car gates and sheet mica strain insulators.

The Standard Underground Cable Company, of Pittsburgh, Pa., supplied all the underground cables that connect the Postal Telegraph Cable Company's offices in that city through the underground district to the overhead lines outside of the district. The cables go out in two different directions, and comprise all the circuits eastward and westward from Pittsburgh. The Standard Company is also laying some large underground cables for the Western Union Telegraph Company in Pittsburgh, taking in most of the Western wires of that company, and in this work is replacing several non-leaded cables of other makes.

The Paige Iron Works, of Chicago, state that they are the sole owners of letters patent, covering the use of supplemental or twin rails, placed at the outer side or parallel with and immediately adjacent to the main crossing rails. Claim 2 of this patent, 366,922, reads as follows: "The combination with the railway crossing of supplemental (or twin) rails, arranged to the outer side of the crossing rails, substantially as and for the purpose specified." The company states that this claim is in very broad language and gives it a monopoly in the manufacture, use and sale of railway crossings which use these auxiliary easing rails.

The Fitzgerald-Van Dorn Company, of Chicago, reports by far the largest business this season that it has ever experienced. The company is well known in the street railway field as the manufacturer of the Van Dorn automatic coupler for electric cars. This coupler has been constantly improved, and it is so exactly and carefully fitted and works so perfectly that one trial on a road generally insures its adoption. The company manufactures it in various sizes adapted to either large elevated cars or tramway cars of any size. The orders for the past month have been very large and come from many of the most prominent lines of the country.

The Metropolitan Electric Company, of Chicago, writes us that John Gorman, for twenty years practical electrician and dealer in electrical apparatus in St. Paul, will represent that company in handling N. I. R. wire, Metropolitan lamps, "Mac" tape, P. & B. compound varnish, etc. Mr. Gorman is prominently identified in electrical interests in St. Paul and Minneapolis, and has done a large share of the electrical work in that section during the last twenty years. The Metropolitan Electric Company has just taken the agency for the Diehl Manufacturing Company, of Elizabethport, N. J., and will carry in stock a complete line of its ceiling fan motors.

H. E. Collins & Company, of Pittsburgh, Pa., has recently published in pamphlet form the result of a test recently made by the Pittsburgh Testing Laboratory, Limited, at the works of the Carrie Furnace Company, Keating Station, Pa., of one 250 h. p. Cahall boiler and one of the same size of a different manufacturer. The pamphlet carefully discusses the test which was greatly in favor of the Cahall boiler and which showed that the latter evaporated 5⅔ per cent more water per square foot of heating surface per hour, used 29 per cent less fuel to the pound of water evaporated, wasted 10 per cent less heat in the escaping gases, and furnished 35 per cent drier steam than the other make.

The Standard Air Brake Company is just bringing out an exceedingly beautiful and attractive catalogue, one of the finest which has come to hand for a long while. It is understood that the letter press is written by the company's general manager, Mr. Wessels, whose terse, vigorous English is plainly evident on many of its pages. In this catalogue the company describes its various types of apparatus, gives mechanical data relating thereto and presents a number of interesting trade points, such as its microscopic parallel which is a novelty in its way. The new electric compressor is practically ready for service, and shipments will be made within a short time. The company has made a series of extensive shipments of its apparatus abroad during the last two weeks, fourteen steamers of the Hamburg, American, Red Star and other lines taking its brake equipments to Germany, Belgium, Switzerland and New South Wales.

The Falk Manufacturing Company, of Milwaukee, has lately closed several large contracts for putting in its cast weld rail joint. The company reports that its large shops are taxed to their fullest capacity in building the large portable cupolas and apparatus necessary for the cast welding work. Among its recent contracts are the Brooklyn City & Newtown Railroad Company, Brooklyn; Milwaukee Street Railway Company, Milwaukee; the Lindell Railway Company and Missouri Railroad Company, St. Louis. The downtown lines of the latter companies are to be finished prior to the Republican convention. Machines are now busily at work in Brooklyn, Minneapolis, St. Paul, Providence, Newark, Chicago, St. Louis and Memphis.

The Raw Hide Pinions on the cars of the Albany Railway, of Albany, N. Y., have made an excellent record. Edgar S. Fassett, assistant general manager of the company, writes that with the pinion it is possible to get four years' wear out of the motor gears and that the company has had gears meshing with raw hide pinions in use for twenty-four months on which there was practically no signs of wear. The average daily mileage of these gears has been 186, while the car has not lost more than ten days in two years. The company is so well satisfied with the pinion that it has specified them on new equipments ordered from the Westinghouse Company this spring. The pinions used are manufactured by the New Process Raw Hide Company, of Syracuse, N. Y.

The Sterling Varnish Company, of Pittsburgh, Pa., writes us that it has just received a large order for Sterling extra insulating varnish from Ludw. Loewe & Company, Berlin, Germany, this order was preceded by a letter ordering a sample lot and stating that this firm had had the Sterling varnish very highly recommended to them and also state in the present order that they have had most excellent results from their tests of the sample and expect to use it exclusively in the future. The Sterling Varnish Company has also received some very flattering letters from its customers in the electrical field showing that it is giving good satisfaction. Among others who are using the varnish are the Citizens' Street Railway Company, of Indianapolis, the Eddy Electrical Manufacturing Company and the Elektron Manufacturing Company all of whom speak of it, as especially adapted for armatures.

The Pantasote Leather Company, of New York, has recently been awarded by the Franklin Institute, of Philadelphia, the Edward Longstreth medal of merit for its product Pantasote. The committee of award stated that among other points "the product possesses in high degree the qualities of flexibility and imperviousness to moisture, a notable freeness from any tendency to develop a stickiness or brittleness under ordinary conditions of temperature." The committee in its investigation of Pantasote obtained the testimony of a number of manufacturers, builders, etc., who had employed it during the last two years. The committee states that "the replies were uniformly favorable and indicate that as a substitute for leather in upholstery and carriage work the Pantasote products have undoubted merit and for these uses it is the best substitute for leather that has thus far been placed upon the market."

The McGuire Manufacturing Company, of Chicago, seems to be after the record for prompt delivery. This company received an order on Monday, Apr. 20, from the Consolidated Traction Company, of Pittsburgh, for twenty-five A 1 suspension trucks, on condition that they would be delivered in Pittsburgh within one week. The wheels were special and had to be brought on from Buffalo to Chicago, which usually takes more time than was given for the delivery of the trucks. Then the trucks, of course, had to be built and shipped from Chicago to Pittsburgh. Ordinary freight takes from five to ten days between these points, but the Traction Company had to have the trucks on the day contracted for. The McGuire Company undertook the work, and notwithstanding that its works are running day and night on other orders, delivered the twenty-five trucks in Pittsburgh, Monday, Apr. 27, by special train. Under the circumstances this is certainly a record breaker.

The Johnson Company, of Johnstown, Pa., and Lorain, O., reports an excellent demand for the Du Pont truck. Among other companies which are using this truck are the following: Nassau Electric Railway Company, Brooklyn, N. Y.; Brooklyn Traction Company, Brooklyn, N. Y.; Detroit Citizens' Railway Company, Detroit, Mich.; Louisville Railway Company, Louisville, Ky.; Lorain Railway Company, Lorain, O.; Yonkers Railway Company, Yonkers, N. Y.; Atlanta Consolidated Railway Company, Atlanta, Ga.; Springfield Consolidated Railway Company, Springfield, Ill.; Schuylkill Electric Railway Company, Pottsville, Pa.; Richmond Railway Company, Richmond, Va.; Irondequoit Park Railway Company, Rochester, N. Y.; Buffalo Railway Company, Buffalo, N. Y.; Commonwealth Avenue Railway Company, Boston, Mass.; Plainfield Street Railway Company, Plainfield, N. J.; Columbus Consolidated Railway Company, Columbus, O.; Cleveland Electric Railway Company, Cleveland, O.; Washington Electric Street Railway Company, Washington, Pa.

The Chicago Varnish Company has, in its new office in Chicago, an interesting exhibit of fossil varnish gums. At first glance they might easily be mistaken for gems, so gorgeous is the coloring and so brilliant the light that shines through them. In reality they are only exudation of sap from trees long since extinct, which, through the refining effect of the sand in which they have lain buried for ages, have taken on the beautiful coloring and marvelous features that distinguish them from all other known substances. Here are gathered from the ends of the earth, Zanzibar, New Zealand, the Congo, Demarara, Brazil, Ceylon, Manilla, huge beetles, brilliantly colored flies and tiny ants imprisoned in the molten gold that flowed from giants of the forest in prehistoric times, and so wondrously preserved that when by accident one of these priceless bits of gum was broken into fragments the insect which was picked out of the wreck was as soft to the touch as in life, and when pierced with a knife promptly gave out the rich red blood of its prey as fresh as if it had robbed it but an hour before. It has taken the company many years to assemble this collection, and it is said to be the finest of its kind in the world, and it would repay any one for a trip to Chicago to see it.

The Ohio Brass Company, of Mansfield, O., reports an increasing demand for the Walker trolley ear manufactured by it. This ear is being adopted by electric roads in various sections of the country, and has been endorsed by leading engineers and contractors. Its design and construction are such that it offers no obstruction to a free passage of the trolley wheel, therefore reducing the sparking of it to a minimum. No solder is required to hold the wire in position, and when placed on the line a perfectly straight underrunning surface is presented to the trolley wheel, due to the fact that the lower surfaces of the ear and trolley wire are on the same plane and are of the same width. The Ohio Brass Company reports having lately secured a number of large contracts for overhead material, in which this ear is specified, and is also obtaining a nice business on motor repair parts and car appliances. The various specialties manufactured by this company at its works at Mansfield, are well known, and have been extensively adopted as the standard by roads which have used them.

The Missouri Car & Foundry Company, of St. Louis, reports an excellent business at the present time with work in all its departments. In street car wheels the company is making some remarkable records. A large number of its wheels are running in St. Louis and many interesting figures have been obtained. St. Louis is an especia llyhard city on street car wheels. It is hilly, which calls for a constant use of the brakes. The dirt is gritty and a large portion of the streets are macadamized, or what is still worse entirely unimproved. This causes the wheels to wear with the greatest rapidity. On many of the lines, especially on those which carry the working people, there are constant stoppages, because the moving population is distributed over the whole length of the different roads. Notwithstanding these unusual and unfavorable conditions the wheels of the company are making good averages and in not a few cases producing phenomenal records.

The Central Electric Company, of Chicago, reports a very marked improvement in business this month. Its street railway department under the careful and intelligent management of Mr. Garton has been splendidly organized. The company's plan has been to make its line of supplies in the department complete, but to handle nothing but first class goods and material such as it could safely recommend. Indeed such care and conservatism have been used in selecting its line of specialties that its listing or handling any new specialty is equal to a first class endorsement of it. The latest specialties added to the company's already splendid list and for which it is general Western agent, are De Witt's Common Sense sand box, which has after two years of service satisfactorily demonstrated that may always be relied upon, and the changeable electric headlight that it may be changed instantly and with no trouble from one dash to the other. The company is also Western agent for the Massachusetts Chemical Company, and is doing a large business in the well known products "Iusullac" and "Armalac."

The National Switch & Signal Company, of Easton, Pa., has been awarded the contract for interlocking the crossing of the Peoria & Pekin Union with the Peoria Terminal, which is a double track line of the Rock Island; also the drawbridge crossing the Illinois River which is to be operated and controlled from the tower at the crossing above mentioned. The company has also the contract for installing the plant for the double track junction of the Peoria & Pekin Union with the L. E. & W., known as L. E. & W. Junction, about a mile east of the Illinois River at Peoria. The drawbridge is crossed by a gantlet, and electrical interlocking will be applied on the drawbridge so that the presence of a pair of wheels anywhere between the ends of bridge will lock up the engine on the bridge as well as the levers controlling the signals from both directions. This will be the first installation of signal work in the vicinity of Peoria, and the entire plant will amount to sixty-four levers. On and after May 1 the New York office of the National Switch & Signal Company will be transferred to Easton, and all correspondence formerly addressed to No. 32 Liberty Street should be addressed to Easton.

The Changeable Electric Headlight Company, of Syracuse, N. Y., is enlarging its factory and getting ready for a large spring and summer business. This company is rapidly pushing its headlight into the front rank, and has in its latest lamps embodied many important improvements. The reflectors are a perfect parabola, and are made of either aluminum, or nickeled copper, as preferred by the buyer. These are reinforced by a jacket of steel, leaving one-eighth of an inch air space between it and the reflector, thus preventing injury and making a very strong and durable headlight. The absolute accuracy of the parabola, on which the company lays great stress, gives the greatest amount of reflection possible with a twelve inch opening, making it the most powerful dash electric headlight on the market. The new headlight is finished in the handsomest manner with nickeled rim and is provided with a waterproof shield to make the receptacle box watertight. The distinctive feature of the headlight, aside from the perfection of its design and finish, is the permanently wired receptacle box and the fact that the headlight is changed from one end of car to the other, requiring but one headlight to a car. The company reports the light as meeting with a great deal of favor, and it is displacing the oil lamps in many cities, giving, it is claimed, one third more light than the best oil lamp. The general Eastern agents of this company are Rodgers, Baldwin, & Vickers, 136 Liberty Street.

The Partridge Carbon Company, of Sandusky, O., has recently received from Point Pleasant, N. J., an excellent testimonial to the wearing qualities of its brushes. This was in the form of a letter from the South Jersey Street Railway Company inclosing two Partridge carbon brushes which had been in use seven months and had made a mileage of from 48,000 to 50,000. The letter said: "We send you to-day two motor brushes made by you and bought by us from the Westinghouse Electric & Manufacturing Company during July, 1894. These two brushes have been in use for seven months, during which time the car from which the brushes were taken has made a mileage of about 48,000 to 50,000. The brushes sent are about the worst worn of a set of ten which I have in my possession. To me this is something extraordinary, as I have had the experience of seeing new carbon brushes put on motors every other night. We are using a Westinghouse No. 12 twenty horse power motor. I would say that I originally bought 100 brushes and I have them all now, none having been used, except the ten as above, which are good for another 50,000 miles' run. I do not think there is another such brush on earth as the Partridge for long life, wear on commutator, etc. I believe in showing appreciation of a good thing, hence my letter. I would say in addition that our line runs along the beach front where sand and dust are plenty. In spite of this excellent record the brushes show but little wear."

The Cutter Electrical & Manufacturing Company, of Philadelphia, received an excellent testimonial to the value of magnetic circuit breakers through the recommendation for their use in a recent report made by Wm. H. Merrill, Jr., electrician of the National Board of Fire Underwriters. The circuit breaker covered by this report is intended to be used for service wires entering buildings, taking the place of the usual service switch and cut-out, also for all mains carrying currents in excess of ten amperes. There are but two forces employed in this device, namely, gravity and magnetism, no springs or catches being employed. It is therefore impossible for the conditions to change after the device has once been adjusted. The company also makes an I. T. E. mercury contact, automatic magnetic circuit breaker, having the same form and features as contained in the report mentioned, but specially designed for use in connection with motors, to open a circuit in case of an underload or a break between motor and service supply. The Cutter Company has also just published a new catalogue on C. S. flush switches and accessories. Full details are shown as to the interior construction of the switch, and plans for wiring are also given. The switches have so long been before the public that an indorsement is unnecessary, but a short list of some of the users is printed on the last page of the catalogue and these names bear out their claim that the C. S. switches are the standard for high grade work. The catalogue is very artistically printed and is bound in heavy artists paper, with title in red and black.

The Universal Construction Company, is the title of a new company which has taken a lease of what is known as the "North Works" of the Illinois Steel Company, located in Chicago. The stock of the company is held by Eastern as well as local men and it is its purpose to develop the manufacture of structural steel and special shapes, and to cater particularly to the bridge building, railroad and contracting trades. Fred Heron, who is general manager and one of the directors, is well known in the iron and steel business, having been long associated with the Homestead Works, in Pittsburgh, and for the last nine years with the Phœnix Iron Company, at Phœnixville, Pa. The secretary of the company, Edward Haupt, has also been for some years with the Phœnix Iron Company. During the last three years, the Illinois Steel Company has been so busily engaged in developing its other plants—which are five in all—that the officers of the company have given little time to the structural business, and involving as it does an immense amount of detail, have deemed it preferable to lease the plant to a responsible corporation, rather than enter upon this branch of business itself. The plant is rapidly being put in order, and the managers expect to have it in operation within thirty days. In the meantime, its fitting shop is being operated with material supplied from other works of the Illinois Steel Company and purchased in the open market. The Construction Company has secured as president, W. R. Stirling, who has long been connected with the Illinois Steel Company and who still retains his position of first vice-president with it.

The Dorner & Dutton Manufacturing Company, of Cleveland, O., reports the business outlook for the coming year as very bright. The works of this company are now busy on an order for seventeen D. F. Henry patent trucks for the Federal Street & Pleasant Valley Street Railway, of Pittsburgh, Pa. The company is also building thirty of its 25 A trucks for the Fort Wayne Consolidated road and has recently shipped five trucks to Bangkok, Siam. There are twenty of the Dorner & Dutton trucks now running in that curious Oriental city, which was at one time supposed to be almost exclusively a city of boats. In the company's gear department, which by the way it is contemplated to enlarge, 400 gears are being made for a Chicago road and 700 gears for the Cincinnati Street Railway Company. There are various orders on the company's books in small lots bringing up the total to about 1300 gears. The location of the shops is an unusually favorable one. There is a separate railroad switch, and on the opposite side of the street from the works the heavy cranes of a stone and marble yard, which enable the company to reduce the cost of loading to a mere nothing. The trucks loaded during a recent visit of the representative of the Street Railway Journal were piled several deep upon flat cars without any more trouble than though they had been boxes that could be handled by hand, and with even less cost. The company is just bringing out a novel car heater for electric roads which is both neat and extremely economical.

The St. Louis Car Wheel Foundry is very busy at the present time turning out car wheels of all descriptions and also a large amount of miscellaneous work for which its works are most conveniently situated. Their output is about 50 street car wheels and 400 steam wheels per day. If pushed the foundry can turn out 100 street car wheels and 500 steam wheels per day. The company is making a very strong and tough wheel. When tested during a recent visit of a representative of the STREET RAILWAY JOURNAL it did not crack until the 110th blow of a 12 ft. 140 lb. drop. After the 118th blow the wheel was removed and finally broken under the heavy drop. This was a 33 in. steam wheel. The quality of the metal was most tough and ductile. The hub was swaged out until it appeared like a great saucer. The works are very conveniently arranged with double cupolas and a double line of elevated tracks for handling stock. One of these tracks is directly over the other. The empty cars return to the hoists by gravity. The works are well located having easy access by switches to several lines of railway. They cover four or five acres of ground and have facilities for making very heavy work. They are using to a considerable extent the Fawcett patent chill by which the usual cuts in the face of an expanding chill are put in a curved form so that the resulting fins do not cut square across the rail. The advantage of this is that they do not cut the rail and the wheel rolls more smoothly. All the company's work showed a great amount of care in the chill making and the wheels were in consequence very smooth. The zigzag chills leave the wheels in such shape that grinding of the wheels is not considered necessary by many superintendents, a rubbing with an emery block answering perfectly. The machine shop of the establishment is quite extensive, occupying both stories of a building 200 ft. × 70 ft. Here all the work of boring wheels, fitting axles and pressing on wheels is performed.

The Berlin Iron Bridge Company, of East Berlin, Conn., has a contract with the Carteret Steel Company, of Carteret, N. J., for a steel frame to support the furnaces which are to be placed in the new iron building which the Berlin Company is erecting. The Michigan Peninsular Car Company, of Detroit, Mich., has also placed contract with the Berlin Company, for a new foundry building 160 ft. square. This building is one story high, has a steel framework throughout, and is so designed that the lower chords of the trusses support runways extending the whole length of the building. These runways carry trolleys having a capacity of 2000 lbs. By means of these overhead trolleys the molten metal is quickly and easily conveyed from the cupolas to any part of the casting floor. Another recent contract is that with the New Britain Knitting Company, for the steel work for that company's new boiler plant. The roofs of the buildings will have steel trusses throughout, and in designing these buildings everything has been so constructed as to render them thoroughly fireproof. R. Hoe & Company, of New York City, is another manufacturer which has placed an order with the Berlin Iron Bridge Company, for an all-steel building. It will be 40 ft. × 60 ft., three stories high and fireproof. To avoid condensation of moisture, the roofs and sides are lined with the Berlin Company's patent anti-condensation fireproof lining on the under side of the corrugated iron covering. The floors are concrete supported by corrugated iron arches resting on I beams. A traveling crane is attached to the trusses, having a capacity of three tons, and so arranged that it takes the material to be raised in the building from the lower floor, and raises it to any part of the building on any of the floors. It is a very conveniently arranged and compact store house. The Berlin Company has also received an order from George H. Morrill & Company, of Boston, Mass., for the erecting of a new building. This will be of steel construction throughout, having steel siding, roof trusses and covering, and the interior platforms will be constructed in the same manner.

New Publications.

THE ELECTRIC MOTOR, ITS GENERAL PRINCIPLES AND CONSTRUCTION. By James F. McElroy, M. A., Albany, N. Y. 27 pages. Illustrated.

This pamphlet is an address given by Mr. McElroy before the New England Railroad Club, of Boston, Feb. 11, 1896.

THE LAW OF NEGLIGENCE IN NEW YORK. Being all the reported cases subject in the court of last resort of the State of New York, to Jan. 1, 1895, condensed, codified and classified. By John Brooks Leavitt. Diossy Law Book Company, New York.

This admirable and unique work is the subject of the legal editorial this month, and space prevents any further review of it.

WESTINGHOUSE ELECTRIC STREET CAR EQUIPMENTS. By F. L. Hutchinson and L. A. Phillips. Published by the authors. Pittsburgh, Pa. Bound in leather. 91 pages. Illustrated. Price $1.00.

This is a handbook for the use of electric railway employes who use Westinghouse motors. After a short introduction in which a number of technical terms and expressions are defined, a description is given of the different parts of the Westinghouse motor and controller, illustrated by perspective views and diagrams. There are also chapters on the method of inspecting and locating and repairing faults, and rewinding armatures. The book should be a valuable one to users of Westinghouse equipments.

A MAP OF THE STREET RAILWAY SYSTEM OF MASSACHUSETTS, prepared by R. H. Derrah, Assistant to President, West End Street Railway Company, of Boston. Price $11.00.

This is a fine wall map of the State of Massachusetts about 70 ins. × 44 ins., on which are drawn all the street railway systems in that state. Mr. Darrah has performed an exceedingly valuable service to the street railway promoters and others interested in the development of interurban lines, as the relative distances and general layout of the lines is shown to great advantage. It is one thing to say, for example, that one can travel from Boston to Framingham, Milford and Blackstone, on the southwest, or from Boston to Amesbury and Newburyport via Lowell on the north, or from Boston to Fall River on the south; and another thing to see just how this is done on this interesting map.

ECONOMICAL DESIGNING OF TIMBER TRESTLE BRIDGES. By A. L. Johnson, C. E. Published by the United States Department of Agriculture. Division of Forestry. 57 pages. Paper covers.

In this bulletin, issued by the Agricultural Department, Mr. Johnson discusses the life and safe unit stress of the principal timbers used in trestles and makes some valuable suggestions upon methods of designing trestle panels. The tables given are important as presenting the results of the governmental experiments of timbers and represents an extensive series of tests. The principal features of the new design of trestles consist in the introduction of corbels and the reduction of the caps. With the paper by Mr. Johnson are included reviews by the chief engineer of the North River Bridge Company and the principal assistant engineer of the Lehigh Valley Railroad who present certain criticisms to the conclusions drawn by Mr. Johnson.

UEBER NORDAMERIKANISCHE STRASSENBAHNEN. By Hugo Koestler, Engineer of the Royal Austrian Railroads. Published by J. L. Pollak, Vienna and Leipsic. 184 pages. Illustrated. Price 3 Marks.

This book presents a review of American street railway practice of the present day, and is intended to enlighten German speaking railway engineers upon the rapid advance made in this country in electric railway practice. The author also expresses the hope that through a wider acquaintance with the advantages of electric traction an impetus will be given to the adoption of electricity for propulsion in the Austrian Empire. Much of the information contained was secured by the author during an extended visit to this country in 1893 and this has been supplemented by a careful study of the improvements made in railway practice since that time.

Mr. Koestler discusses not only the mechanical and electrical features of the American electric railway, but its financial and sociological aspects as well. He estimates that considering the difference in wages and purchasing power of money between Austria and America, the five cent fare universal here is very much lower than the average fare charged on Austrian roads, and seems greatly impressed with the benefits conferred upon communities by good transportation facilities, such as are afforded by electric roads here. The traffic induced by American street railways in proportion to the population of different cities is a source of astonishment.

The author presents engravings of a number of the principal stations and appliances used in this country.

THE AMERICAN CORPORATION LEGAL MANUAL, Volume 4, 1896; edited by Charles L. Borgmeyer and Honeyman & Co., Plainfield, N. J.

This is a valuable directory of law and an index to statutes relating to corporations in all the states of the Union, and in all the principal countries of the world. It contains also forms for articles of incorporation and of acknowledgements in the various states; a compendium of the street railway laws of the United States; an extended essay upon the Patent Office practice and an epitome of the patent, trademark and copyright laws of the world.

To the lawyer who is familiar with Hubbell's and Story's legal directories it is a sufficient description of the present work to say that it is built upon similar lines, but treats solely of corporations and therefore gives, in much greater detail, the various statutory enactments relating to their organization and operation.

The subjects of banks, trust companies and railroad corporations are not treated except by an occasional reference, but the work is mainly devoted to business corporation law.

There is however in the present manual about fifty pages devoted to street railway laws. Here we find digested the laws of all the states under which street railways may be formed. This includes, of course, many states where the street railroad company must be incorporated under the ordinary business corporation act, and also those states, such as Delaware, where the street railway corporation must be chartered by the legislature. The prospective incorporator, as well as the present or future creditor of street railway companies, and the attorney and counsel of all such will find these pages useful. The work is well printed, and each of the annuals, of which this is the fourth, is an improvement upon its predecessors.

Trade Catalogues.

The following trade catalogues were received last month:

THE AJAX LIGHTNING ARRESTER. Published by C. S. Van Nuis. 20 pages. Illustrated.

CATALOGUE. Published by L. A. Chase & Company. Boston, Mass. 12 pages. Illustrated.

THE STANDARD AIR BRAKE SYSTEM FOR ELECTRIC PASSENGER, FREIGHT CARS AND LOCOMOTIVES, RACK RAILWAY CARS, LIFT BRIDGES, ETC. Published by the Standard Air Brake Company. 34 pages. Illustrated.

Views of Road Construction. Published by T. William Harris, Contractor. Sixteen pages of illustrations.

The Worthington Self Cooling Condenser. Published by Henry R. Worthington, New York. Illustrated. 24 pages.

Catalogue E. C. S. Flush Switches and Accessories. Published by the Cutter Electrical & Manufacturing Company, Philadelphia, Pa. Illustrated. 16 pages.

The Cookson Combination Feed Water Heater, Purifier, Filter and Oil Separator. Published by the Bates Machine Company, Joliet, Ill. Illustrated. 18 pages.

Special Track Work on the Metropolitan West Side Elevated Railway of Chicago. Published by the Paige Iron Works, Chicago. 11 pages of illustrations.

The Hoppes Live Steam Feed Water Purifier and Exhaust Steam Feed Water Heater. Published by the Hoppes Manufacturing Company, Springfield, O. Illustrated. 56 pages.

Comparative Test Made by the Pittsburgh Testing Laboratory, Limited, for the Carrie Furnace Company. Published by H. E. Collins & Company, Pittsburgh, Pa. Illustrated. 26 pages.

Current Practice in Protecting Electrical Apparatus Against Lightning. By A. J. Wurts. Published by the Westinghouse Electric & Manufacturing Company. Pittsburgh, Pa. Illustrated. 26 pages.

List of Street Railway Patents.

U. S. Patents Issued March 24, 1896, to April 14, 1896, Inclusive.

Mar. 24.

Car Fender.—F. W. Darling, Hampton, Va. No. 556,810.

Has springs with downwardly bent upper ends secured to the front face of the car and having hooked lower ends and the rectangular fender frame having its rear cross bar or side detachably seated in said hooked lower ends.

Car Fender.—O. G. Hallenbeck, New York, N. Y. No. 556,845.

Trolley Support.—E. B. Reichel, Germany. No. 556,864.

Consists of yieldingly pressed levers pivoted to stationary supports, a pivoted trolley arm mounted upon the ends of said levers and springs for imparting to said trolley arm a tendency to occupy a vertical position.

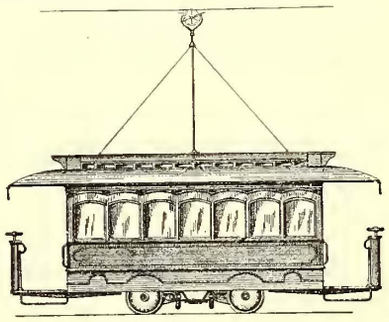
Clip for Trolley Wires.—R. H. Beach, E. Orange, N. J. No. 556,876.

Trolley Attachment for Electric Cars.—F. S. Smith, Hartford, Conn. No. 556,941.

Car Fender.—E. S. Graham, Philadelphia, Pa. No. 556,969.

A fender, an oscillating arm carrying the same and a pick-up which is mounted on said arm, in combination with means for holding said pick-up in elevated position, and releasing the same to permit it to drop.

Electric Trolley.—G. R. Mitchell, Newtown, Pa. No. 557,008.



PAT. NO. 557,015.

Trolley for Electric Railways.—P. F. O'Shaughnessy, New York, N. Y. No. 557,015.

An electric car, and a trolley for making an underneath contact with a conductor, a telescopic support for said trolley on the roof of the car and means extending within reach of the operator for adjusting said trolley.

Mar. 31.

Trolley Support.—N. H. Davis, Philadelphia, Pa. No. 557,114.

Car Fender.—P. McMenamin, Jersey City, N. J. No. 557,145.

A receding cushioning device consisting of a series of upright springs attached by their inner ends to the fender frame and bowed outwardly and downwardly, their outer ends being free and their outer portions connected together by a series of transverse strips.

Car Fender.—T. C. Hammond, Newark, N. J. No. 557,201.

Car Fender.—Paul Jones, Cincinnati, O. No. 557,206.

Fender supporting hangers secured to the front platform, a pivoted fender frame supported by said hangers and means for sustaining the fender in its elevated position against force applied to throw it down.

Car Fender.—S. A. Politsky, Boston, Mass. No. 557,226.

Car Fender.—J. P. Geraghty, Jersey City, N. J. No. 557,262.

A car fender comprising a main frame, a plate mounted to slide thereon and pressed on by springs and a locking bar on said plate and adapted to engage a stepped lug in the said platform.

Car Fender.—F. Padberg, New York, N. Y. No. 557,316.

Cable Railroad.—W. M. Wood, Elmira, N. Y. No. 557,320.

Consists of a conduit and a car, circuit closers in the conduit, a shaft on the car having an arm adapted to be made to engage said circuit closers, a vertically movable rod, connections between said rod and shaft, means for maintaining said rod normally elevated, means for releasing the rod and a spring for causing said rod to forcibly descend.

Car Fender.—G. H. Moller, New York, N. Y. No. 557,334.

A car body, an inclined screen or net, a fender consisting of a frame having a yielding guard secured therein and a rearwardly yielding guard and means for raising and lowering said fender and securing the same to its adjusted position.

Street Car Fender.—J. H. McDonald, New Haven, Conn. No. 557,336.

Apr. 7.

Car Fender.—Frank Oakden, Dunedin, New Zealand.—No. 557,598.

Electric Railroad.—W. R. Elliott, Chicago, Ill.—No. 557,657.

Comprises an underground conductor, a movable contact device associated with said conductor, a car having a magnet thereon the ends of which are bent downwardly so as to be in a lower plane than the main body of the magnet, and so situated that its downwardly bent ends pass said movable contact device at a distance sufficiently short to allow it to be attracted.

Car Fender.—L. E. Anderson, Pittsburgh, Pa.—No. 557,750.

Consists of a suitable frame made in two sections hinged together, a drum having projections thereon, a crossed belt connecting said drum and a loose pulley on the axle, a clutch on said axle and mechanism for throwing up the front section of said frame and disengaging said clutch at the same time.

Closed Conduit and Appliances for Electric Railroads.—W. R. Edelin, Washington, D. C.—No. 557,784.

A closed conduit for electric and other railways, having a series of covers, each normally locked in a closed position and adapted to be released or unlocked by the movement of a preceding cover.

Operating Mechanism for Street Railway Cars.—S. Messier, Springfield, Mass.—No. 557,853.

Hanger for Trolley Wires.—W. A. McCallum, Avondale, O.—No. 557,860.

Car Fender.—H. Boermermann, Brooklyn, N. Y.—No. 557,951.

A car fender having a cushion mounted on its front edge comprising a flexible strip of wood, mounted on a spring fixed to the fender at its middle part and secured to the flexible strip near the ends of the latter, whereby the yielding or flexing of the strip supplements the yielding of the spring.

Apr. 14.

Signaling System for Electric Railways.—F. Bathurst, Schenectady, N. Y.—No. 558,028.

A signaling system for an electric railway, consisting of block and signal lights situated at the ends of a section of track, one set of signal lights indicating at all times the direction of the last car, and switches for closing the circuits of all lamps when a car is on the section.

Electric Railway System.—H. M. Brinckerhoff, Chicago, Ill. No. 558,033.

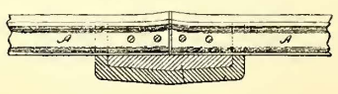
Sanding Box.—T. Dowd, Omaha, Neb. No. 558,047.

Car Fender.—G. Rischmiller, San Francisco, Cal. No. 558,112.

Car Step.—J. A. Miller, New Haven, Conn. No. 558,194.

The combination with the floor or platform of the car and the foot board, running at the side of the car and supported from the platform of a series of intermediate steps mounted midway between the floor and foot board and arranged alternately of the seats.

Electric Railway.—H. L. Tyler, Corning, N. Y. No. 558,238.



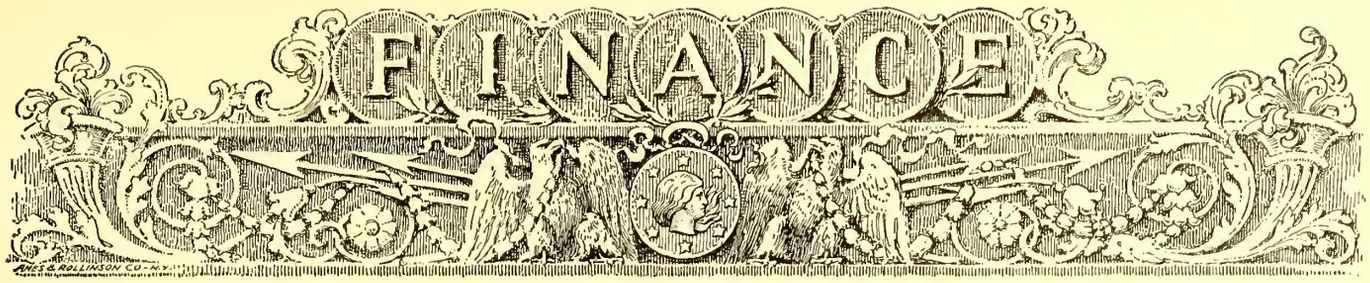
PAT. NO. 558,270.

Method of Forming Joints on Railway Track Rails.—H. W. Falk, Milwaukee, Wis. No. 558,270.

Consists in arranging a pair of rail ends so as to prevent longitudinal expansion thereof, casting a body of metal around and upon the lower portions of the rail ends and dressing down or surfacing the upper faces of said rail ends to the level of the track.

Car Fender.—C. P. Mains, Cleveland, O. No. 558,404.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. The Street Railway Publishing Company, Havemeyer Building, New York.



Annual Report of the General Electric Company.

The annual report of the General Electric Company is always looked for with great interest, as in it are found signs which tend to show the general condition of the industry during the preceding year. An abstract follows.

PRESIDENT'S REPORT.

Referring to that portion of last year's report in which it was stated that the sum of $2,000,000 had been charged to profit and loss for the purpose of providing for all shrinkages in the liquidation of old matters which could then be anticipated, President Coffin states that much has been accomplished during the past year in liquidating old and slow assets, and in this process $530,152 out of the $2,000,000 item represents the shrinkages accruing from the liquidation so far as completed, so that the sum of $1,469,848 remains to provide for further shrinkages and it is the belief of the directors that this amount is sufficient for the purpose.

Referring to the sales department, the president says that its organization is most excellent and effective, and the total expenses of selling and distributing the factory product have been materially less than for any previous year. Referring to the manufacturing and engineering department the president says its achievements, notably in installations involving the highest class of engineering and mechanical skill, have been especially gratifying.

President Coffin refers to the recent arrangement with the Westinghouse Company in these words, "Since the close of the fiscal year a contract has been concluded with the Westinghouse Electric & Manufacturing Company, which embodies a recognition of the patents of each company by the other, and the right, subject to certain exclusions, to a joint use thereof. An official notification of this contract was given out on Mar. 13, and since then details necessary to make the arrangement effective have been concluded. It is believed that many advantages will be derived from this contract, especially in eliminating much costly patent litigation, and in the important relations of co-operation in engineering and manufacturing methods."

Referring to patent litigation, the president speaks of the successful outcome of the company's cases against the Elmira & Horseheads Railway Company and the Winchester Avenue Railroad Company, and regards these decisions as of great importance tending to make the patents of substantial value to the company.

Under the heading of "General Conditions," President Coffin says, "The prices of your company's products have undergone excessive shrinkage in the adverse conditions of the past three years, and the securities held by it in local companies which were constructed upon the high prices of the past depreciated in like degree during the panic of 1893 and in the year subsequent thereto. Greatly modified valuations of your various assets have thereby been made necessary from time to time, and much information relating thereto has been brought to your attention in former reports.

"It is believed that the necessity of further reduction of aggregate values will not arise, nor is it expected that the market prices of your products can suffer any substantial decline in the early future. The local enterprises in which your company is interested as a creditor or a security holder are, as a rule, returning to normal conditions. Many of them give promise of greatly increased prosperity.

"Similarly the inventories and other investments of your company are in such shape as to lead your directors to anticipate no shrinkage therein, beyond that for which provision has been made. In the meantime the varied applications of electricity are increasing and the output of the company's works should be augmented as a result of the added uses to which electrical apparatus is almost daily being put."

FIRST VICE-PRESIDENT'S REPORT.

The report of First Vice President Griffin, in charge of the sales department, states that the company has over 10,000 customers, from whom were received 104,000 separate orders. Besides the regular supply business which comprehends not less than 9000 separate articles including renewal and repair parts of machines, the department has sold nearly 12,000 complete machines, having a total capacity of about 500,000 h. p. These figures include over 8800 street car motors and over 90,000 h. p. of railway generators, 6,000,000 incandescent lamps, 27,000 meters and other auxiliary apparatus and supplies in proportion.

The list of customers is largely made up of corporations operating central lighting stations, and street railways which conduct their business on a strictly cash basis. This being the case they are able to pay cash for apparatus and supplies, and over ninety-three per cent of the sales provided for cash payments within sixty days and only three-tenths of one per cent provided for payments in stocks, bonds and exchanged apparatus.

The foreign business has shown a gratifying increase.

THIRD VICE-PRESIDENT'S REPORT.

Third Vice-President E. W. Rice, in charge of the manufacturing department, states that the manufacturing costs have continued to decrease, particularly in railway apparatus which has been made in large quantities.

The output in generators and motors for the year was 380,000 k. w., as against 275,000 k. w. in the previous year, an increase of thirty-five per cent. This is partly due to the larger size of the average generator and motor constructed and partly to the growth of the business.

The engineering work has been of a most interesting, and in many cases a pioneer character. The works have furnished or have on order 60,000 h. p. of apparatus for the conversion of the energy from water power into electricity and its transmission to distant places. Among these installations are mentioned a transmission of 4000 h. p. from Folsom to Sacramento, Cal., a distance of twenty-four miles, 1400 h. p. for thirty-five miles at Fresno, Cal., 1800 h. p. for fourteen miles at Portland, Ore., and 2350 h. p. for twenty-three miles at Pachuca, Mexico.

The largest electrical transformers in the world have been sent to the Carborundum Company and the Carbide Manufacturing Company for the production of carborundum and calcium carbide respectively. Over thirty generators of 1000 h. p. and over have been manufactured during the year.

SECOND VICE-PRESIDENT'S REPORT.

The report of the Second Vice-President, J. P. Ord, in charge of the accounting department, is briefly abstracted as follows:

Consolidated Balance Sheet of Jan. 31, 1896.

ASSETS.

Patents and franchises			$ 8,000,000
Factory plants			3,468,002
Real estate.			
Edison Building, New York City	$412,585		
Less mortgage	$200,000	$212,585	
Other real estate		241,000	453,585
Stocks and bonds			5,479,332
Notes and accounts receivable			6,584,123
Cash			879,686
Work in progress			961,386
Inventories			4,219,884
Profit and loss (deficiency)			13,917,071
Total			$43,963,069

LIABILITIES.

Capital stock.			
Common stock	$30,460,000		
Preferred stock	4,252,000	$34,712,000	
Five per cent gold coupon debentures			8,750,000
Accrued interest on debentures		72,916	
Accounts payable		428,153	501,069
Total			$43,963,069

Consolidated Profit and Loss Account.

EARNINGS.

Sales	$12,730,058
Royalties and sundry profits	585,609
Int. and dividends received on securities owned.	320,257
Interest and discount	100,784
Total receipts	$13,736,708

EXPENSES.

Cost of goods sold	$ 9,860,216
General, patent and legal expenses and taxes	1,899,641
Sundry losses	27,178
Depreciation on inventories	101,191
" " consignments	22,013
Interest on debentures	437,500
Total expenses	$12,347,740
Balance, profit of the year	1,388,967
Total	$13,736,708

(*Continued on page 332.*)

STOCK AND BOND QUOTATIONS.

Notice.—These quotations are carefully revised from month to month by local bankers and brokers, and closely represent the market value of the different securities as tested by individual sales. Few of these, however, are actually quoted on city exchanges, and accuracy in the range of prices cannot, therefore, be vouched for.

Securities.—Active securities only are quoted in these tables, and the bond issues described do not necessarily constitute the entire funded indebtedness of the different properties. For a full and detailed description of all the securities, see AMERICAN STREET RAILWAY INVESTMENTS, published annually on March 15th.

Abbreviations.—The following abbreviations are used: M. mortgage; Gen. M. general mortgage; Cons. M. consolidated mortgage; deb. debentures; convert. convertible; in esc. in escrow; g. gold; guar. guaranteed; bds. bonds; int. interest; + in addition; auth. authorized; incl. including; cert. indebt. certificates of indebtedness; in tr. in trust; n nominal.

Company. STOCKS AND BONDS.		Issued.	Due.	Quotations. 1896. High.	1896. Low.	Apr. High.	Apr. Low.	Apr. Closing
ALBANY, N. Y.*—Local quotations to Apr. 13								
Albany Ry. Co., Stock	100	1,250,000	.....	140	135½	140	138	138
Cons. M. 5% bds. (incl. $112,000 in esc.).		500,000	1930	111	105½	111	110½	111
Deb. 6% (convert.) bds		200,000	1901	....	....	....	....	....
Wat. Tp'ke & R. R. Co.'s 2d M. 6% bds.		150,000	1919	113½	111	....	....	....
Wat. Turnpike & R. R. Co., Stock.	100	240,000	.....	....	....	....	....	....
1st M. 6% bds. (int. guar. by Alb'y Ry.		350,000	1919	114	113½	....	....	....
BALTIMORE, MD.*—Local quotations to Apr. 15.								
Baltimore Traction Co., Stock	25	5,750,000	.....	1[illegible]¾	16¾	18¾	17¼	....
1st M. 5% bds		1,500,000	1929	112½	110½	....	....	....
No. Balt. Div. 1st M 5% bds		1,750,000	1942	110½	107	107½	107	..
Ext. and Imp. 6% bds		1,250,000	1901	107	102½	107	102½	....
City & Suburban Ry. Co., Stock	50	4,000,000	.....	50	43	45½	43	....
Gen. M. 5% g. bds		3,000,000	1922	112	107	109	107	....
Baltimore City Pass. Ry. Co., Stock	25	2,500,000	.....	72	66	66	65½	....
1st. M. 5% g. bds		2,000,000	1911	115	114	115	114	....
Central Pass. Ry. Co., Stock	50	300,000	.....	72½	68	....	....	....
Cons. M. 5% bds. (+ $151,000 in esc.).		549,000	1932	112	111	112	112	....
1st M. 6% bds		151,000	1912	110	110	....	....	....
BOSTON, MASS.*—Local quotations to Apr. 17.								
West End St. Ry. Co., Stock, {common	50	9,085,000	.....	70	64	69	67	68 b
{preferred 8%	50	6,400,000	.....	91	88	90¾	89	....
Deb. 5% g bds		3,000,000	1902	105	103	105	104¾	....
Deb. 4½% g. bds		2,000,000	1914	105¾	104	104⅞	104¾	....
North Shore Traction Co., Stock, {common	100	4,000,000	.....	....	....	....	....	....
{preferred 6%	100	2,000,000	.....	83	80	....	....	....
Lynn & Boston R. R. Co.'s 1st Cons. M. 5% g. bds. (+ $1,677,000 in esc)		3,702,000	1924	....	....	....	....	....
BROOKLYN, N. Y.*—New York quotations to Apr. 23.								
Brooklyn Rapid Transit Co., Stock,		.....	.....	25½	19	25⅛	19	25
1st M. bds		.....	.....	82	76	82	76	78
Brooklyn Heights R. R. Co. 1st M. 5% bds		250,000	1941	....	....	....	....	....
Brooklyn City R. R. Co., Stock	10	12,000,000	.....	172½	159	172	165	170
1st Cons. M. 5% bds		6,000,000	1941	111	109	114	113	114
Brooklyn, Q. Co. & Sub. R. R Co. 1st M. 5% g. bds. (+ $350,000 in esc.)		3,150,000	1941	102	97	100	97	99
1st Cons. M. 5% g. bds		2,500,000	1941	80	80	80	80	80
Brooklyn Traction Co. Stock, {common	100	6,000,000	.....	15	7	15	13	14
{preferred 6%	100	3,000,000	.....	55	43	50	45	48
Atlantic Ave. R. R. Co. Gen. M. 5% bds		750,000	1909	107½	104½	106	104½	105
Cons. M. 5% bds. (+ $1,034,000 in esc.)		1,966,000	1931	108	104½	106	104½	105
Imp. M. 5% g. bds		1,500,000	1934	82½	71	82	76	80
B'kl'n, Bath & W. E. R. R. Co. Gen. M. 5% bds. (+ $552,000 in esc.)		448,000	1933	85	70	70	70	70
Coney Isl. & B'kl'n R.R. Co., Stock	100	1,000,000	.....	....	....	....	....	....
1st M. 5% bds		300,000	1904	....	....	....	....	....
Cert. Indebt. 6%		200,000	1910	....	....	....	....	....
B'kl'n City & Newt'n R.R.Co. Stock	100	1,000,000	.....	185	185	185	185	185
1st Cons. 5% bds		1,900,000	1939	111½	109	111½	111	111
BUFFALO, N. Y.*—New York quotations to Apr. 23.								
Buffalo Ry. Co., Stock	100	5,370,500	.....	80	68	78	71	74½
1st Cons. M. 5% bds. (+ $1,457,000 in esc.)		3,543,000	1931	106½	100	106½	104½	106
Crosstown St. Ry. Co.'s 1st M. 5% bds.		2,200,000	1932	105	100	105	103	104½
CHARLESTON, S. C.*—Local quotations to Apr. 14.								
Enterprise St. R. R. Co., Stock	25	250,000	.....	....	....	....	....	6
1st M. 5% bds		50,000	1906	....	....	....	....	102
Charleston City Ry. Co., Stock	50	100,000	.....	....	....	....	....	70
1st M. 6% bds		100,000	1915	....	....	....	....	112
CHICAGO, ILL.*—Local quotations to Apr. 18.								
Chicago & So. Side R. T. R. R. Co. Stock	100	7,500,000	.....	7	4½	6¾	4½	5¼
1st M. 5% bds		7,500,000	1929	60	59	....	....	....
Exten 5% bds		3,000,000	1933	42	37	....	....	....
Chicago City Ry. Co., Stock	100	9,000,000	.....	315	275	280	275	280
1st M. 4½% bds		4,619,500	60 d.	100½	99¾	100	99¾	99⅞
Lake St. Elev. R. R., Stock	100	10,000,000	.....	30¾	18½	30¾	20½	27
CHICAGO, ILL.—Continued.								
Met. W. S. Elevated Ry., Stock	100	11,500,000	.....	47	12½	19½	14	19
1st M. 5% bds		12,500,000	1942	68	64	67	64	67
North Chicago St. R. R. Co., Stock.	100	5,500,000	.....	308½	245	256¾	245	254¾
1st M. 5% bds		2,413 000	1906	104	103¾	103¾	103¾	103¾
Cert. Indebt. 6%		500,000	1911	....	....	....	....	....
No. Chi. Cy. Ry. Co.'s 1st M. 6% bds		500,000	1900	....	....	....	....	....
" " " " 2nd M. 4½% bds.		1,850,000	1927	....	....	....	....	....
" " " " Deb. 6% bds		550,000		102½	98	....	....	....
North Chicago City Ry. Co., Guar. Stock	100	500,000	.....	....	....	....	....	....
West Chicago St. R. R. Co., Stock	100	13,189,000	.....	114	100	107⅛	102½	105
1st M. 5% bds		4,100,000	1928	102	100	102	102	102
W. C. S. R. R. Tunnel Co.'s 1st M. 5% bds.		1,500,000	1909	....	....	....	....	....
Deb. 6% bds		4,000,000	....	100	97	98⅜	98	98⅜
Chi. W. Div. Ry. Co.'s 1st M. 4½% bds.		4,040,000	1932	101	101	....	....	....
Chi. Pass. Ry. Co.'s 1st M. 6% bds		400,000	1905	109	108	....	....	....
" " " " Cons. M. 6% bds		600,000	1929	....	....	....	....	....
Chicago W. Div. Ry. Co., Guar. Stock	100	1,250,000	....	600	600	....	....	....
CINCINNATI, O.*—Local quotations to Apr. 16.								
Cincinnati St. Ry. Co., Stock	50	11,000,000	....	115¼	111½	115¼	114⅝	115
1st M. 7% bds		50,000	1896	....	....	....	....	....
1st M. 4% ext'n'd bds		100,000	....	....	....	....	....	....
" " 5% " "		150,000	....	....	....	....	....	....
Mt. Adams & Eden Park Inclined Ry., Stock	50	2,500,000	....	112	'09	111¾	110	110½
1st M. 6% bds		50,000	1900	....	....	....	....	....
" " 6% "		100,000	1905	....	....	....	....	....
Cons. M. 5% bds		531,000	1906	....	....	....	....	106 b
Cincinnati, Newport & Covington St. Ry. Co., Stock	100	3,000,000	....	36½	32½	35	32⅜	34⅜ b
Cons. M. 5% g. bds. (incl. $500,000 in esc.)		3,000,000	1922	99½	97	99¼	98¾	99
So. Cov. & Cin. St. Ry. Co 1st M. 6% bds.		250,000	1912	....	....	....	....	....
" " " " " " " 2nd Cons. M. 6% g. bds. (incl. $250,000 in esc.)		400,000	1932	....	....	....	....	....
COLUMBUS, O.*—New York quotations to Apr. 23.								
Columbus St. Ry. Co., Stock	100	3,000,000	...	50½	44½	50	46	47½
Cons. M. 5% g. bds. (incl. $780,000 in esc).		3,000,000	1932	100	93½	99	95	97½
Crosstown St. Ry. Co.'s 1st. M. 5% g. bds. ($90,000 in esc.)		500,000	1933	95	88	95	91	95
COVINGTON, KY.*—(See Cincinnati.)								
DETROIT, MICH.*—Local quotations to Apr. 14.								
Detroit Citizens' St. Ry. Co., Stock.	100	1,250,000	....	100	100	100	100	100
1st M. 6% bds. (+ $1,150,000 in esc)		1,150,000	....	100	100	100	100	100
Fort Wayn. & Belle Isle Ry. Co., Stock	100	250,000	....	250	225	250	250	250
1st M. 6% g. bds. ($60,000 in tr.)		340,000	....	100	100	....	....	....
Wyandotte & Detroit River Ry. Co., Stock	100	200,000	....	110	100	100	100	100
Rapid Ry. Co., Stock		250,000	....	110	100	....	....	....
1st M. 5% bds		300,000	....	96	90	....	....	....
The Detroit Ry., Stock		1,000,000	....	....	....	....	....	....
1st M. 5% bds		1,800,000	1925	....	....	....	....	....
HARTFORD, CONN.*—See New Haven.								
HOBOKEN, N. J.*—See Newark.								
HOLYOKE, MASS.*—Local quotations to Apr. 14.								
Holyoke St. Ry. Co., Stock	100	250,000	....	210	190	210	200	....
Springfield St. Ry. Co., Stock	100	1,000,000	....	215	200	205	200	....
Northampton St. Ry. Co., Stock	100	225,000	....	195	185	190	185	....
INDIANAPOLIS, IND.*—New York quotations to Apr. 23.								
Citizens' St. R. R. Co., Stock	100	5,000,000	....	40	21	26	21¾	24¾
Cons. M. 5% g. bds. (incl. $1,000,000 in esc.)		4,000,000	1933	90	79	87½	81	80
JERSEY CITY, N. J.*—See Newark.								
LOUISVILLE, KY.*—Local and New York quotations to Apr. 23.								
Louisville Ry. Co., Stock, {common	100	4,000,000	....	53¾	46	53¾	48	50½
{preferred 5%	100	2,000,000	.. ..	102½	95	102¾	99	100
Cons. M. 5% g. bds. (incl. $1,263,000 in esc.)		6,000,000	1930	109½	105	109	106	108¾

*For detailed description of these and other securities issued, see **AMERICAN STREET RAILWAY INVESTMENTS, a supplement to the STREET RAILWAY JOURNAL,** published annually on May 1st.

Company. STOCKS AND BONDS.	Issued.	Due.	Quotations. 1896. High.	1896. Low.	Apr. High.	Apr. Low.	Apr. Closing
LYNN, MASS.*—See Boston.							
MINNEAPOLIS, MINN.*—New York quotations to Apr. 23.							
Twin City Rapid Transit Co. {com.. 100	15,000,000	....	25	23	25	25	25
Stock. {pref. 7%	1,500,000	....	100	100	....	....	....
Minn. St. Ry. Co.'s Cons. M. 5% g. bds. (+ $960,000 in esc.)	4,040,000	1919	98	90	90¼	90	90
St. Paul City Ry. Co.'s Cab. Cons. 5% g. bds. (incl. $680,000 in esc.)	4,298,000	1937	93	84	88¾	84	86
St. Paul City Ry. Co.'s Deb. 6% g. bds.	1,000,000	1900	....	....	....	....	....
MONTREAL, CAN.*—Local quotations to Apr. 13.							
Montreal St. Ry. Co., Stock..... 50	4,000,000	....	226	206½	222½	217	221
1st M. 5% bds.....	300,000	1908	....	....	....	....	....
2nd M. 4½% bds.....	700,000	1922	....	....	....	....	....
NEW ALBANY, IND.*—See Louisville.							
NEWARK, N. J.*—New York and Philadelphia quotations to Apr. 23.							
Consolidated Traction Co., of N. J., Stock..... 100	15,000,000	....	25	20	24	21	22
1st M. 5% g. bds.....	11,711,000	1933	85	78¾	84	81½	84
North Hudson Co. Ry. Co., Stock... 25	1,000,000	....	....	....	....	....	....
Cons. M. 5% bds. (incl. $620,000 in esc.)	3,000,000	1928	....	....	....	....	....
2nd M. 5% bds.....	350,000	1928	....	....	....	....	....
Deb. 6% bds.....	500,000	1902	....	....	....	....	....
NEW HAVEN, CONN.*—Local quotations to Apr. 14.							
Fair Haven & Westville R. R. Co., Stock..... 25	600,000	....	53	53	53	53	53
Winchester Ave. R. R. Co., Stock... 25	400 000	....	25	25	....	....	....
1st M. 5% g. bds.....	500,000	1912	103	102	103	103	103
Deb. 6% bds.....	100,000	1909	102	100	102	101	102
New Haven St. Ry. Co., 1st M. 5% bds.	600.000	1913	102	102	102	102	102
Hartford St. Ry. Co., Stock..... .. 100	200,000	....	219	215	215	215	215
H'd & W'th's'fl'd H. R. R. Co.'s deb. 5% bds.....	1,344,000	....	102	101	102	102	102
NEW ORLEANS, LA.*—New York quotations to Apr. 23.							
New Orleans Traction Co., Stock, {common.. 100	5,000,000	....	20	15¾	17	16	16½
{pref. 6%... 100	2,500,000	....	70	60½	64½	63	63
N. O. City & Lake R. R. Co.'s 1st M. 6% g. bds. ($423,500 in esc.)	3,000,000	1943	102	99	100	100	100
Crescent City R. R. Co.'s Cons. M. 5% g. bds.....	2,350,000	1943	95	87¾	91¾	87½	90
New Orleans & Carrollton R. R. Co., Stock..... 100	1,200,000	....	127½	123	126½	126½	126½
1st M. 6 % bds.....	250,000	1897 / 1906	....	....	....	....	....
2d M. bds.....	350,000	1905 / 1907	....	....	....	....	....
Canal & Claiborne R. R. Co., Stock. 40	240,000	....	48¾	46	48¾	47¾	48
1st M. 6 % bds.....	150,000	1912	102½	102¼	102¼	102¼	102½
Orleans R. R. Co., Stock..... 50	185,000	....	46	42	44	43½	43½
1st M. bds.....	18,000	....	114	111	112½	112½	112½
St. Charles St. R. R. Co., Stock.... 50	594,350	....	68	63	64½	64	64
1st M. 6% bds.....	150,000	1912	....	....	....	....	....
NEWPORT, R. I.*—See Providence.							
NEW YORK, N. Y.*—Local quotations to Apr. 23.							
Metropolitan Traction Co., Stock... 100	30,000,000	....	108½	92	106	101½	105½
Metropolitan St. Ry. Co., Stock.... 100	13,500,000	....	....	....	....	....	....
B'y. Surf. R. R. Co.'s 1st M. 5% bds....	1,125,000	1924	114	110	113	113	113
" " " " " 2nd M. 5% bds....	1,000,000	1905	110	102	110	110	110
So. Ferry R. R. Co., 1st. M. 5% bds....	350,000	1919	107½	105	105	105	105
Lex. Ave. & P. F. Ry. Co.'s 1st M. 5% bds.	500,000	....	114	110	111¾	111	111
Broadway & Seventh Ave. R. R. Co., Guar Stock.... 100	2,100,000	....	198	188	198	190	194
Cons. M. 5% g. bds. (+ $4,850,000 in esc.)	7,650,000	1943	116	113	115	113	115
1st M. 5% bds.....	1 500,000	1904	107¾	107	107½	107	107½
2nd M. 5% bds.....	500,000	1914	111	108¾	110	110	110
Sixth Ave. R. R. Co., Guar. Stock 100	2,000,000	....	220	195	200	195	198
Ninth Avenue R. R. Co., Guar. Stock 100	800,000	....	161¾	160	161¾	160¾	161½
Twenty-third St. Ry. Co., Guar. Stock 100	600,000	....	308	305	305	305	305
1st M. 6% bds.....	250,000	1909	115½	103	103	103	103
Deb. 5% bds.....	150,000	1906	104	102	....	....	....
B'y. Surf. R. R. Co.'s 1st M. 5% bds....	375,000	1924	114	110	113	113	113
42nd St. & G'd. St. Ferry R. R. Co., Guar. Stock..... 100	748,000	....	325	310	325	323	325
1st M. 6% bds.....	236,000	1909	116	115½	....	....	....
Cent. Pk., No. & E. Riv. R. R. Co., Guar. Stock..... 100	1,800,000	....	165	160	163	161	163
Cons. M. 7% bds.....	1,200,000	1902	115	113	115	115	115
Bl'cker St. & Fulton Ferry R. R. Co...... 100	900,000	....	30½	28⅝	30	30	30
1st M. 7% bds.....	700,000	1900	111	107½	109	107½	108½
Third Avenue R. R. Co., Stock..... 100	9,000,000	....	186	172	183	176	179½
1st M. 5% g. bds.....	5,000,000	1937	121	116	121	120	121
Second Avenue R. R. Co., Stock.... 100	1,862,000	....	168¾	150	168¾	160	166
Cons. M. 5% bds.....	1,600,000	1909	108¾	107½	108	108	108
Deb. 5% bds.....	300,000	1909	104½	102	103	103	103
Eighth Avenue R. R. Co., Stock..... 100	1,000,000	....	360	325	325	325	330

Company. STOCKS AND BONDS.	Issued.	Due.	Quotations. 1896. High.	1896. Low.	Apr. High.	Apr. Low.	Apr. Closing
NEW YORK—Continued.							
Cert. Ind'bt. 6%.....	1,000,000	1914	110¾	110	110	110	110
42nd St., M. & St. N. Ave. Ry. Co., Stock..... 100	2,500,000	....	63	52	55	55	55
1st. M. 6% bds.....	1,200,000	1910	117	113	117	115	116¾
2nd M. inc. 6% bds.....	1,500,000	1915	71	65	68	66	67½
Dry Dock, E. B'y. & Battery R. R. Co., Stock..... 100	1,200,000	....	172	161	169	165	166
Gen. M. 5% g. bds.....	885,000	1932	114	112¾	113¾	112½	113½
Cert. Ind'bt 5%..... 100	1,100,000	1914	103	100	102	101	102
Central Crosstown R. R. Co., Stock 100	600,000	....	200	190	200	195	199
1st M. 6% bds.....	250,000	1922	120	118	120	120	120
Christopher & 10th St. R. R. Co., Guar. Stock..... 100	650,000	....	155	150	153½	152	152
Union Ry. Co., Stock..... 100	2,000,000	....	104	95	100	99	100
1st M. 5% bds.....	2,000,000	1942	105	100	104½	102½	103½
Westchester Elec. R. R. Co.'s 1st M. 5% bds.....	500,000	1943	103	99	103	103	103
NORTHAMPTON, MASS.*—See Holyoke.							
PATERSON, N. J.*—New York and Philadelphia quotations to Apr. 23.							
Paterson Ry. Co., Stock..... 100	1,250,000	....	30	22	30	26	28
Cons. M. 6% bds. (inc. $250,000 in esc.).	1,250,000	1931	101	94	100	99	100
PHILADELPHIA, PA.*—Local quotations to Apr. 16.							
Union Traction Co., Stock.....	....	....	15¾	10	....	....	....
Philadelphia Traction Co., Stock.... 50	15,000 000	....	72¼	62	....	....	....
Coll. Tr. 4% g. bds.....	1,053 000	1917	....	....	....	....	....
Continental Pass. Ry. Co., Guar. Stock..... 50	1,000,000	....	129	128¾	129	....	....
1st M. 6% bds.....	350,000	1909	....	....	....	....	....
Empire Passenger Ry. Co, Stock.. 50	600,000	....	152	150	....	....	....
1st M. 7% bds.....	200,000	1900	....	....	....	....	....
Phila. & Darby Ry. Co., Guar. Stock 50	200,000	.	85	85	85	....	....
Phila. City Pass. Ry. Co., Stock.... 50	475,000	....	176	168¼	168¾	....	....
1st M. 5% bds.....	200,000	1910	....	....	....	....	....
Phila. & G'ys Ferry Pass. Ry. Co., Guar. Stock..... 50	308,750	....	85	83	84	....	...
Ridge Ave. Pass. Ry. Co. Guar. Stock 50	420,000	....	250	240	250	....	....
13th & 15th Sts., Pass. Ry. Co., Guar. Stock..... 50	334,529	....	233	223¾	230	....	...
1st M. 7% bds.....	100.000	1903	....	....	....	....	....
Union Pass. Ry. Co., Guar. Stock.. 50	925,000	....	205	201	202	....	....
1st M. 5% bds.....	500 000	1911	....	....	....	....	....
2nd M. 5% bds.....	250,000	1910	....	....	....	....	....
W. Phila. Pass. Ry. Co., Guar. Stock 50	750,000	....	225	222	225	....	..
1st M. 6% g. bds.....	246.000	1906	....	....	....	....	....
2nd M. 5% bds.....	750,000	1926	....	....	....	....	....
Frankford & S'thw'k P. C. Pass. R. R. Co., Guar. Stock..... 50	1,875,000	....	325	320	320	....	....
Lombard & So. St. P. R. R. Co.'s 1st M. 5% bds.....	150,000	1901	92	90	90¾	....	....
West End P. Ry. Co.'s 1st M. 7% bds..	132,100	1905	....	....	....	....	....
Citizens' Pass. Ry. Co., Guar. Stock 50	192,500	....	280	271	272	....	....
2nd & 3rd Sts. Ry. Co., Guar. Stock 50	848,160	....	227	225	225	....	....
Lehigh Ave. Ry. Co., Stock..... 50	599,950	....	52	51	51	....	....
People's Traction Co., Stock.....	8,000,000	....	57½	57⅛	57⅛	....	....
People's Pass. Ry. Co., {common.... 25	740,000	....	....	....	....	....	....
Stock {preferred... 25	277,402	1905	....	....	....	....	....
1st M. 7% bds.....	219.000	1905	....	....	....	....	....
Cons. M. 5% bds.....	246,000	1912	....	....	....	....	....
Germantown Pass. Ry. Co., Guar. Stock..... 50	572,800	....	130	120	120	....	. ..
Green & Coates Sts. P. P. Ry. Co., Guar. Stock..... 50	500.000	....	131	127	130	....	....
1st M. 6% bds.....	100,000	1898	....	....	....	....	....
Hest'v'e, Mantua & F'r'm't P. R. R. Co., Stock..... 50	2,500,000	....	49½	46	46	....	....
PITTSBURGH, PA.*—Local quotations to Apr. 18.							
Citizens' Traction Co., Stock..... 50	3,900,000	....	57	55	57	56½	....
1st M. 5% bds.....	1,250,000	1927	....	....	....	....	110a
Pittsburgh Traction Co., Stock..... 50	2,500,000	....	....	....	....	....	....
1st M. 5% bds.....	750.000	1927	....	....	....	....	....
Duquesne Traction Co., Stock..... 50	3,000,000	....	36¾	32⅞	36	36	....
1st M. 5% bds.....	1,500,000	1930	104½	102½	..	....	....
P'b'gh, Allegheny & Manch'r Tr. Co., Stock..... 50	3,000 000	....	38¼	38	....	....	....
Gen. M. 5% bds.....	1,500,000	1931	107	106	107	107	105 b
P'b'gh Union P. Ry. Co.'s 1st. M. 5% bds.	100,000	1901	....	....	....	....	....
Federal St. & P. V. R. R. Co., Stock 25	1,400,000	....	19⅞	18	18⅛	18⅛	8¼ b
Gen. M. 5% bds.. (new).....	1,250,000	1931	102¼	102¼	....	....	102¼
P'b'gh & Birmingham Tr. Co., Stock 50	3,000,000	....	16¾	15¼	16⅛	15¼	1....
Gen. M. 5% g. bds.....	1,500,000	1929	97½	96	97	97	....
Central Traction Co., Stock..... 50	1,500,000	....	28½	26	28½	28½	29 a
1st M. 5% bds.....	375,000	1929	....	....	....	....	....
P'b'gh & West End P. Ry. Co., Stock 50	1,500.000	....	....	....	....	....	....
1st. M. 5% bds.....	450,000	1922	....	....	....	....	....
PROVIDENCE, R. I.*—Local quotations to Apr. 13.							
United Traction & Electric Co., Stock 100	8,000.000	....	50	50	50	50	50
1st M. 5% g. bds.....	8,000,000	1933	100	100	100	100	100
Newport St. Ry. Co. 1st M. 5% bds.....	50,000	1910	100	95	100	95	95

*For detailed description of these and other securities issued, see **AMERICAN STREET RAILWAY INVESTMENTS, a supplement to the STREET RAILWAY JOURNAL,** published annually on May 1st.

Company. STOCKS AND BONDS.		Issued.	Due.	Quotations. 1896. High.	Low.	Apr. High.	Low.	Closing
ROCHESTER, N. Y.*—New York quotations to Apr. 23.								
Rochester Ry. Co., Stock	100	5,000,000	....	32	25	25	25	25
Cons. M. 5% g. bds. (incl. $1,000,000 in esc.)		3,000,000	1930	106	100	102	100	101
2nd M. 5% g bds. (incl. $750,000 in esc.)		1,500,000	1933	85	80	80	80	80
ST. LOUIS, MO.*—Local quotations to Apr. 20.								
St. Louis R. R. Co., Stock	100	2,000,000	....	144	118	120	118	120
1st M. 5% bds		2,000,000	1900/1910	100	99	100	100	100
Citizens' Ry. Co., Stock	100	1,500,000	....	92	71	90	90	90
1st M. 6% bds		1,500,000	1907	107	106	106½	106	107
Cass Ave. & Fair Grounds Ry. Co., Stock	100	2,000,000	....	60	54	....	....	....
1st M. 5% bds		1,911,000	1912	99	97	99	98	98
Union Depot R. R. Co., Stock	100	4,000,000	....	160	125	125	125	125
Cons. M. 6% g. bds		1,150,000	1918	111	109	110	110	110
Benton, Bellef'ne Ry. Co.'s 1st M. 6% bds		300,000	1896/1911	101	100	100	100	100
Mound City R. R. Co.'s 1st M. 6% bds.		400,000	1900/1910	104	102½	103	102½	103
Jefferson Ave. Ry. Co., Stock	100	112,000	....	135	126	135	135	135
1st M. 5% bds		250,000	....	102	100	102	102	102
Missouri R. R. Co., Stock	100	2,300,000	....	208	180	180	180	180
1st M. 6% bds		500,000	1907	104	100	104	103	103½
Lindell Ry. Co., Stock	100	2,500,000	....	140	131	133¾	133	134
1st M. 5% bds		1,500,000	1911	104½	103	104	103	103
St. Louis & Suburban Ry. Co., Stock	100	2,500,000	....	44	32	44	43	43
1st M. 5% bds. (incl. $600,000 in esc.)..		2,000,000	1921	98	93	94	93	94
Inc. 6% bds		300,000	....	52	52	52	52	52
People's R. R. Co., Stock	100	1,000,000	....	22	10	11	10	10
1st M. 6% bds		125,000	1892/1902	101	98	99	98	99
2nd M. 7% bds		75,000	1902	101	100	....	....	....
Cons. M. 6% bds. (incl. $200,000 in esc.)		1,000,000	1899/1904	75	75	....	....	....
Fourth St. & Arsenal Ry. Co., Stock	50	150,000	....	20	15	16	15	15
1st M. 6% bds		50,000	1898/1903	100	100	100	100	100
Southern Electric Ry. Co., Stock {common	100	700,000	....	42	40	....	....	....
{preferred 6%	100	800,000	....	85	84	....	....	....
Cons. M. 6% bds (incl. $200,000 in esc.)		500,000	1909	108	106	108	106	106
St. L. & E. St. L. E. R. Co., Stock..	100	250,000	....	....	....	....	....	....
1st. M. 6% bds		75,000	1905	102½	102	....	....	....
Baden & St. Louis R. R., Stock	100	50,000	....	....	....	....	....	....
1st M. 6% bds		250,000	1913	100	98½	99	98½	98½
SAN FRANCISCO, CAL.*—Local quotations to Apr. 14.								
Market Street Ry. Co., Stock	100	18,616,782	....	48	44	48	46¾	47
M'k't St. Cable Co.'s 1st M. 6% bds....		3,000,000	1913	123	121	123	123	123
Omnibus Cable Co.'s 1st M. 6% bds....		2,000,000	1918	119½	117	118¾	117	118¾
Park & Ocean R. R. Co.'s 1st M. 6% bds.		250,000	1914	....	....	....	....	....
Park & Cliff House R. R. Co.'s 1st M. 6% bds		350,000	1913	103	102½	103	103	103
Powell St. R. R. Co.'s 1st M. 6% bds...		700,000	1912	....	....	....	....	....
Ferries & Cliff House Ry. Co.'s 1st M. 6% bds		650,000	1914	....	....	....	....	....
Geary St., P'k & O. R. R. Co., Stock	100	1,000,000	....	101	101	....	....	....
1st M. 5% bds		671,000	1921	106	100½	100½	100½	100½
Cal. St. Cable R. R. Co., Stock	100	1,000,000	....	109	108	109	108	109
1st M. 5% g. bds		900,000	1915	112	109¾	112	112	112
Sutter Street Ry. Co., Stock	100	2,000,000	....	....	....	....	....	....
1st M. 5% g. bds		900,000	1918	110¼	109¼	110	110	110
Presidio & Ferries R. R. Co. Stock	100	1,000,000	....	9	7½	9	7½	....
Oakland, S. L. & Haywards Ry. Co. Stock	100	1,000,000	....	....	....	....	....	....
SPRINGFIELD, MASS.*—(See Holyoke.)								
TORONTO, ONT.*—Local quotations to Apr. 13.								
Toronto Ry. Co., Stock	100	6,000,000	....	77½	66½	76¾	74	....
WASHINGTON, D. C.*—Local quotations to Apr. 14.								
Capital Traction Co.		12,000,000	....	77¼	67	69	67	68
Metropolitan R. R. Co Stock	50	750,000	....	116	97	116	112	115½
Coll. Tr. 6% conv. bds		500,000	1901	122	110	122	120	123
Belt Ry. Co., Stock	50	500,000	....	30	15	25	25	25
Cons. M. 6% bds. (inc. $50,000 in esc.)..		500,000	1921	84	77	80	77	78
Eckington & Soldiers' Home Ry. Co., Stock	50	352,000	....	18	14	....	....	....
1st M. 6% bds		200,000	1896/1911	101	99	100	99	99
G'getown & Ten'town Ry. Co., Stock	50	200,000	....	25	14	25	25	25
Columbia Ry. Co.	50	400,000	....	60	50	60	56	60
1st M. 6% bds		500,000	1914	116½	112½	115	114	115
WORCESTER, MASS.*—New York quotations to Apr. 23.								
Worcester Traction Co., Stock {common..	100	3,000,000	....	17	12	17	15	16½
{pret. 6%...	100	2,000,000	....	90	80	90	86	88
Worcester Cons. St. R. R. Co.			....	....	....	....	....	....
1st. M. 5% bds		150,000	....	103	100	....	....	....
Deb. 5% g. bds		500,000	....	99	99	....	....	....

* See foot note on preceding pages.

New York and Philadelphia quotations of Brooklyn, Buffalo, Columbus, Indianapolis, Louisville, New Orleans, New York City, Paterson, Rochester and Worcester. Securities furnished by Gustavus Maas, 26 Broad Street, New York.

(*Continued from page 329*).

GENERAL.

Balance Jan. 31, 1895, (deficiency)		$14,794,717
Written off factory plants	$322,339	
" " other real estate	29,719	
" " patents and franchises	159,264	511,322
Total		$15,306,039
Deduct profit for the year		1,388,967
Balance Jan. 31, 1896, (deficiency)		$13,917,072

Factory Plants.—The book value of the factory plants on Jan. 31, 1896, was $3,468,002 as against $3,958,528 on Jan. 31, 1893.

The following is a comparative estimate of the value of the factory plants:

For all three plants.	Jan. 31, 1893.	Jan. 31, 1896.
Land and buildings	$1,742,907	$1,800,000
Machinery and tools	1,672,507	1,668,000
Patterns and drawings	270,233	1
Sundry accounts	272,881	1
Total	$3,958,528	$3,468,002
For each plant.		
Schenectady factory	$2,215,364	$2,135,001
Lynn factory	1,280,980	1,038,001
Harrison factory	462,184	295,000
Total	$3,958,528	$3,468,002

Stocks and bonds.—Included in the report is a schedule of the company's holdings of stocks and bonds. The stocks represent an interest in 141 street railway, lighting and miscellaneous companies, and have a par value aggregating $8,422,531. The bonds represent an interest in 100 companies, and have a total par value of $5,236,475. The total par value of both stocks and bonds is thus $13,659,006. These are carried on the balance sheet at $5,479,332, and concerning this Vice-President Ord says, "Those having a market value are carried at slightly under the price of recent sales. The book values of those not readily saleable have been fixed after making inquiries of the officers of those companies and of banks and others in cities where the properties are situated. 'I believe the aggregate book value of these stocks and bonds is not in excess of their present value. Included in Schedule A are stocks and bonds of various companies, amounting to $2,897,103, at par. The present value of these is doubtful and their future value speculative. They are therefore carried at a total book value of only $96, being one dollar for each lot; but it is not unlikely that in time a considerable amount may be realized from them, for, as shown elsewhere the amount realized during the year from sales of securities similarly valued was $41,647. There are also stocks of twenty-four underlying and other manufacturing, selling and patent owning corporations of a total par value of $40,654,900, which must be held until those corporations are dissolved. They too are carried at $1 for each lot, in all $24—the difference between this sum and their original cost being carried in the patent account or written off in profit and loss. Included in these is the company's entire holdings of stock of the Brush Electric Company, of Cleveland, which were carried last year at $351,507."

Notes and Accounts Receivable.—On June 20, 1893, the face value of the notes and accounts receivable was about $16,000,000. "During three years of persistent work the collection of this work has progressed as satisfactorily as was possible under the circumstances, and another year will probably result in the conclusive liquidation of most of the remaining old indebtedness."

The total amount now due to the company by customers is as follows, taken at their face values:

	Par Value.	Carried at.
Current notes	$1,522,178	$2,107,169
Old notes in liquidation	1,371,562	
Current accounts	2,910,443	4,122,743
Old accounts in liquidation	494,177	
New Orleans investment	1,431,470	
Brush Electric Company	479,756	
Due from local lighting and street railway properties owned by the company	516,305	353,775
"Dollar" notes and accounts	2,432,861	436
Total	$11,158,751	$6,584,123

Sales of Assets.—The following statement shows the result of the securities sold during the year:

Par Value.	Book Value.	Amount Realized.	Net Result.
$ 783,490	$467,859	$627,278	$159,419 profit.
423,710	6	41,647	41,641 "
152,620	46,189	38,475	7,714 loss
$1,359,820	$514,054	$707,399	$193,346 profit.

Besides stocks and bonds the principal asset sold was the Schuyler factory at Middletown, Conn.

Work in Progress.

Expenditures to date on 285 installations in progress	$1,406,262
Less partial payments thereon	444,875
Net expenditure	$961,386

TABLE OF OPERATING STATISTICS.

Notice.—These statistics are 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.

Abbreviations.—The following abbreviations are used: * Including taxes. d. deficiency. m. months.

Company.	Period.	Gross Receipts.	Operating Expenses.	Earnings from Operation.	Fixed Charges.	Net Income.
ALBANY, N. Y.						
The Albany Ry	3 m., Dec. '94	122,382	85,240	37,142	22,579*	14,564
	3 " " '95	132,407	83,928	48,479	21,457*	27,022
	12 " " '94	461,918	298,972	162,947	92,592*	70,354
	12 " " '95	522,276	314,319	207,957	88,657*	119,300
ALTOONA, PA.						
The Altoona & Logan Valley Elec. Ry. Co.	12 m. Dec. '94	73,128	33,217	39,911	32,248*	7,663
	12 " " '95	83,292	41,158	42,135	33,564*	8,570
City Pass. Ry. Co. of Altoona	12 m. Dec. '94	50,303	40,302	10,000	4,300*	5,700
	12 " " '95	56,527	46,146	10,381	4,051*	6,330
BALTIMORE, MD.						
Baltimore Traction Co	12 m., Dec. '94	1,012,319	623,040	389,279	359,243*	30,037
	12 " " '95	1,179,191	639,707	539,485	413,097*	126,387
City & Suburban Ry. Co	12 " June '94	605,123	409,363	195,760		
	12 " " '95	751,720	546,970	204,750		
BATH, ME.						
Bath St. Ry. Co	12 m. June '94	16,300	12,862	3,438	2,500	938
	12 " " '95	21,703	14,698	7,005	3,400	3,605
BAY CITY, MICH.						
Bay Cities Cons. Ry. Co.	12 m. Dec. '94	83,450	52,011	31,439	30,000	1,439
	12 " " '95	88,658	58,517	30,141	30,000	141
	1 " Mar. '95	6,121	3,920	2,201		
	1 " " '96	6,258	4,384	1,874		
	3 " " '95	17,464	12 188	5,276		
	3 " " '96	18,866	14,188	4,678		
BIDDEFORD, ME.						
Biddeford & Saco R R Co	12 m. June '94	24,219	14,813	9,406	6,391*	3,016
	12 " " '95	24,287	12,186	12,101	5,915*	6,186
BINGHAMTON, N. Y.						
Binghamton R. R. Co.	12 m. Jan. '95	121.969	69,581	52 388	30,152*	22,237
	12 " " '96	128,972	73,345	55,628	35,459*	20,169
	1 " Mar. '95	8 372	5,615	2,757		
	1 " " '96	9,932	6,165	3,767		
	2 " " '95	15,415				
	2 " " '96	19,173				
BOSTON, MASS.						
West End St. Ry. Co	12 m. Sept. '94	6 823,879	4807,082	2,016,796	725,064*	1291,732
	12 " " '95	7,746,171	5633,163	2,113,008	746,963*	1366,044
Lynn & Boston R. R. Co. / North Shore Traction Co	12 m. Sept. '94	1,238.410	746.304	492,106	379,029*	113,077
	12 " " '95	1,381,389	784,392	59,997	391,681*	205,316
	1 " Feb. '95	76,851	59.450	17,401		
	1 " " '96	87,291	56,931	30,660		
	5 " " '95	448,646	313.125	135.521		
	5 " " '96	481,014	330,154	150,860		
BRIDGEPORT, CONN.						
Bridgeport Traction Co	12 m. Dec. '94	144,447				
	12 " " '95	298,883	151,697*	147,186	75,000	72,186
	1 " Mar. '95	20,227	14,321	5,906		
	1 " " '96	22,406	13,645	8,761		
	3 " " '95	55,660	41,259	14,401		
	3 " " '96	65,573	41.515	24,058		
BROCKTON, MASS.						
Brockton St. Ry. Co.	12 m. Sept. '94	214.370	143.511	70,859	70,974*	d 115
	12 " " '95	266,892	154,950	111.942	84,691*	27,251
	1 " Feb. '95	15,683	10,457	5,226		
	1 " " '96	19 970	12,632	7.338		
	5 " " '95	92,815	54,089	38.726		
	5 " " '96	106,798	70,939	35,859		
BROOKLYN, N. Y.						
Brooklyn Elev. R.R. Co	12 m. Dec. '94	1,780,848	1041,095	689,754	831,093*	d 141339
	12 " " '95	2,082,937	1158,219	924,718	859,447*	65,271
Brooklyn Traction Co.	1 m. Jan. '95	44.599	56,3 7	d 11,728		
	1 " " '96	82.796	52,236	30,560		
Atlantic Ave. R. R. Co.	12 m., Dec. '94	1,011.258	615,863	395,395	265,118	130.277
	12 " " '95	891,940	706,900	185,040	302,918	d 117877
Brooklyn, Bath & West End R. R. Co	12 m June '94	111,605	86,717	24,888	39,718*	d14,830
	12 " " '95	130,928	79,394	51,535	61,150*	d9,616
Brooklyn City & Newtown R. R. Co	12 m., Dec. '94	595,449	346,285	249,164	120,632*	128,532
	12 " " '95	598,691	372,554	226,137	127,647*	98,489
Brooklyn, Queens Co. & Sub. R. R. Co.	12 m., June '94	543.413	427,101	116,312	169,225*	d52,913
	12 " " '95	625,537	415,255	210,282	339,068	d 128786
	6 " Dec. '94	348,969	213,351	135,618	167,644*	d32,026
Brooklyn Heights R.R. Co	6 " " '95	362,162	230,425	131,737	169,134	d37,396
	12 m., Dec. '94	3.509 016	2143,567	1,365,448	1468,553	d 103105
	12 " " '95	4,076,117	2682,614	1,393,504	2102,061	d 706758
Coney Island & Brooklyn R. R. Co	12 m., Dec,'94	316 183	207,478	108,706	52,157*	56,549
	12 " " '95	383,367	236,547	146,820	52,861*	93,959
	1 " Feb.'95	24.418				
	1 " " '96	19,313				
	2 " " '95	51,242				
	2 " " '96	40,801				
Nassau Elec. R. R. Co.	3 m Dec. '95	'82,140	59,904	22,236	20,286*	1,950
	6 " " '95	173,757	106,127	67,630	33,627*	34,003
BUFFALO, N. Y.						
Buffalo Ry. Co	12 m., Dec. '94	1,536,284	856,631	679,653	468,917*	210,736
	12 " " '95	1,351,919	649,097	702,822	417,038*	285,783
CHICAGO, ILL.						
Chicago City Ry. Co.	12 m., Dec '94.	4,264,618	2838,684*	1,425,934	207,878	1218,057
	12 " " '95	4,476,824	2807,726	1,669.098	300,389	1368,709
Chicago General Ry. Co	12 m., Dec. '95	82,082	64,334	17,748		
Lake St. Elev. Ry. Co.	12 m. Dec. '94	428,095	290,090	138,005		
	12 " " '95	517,301	319,606	197,695		
	1 " Jan. '95	44,670	28,180	16,490		
	1 " " '96	52,855	30,713	22,142		
No. Chicago R. R. Co.	12 m., Dec. '94	2.565,618	1347,326	1,218,292	465.648	752,644
	12 " " '95	2,780,487	1311,607	1,468.880	471,251	997,629
West Chicago R. R. Co	12 " " '94	4,181,237	2518,627	1,662.610	859,471	803,139
	12 " " '95	4,201.477	2267,195	1,931,282	902.016	1,032,266
Chicago & So. Side R. T. Co.	1 m., Mar. '95	70,013	47,113	22,900		
	1 " " '96	67,026	46.250	26,776		
	3 " " '95	193,073	140 694	52.379		
	3 " " '96	193,012	125,449	67,563		
CINCINNATI, O.						
Cinn. Newport & Cov. Ry. Co	12 m., Dec. '94	497,950	370,606	127,344		
	12 " " '95	624,034	418 710	205.324		
	1 " Feb. '95	37 254	34,293	2,961		
	1 " " '96	42 702	33,917	8,885		
	2 " " '95	76 689	65,557	11,132		
	2 " " '96	89,402	68.399	21,003		
CLEVELAND, O.						
Cleveland Elec. Ry. Co	1 m. Feb. '95	95.631	73 096	22,535		
	1 " " '96	118.977	82,781	36.196		
	2 " " '95	199.527	146.494	53,033		
	2 " " '96	244,384	167,551	76,833		
COLUMBUS, O.						
Columbus St. Ry. Co.	12 m., Dec. '94	566,811	269.362	297,449	176,648	120.801
	12 " " '95	629,905	311,594	318,401	183,506	134,895
	1 " Mar. '95	47,828	23,481	24.347		
	1 " " '96	50,896	25,743	25,154		
	3 " " '95	133,726	69,571	64,155		
	3 " " '96	148,507	78,549	69,958		
DENVER, COL.						
Denver Cons. Tramway Co	12 m., Dec. '94	753,483	445,684	307.798	244,172*	63,625
	12 " " '95	716.039	441.283	274,756		
	1 " Feb. '95	48.001	30.485	17,516		
	1 " " '96	51,901	31 534	20,367		
	2 " " '95	103,697	66.380	37,317		
	2 " " '96	106,441	65,755	40,686		
DETROIT, MICH.						
Ft. Wayne & Belle Isle St. Ry. Co.	6 m., June '95	116,945				
Citizens' St. Ry. Co.	6 m., June '95	386,575				
Rapid Ry. Co	5½ m. Dec. '95	30,356	15.586	14.770	6,875	7.895
Detroit Ry	3 m., Jan. '96	113,738	70,818	42.920		
DULUTH, MINN.						
Duluth St. Ry. Co	12 m., Dec. '94	208.105	111,105	97,000		
	12 " " '95	213,229	95,329	117,900		
	1 " Feb. '95	15.712	8,833	6,879		
	1 " " '96	15,247	8,679	6.568		
	2 " " '95	31,415	19,161	12,254		
	2 " " '96	31,087	17,754	13,333		
FALL RIVER, MASS.						
Globe St. Ry. Co	12 m., Sept. '94	248,106	147,352	100.754	75,284	25,470
	12 " " '95	269,786	159 090	110,696	76,479	34,217
FINDLAY, O.						
Findlay St. Ry. Co	12 m. Dec. '95	29,798	20,308	9,490	7,415	2,075
FITCHBURG, MASS.						
Fitchburg & Leominster St. Ry. Co	12 m., Sept. '94	89,260	61.416	27,845	7.209	20.636
	12 " " '95	110,275	74,103	36,172	7,017	29,155
GALVESTON, TEX.						
Galveston City R. R. Co	12 m., Dec., '94	199,133	131,407*	67,726	50,000	17,76
	12 " " '95	216,271	141,080	75,191		
	1 " Feb. '95	12,449	8,741	3,708		
	1 " " '96	13,058	9,303	3,755		
	2 " " '95	27,010	18,602	8,408		
	2 " " '96	26,317	19.610	6.707		
GIRARDVILLE, PA.						
Schuylkill Traction Co.	12 m. Sept. '94	88.288	56.564	31,724	25,000	6,724
	12 " " '95	90,981	52.851	38,130	29,770*	8,360
	6 " Mar. '95	40,597	27,855	12,742		
	6 " " '96	46,157	26,758	19,399		
GREAT FALLS, MONT.						
Great Falls St. Ry. Co	12 m., Dec. '94	26,431	24.905*	1,526		
	12 " " '95	26,650	28 126	d 1,476		
HAZLETON, PA.						
Lehigh Traction Co.	12 m., Dec. '94	97,202	50,605	46,597		
	12 " " '95	119,588	67,979	51,609	39,297	12,312
	1 " Mar. '95	8,941	5,837	3.104		
	1 " " '96	9,166	5,613	3,553		
	3 " " '95	24,273	16,527	7,746		
	3 " " '96	27,882	18,241	9,641		
HOBOKEN, N. J.						
No. Hudson Co Ry. Co.	12 m., Dec. '94	818,280	611,482*	206,798		
	12 " " '95	871,273	619,830	251,443	246,649*	4,794
HOLYOKE, MASS.						
Holyoke St. Ry. Co	12 m., Sept. '94	75,427	48,546	26,881	3,524*	23,356
	12 " " '95	112,547	69,627	42,920	20,058*	22,862
KANSAS CITY, MO.						
Metropolitan St. Ry. Co	1 m. Feb. '95	107,058	77,238	29 820		
	1 " " '96	124,935	82,620	42,315		
	9 " " '95	1,285,498	806,109	479,389		
	9 " " '96	1,343,367	782,447	560,920		
LAWRENCE, MASS.						
Lowell, Lawrence & Haverhill St. Ry. Co	12 m., Sept. '95	269,740	205,816	63.924	73,423*	d 8,498
	12 " " '96	403.530	262.935	140,595	84,081*	56,514
	1 " Feb. '95	20,475	18,548	1,927		
	1 " " '96	26,132	18,160	7,972		
	5 " " '95	114,947	93,012	21,935		
	5 " " '96	141,835	98,265	43,570		

Company.	Period.	Gross Receipts.	Operating Expenses.	Earnings from Operation.	Fixed Charges.	Net Income.
LORAIN, O.						
Lorain St. Ry	12 m., Dec. '95	80,176	46,092	34,084		
	1 " Mar. '95	6,337	3,254	3.083		
	1 " " '96	5.431	4.207	1,224		
	3 " " '95	15,861	10,940	4,921		
	3 " " '96	14,496	11,915	2,581		
LOUISVILLE, Ky.						
Louisville Ry. Co	12 m , Dec. '94	1,176,790	633.206	543,584	355.799*	187.784
	12 " " '95	1,288,172	672,080	616,092	359.366*	256,726
LOWELL, MASS.						
Lowell & Suburban St. Ry. Co	12 m. Sept. '94	277.029	179,409	97,620	66,624*	30,995
	12 " " '95	329,817	199,346	130,471	66.575*	63,896
MACON, GA.						
Macon Cons. St. Ry. Co.	12 m., Dec, '95	69,190	44,529	24,661	16,711*	7,951
MANCHESTER, N. H.						
Manchester St. Ry. Co.	12 m ,June '94	81,627	76,906*	4,721	3,302	1,419
	12 " " '95	82,923	87,594	d 4,670		
MARSHALLTOWN, IA.						
Marshalltown Light, Power & Ry. Co	12 m., Dec. '94	38,758	24,190*	14,568	7,650	6,918
	12 " " '95	40,757	24,307*	16,450	7,500	8,950
MINNEAPOLIS, MINN.						
Twin City R. T. Co	12 m., Dec '94	2,003,679	1,044,548	939,131	738,961*	220,170
	12 " " '95	1,988.803	979,485	1,009,319	750,839*	258,479
	1 " Feb. '95	134.896	67,947	66,949		
	1 " " '96	145,061	69,383	75,678		
	2 " " '95	286,927	143,024	143,903		
	2 " " '96	303,974	144,585	159,389		
MONTGOMERY, ALA.						
Montgomery St. Ry. Co	12 m., Dec. '94	35,216	21,724	13,492		
	12 " " '95	50.645	27,915	22,730		
	1 " Feb. '95	2,825	1.794	1,031		
	1 " " '96	3,462	1,753	1,709		
	2 " " '95	6,330	3,958	2,372		
	2 " " '96	7,150	3,822	3,328		
MONTREAL, CAN.						
Montreal St. Ry. Co	12 m., Sept. '94	897,838	628,454	269,384	55,363*	214,021
	12 " " '95	1,102.778	652.812	449,966	98,617	351,349
	1 " Mar. '95	78,638				
	1 " " '96	92,146				
	6 " " '95	462,431				
	6 " " '96	664,997				
NEWBURGH, N. Y.						
Newburgh Elec. Ry. Co.	12 m., Feb. '96	91,156	55,190*	35,966	26,458	9,507
NEWBURYPORT, MASS.						
Haverhill & Amesbury St. Ry. Co	12 m., Sept. '94	98.346	58,061	40,284	27,664*	12,621
	12 " " '95	104,853	65,936	38,917	28,223*	10,694
NEW HAVEN, CONN.						
New Haven St. Ry. Co	12 m., Dec. '94	126,183	69,517	56,666		
	12 " " '95	198,719	124,454	74,265		
	1 " Mar. '95	11.742				
	1 " " '96	12,679				
	3 " " '95	34,712				
	3 " " '96	39,988				
NEW LONDON, CONN.						
New London St. Ry. Co.	12 m., Sept. '94	49,899	29,150	20,749	6,423*	14,326
	12 " " '95	51,759	30,230	21,528	7,650*	13,878
NEW ORLEANS, LA.						
New Orleans Traction Co	12 m., Nov. '94	951,528	620,508	331,020		
	12 " " '95	1,327,756	752,158	575,598		
	1 " Feb. '95	87,511	53,135	34,376		
	1 " " '96	115,326	59,256	56,070		
	3 " " '95	280,236	162,286	117,950		
	3 " " '96	343,183	180,282	162,901		
NEWTON, MASS.						
Newton & Boston St. Ry. Co.	12 m., Sept. '94	33,478	25,262	8,216	7,677*	539
	12 " " '95	32,297	24,685	7,613	7,108*	504
Newtonville & Watertown St. Ry. Co	12 m., Sept. '95	7,580	6,599	981	809*	172
NEW YORK, N. Y.,						
Third Ave. R. R. Co.	12 m., Dec. '94	2,178,336	1,177,344	1,000,991	341,083*	659,909
	12 " " '95	2,355,154	1,456 782	1,198,372	328,917*	869,454
Metropolitan St. Ry. Co.	12 m., June '94	5,398,466	3,223,956	2 174,510	1,859,971*	314.539
	12 " " '95	5,772,260	3,183.210	2,589,050	2,016,889*	572,161
	6 " Dec. '94	2,885,101	1,632,245	1,252,856	963,046	289.810
	6 " " '95	3,613,850	1,832,246	1,781,604	1,155,620	625,984
Manhattan Ry. Co	12 m., Dec. '94	9,953,840	5,446,029	4,507,811	2.674,049*	1,833,762
	12 " " '95	9,731,213	5,533,959	4,197,254	2,988,167*	1,209,087
Central Crosstown R. R. Co	12 m., Dec. '94	546,026	385,309	160 717	90,427*	70,291
	12 " " '95	547,491	379,523	167,968	101,526*	66,442
D. D., E. B. & Bat'y R. R. Co.	12 m., Dec. '94	691,861	465.236	226,626	171.423*	55,202
	12 " " '95	748,443	557,074	191,369	138,112*	53,256
Eighth Ave. R. R. Co	12 m., Dec '94	768,064	565.927	202,138	95,545*	106,592
	12 " " '95	580,009	424,706	105,303	68,978*	36,324
42d St., Man & St. N. Ave. R. R. Co	12 m., Dec. '94	645,130	517,445	127,685	122,804*	4,881
	12 " " '95	626,337	527,155	99,182	122,800*	d23,618
New York & Harlem R. R. Co	12 m., Dec '94	1,106,017	670,970	435,047	37,524*	397,523
	12 " " '95	1,015,076	693,487	321,589	40,150*	281,439
Second Avenue R.R. Co	12 m., Dec. '94	987,923	755,395	232,529	140,078*	92.450
	12 " " '95	941,290	724,417	216,873	124.566*	92,308
Union Ry. Co	12 m., Dec. '94	470,446	254,973	215,473	141,934*	73,539
	12 " " '95	457,457	280,435	177,022	127,287*	49,735
NORRISTOWN, PA.,						
Schuylkill Val. Trac. Co	12 m., Dec. '95	50,752	36,580	14,172		
NO. ABINGTON, MASS.						
Rockland & Abington St. Ry. Co	12 m., Sept. '94	52,762	38,836	13,926	5,282*	8,644
	12 " " '95	67,815	49,759	18,056	6,008*	12,048
NORTHAMPT'N, MASS.						
Northampton St. Ry. Co	12 m., Sept. '94	50.090	28,904	21,186	2,375*	18,811
	12 " " '95	83,504	46,240	37,264	3,131*	34,133

Company.	Period.	Gross Receipts.	Operating Expenses.	Earnings from Operation.	Fixed Charges.	Net Income
NORWALK, CONN.						
Norwalk Tramway Co.	12 m., Sept. '95	43,315	29,858	13,457		
NORWICH, CONN.						
Norwich St. Ry. Co	12 m., Sept. '94	80.069	50,693	29,376	16,035*	13,341
	12 " " '95	85,210	53,454	31.756	17,400*	14,356
OAKLAND, CAL.,						
Central Av. Ry. Co	12 m., Oct. '94	32.668	26,781	5,887	1,852	4,035
	12 " " '95	30,808	26,148	4,660	3,785	875
Oakland Consol. St. Ry. Co	12 m., Dec. '94	129,351	95 821	33,530	31,139*	2,390
	12 " " '95	125,485	94,115	31,370	25 140	6 230
ORANGE, N. J.						
Suburban Traction Co.	12 m., Dec. '94	42 502	42,938*	d 431		
	12 " " '95	52,000	56,000	d 4,000		
PATERSON, N. J.,						
Paterson Ry. Co	12 m., Dec. '94	243,921	157,520	86,401	88,597	2,196*
	12 " " '95	298,689	174,619	124,070	97,264	26,806
	1 " Mar. '95	19,452	13,474	5,978		
	1 " " '96	23.643	14,659	8,984		
	3 " " '95	54,848	37.880	16,968		
	3 " " '96	69,121	41,006	28,115		
PHILADELPHIA, PA.,						
People's Traction Co	12 m., June '94	1,044.159	673,479	370 6'0		
	12 " " '95	1,660,676	829,815	830,861		
Hestonville M. & F. P. Ry. Co	12 m., Dec. '94	286,021	315,762	207,450	97,966	109,485
	12 " " '95	523,212				
Electric Traction Co	12 m. June '94	1,900 606	1,120 026	780,580		
	12 " " '95	2 151,853	1,241,584	910,269		
PORT HURON, MICH.						
City Elec. Ry. Co	12 m., Dec. '94	46,702	32.585	14,117		
	12 " " '95	52,848	34,771	18,076		
POUGHKEEPSIE, N. Y.,						
Poughkeepsie City & Wappinger's Falls E. R. Co	12 m., Dec. '95	93.557	60.257	33.300		
	1 " Mar. '96	5,448	4.198	1.250		
	3 " " '96	16,043	11,593	4,450		
ROCHESTER, N. Y.,						
Rochester Ry. Co	12 m., Dec. '94	782,520	448,304	334,216	269,045*	65,171
	12 " " '95	873,445	517,519	355,926	307,118*	48,808
ST. LOUIS, MO.,						
National Ry. Co	12 m., Dec. '94	1,353.136	776,582	576,554	337,684	238,870
	12 " " '95	1,403,957	821,315	582,642	366,587	216,055
SCRANTON, PA.,						
Scranton Trac. Co	12m., June, '94	247,768	140.080	107,688	105,796*	1,892
	12 " " '95	270,700	142,278	128,422	119,858*	8,564
	1 " Mar. '95	20,919	11.889	9,030		
	1 " " '96	25.523	14,219	11,303		
	9 " " '95	194,781	119,599	75,182		
	9 " " '96	243,967	121,977	121,991		
SEATTLE, WASH.						
West St. & No. End Elec. Ry. Co	12 m., Dec. '95	29,737	15,031	14,706		
SPRINGFIELD, MASS.						
Springfield St. Ry. Co.	12 m Sept. '94	373,903	252,269	121,634	18,210*	103,424
	12 " " '95	442,006	277,156	164,850	30,637*	134,213
SYRACUSE, N. Y.,						
Syracuse Cons. St. Ry. Co	12 m., Dec. '94	194,547	181.105	13,442	197*	13,244
	12 " " '95	164,626	178.072	d13,446	304*	d13,750
Syracuse St. R. R. Co.	12 m., Dec. '94	245,805	145,934	99,870	93,965*	5,905
TERRE HAUTE, IND.						
Terre Haute Elec. Ry. Co	1 m., Dec. '94	8,354				
	1 " " '95	11,602	7,939	3,663		
	6 " " '94	60,336				
	6 " " '95	83,507	48,855	34,652		
TRENTON, N. J.						
Trenton Pass. Ry. Co.	12 m., Dec. '94	198,681				1,129
	12 " " '95	222.761				1,771
TORONTO, ONT.,						
Toronto St. Ry. Co	12 m., Dec. '94	958.371	517,708	440,663		
	12 " " '95	992,801	489,915	502,886		
	1 " Feb. '95	62,460	39,032	23,428		
	1 " " '96	72,468	42.740	30,728		
	2 " " '95	132,997	82,114	50,883		
	2 " " '96	147,845	85,878	61,967		
TROY, N. Y.,						
Troy City Ry. Co	12 m , Dec. '94	432,596	212,407	220,189	130,474	89,705
	12 " " '95	490,489	242,775	247,714	126,116*	121.598
UTICA, N. Y.						
Utica Belt Line St. RR.	12 m., Dec. '94	119,105	90,754	58,351	29.844*	28,508
	12 " " '95	160,284	105,297	54.988	44 791*	10.197
WASHINGTON, D. C.						
Capital Traction Co	12 m., Dec. '95	1,063.776	634,013	429.754		
WATERBURY, CONN.,						
Waterbury Trac. Co	12 m., Dec. '95	247,730	142,073	105 657		
	1 " Feb. '95	16.588				
	1 " " '96	19.282	11,265	8,017		
	2 " " '95	33,830				
	2 " " '96	40,738	23,401	17,337		
WHEELING, W. VA.						
Wheeling Ry. Co	12 m., Dec. '94	133,517	119,378	14,139		
	12 " " '95	150,094	88,552	61,542	32,248*	29,294
WILKESBARRE, PA.,						
Wilkes Barre & Wyoming Val. Trac. Co	12 m., Dec. '94	400,143	196 824	203,319	122,607*	80,711
	12 " " '95	451,941	209,600	242,341	134,215*	108,127
	1 " Mar. '95	30,557	15,223	15,334		
	1 " " '96	36,791	18,437	18,354		
	3 " " '95	81,992	47,987	34,005		
	3 " " '96	112,057	53,612	58,445		
WILLIAMSPORT, PA.						
Williamsport Pass. Ry. Co	12 m., June '94	64,863	49,646	15,217	10,255	4,962
	12 " " '95	66,845	52,459	14,386	9,691	4,695
WORCESTER, MASS.						
Worcester Cons. St. Ry. Co	12 m., Sept. '94	355,000	284,215	70,785	45,479	25.306
	12 " " '95	420,498	309,787	110,711	51,778	58,933
	1 " Feb. '95	25,947	23,466	2 481		
	1 " " '96	34.168	26,505	7,663		
	5 " " '95	150,823	118,226	32,597		
	5 " " '96	186,686	139,100	47,586		