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RECENT IMPROVEMENTS IN THE SOUTHWEST MISSOURI ELECTRIC RAILWAY SYSTEM

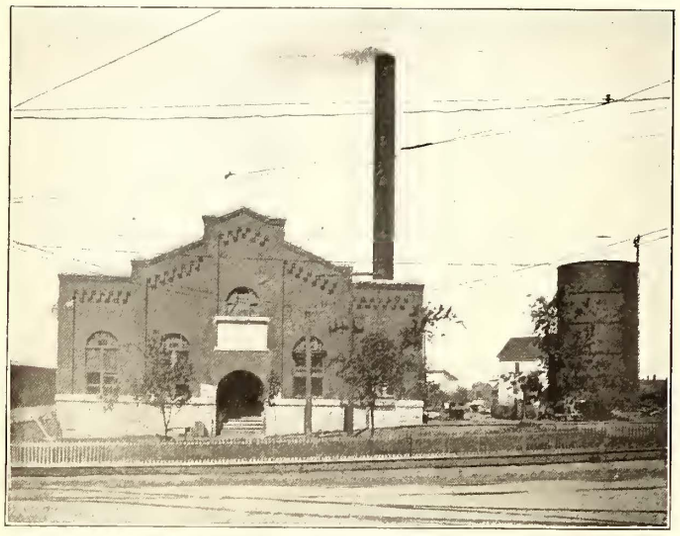
Since the publication of an article on this system, in the Street Railway Journal of May, 1899, extensive improvements have been made; which warrant a rediscussion of this interesting interurban proposition. About $300,000, raised by second-mortgage bonds, has been expended during the last year on extensions, double tracking, new car houses, and particularly on a new power plant and complete polyphase system of distribution with rotary converter sub-stations.

The line of the Southwest Missouri Electric Railway Company connects and runs through the cities of Joplin, with a population of 30,000; Webb City and Carterville, with a combined population of 15,000, and Carthage, Mo., with a population of 12,000, and Galena, Kan., with a population of 15,000, by far the greater part of its traffic being interurban. The country through which the road runs is highly cultivated farming land on the surface, thickly dotted with the head houses of the zinc mines for which Joplin and Galena are noted. These mines employ many men in their underground workings. This unusual double occupation of the land gives a correspondingly large passenger traffic. The line is 31 miles long, about 20 miles of which is on private right of way, 50 ft. in width. The roadbed is laid out on standard steam railroad plans, the rails being laid on 6-in. x 8-in. x 8-ft. oak ties, laid 2 ft. between centers. All the new rail is 60-lb. T, made by the Pennsylvania Steel Company, in 60-ft. lengths.

The line is favorably situated with regard to securing ballasting material. The piles of tailings from crushers of the zinc mines, between which the road twists and turns in places, consist of a coarse, dustless, crushed flint rock, which makes as good a ballast as broken stone. It drains nicely and weeds do not grow upon it. The line is shouldered and ditched through the cuts. Of the total length of about 31 miles, approximately 8 miles are double tracked, nearly all of this double tracking having been put in during the last year; the double-track sections are being extended as rapidly as circumstances will permit. The line is laid out to obtain as long tangents as possible,

CAR HOUSE AT WEBB CITY, SHOWING STANDARD TYPES OF CARS

grades being permitted to avoid curves to a greater extent than in steam railroad practise, as electric cars—if supplied with good voltage—can go over the grades without difficulty, while curves necessitate slowing down and introduce greater possibilities of accidents. The speed



EXTERIOR OF POWER STATION

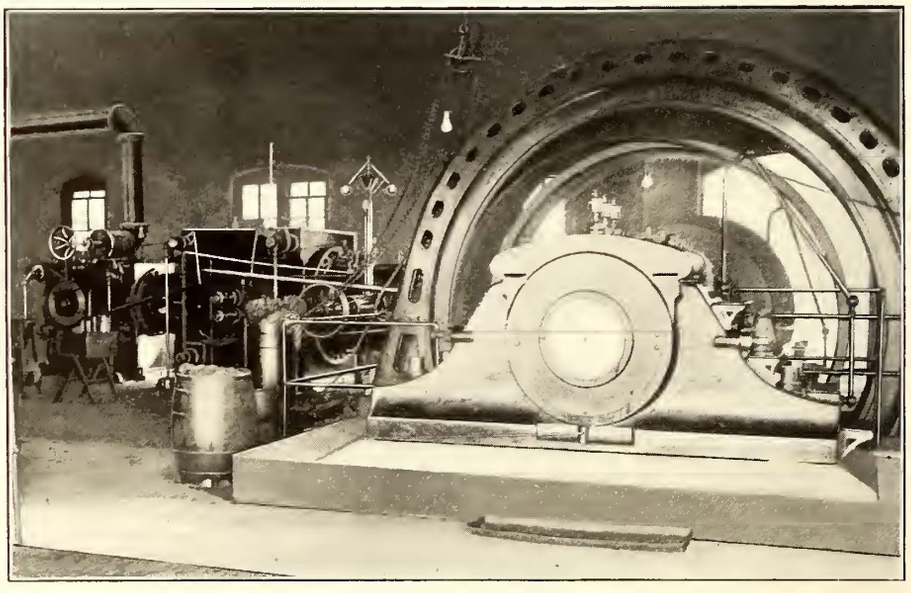
obtained is consequently comparable with that of steam lines.

From Joplin to Carthage, Mo., a distance of 19 miles, there is run what is termed the "Empire County Express." This car makes four intermediate stops for passengers and five stops for railroad crossings. It is scheduled to run 19 miles, with a total of ten stops, in one hour, and makes the schedule with great regularity. This express runs at intervals of one hour and a half, there being six local cars at thirty-minute intervals between the expresses, thus giving frequent service. The local cars take nearly one-half hour longer than the express to make the run, so that an express starting five minutes ahead of a local nearly overtakes the local ahead before reaching its destination. In the other direction, from Joplin to Galena, a twenty-minute service is given.

The rates charged are about 1 cent per mile, the fares being 10 cents from Joplin to Galena in one direction, or Webb City, in the other, and 10 cents from Webb City to Carthage. A book of one hundred 5-cent fares is sold for $4.50. There is being waged a sharp competition by the steam road operating between the same points, which is now giving the same rates as the electric line. Some freight is carried on the front platforms, but no effort is made to obtain it. Between Joplin and Carthage, 19 miles, which the Empire County Express (electric) makes in one hour, the steam road is scheduled to run in fifty minutes. The steam road, however, is handicapped by its inability to reach the business centers. In Carthage, as well as in Webb City, a free bus is operated by the steam road, which enables passengers to get to and from the trains. The frequency of the steam service is two hours from Joplin to Carthage, as compared with every hour and a half on the electric express and every thirty minutes on the electric locals.

Eighteen cars are usually in operation, all of which are double truck, there being no value in single-truck cars for this class of service. The cars have unusually wide bodies, 8 ft. x 4½ ins. maximum, and an exceptionally large amount of steel in their framing, as called for by the rigid specifications, a reprint of which will be found on another page of this issue. The cars have cross seats and smoking compartments in most all cases. The cars were made by the Laclede Car Company and Jackson & Sharp, and are mounted on Brill No. 27 G and Jackson & Sharp trucks, some Peckham trucks being also used. No small-wheel maximum-traction trucks are used, owing to the comparatively easy riding of the uniformly sized larger wheels and the high speed. The cars are equipped with two motors each, Westinghouse 38 B and General Electric 57's being used, geared up to 31 miles per hour at 500 volts; they get, however, about 600 volts. The weight of each car is kept down to about 18 tons, so that two motors can handle the work easily. Sufficient maximum-traction effect is obtained by overhanging the motor at one end of the truck, instead of mounting it between the wheels.

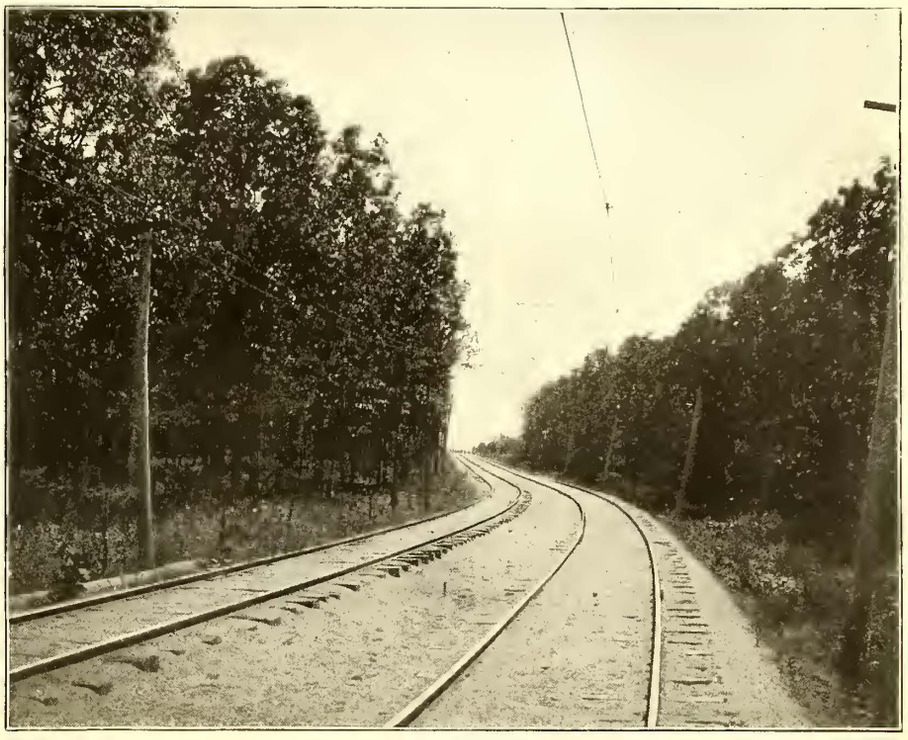
The cars are fitted with Wagenhals' inclosed arc headlights. These headlights are adjusted for 6½ amps., and throw an astonishingly brilliant searchlight beam along the track in the dark country districts. Their use is found to be of great benefit in reducing the number of cattle killed at night, the brilliant beams of light serving not only to show up cattle on the track, but to frighten them away. While without the arc headlights more cattle were killed during the evening than during the day time, this condition is now reversed. The head-lights do not seem to frighten horses, as might be expected. The head-lights are wired in the motor circuits, thus obtaining their current through the circuit breakers, with which every car is provided. To avoid blinding the motorman of an approaching car, the lights are turned off by tripping the circuit breaker and pulling out the plug which supplies current to the light. In this way arcing at the plug is avoided. Curtains are drawn in the front doors of the cars to darken the platform and further enable the motorman to see ahead on the track.



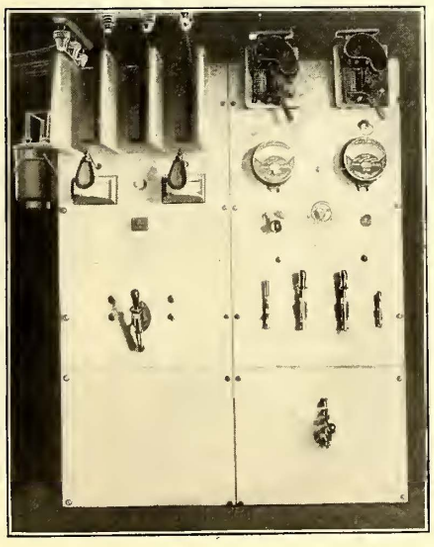
INTERIOR OF POWER STATION, SHOWING 1200-HP UNIT

The work on the new power plant was begun in September last, previous to which time the road was operated by two direct-current plants, the long feeds being carried by means of boosters. The polyphase equipment was first put in service April 25. The direct-current apparatus was

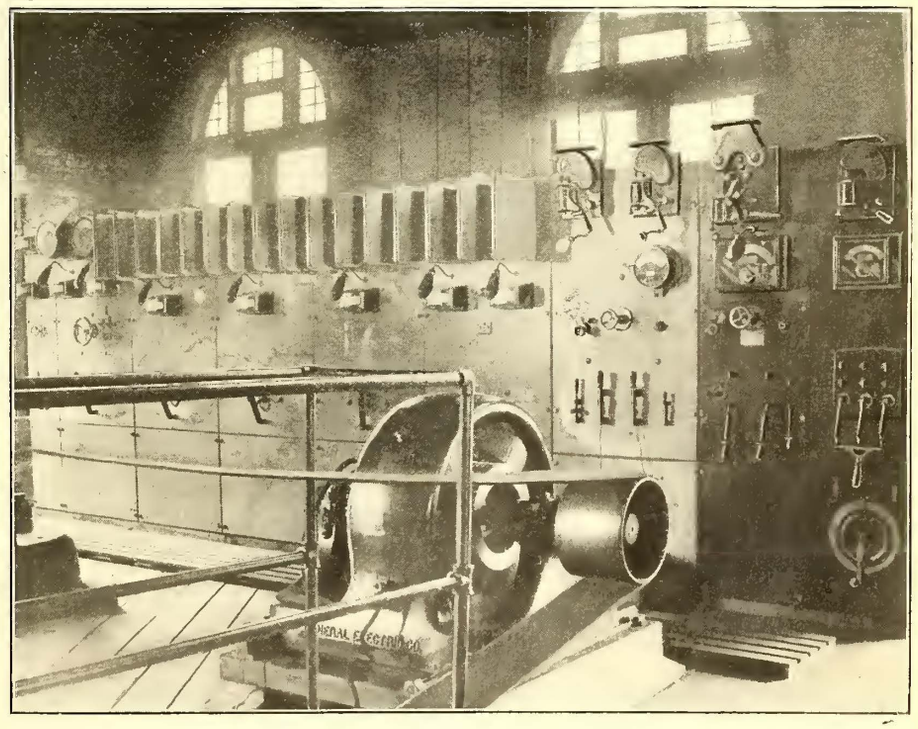
very heavily loaded, and in spite of this fact the new polyphase generating system was set up in place of old engines and generators in one of the existing plants, new boilers were installed in the places occupied by the old, and service was maintained while the changes were being carried out. This was almost as difficult an undertaking as the alleged proposal of a Southern Board of County Commissioners to erect a new court house in place of the old, to use the materials of the old in the construction of the new, and to occupy the old house until the new one was finished. The power house not changed over is now maintained as a reserve, but is not operated, the polyphase system carrying the whole load. In laying out the polyphase system the rather unusual principle has been followed of putting in no reserve units in the original installation, thus making all machines of as large a capacity and of as economical a size as possible, future extensions being depended upon to call for duplicate and reserve machines. Thus the original installation has only one engine, one generator, one exciter, one high-tension line in each direction, and one rotary converter in each sub-station. The adoption of such a policy in place of the usual use of at least two, and generally three, units, common until lately, speaks well for the improvement in reliability and freedom from shut down of power-house machinery. The new generating equipment consists of one tandem compound horizontal Cooper-Corliss side-crank engine, rated at 1200 hp, driving at 95 r. p. m. one 32-pole, 25-cycle, revolving-field three-phase generator. To avoid oscillations and hunting of rotary converters with a single-crank engine, there is fitted to it a 55-ton fly-wheel, 18 ft. in diameter, with a cast iron rim having a cross section 18 ins. square. The engine is guaranteed to use no more than 14 lbs. of steam per ihp-hour at its rated load. The generator, as well as the whole of the polyphase equipment, was built by the General Electric Company. The generator is wound to deliver the full high-tension pressure of 11,000 volts directly from its windings, thus doing away with the need of step-up transformers. It is rated as able to carry 750 kw with a 90 per cent power factor, *i. e.*, it will carry its full rated output of 750 kw without overheating, even if the current lags behind the e. m. f., due to reactance in the circuit, to such an extent that the current is necessarily increased 11 per cent above what would be necessary with a non-inductive load. The generator is guaranteed to carry its rated load continuously with a temperature rise not over 40 degs. C. above the air at 25 degs. C., and to carry a 25 per cent overload for two hours with a temperature rise not exceeding 50 degs. C. The guaranteed efficiencies are 95 per cent at full load, 94 per cent at three-quarters load, and 92 per cent at half load. The



TYPICAL INTERURBAN TRACK VIEW



SUB-STATION SWITCHBOARD



MAIN STATION SWITCHBOARD

guaranteed regulation is a rise of voltage of 8 per cent on throwing off full non-inductive load.

Three new double-decked Cahan boilers, each rated at 450 hp, have been put up with chain-grate stokers built by the makers of the boilers—the Aultman-Taylor Company. Coal and ash handling apparatus, coal bunkers and a new

INTERIOR OF SUB-STATION

chimney will be built later. Good feed water is obtained from a driven well 825 ft. deep, in which the water rises to within 75 ft. of the surface, from which level it is raised by a deep-well pump. Otherwise, it is a difficult matter to obtain good feed water in this locality, as the mines discharge considerable acid into the stream. A Cookson feed-water heater is used. The engine exhausts into a Worthington condenser, the water for which is cooled in

TYPICAL SUB-STATION, COMBINED WITH RESIDENCE OF ROTARY ATTENDANT

a Worthington cooling tower of the forced-draft type. This tower, which appears in one of the illustrations, is 17½ ft. in diameter and 34 ft. high, built of boiler plate, and is guaranteed to handle 21,000 lbs. of steam per hour, giving a vacuum of 24 ins. to 26 ins. The 108-in. fan of the cooling tower is driven by an old S. R. G. 30 motor, with suitable gearing.

The switchboard of the generating station is of the usual General Electric high-tension form, with type G oil switches and spring-expulsion type fuse holders. General Electric electrostatic ground detectors are used, connected in series with carbon rod resistances to prevent a short circuit in case the voltage jumps between the vanes of the ground detectors.

From the station two high-tension feeders run out in opposite directions along the track, as indicated in the wiring plan. One of these is of No. 4 wire as far as the first sub-station and No. 6 wire the remainder of the distance to the second sub-station in the same direction; the other is No. 6 wire from the station to the only sub-station in that direction. The high-tension lines are carried on Locke 5½-in. triple-petticoat insulators on the poles which support the span wires. The high-tension wires are on one side of the road, clear of the feeders and telephone line, which are kept on the other. The central power station itself contains a sub-station equipment, thus making four sub-stations altogether. Two 0000 feed wires are

MAIN OFFICES OF COMPANY

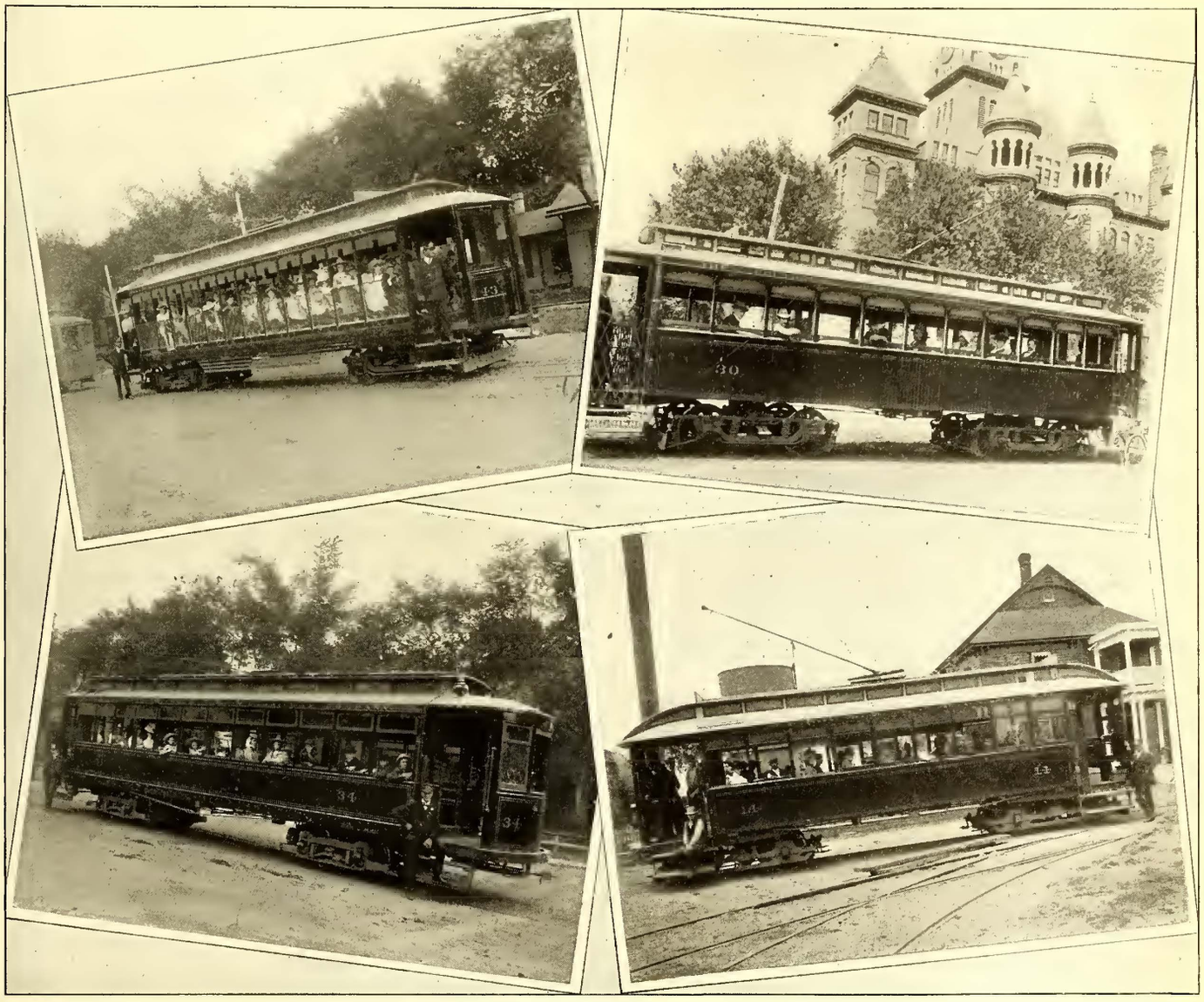
carried throughout the whole length of the line as a sort of side feeder. The company now has considerable unused feed wire on its hands, owing to the greatly reduced amount of copper necessary with the new system feeding 500-volt lines at all points. In front of the central power station the trolley line is divided by section insulators and the 0000 feed wires going to each direction are brought into circuit breakers on the board, so that either half of the line can be shut down and service continued on the other half in case a wire is down or there is a heavy thunder storm on one section. The sub-station switchboards are also fitted with two feeder breakers, so that the electrical continuity of the line can be interrupted for the same purpose in front of the sub-stations by putting in section insulators if at any time it is found desirable.

The sub-station equipments are in all cases the same. The apparatus consists of one 250-kw rotary converter supplied by three 80-kw oil-insulated, oil-cooled, step-down transformers, thus doing away with blowers and their motors, which are necessary with the forced-draft type of transformers. No copper bridges or equivalent devices for reducing hunting are used on the rotaries, although they are supplied from a single-crank engine running at only 95 r. p. m. In spite of this, there is no

trouble whatever from hunting, the alternating ammeters showing only the slightest perceptible beat in time with the engine strokes. Although the rotaries are rated at 417 amps., 900 amps. have been drawn from one of them for a short period without sparking and without overheating. The rotaries are compound wound, and, with the exception of the machine in the central power station, are oil insulated and air cooled. Reactive coils have been put in the alternating circuits to give the proper compounding.

The method of starting the rotaries is as follows: When starting up in the morning the main generator is run up to about half voltage, and the rotary in the main power station is thrown on and started up by the induction motor rheostat switch is installed on each rotary switchboard for this purpose.

The sub-stations are attractive appearing structures of the style illustrated herewith. The interior is largely given over to the living quarters of the sub-station attendant and his family. By combining the residence and the sub-station proper in this way but one man is needed per sub-station, as other members of his family are capable of watching the apparatus in his absence. The one room devoted to the electrical apparatus is provided with a double door sufficiently wide to accommodate the rotary, and the sub-stations are so planned that this room can be extended when more machines are needed.



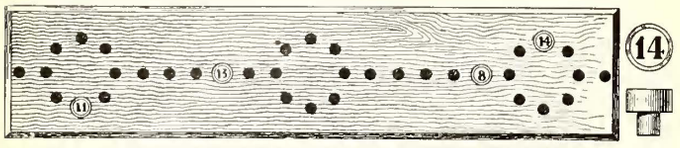
STANDARD OPEN AND CLOSED CARS

action of the alternating currents; that is, by the method usually adopted with General Electric apparatus; the half voltage of the generator serves the same purpose as compensating transformers, reducing the alternating voltage impressed on the collector rings of the rotary down to about half the normal. When synchronized and brought up to full pressure, the direct-current end of the power-station rotary is closed on the 600-volt lines and the sub-station rotaries are started from it by means of direct current sent out over the trolley wires and 0000 side feeders, which, as noted above, are continuous from station to station. In this way the sub-station rotaries are brought up to speed without using alternating currents. A four-step

Among the other extensions during the last year are the new car house and shops, a view of which appears herewith. This building has a frontage of 143 ft. and is 200 ft. long, affording accommodation for forty cars. It is located just across the track from the power station and general office in Webb City. In it the cars are cleaned and all repairs are made. The company does not allow the use of any water in cleaning its cars, Modoc liquid car cleaner, made by the Modoc Soap Company, of Cincinnati, Ohio, being used exclusively.

A view of the general office of the company is also given. The lower floor contains the usual general offices, and the upper floor the dispatcher's office, the dispatching being

done, as usual, by means of a telephone line with bridging stations of the police-patrol type. The phone dispatcher has in front of him a board with holes arranged as in the accompanying sketch, in which he can insert buttons numbered to represent the cars, so as to keep track of their locations on the line.

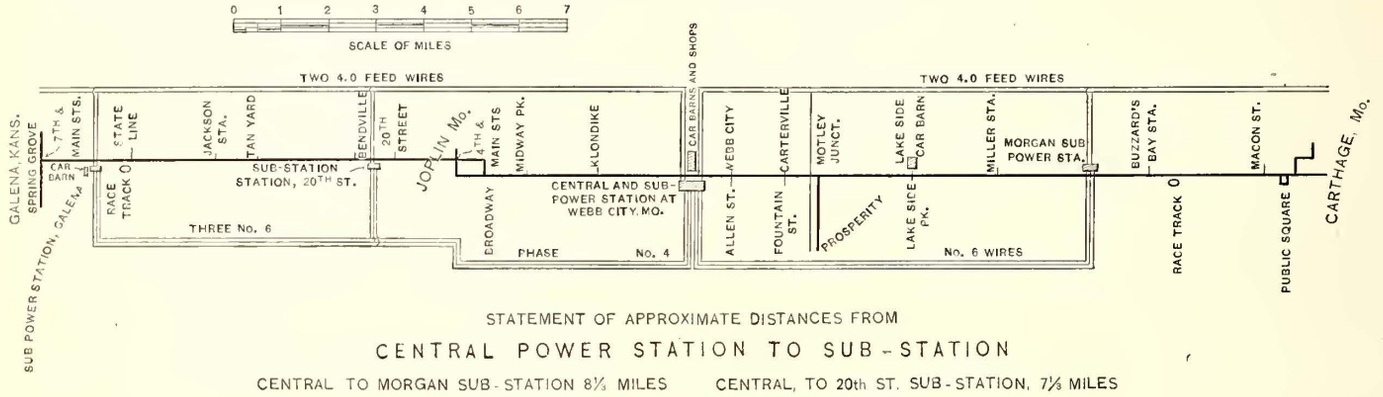


BOARD USED BY TRAIN DISPATCHER FOR RECORDING LOCATION OF CARS

Another interesting point about the operation of this system is the method of paying the men. The rate paid conductors and motormen is 12½ cents per hour during the first six months, after which 15 cents is paid, with an addition of what is termed a "10 per cent dividend," *i. e.*, each man is paid at the end of six months a further sum equal to 10 per cent of his total wages during the previous six months' period. In this way the amount actually paid is 16⅔ cents per hour, provided a man does not leave during the six months.

On July 4 the company made an innovation which perhaps is worthy of mention. On that day it was decided to dispense altogether with the use of fare registers. Instead, each conductor reported the amount of cash he had on hand in the morning of the 4th, put in the entire day and a good part of the night in collecting fares, not registering any of them, and then turned in amount of cash on hand at close of business, less amount he started with in the morning. The experiment was successful, and the total receipts for the day were $530 in excess of any previous day in the history of the road. One conductor turned in $196.20, which is the record for the road; all of this was collected from one car with no trailer.

The Southwestern Missouri Electric Railway Company is capitalized at $800,000, all of which is issued, and has an authorized bond issue of an equal amount, of which $750,000 is issued, the bonds drawing 6 per cent and being redeemable inside of three years. The receipts for the month of May, 1900, the last month previous to the writing of this article, amounted to $22,593, of which the operating expenses, including paving, car licenses and legal expenses, amounted to $9,647, leaving a net income of $12,946. The interest on the bonded indebtedness amounts to $3,750 per month. Occasional dividends have been paid in the past, and from now on regular dividends will be paid, although at the time of this writing the amount of these dividends was not decided. The stockholders of the road are identical with the bondholders, and are largely residents of Harrisburgh and Philadelphia, Pa. The road has an Eastern office in the former place.

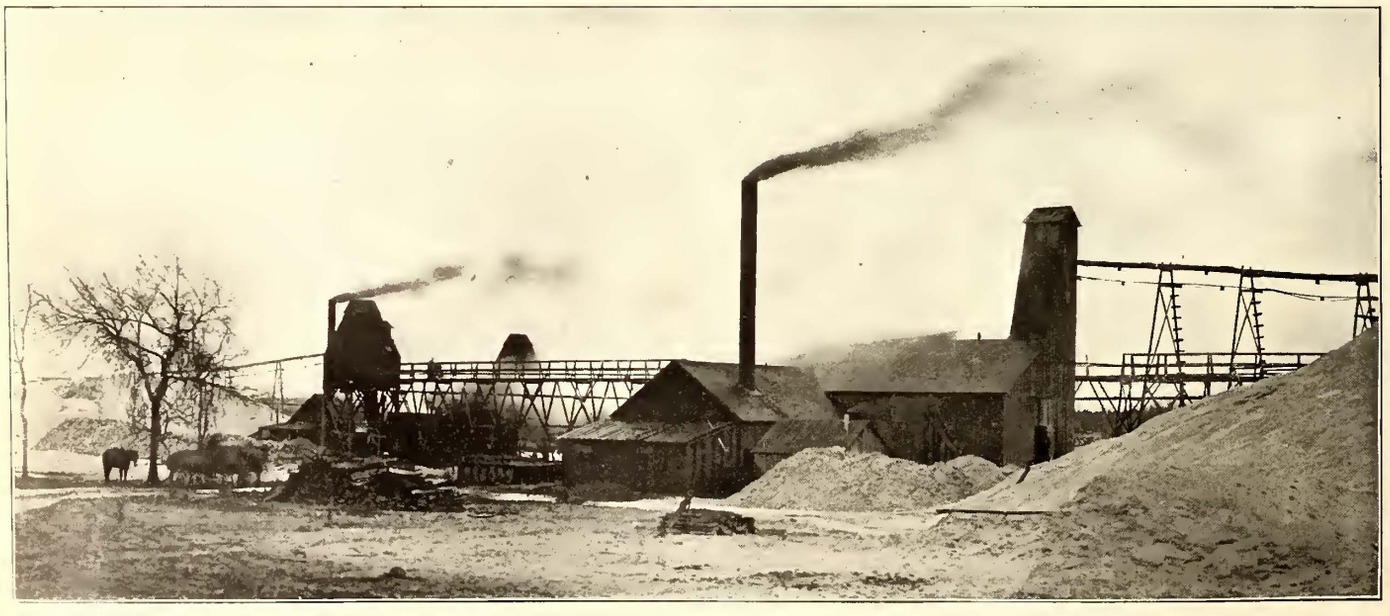


STATEMENT OF APPROXIMATE DISTANCES FROM

CENTRAL POWER STATION TO SUB-STATION

CENTRAL TO MORGAN SUB-STATION 8⅛ MILES CENTRAL, TO 20th ST. SUB-STATION, 7⅛ MILES

CENTRAL, TO GALENA SUB-STATION, 13½ MILES



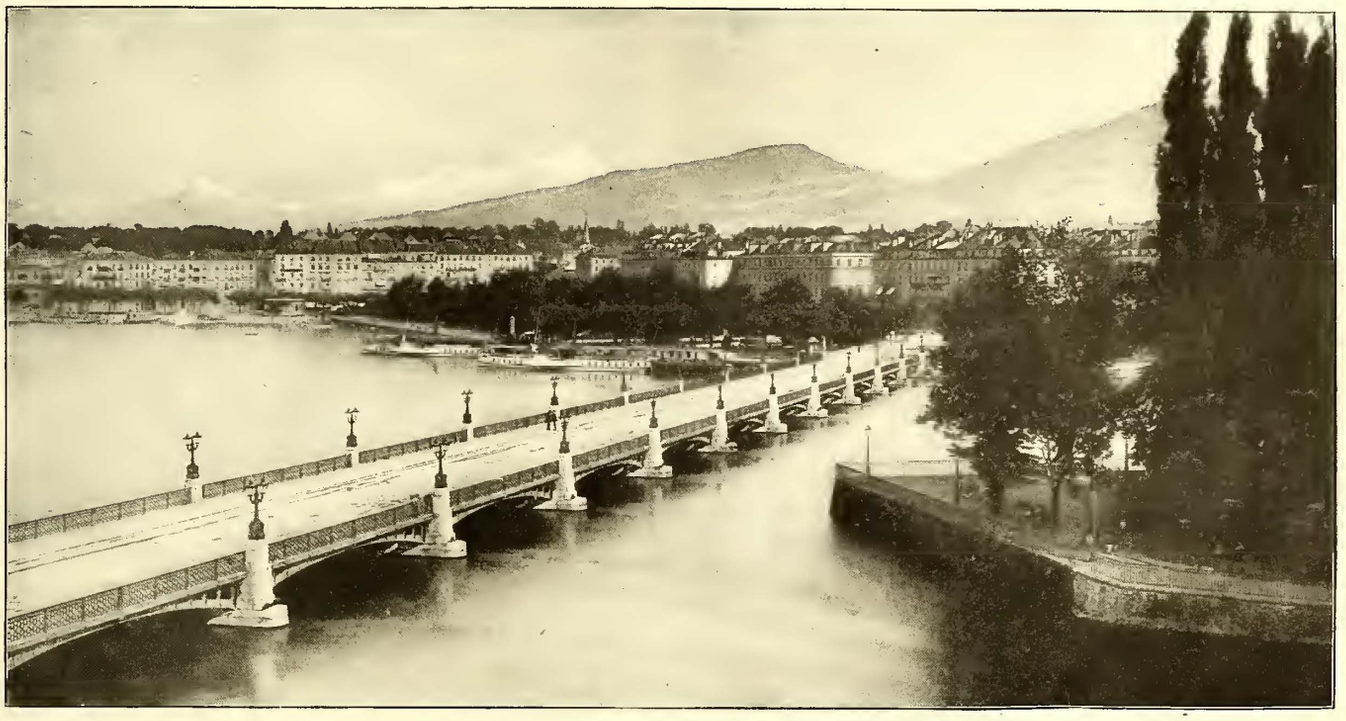
HEAD HOUSE OF ONE OF THE MANY ZINC MINES ALONG THE ROUTE

The president and treasurer of the road, A. H. Rogers, manages its affairs, taking personal charge both of its larger and more important dealings and the many details of operation. To President Rogers is due the credit for the road's good equipment, successful operation and pros-

perous condition. The other officers of the road are as follows: E. J. Pratt, superintendent motive power; C. E. Baker, superintendent transportation; J. M. Maret, superintendent tracks, lines and bridges, and H. T. Morrison, superintendent repair shop.

The Street Railway System of Geneva, Switzerland

The beautiful city of Geneva, situated at the western end of Lake Leman, has of late become more than usually interesting to the American tourist and engineer, by reason of the remarkable change that has been made in its street railway system. In view of the size and importance of the city and the extent to which all the facilities for travel are liberally patronized, it is a little curious that the initiative in the new work should have come from outside; but this has also occurred elsewhere in Europe. Geneva was early in the possession of steam tramway and trolley roads, but it has been reserved for foreign capitalists to unify the existing systems, create a most extensive network of new lines, and to develop plans which comprise not only the whole canton, but all the adjacent country in Switzerland and France that is physically part of Genevese territory. The past month has witnessed the completion of a large part of the enterprise, giving, therefore, an opportunity for presenting the work and its history in more or less appropriate detail.*



BRIDGE OF MT. BLANC, AN ARTERY OF STREET RAILWAY TRAVEL, GENEVA

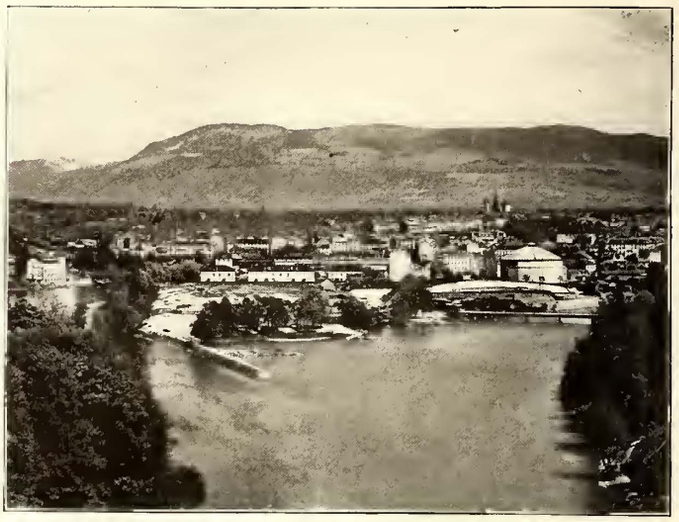
It would appear that about three years ago H. E. Butters, of San Francisco, prominently identified with Californian and South African mining interests, was very much impressed while passing through Geneva on a tour, with the fact that the street railway service was not adequate to the population, and that with abundant cheap water power in the city itself, the methods employed depending largely on steam "dummies," were intolerably behind the times. The idea immediately suggested itself to Mr. Butters to effect improvement by consolidation and the injection of new capital. Steps were at once taken to this end, outside capital was readily enlisted on a rough presentation of the plan, and ultimately control was obtained of the Narrow Gage Street Railway Company (Voie Etroite) of Geneva, with nearly 45 miles of track in the city and suburbs, and of the General Company of Swiss Tramways (Compagnie Générale des Tramways Suisses), operating about 22 miles of track in the best parts of the city. The parties thus becoming interested, namely, the General Tramways Construction Syndicate, Ltd., of 43 Threadneedle Street, London, also secured a federal charter for the Genevese Company of Electric Tramways (Compagnie Genevoise de Tramways Electriques), and with it concessions for new lines of nearly 18 miles in and around the city and some 14 miles in extensions each side eastward of the Lake of Geneva to the charming suburbs of Versoix on the Swiss shore, and Hermance, at the French border. The Compagnie Genevoise has already done a large part of its work in welding together the system thus created, which serves a city of about 100,000 souls; a canton with a population of 120,000 and an area of 109 square miles, and which is reaching out necessarily to annex or associate with itself lines that ramify in every direction in territory hitherto dependent chiefly upon slow and expensive steam locomotion. A map is shown herewith of the Genevan network of the company, presenting graphically the manner in which, with an expenditure when all is done of about $5,000,000, the old and new lines thus consolidated and amounting to nearly 100 miles will cover the city and its suburbs, and will furnish a first-class modern system with all the improvements that the most skillful engineering can suggest.

It was natural that those who had undertaken this great enterprise should look to America for the expert ability to direct and supervise the expenditure of their money, and thus it came about that Stephen D. Field, so well known in the United States, not only as a brilliant inventor, but as one of the oldest electric railway engineers in the country, was invited to take the position of engineer-in-chief. This he consented to do, and associated with himself A. Kundig, a young Swiss engineer, who had had considerable experience in America. Under the vigorous and efficient management of these two men an amount and quality of work has been done in a manner and at prices

* Illustrated articles on street railway work in Geneva appeared in the STREET RAILWAY JOURNAL for February, 1897, and November, 1898, and they contain detailed information as to the older systems which it is not necessary therefore to repeat here.

that are simply amazing, and it may fairly be questioned whether there is in all Europe a system that has been more liberally, yet more economically, constructed. Preliminary to any attempt to consolidate car houses, rolling stock, etc., the Compagnie Genevoise determined to establish its own headquarters, and this it has done at a most picturesque part of the city, in the southwest, at a point called La Jonction, just where the blue Rhone from Lake Geneva and the arrowy, turbid Arve, from the Mount Blanc ranges, mingle their waters and flow southward to the Mediterranean. Herewith are shown views of the property and buildings, with a plan of the offices, car house and machine shop, as at present developed. The company owns at this spot about 20,000 sq. m., and thus has ample provision for the inevitable growth. As a matter of fact, this little real estate investment has proved one of the best of the concern's many shrewd moves, for the river detritus taken out and crushed electrically for roadbed material has pretty well covered the price. As is usual in Europe, the office building is a handsome, substantial edifice. It is three stories in height, with clock tower, and is built of a rich French white stone, upon which ornamental carving has been freely bestowed. It has a frontage of over 115 ft. and a depth of nearly 120 ft. in an L shape. The ground floor is devoted to the offices for cashier and bookkeeper and general accounts, and to an

LAYING TRACK ALONG ROUTE D'HERMANCE, NEAR PARK DES EAUX VIVES

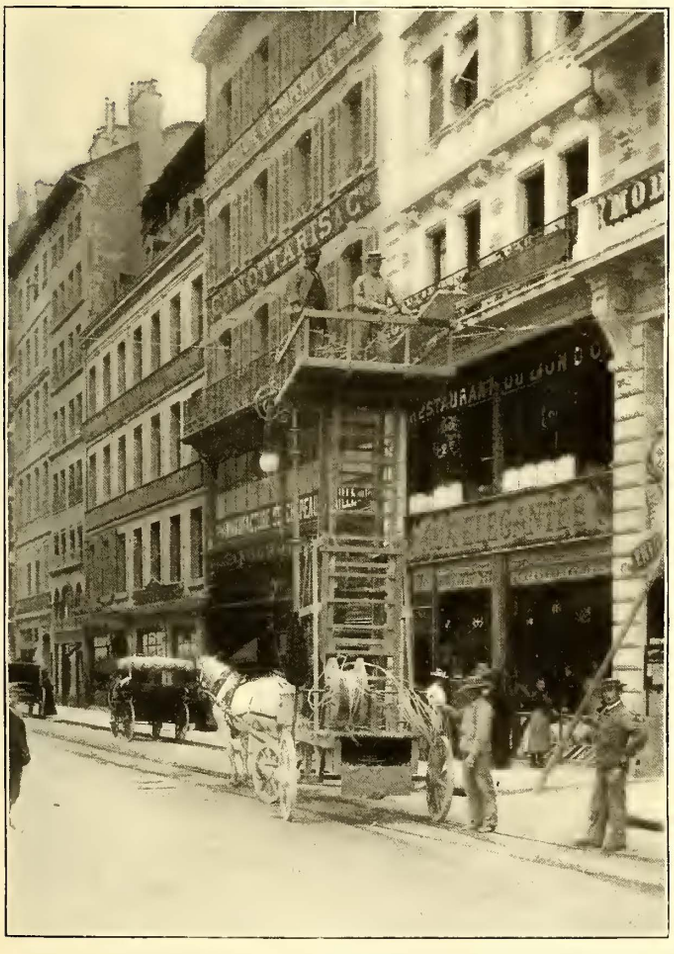


LA JONCTION, HEADQUARTERS OF THE CIE. GENEVOISE DE TRAMWAYS ELECTRIQUES

CHEVRES POWER STATION, GENEVA

assembly room for the motormen, while the long wing of the building carries a large stock of supplies, for which there is also a commodious basement. The first floor is occupied by the management, with rooms for the superintendents and various officials, and a large board room for the directors and receptions. The second floor is reserved for the engineering department, and has excellent light, and there are also a salon, bath, dormitory, etc. In the clock tower an archive room for files, etc., has been placed.

Closely adjoining the office building is the car house, of steel and brick construction, the face of the bricks being covered with hard cement. It is about 275 ft. long by 80 ft. wide, has six tracks, and can be added to indefinitely as to width. It will now carry fifty 18-ft. cars, and the pit has been made clear across the lower end, so that no switching is necessary to get cars over it. Immediately in the rear is a fine machine shop and repair shed at right angles to the car house, with one of its sides on the bank of the River Rhone. It is of the same general construction as the car house and is nearly 200 ft. long by 60 ft. wide. It is equipped with a 15-ton traveling crane and the necessary complement of tools. The yards outside the buildings



RUE DU RHONE, OVERHEAD CONSTRUCTION

constitute a depot for heavy material, such as poles, rails, road material, etc.

It is probably well known that the gage of street railway favored in Switzerland is only 1 m. (3 ft. 3 ins.), called the Voie Etroite. In Geneva, when the new company came into power, there were about 45 miles of such gage in the city in operation and about 18 miles of medium gage. All the new work is of 1-m. gage, which, of course, becomes therefore the standard of the whole system. Mr. Field and his staff are thoroughly well satisfied with this width, which has its advantages in view also of the narrowness of many of the streets traversed, and Mr. Field has even worked out a novel type of car known as the Hotel de Ville, from the section in which it will run and which is intended to go through narrow streets rather than wreck or abolish the existing architecture. It is only 1.70 m. in width, seats

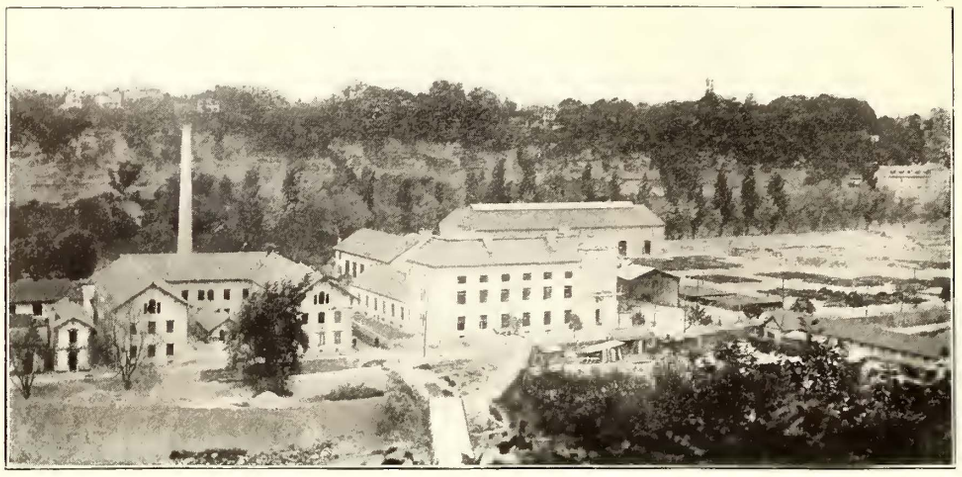
LAYING CONDUIT ALONG ROUTE D'HERMANCE

eighteen people, and provides standing room for eight more. But the standard size of car, which will doubtless be generally adhered to, is 2 m. (6 ft. 6½ ins.) in width over all, although it can be made 2.20 m. (7 ft. 2½ ins.) and keep within the official requirements and conditions. The company has thirty-six existing cars and is adding ninety new ones, for the electrical equipment of which Westinghouse motors and controllers will be used, of the familiar type. The new cars are being furnished by the Societé Industrielle Suisse, of Neuhausen, Schaffhausen, and some were equipped by the Basle works of the Allgemeine Elektricitäts Gesellschaft. The charter of the company, it may be fitly mentioned here, requires broadly that all materials and supplies used shall be preferably of Swiss origin or bought through Swiss houses. The engineers of the road are very much in favor of the Brill type of car, as used in California and also at Capetown, and one of these was actually imported by special permission to serve as an object lesson to the Genevese, who have been very enthusiastic about it, and apparently would like all the rest to be of the same comfortable and commodious model. Each car has two 25-hp motors, with ordinary controller, and is furnished with two series of five incandescent lamps of 110 volts, and is heated in addition with the McElroy electric heaters of the Consolidated Car Heating Company, of Albany, N. Y.

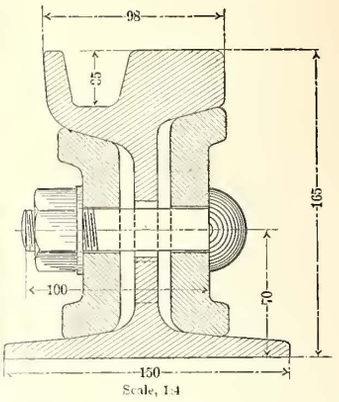
The rail used by the Compagnie Genevoise is the Phœnix, model 18 C, furnished by the firm of Demierre & Company, of Geneva. It is shown herewith in cross section, and has a weight for city use of 105 lbs. For country

lines the Phœnix model 5 F is used, with a weight of between 65 lbs. and 70 lbs. All the angle-plates have three bolts on either side of the joint, and the Edison-Brown plastic bond is used, with three or four 00 copper wires at

later. The unit of conduit is a two-duct piece, 70 cm (29½ ins.) in length, each duct having a 2½-in. bore. These pieces are laid edge to edge and bound with tar paper, as shown in one of the illustrations, and they are then grouted



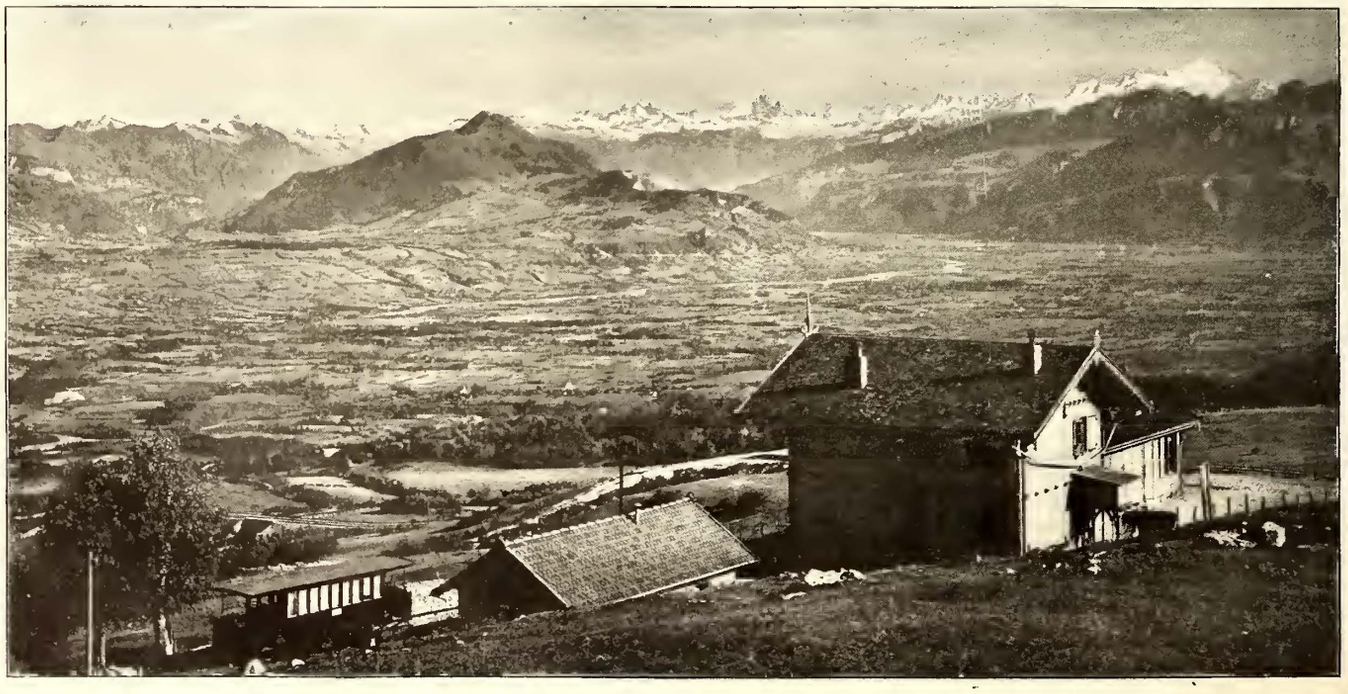
OFFICE, CAR HOUSE, ETC., AT LA JONCTION



STANDARD SECTION OF RAIL

crossings. The nature of the track and roadbed construction can be seen from the views presented. All the track in the city is carried on concrete girders, with a height of 12 ins. and a breadth of 10 ins., while the total depth of masonry under the track is 1 m. This solidity is not only due to the fact that the bed has to stand the crushing strain of the city's 15-ton road rollers, but because the streets are generally dug out of slimy clay soil, which has a mean trick of caving in, so that special stability was the best

10 cm (4 ins.) on all sides, making a solid, impermeable, yet easily accessible, system. In some places, as in the main thoroughfare, the Rue du Rhone, the conduit is under the track. The number of ducts varies from place to place, according to the requirements, being twenty in the section across from the power house to the Plaine de Plainpalais, and twelve, eight, six, four, etc., in other parts of the city. The system is reached by means of one hundred manholes, all of good size, the largest near the



TERMINUS OF MT. SALEVE RACK RAIL ELECTRIC RAILROAD, GENEVA—MT. BLANC IN DISTANCE

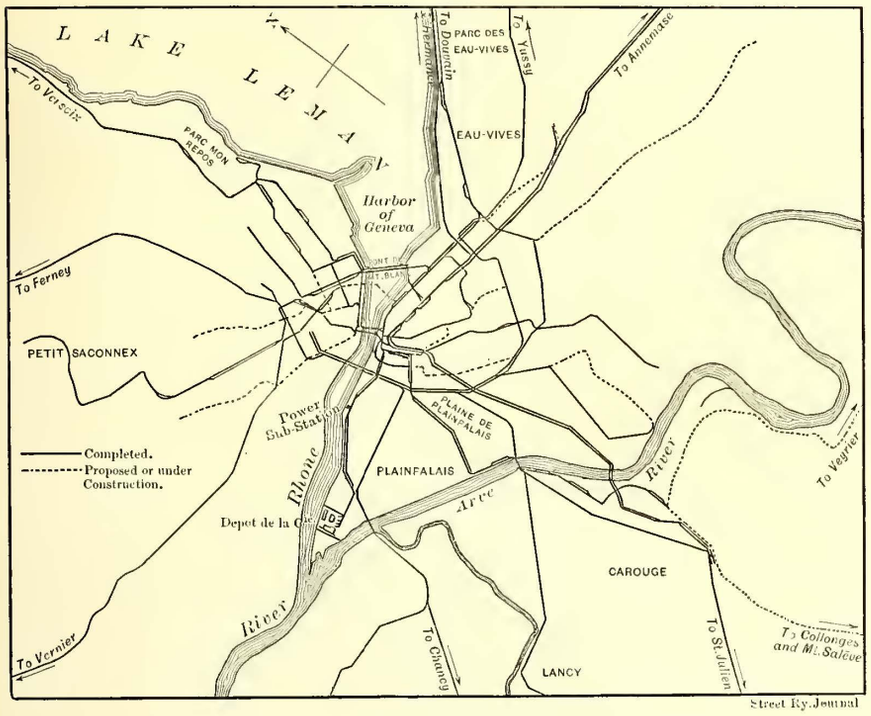
means of guarding against disruption. Rigidity of the rails in relation to each other is also insured by the tie-rods, of which there are five to each length of 12 m., or, say 40-ft. rail. The radius of curves is 11 m. at La Jonction and 15 m., 18 m. and 20 m. in other parts of the city.

The entire new network of feeders is distributed by means of terra cotta conduit, which Mr. Field has had made specially in Switzerland for his work. It starts out from the city power plant at Coulouvreniere, from which current is taken under conditions that will be touched upon

power house, central for the whole system, being 10 ft. cube. The cables for the work have been furnished by the Société D'Exploitation des Cables Electriques (Systéme Berthoud, Borel & Cie), Cortaillod, Switzerland. From the power plant to the big manhole, each way out, there are three cables on each side of 700,000 circ. mils each, and then smaller cables lead off for each line, according to the demand. To start up the first cars, some 12 km of 500,000 circ. mil cable had been drawn in at the time these notes were made, in the early part of the summer. In addition

to this there is a four-circuit telephone cable cut at each manhole, so that from those points communication can be had immediately with the power plant, office or car house.

The line construction may be said to follow American



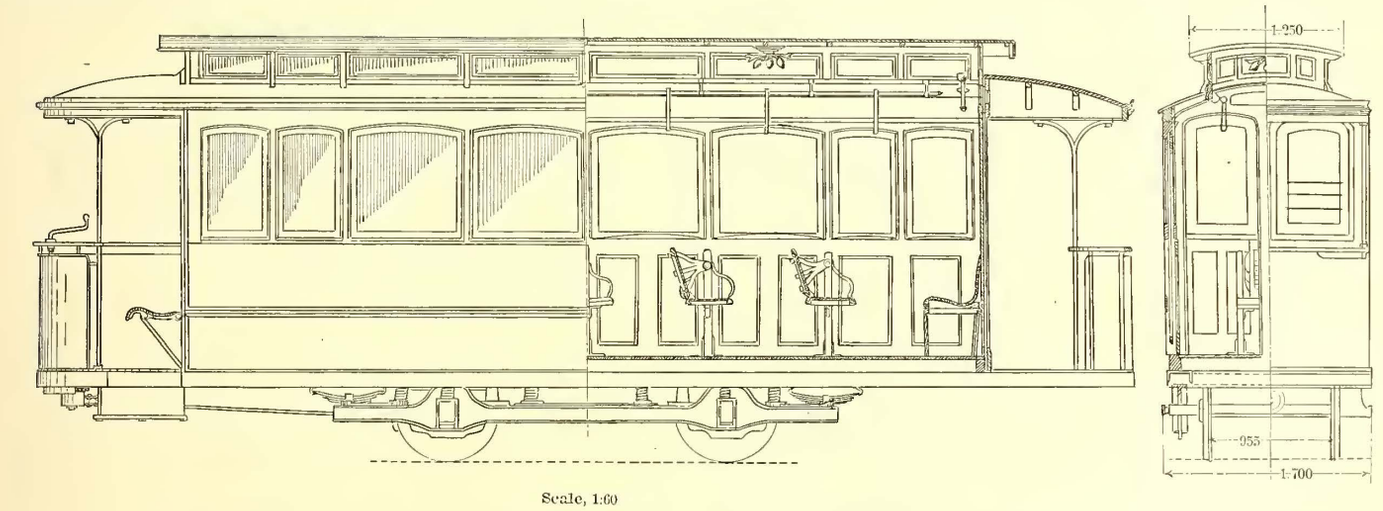
MAP OF GENEVA, SHOWING THE TRAMWAY SYSTEM

practise in general so far as relates to the pole line, etc., and much of the material has been supplied by Robert W. Blackwell & Company, Ltd., of London; while some excellent insulating pieces used are from the Société Fran-

two flat slabs of iron, drawn and welded at the same time; with 20 ft. in the single lower piece and 10 ft. in the single upper piece. In securing heavy corner poles to sustain unusual strain, Mr. Field, with characteristic ingenuity, has resorted to the device of taking a pole of large diameter, filling up the hollow space by dropping old rail down into it and then cementing the whole mass inside. The result is enormous stability.

In addition to the pole line, the company has up about 15 km (9½ miles) of line fastened on buildings by rosettes, a great many of the streets being too narrow to admit poles. One of our views shows a construction gang putting up line of this type last May. The least distance permitted from wire to rail is 6 m. In the Place du Rhone there is a very interesting piece of work of this character, it being a very open space, with a cross street on one side, coming in at right angles. One long span across is 80 m. (244 ft.) at a height of 7 m. (21.3 ft.), and across the street is a parallel span of 50 m. (152 ft.) length. The span wires are composed of fourteen steel wires stranded, each 2 mm in diameter. The unusually heavy construction here was rendered necessary by the fact that a double trolley wire had to be supported for the turn-out. The end plates for this style of construction are heavy, and their pins, made of inch rod corrugated, are driven in about 8 ins.

In making his cable joints on the construction work, Mr. Field has adopted a plan which seems to be both new

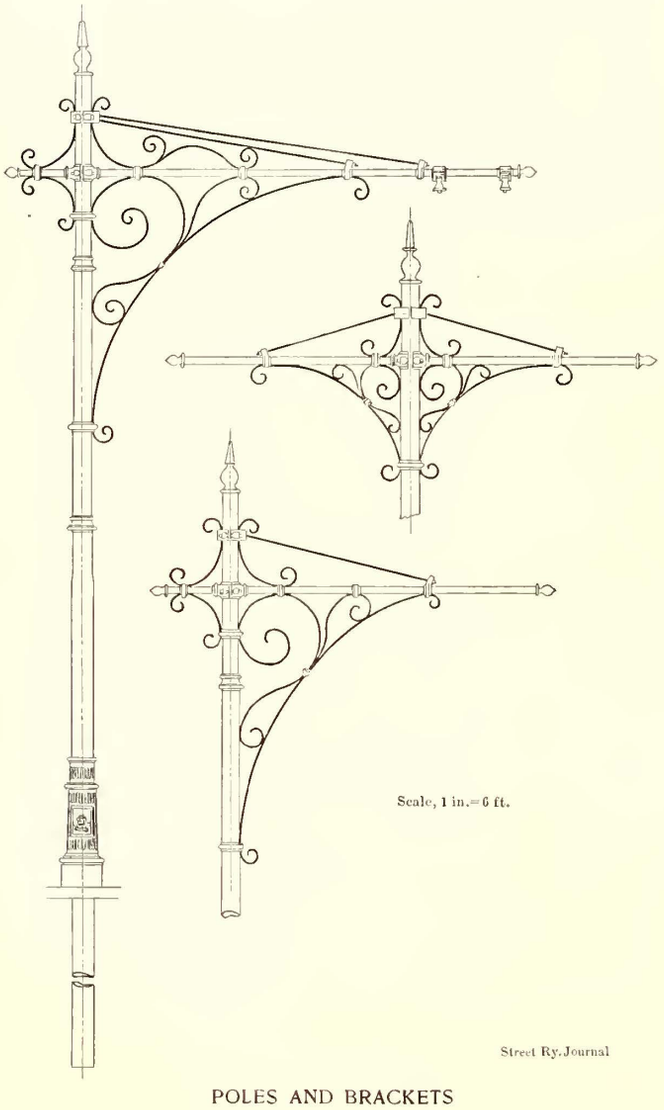


PROPOSED NARROW GAGE CAR, GENEVA

caise d'Ambroine, of Paris, and other material has been supplied by the Duisburg Iron Works, of Duisburg, near Cologne. About 13 km (8 miles) of pole line have been put up. Some of the poles are made with side web, from

and meritorious. The cable to be jointed is first scarfed at an angle of 45 degs. The cut-bare ends are left separate about 1/32 in. apart and clamped in a bullet mold in which is cast very hot nearly pure tin solder. This

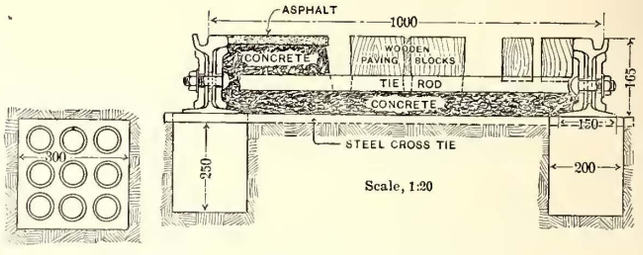
at once solders the ends of all the wires together and also the abutting ends of the cable, surrounding the whole core with an enlarged ferrule of the solder and giving the core a conductivity which slightly exceeds the theoretical. The joint thus made is then served and a sleeve of lead pipe is slipped over it. The ends of the sleeve are connected to the cable pipe by means of a cast joint made of very fusible solder. An air pump is then applied to the joint and the air exhausted until quite a high vacuum is obtained, thus testing the integrity of the envelope with the soldered ends. If when this vacuum has been obtained the joint tests out to have perfect insulation, a pot of hot



POLES AND BRACKETS

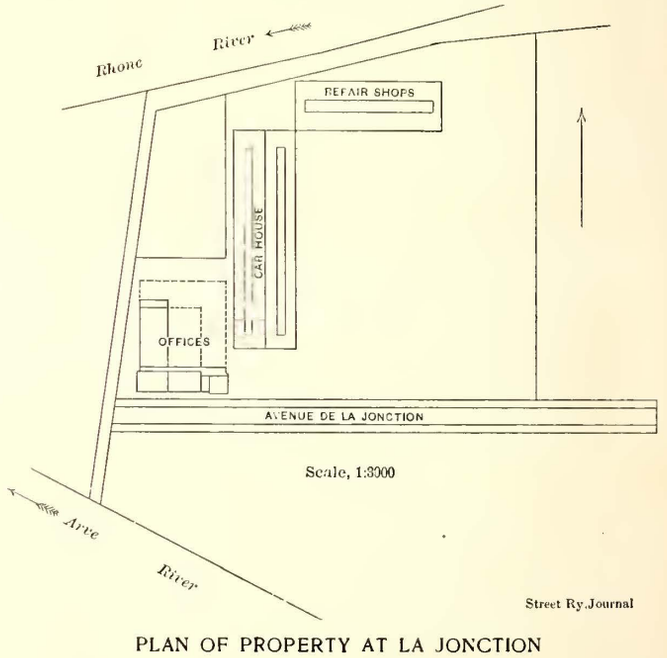
melted resinous composition is applied by a pipe leading into the joint, the opening of said pipe having been previously stopped with a wax plug. The hot compound melts the plug and the vacuum does the rest. The result of the process, Mr. Field says, is a joint of higher insulation than the normal cable itself.

The Compagnie Genevoise is relieved of all necessity of generating its own current, the city having, as is well known, developed the water power of the lake and river at its own expense and having set up a virtual monopoly of the supply, which it has been extending for some years past. The earliest plants are on the Rhone within the city itself, as in the case of the Thury plant, installed for the Tramways Suisses, as described in these pages three years ago. But the city, in 1896, having exhausted these nearby facilities, went further down the Rhone 3 miles or 4 miles to Chevres, where it established a fine Œrlikon plant for long-distance transmission to the Coulouvreniere power and pumping house, which is situated on the Rhone just above La Jonction and the property of the Compagnie Genevoise. A view is here shown of the present enlarged Chevres plant, for which we are indebted to Brown, Boveri & Company, of Baden, Switzerland, whose two-phase ma-



SECTION OF TRACK CONSTRUCTION

chines, supplied more recently, are seen in the picture. These machines have each a capacity of 1200 hp and furnish two-phase current at a frequency of forty-five periods per second at a potential of either 5500 volts or 2750 volts, at will. They are of the umbrella, vertical-shaft type, with fixed armature and revolving field, having forty-six poles carried by the cone-shaped magnet wheel. Above the machines is seen the large white marble switchboard of thirty panels and about 65 ft. in length, in the center being the three panels reserved for the service to the city, the tramways and the transformers at 2500 volts. This new



PLAN OF PROPERTY AT LA JONCTION

board was also put in by Brown, Boveri & Company, with their machines, to permit an easy manipulation of all the various units and types comprised in the plant. The current, delivered by underground cable at Coulouvreniere for the street railway work, is received at present by a 600-kw rotary on the same shaft as the generator, which in turn delivers direct current to the system at 560 volts. The contract with the city is at the rate of 12 cm, or 2.3 cents American, per kw-hour for all current up to 1,800,000 kw-hours per annum, and above that, 9 centimes, or 1.7 cents, for all current consumed. The current is delivered through meter, is available night and day, and the company's employees have access to the apparatus. The city concedes, however, to the Compagnie Genevoise the right to generate its own power, if it wishes to do so, after the quantity named above has been reached, and Mr. Field, who has had considerable experience in these matters, believes it would be worth while to do that rather than pay such

rates. It is to be hoped and expected, however, that with the opportunity to draw from such a fine plant as that at Chevres, where every increase of output must tend to reduce the cost of production materially, a basis of agreement on fair terms can readily be found. It will be understood that the cost to the company begins only at the moment when it receives the current on its own network. Examples of this plan of current supply are probably quite rare.

The Compagnie Genevoise is allowed five years for its work of construction and equipment, and the charter runs sixty-five years. It is permitted to collect a fare of 10 centimes, or 2 cents American, for the first kilometer, which is at the rate of nearly 3 cents a mile, and 5 centimes, or 1 cent American, for each succeeding kilometer. City

ENTRANCE TO EAUX VIVES

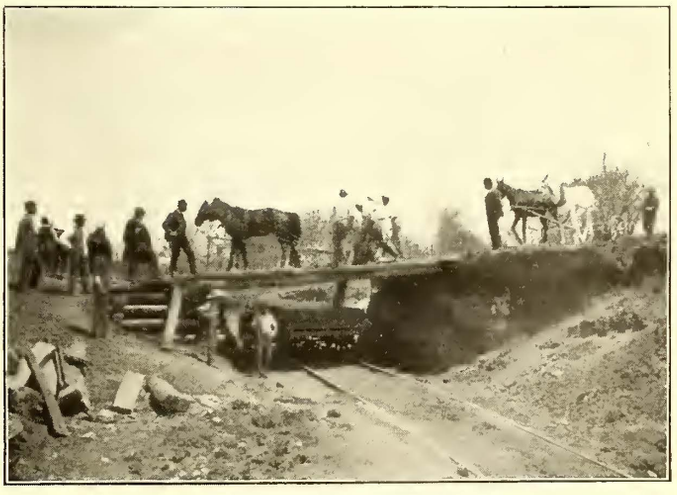
servants on duty are allowed to travel free, and there are school children rates, which do not seem to be used much. There are no transfers, and the tariff is considered such as will yield the company a fair return on its large investment.

Naturally, the American management of the road has been very much alive to the creation of new travel, and especially to the development of pleasure parks which shall induce the people to seek rational and healthful amusements by patronizing the lines. Among the parks reached by the lines are the Ariana and Mon Repos, but the most striking is that known as the Parc des Eaux Vives, at the end of No. 2 , or Hermance, line, on which were taken the views of track construction shown in this article. This beautiful resort was the homestead of Louis Favre, the famous engineer of the great St. Gotthard Tunnel, whose construction ruined him, so that the property has passed out of the hands of his family and has become one of the most picturesque resorts imaginable, with its springs, chalets, alpine groves, theater, dancing hall, etc. The possibilities of traffic in this direction may be inferred from the fact that last summer, when proper car facilities were lacking, over 250,000 people went out to this place in rough wagons. From this Hermance side of the lake a line of ferry boats run to the other side, or Versoix, where many of the wealthy have their homes, and out in which direction the Compagnie is also pushing its lines along the Swiss shore of the lake, with its memories of Voltaire at Ferney, the Napoleons at Prangins, and Madame de Stael, at Coppet. In the mere tourist travel to such places the company has a rich lode to work, for Geneva is one of the most frequented spots in all Europe. Moreover, the mountains around the city offer excellent opportunities for pleasure travel development, if made cheaper, as exemplified by the rack rail up Mont Saleve, from whose terminal chalet, at a height of some 4000 ft. above sea level, a magnificent view is obtained, not only of Mont Blanc and the Dent du Midi, but the valleys of the Arve and the Rhone, the shores of Lake Leman and the distant crests of the Jura Alps. All this region is practically covered by the present and prospective system of the Compagnie Genevoise, and it may be doubted whether there is a better territory to be found for a system wisely and liberally administered.

There are other points of interest in the construction and operation of the road that might well be touched upon, but these must await the completion as a whole of the work, whose first stages were brought to a close in the past month of July. The executive of the system consists of S. D. Field, ingenieur directeur, and A. Kundig, chief of staff, to both of whom we are under deep obligations for courtesies extended. With them are associated F. Landolt, assistant to the chief of staff, and L. Delphin, H. Weber, J. R. Selfridge and E. Laval. It will also interest many of his former friends in America to know that young Robert McCulloch, of St. Louis, has also been associated with Mr. Field in work centering at Geneva, work of which, however, this is not yet the time or place to speak.

Filling Gravel Cars

The accompanying engraving shows an ingenious method of loading gravel at the pits, employed on the Indianapolis & Greenfield Railway, now building. The method was suggested by Mr. McMath, civil engineer of the road, with the result that the cost of loading the gravel car was only about one-quarter of that when the car was loaded with shovels. As will be noted, the means em-



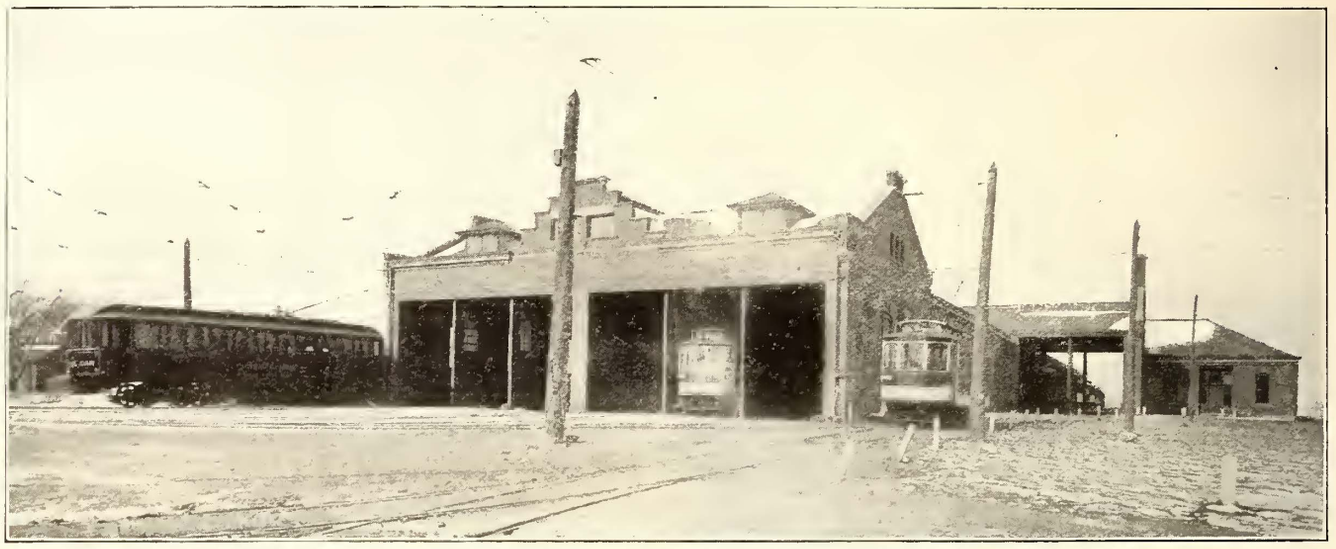
FILLING GRAVEL CARS

ployed are a temporary bridge, which can be readily removed and which is placed over temporary trucks. The road scrapers bring up the gravel and drop it through a hole in the bridge. Each team handles about 50 cu. yds. per day. The scheme, while not new, is an excellent one, but is doubtless unknown to many.

The Street Railway Journal is indebted to the consulting engineers of the Indianapolis & Greenfield Railway Company, E. P. Roberts & Company, of Cleveland, for the photograph from which the engraving was made.

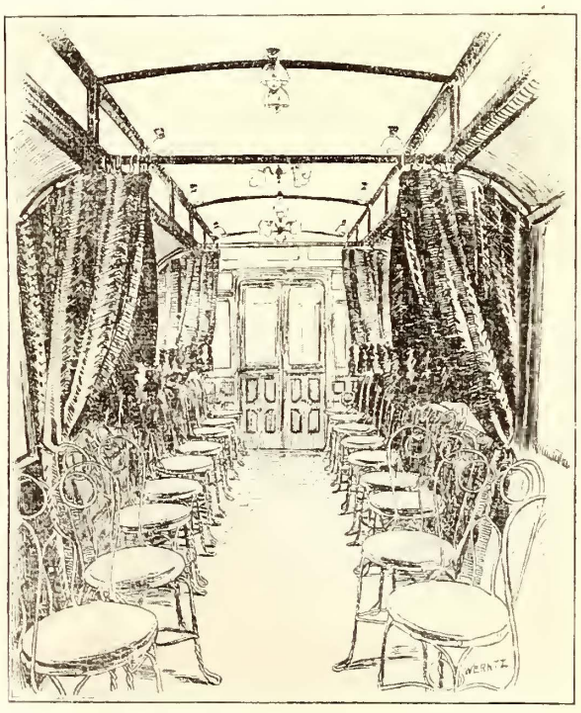
Funeral Cars on American Street Railways

Two years ago a description was published in these columns of street cars used for funeral purposes in the city of Mexico. Several cities in this country have now taken up the idea and the funeral trolley car may be seen in Chicago, Cleveland and St. Louis. The system has not as yet been adopted in any other cities in the United States, so far as is known, but the comfort and convenience which it gives will probably extend its use.



CAR HOUSE OF CLEVELAND ELECTRIC RAILWAY, SHOWING FUNERAL CAR AT LEFT

The electric funeral cars now in commission have in nearly every case been made in the railway company's own shops by changing over one of the regular cars to suit it for the service required. The cars selected have, in general, been of the eight-wheel type, and have been repainted in some sombre hue so as to combine solidity, ease of motion and elegance of appearance. Some special arrangement has had to be made for admitting the casket, but with this exception little alteration in the car body is necessary.



INTERIOR OF CHICAGO ELECTRIC TRACTION FUNERAL CAR

The car shown on the tracks at the left of the first illustration on this page was built in the summer of 1899 by the Cleveland Electric Railway Company for the joint use of that company, the Cleveland City Railway nd the interurban lines running from Cleveland to Akron, Painesville, Lorain, Oberlin, etc. It is 28 ft. long and 8 ft. wide, is painted an ebony black with simple gold trimmings and has the windows draped with green tapestry and yellow silk. The interior is divided into two compartments. The one in front, intended to receive the casket, has drop-down doors on each side and is draped throughout in heavy broadcloth. There is accommodation for four caskets besides shelves for receiving the floral offerings. Sunken rubber rollers are placed in the floor to facilitate the entrance and removal of the caskets. The rear compartment contains seating capacity for twenty-eight persons. The seats, for greater durability, cleanliness and healthfulness, are of split rattan.

Instead of a fixed partition the car used in Chicago has portieres which may be drawn or not as desired. The remains are admitted through doors in the end of the vestibules and the casket is placed on pedestals in the ordinary manner in any part of the car the mourners wish. The lines of the Chicago Electric Traction Company, which operates this car, reach the cemeteries of Oakwoods, Mt. Olivet, Mt. Hope and Greenwood, and in the spring and fall of the year it averages a trip a day.

A funeral car has lately been started in St. Louis which sets aside the middle of three compartments as the resting place of the casket. Entrance is effected by a movable panel in the side of the car which rolls upward while a trestle containing rollers on the bottom may be pulled outward to receive it from the pallbearers. It is intended that the immediate family will occupy one of the end compartments and the friends of the deceased the other. The car, which is the first of six to be installed on this road, is handsomely finished on the outside in chocolate brown and has the interior upholstered in appropriate colors with black velvet curtains and Brussels carpets.

In operation, the cars are side-tracked at the nearest convenient point during the funeral service. In Cleveland thirty-six stations have been set aside for this purpose. At the conclusion of the service the casket is carried from the church or house by the pallbearers and placed in its position. Arriving at the cemetery the casket is again taken up by the pallbearers and either carried to the grave or else placed on a hand carriage or hearse which is in attendance. While in use the funeral car has the right of way, and as it waits on a switch, both at the church and cemetery, the funeral party proceeds throughout with no delays.

Testing and Repairing Methods of the North Jersey Street Railway Company

The North Jersey Street Railway Company, which operates all of the lines in Jersey City, Newark, Paterson and in many of the neighboring towns and country, has in service over 231 miles of track and about 750 cars. The extent of its system has compelled the company to give especial attention to the care and repair of its rolling stock. Most of this work is carried on at the Plank Road repair shop of the company in Newark, although many of the car houses of the company are necessarily equipped with facilities for making slight repairs.

One interesting feature of the Plank Road repair shop is that nearly all work done is paid for on the piece-work system. This method was introduced into these shops four or five years ago and has proved most satisfactory to both men and company. The former find that they earn more than formerly, while the total cost of repairs has been reduced to the company.

The first test illustrated is that to determine short circuits in railway armatures, and employs the well-known alternating-current method, the chief novelty lying in the fact that the alternating field is portable and is taken to the armature, instead of having the apparatus stationary and

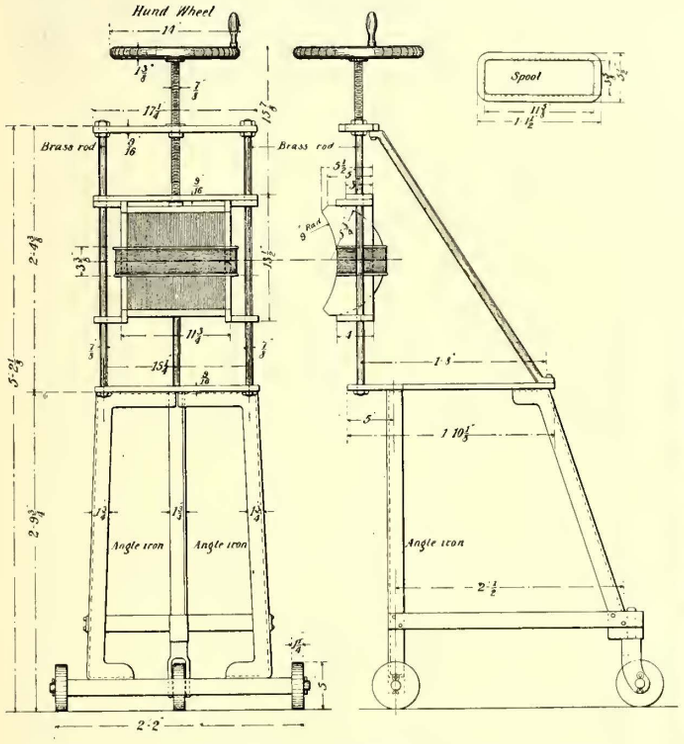


FIG. 1.—ALTERNATING CURRENT COIL FOR TESTING MOTOR ARMATURES

moving the armatures to it. The great advantage of this is that the testing rack can be moved from one lathe or winding bench to another, or wherever an armature is being repaired, and the armature coils can then be tested with a minimum amount of trouble.

The alternating field rack employed was designed by the master mechanic of the North Jersey Street Railway Company, H. H. Adams, and is so easily constructed that working drawings are given in Fig. 1, which shows a framework made of angle iron mounted on three rollers. The magnet core is made of laminated iron about 1/32 in. thick, and of the shape and size shown in Fig. 1. This device is adapted to test G. E. 800's, 1000's, 1200's and 57's, and Westinghouse No. 3's and No. 12's. The magnetizing coil is made as shown and wound with 1210 turns of No. 13 B. & S. double-covered cotton wire. The curved face of the pole piece is adjusted by a hand-wheel and screw, so that it can be shoved up against the armature without removing the latter from the winding bench.

The body of the armature completes the magnetic circuit of the alternating current magnet; the armature is then rotated by hand in this field. If any two windings are

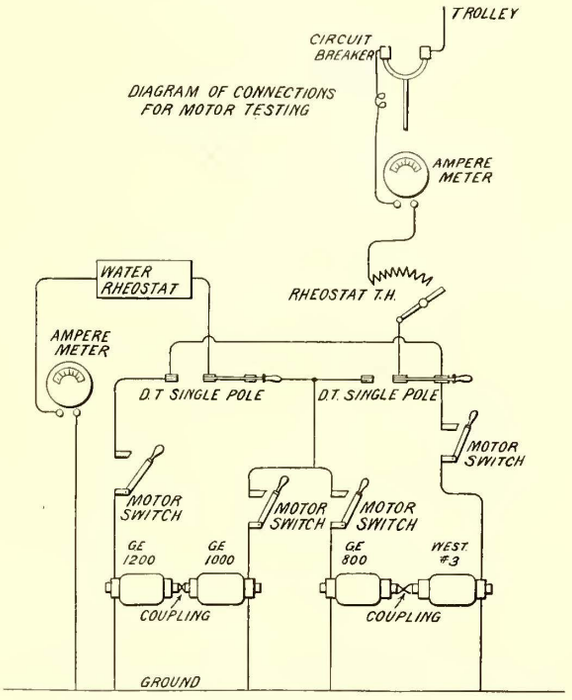


FIG. 3.—DIAGRAM OF CONNECTIONS FOR TESTING TWO ARMATURES

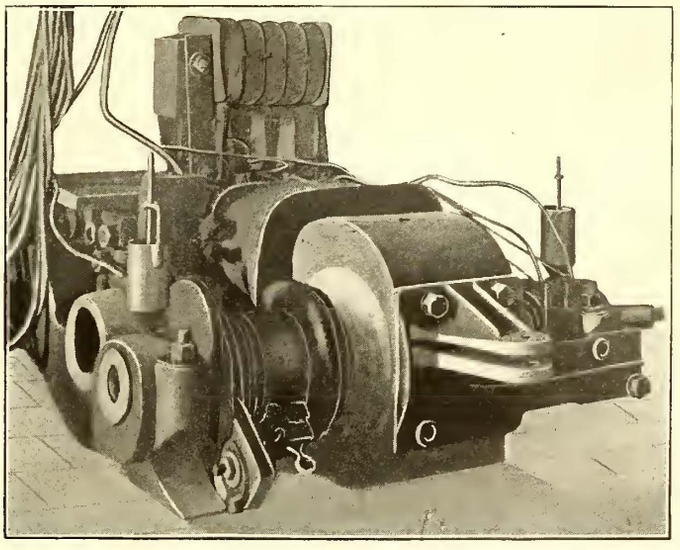


FIG. 2.—S. R. G. 30 MOTOR USED AS ROTARY CONVERTER

short-circuited and are within the influence of the varying magnetism, a local induction circuit is created which causes a vibrating magnetic flux in the teeth of the armature included in the short circuit. This is discovered by passing a thin strip of iron around the armature, which, when over a short-circuited coil, will vibrate in unison with the alternating current supplied to the magnet. This vibration is due to a local short circuit formed by the connection of two adjacent coils. The magnetism, which is induced by the local flow of current in the short-circuited coils, produces a magnetizing effect differing in its time from the magnetism of the adjacent teeth. This, as stated, causes a vibration of the iron strip when over the tooth lying between the short-circuited coils. There will be two such points in the armature at a quarter from each other

when two adjacent coils are short-circuited; but four coils are affected when the short is between commutator bars, which are connected to these two coils, and the four magnetizing areas will be found at equidistant points around the armature body.

The current for this testing device is obtained from an S. R. G. 30, Fig. 2, having two slip-rings secured to and insulated from the shaft and connected to the windings of the armature. These rings are located one-quarter of the circumference of the armature from each other in a two-pole motor. This motor is wound with a shunt field of fine wire, and has a speed of 1400 r. p. m.; this gives a good frequency to detect these crosses.

The armature room is wired for this current over the winding benches, and flexible cords with attaching sockets are located at points convenient for connecting to the testing device. When located at any winding bench an armature can be tested by this method in less than one minute.

The armature is then given a running test. There are two pairs of standard railway motor fields fixed to the floor, but turned upside down, so that it is only necessary to raise the cover of each to introduce the armature to be tested into the field, the brushes being out of the way. Four different fields are provided for the four types of motors used on the road. The armature to be tested is then directly connected with another armature in the other field of the pair already mentioned, one machine running as motor and the other as generator. The G. E. 1200 and 1000 motors are tested against each other and the G. E. 800 and Westinghouse No. 3. A chuck coupling is provided, which couples both pinions with set screws that enter between the teeth, and each pair of frames is set so that the armature shafts are aligned. Fig. 3 gives the diagram of connections for the testing of these motors. By the way the switches are thrown, the Westinghouse No. 3 is ready to run as a motor and the G. E. 800 will run as a dynamo, the water rheostat being adjusted to give the proper load for the test. The armatures are run this way for five minutes and then, by throwing over both double-throw switches, the G. E. 800 becomes the motor and the Westinghouse No. 3 the dynamo. The armatures are raised and lowered into the fields by an air hoist, which is on an overhead track, so that they can be moved easily from one end of the shops to the other.

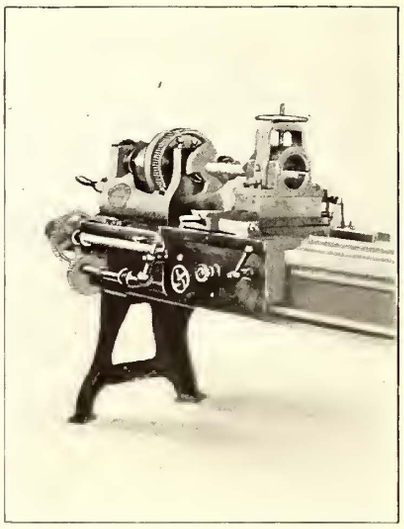


FIG. 4.—BORING ARMATURE SHELLS

FIG. 5.—CHIPPING OIL WAYS

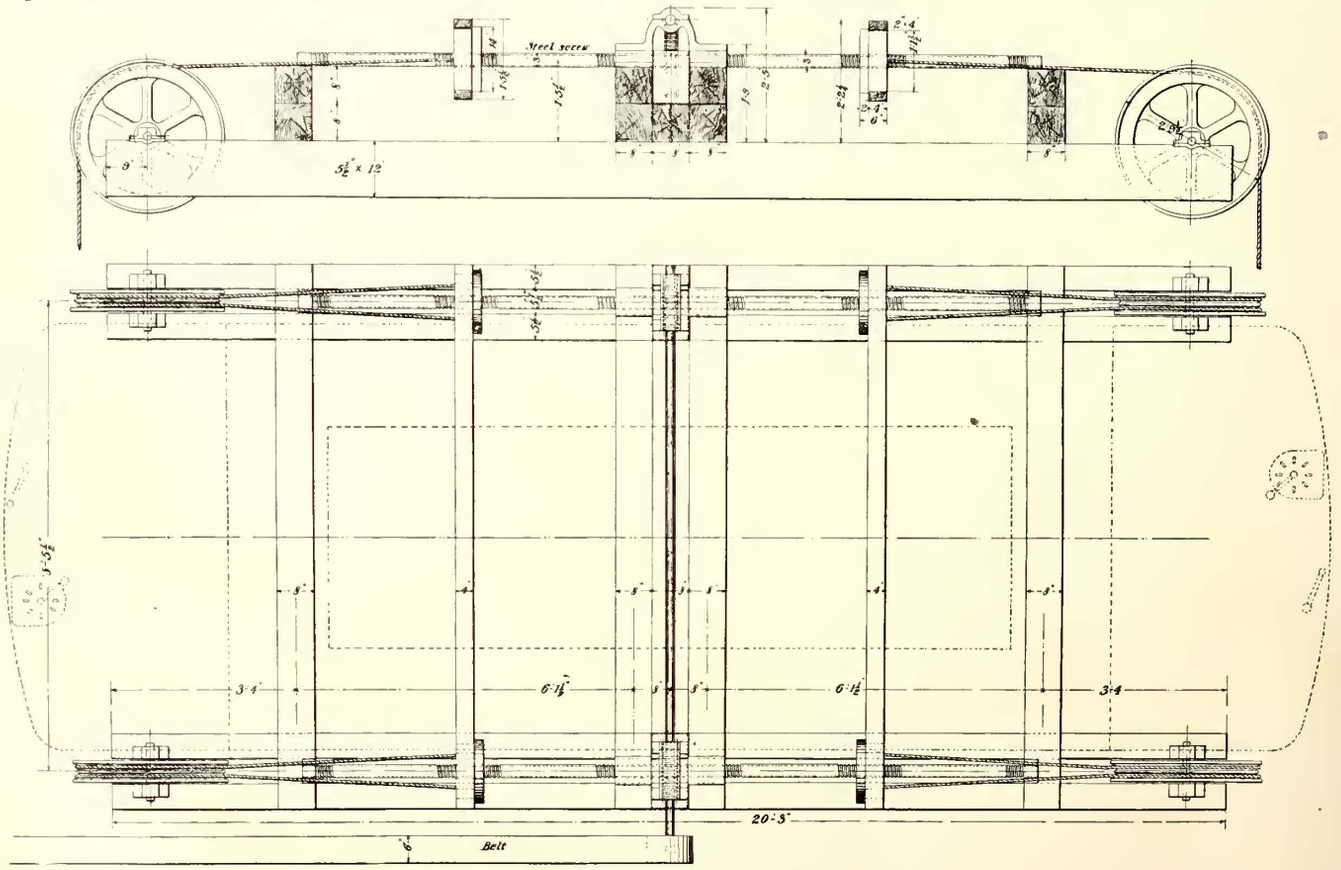


FIG. 6.—PLAN AND ELEVATION OF CAR HOIST

The method of boring out shells employed by the North Jersey Company is to mount a chuck, shown in Fig. 4, proper size chucking pieces being used for each style of shell, on the carriage of a lathe. The boring tool is fed into the shell and the babbit bored with one cut to size.

The oilways are cut by a pneumatic tool, as shown in Fig. 5. One man tends to both operations, cutting oil-

FIGS. 7 AND 8.—SNOW PLOW, NORTH JERSEY STREET RAILWAY CO.

ways while the boring tool is being automatically fed through the shell.

The car-body hoist, as shown in Fig. 6, has been described in a previous issue of this paper, but the working dimensions are given, so that duplicates can be made more easily, if desired. This hoist consists of an old railway motor belted to a shaft carrying a worm, the gear of which meshes into the worm and turns a shaft provided with a right and left-hand screw thread. To the nuts which run on this thread are attached the hoisting cables, which pass over the sheaves at the four corners of the hoisting device, and drop to the floor below where the repair pits are located.

Two stringers are placed under the car body, and to these stringers the cables are attached. The motor is then started up and the car body raised out of the way of the truck. The hoist shown, Fig. 6, can raise with ease a double-truck body weighing 18,000 lbs.

The snow-plow which the North Jersey Street Railway Company employs and has designed is shown in Fig. 7 and Fig. 8. The front of the plow has a curved surface, which, instead of pushing the snow ahead of the plow, runs under the snow and rolls it over like the mould-board of an ordinary farmer's plow. The adjustment of this plow is parallel with the track and is effected by swinging the plow on two chains, both winding on a drum, to which is attached a gear, into which meshes a worm gear terminating in a staff and hand-wheel.

When in use, the plow is operated by two long radial arms secured to the car body, which resist the pressure of the snow, and the plow can be readily swung up and down by the chains. The side wings are raised and lowered by a lever hinged from a standard projecting below the platform. The width of the plowed way is regulated by a chain-guy attached to a locking lever as shown.

The track plow is a short V-shaped plow resting on the head of the rail. This clears special work and high joints by being supported on a spring, acting in the line of movement of the car. The North Jersey Street Railway Company reports such good results from the performance of this plow that the company is building a number of others.

The Milwaukee Carnival

The possibilities in the way of electrical decoration and illumination in street parades afforded by the overhead wires of a trolley road have been proved in several cities, particularly in New Orleans, and views of the floats used in the Mardi Gras processions in that city last winter were published in the STREET RAILWAY JOURNAL. The unlimited current available for lighting and power to propel the floats makes it possible to secure finer spectacular effects than would otherwise be possible. This was shown during the special carnival, held June 28 in Milwaukee, in which the trolley current was used for this purpose to a greater extent probably than ever before, and which was generally regarded as one of the most successful night pageants ever held on this continent.

The parade consisted of twenty floats, placed on electric

ILLUMINATED STREET, MILWAUKEE

trucks, and lighted by 6000 lights of different colors. They consisted of a variety of subjects, presented without any aim at continuity of idea, but solely for their picturesque beauty and scope for fantastic display of form, color and effulgent light.

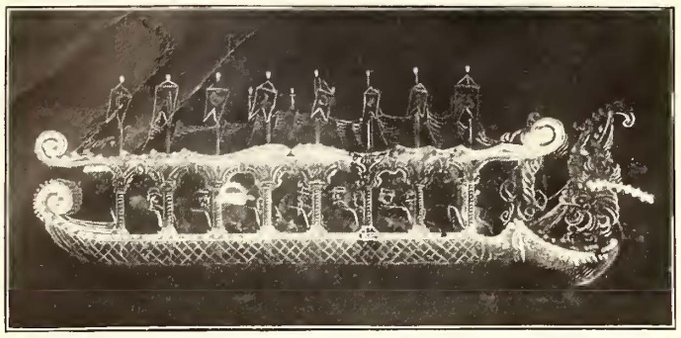
The first float was a fac-simile of the battleship "Wisconsin," and, under the strong lights that focused on the spot, she seemed a real ship afloat on a white sea. Several musical chariots, decorated with swans' necks, whose heads extended far in advance of the charioteers, dispersed radiance and music at the same time. The float carrying

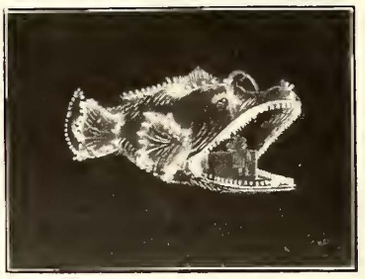
Rex was draped with foliage of tropical abundance. The king stood up in the midst of four columns, surrounded by hundreds of lights, which added an effect of royal splendor to his luxurious and majestic appearance.

A striking float was that in which the Goddess of Light stood on a sun bristling with golden rays, covered with electric lights, driving two prancing white horses. On the next float was a half godlike figure, poised on one foot, ready to fly from the banked clouds of Olympus on some world-wide errand.

"Comus," the king of laughter, and "Jupiter," the king of gods and men, were two very attractive floats. A representation of Hades followed, which gave the public a realistic show of the unholy world, the head of Hades and his satellites having prominent positions on the car.

The largest figure in the parade, and the one that caused quite a sensation after the battleship "Wisconsin," was the whale, with one supposed to represent the prophet Jonah sitting in his wide-open jaws. This float was on a 50-ft. flat car, and was decorated with 900 lights, giving it such a glowing appearance that one could almost imagine that the sides were transparent and that by some hocus-pocus the figure in the jaws would pass down the throat and be seen after he had reached the bottom. A view of this is given.





VIEWS AT NIGHT OF TWO OF THE ILLUMINATED CARS

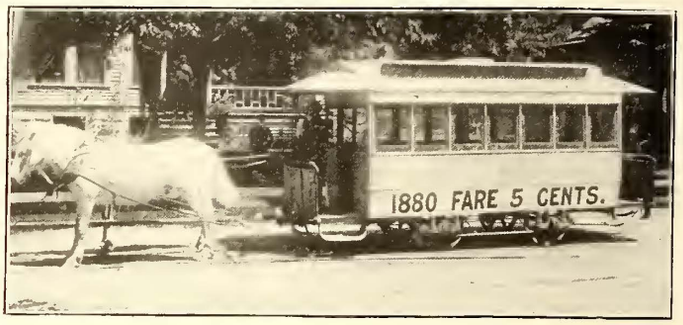
Another float was founded on the Mother Goose tale of "The Three Wise Men" of Gotham and their nautical experiences. The sea, with green and blue waves tossed mountain high, was there, and in the midst, emphasized by a corona of light that came from fifty lamps, was a bowl that carried the three immortal men.

Another float represented a dragon, with its writhing folds fitted in every joint with clusters of white lights.

Probably the most interesting of all the floats was the one that brought up the rear. It was symbolical, and represented the ideal Prince Carnival and his court. All races were represented in the motley group, not only Caucasian, Indian and Malay, but Negro, Chinese and Zulu as well. The Chinese representative was particularly admired by the crowds as the float passed, and he was pointed out derisively as a "Boxer."

The contract price for the making of the floats was $5,700, and the wiring, power and cars cost $1,800 more, making $7,500 in all.

One of the interesting features in the "funny parade" on Corso Day was the exhibit of the street railway company, which consisted of four cars, viz.: The first was an old car of the bus type, which was used on the Cream City lines in 1870. It bore a sign reading, "1870, fare 6 cents." The second was an old box-car, which had been used on the McGeogh lines in 1880. It bore a sign reading, "1880, fare 5 cents." The third was an old box-car, which had been used on Milwaukee Street Railway's lines in 1890. It bore a sign reading, "1890, fare 5 cents." The fourth was a standard double-truck, four-motor closed car, of the Milwaukee Electric Railway & Light Company, 1900. It bore a sign reading, "1900, fare 5 cents, with universal transfer." This was an object lesson, showing the great

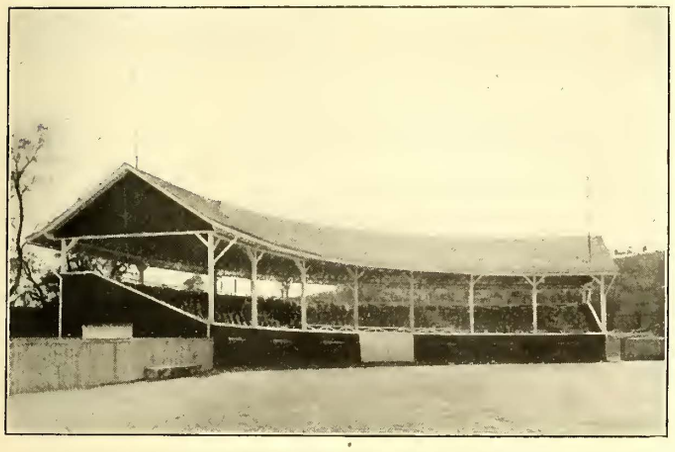


DAY EXHIBIT OF THE MILWAUKEE ELECTRIC RAILWAY AND LIGHT COMPANY

advance in street railway transportation facilities, which the thousands of spectators were not slow to appreciate.

Kennywood Park

In the monthly issue for April of the STREET RAILWAY JOURNAL a description and some views were published of the Monongahela Street Railway Company's Kennywood Park, near Pittsburgh. The views shown were of improvements made in 1899 when the park was first laid out. The success of the park during its first season was so great that the company decided to make extensive improvements this year, and the views shown in this issue are all of structures that have just been completed.



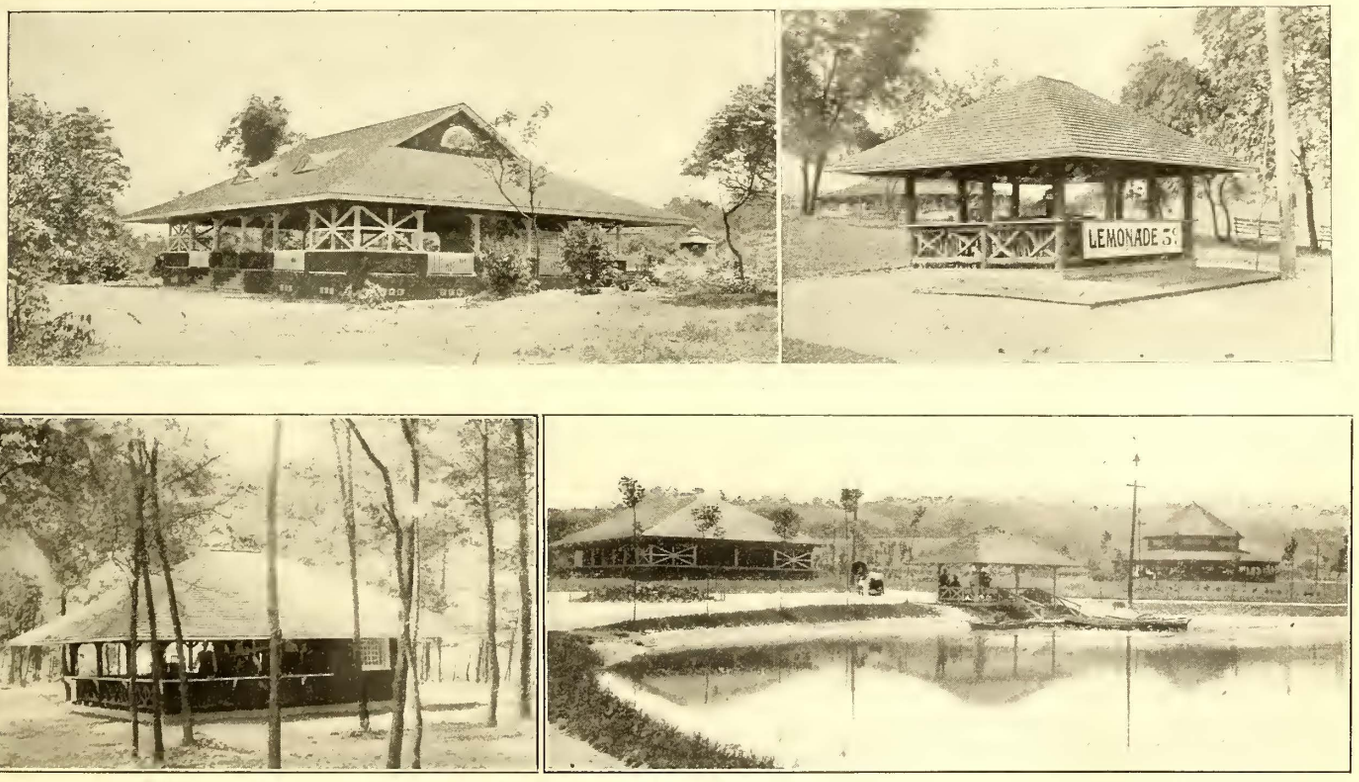
GRAND STAND

BAND SHELL

One of the principal attractions is the new band-stand, which has a stage 40 ft. wide and 40 ft. deep, with a proscenium arch 30 ft. high. There are six dressing-rooms, three on each side of the stage, for use when performances other than band concerts are given, it being the intention of the company to have minstrels, concert troupes, etc., during the present season. The stage is also provided with a plain white canvas curtain, as a protection from rain and for biograph pictures. The structure is well lighted, having over 500 incandescent lights.

Another new feature is the baseball ground, measuring 400 ft. x 400 ft. There is a grand stand having a seating capacity of 600, and two sets of "bleachers," each seating 700 persons, or a total seating capacity of 2000. The space under the grand stand is utilized by dressing-rooms for the players, a refreshment stand and storage room.

One feature of the park which was very popular last year was a private dining pavilion and kitchen, where picnic parties could have conveniences for eating their lunches, preparing hot coffee, etc. This pavilion was in such great demand that a second one was built this year, and is shown in one of the views.



TYPICAL BUILDINGS IN KENNYWOOD PARK

There have also been built several rustic refreshment stands, scattered around through the park, views of two of them being given.

The park was laid out and the construction superintended by Wilkins & Davison, civil engineers, Pittsburgh, and the improvements made this year and shown in the

TROLLEY STATION AT PARK

views were designed by and built under the supervision of Wm. Glyde Wilkins, C. E., successor to the above firm.

As will be seen from the views, the improvements are much more artistic in their design than is usual at street railway resorts, and, while they are artistic, their cost has not been great.

A Test of Incandescent Lamps for Street Railway Service

The Massachusetts Electric Companies, which own a large number of the street railway systems in eastern Massachusetts, have made unusually thorough and elaborate tests of incandescent lamps under railway conditions to determine the most desirable make for use in their cars. Twenty makes were tested, a barrel of each being bought on the open market. Ten lamps of each make were connected in two series of five each and supplied from a street-railway circuit with the usual commercial regulation. The five lamps in one series were given a life test, and whenever one burned out a lamp which had burned the same number of hours in the other series of the same make was put in its place, a new lamp being put in the second series. Each lamp in the life-test series was measured every twenty-four hours for candle power and watts. The work was carried on at the Hyde Park station and required no small amount of work, two men being constantly employed for the six weeks during which the test was continued. By night, when the street railway system was shut down, the 200 lamps under test were supplied by a special machine at constant voltage.

Great care was taken to obtain accurate standards, three standards being obtained from each of the three companies; one from each company was sent to the electrical laboratory of the Massachusetts Institute of Technology, where five more standards were prepared; secondary standards were then made from these five. The companies' specifications call for a 4-watt lamp giving an initial candle power between 15 and 17, and taking initially a power between 60 and 66 watts at 110 volts, no lamps to drop below 25 per cent of the initial candle power within 1000 hours.

Can Small Electric Railways be Operated at a Profit? I.

BY JAMES BLAKE CAHOON

The statistics given in the report of the New York Railroad Commissioners for 1899 are certainly deserving of the most careful study by the managers of small roads. When the electric railway was first introduced everybody took it for granted that under any condition in which a franchise for the operation of an electric road could be obtained, no particular thought need be taken as to whether or not it would be a paying proposition because it was assumed that it must be. This assumption was perfectly correct so far as the operation of an electric road in a large city is concerned, this class being money makers from the start, but to the surprise of nearly everyone electric railways in smaller cities as a rule are only just able to make their bond interest, or show a deficit.

There are ninety-four electric roads in operation in the State of New York; in the year 1899 forty-one of these showed an actual deficit, fourteen declared dividends ranging from 1 per cent to 12 per cent. Of those that declared dividends, four only were in the smaller cities, three being operated partly as interurban roads, and one declaring a dividend on its capital stock, although it had accounts payable largely in excess of the amount of the dividend and its surplus, the interurban part of the roads in smaller cities seeming to be the salvation of the whole.

We are then confronted with the condition, practically, that roads in other than the first and second-class cities, where electrically operated, are not at the present time a paying investment. In searching for a reason for this it is necessary to go back over the history of the equipment of electrical roads in the past ten years, and study cost of installation, methods of management and rates of fare, and see whether one or all of these were instrumental in bringing about the present condition. Naturally, in the beginning of the industry, equipments were crude and expensive. Many roads, in changing over from horses to electricity, placed the motor equipments on their old cars, and did nothing to their tracks other than to bond them and build an overhead line. First the cars went to pieces, then the tracks, and the equipments struggled along in varying conditions, all having finally to be replaced.

When the conversion was made the money for it was obtained, as a rule, by issuing bonds; then, when the tracks had to be rebuilt and new cars and new equipments ordered, new bonds had to be issued, so that for the ultimate equipment of the road, practically a double issue of bonds was made, the first issue being for experience so far as actual benefit was concerned. The result is that the roads which were converted from horse to electric are now confronted with interest charges on a double issue of bonds, which render the task of making the roads a paying investment very difficult, and one by one these roads have given up and gone through the process of reorganization and rehabilitation in an effort to place themselves on a paying basis.

The *Century Magazine* for June, 1900, contains an article in "Topics of the Time," headed "Public Peril in City Franchises," in which it states that "those who are watching current events must be aware of a remarkable activity on the part of those corporations engaged in the performance of public services in the cities in the direction of securing extension or confirmation of the privileges they are enjoying, and that franchises have been granted and renewed for almost no consideration," and further on it remarks that "these franchises are in almost all cases

enormously overcapitalized;" that "what they wish to do is to pay interest on two or three times as much capital as they have actually invested."

It is true that a street railway to-day could be built at much less expense, and with much less burden of bonded indebtedness than roads are at present carrying, but the bonded indebtedness of existing roads is an honest debt, contracted with the idea of, in the first place, giving the public adequate service, and secondly, meeting the constantly increasing requirements of the people for better service. Undoubtedly, the original promoters went into the project with the idea of making money for themselves; they built the road, placed the bonds and took as compensation stock which paid well for a sufficient time to enable them to unload largely on the local people, but as years went on the dividends became less and less, the stock depreciated in value to nothing almost, and the men who are holding these stocks to-day are men who put their money into them in good faith and are endeavoring under almost hopeless conditions to obtain a fair return for their investment.

If their franchise expires and they do not obtain another or a renewal of the old, the money they have invested is hopelessly lost. The *Century* speaks of overcapitalization, injecting water into the stock, etc., and thinks that franchises should be paid for, and it is conceded that they should be where the franchise is of value, but, so far as railways are concerned, such franchises are of value only in the large cities, and in order that justice be done, distinction must be made between street railways of small cities and those of larger cities. What they may assert with perfect truth as regards railways in large cities would be anything but true, and a rank injustice to railways in small cities.

In general, the roads of which we speak were laid out somewhat crudely, but they may be roughly divided into four classes: First, the city having its business concentrated largely on one main thoroughfare, covering a territory about one-half mile in length; surrounding and reaching out from this lie the residence districts, and the road found in this class of city usually consists of three to five short branches running out into the residence districts and centering in the business district. In the more pretentious cities efforts have been made to attract travel to the road by the establishment of a summer theater and park on an extension of one of these radial arms, and this may be classed as the second division. The third division is where the town is divided by a river, and has the main business thoroughfare along the river, the town extending in a general way along both banks without running very far back at any one point. In this class of town the railway usually zigzags from one end of the town to the other, and if the settlement be about equal on both banks of the river, effort is made to reach the people on one side by means of branches or a loop system shooting off from the main line. The fourth class is formed from a combination of the first and third classes, with an interurban branch extending to a small town from 5 miles to 15 miles distant. A distinct characteristic that may be noted of all this class of roads that have been in operation for some years is that their superintendents and managers, who have striven hard to make the roads pay in the face of an utter indifference on the part of the public toward helping them, have become imbued with the idea that, even though they practise the most rigid economy, they can just barely scrape together enough to make both ends meet.

They have become, as it were, hardened to the work and more or less blind to existing conditions, with the result that the property is gradually running down hill without their knowing it, and people become more and more indifferent to riding on the cars. Another characteristic is of the people of the towns themselves—a great majority is made up of those whose income is not great and to whom a nickel seems large. In the large cities, where the distances are great, the people naturally have to ride to and from their work; in the smaller towns this is not so. Usually in fifteen minutes the mechanic can walk from his house to his place of work, and the same is true of the great majority of people. The result is that rather than spend 10 cents a day to ride to his work in the morning and back at night, he will start ten or fifteen minutes earlier and walk the distance, hence the proportion of passengers riding in the smaller cities is much smaller than in the large cities.

For instance, if we were to compare the city of New York and one of the small inland cities of the State, we would find the number of passengers carried per car-mile to be three to one in favor of the large city, while, by rigid economy, the operating cost per car-mile on the smaller road is less even than on that of the big system; yet an operating expense of less than 10 cents a mile on the small road may mean that their operating expenses are 90 per cent of their gross receipts, while on the large road the same cost of operation per car-mile would probably mean not over 45 per cent of the operating expenses to gross receipts. The small road would not pay; the large road would pay the interest on its bonded indebtedness and a handsome return on a proportionate amount of stock based on water.

In the large cities the people must and will ride; in the small cities the people will not ride unless they either have to for some particular reason, or are willing to give up their nickel for considerably more than its value in pleasure, and the problem presented to the street railway manager is how to get this class of people to ride so that he can make his road pay. In general, the answer is that, taking into consideration all local conditions, he must contrive in some way to convince the people of the small town that he is not only giving them the worth of their nickel, but several times more than that, either in the way of very quick transit to and from their business, or in the way of amusements and pleasure of much more than the value of the nickel.

The nickel has become in a measure accepted as the general rate of fare for street railways, but local conditions may be such that, in order to get people to ride, it may prove the salvation of the road to lower the price; as, for instance, take in the first class of towns mentioned, where lines branch from a common center and no one of the branches is more than about a mile long. In a town like this the great majority of people would walk rather than pay 5 cents to ride a short distance, and a road charging 5-cent fares would have uphill work, but it might be so arranged that very cheap rates of fare could be given—say forty tickets for $1, with the understanding that those tickets are good for a ride on any one of the branches to or from the center of the town. If a passenger wants to go beyond the center of the town, then he pays for another ticket, and in case there was a park situated at one end of one of the branches, coupon tickets could be provided so that everybody riding to the park would have to pay 5 cents each way. Where passengers got on and did not have tickets, the cash rate of fare could be made 3 cents.

Suppose, under these conditions, the road just barely paid expenses with 5-cent fares, and by the reduction of these you could get three to four times as many people to ride, it will be seen that the road would naturally become

a paying proposition. Another method applicable to roads that zigzag through a town is the introduction of low rates of fare similar to the above outline, that is, forty tickets for $1, to be used during working hours. This has often proved the salvation of a road of that class.

On the roads of the fourth class, having an interurban connection, where the ordinary fare is 10 or 15 cents between the towns, make a commutation ticket, good for people going between the towns for business or work daily, on the basis of 60 per cent of the regular rate of fare, and on pleasant days give excursion rates in the afternoon and evening in the summer time, or when there is a skating carnival or anything of that nature gotten up in the winter time, at half rates. Then, instead of the cars running nearly empty during these hours, they will be well patronized and the receipts of the road materially increased without adding much to the operating expenses.

Naturally following this comes consideration of what it is necessary to have in the way of car equipments. It is absolutely necessary that these small roads be operated with a minimum amount of car equipment, and the first thing to be settled is the type of car which is best suited to work under all conditions in both winter and summer, as this class of roads cannot afford to maintain a double equipment of cars. Meeting this requirement as well as anything at the present time is a car of about 26 ft. length of car body, with double trucks, center aisle and cross seats of cane bottoms, vestibule ends, window sills cut down low, and the windows preferably double sash, so that they can be dropped down to make the car to all intents and purposes an open car in pleasant weather. Several combination cars have been exhibited—some with panels which can be taken out, and some with panels which slide up on the roof. These are now on trial and may prove a satisfactory solution of the problem, but their expense and construction are against their being adopted by small roads.

If we take, for instance, a road operating ten cars gen erally, and it has a park on one of its lines, in the summer time it may become necessary to operate twenty-five or thirty cars to handle the crowds during rush hours or on circus days or Fourth of July. A ten-car road should have as its equipment, where it has a park, fifteen motor cars of the type mentioned above, and as many trail cars. Where no park is in existence and it is only necessary to operate short lines, trail cars are not necessary, but the same number of motor cars should be had, for reasons which will appear later under method of inspection. Interurban roads would require two-thirds as many trail cars as motor cars.

The motor equipment where there are any grades should preferably consist of two 50-hp motors; 25-hp motor equipments, although they cost less at the beginning, are more expensive in the end, on account of costing more to maintain, and not being capable of satisfactorily handling two or three trail cars, heavily loaded, as may be often necessary. Speed is especially desirable in small towns, and usually these cities do not limit the speed as closely as in the larger towns, and, as a rule, cars should be operated at as high a rate of speed as is consistent with safety, slowing down on the busy thoroughfares, and the point of rapid transit should be strongly emphasized to induce people to ride. The heavy equipments mentioned serve admirably to the furtherance of this purpose, having sufficient reserve power to maintain time schedules with two trailers added.

Much has been written and more said, pro and con, in regard to the rate of speed at which to operate cars than on any other subject. I believe every writer who has given the matter serious consideration has tried to solve the problem by deducing rules governing the operation of electric roads in general. As a matter of fact, every road has got to be treated in a more or less different way, for roads are very much like human beings—they may have a general type of sickness and the same remedy may be applicable to all cases, but each requires supplementing with other remedies peculiar to the patient considered. Just so with regard to speed—one road may find it decidedly advantageous to operate at a very high rate of speed, while another, on account of certain local conditions, may find it more profitable to operate at a moderate rate of speed.

I remember one case in particular where a road zigzagged all over the town, and crossed and recrossed the steam railroad track several times in the course of its route. The cars were operated on fifteen-minute headway, but given a very slow time card. In talking the matter over with the manager, seeking the reason for this, I found that while he wanted, and his patrons almost imperatively demanded a high rate of speed, it was practically impossible for him to give it, the town being situated on the main line of one of the large steam railroads with an enormous freight traffic; long freight trains were running through the town continuously, so that the same motor car would be stopped at the first crossing to wait from two to seven minutes for a freight train to pass, and then get up to the second crossing and strike the same train again. If he operated at a high rate of speed the cars would simply get up there and wait for that train to pass again. The only thing he could do under the circumstances was what he did—that was, to give between these crossings a slow enough time card so that the car, if blockaded at the first crossing, would arrive at the second crossing about as the freight train was getting by, and hence would not be detained there any length of time.

If he had operated his cars at the rate of 20 miles an hour he could not have made the second crossing ahead of the freight train which blocked him on the first crossing. The final solution of the problem presented was to take up the tracks between the first and second crossings and relay them so that they paralleled the steam road, cutting out the first and second crossings and effecting a crossing so as to reach the most populous part of the town at a distance of something like a mile further away. The track then doubled back on the opposite side of the steam road for a distance of about one-half mile to reach certain manufacturing establishments located at that point. By doing this they were enabled to increase the speed of the cars and largely increase their traffic by taking the operatives night and morning to and from the manufacturing establishments in question, and the people all along the line patronized it much more extensively than they did, simply because of the increased speed.

One peculiarity of the operation of cars in small towns is the fact that each individual patron thinks the road is run especially for his benefit, and consequently, that the cars can stop anywhere, and ladies think that they can signal the car and then go back and put on their things, and the car ought to wait while they do it. People who reside along the line think that the conductor ought to know where they get off without saying anything to him; consequently, they visit with their neighbors on the car and chat along; by and by the car goes by where they live two or three blocks, and they look up and find that they have been carried by and are highly indignant at the conductor. It takes a great deal of education to remove this impression. I recall an instance in my own experience where, having resolved on putting into effect a higher rate

of speed for the cars, I had large signs made, which were attached to poles at the corners of certain streets on this particular line, two blocks apart. On these signs were painted the words, "Car stops here," and I gave instructions that the cars were not, under any circumstances, to stop except at those points.

The result was that I was kept busy for a week or more explaining to indignant citizens that in order to serve the interests of all to the best advantage it was necessary to adopt a higher rate of speed, and therefore, in order to make the schedule time, cars could not stop except at the points indicated. Finally, after several weeks' trial, the people got used to the change and found it so satisfactory that all signs of discontent passed away and the traffic on the road increased considerably, due, as most people said, to the fact that they did not have to stop at everybody's door, and consequently could get down town in much less time. At cross streets where there were numerous carriages, truck teams, bicycles, etc., passing, I put up danger signals and signs on which were painted, "Cars must stop here," and required all cars to come to a stop at these points whether they had passengers for them or not, in this way materially reducing the liability to accident incidental to a high rate of speed.

Another precaution taken was to absolutely prohibit anyone riding on the front platform with the motorman. It seems almost unnecessary to mention this, but in numerous towns that I have visited I have found passengers riding on the front platform, and that at all times, and it is absolutely certain that cars cannot be operated at a high rate of speed with safety unless the motorman has nothing to distract his attention from the work in hand. When this rule is first put into effect there is a universal protest against it on the part of patrons of the road, but it should be rigidly adhered to, and they soon get accustomed to and do not mind it. Several managers with whom I talked in regard to putting this rule into effect raised the point that, in order to encourage traffic, they must give citizens the entire run of the car and practically let them do as they please. Where this latter rule is followed, however, discipline is lax, accidents are of frequent occurrence, and the road presents a slipshod appearance, which is not inviting, to say the least. If people are made to understand that it is necessary for them to observe certain rules in order to co-operate with the company to secure safety in operation there will be little or no difficulty in the enforcement of the few requirements necessary to insure the greatest freedom from accident.

Insurance companies offer to insure street railways in the smaller towns against accidents for from 2 per cent to 2½ per cent of the gross income, and are apparently not overprosperous at that rate. It seems to me that this is a direct reflection on the operation of this class of roads, for, following out the few simple rules laid down above, during five years that I operated a street railway in a town of 40,000 inhabitants, the amount paid for injuries and damages in any one year never reached one-half of 1 per cent of the gross receipts, and usually did not exceed one-quarter of 1 per cent, and yet we were operating the road, except on one crowded thoroughfare, where we slowed to 6 miles an hour, at an average speed of about 12 miles an hour, including stops, making the actual running speed of cars about 50 per cent higher. Probably many railroad men when they see this will immediately want to know what fender we used to make our accident list so small, and as a reply to them I will say that we used no fender at all, except that best of all, a competent and vigilant motorman, who was carefully selected and trained for his duties before being given a car, and careful and systematic attention to the brake mechanism.

Another peculiarity of operating cars in small cities is the irregularity of about one-half the traffic. There is a certain constant load at what may be called the working hours, in the morning, at night and at noon, and this is supplemented or decreased according to the time of the year, condition of the weather, etc. From about 10 o'clock in the morning until 11:30 cars coming from the residence districts to the business center of the town often have very light loads and occasionally, as the boys say, "turn a goose egg;" that is, do not register a single passenger. We plotted a curve of traffic at different seasons of the year, taking a week's record at each time, and subsequently kept a check on this curve, and, as we all know that the best economy is obtained by getting the low points and peaks out of this curve, the problem presented is how to get people to ride during these idle hours was an interesting one.

The stores would have mark-down sales, which would bring the ladies out in force, and, as they opened at 8 o'clock in the morning on these days, the ladies would supplement the ordinary travel during the heavy-load hours, and often tax the regular cars to their utmost. It finally occurred to me that if I would take the merchants into my confidence it might solve this difficulty very nicely, so, as the opportunity presented without making any marked effort in the matter, it was suggested to the different merchants that if they would arrange to have their sales open at 10 o'clock, instead of 8, when they opened their stores, they would help us and give the ladies a chance to get their housework out of the way before coming down town, and they would therefore feel free to stay longer and shop more than they would if they had to hurry home and get their housework out of the way before dinner.

They readily fell in with the suggestion, and I think it was profitable to them, as it certainly was to us. Of course, the manager of a road in a large city would not be obliged, nor would he have the time to study these finer problems, but in the smaller cities it behooves the manager of the street railway to thoroughly familiarize himself with every detail that will affect the traffic of his road and cultivate the friendship and good-will of the storekeepers, and by keeping in close touch and working together the irregularity of the traffic can often be eliminated.

(To be Continued.)

Plans for a Chicago Subway

President Roach, of the Union Traction Company, presented the Street Railway Commission with detail plans for a subway under the down-town streets of the city, at its meeting July 25. Mr. Roach had previously outlined his plans to the Commission, and at their invitation presented his plans in detail on the date mentioned. President Roach has intimated that if the subway is built by the Union Traction Company, the franchise will have to be perpetual. He positively refused to consider a twenty years' proposition, and stated that if the subway is constructed it must be on terms that will settle the problem for all time.

President D. G. Hamilton, of the Chicago City Railway, was present, and listened with deep interest to the proposition advanced and criticisms made.

The Metropolitan Street Railway Company, of Kansas City, is now operating five cars painted a Pullman brown, both outside and inside. The cars are being run as an experiment to test the wearing qualities of the new color, and with a view to its adoption as a standard with the company. Its cars are now painted a light color, but this requires much care and constant retouching.

CORRESPONDENCE

The Characteristics of a Successful Street Railway Manager

Metropolitan Street Railway Company
New York, July 2, 1900.

Editors Street Railway Journal:

I have read with much interest the editorial in your June issue describing the "Characteristics of the Successful Street Railway Manager," and heartily indorse all that you say therein as being strictly true. If the imaginary and rare man you have depicted is possessed of good health—one very important element in success—there is nothing left to be desired. As I review the characteristics you have named, they are:

First—Honesty and loyalty.
Second—Sincere regard for employees.
Third—Force and decision of character.
Fourth—Organizing ability.
Fifth—Diplomacy in dealing with the public.
Sixth—"Horse sense" concerning engineering problems.
Seventh—Determination never to undertake an impossible nor to abandon an achievable thing.

These seven virtues combined in one person would constitute, from my point of view, "the very figure of a man," and yet I can conceive conditions under which he might not be a success in managing a property. We managers are now and then apt to lose sight of the influence of our surroundings and associations, and vaingloriously appropriate all the credit for successes which are the result of co-operation of various kinds; for, powerful as the modern manager is, there are limits set to his authority by the superior power of ownership. Hence, I can conceive such a man as you have described making a failure with a property, the ownership of which was in the hands of selfish, narrow-purposed men, uninfluenced by those broad public considerations which are so interwoven with the affairs of public service corporations.

It may be answered that to allow himself to become associated with such a class of owners would in the first instance argue that the manager lacked the virtues of the seventh class. The real character of owners, however, is not a matter of record. One does not demand a certificate of character from an employer, indorsed by the last servant, and there is no way a manager can ascertain what the owners are like until he has tried them, off and on, in fair weather and foul.

And so the thought has come to me, in thinking the thing over, that, after all, the manager is unlike the poet, for he is made, not born. Put the man, born with all the characteristics named, into bad company, and the chances are nine to ten you will spoil him. I have no sympathy with those impossible men who have never worked out their potentials because they have never been in the proper kind of company, but, with my conviction that there are more good and able men in the world than is generally supposed, I can only account for the small evidence they give of their existence by the probability that they are in bad company.

One might go even a step further with this idea and arrive at the conclusion that a pretty fair kind of a manager, without some of the seven virtues, could be made by the loyal and liberal co-operation of an enlightened and public-spirited ownership, but to pursue the thing too far would be looking at the manager through reversed binoculars, and, being of the class myself, I do not care to inaugurate a habit of this kind. H. H. Vreeland.

June 30, 1900.

Editors Street Railway Journal:

I am much interested in an editorial appearing in the Street Railway Journal of June 2, this year, entitled "Characteristics of the Successful Street Railway Manager." I have read the same carefully, and certainly indorse fully all that portion directly referring to what the manager should be, but is it true that there is a great scarcity of competent managers? My impression has been the reverse. It appeared to me that the recent consolidations all over the country had thrown out many managers, some of whom, at any rate, it would seem must be men of ability. I placed an advertisement in the Street Railway Journal in two issues which brought only two replies, and these from small properties wanting "a capable manager for $75 or $80 per month." This should not be considered as a reflection on the value of the paper as an advertising medium, but shows that there is a surplus of men capable of handling large properties. These offers were, of course, courteously declined; a man of any ability can double that loafing in this country.

I will not tire you with a long recital, but I believe that I can fill every requirement outlined in the editorial referred to, and believe that I can make it so appear to any syndicate requiring such a manager if I can get into communication with them. If you know of any such I should be glad to be furnished with their address. I am a man who studies his business and is always prepared for the emergency before it arrives, and I have been successful in the extreme in maintaining amicable relations with city officials, the public and the press without giving away all the company's property, and have been successful in the handling of employees, and yet retaining their good will. This latter was exemplified here when giving up my position in the reorganization, the employees made me a present and still seem to try if possible to show me greater deference than when I held their jobs in my hand. This was a surprise to me, as I had always been very strict, and would never tolerate inattention to duty, yet careful that employees should all be treated justly and no favorites. I have also had to face the "stockholder's son" and kindred propositions, too, but I would simply tell them that all I could do was to give them a place—*they must hold it*—and turn them over to their superintendent. Prompt decision is one of my strong points. I have always made it a point to have my business so well in hand that I can say instantly what I will do—I have a strong contempt for a vacillating business man. I combine the engineer with the business man—know thoroughly how things should be done and how to pick the cheapest and the best way, yet understanding that the ever-present problem in railway management is not simply what can we do, but rather *what can we do without.* John Smith.

A Note of Warning on Polyphase Transmission

Boston, Mass., July 16, 1900.

Editors Street Railway Journal:

I have noted with the greatest interest the long array of electric railways using rotary converters, as published in the Street Railway Journal for June. So long a list augurs well for the practical advantages of polyphase power transmission for railway purposes; and a little inspection brings into prominence the fact that these roads represent almost every possible case of transmission to rotaries. Some of them merely utilize transmitted power in a central station; others are long roads, winding from city to city, and fed from sub-stations deriving their power from a long transmission line, linking them with a main

generating station; and still others represent various phases of distribution, from a huge urban station to its auxiliaries. All these applications of the general methods of power transmission may be of great value in electric traction, but as a consistent advocate of polyphase apparatus and methods, and an earnest student of the problems arising from the enormous growth of electric traction, I feel it my duty to sound a note of warning—a warning directed, not against power transmission to rotaries, but against making a fetish of any method, however useful intrinsically.

I regard it as certain that many of the roads enumerated in your imposing array are transmitting power wisely and economically, but there is, on the other hand, little doubt that some of them are wasting their substance fruitlessly in zealous endeavors to follow the latest fashion. It is no more reasonable for all roads to use the same engineering methods than it would be for all their superintendents to wear white bell-crowned beaver hats as a badge of office.

Now, in point of solemn fact, it is sound engineering to transmit power only when such transmission has a logical, economic reason for existence. Every such plant necessarily wastes power in the transformations necessary to its operation, and must show due cause therefor in an ultimate saving or stand condemned.

In the ordinary use of rotary converters there are to be encountered the aggregated losses in the transformers, the lines and the rotaries themselves. In these are consumed under ordinary conditions of load from 20 per cent to 25 per cent of the energy input. This loss is irretrievable, and must in some way be compensated if an economic result is to be attained. For every 75 kw to 80 kw delivered by the rotaries 100 kw must be delivered at the generators, and in addition one must buy and install transformers and rotaries nearly equaling in output the main generators, besides installing the transmission line itself. That is, to deliver 75 kw or 80 kw to the lines one must have a rotary converter of that capacity, transformers for the same, and a 100-kw polyphase generator at the other end of the line. If one can drive that generator by cheap water power the outlook is generally comforting, but when it is deliberately proposed to drive it by steam power there must be a truly prodigious saving somewhere to offset the necessary and unavoidable losses. If one is dealing with 10,000 kw, instead of 100, the need of showing a saving is by so much the more imperative. Now, it is undoubtedly true that power can be generated much more cheaply on a large scale than on a small one, and in this fact lies the key to the situation; but unless the saving is in the neighborhood of 25 per cent or 30 per cent there is a hard outlook for economy in using rotaries, and the bigger the system the more difficult is it to show such a saving. In considering the application of transmission methods on a large scale a good preliminary step is to consider the effect on the economy of a great station of merely putting up a heavy partition wall, dividing the station into two equal and symmetrical parts, and forbidding employees to cross from one to the other upon any pretext without an hour's notice of their intention. Unless the total cost of the year's output would be increased at least 25 per cent by this simple change sufficient reason for the use of rotaries, rather than distributed stations, will have to be looked for with a search warrant. In rare instances some one site for a station may have great natural advantages and lead to economic results that could not otherwise be approached, but it is not safe to jump at such a conclusion or to accept it without heavy preponderance of evidence, particularly in view of the fact that even sub-stations require costly space and considerable attendance. If in the course of events it becomes generally feasible to use alternating motors for traction purposes, the case will resolve itself into a simple transmission problem, and a favorable solution will not be difficult to reach. At present, as I have endeavored to point out, the application of transmission methods to traction work involves economic losses so considerable and serious that one will do well to stop and think twice before incurring them. In very many cases they can be more than offset by gains due to the very processes that involve them, but it is worth while to call forcible attention to the fact that such is by no means a foregone conclusion.

Louis Bell.

Street Railway Statistics and Municipal Ownership

Cleveland, Ohio, July 17, 1900.

Editors Street Railway Journal:

I am anxious to get statistics for the last five years on the mileage, number of cars and capitalization of the street railways of the United States, and would also like to know in which issues of the Street Railway Journal you have published articles on municipal ownership of street railways.

F. S. Vernon.

[Answer.]

Statements of cars, mileage and capitalization of American street railways for the past five years can be found in the Street Railway Journal for July, 1895; August, 1896; October, 1897; February, 1899, and June, 1900.

We have, of course, published a great many articles on the subject of municipal ownership and operation of street railways, and almost every number of the Street Railway Journal has contained something on this subject, but possibly the most important articles are in the following list.—[Eds.]

May, 1897. Editorial on "Street Railways vs. Municipalities."

September, 1897. "Municipal and Private Ownership and Operation of Street Railways. A Study of Results and Possibilities," by Edward E. Higgins. This is, so far as we know, the most extended defense of private ownership which has been made in this country.

September, 1897. Editorial entitled "Municipal vs. Private Management of Street Railways."

November, 1897. Paper by P. F. Sullivan on "Municipal Ownership and Operation of Street Railways."

December, 1897. Editorial on "The Case for Municipal Operation of Street Railways."

August, 1898. "An Act Relative to Street Railways," passed by the Massachusetts State Legislature.

May, 1899. Editorial discussion on municipal ownership.

May, 1899. "Municipal Ownership in Detroit."

August, 1899. Editorial and article on "Proposed Solution of Municipal Franchise Problem," from Allen Ripley Foote's work upon "Municipal Public Service Industries."

April, 1900. "Some Differences Between American and British City Transportation Methods," by Edward E. Higgins. This is a complete refutation of the prevailing popular belief that British methods of dealing with street railway companies means greater revenue to the public treasury or improvements in any way as compared with " the American system."

On July 19 the Mayor of Montgomery, Ala., vetoed the ordinance to prohibit the operation of street cars in the city of Montgomery without conductors. The Council passed the ordinance July 9, with an amendment excepting roads that did not operate six cars. The Mayor vetoed the ordinance on the ground that it was illegal and inoperative, in that it excepted roads not operating six cars. The Mayor thinks that if the safety and convenience of the public demands conductors on some cars they are necessary on all, and he is opposed to any discrimination between the railroads operating cars in this city.

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NOTICE.

Papers and correspondence on all subjects of practical interest to our readers are cordially invited. Our columns are always open for the discussion of problems of operation, construction, engineering, accounting, finance and invention.

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 news columns.

All matters intended for publication in the current issues must be received at our office not later than Wednesday of each week.

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It may be news to some of our readers to know that funeral cars are now running regularly on street railway lines in Chicago, Cleveland and St. Louis. Elsewhere in this issue we publish a description of some cars now in commission, and of their mode of operation. As yet the system may be said to be in an experimental stage, as nearly all the cars have been made by the traction companies themselves, but their success wherever they have been introduced will probably compel the regular manufacturers to take up the matter before long. The introduction of an innovation of this kind must necessarily be somewhat slow, as there is probably no custom of any community which is so regulated by conservatism as that relating to the disposal of the dead; but the reported daily use which comes from Chicago indicates that already there are many persons who prefer the comfort and convenience of the service to the conventional hearse and its accompanying "procession." The funeral car seems to be peculiarly adapted to the use of the larger cities, where the cemeteries are usually located in the suburbs and at a considerable distance from the majority of the residences. Where this distance is several miles every consideration points to the use of the trolley car in preference to the carriage. In the city of Mexico funeral cars, run by horses, have been in use for a long time, and the returns last year from this service were as much as $80,000, in the currency of the country, or nearly 5 per cent of the gross receipts. It may take a long time to introduce the system to any extent in this country, but it is a step in the right direction, and is worthy of serious consideration.

The attention of street railway managers may well be given to the admirable work done by Allen Ripley Foote during the past three or four years in pointing out and codifying certain important principles which should govern contracts between municipalities and public service corporations, such as street railway, electric lighting and gas companies, etc. This work appears in excellent form in a series of bills prepared by Mr. Foote at the request of the Ohio State Board of Commerce for presentation to the Ohio Legislature at its last session, and while action upon these bills was deferred until the next session, it is expected that they will be taken up for consideration next winter.

The essential provision of these bills are as follows:

1. Bonds issued by a municipality for the establishment of a public service plant shall be secured only by mortgage of the plant itself and the franchises for operation. In other words, the general credit of the city shall not be placed behind these bonds, but they must stand or fall upon their own merits and earning power.

2. No public service owned by a municipality shall be sold for less than cost. If the service does not pay at the prices originally established, these prices must be increased. The general body of taxpayers must not be called upon to help pay for a service to a private user.

3. The true and entire cost of service, whether given by a private company or by the municipality, shall be determined by a State Auditing Department, to be established, and shall include the following terms:

a. The full operating expenses.

b. A sufficient provision for depreciation, for losses from fire, and for accidents of every kind.

c. Taxes paid (in the case of private companies) or relinquished (in the case of municipalities), these taxes including any special bargains concerning franchise taxes which may be made between municipality and company based on a payment of percentages on gross receipts.

d. Interest on the full amount of actual investment at the rate per cent paid by the municipality on its bonded debt.

4. To the cost of service as above specified, there shall be added in the case of enterprises owned and operated by the municipality a provision for a sinking fund sufficient to pay off at maturity the bonds issued on investment account.

5. All surplus earnings over and above the true cost of

service, as defined in paragraphs 3 and 4, are to be regarded as the true profits of the enterprise.

6. Out of these true profits, when earned by a private company, the latter may pay upon its true investment a rate per cent double that paid by the municipality on its bonds.

7. If a private company adopts a system of profit sharing with its employees, it shall be entitled to earn and pay to the employees the same rate per cent upon the wages earned by them as the company earns on its investment

8. All surplus profits, after making the distributions provided for in paragraphs 6 and 7, are to be divided equally between the municipality and the company.

9. The determination of the investment value to be used as a basis for the foregoing computations shall be determined originally by appraisement or by arbitration. Additions shall be made in a manner specified by the municipality.

10. The price for service to be paid by users shall be fixed by the municipal council for a period not less than five nor more than twenty-five years, and the prices so fixed shall be computed on the basis of cost, and must be such as to produce an annual revenue sufficient to fully pay all costs and to yield the company its authorized share of profit.

The above programme is clear, logical, and seems to be fair to all parties in interest. It embodies many of the principles which we have several times recommended to street railway companies which have short time, imperfect or otherwise unsatisfactory contracts with municipalities at present, and we believe that where such a programme is adopted there will be a cessation of friction between the municipality and the companies. The difficulties in the way lie in the opposition of the professional politicians, who do not, as a rule, care to see a permanent settlement of these questions, but prefer to have them left open for possible "strikes" when the political exchequers are low. The public in general, however, will be greatly benefited by contracts of this character—far more so than will be the case where municipal ownership, with all its crudities and imperfections, is adopted, and many of the most intelligent and fair-minded of the advocates of municipal ownership grant that the principles above laid down would be satisfactory to them as a substitute.

Concerning Tractive Resistances

Despite all that has been written upon this very important topic, engineers are still confronted with a degree of uncertainty as to the exact facts, which is anything but comforting. It is the purpose of these lucubrations to exhibit the present state of general ignorance and to point out the line which experiments should take in order to clear matters up. In ordinary tramway practise the engineer takes his medicine, and says no more about it—the conditions change every time the street is torn up and repaved or resurfaced by a new gas company or an overzealous street department. When, however, he is confronted by the problem of planning a high-speed line, and proceeds to look up the available data on train resistances, he finds himself up against a pretty tough proposition. Suppose one starts by assuming a 100-ton train and a speed of 100 miles per hour, and takes the data now available, what conclusion will he reach? Passing by some of the earlier formulæ, we will start with the well known results of Wellington, founded upon a legion of experiments. Taking our train as composed of five cars, we set gaily to work, and promptly get out a tractive resistance of no less than 97 lbs. per ton, which is equivalent to an output of 2586 hp. This is a cheerless outlook, indeed, so we make a mental reservation to the effect that Wellington's data do not quite represent modern results, and hunt up Barnes' formula, deduced from a large amount of high-speed work with locomotives. This seems pleasanter, giving as it does a net 20 lbs. per ton, just 533 hp for the job. But which is correct? It would be decidedly unpleasant to advise, say a 600-hp equipment, and then find that Wellington was right, and it would be annoying to build a 2500-hp locomotive and find it nearly five times larger than required. So, in this dilemma we look over the files of the STREET RAILWAY JOURNAL, and hunt out Lundie's results. They look reasonable, and applying them to the case in hand we find that 34 lbs. per ton is about right, calling in all for 907 hp. This seems more agreeable, and we are just settling down to a contented frame of mind when someone unkindly calls our attention to a batch of very careful tests made in France about fifteen years ago. We cannot entirely reject these, and, applying the resulting formulæ, find to our horror that 58 lbs. per ton is the figure indicated, and that we shall certainly need 1546 hp to pull that wretched train.

Now, bearing in mind that each of the formulæ represents the results of painstaking experiments, it certainly seems queer that they lead to results so discordant. To say what is true enough, that they are horrible examples of the dangers of extrapolation is begging the question, for what we really want to know is the reason why the formulæ seem to go crazy and talk nonsense as soon as they get out of sight of the experiments.

To begin with, train resistance is certainly a very complex variable, and to assume that it can be correctly represented over any considerable range by a linear, parabolic, or hyperbolic, relation between the co-ordinates, is altogether gratuitous. To analyze the total resistance roughly, it is composed of three separate elements, varying in relative importance as the speed varies. First comes the track resistance proper, *i. e.*, the resistance to dragging the turning wheels over a track which is far from being frictionless; second comes the drag of journal friction, which is comparatively simple; and finally the air resistance, more complex than either of the others. The first mentioned factor is the predominant one at all low and moderate speeds. The third at these speeds is rather small, but controls the situation at very high speeds. The second is, fortunately, tolerably stable and not large enough, ordinarily, to complicate the situation.

We may now further analyze each of these factors of the resistance. The track resistance is made up in the main of pure rolling friction, small and fairly steady; joint friction, rather large and variable; flange friction due to jarring and rocking of the trucks and to wind, large and exceedingly irregular, and finally, the work against gravity, due to irregularities and flexure of track, very variable and at times very large. It is impossible to define the exact relative importance of these factors, but it is safe to say

that the friction of bearings and the rolling friction of wheels upon track, particularly the last named, cut a rather small figure in the total. Their sum constitutes the principal component of train resistances at extremely low speeds, particularly in the case of long and lightly loaded trains. It probably does not exceed 3 lbs. per ton, to judge from the evidence of various investigations, and, perhaps, may be somewhat less. Moreover, it is likely to remain fairly uniform irrespective of speed. The flange and gravity components may be estimated roughly from the increment of the track resistance as the speed rises within moderate limits, for the air resistance in case of a heavy train is so small that while it cannot be neglected it is not likely to involve uncertainties considerable enough to introduce material errors. With a heavy train at 10 miles to 15 miles an hour the head pressure due to air resistance is unlikely to exceed about 1 lb. per ton, and the characteristics of the various formulæ indicate that at such speeds the factors we are examining have already exceeded the pure friction and probability range about 4 lbs. to 5 lbs. per ton. Their rate of increase is a very uncertain quantity, indeed. On a poor track the jarring and swaying increases rapidly with increased speed, and this must cause a very considerable rise in the amount of power required. On the other hand, a train upon a good, or fairly good, track sometimes seems to steady down at high speeds, so that it seems to run quite as smoothly at 60 miles per hour as at half that speed. While the real facts of the case have not as yet been ascertained, there seems to be considerable evidence that on the whole these resistances do not increase directly as the speed, but at a variable and finally decreasing rate, so that at very high speeds they are scarcely, if at all, greater than at 10 miles or 15 miles per hour. In other words, at very great velocity, the running gear, and perhaps even the track, works more smoothly than at low speeds. This view is borne out by the very extraordinary fact that of the comparatively few experiments at speeds above 75 miles per hour all give values of the total resistance so low as to leave no room for a considerably increased track resistance unless the air resistance is much smaller than there is the slightest reason to suppose.

Of the air resistance we have now considerable knowledge, enough to say with certainty that it does not increase as the square of the speed, but at a much less rate. Crosby's experiments, of course, show an almost linear relation between speed and air pressure, but these were made upon short bodies, no more than two or three diameters long. Now, the air resistance to a train is composed of two distinct parts—first, the head pressure, and second, the eddy or wave pressure along the sides. The first may reasonably be expected to obey some fairly simple law, but the second is an altogether unknown function of the velocity and length of the train. Now, even as regards the head pressure, while it is true that doubling the speed of a train doubles the amount of air per minute pushed aside by its front, there is a great deal of doubt as to the velocity acquired by the said air and the actual work expended upon it; and, when we consider the resulting eddies, unknown as to velocity and somewhat uncertain as to direction, it is small wonder that air pressure in general is a somewhat uncertain quantity. There is a strong probability that the value of the eddy resistance passes through a series of maxima and minima, as does the wave resistance of a ship, the values of these depending on the velocity, length of train and perhaps even the length of individual cars. Data bearing upon this phase of the subject are greatly needed.

In taking up the application of resistance formulæ to high-speed electric work, it must not be forgotten that motor gearing, if gearing be used, is a very material matter, and that if the number of motor-driven axles is considerable, an entirely new factor enters the calculation. There is some good reason to believe that the grinding friction of a driving wheel is entirely different from the rolling friction of a trailing wheel, so that where minimizing the power at high speed is the controlling consideration, the fewer driving axles the better.

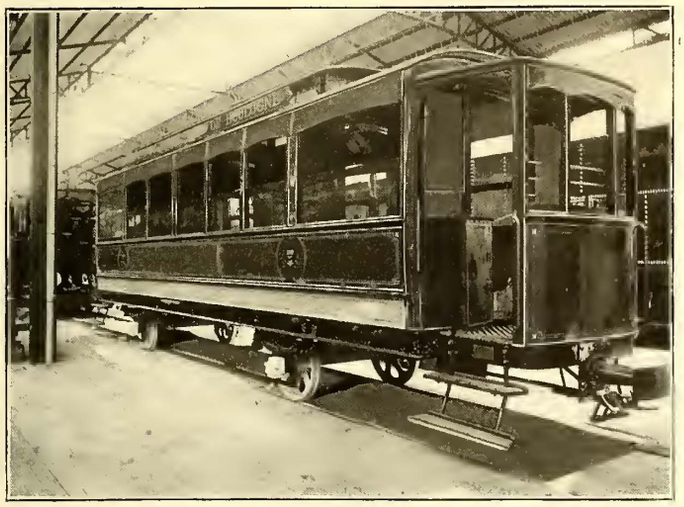
Now, all this is intended to point out as nearly as may be what are the uncertain factors in train resistances at the high speeds to which electrical traction must in the course of events tend, and to stimulate if possible the research that is necessary to finding out the conditions upon which success depends. There is much to be done, and many hands are needed to do it. First of all, it is desirable to get data on the values of the track resistances at various speeds. Second, we need, and need badly, a redetermination of the air resistances on a large scale; if possible, direct dynamometric measurement of the power required to tow at the end of a very long cable a car having a front of definite area and shape. Finally, the head resistance should be as far as possible differentiated from the eddy resistance by experimenting on trains of various lengths in some such manner as we have just indicated. With these data in hand it would be easy to deduce graphically the actual power required to drive a given train at any required speed within very wide limits. We say graphically because it is extremely doubtful whether any formula simple enough to be convenient for reference would represent the experiments with sufficient exactness. The facts of the case are necessary not only to determine the absolute power required, but to indicate the best means of supplying it. It is certain that very high speed traction must in the nature of things come, and the sooner preparation is made for it the better, for failure in the first serious attempt would not only be costly, but would have a discouraging effect on future work along the same line. Meanwhile it may be noticed that we have vouchsafed no solution of the hypothetical question we propounded at the start. The reason for such mental abstinence should by this time be tolerably clear. In the present state of the data we must firmly decline to hazard anything more authoritative than a guess—sometimes called an estimate by those who desire to appear wise in the eyes of their fellowmen. But our guess is that when the first well designed train of 100 tons is run at 100 miles per hour the total resistances will not exceed 20 lbs. per ton of weight.

The Grand Rapids Railway Company, Grand Rapids, Mich., has issued a neat little folder for the benefit of its patrons. A map of the system is given, but nearly the entire space is occupied by reproductions of views to be seen from the trolley cars. One page is devoted to the details of a trip around the city, which will give the passenger a chance to see the greater part of the city, with stopovers at the parks, for the sum of 20 cents.

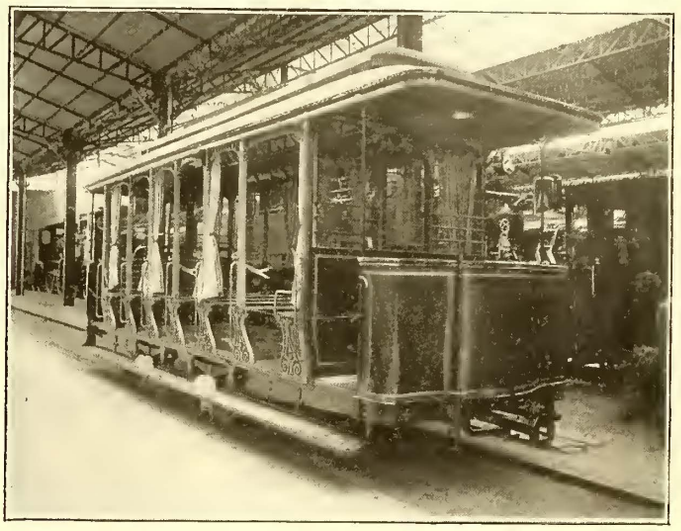
Paris Exposition Notes

[*From Our Regular Correspondent.*]

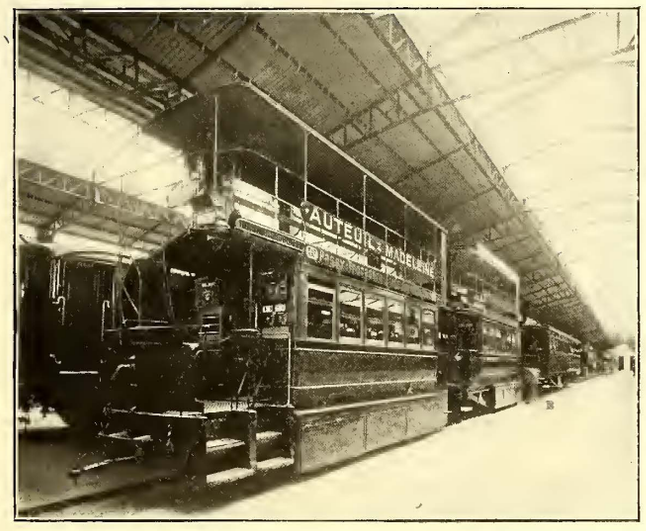
Since the last appearance of the STREET RAILWAY JOURNAL, the Transportation Exhibition, both on the Champs de Mars and at Vincennes, may be said to have been completed and put in such a shape that the visitor can at last make for himself a fairly thorough and comprehensive study of what is shown in each group. Best of all, the section of the official catalogue, which comprises Group 6, dealing with civil engineering and means of transport, has at last made its appearance in the shape of a bulky volume of several hundred pages, which, however, are not numbered consecutively. As the material under each of the several classes in the group is treated separately, however, the catalogue is easier for reference than might appear at first sight. Preceding the section which deals with Class 32, or material for railways and tramways, is a very interesting summary of the situation in France. A large part of this deals necessarily with steam railroads, but there is an interesting section of three or four pages which treats more particularly of street railways. There is also a little section which deals with what are called "railroads of local interest," or which, perhaps, in England would be called "light railways," using a narrow gage. Many of them are really rural street car lines. Of these light railways, it would appear that there were in France when the figures were compiled, about two years ago, 4200 km in operation and 563 km under construction. Under the head of tramways, the total mileage in operation, given under date beginning 1899, was 3282 km; while another table, as of 1898, gives in operation, 2908 km of different gages, and 1351 km under construction. It is worthy of note that of the mileage thus presented, 1988 km was of one meter gage in operation, and 1152 km under construction. It is stated that for the track the types of rail in use are Marsillon, Broca and Vignole, of weights varying from 14 kg to 48 kg per meter, while in cities where self propelling vehicles are used weighing as much as 20 tons a track weighing as much as 50 kg to the meter is in use. According to another table, at the beginning of 1899 there were in operation in France 317 km of street railway operated electrically, of which 298 km were overhead wire. These figures have, of course, been greatly increased since the data were compiled for the catalogue, and this is equally true of the professional and industrial census given, reported for 1896, when, it is stated, some 4400 persons in France were employed in building locomotives and materials for railways coming within this class. It would seem that the data could easily have been made more complete and closer to date, but in view of the inordinate lateness with which the catalogues have appeared we ought to be profoundly thankful that no such cause for further delay was interposed.



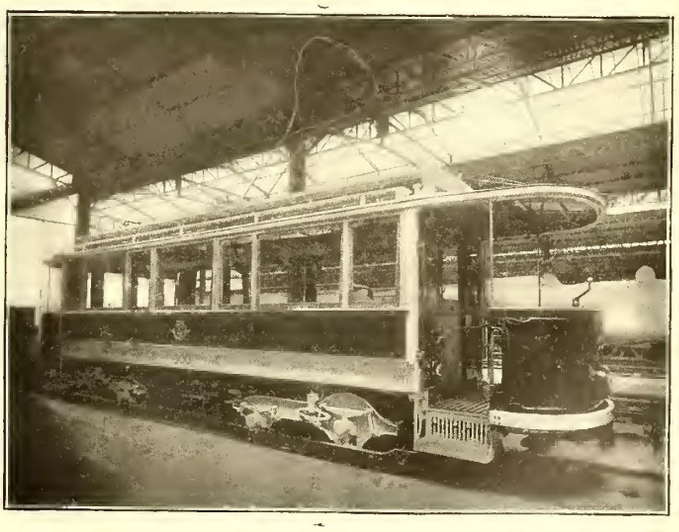
TYPE OF CAR ON BOIS DE BOULOGNE TRAMWAY, VINCENNES



ITALIAN OPEN TROLLEY CAR, VINCENNES

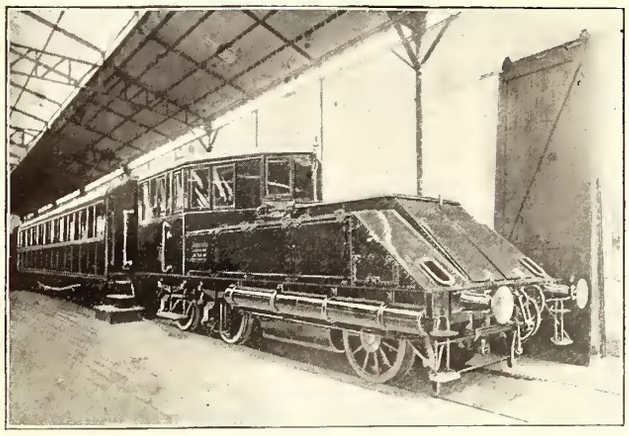


COMPRESSED AIR CAR, PARIS GENERAL OMNIBUS CO., VINCENNES



RINGHOFFER, AUSTRIAN TROLLEY CAR, VINCENNES

Taking up the catalogue as it stands, it would appear that there are nearly 500 exhibitors in Class 32, as follows: Japan, 2; Luxembourg, 2; Mexico, 2; Norway, 1; Holland,



END VIEW ELECTRIC LOCOMOTIVE, PARIS, LYONS, MEDITERRANEAN RAILROAD, VINCENNES

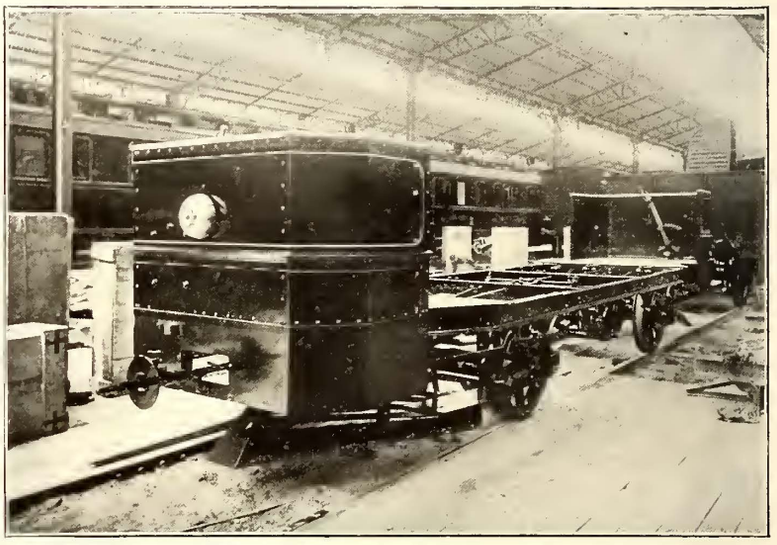
2; Peru, 1; Portugal, 4; Roumania, 2; Russia, 43; Servia, 1; South African Republic, 1; Sweden, 1; Switzerland, 7; Turkey, 1; France, 112; French colonies, 9; Germany, 25; Austria, 23; Belgium, 23; Bosnia, 1; Spain, 2; United States of America, 161; Great Britain, 24; Hungary, 28; Italy, 12, making a total of 490. Of these, a large proportion deal with street railway apparatus and material. It will be noticed that the United States makes a much larger numerical exhibit than France itself, but this is somewhat deceptive as to the space occupied, France exhibiting actual material upon the tracks, whereas the American material consists in a great many cases of official reports and volumes of transactions, or photographs and drawings.

A great many views of the apparatus installed both in the Transportation Building of the Champs de Mars and at Vincennes have already been presented in the pages of the Street Railway Journal, pending a more elaborate and complete discussion, and a few others are now forwarded

ELECTRIC LOCOMOTIVE, PARIS, LYONS, MEDITERRANEAN R. R.

herewith. A liberal exhibitor in the French class is the Companie Générale des Omnibus de Paris, which exhibits a street railway car operated by accumulators, one of the steam type, one with an oil engine, and one of the compressed-air type. Some of these have been shown already, and a view is presented herewith of the compressed-air cars operated by this company. The air is stored at a pressure of 80 kg. per cm² in a reservoir below the floor of the car, and is reduced to 15 kg. per cm² before use in the motor. This ponderous double-deck car and its associate are in sharp contrast to the lighter recent types of trolley car and trailer, especially those of the single-deck type shown in the sample of car built for the Bois de Boulogne. This heavy compressed air car is also in sharp contrast with the light open trolley car, of which a view is here shown, built by Miani Silvestri & Company, of Milan, which is brought to notice in the Italian section on the tracks at Vincennes, and which is characterized by considerable lightness and grace of design. This concern is well known as a builder of rolling stock in Italy, and its name and material will be more or less familiar to readers of the Street Railway Journal. Another very interesting and handsome trolley car not included in the last batch sent of foreign exhibits at Vincennes is that shown in the Austrian section by F. Ringhoffer, of Prague, with a bent-loop trolley, as shown in the photograph.

The Miani Silvestri car is 7.84 m in length, and carries



TRUCK OF GANZ ELECTRIC LOCOMOTIVE, VINCENNES

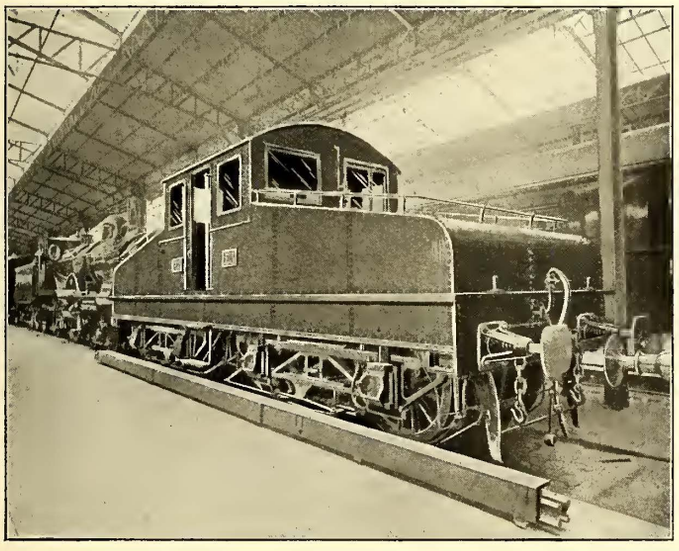
two General Electric motors of 25 hp each. It affords thirty-five seats, and the back rails of all but the end benches are reversible. The Ringhoffer car seats twenty-four passengers, and has standing room for eleven. It carries two motors of 25 hp each, of the Siemens-Halske make.

In previous correspondence no note has been made of the electric locomotives or locomotive trucks on view at the Vincennes part of the Exposition. It is well known that the various steam railroads of France have been experimenting in the direction of the utilization of electricity on their lines, particularly on urban stretches and around their terminal depots. And this is an important subject which demands more space than can be here given it, while so far very few details have been given out as to the actual construction and operation of the locomotives themselves, with which, it would appear, some very exhaustive tests are being made. During the earlier stages of the work on Electricity Building, the Railroad of the North had a very handy and effective little storage battery locomotive, with which a good deal of work was done, hauling and pushing carloads of exhibits into position along the temporary tracks through the building, and this in itself constituted a striking demonstration of utility in this branch of locomotion. But the machines on view at Vincennes are of a far more imposing character. Views of some of them are presented herewith, such as that of the Paris, Lyons & Medi-

terranean Railroad, that of the Paris-Orleans Railroad, and the truck exhibited by the Ganz Company, of Budapest.

The Ganz truck is in reality that of a motor car of ordinary size, but it has a lever brake. The total length is 8.26 m, and 3.10 m between centers of axles. It carries two motors of 25 hp each. The locomotive of the Paris, Lyons, Mediterranean Railroad, however, is something serious, as will be seen from its length and bulk. It is, moreover, equipped with two motors of 225 hp each, able to exert, it is said, between 500 and 600 hp.

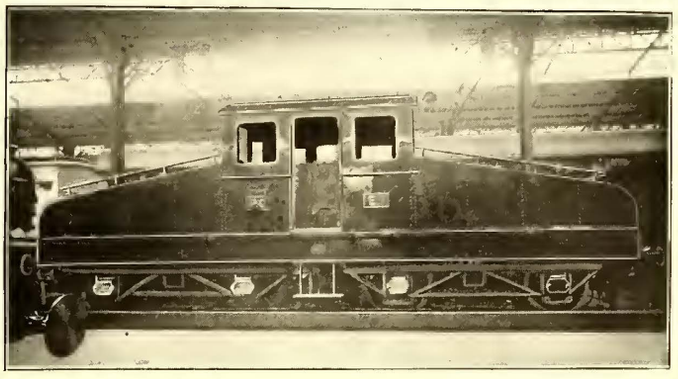
With regard to the electric locomotive of the Orleans Railroad, its resemblance to those employed at Hoboken, N. J., and in the Baltimore Tunnel, will be at once noted by every American reader. It is due to the French Thomson-Houston Company, a fact which will account for its construction on these approved lines. It may not be generally known that the Orleans Railroad, which at present has its terminal at the very outskirts of Paris, and has therefore been most inconvenient to reach, has lately pushed its way nearer to the heart of the city and has erected a magnificent new station on the Quai d'Orsay. This prolongation of its track is 2½ miles in length, which will give an idea of the distance to be saved by the great majority of those who use the road. Over this stretch of track eight electric locomotives are to be used, of the type



FRENCH THOMSON-HOUSTON ELECTRIC LOCOMOTIVE, ETC., PARIS-ORLEANS R. R.

shown, and they have already been tested for their work in situ. Each locomotive has four driving axles with a motor in each, and weighs about 45 tons. These motors are of the G. E. 55 type, of 175 hp each. Each locomotive is easily capable of hauling passenger trains from the old station to the new in seven minutes, each train being estimated at about 250 tons. It is stated that 150 such trains will be hauled per day to and fro. The trains will arrive at the outer terminus under steam power, and a change of locomotive will be effected in two minutes. Current is to be generated at high tension and then delivered by two sub-stations—one at the Quai d'Orsay and the other at the Quai d'Austerlitz, where the old depot stands. The local current distribution system comprises a third rail external to the track and an overhead contact in the tunnel at the entrance to the Quai d'Orsay, so that each locomotive is provided with three sliding-shoe collectors and with two overhead trolleys, for the double service. Fuller details of all this highly important work will be given at the proper time.

In the immediate vicinity of this compact looking electric locomotive are a great many steam locomotives of the highest state of development, and the contrast both in shape and in mechanism naturally attracts a great deal of attention. It is not alone in electric locomotives that the initiative may be said to be due to American practise, for only the other day quite a dispute arose in the Chamber of Deputies owing to the fact that in one of the State railroad exhibits at Vincennes an American steam locomotive was



ELECTRIC LOCOMOTIVE FOR PARIS-ORLEANS R. R., VINCENNES

shown in all its glory, whereupon the inquiry arose why French locomotives were not good enough for systems in which the State itself had an interest. It is not to be understood that France or any other power of Europe is about to adopt the American style of locomotive, electric or steam, but there is no question that American practise as exemplified at this exposition is destined to have a great influence.

Compressed Air Cars in New York

Considerable interest has been aroused by the proposal of the Metropolitan Street Railway Company, of New York, to change the type of compressed air motors in use on its Twenty-Eighth and Twenty-Ninth Streets Railway. Reference has already been made to the fact that the Hardie motors are to be used on this line in place of the motors which have been employed, and which were described at length in the STREET RAILWAY JOURNAL for June, 1899. The reasons for this change can best be explained by a brief history of compressed air traction in this country during the last three years. About three years ago two manufacturing companies were making vigorous efforts in New York to solve the problem of the application of compressed air to street car service. One of these was the General Compressed Air Company, which was operating three motor cars on the 125th Street line of the Third Avenue Railroad Company; the other was the Compressed Air Power Company, which was owned largely by some of the principal stockholders of the Metropolitan Street Railway Company. These gentlemen were induced to become interested in compressed air traction, largely by the hope that independent compressed air cars could be used on the cross-town lines of the Metropolitan Street Railway Company, on which the installation of the underground conduit was practically out of the question on account of expense, and on which the installation of the overhead trolley was prohibited by the municipal authorities.

The motors used by the two systems mentioned, and which were popularly known respectively as the Hardie and Hoadley systems, were alike in that a high pressure, *i. e.*, 2000 to 2500 lbs. per square inch was carried in the air reservoir, but differed in practically every other respect. In the Hardie system, two long stroke (14 ins.) single expansion engines were carried on the car truck and drove

directly the wheels of one axle of the car, the other axle being connected to the driven axle by side rods. The Hoadley motors on the other hand were patterned more after an electric motor, so far as the application of the power was concerned. Each motor, of which there were two on each car, was of the compound type with short stroke (6 ins.), and drove a shaft carrying a pinion which in turn was geared to the car axle. The two axles were thus driven independently, the motors ran in oil, and the whole equipment did not differ very much in external appearance from an electric equipment. There were a great many other variations in practise between the Hardie and Hoadley systems, as in the method of reheating, etc., but those already mentioned are sufficient to characterize the two systems as radically different.

The satisfactory results secured by the Hardie motors on the Third Avenue line, as mentioned above, convinced the managers of the Metropolitan Street Railway Company that the patents of the General Compressed Air Company were essential in securing the best results in compressed air motor work. As a consequence, negotiations were entered into by which a new company, the American Air Power Company, was formed to consolidate the interests of the other two. The Metropolitan syndicate controlled the new company, and though certain modifications were made, the general characteristics of the systems used on the Metropolitan line remained the same, that is, the compound short stroke motor driving the two axles independently. Soon after the consolidation, the services of Robert Hardie were secured by the Compressed Air Motor Company, which was a licensee for Wisconsin and Illinois of the General Compressed Air Company, and whose stockholders still believed in the "locomotive" principle, as applied to compressed air traction. The scene of the competitive trial between the two systems was now transferred, the American air power motors being used in New York, while the Hardie motors were employed in Chicago. The Chicago motors were used on the North Clark Street road, to operate between 12 o'clock at night, when the cable of that line shut down, and 6 o'clock next morning, when the cable was again put in operation. The motors gave good satisfaction and frequently hauled a trail car, and sometimes two trail cars, with a total of 300 passengers on a train. The results secured were so much more satisfactory than those in New York that the Metropolitan syndicate decided that if success was to be secured in the latter city, it would have to be, by following the Hardie system as employed in Chicago. Negotiations were then entered into between the American Air Power Company and the Compressed Air Motor Company for a second consolidation of interests, and resulted in the organization of the Compressed Air Company, with Mr. Hardie as chief engineer for the consolidated company. Henry D. Cooke, the president of the Compressed Air Motor Company, was also elected president of the new company. This has resulted in the retirement of the old equipment on the Twenty-Eighth and Twenty-Ninth Streets lines, and the placing of an order by the Metropolitan Street Railway Company for the equipment of the line with the Hardie motors. The new motors for the Twenty-Eighth and Twenty-Ninth Streets lines are now being built, and will be in operation at an early date. It is the purpose of this article to describe the system as it will be employed on this road, as fairly representing the best American compressed air practise at the present date.

FIG. 1.—COMPRESSED AIR MOTOR CAR AND TWO TRAILERS, NORTH CLARK STREET, CHICAGO

The compressing station is located at the foot of West Twenty-Fourth Street, New York, western terminus of the line, and was fully described in the Street Railway Journal for June, 1899. It contains a 1200-hp engine, operating directly four-stage Ingersoll-Sergeant air compressor, with a capacity of 56,735 cu. ft. of free air per revolution, and compressing to 2500 lbs. per sq. in. This air is stored in a series of reservoirs of seamless tube flasks in the car house, from which the reservoirs on the cars are charged.

There are sixteen reservoirs on the cars, having an aggregate capacity of 55 cu. ft., and weighing 4340 lbs. Fourteen of these reservoirs are carried on the truck, and one under each seat. From these reservoirs the air passes into one common header, and from this header is a pipe passing to each end of the motor car. The flow of air through this pipe is regulated by a stop valve under the control of the motorman. When the motorman opens the valve at either end of the car, the air, which is still under 2500 lbs. pressure, passes from the valve to the reducing valve.

The reducing valve is illustrated herewith, and automatically keeps the working pressure uniformly at about 150 lbs. per sq. in., whether the storage pressure is at its maximum or its minimum or at any intermediate point. As will be seen, the reduction valve is balanced by a hydraulic packed piston (shown below the reduction valve) in such a way that a variation in the storage pressure, as would be experienced during a trip, does not affect the operation of the valve. Ordinarily, double valves are used for this purpose, but these rarely give a constant reduced pressure, with a variable high pressure; they also give trouble by leakage. As will be seen, there is a spring which tends to open the reduction valve, and whose pressure is balanced by a flexible disc, upon which the reducing pressure acts, tending to close the reducing valve. When this reduced pressure reaches a point sufficiently high to compress the spring, it seats the valve automatically.

The cap which closes the opening through which the valve is passed into its place is also a cylinder, in which is another hydraulic packed piston. The object of this piston is to enable the motorman to increase the working pressure for starting quickly from a state of rest. Its operation is as follows: A pipe connects the space *A* with the motor-

man's brake valve, and when the brake handle is moved to a certain position it bleeds the air from pocket *A*. The working pressure then acts on the under side of this piston to assist the spring in opening the valve. It now requires a higher pressure acting on this disc to close the valve against the combined resistance of the spring and this piston, which higher pressure enables the motor to start quickly. As soon as the motor has acquired the necessary speed, the motorman moves the brake handle to the normal running position, which restores the working pressure in the space *A*, so that the piston is now in equilibrium

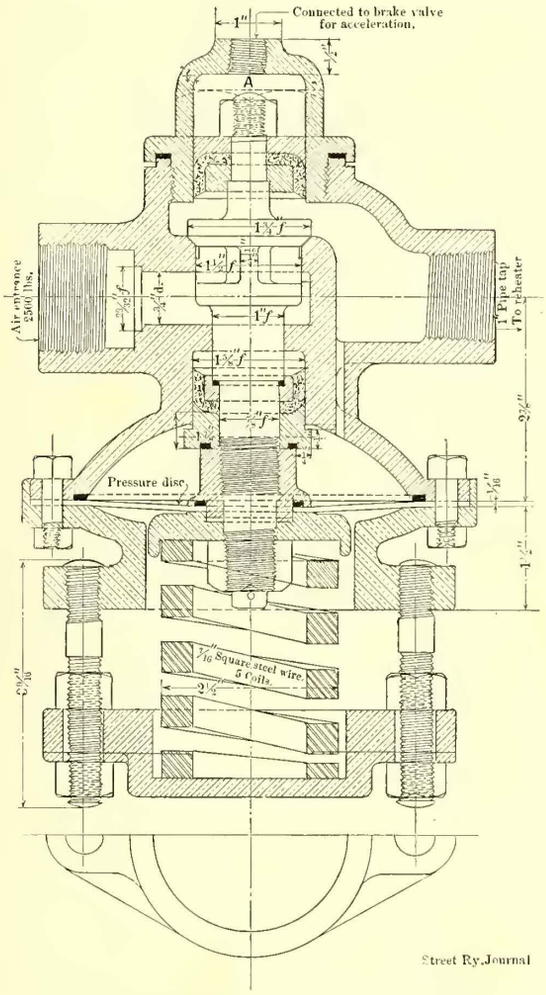


FIG. 2.—SECTION OF REDUCING VALVE

and the normal working pressure is now sufficient to close the valve against the spring and keep the motor in operation.

It will be noticed that the valve itself is connected by ribs or wings to a collar on the valve stem. This is done as a matter of safety. Should the valve stem break at any point under this collar, the entering high pressure would immediately open the valve, but the collar entering the seat prevents a dangerous rush of air into the working pressure reservoirs and pipes. It will also be noticed that the follower of the equalizing piston has a shoulder which will permit of 1-16 in. movement of the valve in ordinary working, so that the safety collar can never enter the seat unless the valve stem breaks.

After passing through the reducing valve, the air is at working pressure of 150 lbs., and is then led to the reheater, which is placed in the middle of the truck. This reheater contains about 500 lbs. of hot water, the temperature of which at the start is about 320 deg. F., but during a trip this temperature falls sometimes as low as 170 deg The air is passed into the bottom of this heater and escapes into the water through a perforated pipe lying along the bottom of the heater. When the reservoirs need to be recharged with air, and the car is run to the charging station for this purpose, steam is passed through this same perforated pipe to reheat the water.

During its passage through the water, the air is heated to the temperature of the water, and is then drawn off at the top through the perforated pipe *T*. The baffle plates shown are to prevent a swash of water caused by the car oscillation.

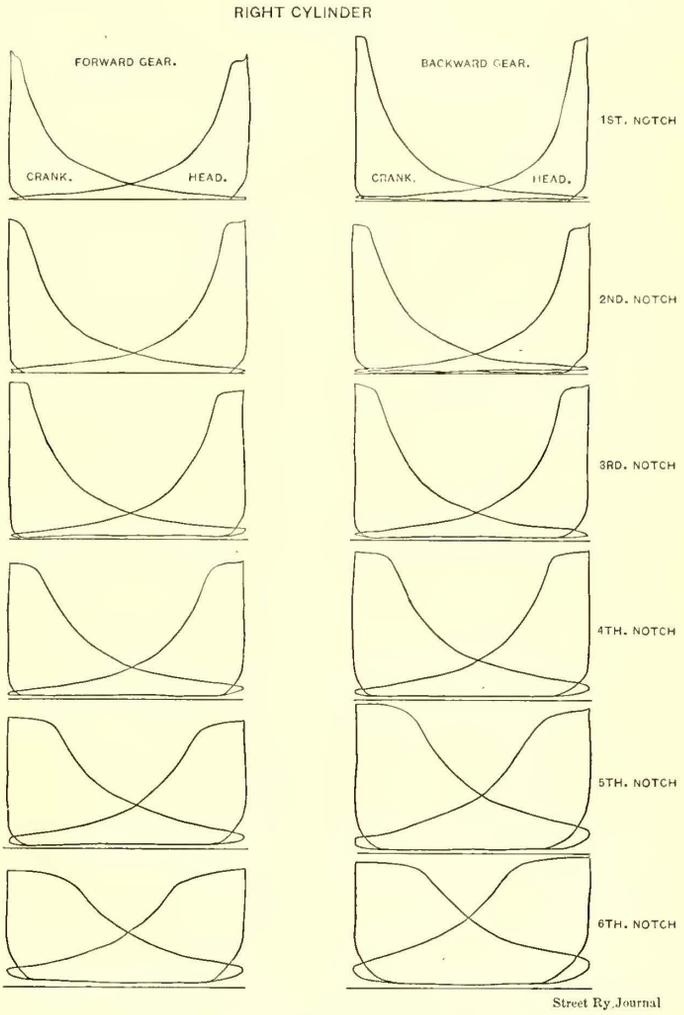


FIG. 3.—TYPICAL INDICATOR DIAGRAMS AT DIFFERENT NOTCHES

The efficiency of reheating is illustrated by the following test: A motor was run two trips, as far as possible each trip, on a full charge of air, first without heat and afterward with heat, covering 8 miles and 15 miles respectively; showing that the additional 7 miles were obtained from the heat, and careful measurements showed that the amount of heat used was 98,000 heat units. In ordinary practise, from 10 to 12 lbs. of coal will supply this amount of heat to generate steam in steam boilers. As this amount of steam injected into the water in the heater will restore the 98,000 heat units, it follows that the additional 7 miles were obtained on an equivalent of from 10 to 12 lbs. of coal.

Returning now to the cycle of operations, the air, which is now at about 150 lbs. pressure, and at a temperature of about 320 deg. F., passes from the perforated exit pipe *T* to the throttle valve of the motor, and thence to the valve chest of the engine in exactly the same way as steam in a steam engine.

The valve chest of the engine cylinders contains two valves, one the distribution or main valve, and the other the cut-off valve. These valves are operated in such a man-

ner that any degree of cut-off can be obtained, as illustrated by the indicator diagrams. Compressed air has this advantage over steam, that it does not condense during expansion in the engine cylinder. Therefore, expansion may be carried with economy clear down to atmospheric pressure. To do this in a steam engine would cause what is

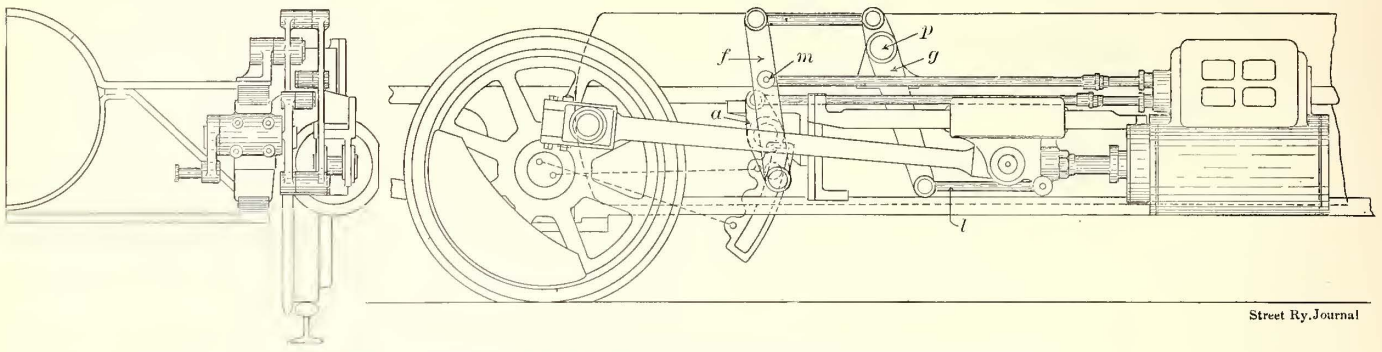
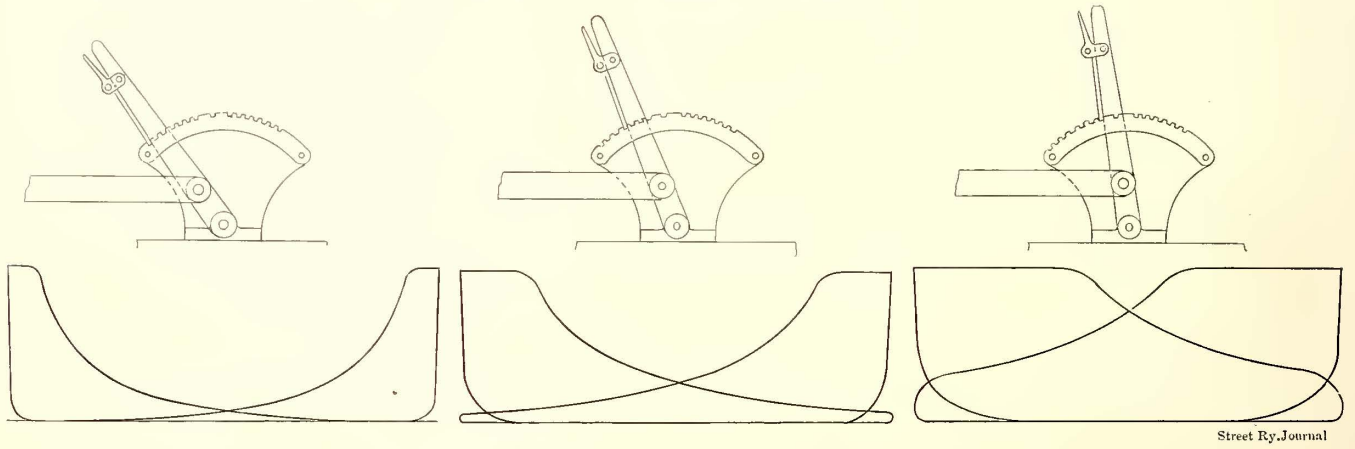


FIG. 4.—DIAGRAM OF ENGINE CYLINDER, SHOWING VALVE GEAR

RESULTS OF DISTRIBUTION OBTAINED BY HARDIE VALVE GEAR FOR THREE POSITIONS OF LINK, WITH 3-16 IN. INSIDE AND OUTSIDE LAP OF MAIN VALVE AND 11-16 IN. NEGATIVE LAP OF CUT-OFF VALVE
ADMISSION PORTS 2½ INS. X ⅝ INS. CYL. 6½ INS. X 12 INS.

First Position. Main Valve (Full) Travel 2 in.; Cut-off Valve Travel 2 in.							Second Position. Main Valve Travel 1½ in.; Cut-off Valve Travel 1 11-16 in.						Third Position. Main Valve Travel 1 in.; Cut-off Valve Travel 1½ in.					
Crank Angle	Cut-off Valve Opening		Main Valve Opening		Piston Travel		Crank Angle	Cut-off Valve Opening		Main Valve Opening		Piston Travel		Crank Angle	Cut-off Valve Opening		Main Valve Opening		Piston Travel	
	Front	Back	Front	Back	Front	Back		Front	Back	Front	Back	Front	Back		Front	Back	Front	Back	Front	Back
Deg.	In.	In.	In.	In.			Deg.	In.	In.	In.	In.			Deg.	In.	In.	In.	In.		
0	15-16	⅞	7-32	7-32	.0	.0	0	1	1 1-16	5-32	5-32	.0	.0	0	1 1-16	1⅛	⅛	7-64	.0	.0
10	21-32	19-32	3/8	3/8	.11	.08	10	13-16	⅞	¼	9-32	.11	.08	10	15-16	1	5-32	5-32	.11	.08
20	11-32	5-16	½	½	.42	.31	20	9-16	19-32	11-32	3/8	.42	.31	20	13-16	29-32	7-32	7-32	.42	.31
30	0	0	5/8	21-32	.94	.67	30	5-16	3/8	7-16	7-16	.94	.67	30	21-32	¾	¼	9-32	.34	67
40	— ¼	— ¼	11-16	¾	1.61	1.20	40	⅛	5-32	15-32	15-32	1.61	1.20	40	17-32	19-32	¼	5-16	1.61	1.20
50	— ½	— 15-32	¾	27-32	2.46	1 83	*50	— 3-32	— 1-16	9-16	19-32	2.46	1.83	50	⅜	7-16	¼	5-16	2.46	1.83
60	— 11-16	— 23 32	¾	⅞	3.39	2,62	60	— ¼	— ¼	9-16	19-32	3.39	2.62	60	¼	5-16	¼	5-16	3.39	2.62
70	— ⅞	— 29-32	¾	15-16	4.44	3.48	70	— 7-16	—13-32	9-16	5/8	4.44	3 48	70	⅛	5-32	7-32	5-16	4.44	3.48
80	—1 1-32	—1 1-16	¾	15-16	5.47	4.45	80	— 9-16	— 9-16	½	9-16	5.47	4.45	80	0	0	3-16	5-16	5.47	4.45
90	—1 3-32	— 1⅛	11-16	⅞	6.53	5.48	90	—21-32	— 5/8	7-16	½	6.53	5.48	90	—1-16	—1-16	5-32	9-32	6.53	5.48
100	— 1⅛	— 1⅛	21-32	25-32	7.55	6.54	100	—11-16	—21-32	3/8	7-16	7.55	6.54	100	— ⅛	—3-32	3-32	3-16	7.55	6 54
110	—1 1-32	—1 3-32	½	21-32	8.54	7 56	110	—21-32	— 5/8	5-16	3/8	8.54	7.56	110	—5-32	—3.32	1-64	⅛	8.54	7.56
120	— 15-16	— 31-32	13-32	½	9.39	8 62	120	—19-32	— 9-16	¼	9-32	9.39	8 62	120	—5-32	—3-32	— 1-16	1-32	9.39	8.62
130	— 25-32	— 27-32	9-32	5-16	10.17	9,54	130	— ½	— 7-16	3-32	⅛	10.17	9.54	130	— ⅛	—1-16	— ⅛	— 3-32	10.17	9.54
140	— 5/8	— 11-16	⅛	5-32	10 81	10 39	140	— 3/8	— 5-16	— 1-32	— 1-32	10.81	10.39	140	—3-32	0	— 3-16	— 5-32	10.81	10.39
150	— 13-32	— 15-32	— 1-32	— 1-32	11.33	11.06	150	— 9-32	— 5-32	— 9-64	— 5-32	11,33	11.06	150	0	3-32	— 9-32	— 9-32	11,33	11,06
160	— ⅛	— 7-32	— 7-32	— 7-32	11.70	11.58	160	— ⅛	— 1-32	— ¼	— 9-32	11.70	11.58	160	1-16	3-16	—11-32	— 3/8	11.70	11.58
170	⅛	3-32	—13-32	— 3/8	11.93	11.89	170	1-16	5-32	— 3/8	—13-32	11.93	11 89	170	¼	9-32	—13-32	— 7-16	11.93	11.89
180	15-32	13-32	— 9-16	—19-32	12.00	12.00	180	5-16	3/8	— ½	—17-32	12 00	12.00	180	7-32	5-16	—15-32	—15-32	12.00	12.00

* Cut-off at 47 deg. Average piston travel, 1.91 in.



Main cut-off and compression crank angle, 148 deg.
Lead angle of crank—front, 12 deg.; back, 12 deg.
Point of cut-off, not including clearance, $\frac{1}{14.81}$ of stroke
Point of cut-off, including clearance, $\frac{1}{9.54}$ of stroke
Greatest port opening, 7-16 in.
Relative travel of main and cut-off valves, 3⅝ in.

Main cut-off and compression crank angle, 138 deg.
Lead angle of crank—front, 13 deg.; back, 13 deg.
Point of cut-off, not including clearance, $\frac{1}{6.29}$ of stroke
Point of cut-off, including clearance, $\frac{1}{5.19}$ of stroke
Greatest port opening, ⅜ in.
Relative travel of main and cut-off valves, 2 11-16 in.

Main cut-off and compression crank angle, 117 deg.
Lead angle of crank—front, 18 deg.; back, 18 deg.
Point of cut-off, not including clearance, $\frac{1}{2.42}$ of stroke
Point of cut-off, including clearance, $\frac{1}{2.29}$ of stroke
Greatest port opening, 9-32 in.
Relative travel of main and cut-off valves, 1⅝ in.

The variation of cut-off is effected by changing position of reverse lever (see above sketches), and grades of cut-off are obtainable between those given in the tables, the earliest grades being when lever is full over, so as to give valve full throw. In this position there is also the greatest amount of lead. Cut-off, including clearance, means $\frac{\text{piston travel at cut-off + clearance}}{\text{stroke of piston + clearance}}$; clearance in cylinder, 4 per cent.

Inside and outside lap being equal, main valve cut-off and compression take place at the same point.

The greatest port openings noted above are taken at the point where cut-off and main valve openings are equal, the cut-off closing while the main valve is opening. In the earlier grades this takes place near beginning of stroke when piston is moving slowly, and in the later grades when motor is moving slowly. There is always ample exhaust opening.

Readings were taken at equal crank angles for convenience, but valves would be set to cut-off at equal piston movements from each end of cyl.

known as cylinder condensation. Steam engines are compounded principally to reduce this cylinder condensation to a minimum, but this is not necessary with compressed air.

It was necessary to contrive a valve mechanism which would not be too complicated to operate, and yet obtain the best results. The valve mechanism which is attached to these motors is illustrated in Fig. 4. The usual Stephenson link motion is used to operate the main valve, but on the outside of the link there is an arm *a*, looking down as well as up. At the lower end of the lower arm is attached the lower end of a floating lever, *f*. The upper end of lever *f* receives a reduced motion, which is the opposite of the piston, through the lever *g* and link *l*, lever *g* being pivoted by a bracket attached to the frame at the point *p*. It will be observed that the lower end of floating lever *f* receives a motion directly the opposite of the main valve, and that its upper end has a motion directly the opposite of the piston rod. This lever *g* is attached to the cut-off rod at the point *m*, and gives to the cut-off valve a motion which is the resultant of the other two. The consequence is that when the main valve is traveling in full gear, the cut-off valve is also traveling at its longest stroke, and gives the earliest cut-off. When, however, the link motion is "cut back" so as to reduce the motion of the main valve, it gives a later cut-off. The indicator cards, shown in Fig. 3, indicate the effect of this. The first notch indicates the full travel of both valves, and each succeeding notch a reduced travel of both valves, showing a later cut-off. It will be observed that the latter grades show some terminal pressure which produces an audible exhaust, but these grades of cut-off are used only for starting the motor, and the lever is immediately moved to a position corresponding with either of the first three notches, according to the power required, which depends upon the loads and grades. It will be observed while cutting off at the earlier notches there is a freer exhaust, which will more readily free the cylinder when going fast. In the ordinary locomotive the cutting off is effected by the link motion only, with the result that the exhaust openings are diminished.

It will also be observed that the various grades of cut-off within the control of the motorman are effected by the same lever which reverses the motion, thus simplifying the operation of the motor very materially, and bringing it within the comprehension of the average street railway employee.

The weight of the entire equipment is said to be practically the same as an electric equipment, and all parts are flexibly supported on the axle box by means of four semi-elliptical springs, after the most modern locomotive practise. This support is entirely separate from that of the car bodies, which are carried on a different set of springs resting on the frame of the truck. In this use of flexible suspension, the system differs radically from the former air motors used on the Twenty-Eighth and Twenty-Ninth Streets line, where the case carrying the motors rested directly on the axles.

There remains now only one portion of the equipment to be described, *i. e.*, the air brakes. The air brake cylinder is illustrated in section in Fig. 6. In applying the brakes air is admitted to the annular space *R*, around the hollow piston rod, and to release the same air is made to pass to the other side of the piston from *T* around through *V*, thus equalizing on both sides of the piston. Having a larger area to act upon on the other end, the brake is released at once, the air escaping silently through the small opening

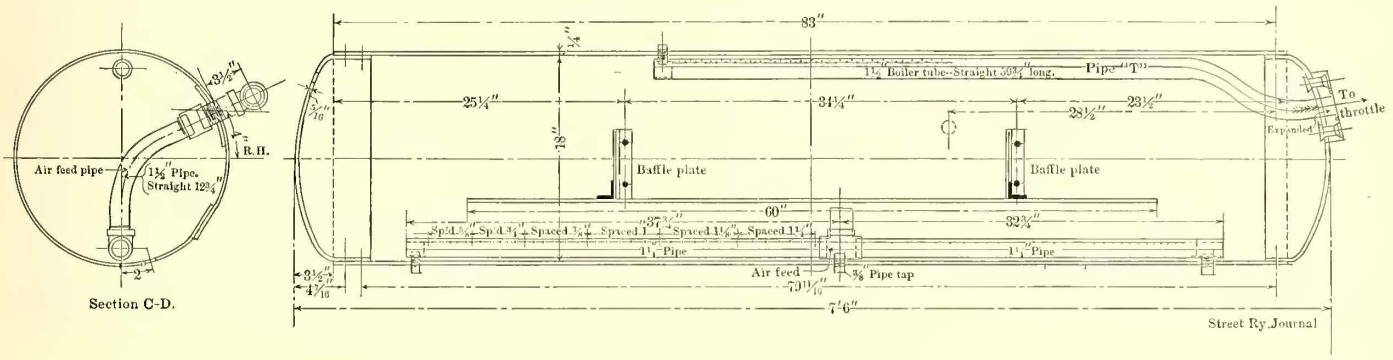


FIG. 5.—SECTIONS OF REHEATER

S, and out to the atmosphere through the openings at *W*, at the end of the plunger.

The Twenty-Eighth and Twenty-Ninth Street railway is now being operated by horses pending the change from the Hoadley-Knight to the Hardie motors. There is every reason to expect that these new motors will be successful, because Mr. Hardie has had more experience in this line than any other engineer in the United States, and has made the subject a special study for years. He has, moreover,

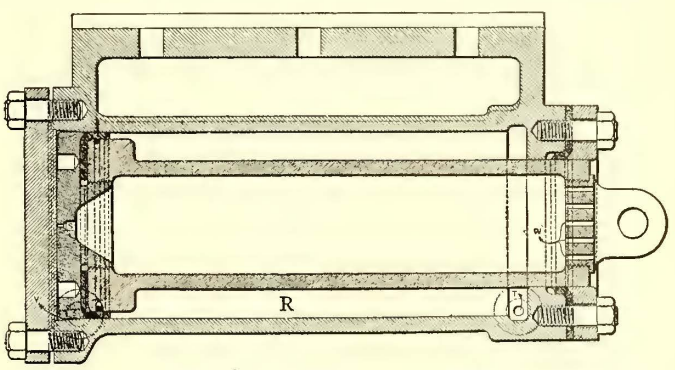


FIG. 6.—AIR BRAKE CYLINDER

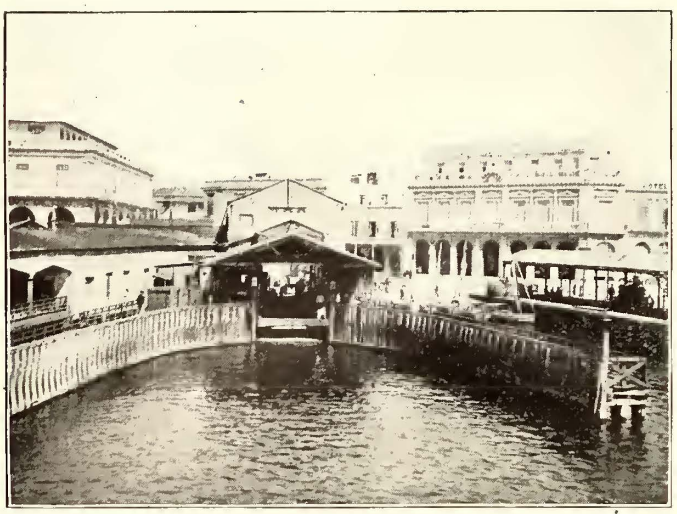
held many responsible positions, and stands high in the profession. His standing among engineers is well expressed in the following extract from *Compressed Air*: "His mechanical ideas are marked by much individuality, the elements of simplicity being prominent. It is doubtful if any one has had as much experience as Mr. Hardie in pneumatic traction, and he is the acknowledged authority on the subject."

The work of transforming the Lexington Avenue line in New York from a cable to an underground trolley road is completed between 105th Street and Twenty-third Street. The final change from cable to trolley, however, is not to be made until the work is finished in Broadway, as the managers of the Metropolitan Street Railway Company believe the patrons of the road would not relish a change at Twenty-third Street from the trolley cars to the cable car in Broadway. The Columbus Avenue line is now being changed, and President Vreeland believes that both the east and west side cable lines and the Broadway line above Twenty-third Street will be finished by Nov. 1.

The Electric Railways of Havana

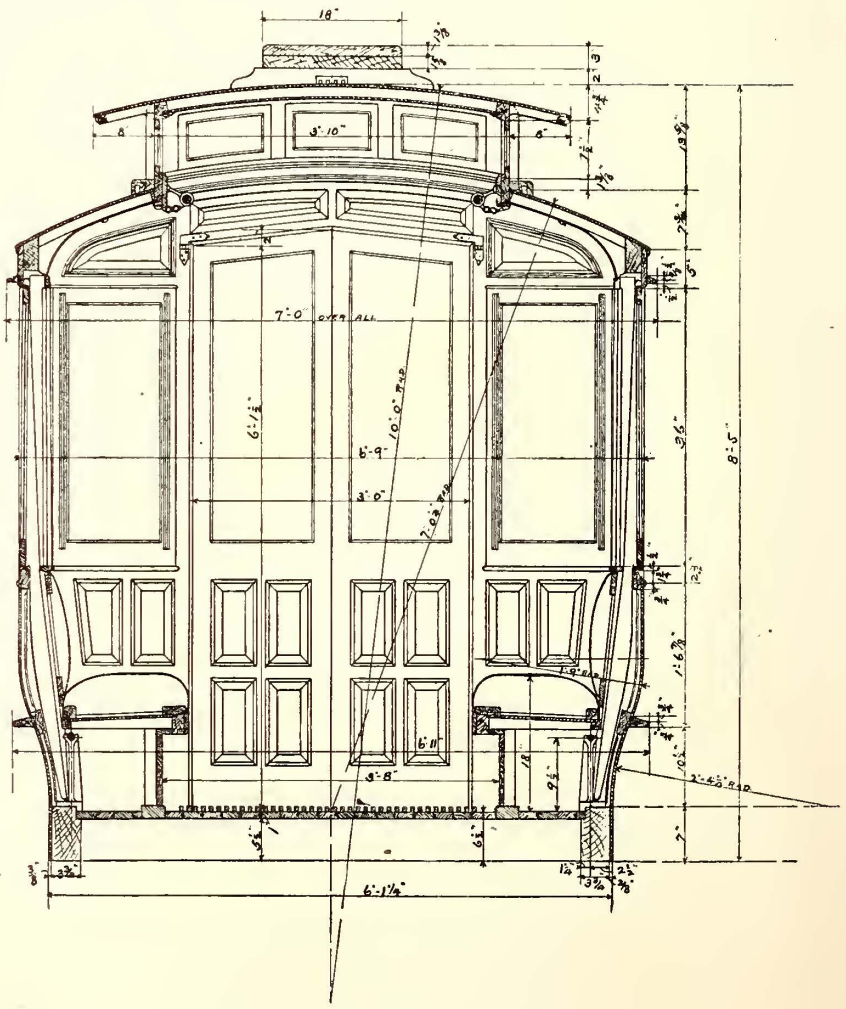
The city of Havana is located upon a peninsula and is very densely populated. The unhealthy condition of the city is, to a considerable extent, due to this dense population. There is a good chance for development of the suburbs in various directions, and as soon as a good system of rapid transit is provided these suburbs will grow rapidly. In the immediate vicinity of Havana are some very fine suburbs, particularly Carmelo and Vedado. This quarter is located upon the seashore a few miles from the city, and is now inhabited by the wealthier classes and by foreigners. It is now considered the healthiest location in the vicinity of Havana. Beyond this about 4 miles is a very fine beach, Maraino. The census of 1887 showed the population to be about 250,000. There was considerable increase since that date up to the time of the last war, when the population naturally fell off, and it is estimated that at present the population is about 275,000. It is estimated that the population in 1905 will be about 400,000. Up to the time of the organization of the Havana Electric Railway Company the street railway system, Ferro Carrill Urbano, consisted of about 25 miles of track located upon 13 miles of streets. Considering the size of the city, this amount of mileage was totally inadequate for the proper accommodation of the public, and, based on the experience in American cities, could be increased to three or four times the amount with advantage. The "Ferro" operated sixty-one cars and eleven steam engines. The number of passengers carried on the street railway lines before the war reached about 7,500,000 per year, even at the high rates of fare of 15 cents, 10 cents and 5 cents, which were charged on many of the lines. The Havana Electric Railway Company, which has taken over the property of the "Ferro" Company, has now in course of construction about 80 miles of track, and proposes to operate about 120 cars.

Before construction could be commenced it was necessary to submit to the Governor of Havana plans showing routes and details of construction, as well as specifications, plans and estimates for equipping the lines with electric motive power. The requirements of the Department of Havana were that the electrical system to be provided must be safe, rapid, elastic as to speed, comfortable, clean, convenient, flexible enough to serve all routes and sections of the city and suburbs, and cheap to operate and maintain. This would enable the dense population of Havana to spread out and live in a more healthful manner.



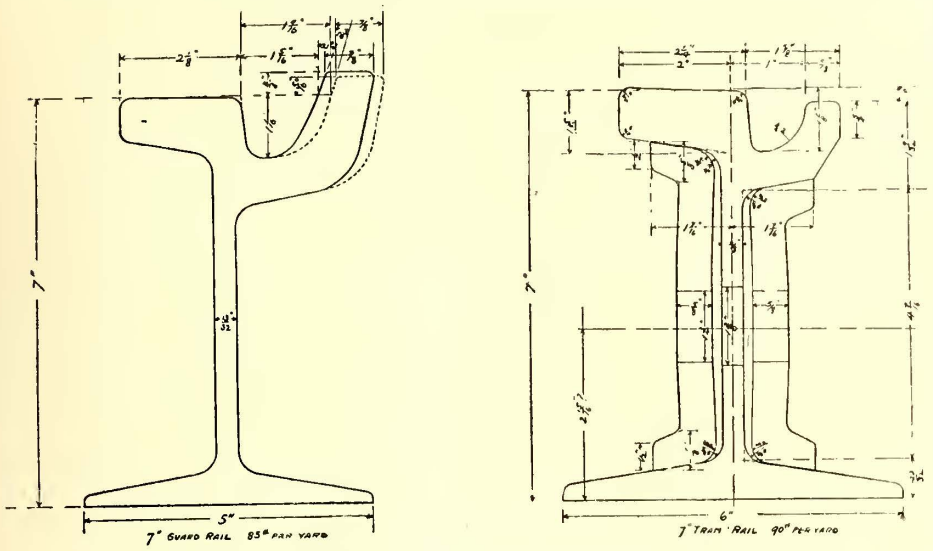
VIEW OF FERRY TO REGLA, OWNED BY THE CUBAN ELECTRIC CO.

Owing to the narrow streets in part of the city it was deemed proper to fix upon two maximum rates of speed on narrow streets, the average speed to be 6 miles per hour and maximum 8.5 miles per hour, and on wide streets the



SECTION OF STANDARD CAR, HAVANA

average speed to be 8.5 miles per hour and maximum 14 miles per hour. On each route cars will be run on a varying schedule to suit the requirements of travel, starting with ten-minute headway, reducing the headway to 7½ minutes and then to 5 minutes, so that during six hours daily the headway on each of the four lines will be 2½ minutes. Night-car service will be established from midnight until regular day-car service.



SECTIONS OF STANDARD RAILS

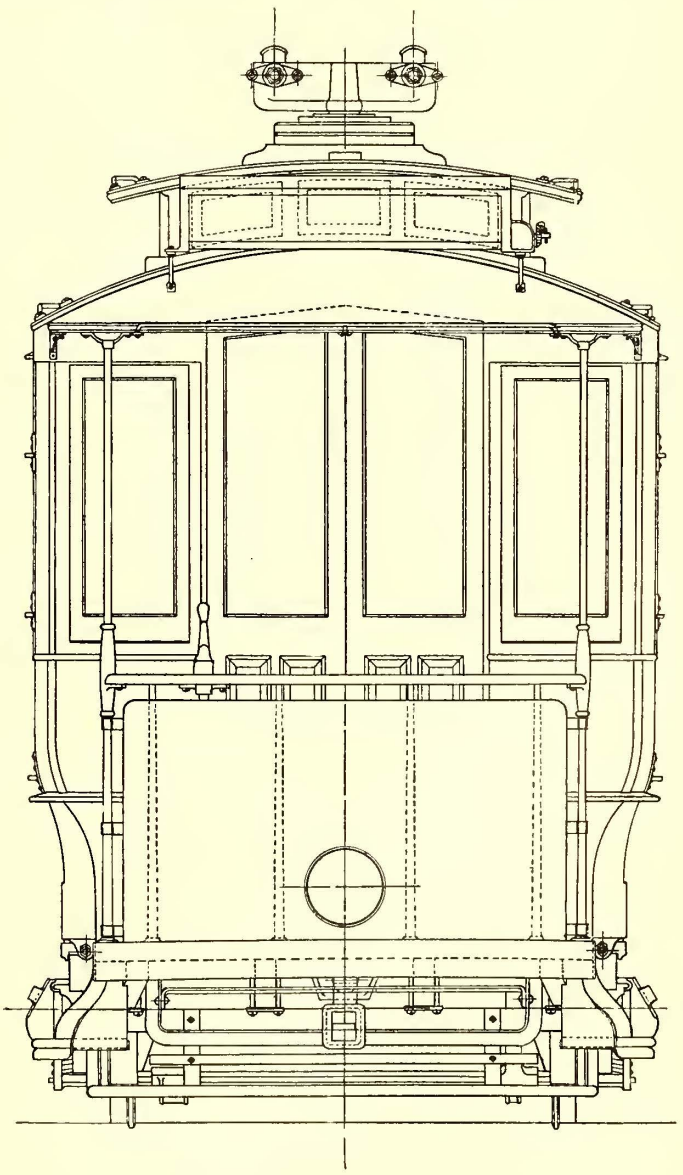
The cars, which are being made by the Jackson & Sharp Company, will have a seating capacity of twenty-six passengers and a maximum load of forty-five passengers. There are 120 of these cars, each being equipped with two Parmenter fenders. The cuts give a good idea of their construction.

The general dimensions of the car bodies are as follows: Length over all, 29 ft. 6½ ins.; length of body, 20 ft.; width of body over all, 7 ft.; height of body, 8 ft. 5 ins.; track gage, 4 ft. 8½ ins.; diameter of wheels, 30 ins.; wheel base, 7 ft.; type of truck, McGuire, A-1 suspension. Each motor car to be equipped with two General Electric 52 motors, capable of developing continuously for one hour 25 hp each without increasing the temperature of the motor windings more than 75 degs. C., and when so working to have not less than 77 per cent efficiency. If found necessary, freight cars will be placed on the lines to carry freight and express packages.

The track construction consists of 7-in. girder-rail, weighing 90 lbs. per yard, laid on concrete stringers, with standard soft steel ties 5 ft. 9 ins. in length and 7 ins. wide. The rail is fastened to the ties by clips or chairs, as shown in the illustration. The special track work will be of a design known as Adamantine construction. The rails, ties, etc., are being supplied by the Pennsylvania Steel Company. Between the rails and to a distance of 22 ins. outside the paving will consist of pyrogranite, asphalt and Macavoy brick. Beyond that limit the ordinary macadam will be used on the roadway.

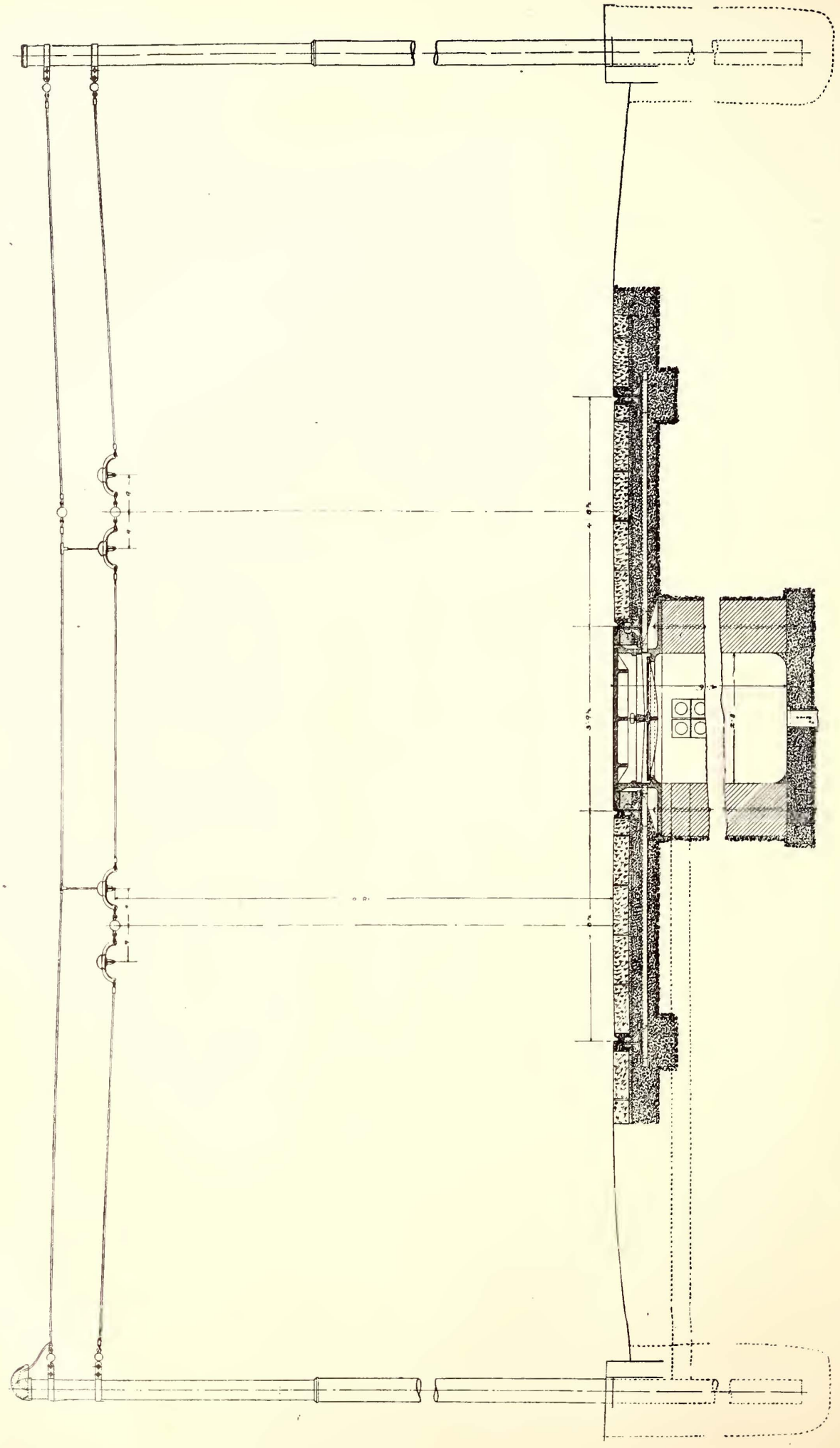
Most of the poles for the overhead construction are made of heavy iron pipe in two sections, the lower section being 6 ins. in diameter and the top section 5 ins. in diameter. The lower section is shrunk onto the top section, the poles when finished being 26 ft. over all. On narrow streets the overhead wire will be supported from hangers attached to the buildings, or the construction shown in the accompanying drawing will be used. All poles are to be set 6 ft. in the ground in concrete, the holes for receiving the poles being not less than 24 ins. in diameter. The span wire to be used is No. 7 galvanized iron wire. The Havana authorities have insisted that the double overhead trolley system be installed. The two trolley wires erected over each track, one for each side of the circuit, are 18 ins. center to center, the trolley wire being of hard drawn copper wire .325 ins. in diameter. The trolley wires are supported from the span wire by double curve insulators composed of a malleable iron body, screw cap and cone insulators and bronze ear, the ears being securely soldered to the trolley wire. The poles are being supplied by the Electric Railway Equipment Company, and the overhead material by the A. & J. M. Anderson Manufacturing Company. All feeder wires will be laid beneath the surface of roadway in ducts made of Potomac terra cotta. The feeders consist of 1,000,000-circ. mil and 500,000-circ. mil cables. All feeders were supplied by W. R. Brixey.

The power-station equipment consists of three vertical cross compound condensing engines with 48-in. stroke, high-pressure cylinder 23 ins. in diameter, low-pressure cylinder 60 ins. in diameter. The



END ELEVATION OF STANDARD CAR

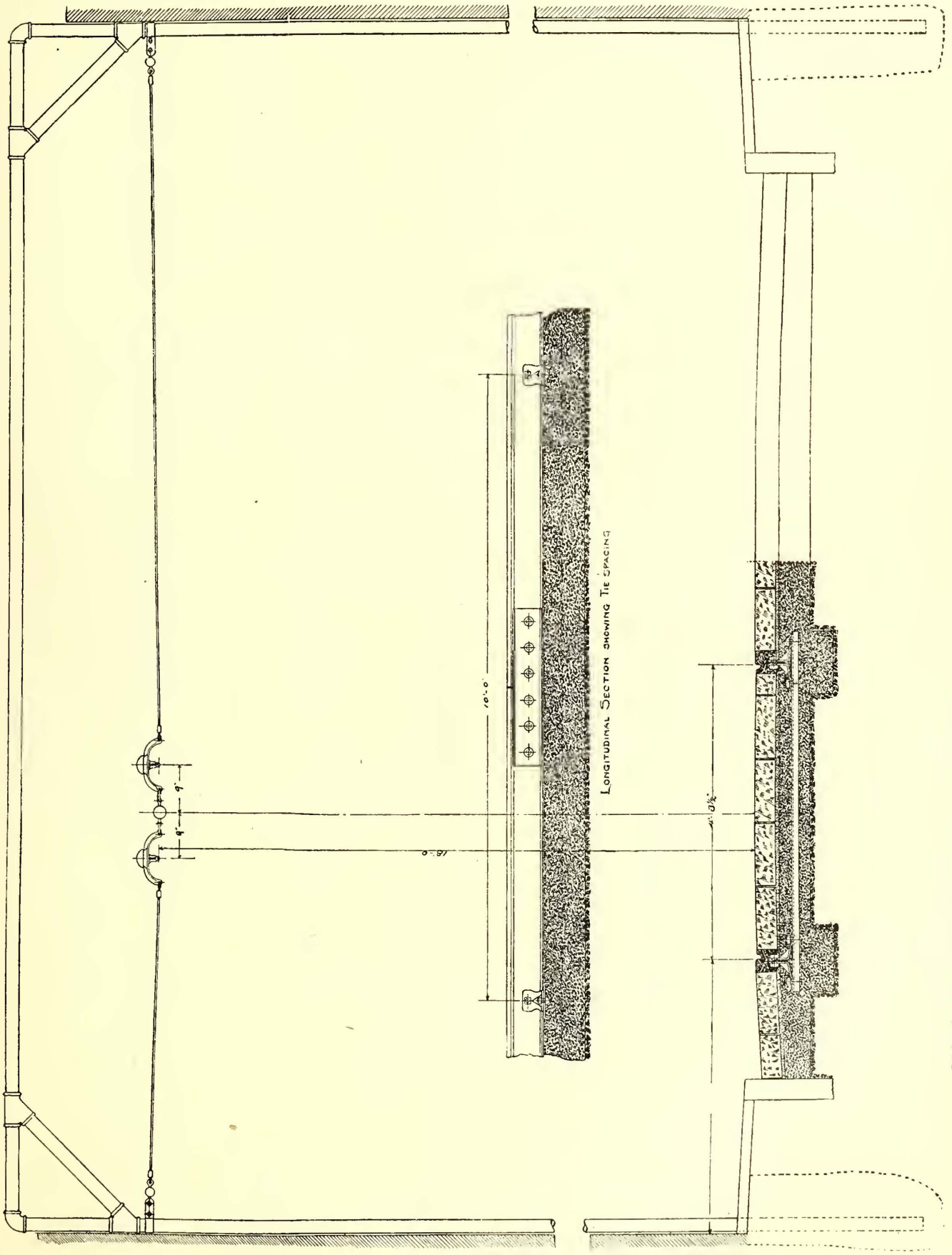
engines are of the E. P. Allis make, and are to be operated at 80 r. p. m., with 125 lbs. steam pressure. The



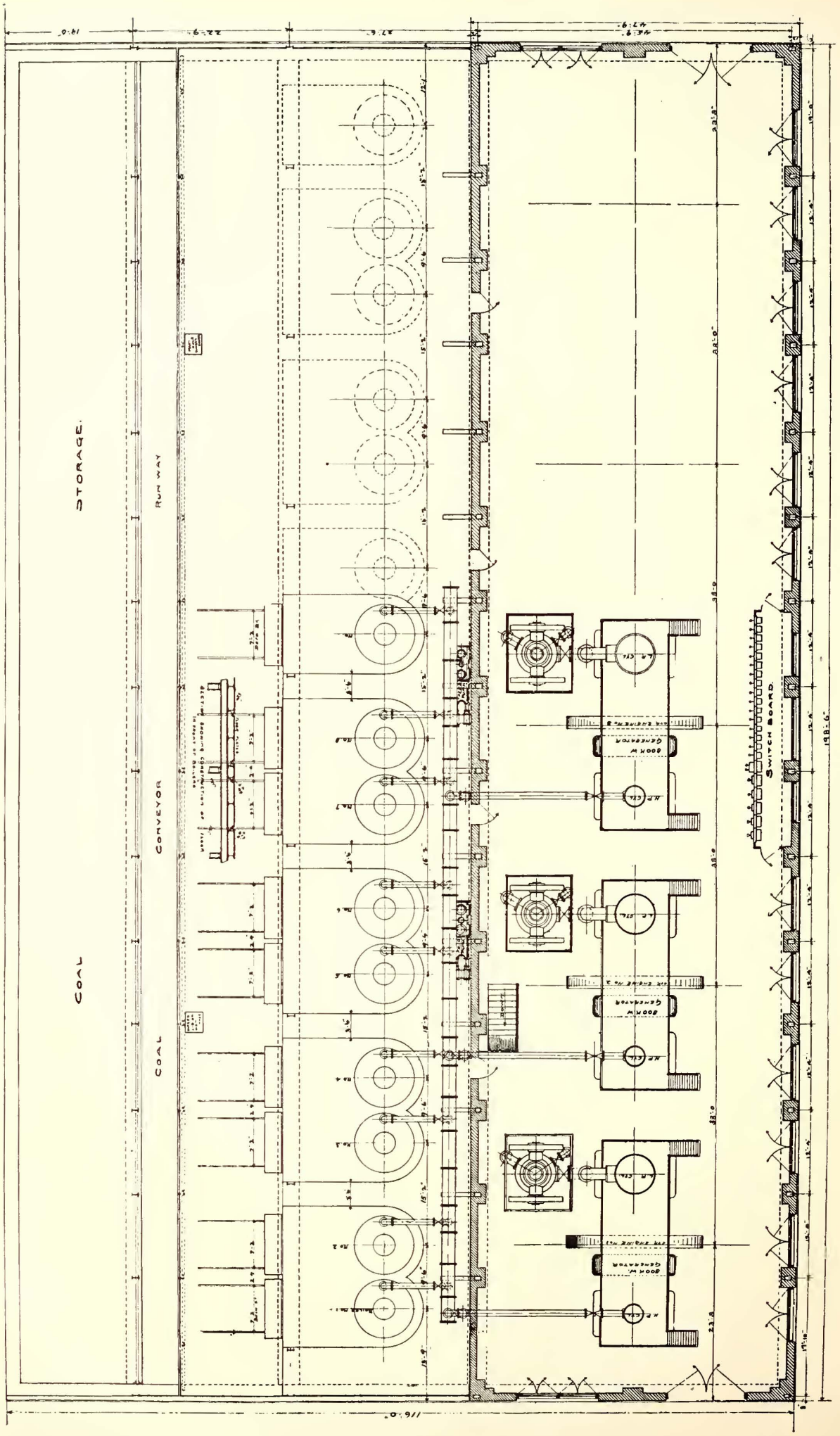
SECTION OF TRACK AND OVERHEAD CONSTRUCTION IN BROAD STREETS, SHOWING DOUBLE OVERHEAD WIRES AND UNDERGROUND FEEDER CONDUITS

boiler plant consists of nine vertical water-tube boilers of 250 hp each, set in three batteries. The boilers are of the Cahall vertical type.

The electrical equipment consists of three 850-kw generators of the General Electric Company's manufacture, voltage being 550, complete switchboards and accessories being furnished. A 50-kw Triumph dynamo is also included for lighting purposes. The power house building will be of steel construction, 198 ft. 6 ins. long by 96 ft. 6 ins. wide with a span in engine room of 45 ft. and a span over boilers of 51 ft. The walls of the building are to be of brick laid in lime mortar. The interior wall will be laid with enamel brick for a wainscot 6 ft. in height. The engine-room roof will be constructed of concrete laid on and between the steel purlins and covered with tile laid in cement. The roof over the boiler room is to be constructed of corrugated



SECTION OF TRACK AND OVERHEAD CONSTRUCTION IN NARROW STREETS, SHOWING OVERHEAD PIPE BRACE

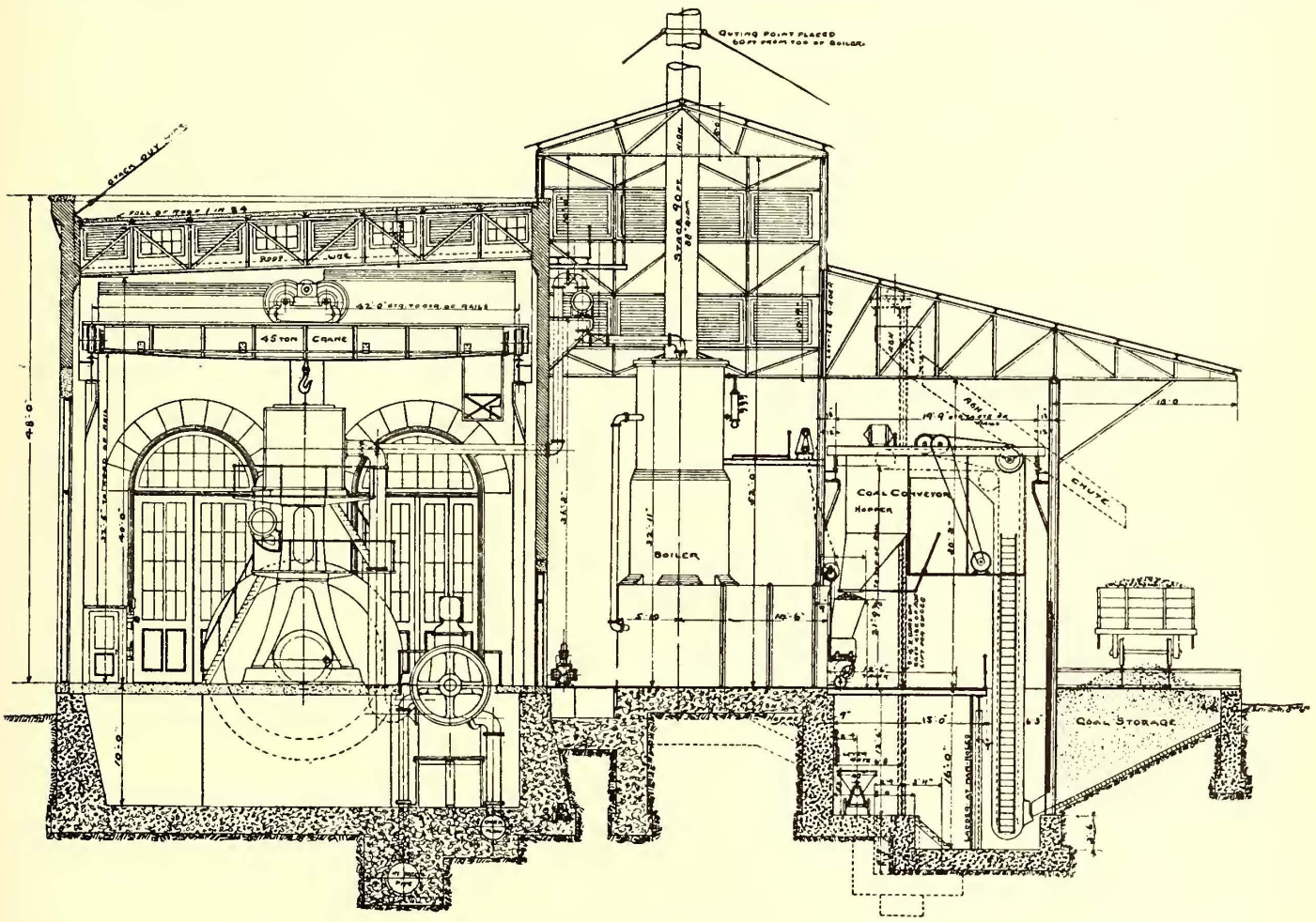


PLAN OF POWER STATION, HAVANA

iron securely fastened to the steel purlins. It is proposed to make the fare 5 cents, United States currency, anywhere in Havana. Transfer tickets will be given at intersecting points. The lines immediately within the city are expected to be in operation by Dec. 1, 1900. The Havana syndicate consists of Thomas F. Ryan, of New York; W. L. Elkins and P. A. B. Widener, of Philadelphia; A. Marcus, of New York, representing the French and English interests; Sir William Van Horne, Hanson Brothers, bankers; W. M. Doull and Frederic Nicholas, all of Montreal; William Mackenzie, of Toronto; A. H. Paget, Col. G. B. M. Harvey, F. S. Pearson, Percival Farquhar, of New York. G. F. Greenwood, formerly of Pittsburgh, is chief engineer and general manager. Owing to the many arduous conditions, the engineering work involved required unusual study and ability, and the successful results already shown are a tribute to Mr. Greenwood's skill and foresight.

Across the harbor from Havana and connected with it by ferry is the town of Regla. On March 10 last the first Cuban electric railway was opened, between this town and that of Guanabacoa, 4 miles inland. This line is part of the former Le Prueda Railroad Company's system, which was the first railway in Cuba to be operated by steam power, and is likewise the first to adopt electricity for its motive power. Originally, in 1858, the company was inaugurated for transit across the bay, and was known as the Primera Empresa de Vapores de la Bahia movidos porfuerza animal. Since then the town of Regla has developed into a suburb of 10,000 people, and the town of Guanabacoa has 20,000 inhabitants, and both contribute most of their working population to the main city of Havana, so as to require not only ample, but prompt, transit between the two points most of the day. With the electric cars and boats from the Lux wharf, this demand is now supplied in the most modern fashion.

The Cuban Electric Company bought the road on Jan. 16, 1899, and at once began the work of change of motive power. The company is organized under the laws of New Jersey with the following officers: President, Hon. A. F. Gault, of Montreal; directors, W. M. Doull and Wm. Hanson, Montreal; B. F. Pearson, Halifax, N. S.; F. S. Pearson and Col. G. B. M. Harvey, New York; general manager, A. C. Goudie. The company operates two ferry boats between the city of Havana and the town of Regla.



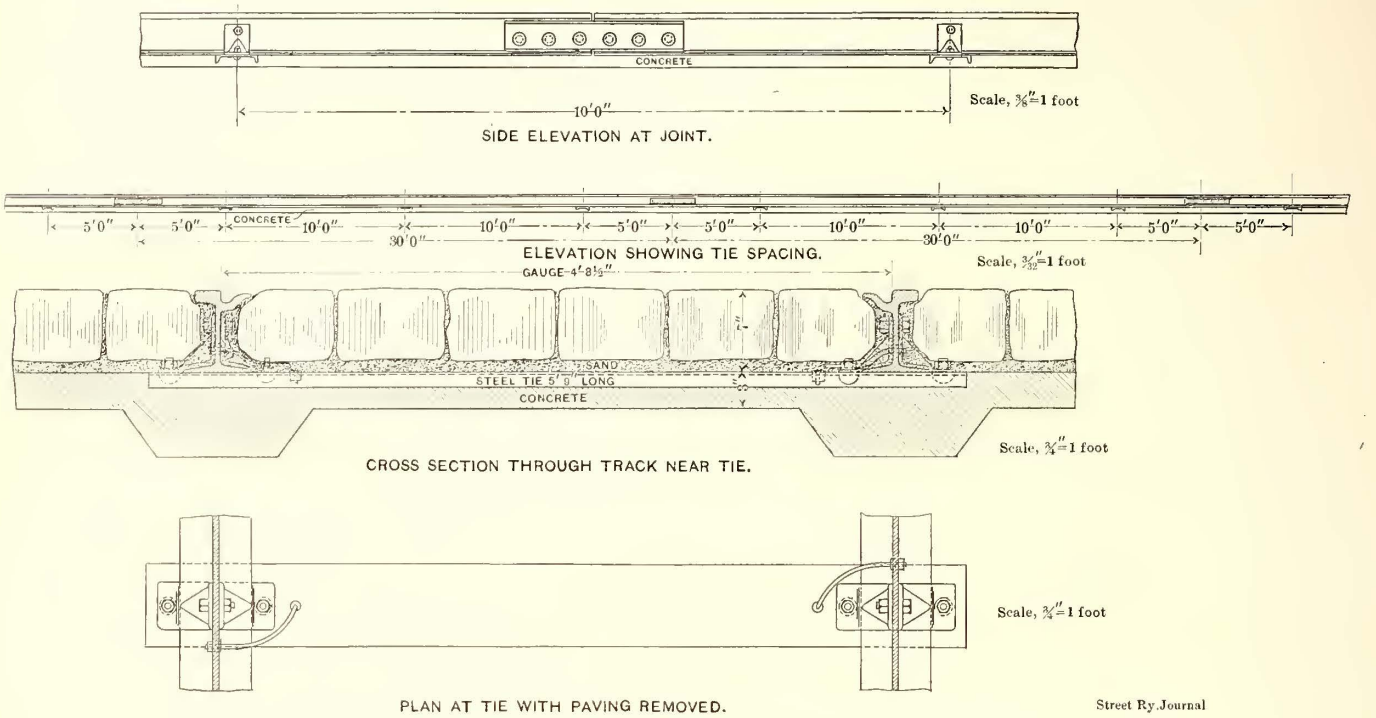
CROSS SECTION

SECTION OF POWER STATION, HAVANA

The trolley line begins at the ferry landing in Regla, and, after a winding course through the town and over private right of way, leads out into the open country through abandoned farm lands, where cool sea breezes greet the passengers. In the near future it is proposed to extend the line to the town of Cojimar, about 1 mile beyond Guanabacoa. In Guanabacoa the company is now constructing a pleasure park, where concerts and entertainments will be held and refreshments served. Later it is proposed to install an electric fountain. Besides the income from the transportation of passengers, the receipts from the passage of vehicles on the ferry line are considerable. Ample provision is made for their accommodation in the ferry houses. The present terminal at Regla is soon to be replaced by a modern steel frame building and proper facilities for handling the traffic. The electric cars are to run in between platforms which lead directly to the ticket booths and waiting rooms.

The track construction consists of both girder and T-rail.

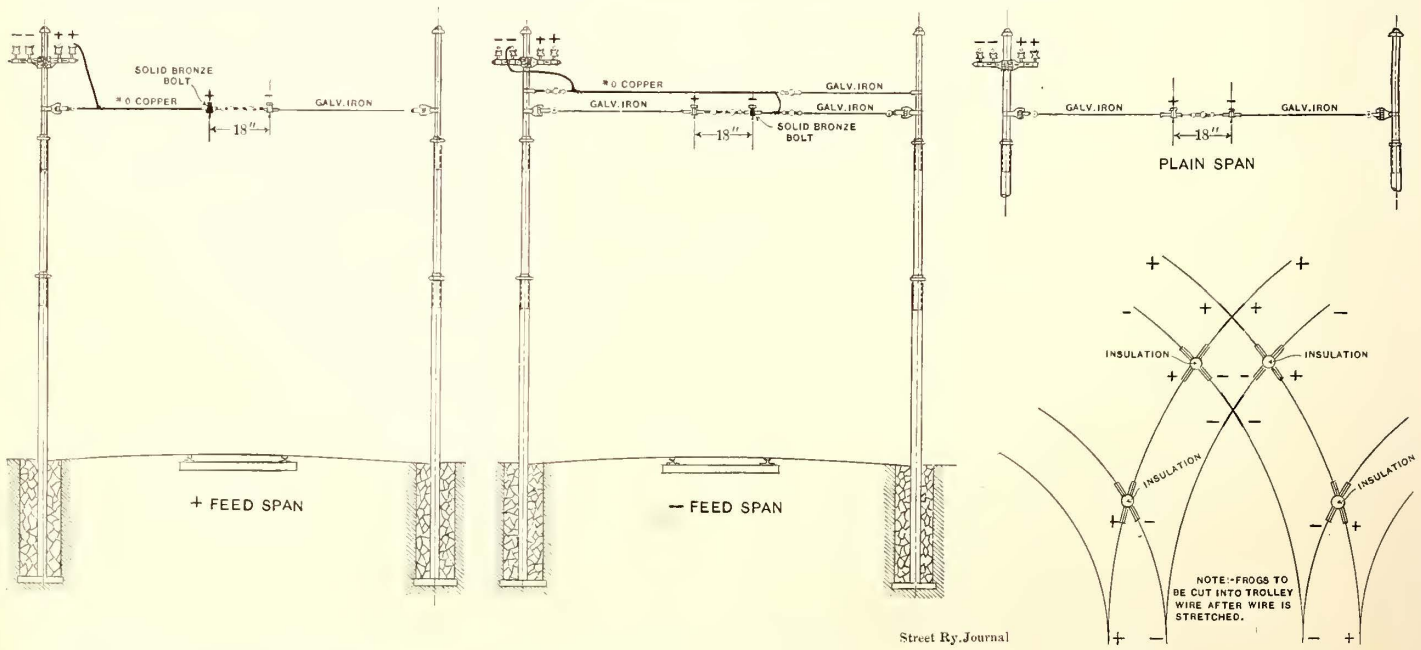
The girder-rail used is the Pennsylvania Steel Company's section No. 272, weighing 62 lbs. to the yard, and is laid on and securely bolted to steel cross-ties spaced 10 ft. apart on a longitudinal bed of concrete. The T-rail is of the Pennsylvania Steel Company's section No. 243, weighing wire. For a portion of the road the trolley wires are supported by single-pole brackets, but in general the span wire suspension is used. The maximum distance between poles is set at 125 ft. The feeders are of 500,000-circ. mil cable, and in Guanabacoa 00 grooved trolley wire is used. Light-



PLAN AND SECTION OF TRACK CONSTRUCTION, CUBAN ELECTRIC CO.

90 lbs. to the yard. The T-rails are laid on native hardwood ties 6 ft. x 6 ins. x 8 ins. spaced 2 ft. apart, on which they are securely spiked. The return circuit to the power station being by means of the trolley wire and overhead feeders, the track is not bonded. On account of local conditions the authorities, as in the city of Havana, com-

ning arresters for the protection of the line from lightning have been installed. The wire for the overhead construction was furnished by the American Steel & Wire Company, John A. Roebling Sons' Company and the General Electric Company. Line material, by the A. & J. M. Anderson Manufacturing Company.



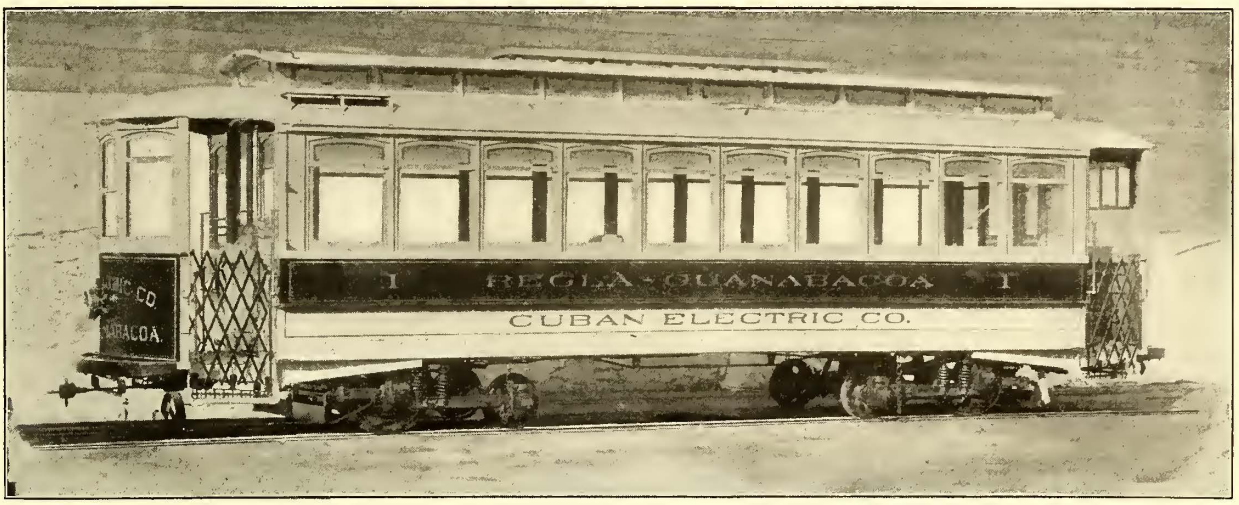
VIEWS OF TROLLEY SPANS WITH PLUS AND MINUS FEEDER CONNECTIONS, AND PLAN OF DOUBLE TRACK Y, SHOWING LOCATION OF INSULATORS

pelled the company to install a double overhead trolley system. The construction is much like that described above, except that overhead feeders are used. The illustrations show the peculiar precautions which must be taken with the double trolley construction at turnouts and where the positive or negative feeder is connected to its respective

The rolling stock consists of four 28-ft. vestibuled cars of the J. G. Brill Company's make, mounted on Eureka maximum traction trucks. The old cars of the company are used as trailers. The seats of the new cars are upholstered in cane and arranged transversely with an aisle through the center, having a seating capacity of forty pas-

sengers. The cars are equipped with the West End type of fender. The motor equipment consists of two Westinghouse No. 38-B, 50-hp motors.

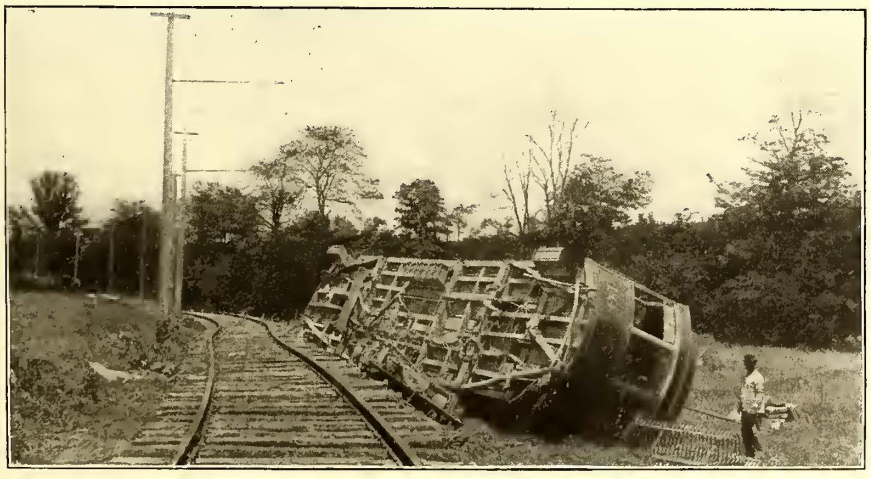
The power-station equipment consists of two horizontal tandem compound condensing side-crank engines made by the Robb Engineering Company, Amherst, N. S., directly connected to two Westinghouse 150-kw generators, the voltage at full load being 550 volts. The entire electric equipment of the power station was furnished by the Westinghouse Company. The steam, exhaust and water piping, with valves and fittings, were furnished by the Robb Engineering Company. The boiler equipment consists of one battery, 400 hp, of Cahall vertical boilers furnished through Thayer & Company. The power-station building is of steel construction, and was furnished by the Ritter-Conley Company. Two iron tanks are used, having a capacity of 10,000 gals., for the purpose of supplying the water for condensing purposes, these tanks being connected to the roofs of the buildings by drips, so as to catch the rainwater.



STANDARD 28-FT. MOTOR CAR, CUBAN ELECTRIC CO.

An Accident on the Cincinnati, Lawrenceburg & Aurora Street Railway

The accompanying illustration shows an accident which took place on July 4 on the Cincinnati, Lawrenceburg & Aurora Street Railway, caused by the breaking of a flange on the outside front wheel of the rear truck. The piece of the flange broken out was 12½ ins. long, and was broken off at a point 3 miles from where the accident occurred.



ACCIDENT NEAR AURORA

The car was running 20 miles per hour on a 1000-ft. curve, when it left the rails. The motorman applied the brakes, and stopped the car after it ran 150 ft. on the ties. The car had come to a stop before it turned over, and although there were thirty-four people aboard no one was seriously hurt, except a boy who jumped from the rear platform just as the car turned over; he was caught under the corner post and killed.

The irregular bend in the track, as shown in the engraving, was caused by throwing over the track after the accident occurred, in order to clear the line. The car itself was but slightly injured.

The accompanying illustration was furnished by J. B. Crankshaw, engineer of the road.

Street Car Building

(Stephenson Practice.)

BY CHARLES HENRY DAVIS, C. E.

VII.—Assembling—(Continued)

In the July issue of the STREET RAILWAY JOURNAL we gave the details of the bodies for our two standard cars, namely, the Boston (closed) and the Brooklyn (open). Tables Nos. 35 and 36 give respectively the details of roofs for the standard cars, while Plates VII. and VIII. illustrate the various parts. As in tables Nos. 31, 32, 33 and 34, each distinct part of the roof is described, giving the material, the general dimensions, how made, on what tools and how assembled, all in consecutive order as each car is built in the shop. In using these tables they are to be read across the page, line by line, as in the case of any book. In Column 1 the numerals indicate, in consecutive order, the number of distinctive pieces; where a letter follows the numeral it indicates another operation, but not another distinctive piece. Letters in Column 4 are the same abbreviations of wood work and metal work as used on Plates I. and II. These tables are given on the following pages.

TABLE NO. 35

DETAIL OF ROOFS AND BONNETS OF BOSTON CLOSED CAR, IN THE ORDER OF ASSEMBLING

(25 ft. Body; Car No. 2; Fig. 3; Plates I. and VII.)

Consecutive Number	Quantity	Name of Piece	Piece Number Plates I. and VII.	Material See Plates I. and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate VII	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									During the erection of the sides and ends of the body (*see Table No. 33 and Plate V.*), the assembling of the pieces composing the framework of the "Moniter" roof has been proceeded with independently as follows:—	
104	2	**Ventilator plain-bottom-rails** (Figs. 197, 198)	2002	A.	--	----------	--	25 ft. 0 in. x 4½ in. x 1⅝ in.	Each having:—	
					2	Mortises	--	1¼ in. x ½ in. x 4 in.	Not seen, one at each end, for ventilator side-corner-posts (2003) to tenon into, with two holes for dowel-pins	Hollow chisel mortiser
					8	Mortises	a	1⅝ in. x 1¼ in. x ½ in.	For ventilator side-posts (2005) to tenon into, with holes for dowel-pins	Hollow chisel mortiser
					8	Double Mortises	b	½ in. x ¾ in. x ½ in.	For rafters for lower-deck compound-carlines (2016) to tenon into	Hollow chisel mortiser
					27	Mortises	c	1⅛ in. x ¾ in. x ½ in.	For lower-deck rafters to tenon into (2015)	Hollow chisel mortiser
					1	Rabbet	d	full length x ⅞ in. x ⅜ in.	For ventilator side-sash (4001) to rest on	Molding machine
					1	Rabbet	e	full length x 1 in. x ⅜ in.	For roofing-boards (2014) and ventilator bottom-rail roof-molding (2027) to fit in	Molding machine
					2	Rabbets	f	full length x ½ in. x ⅛ in.	To fit the ventilator bottom-rail facia (4104)	Molding machine
									These rails are laid on horses, being prepared as above, and the following pieces are adjusted to them:—	
105	4	**Ventilator side-corner-posts** (Fig. 210)	2003	A.	--	----------	--	10⅛ in. x 4 in. x 1⅝ in.	Each having:—	
					1	Tenon	a	4 in. x 1¼ in. x ½ in.	Tenoned into the end mortises of ventilator plain-bottom-rail (2002), glued and secured with two hickory dowel-pins each	End tenoner
					1	Tenon	b	4 in. x 1 in. x ½ in.	To tenon into end mortises (a) of ventilator top-rail (2001), Fig. 199	End tenoner
					2	Holes	c		For No. 14 x 2½ in. screws to secure the ventilator end-corner-posts (2004), Figs. 211, 212	Borer
					1	Bead	d		For inside ornament	Molding machine
106	16	**Ventilator side-posts** (Fig. 213)	2005	A.	--	----------	--	10⅛ in. x 1⅝ in. x 1¼ in.	Each having:—	
					1	Tenon	a	1¼ in. x ½ in.	Tenoned into mortises (a) of ventilator plain-bottom-rail (2002), glued and secured with hickory dowel-pins	End tenoner
					1	Tenon	b	1 in. x ½ in.	To tenon into mortises (f) of ventilator top-rail (2001), Fig. 199	End tenoner
					1	Bead	c		For inside ornament	Molding machine
					2	Ogees	d		For inside ornament	Chamfering machine
107	2	**Ventilator top-rails** (Fig. 199)	2001	Y. P.	--	----------	--	24 ft. 11¾ in. x 3 in. x 1⅝ in.	Each having:—	
					2	Mortises	a	4 in. x 1 in. x ½ in.	For ventilator side-corner-post tenons (b) to fit into; they are glued and secured with 4 No. 10 x ¾ in. steel screws	Hollow chisel mortiser
					2	Tenons	b	1 in. x 1 in.	To fit in rabbets (b) of the upper-deck head-rafters (2006), Fig. 205	End tenoner
					8	Gains	c	1½ in. x 1¼ in.	For upper-deck compound-carlines (2008), Fig. 196, to fit in	Multiple gainer
					27	Gains	d	1⅛ in. x 1¼ in.	For upper-deck rafters (2007), Fig. 217, to fit in	Multiple gainer
					1	Ogee	e		For inside ornament	Chamfering machine
					8	Mortises	f	1 in. x ½ in.	On under side, not seen, for ventilator side-post tenons (b) to fit into; they are glued and secured with 16 No. 10 x 1¼ in. steel screws	Hollow chisel mortiser
108	4	**Ventilator end-corner-posts** (Figs. 211, 212)	2004	A.	--	----------	--	10½ in. x 2⅜ in. x 1⅜ in.	Each having:—	
					1	Tenon	a	2 in. x 1¼ in. x ⅝ in.	To fit in rabbet (c) of the end top-rail (1006), Fig. 108, Plate V.	End tenoner
					1	Tenon	b	2⅜ in. x 1 in. x ½ in.	To fit in mortise (a) of the upper-deck head-rafter (2006), Fig. 205. They are also further secured to the ventilator side-corner-posts with 8 No. 14 x 2½ in. steel screws	End tenoner
					1	Rabbet	c	¾ in. x ⅜ in.	For ventilator end-sash (4007) to fit in	Molding machine
109	2	**Upper-deck head-rafters** (Figs. 204, 205)	2006	A.	--	----------	--	5 ft. 9¼ in. x 2 15-16 x 1⅜ in.	Each having:—	
					2	Mortises	a	2⅜ in. x 1 in. x ½ in.	For tenons (b) of the ventilator end-corner-posts to fit into; they are glued and secured with hickory dowel-pins	Hollow chisel mortiser
					2	Rabbets	b	1⅝ in. x 1 in. x 1 in.	For tenons (b) of the ventilator top-rails (2001) to fit in; they are secured with 4 No. 14 x 3½ in. steel screws	Car gainer
					2	Tenons	c	1¼ in. x ½ in. x 1⅜ in.	To fit in mortises (a) of the ventilator eaves-rail (2009), Fig. 200	End tenoner
					1	Rabbet	d	¾ in. x ⅝ in.	For ventilator end-sash (4007) to fit in	Shaper
110	8	**Upper-deck compound-carlines** (Fig. 196)	2008	----	--	----------	--	5 ft. 9¼ in. x 1½ in. x 1¼ in.	They being composed of:—	
111	16	**Upper-deck rafters** (Fig. 218)	2007	A.	--	----------	--	5 ft. 9¼ in. x ½ in. x 1¼ in.	In pairs, each having:—	
					2	Tenons	a	1¼ in. x ½ in. x ½ in.	To fit into mortises (c) of the ventilator eaves-rail (2009), Fig. 200	End tenoner
					2	Ogees	b		On one side and at each end of the rafters. These rafters are bolted with 48 bolts 2 in. x ¼ in., round heads, one to each side of the top part (A) of	Chamfering machine
111a	8	**Steel-carlines** (Fig. 206)	2501	W. S.	--	----------	--	9 ft. 11 in. x 1⅛ in. x ½ in.	Each having:—	
					6	Holes	a	5-16 in. diam.	For bolts to secure upper-deck rafters	Drill press
					6	Holes	b	5-16 in. diam.	For bolts to secure lower-deck rafters (2015), Fig. 216. (*See Con. No. 117*)	Drill press
					2	Feet	c	1 in. long	With 7-16 in. hole through them for bolting to side top-rail. The compound carlines are now fixed in the gains (c) of the ventilator top-rails (2001), Fig. 199, and secured with 32 No. 10 x 2 in. steel screws	
112	27	**Upper-deck rafters** (Fig. 217)	2007	A.	--	----------	--	5 ft. 9¼ in. x 1⅛ in. x 1¼ in.	Each having:—	
					2	Tenons	a	1¼ in. x 1⅛ in. x ½ in.	To fit into mortises (b) of the ventilator eaves-rail (2009), Fig. 200. These rafters are now fixed in the gains (d) of the ventilator top-rails (2001) and secured with 54 No. 10 x 2 in. steel screws	End tenoner
					4	Ogees	b		One on each side at and each end of the rafters, for ornament	Chamfering machine
113	2	**Ventilator eaves-rails** (Fig. 200)	2009	A.	--	----------	--	About 25 ft. 8 in. x 1¼ x 1¼"	Each having:—	
					2	Mortises	a	1⅜ in. x ½ in.	For tenons (c) of upper-deck head-rafters to fit into	Hollow chisel mortiser
					27	Mortises	b	1⅛ in. x ½ in.	For tenons (a) of upper-deck rafters to fit in	Hollow chisel mortiser
					8	Double mortises	c	½ in. x ½ in.	For tenons (a) of the upper-deck compound-carline rafters (2007) to fit into. (*See Con. No. 111*)	Hollow chisel mortiser
					2	Splice-bevels	d	4 in. long	For splicing to ventilator-hood bow (2011), Fig. 219. Sometimes the mortises into which the upper-deck head-rafters tenon into are in the bow, as shown in Fig. 219, in which case the eaves-rails would be about 24 ft. 7½ in. long. The eaves-rails are fitted to the upper-deck rafter tenons and draw-pinned with 74 hickory dowel-pins	Usually sawed and fitted by hand
114	2	**Ventilator-hood bows** (Fig. 219)	2011	R. E.	--	----------	--	7 ft. to 8 ft. 2 in. x 1¼" x 1¼"	Bent to shape and having:—	
					2	Mortises	a	1⅜ in. x ½ in.	For tenons (c) of upper-deck head-rafters (2006) to fit into	Hollow chisel mortiser
					2	Splice-bevels	b	4 in. long	For splicing to ventilator eaves-rail (2009), Fig. 200; the bows are fitted to the upper-deck head-rafter tenons (c) and draw-pinned with 4 hickory dowel-pins, and also secured to the eaves-rails with 16 No. 10 x 1 in. steel screws	Usually sawed and fitted by hand

115	16	**Compound-carline filling-in pieces** (Not Ill.)	2017	A.	--	----------	--	7 in. x 1¼ in. x ½ in.	Glued between the rafters of the compound-carlines where they project beyond the ventilator top-rails	Band saw
116	16	**Lower-deck compound-carlines** (Fig. 196)	2016	----	--	----------	--	1 ft. 9⅜ in. x 2⅜ in. x 1½ in.	They being composed of :—	Band saw and shaper
117	32	**Lower-deck rafters** (Fig. 216)	2015	A.	--	----------	--	1 in. 9⅜ in. x 2⅜ in. x ½ in.	Each having :—	Band saw and shaper
					1	Tenon	a	¾ in. x ½ in. x ½ in.	To fit in mortises (b) of the ventilator plain-bottom-rails (2002), Fig. 197, to which they are secured with 32 No. 10 x 1 in. steel screws	End tenoner
					1	Gain	b	3¼ in. x 1 in.	To interlock with gains (c) of the side top-rails (1005), Fig. 93, Plate V., and *Con. No. 55, Table No. 33.* These rafters are bolted with 48 bolts 2 in. x ¼ in., round heads, one to each side of the lower projecting piece (B) of the steel carlines described *Con. No. 111*	End tenoner
117a	54	**Lower-deck rafters** (Fig. 215)	2015	A.	--	----------	--	1 ft. 9⅜ in. x 2⅜ in. x 1⅛ in.	Each having :—	
					1	Tenon	a	1⅛ in. x ¾ in. x ½ in.	To fit in mortises (c) of the ventilator plain-bottom-rails (2002), Fig. 197, to which they are secured with 54 No. 10 x 1 in. steel screws	End tenoner
					1	Gain	b	3¼ in. x 1 in.	To interlock with gains (a) of the side top-rails (1005), Fig. 93, Plate V., and *Con. No. 55, Table No. 33.* The skeleton frame-work of the roof as it now appears is shown very clearly in Fig. 196, the lower-deck rafters at the back being omitted, so as to show more clearly the general construction	End tenoner
118	2	**Roofing-boards** (Fig. 208)	2014	P.	--	----------	--	26 ft. 6 in. x 13 in. x ⅜ in.	Beaded on the under side to represent single strips are now laid in white-lead lengthwise over the projecting portion of the upper-deck rafters next the eaves-rails, and are secured to the rafters with 222 No. 10 x 1¼ in. steel screws, and to the ventilator top-rails, eaves-rails and hood-bows with 160 No. 10 x 1¼ in. steel screws ; the intervening space between these two boards is then filled up with	Flooring machine
118a	15	**Roofing-boards** (Fig. 209)	2014	P.	--	----------	--	26 in. 6 in. x 3 in. x ⅜ in.	Beaded on one edge, nailed to the upper-deck rafters and ventilator hood-bows with clout-nails	Flooring machine
119	68	**Upper-deck furring-pieces** (Fig. 224)	2021	A.	--	----------	--	6¾ in. x 2⅜ in. x 1¼ in.	And	
	4	**Upper-deck furring-pieces** (Fig. 225)	2021	A.	--	----------	--	9½ in. x 2⅜ in. x 1¼ in.	Screwed to the roofing-boards between the upper-deck rafters, and alongside the ventilator top-rail with 76 No. 10 x 1¼ in. steel screws The roof is now ready to be attached to the car body, in the condition we left it in at the end of Table No. 33, the order of procedure being	
119b	--	**Steel-carlines** (Fig. 206)	2501	----	--	----------	--		See *Con. No. 111*, are bolted through the holes in the feet (c) to the side top-rails with 16 bolts, 3¾ in. x ⅜ in.	
119c	--	**Lower-deck rafters** (Figs. 215, 216)	2015 2016	----	--	----------	--		See *Con. No. 117*, nave their gains (b) well varnished, interlocked with gains (a and c) of the side top-rails, and screwed to the latter with 86 No. 12 x 1½ in. steel screws	
120	2	**Side-roof joint-breakers** (Not Ill.)	2025	A.	--	----------	--	25 ft. 0¾ in. x 1½ in. x ½ in.	Are nailed to the outside of the side top-rails (1005) above the rabbet (b) for the letter-board. (*See Fig. 93, Plate V. and Con. No. 55, Table No. 33*)	
120a	--	**Ventilator plain-bottom-rails** (Figs. 197, 198)	2002	----	--	----------	--		Are adjusted to notches (b), Fig. 109, Plate V., of the end top-rail (1006) and screwed to it with 4 No. 16 x 3 in. steel screws	
120b	--	**Ventilator end-corner posts** (Figs. 211, 212)	2004	----	--	----------	--		Are adjusted to rabbets (c), Fig. 108, Plate V., of the end top-rail (1006) and screwed to it with 4 No. 12 x 1½ in. steel screws	
120c	2	**Roofing-boards** (Fig. 208)	2014	P.	--	----------	--	25 ft. 0 in. x 14 in. x ½ in.	Are laid in white-lead, and screwed to the lower-deck rafters and side top-rails with 144 No. 10 x 1¼ in. steel screws, their lower edges forming the eaves of the lower-deck. The remaining space up to the ventilator plain-bottom-rails is filled with	
120d	6	**Roofing-boards** (Fig. 209)	2014	P.	--	----------	--	25 ft. 0 in. x 3 in. x ½ in.	Nailed to the lower-deck rafters, fit in the rabbets (e) of the ventilator plain-bottom-rails and screwed to the end top-rails with 12 No. 10 x 1¼ in. steel screws	
121	2	**Upper-deck end-furring pieces** (Fig. 220)	2023	A.	--	----------	--	3 ft. 6⅝ in. x 2½ in. x 1¼ in.	Screwed to the upper-deck roofing-boards close up against the end top-rails with 10 No. 10 x 1¼ in. steel screws	
122	72	**Lower-deck furring-pieces** (Fig. 223)	2024	A.	--	----------	--	6¾ in. x 1¾ in. x 1¼ in.	Screwed to the lower-deck roofing-boards centrally between the rafters with 72 No. 10 x 1¼ in. steel screws	
123	1	**White duck** (Not Ill.)	2020	----	--	----------	--	8 ounce	Is now laid all over the upper-deck roof in thick paste, composed of whiting mixed with linseed oil and japan, carefully stretched and tacked all round to the sides of the ventilator eaves-rails and hood-bows, after which	
124	4	**Ventilator hood-bow lead-moldings** (Fig. 221)	2503	----	--	----------	--	¾ in. half-round	Are nailed over the duck to the sides of the corners of the hood-bows	
125	2	**Ventilator eaves-moldings** (Fig. 203)	2010	A.	--	----------	--	¾ in. half-round	Are nailed over the duck to the sides of ventilator eaves-rails	Molding machine
126	2	**Ventilator hood-bow moldings** (Not Ill.)	2012	P.	--	----------	--	¾ in. half-round	Same as Fig. 203, nailed over the duck to the sides of the hood-bows in continuation of the lead moldings at the corners	Molding machine
126a	1	**White duck** (Not Ill.)	2020	----	--	----------	--	8 ounce	Is laid over the two lower-deck roofs in similar manner to the upper-deck, and tacked to the side-roof joint-breakers (2025), and further secured by	
127	2	**Ventilator bottom-rail roof-moldings** (Fig. 201)	2027	P.	--	----------	--	25 ft. 0 in. x 2¾ in. x ⅜ in.	Inserted in the rabbet (e) of the ventilator plain-bottom-rail (2002), Fig. 197, and nailed to the roof	Molding machine
128	2	**Lower-deck eaves-moldings** (Fig. 207)	2026	A.	--	----------	--	¾ in. half-round	Are nailed over the duck to the sides of the side-roof joint-breakers, after which the roofs receive three coats of white-lead all over the duck	Molding machine
									The preparation of the outside of the car body previous to painting and finishing is now proceeded with as follows :—1st and 2d days—One coat of permanent wood priming, consisting of oil and white-lead laid all over. 3d and 4th days—Two coats of lead priming (white-lead with a little oil). 5th day—Fill all holes and depressions with putty. 6th day—Scrape soft putty in open grains and give first coat of roughstuff. 7th and 8th days—Second and third coats of roughstuff. 9th day—Rub the roughstuff with pumice stone and water to bring to a smooth surface. The cars are now externally in what is termed "the white," ready to receive later their coats of color, as shown in Fig. 107, Plate V.	
									The under surfaces of the roofing-boards receive a coat of boiled oil	
									The top side of the flooring receives two coats of boiled oil	
									It is usual at this stage to attach the platforms to the body, but as their description includes a number of accessories related to "traction" they will be dealt with in a separate table, and	
129	--	**Platform-hoods** (Figs. 226, 227)	2029	----	--	----------	--		(Often called bonnets) will now be taken up. They are made independently whilst the construction of the body as described is in progress, and consist of :—	
129a	2	**Platform-hood bows** (Fig. 228)	2032	R. E.	--	----------	--	2 in. x 1⅜ in.	Steamed and bent to shape on a form, each having :—	
					2	Gains	a		For platform-hood shoulder-carline (2030), Fig. 231	Gainer
					6	Gains	b		For platform-hood rafters (2031), Fig. 232	Gainer
					1	Chamfer	c		For ornament, seen in Fig. 226	Chamfering machine
130	2	**Platform-hood shoulder-carlines** (Fig. 231)	2030	A.	--	----------	--	1 7-16 in. x 1¼ in.	Steamed and bent to shape on a form, each having :—	
					2	Gains	a		To interlock with gains (a) of the platform-hood bows, to which they are screwed with 4 No. 12 x 1 in. steel screws.	End tenoner
					1	Chamfer	b		For ornament	Chamfering machine
131	6	**Platform-hood rafters** (Fig. 232)	2031	A.	--	----------	--	1¼ in. x 1 in.	Steamed and bent to shape on a form, each having :—	
					2	Gains	a		To interlock with gains (b) of the platform-hood bows, to which they are screwed with 12 No. 10 x 1 in. and 12 No. 10 x ¾ in. steel screws	End tenoner
					2	Chamfers	b		For ornament, seen in Fig. 226	Chamfering machine
131a	33	**Roofing-boards** (Fig. 226)	2014	P.	--	----------	--	3 in. x 5-16 in.	Beaded and nailed to platform-hood bows, shoulder-carlines and rafters	Flooring machine
131b	1	**White duck** (Not Ill.)	2020	----	--	----------	--	8 ounce	Is now laid and stretched over the roof in soft white-lead paint, tacked to the bows and further secured by	
132	2	**Platform-hood iron-moldings** (Not Ill.)	2506	W. I.	--	----------	--	¾ in. half-round	Screwed to the bows with 54 No. 12 x 1¼ in. steel screws. The duck is then given three successive coats of white-lead, and when dry the platform-hoods are attached to the car body with 18 No. 16 x 2½ in. round-headed steel screws and washers screwed through the shoulder-carlines into the end top-rails. Further security is given by	
133	4	**Platform-hood brackets** (Fig. 238)	2507	M. I.	--	----------	--		Screwed to the corner-posts and platform-hoods with 36 No. 12 x 1¼ in. steel screws	

TABLE No. 35—*Continued*

Consecutive Number	Quantity	Name of Piece	Piece Number Plates I. and VII.	Material See Plates I and II.	Details: Quantity	Details: Name	Details: Reference Letter Plate VII.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
134	2	**Platform-hood shoulder-carline moldings** (Fig. 229)	2034	P.	--	----------	--	½ in. quarter-round	Nailed to the end top-rails and the top of the platform-hood, the ends joining the ventilator bottom-rail roof-molding (2027) on each side of the ventilator. (*See Con. No. 126*)	Molding machine
135	4	**Platform-hood joint-straps** (Fig. 233)	2505	W. I.	--	----------	--	20 in. x 1¾ in. x ⅛ in.	Are screwed over the joining of the platform-hood roof to the lower-deck roof, with 36 No. 10 x 1¼ in. steel screws	
136	2	**Platform-hood watersheds** (Fig. 230)	2052	A.	--	----------	--	1 ft. 10 in. x ½ in. x ½ in.	Screwed to the top front of the platform-hood with 14 No. 4 x 1 in. and 4 No. 4 x 1¼ in. steel screws	
137	16	**Steel-carline covers** (Fig. 214)	2502	Tin	--	----------	--		Nailed to ventilator side-posts and bottom-rail roof moldings	
138	2	**Trolley cord guards** (Fig. 222)	2508	W. I.	--	----------	--		Screwed to under side of platform-hood bows (2032) with 8 No. 14 x 1½ in. steel screws	
139	--	**One trolley-bridge**	----	----	--	----------	--		Is independently put together, and then attached to the roof. It consists of	
139a	2	**Trolley-board long-rails** (Fig. 244)	2035	A.	--	----------	--	8 ft 0 in. x 3 in. x 1¾ in.	These are bolted to	Planer and shaper
140	4	**Trolley-board short-rails** (Fig. 245)	2036	A.	--	----------	--	4 ft. 2½ in. x 2½ in. x 2 in.	With 8 bolts 4 x 5-16 in. The frame formed by these rails is placed on the roof in the center of the car, the long rails lying exactly over the ventilator side top-rails, bedded in soft white-lead and screwed to the upper-deck roof with 12 No. 20 x 4 in. steel screws	Planer and shaper
141	2	**Trolley-boards** (Fig. 243)	2037	A.	--	----------	--	8 ft. 0 in. x 6 in. x 2 in.	Are then screwed side-by-side to the center of the trolley-board short-rails (2036) with 16 No. 10 x 3½ in. steel screws In the center of these are four bolt holes, 9-16 in. diam for 4 x ½ in. bolts, whose heads are let in flush on the underside and covered with leather to prevent their falling out; they serve to hold the trolley-base in place	Planer
142	--	**Two upper-deck landings** (Fig. 239)	2038	A.	--	----------	--		Are now secured to the upper-deck roof at each end, meeting the trolley-boards in the center; they are composed of	
142a	4	**Upper-deck landing-battens** (Fig. 237)	2041	A.	--	----------	--	3 ft. 4½ in. x 2 in. x ⅝ in.	Curved to the arc of the roof, and	Band saw and shaper
142b	6	**Upper-deck landing-battens** (Fig. 236)	2041	A.	--	----------	--	1 ft. 8¾ in. x 2 in. x ⅝ in.	To which are secured	Band saw and shaper
143	6	**Upper-deck landing-slats** (Fig. 234)	2039	A.	--	----------	--	8 ft. 7½ in. x 3 in. x ⅝ in.	And	Planer
143a	10	**Upper-deck landing-slats** (Fig. 235)	2039	A.	--	----------	--	2 ft. 6½ in. x 3 in. x ⅝ in.	With 100 No. 10 x 1¼ steel screws. The battens being laid in soft white-lead, the landings are then screwed to the roof with 42 No. 12 x 2 in. and 42 No. 12 x 1½ in. steel screws	Planer
144	--	**Two lower-deck landings** (Fig. 241)	2043	A.	--	----------	--		Are now screwed to diagonally opposite corners of the lower-deck roof, being composed of	
144a	4	**Lower-deck landing-battens** (Fig. 240)	2045	A.	--	----------	--	1 ft. 1 in. x 1½ in. x ⅝ in.	To which are screwed	Planer
145	10	**Lower-deck landing-slats** (Fig. 242)	2044	A.	--	----------	--	2 ft.5½ in. x 1½ in. x ⅝ in.	With 40 No. 10 x 1¼ in. steel screws. The battens are laid in soft white-lead and the landings screwed to the roof with 4 No. 12 x 2 in. and 4 No. 12 x 1½ in. steel screws	Molding machine
146	2	**Lower-deck sign-boards, 1 side** (Fig. 246)	2046	P.	...	----------	--	15 ft. 6 in. x 5 in. x ¾ in.	These cars have in some cases six direction signs, and in others eight, on the roofs and bonnets covering five different varieties which will now be described Ornamental ends, one on each side of the car, with 3 holes on under side to fit on the sign-board pins (2510), Fig. 254	Planer and chamfering machine
147	6	**Sign-board washers** (Fig. 263)	2511	M. I.	--	----------	--		Screwed to under side of the boards with 12 No. 12 x 1½ in. steel screws, to protect the holes for the pins named above, Con. No. 146	
148	6	**Sign-board pins** (Fig. 251)	2510	M. I.	--	----------	--		Screwed to the sides of the lower-deck roof with 18 No. 12 x 1½ in. steel screws	
149	--	**Lower-deck box-signs**	----	----	--	----------	--		Are used in some cases, one on each side on the lower deck roof; they are four-sided, and consist of	
149a	8	**Sign-box boards** (Fig. 247)	2047	D.	--	----------	--	8 ft. 4 in. x 4¾ in. x ½ in.	With ornamental ends, fitted together in box-form, by being bolted to	Planer and chamfering machine
150	4	**Sign-box pivots** (Fig. 251)	2512	M. I.	--	----------	--		With 32 carriage bolts 1 x ¼ in. In the center of the boxes and to stiffen them	
151	2	**Sign-box blocks** (Fig 260)	2051	A.	--	----------	--	4¾ in. x 4¾ in. x 1 in.	Are inserted and screwed to the sign-boards with 16 No. 12 x 1¼ in steel screws	
152	4	**Sign-box brackets** (Fig. 250)	2513	M. I.	--	----------	--		To receive the pivots, are screwed to the sides of the lower deck roof with 20 No. 12 x 1¼ in. round-headed steel screws. To keep the boxes in their brackets	
153	4	**Sign-box pivot-washers** (Fig. 261)	2521	M. I.	--	----------	--		Are slipped over the projecting stud of the pivot and secured with	
154	4	**Sign box pivot-cotters** (Not Ill.)	2522	W. S.	--	----------	--		Passed through the holes at the ends of the studs	
155	2	**Upper-deck end sign-boards, 1 side** (Fig. 256)	2048	P.	--	----------	--	4 ft. 4½ in. x 5 in. x ¾ in.	With ornamental ends, one at each end of the monitor roof, with 2 holes on under side to fit on the sign-board pins (2514), Fig. 255	Band saw and shaper
156	4	**Sign-board washers** (Fig. 264)	2515	M. I.	--	----------	--		Screwed to under side of above boards with 8 No. 12 x 1½ in. steel screws, to protect the pin-holes in the boards	
157	4	**Sign-board pins** (Fig. 255)	2514	M. I.	--	----------	--		Screwed to the ends of the upper-deck roof with 8 No. 12 x 1½ in. steel screws	
158	2	**Upper-deck sign-boards, 2 sides** (Fig. 248)	2049	P.	--	----------	--	7 ft. 2 in. x 5 in. x ¾ in.	With round ends, one at each side of the car on the upper-deck, secured to	Planer
159	4	**Sign-board pivots** (Fig. 258)	2516	M. I.	--	----------	--		With 16 No. 12 x ¾ in. steel screws	
160	4	**Sign-board brackets** (Fig. 253)	2517	M. I.	--	----------	--		To receive the pivots are screwed to the sides of the upper-deck roof with 12 No. 12 x 1¼ in. round-headed screws; they are held in place with	
160a	4	**Sign-board pivot-washers** (Fig. 261)	2521	M. I.	--	----------	--		Same as Con. No. 152, and	
160b	4	**Sign-board pivot-cotters** (Not Ill.)	2522	W. S.	--	----------	--		Same as Con. No. 153	
161	4	**Sign-board guards** (Not Ill.)	2523	W. I.	--	----------	--	3½ in. half-round	Same as (2506) No. 132, are screwed to each side of the sign-boards with 56 No. 12 x 1½ in steel screws	
162	--	**Bonnet box-signs** (Not Ill.)	----	----	--	----------	--		Two in number, consisting of	
162a	8	**Sign-box boards** (Fig. 257)	2050	P.	--	----------	--	3 ft. 7¼ in. x 5 in. x ½ in.	With ornamental ends fitted together in box-form by being bolted to	Planer and chamfering machine
163	4	**Sign-box pivots** (Fig. 252)	2518	M. I.	--	----------	-		And	
164	4	**Sign-box frames** (Fig. 259)	2520	M. I.	--	----------	--		With 48 carriage bolts 1 x ¼ in.	
165	4	**Sign-box brackets** (Fig. 249)	2519	M. I.	--	----------	--		To receive the pivots are bolted and screwed to the platform-hoods with 12 round-headed stove-bolts 1 x ¼ in. and 4 No. 12 x 1¼ in. round-headed steel screws	
165a	4	**Sign-box pivot-washers** (Fig. 261)	2521	M. I.	--	----------	--		Same as Con. No. 152, and	
165b	4	**Sign-box pivot-cotters** (Not Ill.)	2522	W. S.	--	----------	--		Same as Con. No. 153	
									Before putting these signs together the boards are primed all over with lead containing oil, then the backs receive two coats of white-lead. After the box signs are fitted to the pivots they, as well as the single sign-boards, are treated as follows:—1st day—All holes and depressions filled with putty. 2d day—Scrape soft putty in open grains, etc. 3d day—Ground coat of white-lead tinted with color. 4th day—First coat of color. 5th day—Second coat of color with varnish to make a gloss. 6th day—Apply the letters as required. 7th and 8th days—Two coats of railway coach finishing varnish. The colors are various, some of the signs being buff, some vermilion and some white. The platforms and accessories will be treated of next. *See Con. No. 166, Table No. 37 and Plates I. and IX.*	

Number of Distinctive Pieces.... 62 (Column 1)
Total Number of Pieces..... 622 (" 2)
Number of Bolts..... 216 (" 6 and 10)
Number of Screws (about).....1622 (" 6 and 10)
Number of Nails..... ?

Total.....2460 +

TABLE NO. 36

DETAIL OF ROOFS AND BONNETS OF BROOKLYN OPEN CAR, IN THE ORDER OF ASSEMBLING

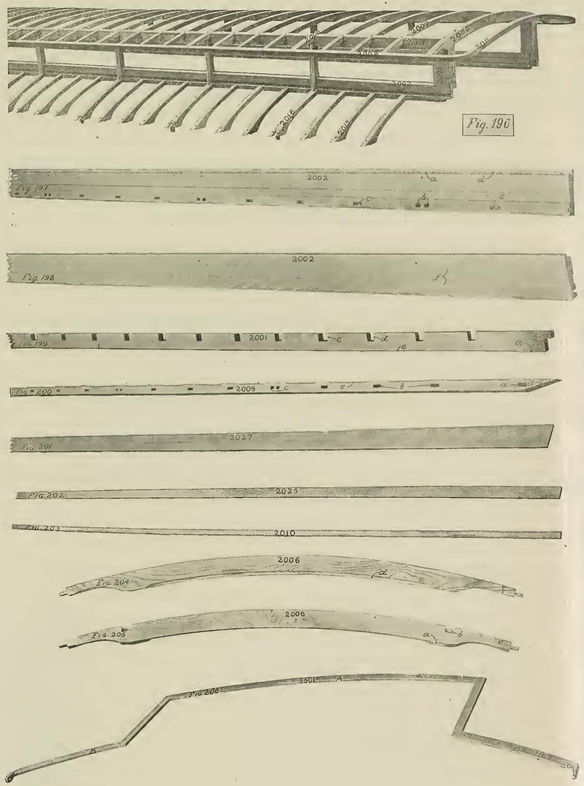
(12 Benches; Car No. 4; Fig. 5; Plates II. and VIII.)

Consecutive Number	Quantity	Name of Piece	Piece Number Plates II. and VIII.	Material See Plates I. and II.	Details: Quantity	Details: Name	Reference Letter Plate VIII.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									During the erection of the sides and ends of the body (see Table No. 34 and Plate VI.) the assembling of the pieces composing the framework of the "Monitor" roof has been proceeded with in a similar manner to that of the closed car, as described in Table No. 35	
66	2	**Ventilator plain bottom-rail** (Fig. 266)	7021	Y. P.	--	----------	--	26 ft. 3¼ in. x 2¾ in. x 1½ in.	Each haviog :—	
					2	Mortises	--	3 in. x 1 in. x ½ in.	Not seen, one at each end, for ventilator side-corner-posts (7003), Fig. 272, to tenon into, with two holes for dowel-pins	Hollow chisel mortiser
					10	Mortises	--	1⅞ in. x 1 in. x ½ in.	Not seen, for ventilator side-posts (7005) to tenon ioto, with holes for dowel-pins	Hollow chisel mortiser
					2	Mortises	a	1⅞ in. x ¾ in. x ½ in.	For lower-deck thick-rafters (7011) to tenon into	Hollow chisel mortiser
					18	Mortises	b	13-16 in. x ¾ in. x ½ in.	For lower-deck thin-rafters (7012) to tenon into	Hollow chisel mortiser
					8	Double mortises	c	13-16 in. x ¾ in. x ½ in.	For lower-deck rafters for compound-carlines (7013) to tenon into	Hollow chisel mortiser
					1	Groove	d	Full length x ⅜ in. x ⅜ in.	For roofing-boards (7016) to fit in	Molding machine
67	4	**Ventilator side-corner-posts** (Fig. 272)	7003	A.	--	----------	--	10⅝ in. x 3⅝ in. x 1½ in.	Each having :	
					1	Double tenon	a	3 in. x 1 in. x ½ in.	Tenoned into end mortises of ventilator bottom rail (7021), glued and secured with two hickory dowel-pins	Double end tenoner
					1	Tenon	b	1¼ in. x 1 in. x ½ in.	To tenon into end mortises of ventilator top-rail (7001), Fig. 265	Double end tenoner
68	20	**Ventilator side-posts** (Fig. 275)	7005	A.	--	----------	--	10⅝ in. x 1⅞ in. x 1½ io.	Each having :—	
					1	Tenon	a	1⅞ in. x 1 in. x ½ in.	Tenoned into mortises of ventilator bottom-rail (7021) and secured with hickory dowel-pins	Double end tenoner
					1	Tenon	b	1⅞ in. x 1 in. x ½ in.	To tenon into mortises (e) of ventilator top-rail (7001)	Double end tenoner
69	2	**Ventilator top-rails** (Fig. 265)	7001	Y. P.	--	----------	--	26 ft. 1¾ in. x 2½ in. x 1½ in.	Each having :—	
					2	Tenons	a	1½ in. x 1 in. x ¾ in.	To tenon into mortise in upper-deck head-rafter (7007), Fig. 267	End tenoner
					2	Mortises	--	1¼ in. x 1 in. x ½ in.	Not seen, one at each end on the underside for ventilator side-corner-posts to tenon-into, with hole for dowel-pin	Holllow chisel mortiser
					2	Gains	b	1⅞ in. x 1⅜ in.	For upper-deck thick-rafters (7008) to fit in	Multiple gaioer
					18	Gains	c	13-16 in. x 1¾ io.	For upper-deck thin-rafters (7009) to fit in	Multiple gainer
					8	Gains	d	1⅞ in. x 1¾ in.	For upper-deck compound-carlines (7010) to fit in	Multiple gainer
					10	Mortises	e	1⅞ in. x 1 in. x ½ in.	To receive tenons (b) of the ventilator side-posts (7005)	Hollow chisel mortiser
70	4	**Ventilator end-corner-posts** (Fig. 273)	7004	A.	--	----------	--	11 3-16 in. x 2½ in. x 1¾ in.	Each having :—	
					1	Tenon	a	2 in. x 1⅞ in. x ½ in.	To fit in mortise (e) of the end top-rail (6006), Figs. 150 to 152, Plate VI. (*See Con. No. 31, Table No. 34*)	Double end tenoner
					1	Tenon	b	2¼ in. x 1¾ in. x ½ in.	To fit in mortise (b) of the ventilator upper-deck head-rafter (7007), Fig. 267	Double end tenoner
					1	Rabbet	c	½ in. x 5-16 in.	For ventilator end-sign-sash to fit in. The end-corner-posts are also secured to the side-corner-posts with 8 No. 14 x 2½ in. steel screws	Molding machine
71	2	**Upper-deck head-rafters** (Fig. 267)	7007	A.	--	----------	--	5 ft. 6½ in. x 2¼ in. x 1¾ in.	Each having :	
					2	Tenons	a	1¾ in. x ¾ in. x ½ in.	To fit in mortises in the ventilator eaves-rail (7014)	Double end tenoner
					2	Mortises	b	2¼ in. x 1¾ in. x ½ in.	On the underside to receive the tenons (b) of the end-corner-posts, the same being glued and secured with dowel-pins	Hollow chisel mortiser
					2	Rabbets	--	1½ in. x 1 in. x ¾ in.	On the other side, to receive the tenons (a) of the ventilator top-rails, Fig. 265 (7001), they are secured with 4 No. 14 x 3½ in. steel screws	Multiple gainer
					2	Mortises	c	2 in. x 1¼ in. x ½ in.	On the underside to receive the tenons (b) of the ventilator end-ceoter-posts (7006), Fig. 276	Hollow chisel mortiser
					2	Rabbets	d	½ in. x 5-16 in.	For ventilator end-sign-sash to fit in	Shaper
72	2	**Upper-deck thick-rafters** (Fig. 268)	7008	A.	--	----------	--	5 ft. 6½ in. x 1⅞ x 1 5-16 in.	Each having :	
					2	Tenons	a	1⅞ in. x ¾ in. x ½ in.	To fit in mortises in the ventilator eaves-rail (7014), to which they are secured with dowel-pios	Double eod tenoners
					2	Gains	b	1½ in. x ½ in. x ⅛ in.	To interlock with gains (b) of the ventilator top-rail (7001), to which they are secured with 4 No. 10 x 2 in. steel screws	Multiple gainer
					4	Chamfers	c		For ornament	Shaper
73	18	**Upper-deck thin-rafters** (Fig. 270)	7009	A.	--	----------	--	5 ft. 6½ in. x 13-16 x 1 5-16 in.	Each having :	
					2	Tenons	a	13-16 in. x ¾ in. x ½ in.	To fit in mortises in the ventilator eaves-rail (7014), to which they are secured with dowel-pins	Double end tenoner
					2	Gains	b	1½ in. x ½ in. x ⅛ in.	To interlock with gains (c) of the ventilator top-rail (7001), to which they are secured with 36 No. 10 x 2 in. steel screws	Multiple gainer
					4	Chamfers	c		For ornament	Shaper
74	--	**Upper-deck compound-carlines** (Fig. 271)	7010	----	--	----------	--		Composed of	
74a	16	**Upper-deck thin-rafters** (Fig. 269)	7009	A.	--	----------	--	5 ft. 6½ in. x 13-16 x 1 5-16 in.	In pairs, same as Con. No. 73, but with the chamfer (c) on one side only ; these rafters are bolted with 32 bolts, 2¼ in. x ¼ in., round heads, one to each side of the top part of	
75	8	**Steel carlines** (Fig. 271)	7501	W. S.	--	----------	--	1¼ in. x 5-16 in.	Each having :	
					4	Holes	a	5-16 in. diam.	On the top for bolts to secure upper-deck rafters	Power punch
					6	Holes	b	5-16 in. diam.	In the side projections for bolts to secure the lower-deck rafters	Power punch
									The compound-carlines are now fitted in the gains (d) of the ventilator top-rails (7001) and secured with 32 No. 10 x 2 in. steel screws	
76	2	**Ventilator eaves-rails** (Not Ill.)	7014	Y. P.	--	----------	--	27 ft. 7¾ in. x 1½ in. x 1¼ in	Each having :—	
					2	Tenons	--	1½ in. x ¾ in. x ½ io.	One at each end, to fit into mortises (a) of the ventilator-hood bow (7015), Fig. 279	End tenooer
					2	Mortises	--	1¾ in. x ¾ in. x ½ in.	To receive the tenons (a) of the upper-deck head-rafters	Hollow chisel mortiser
					2	Mortises	--	1⅞ in. x ¾ in. x ½ in.	To receive the tenons (a) of the upper-deck thick-rafters	Hollow chisel mortiser
					9	Mortises	--	13-16 in. x ¾ in. x ½ in.	To receive the tenons (a) of the upper-deck thin-rafters	Hollow chisel mortiser
					8	Double mortises	--	13-16 in. x ¾ in. x ½ in.	To receive the tenons (a) of the upper-deck compouod-carlines. The eaves-rails are fitted to the various upper-deck rafters, and draw-pinned with hickory dowel-pins	Hollow chisel mortiser
77	2	**Ventilator hood-bows** (Fig. 279)	7015	A.	--	----------	--	5 ft. 8 in. x 1 5-16 in. x 1 in.	Each having :	
					2	Mortises	a	1½ in. x ¾ in. x ½ in.	To receive the end tenons of the ventilator eaves-rails, which are secured with dowel-pins	Hollow chisel mortiser
78	16	**Compound-carline filling-in pieces** (Fig. 287)	7028	A.	--	----------	--	7⅜ in. x 1¾ in. x ¼ in.	Glued between the rafters of the compound-carlines where they project beyond the ventilator top-rails	
79	4	**Lower-deck thick-rafters** (Fig. 278)	7011	A.	--	----------	--	20 in. x 1⅞ in. x 1 5-16 in.	Each having :	
					1	Tenon	a	1⅞ in. x ¾ in. x ½ in.	To fit in mortises (a) of the ventilator bottom-rail	End tenoner
					1	Gain	b	2¼ in. x 7-16 in.	To fit the gains (c) of the side top-rails (6018), Fig. 163, Plate VI.	Band saw

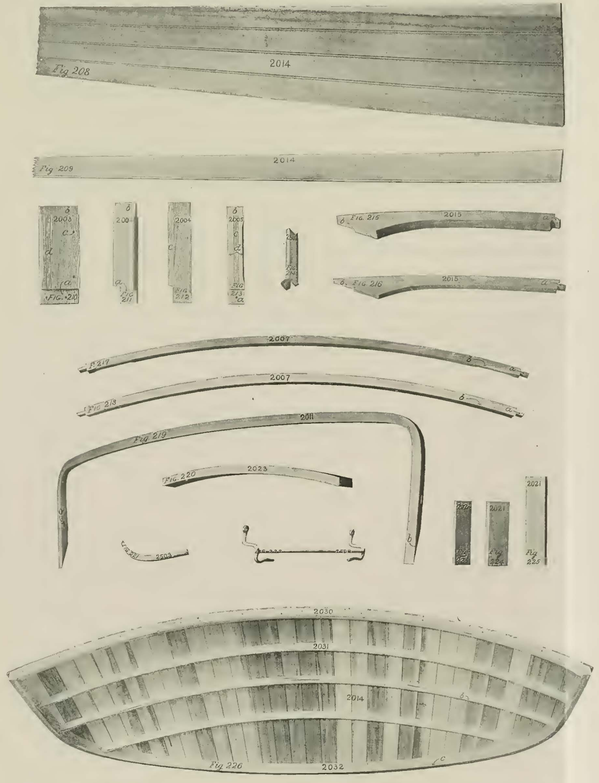
Consecutive Number	Quantity	Name of Piece	Piece Number Plates II. and VIII.	Material See Plates I. and II.	Details: Quantity	Details: Name	Reference Letter Plate VIII.	Dimensions	Observations and Particulars of How Used	Tools Usually Employed (Others can be used if convenience or necessity requires)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
80	36	**Lower-deck thin-rafters** (Fig. 277)	7012	A.	--	----------	--	20 in. x 13 16 in. x 1 5-16 in.	Each having :	
					1	Tenon	a	13-16 in. x ¾ in. x ½ in.	To fit in mortises (b) of the ventilator bottom-rail	
					1	Gain	b	2¼ in. x 7-16 in.	To fit the gains (d) of the side top-rails (6018), Fig. 163, Plate VI.	End tenoner Band saw
81	--	**Lower-deck compound-carlines**	7013	----	--	----------	--		Composed of	
81a	32	**Lower-deck thin-rafters** (Fig. 277)	7012	A.	--	----------	--	20 in. x 13-16 in. x 1 5-16 in.	In pairs same as Con. No. 80 ; these rafters are bolted with 48 bolts, 2¼ in. x ¼ in., round heads, one to each side of the lower projecting pieces of the steel-carlines described, Con. No. 74, and shown in Fig. 271, and fit in gains (b) of the side top-rails (6018), Fig. 163, Plate VI.	
82	2	**Ventilator end-center-posts** (Fig. 276)	7006	A.	--	----------	--	10 9-16 in. x 2 in. x 1¾ in.	Each having :—	
					1	Tenon	a	1½ in. x 2 in. x ½ in.	To fit mortise (d) of the end top-rail (6006), Figs. 150 to 152, Plate VI.	Double end tenoner
					1	Tenon	b	2 in. x 1¾ in. x ½ in.	To fit in mortise (c) of the upper-deck head-rafter (7007), Fig. 267, both of which are secured with wood dowel-pins	Double end tenoner
83	20	**Roofing-boards** (Not Ill.)	7016	P.	--	----------	--	3½ in. wide, ⅜ in. thick	Nailed to the upper-deck rafters, hood-bows and eaves-rails with clout-nails. The roof is now ready to be attached to the car body, in the condition in which it was at the end of Table No. 34	Tongued and grooved and headed on flooring machine
83a	--	**Lower-deck rafters**	----	----	--	----------	--		See Con. Nos. 79, 80, 81 have their gains (b) fitted to the gains of the side top-rails, and are screwed to them with 72 No. 12 x 1½ in. steel screws	
83b	--	**Ventilator end-corner and end-center-posts**	----	----	--	----------	--		Are tenoned into mortises (e) and (d) in the end top-rail, Figs. 150 to 152, Plate VI., and secured with dowel-pins	
83c	--	**Ventilator bottom-rails**	----	----	--	----------	--		Are tenoned and pinned to the end top-rails	
83d	12	**Roofing-boards** (Not Ill.)	7016	P.	--	----------	--	3½ in. wide, ⅜ in. thick	Nailed to the lower-deck rafters and end top-rails	
84	2	**Upper-deck end-furring pieces** (Fig. 285)	7027	V. P.	--	----------	--	3 ft. 11¾ in. x 2 in. x 1¼ in	Nailed to upper-deck head-rafters	
85	1	**White duck** (Not Ill.)	7023	----	--	----------	--	No. 10.	Is now laid all over the upper-deck in thick paste composed of whiting mixed with linseed oil and japan, carefully stretched and tacked all around to the sides of the ventilator eaves-rails and hood-bows, after which	
86	2	**Ventilator eaves-moidings** (Not Ill.)	7028	----	--	----------	--	⅝ in. half-round	Are nailed over the duck to the sides of the ventilator eaves-rails and hood-bows	
87	2	**Ventilator hood-bow lead-moldings** (Not Ill.)	7503	----	--	----------	--	⅝ in. x ⅜ in. half-oval	Nailed over the duck to the sides of the corners of the hood-bows	Molding machine
87a	1	**White-duck** (Not Ill.)	7023	----	--	----------	--	No. 10	Is laid over the lower-deck roofs in similar manner to the upper-deck and secured with	
88	2	**Lower-deck eaves-moidings** (Not Ill.)	7025	----	--	----------	-	⅝ in. x ⅜ in. half-oval	Nailed over the duck to the side top-panel (6020), *see Con. No. 47, Table No. 34 and Fig. 165, Plate VI.*; the roofs then receive three coats of white-lead all over the duck	Molding machine
89	2	**Ventilator bottom-rail roof-moidings** (Fig. 293)	7026	P.	--	----------	--	27 ft. 0 in. x 2 in. x ½ in.	Nailed to the roof against the ventilator bottom-rail	Molding machine
90	--	**Platform-hoods** (Fig. 280)	7017	----	--	----------	--		As in the case of closed cars, Table No. 36, we will now take up Made independently during the progress of construction already described, and consisting of	
90a	2	**Platform-hood bows** (Fig. 284)	7020	R. E.	--	----------	--	15 ft. 0 in. x 1¼ in. x 1¼ in.	Steamed and bent to shape on a former, each having :—	
					2	Gains	a	1¼ in. x ⅜ in.	For platform-hood shoulder-carlines (7018), Fig. 283	Multiple gainer
					8	Gains	b	¾ in. x ⅜ in	For platform-hood rafters (7019), Fig. 282	Multiple gainer
91	2	**Platform-hood shoulder-carlines** (Fig. 283)	7018	A.	--	----------	--	7 ft. 1¾ in. x 1 9-16 x 1¼ in.	Steamed and bent to shape on a former, each having :—	
					2	Gains	a	1¼ in. x ⅜ in.	To interlock with gains (a) of the platform-hood bows, to which they are secured with 4 No. 12 x 1 in. steel screws	Multiple gainer
92	8	**Platform-hood rafters** (Fig. 282)	7019	A.	--	----------	--	1⅛ in. x ¾ in.	Steamed and bent to shape on a former, each having :—	
					2	Gains	a	¾ in. x ⅜ in.	To interlock with gains (b) of the platform-hood bows, to which they are secured with 16 No. 10 x 1 in. and 16 No. 10 x ¾ in. steel screws	Band saw
92a	58	**Roofing-boards** (Fig. 280)	7016	P.	--	----------	--	3 in. x ¼ in.	Beaded, nailed to platform-hood bows, shoulder-carlines and rafters	Flooring machine
92b	1	**White-duck** (Not Ill.)	7023	----	--	----------	--	No. 10	Is now laid and stretched over the roofing-boards in soft white-lead paint, tacked to the bows and further secured by	
93	2	**Platform-hood iron-moldings** (Fig. 281)	7504	W. I.	--	----------	--	4 ft. 0 in. x ¾ in. half-round	Nailed to the middle portion of the bows over the duck, and	
94	4	**Platform-hood moldings** (Not Ill.)	7029	P.	--	----------	--	⅝ in. x ⅜ in. half-oval	Nailed to the sides of the bows over the duck. The duck is then given three successive coats of white-lead, and when dry the platform-hoods are attached to the car body with 28 round-head screws and washers, No. 14 x 3 in., screwed through the shoulder-carline into the end top rails, while further security is obtained by	Molding machine
95	4	**Platform-hood brackets** (Fig. 274)	7505	Bz.	--	----------	--		Screwed to the platform-hoods and corner-posts with 12 No. 12 x 1¼ in. steel screws, and bolted to the corner-posts with four bolts, 3⅞ in. x ⅜ in., round heads and bronze nuts	
96	2	**Platform-hood shoulder-carline moldings** (Not Ill.)	7030	P.	--	----------	--	½ in. x ⅜ in. quarter-round	Nailed to the end top-rails and the top of the platform-hoods, the ends joining the ventilator bottom-rail roof-moldings (7026) on each side of the ventilator	Molding machine
97	4	**Lamp-blocks** (Fig. 288)	7022	A.	--	----------	--	9⅜ in. x 7 in. x 1 5-16 in.	Nailed to the under-side of the upper-deck rafters, having a groove and hole in each for the electric wires	
98	16	**Steel-carline tin-covers** (Not Ill.)	7502	Tin	--	----------	--		Nailed to the ventilator side-posts and bottom-rail roof-moldings over the projecting portion of steel-carlines	
99	76	**Trolley-board cleats** (Fig. 286)	7031	A.	--	----------	--	9½ in. x 1⅞ in. x 1⅜ in.	Screwed to the upper-deck roof-rafters with 152 No. 12 x 1⅛ in. and 152 No. 12 x 1¾ in. steel screws	Shaper
100	2	**Trolley-boards** (Fig. 292)	7032	O.	--	----------	--	26 ft. 8½ in. x 6 in. x 1½ in.	Each in two lengths, laid side by side and screwed to the cleats with 76 No. 16 x 3½ in. steel screws	Planer
101	1	**Trolley base-block** (Fig. 289)	7033	O.	--	----------	--	2 ft. 0 in. x 14 in. x 2 in.	Screwed to the center of the trolley-boards with 12 No. 16 x 3½ in. steel screws	Planer
102	--	**Upper-deck landings** (Fig. 291)	7034	A.	--	----------	--		Are now screwed to the upper-deck roof on opposite corners with 8 No 12 x 2 in. steel screws ; the two of them are composed of :—	
102a	6	**Upper-deck landing-battens** (Fig. 291)	7036	A.	--	----------	--	17⅝ in. x 1⅞ in. x ¾ in.	To which are screwed	Planer
103	16	**Upper-deck landing-slats** (Fig. 291)	7035	A.	--	----------	--	3 ft. 2¼ in. x ⅞ in. x ¾ in.	With 40 No. 9 x ¾ in. steel screws	Molding machine
104	--	**Lower-deck landings** (Fig. 290)	7037	A.	--	----------	--		Are screwed to the lower-deck roof on opposite corners with 8 No. 12 x 2 in. steel screws ; the two of them being composed of :—	
104a	6	**Lower-deck landing-battens** (Fig. 290)	7039	A.	--	----------	--	21⅝ in. x 1⅞ in. x ⅜ in.	To which are screwed	Band saw and planer
105	20	**Lower-deck landing-slats** (Fig. 290)	7038	A.	--	----------	--	3 ft. 2¼ in. x ⅞ in. x ¾ in.	With 52 No. 9 x ¾ in. steel screws	Molding machine
									The work preparatory to painting the whole of the outsides except the posts can now be undertaken as follows :—	
									1st and 2d days—One coat of lead thinned with turpentine ; a little oil is added (very small amount for iron-work) and a little dryer laid all over. 3d day—Fill all holes and depressions with putty. 4th day—Scrape in all iron work with a preparation in paste form of keg lead, dry lead, whiting, gold size and rubbing varnish. 5th day—Apply a coat of roughstuff. 6th day—Rub the roughstuff to a smooth surface. 7th day—Apply a coat of ground color tint. The interior and posts are treated with a coat of wood filler, a coat of white shellac, one of coach rub varnish and one of coach finish varnish left in gloss, 24 hours between each coat.	
									The cars are now ready for their platforms. *See Table No. 38, Con. No. 106 and Plate X.*	

Number of Distinctive Pieces	40	(Column 1)
Total Number of Pieces	446	(" 2)
Number of Bolts	84	(" 6 and 10)
Number of Screws, about	732	(" 6 and 10)
Number of Nails	(?)	
Total	1262 +	

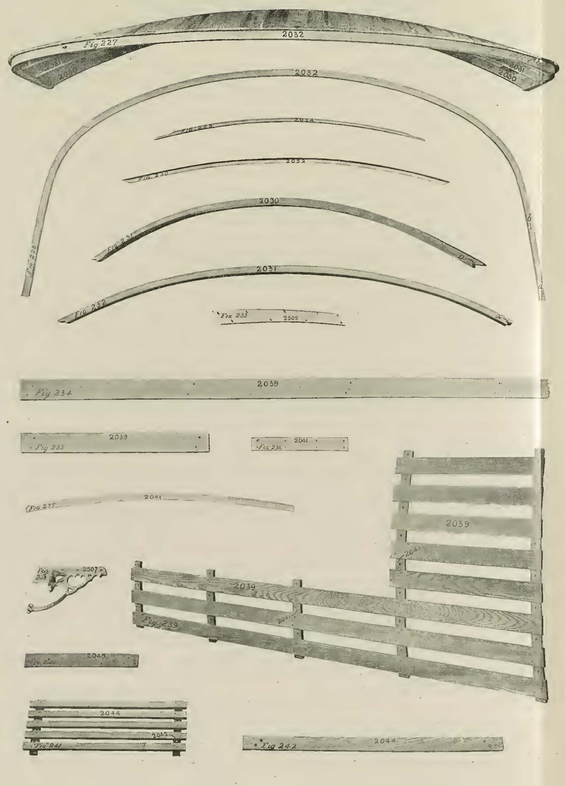
BOSTON CLOSED CAR. (Table No. 37.)



BOSTON CLOSED CAR. (Table No. 37.)



BOSTON CLOSED CAR. (Table No. 37.)



BOSTON CLOSED CAR. (Table No. 37.)

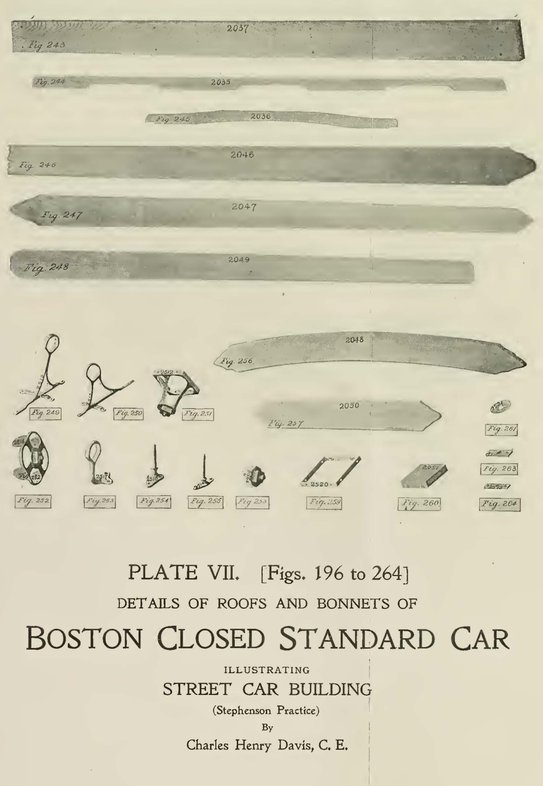


PLATE VII. [Figs. 196 to 264]

DETAILS OF ROOFS AND BONNETS OF

BOSTON CLOSED STANDARD CAR

ILLUSTRATING

STREET CAR BUILDING

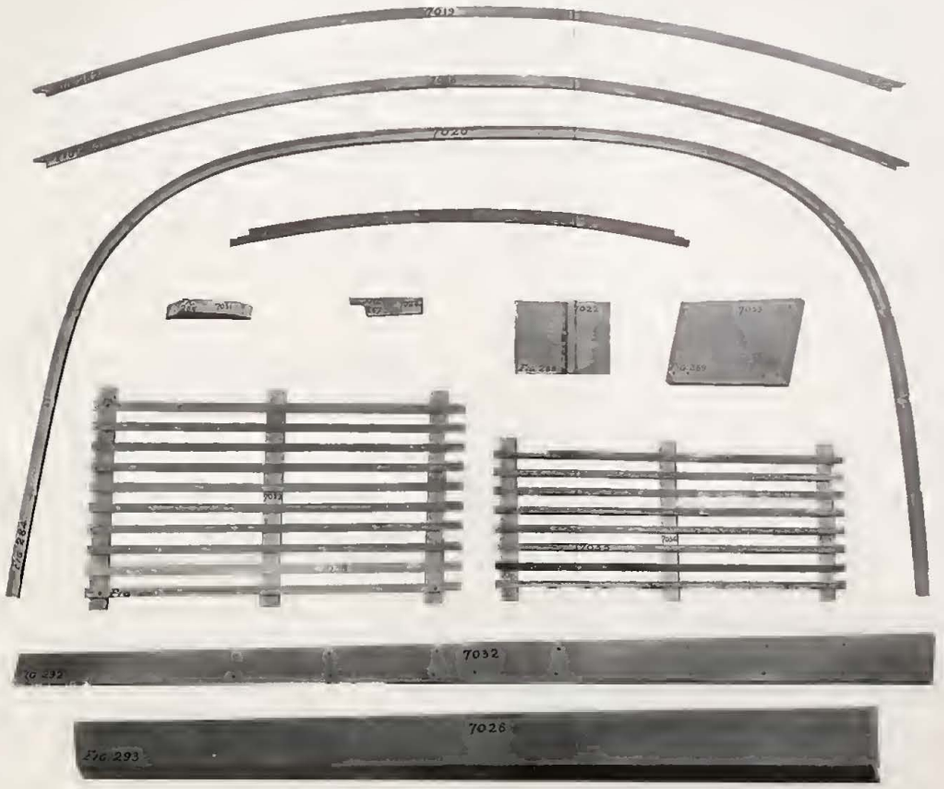
(Stephenson Practice)

By

Charles Henry Davis, C. E.

BROOKLYN OPEN CAR. (Table No. 36.)

BROOKLYN OPEN CAR. (Table No. 36.)



[PLATE VIII. Figs. 265 to 293.]

DETAILS OF ROOFS AND BONNETS OF

BROOKLYN OPEN STANDARD CAR

ILLUSTRATING

STREET CAR BUILDING

(Stephenson Practice)

By

Charles Henry Davis, C. E.

LEGAL NOTES AND COMMENTS

Edited by J. Aspinwall Hodge, Jr., of the New York Bar*

The Statute of Limitations and the New York Elevated Railroad Litigation

The history of the litigation against the elevated railroads of New York for damages and for injunctions, or for damages in lieu of the latter, on account of the taking of the easements of light, air and access from the owners of property abutting on the road, has reached, during the past year or two, a new stage.

Most of the elevated railroads now operating in the city of New York were opened during the years 1878, 1879 and 1880, and thus twenty years have now elapsed and the question arises as to whether or not, where no claim has been made upon the road and no action has been brought, the road has not acquired title to the easements of light, air and access by prescription or adverse possession.

During the first decade of the twenty years, that have elapsed, very little was accomplished on behalf of the property owners in the courts; but, during the last decade, the litigation has been fierce and active, and is probably unparalleled in the history of English or American law, both as to the number of actions, the variety of legal questions involved and the amount recovered against a single defendant. The recoveries have ranged from a few dollars a foot to nearly $2,500 per foot—the latter price having been awarded in two actions brought against the road by the respective owners of the two bank properties on the corner of Wall and Pearl Streets, extending along Pearl Street for a distance of about 80 feet,—the judgments for alternative relief and past damages aggregating nearly $190,000.

In these actions the six years statute of limitations has been held to apply and to prevent the recovery of past damages for more than six years prior to the beginning of the action. The ten years' statute of limitations has been held to have no application to the recoveries. Now that the twenty years have elapsed the question of title in the defendant road, of the easements by adverse possession, must soon be passed upon by the courts.

Already it has been presented, but the court has never been obliged to definitely pass upon it, as it may now be presented. It has arisen because the old Greenwich Street Road, which ran where the lower part of the Ninth Avenue Road now runs, was opened in 1869, ten years before the present system was put into operation. It was at first operated with an endless chain or cable, stationary engines being situated under ground at Cortlandt, Franklin, Bethune and Twenty-Second Streets. There were but two stations. A couple of years later one dummy and three cars were operated, and additional stations were opened from year to year, and engines and cars added, the increase being very gradual, until in the year 1877 the line was operated from Fifty-Ninth Street to South Ferry with twenty-one engines and thirty-five cars. This was superseded by the double track of the present Ninth Avenue line, which was opened on May 1, 1880.

In various suits brought against the road by property owners in Greenwich Street after the year 1889 (that is, twenty years after the opening of the original single-track cable road), the counsel for the Manhattan Railway Company urged that the road had acquired the easements of light, air and access by prescription, having been in adverse possession of them for twenty years.

But it was at once pointed out and afterward maintained by the courts through the Court of Appeals that the rule is unvarying and long established that, where title by prescription is claimed, it must be shown by the claimant that he has been in possession, not only, of a part but of all, that he claims, continuously, for the entire period of twenty years, and that this rule applied to the Greenwich Street cases. He cannot even claim, as a partial defense, title to that part of the property or easement which he has had for twenty years, but his defense is thrown out of court, if it be shown, that he has taken more, after the twenty years began to run, than he had at the beginning.—(*American Bank Note Co. vs. El. R. R., 129 N. Y., 252; Prentice vs. Geiger, 74 N. Y., 341.)*

This was manifestly the case on Greenwich Street, and on the whole line from South Ferry to Fifty-Ninth Street, for the light, air and access taken by the original structure of what was known as the "one-legged road" was very much less than that taken by the structure as it was enlarged, or rather, rebuilt, in 1879 and 1880.

The Second Avenue line was opened to Sixty-Fifth Street March 1, 1880, and to the Harlem, Aug. 16, 1880.

The Third Avenue line was opened to the Grand Central Depot, Aug. 26, 1878, and little by little was opened to the Harlem by Dec. 30 of the same year.

The Sixth Avenue line was opened to Fifty-Eighth Street June 5, 1878, and little by little was extended through Fifty-Third Street to 155th Street and Eighth Avenue by Dec. 1 of the following year.

To anyone who is familiar with the increase of traffic upon the elevated railroads in New York it does not need much legal acumen after a careful consideration of the facts and of the law which we have already given, to see that a strict application of the law to the facts as they have occurred since 1879 will necessarily lead to the conclusion that there are very few pieces of property in the city of New York where the road can successfully claim title by prescription.

For ever since the opening of the present system there has been a constant increase in all the branches and sections of the system in New York, not only in the number of stations, but in the number of engines and cars, and hence in the number of trains. Not many years ago the station platforms were lengthened so as to accommodate trains of five cars, in place of three and four, which formerly were the rule. Heavier engines have been built and are now universally used. Tracks are heavier, and in a large portion of the city a third track has been built. The amount of light and air and access which is kept from the property owner by the structure itself has been increased in many parts of the road by the increase in the size and number of the girders and in many cases by putting solid, in place of latticed girders. Along a large portion of the road a third track has been constructed, and express trains operated upon it.

Each and every one of these alterations tend to increase the amount of light and air and access of which the property owner is deprived. The damage done him by noise has been increased.

It has been held that where a person claimed adverse possession of the right to pollute a stream of water with sewerage, claiming that he had been possessed of the easement for twenty years, and where it was shown that pollution was gradually increased during the twenty years, he cannot maintain any title by prescription.—(*Goldsmidt vs Tunbridge, 1 Eng. L. R. Eq., 160.)*

According to the sworn testimony of the highest officials

* Communications relating to this department may be addressed to the Editors, Johnston Building, 30 Broad Street, New York.

of the road the limit of the train capacity of the present structure has been reached. Without increasing the number of tracks at present existing the road cannot run more trains than it is running to-day; certainly, not during the crowded hours, which is the only time when more trains are needed.

Thus far we have assumed that title by prescription of the street easements can be secured by a company operating an elevated railroad, provided they operate it without increasing the burden upon it, continuously, for twenty years or more under an adverse claim of right. But there is very serious doubt in the minds of a large portion of the legal fraternity as to whether street or highway easements can be acquired by prescription at all, however uniform, however continuous, and however long continued may be the occupation. They point out that each act of the road operated without title to the easement is a tort in the form of a trespass, and gives the right to an action, and these recurring rights are only barred by a six years' statute of limitations, and that these same acts can be enjoined in a suit of equity whenever they occur, whatever may be the frequency and history of past acts of a similar character. There are authorities which would seem to support their contention, but if the proposition is as clear to the courts, as it appears to us, that the elevated railroad has taken more and more of the easements as each increase has been made in the burden imposed upon their structure, then the question as to whether title can be procured by prescription where the burden is not increased for twenty years will not arise for many years to come.

In many cases adverse possession could not in any event be successfully set up, for where the property has been owned by infants or others laboring under similar disability, the period of such disability is not allowed as part of the twenty-year period. H.

CHARTERS, ORDINANCES, FRANCHISES, ETC.

ALABAMA.—Carriage of Passengers—Rules of Carrier—Ejection of Passenger—Question for Jury—Instructions.

1. A rule of a street railway company requiring colored passengers to occupy seats in the front end of its cars, and white passengers to occupy seats in the rear end, is a reasonable regulation.

2. When the existence of a rule of a carrier requiring white and colored passengers to occupy different parts of the same car is established by the evidence, and its violation is shown, the reasonableness of the rule is purely a question of law for the court, and not a mixed question of law and fact.

3. Where plaintiff, a passenger on an electric car, alleged and proved that the ejection from the car was committed jointly by the conductor and motorman, it was not error to charge the jury to find for defendant if they believed from the evidence that the motorman did not aid or assist in ejecting her.—(Bowie vs. Birmingham Ry. & Elec. Co., 27 So. Rep., 1016.)

DELAWARE.—Constitutional Law—Obligation of Contracts—Corporations—Revocation of Corporate Charter or Rights—Street Railways—Traffic Agreements—Franchises—Right to Question—Injunction—Equity—Estoppel.

1. Const. 1831, art. 2, sec. 17, authorizes the Legislature to incorporate "with a reserved power of revocation by the Legislature." Held, that such provision became a part of the charter of corporations subsequently formed, and that the Legislature might exert that power at any time.

2. The provision in Const. 1831, are 2, sec. 17, authorizing the Legislature to incorporate "with a reserved power of revocation by the Legislature," permits the withdrawal of a single right or privilege without revoking the whole franchise.

3. The revocation contemplated under such clause may be either direct or by necessary implication by the passage of an act necessarily inconsistent with some right or privilege possessed by an existing corporation.

4. An act giving a street railway company a franchise to construct lines in certain streets of a city, in which another existing corporation has been granted the exclusive franchise, impliedly revokes such exclusive privilege under the power reserved in the Legislature by Const. 1831, art. 2, sec. 17.

5. An act providing for the construction of a street railway from outside the city required that it be constructed to the boundary line of the city at U Street, and that it should be completed in a certain time. A supplement to such act provided that the road might be extended from a point at which the railway intersected the boundary line, through and along G Avenue, etc., and extending the time for completion. The road, as actually built, did not run to the intersection of the boundary line at U Street, but directly to G Avenue. Held, not a sufficient compliance with the conditions of the charter, and the rights of the corporation thereunder were forfeited, although a strict construction of the statute would necessitate an acute angle in the road.

6. An exclusive right granted to a street railway company to operate its line in a city is such a property right as will entitle it to raise by injunction the question of forfeiture, by failure to perform the conditions, of the charter of a company, which is granted the right to build a street railway in certain streets of the same city.

7. A franchise to a street railway corporation giving it exclusive right and privilege of locating, constructing, operating, and maintaining a city railway within the limits of a city, designating the route of the road, and giving the further privilege of building anywhere within the city, on condition of obtaining the consent of the City Council, is an exclusive franchise as to all streets in the city.

8. Grants of an exclusive franchise to a street railway company to operate a "city railway," which provides, among other things, that steam power shall not be used unless with consent of the Council, and that bells shall be attached to the horses, does not mean, because of the use of such words, and of the fact that horse power was the only power then in use, that the motive power shall be limited to steam or horse power, or prohibit the use of electricity, so that the grant of a right to another company to use electricity would not be a violation of the franchise.

9. A charter for an electric railway company authorized it to make a traffic agreement with a street railway company in an adjacent city, stipulating that the former company should not build its tracks within the limits of said city. Subsequently the former company was granted a franchise to build a street railway line in said city. Held, that such a traffic agreement was ultra vires and void, as being in restraint of competition.

10. A court of equity will not enforce by injunction a traffic agreement between two railway companies by which one of them is restrained from competing with the other.

11. A traffic agreement between two street railway companies, by which one is restrained from competing with the other, does not estop the latter to question the corporate existence of the former, such question not arising out of the contract.—(Wilmington City Ry. Co. vs. Wilmington & B. S. Ry. Co., 46 Atl. Rep., 12.)

NEW JERSEY.—Taxation—Assessment—Correction—Real Estate—Certiorari.

1. A mistake of an assessor in listing as personal, property described in terms showing it to be real estate, may be corrected, even after the duplicate has been delivered to the collector.

2. An electric street railway is real estate, within the tax laws.

3. When it is sought, on certiorari, to set aside a warrant for sale of real estate for taxes on the ground that the prosecutor is a purchaser in good faith, against whom, as such, the tax lien has been lost by failure to make timely return to the County Clerk, and the proof of such status is not satisfactory, the writ should be dismissed, and the prosecutor be left to his defense against a possible purchaser at the tax sale.—(State [Newark & H. Traction Co., Prosecutors] vs. Mayor, etc., of Borough of North Arlington et al., 46 Atl. Rep., 568.)

NEW YORK.—Repeal of Statute—Effect—Pending Cases—Appeal—Street Railways—Consent of Abutting Owners—Crossing Railway.

1. Under Laws 1892, c. 677, sec. 31 ("Statutory Construction Act"), providing that the repeal of a statute shall not affect or impair rights accrued or acts done before it takes effect, a pending appeal, in proceedings by a street railway company to acquire the right to cross the tracks of a railway company at a point where they intersect a highway on which the street railway tracks are laid, was not affected by the enactment of Laws 1897, c. 754, which made changes in the procedure to acquire such right.

2. On appeal from the decision of a referee, the appeal will not be disposed of on a theory not presented to the referee.

3. Under Laws 1890, c. 565, sec. 91, providing that street railways shall not be built in the highways of a town without the consent of the town boards; and sec. 12, providing for the procurement of the right of one road to cross the tracks of another, and for determining the manner thereof and the compensation to be paid therefor—a street railway company owning a road which is to be built from one town into another, which has obtained the consent of the authorities of a town within which a crossing is to be made to the use of the highway of such town by the street railway com-

pany, may maintain an action to acquire the right to cross the tracks of a railway company which intersects the highway on which the street railway company's tracks are laid, though it had not the consent of the other town into which it proposed to build its road.

4. Under Laws 1890, c. 565, sec. 91, providing that a surface street railway shall not be built on any street or highway without the consent of the owners of one-half in value of all the property abutting on the street, a consent by the requisite number of the abutting property owners given to certain promoters of a proposed corporation, their assigns and legal representatives, to the construction of a surface road, which is subsequently assigned to a corporation, is sufficient to authorize the construction of a surface street railway in the highway by the assignee, and a railway over whose tracks the street railway company has instituted proceeding to procure a right to cross at a point where they intersect the highway cannot question the sufficiency of such consent.—(Geneva & W. Ry. Co. vs. New York Cent. & H. R. R. Co. Same vs. Fall Brook Ry. Co., 57 N. E. Rep., 498.)

NEW YORK.—Transfer of Passengers—Action—Complaint.

1. Under Laws 1890, c. 565, sec. 101, providing that no corporation operating a street surface railway under that chapter or chapter 252 of the Laws of 1884, shall charge more than 5 cents for one continuous ride from any point on its road, or on any line or branch operated by it or under its control, to any other point thereof, a complaint in an action by a passenger on a surface railway line against the company for its refusal to transfer him from one of its lines to a connecting line, which does not allege that the company was organized under the provisions of Laws 1890, c. 565, or Laws 1884, c. 252, is demurrable.

2. Same. Under Laws 1890, c. 565, secs. 103-105, providing that street surface railways may contract for the use of any other company's road, and providing that every such corporation entering into such a contract shall carry passengers between any two points on the railroads embraced in such contract for a single fare, a company leasing another connecting company's road, and operating it, is not bound to transfer a passenger riding from a point on the defendant company's original line to a point on the leased line where it intersects a line subsequently leased by defendant, to the line so subsequently leased, since the three roads are not united by one contract.—(Mendoza vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 745.)

NEW YORK.—Contract—Construction—Breach.

1. An agreement between plaintiff's assignor and defendant reciting that defendant should, on foreclosure sale of certain property, furnish the money required to purchase the property, "at such price as may hereafter mutually be agreed upon," will be construed as calling on each party to use reasonable efforts to agree on a price which should be bid for the property; and, if defendant refused to make such efforts, such refusal would be a breach of his contract.

2. Same—Correspondence—Construction. The effect to be given to correspondence between parties, introduced for the purpose of determining whether or not there has been a refusal to comply with the terms of a contract, is one of law, for the court, and should not be submitted to the jury.

3. Same. Defendant agreed with plaintiff to furnish the money required to purchase certain property at foreclosure sale, at a price thereafter to be agreed on. Prior to the sale, defendant's directors passed a resolution declaring that not over a certain sum should be bid, and transmitted a copy of the resolution to plaintiff. Plaintiff, by letter, stated that he was not satisfied with the amount fixed. Defendant answered that it stood ready to carry out the original agreement. Plaintiff wrote that defendant could not, if necessary to secure the property, bid less than an amount stated, which was greatly in excess of the amount fixed by the directors. The contract contemplated the reorganization of the company owning the mortgaged property, of which plaintiff owned a majority of the stock. The letter stated that the essential part of the agreement was that defendant should buy at the sale for the lowest amount practicable, and that the details of the reorganization were the only matters left to subsequent mutual agreement. Held, to show a refusal by plaintiff's assignor to negotiate as to the price to be paid, and not to show that defendant had refused to negotiate, or had arbitrarily fixed a limit for the amount which it would bid. —(Smith vs. United Traction & Elec. Co., 63 N. Y. Suppl., 665.)

NEW YORK.—Transfers—Ejectment of Passengers—Tort.

1. Where plaintiff was ejected from one of defendant's cars, and accused of having picked up his transfer in the street, because the conductor who issued it had punched it to read 2:40 p. m. instead of 3:40 p. m., by mistake, plaintiff was entitled to sue in tort for damanges for the expulsion, and the humiliation and injury to his feelings caused by the insulting remarks of the conductor, and was not limited to an action for the breach of his contract for transportation.

2. Same—Nonforcible Expulsion. That plaintiff left one of the defendant's cars in the middle of the block, at the command of the conductor, without waiting to be forcibly expelled, did not prevent him from suing for being wrongfully expelled.

3. Same—Exemplary Damages. Where plaintiff was put off of one of the defendant's street cars, in the mud, at the middle of the block, and accused of having picked up his transfer in the street, because the conductor who issued it had erroneously punched it to read 2:30 p. m. instead of 3:30 p. m., he was not entitled to recover exemplary damages.—(Eddy vs. Syracuse Rapid Transit Ry. Co., 63 N. Y. Suppl., 645.)

NEW YORK.—Highway — Unlawful Use — Action — Parties Plaintiff. An action to enjoin a corporation from constructing a street railway on a highway, and to compel it to remove a track already laid without lawful authority and to restore the highway to its former condition, can be brought in the name of the town, under Highway Law, sec. 15, authorizing the highway commissioners to bring an action in the name of the town "to sustain the rights of the public in and to any highway in the town."—(Town of Eastchester vs. New York, W. & C. Traction Co., 63 N. Y. Suppl., 1032.)

NEW YORK.—Parties—Corporations and Stockholders.

1. The stockholders of a corporation are neither necessary nor proper parties to an action to enforce an agreement of a third person to hold an assignment of a franchise for the benefit of the corporation, where the corporation does not refuse to sue; they not being persons having an interest in the subject of the action and in obtaining the judgment, within Code Civ. Proc., sec. 446.

2. Demurrer—Misjoinder of Plaintiffs. A complaint is demurrable because a plaintiff is neither a necessary nor proper party; Code Civ. Proc., sec. 488, subd. 5, permitting a defendant to demur on the ground that there is a misjoinder of parties plaintiff.—(Havana City Ry. Co. et al vs. Ceballos et al, 63 N. Y. Suppl., 417.)

WASHINGTON.—Taxation — Property Subject — Corporate Franchises—Assessment—Board of Equalization—Valuation.

1. Corporate franchises are taxable.

2. A board of equalization, which received affidavits and all information tendered, and heard arguments of counsel in support of an application for a reduction of assessments, cannot be said to have arbitrarily refused to receive testimony in support of such application, merely because it failed to pass on an offer on the part of one of the property owners to swear a witness, who afterward stated his views, together with others having knowledge of the values of the properties assessed.

3. It is only when taxing officers have acted maliciously, fraudulently, arbitrarily, or oppressively, that their determination of values will be disturbed.

4. A corporation had notice that its franchises were assessed, where the assessor, before returning the roll to the board of equalization, at a time when he could lawfully make corrections, inserted the word "franchises" in the column entitled "Other Property," without changing the valuation, and its officers subsequently appeared before the board and applied for a reduction of the assessment.—(Spokane St. Ry. Co. vs. Spokane County, 60 Pac. Rep., 132.)

LIABILITY FOR NEGLIGENCE

MICHIGAN.—Liability for Negligence — Injuries — Bicycle Rider—Contributory Negligence. Plaintiff was injured by a street car when attempting to cross the track on a bicycle. He was going at the rate of four to six miles an hour, and did not look for the car till he was on the track. If he had looked, he could have seen the car in time to have stopped or turned aside. Held, that the plaintiff could not recover for the negligence of the company in running the car at an excessive speed and not ringing the gong, as his own negligence contributed to the injury.—(Bennett vs. Detroit Citizens' St. Ry. Co., 82 N. W. Rep., 518.)

NEW YORK.—Appeal—Review—Collision—Admissibility of Evidence—Instructions—Province of Jury—Negligence—Pleading —Special Damages.

1. An objection that certain evidence was immaterial and irrelevant as no part of the negligence charged, and as not showing negligence, did not raise the objection that the evidence, if it showed negligence, was not such negligence as contributed to plaintiff's injury.

2. Evidence of omission to sound a street-car gong at a place where the law did not require it to be sounded is admissible as a part of the history of the transaction, and as bearing upon the degree of care exercised by the street-car employees, and upon the question of plaintiff's contributory negligence.

3. Sufficiency of evidence to sustain a verdict cannot be reviewed in the Court of Appeals, where the decision below was unanimous.

4. An instruction that, if the jury believed that an accident occurred as described by plaintiff's witnesses, then plaintiff is entitled to recover, is not open to the objection that it prevents the

jury from construing the evidence and determining the facts established; such charge being equivalent to an instruction that, if the facts claimed by plaintiff were established, she was entitled to a verdict.

5. An objection that instructions to find for plaintiff if the jury believe that an accident occurred, as described by his witnesses, is not open to the objection that it prevents the jury from construing the evidence, where another instruction gives the jury the same power if witnesses for defendant are believed.

6. Testimony that plaintiff's "heart was affected, that the dorsal muscle on the right side was paralyzed, and that she had trouble with her menstruation, suffered from vertigo, and had curvature of the spine," is not admissible under a complaint, alleging that plaintiff received "severe and painful contusions to her head, body and arms, and lacerated her scalp, and whereby she sustained severe nervous shock and concussion of the brain, and injured her eyesight, and she was for a time rendered unconscious, and she thereby sustained permanent injuries, and was injured for life."—(Kleiner vs. Third Ave. R. R. Co., 56 N. E. Rep., 497.)

NEW YORK.—Collision at Crossings—Evidence—Negligence—Instructions—Presumption.

1. In an action to recover for injuries by a collision of two street cars at a crossing, the fact that one of the cars was first on the crossing is not conclusive proof that such car had the right of way, but, in the absence of evidence as to the relative position and speed of the two cars as they approached the crossing, it constituted evidence from which the jury might have inferred that the car first on the crossing was entitled to precedence; and that the car first on the crossing was nearly over when struck is admissible to throw light on the relative position of the cars.

2. In an action to recover for injuries by the collision of two street cars at a crossing, an instruction that the accident raised a presumption of negligence against the company on whose car plaintiff was not a passenger, requiring an explanation on its part, is erroneous, since, not being the carrier, it was bound only to exercise ordinary care in the management of its cars, and, as there were two actors in the collision, it might have been due entirely to the fault of one party, and not at all to the fault of the other.

3. The mere fact of the accident raises a presumption of negligence on the part of the carrier, which makes it incumbent on the company carrying the passenger injured to show that it occurred without negligence on its part.

4. There was but little evidence as to how the accident occurred. It appeared, however, that the car in which plaintiff was a passenger had nearly crossed over the other company's track when it was struck by its car. Held, that it was error to charge, as a matter of law, that the company on whose line plaintiff was a passenger had offered no explanation of the cause of the accident, to rebut the presumption of negligence arising from the fact of the accident, since the relative position of the cars at the time of the accident should have been considered in determining whether or not the company was negligent.

5. In an action against two street railway companies, jointly, to recover for injuries sustained by reason of a collision at a crossing, an instruction that defendants were liable in case the jury should find that "the collision can be attributed to the want of reasonable care on the part of defendants" is erroneous, as their liability depends on whether or not, as a fact, it was attributable to their negligence.—(Londoun vs. Eighth Ave. Ry. Co. et al., 56 N. E. Rep., 988.)

NEW YORK.—Attorney and Client—Lien of Attorney—Enforcement as Against a Defendant—Practise. The practise of forcing an attorney's lien for his compensation, given by Code Civ. Pros., sec. 66, as against a defendant, who has settled with his client without his knowledge, by action, and not by motion, is not affected by the amendment of 1899, providing that the court, "on petition of the client or attorney, may determine and enforce the lien," as the amendment does not, in terms, relate to a defendant, but merely aims to formulate a practise applicable as between an attorney and his client.—(Rochfort vs. Metropolitan St. Ry. Co., 63 N. Y. Suppl., 1036.)

NEW YORK.—Negligence—Extent of Injuries—Evidence.

1. Where plaintiff, an actress, suing for injuries sustained, testified that on joining her company, some weeks after the accident, she was so ill as to seldom be able to attend rehearsals, and was under a doctor's care all the time; that her manager well knew how ill she was; and that she was finally compelled by sickness to stop work—it was error to exclude testimony of the manager as to what he had observed as to her physical condition during that period.

2. Same. Where plaintiff had testified that she was forced to disband her theatrical company through ill health due to injuries sued for, and not because of her incompetency as an actress, it was error to exclude the testimony of her manager as to why the company was disbanded.—(Farrell vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 709.)

NEW YORK.—Negligence—Instructions.

1. In an action for injuries caused by plaintiff's wagon colliding with a street car while he was driving across defendant's tracks, an instruction that if, just before the accident, the wagon was driven alongside the track and it was turned into the track in front of the car, the verdict must be for the defendant, was properly refused, since the turning into the track might have been far enough in front of the car to have given the gripman ample time to stop the car and prevent the accident.

2. Same — Special Damages — Allegation — When Necessary. Where injuries for which recovery is sought do not necessarily result from those described in the complaint, they must be alleged as special damages; and an injury to plaintiff's eye could not be recovered for on an allegation of injury to the head and brain, since it did not necessarily result therefrom.—(Geoghan vs. Third Ave. Ry. Co., 64 N. Y. Suppl., 630.)

NEW YORK.—Excessive Damages—Personal Injuries. Plaintiff, a teacher, was injured by the sudden stopping of defendant's street car, on which she was a passenger; the injury being a dislocation of a cartilage in each knee, with other injuries to her body. She expended $1670 for medical services, and was confined to her bed about ten weeks. At the time of the trial, eighteen months after the accident, she could not go up and down stairs without pain, and, in consequence of her condition, had to give up her position of general superintendent in a school. Held, that a verdict of $15,000 should be set aside as excessive.—(Kraemer vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 619.)

NEW YORK.—Malicious Prosecution — Evidence — Judicial Proceedings. An action for malicious prosecution will not lie against a defendant for having illegally arrested plaintiff without a warrant, and having brought him before a police court, where he is discharged without the filing of a complaint; an essential element of malicious prosecution being a commencement of judicial proceedings.—(Barry vs. Third Ave. R. Co., 64 N. Y. Suppl., 615.)

NEW YORK.—Damages—Evidence—Pleading.

1. Where the complaint alleges that plaintiff received a "wound at the right upper angle of the forehead; also a fracture of the skull, concussion of the brain, and a fracture of the nasal bone," he cannot introduce evidence of hysteric epilepsy, unless that condition resulted immediately and necessarily from those injuries.

2. Special Damages. Where it appears from the evidence that the hysteric epilepsy from which plaintiff suffered did not result immediately and necessarily from the injuries set out in his complaint, a motion to strike out the evidence of this condition on the ground that plaintiff has not pleaded it as a basis for special damages should be sustained.—(Ackman vs. Third Ave. R. Co., 65 N. Y. Suppl., 97.)

NEW YORK.—Personal Injuries—Earning Capacity—Excessive Damages.

1. Where the evidence in a personal injury case does not show that plaintiff's injuries have, or will, affect his earning capacity to any great extent, a verdict for $5000 is excessive.

2. Same—Stipulation for Reduction—New Trial—Plaintiff's Option. Where a verdict for personal injuries is found excessive, plaintiff will be given the option to stipulate for a reduction of the recovery to an amount deemed proper by the Appellate Court, or to have the order of the trial court denying defendant a new trial reversed.—(Kaplan vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 91.)

NEW YORK.—Personal Injuries—Negligence—Trial. Plaintiff (a woman sixty years of age), before starting to cross the street in the middle of a block, stopped and looked, and saw that there was no approaching car nearer than one in the next block, and that it was slackening its speed at the crossing. There was evidence tending to show that the motorman had applied the power at the corner, that the speed increased until plaintiff was struck, that no bell was rung, and that the motorman's head was turned, and he was talking with a person inside the car. Held, that whether plaintiff exercised reasonable care, and whether defendant was negligent, should have been submitted to the jury, and it was error to nonsuit plaintiff.—(Killen vs. Brooklyn Heights R. Co., 62 N. Y. Suppl., 927.)

NEW YORK.—Injuries—Defective Track—Proof. Where the complaint, in an action against a street railway company for an injury resulting from the defective condition of a certain part of its track, alleges that such road was operated by the defendant company, and the answer admitted the operation thereof, it was error to dismiss the complaint because the evidence failed to show that defendant was prima facie liable for the defective condition of the track.—(Schnell vs. Metropolitan St. Ry. Co., 64 N. Y. Suppl., 67.)

The International Tramways and Light Railways Exhibition

(From Our Own Correspondent.)

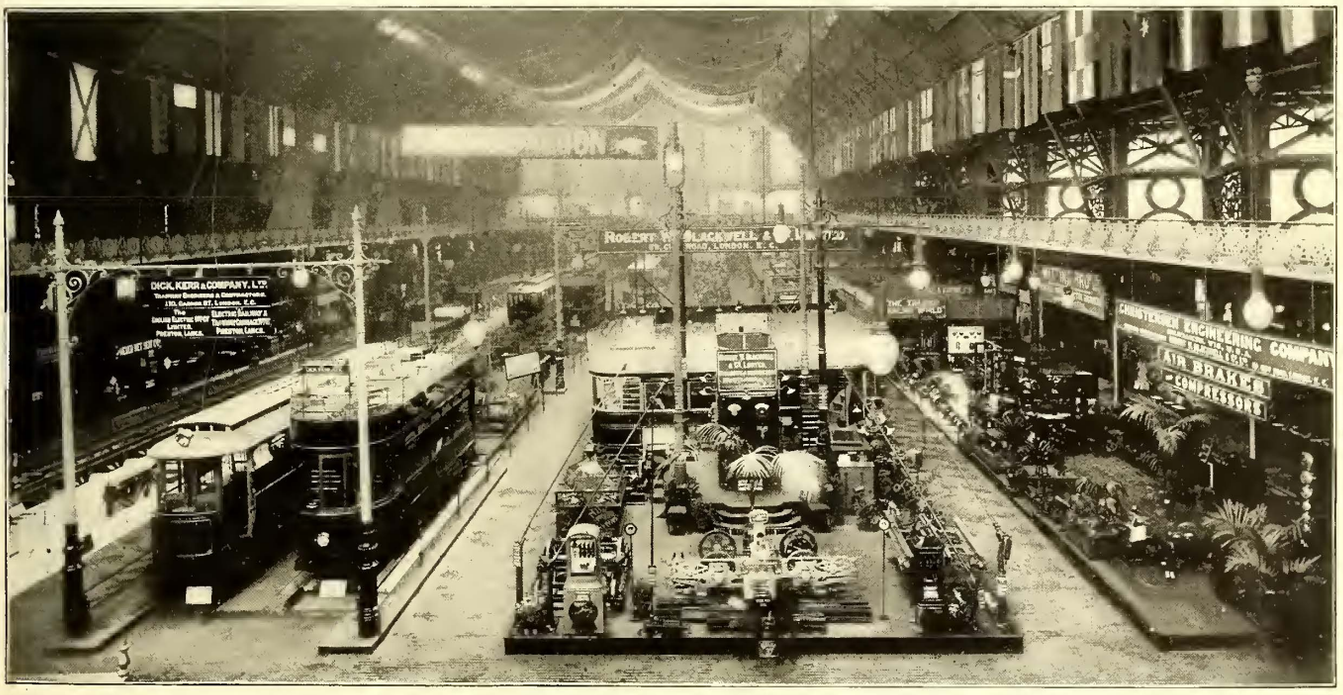
The opening of the International Tramways and Light Railways Exhibition at Agricultural Hall, London, on June 27, has already been chronicled in these columns, but the lateness in the month of the opening date prevented the publication in the July issue of any of the papers presented, or of any views of the exhibits. The exhibition, which was under the patronage of many prominent railway managers and municipal corporation officials in the United Kingdom, was the largest and most successful event of the kind ever held in Great Britain, and great interest was taken in it, as the large attendance testified.

THE EXHIBITS

From the different views of the exhibition which are published it will be seen that the large hall was amply filled with exhibits of cars, overhead-line equipment, track, generators, motors, etc.; in fact, all that goes to make a successful tramway installation.

THE BRITISH WESTINGHOUSE ELECTRIC MANUFACTURING COMPANY, LTD., had a space which extended the whole length of the hall, a little more than 300 ft., in which the company had erected a perfectly equipped conduit system, on which was a very handsome car, built to the company's designs, by George T. Milner & Company, of Birkenhead. The conduit was all above the floor, and its working parts were readily examined by those interested. The power for operating the car was furnished by a Westinghouse three-cylinder gas engine, rated at 112 B. H. P., direct coupled to a 75-kw, 500-volt Westinghouse generator. A fine panel switchboard, fitted with the usual switches, circuit workers and instruments controlled the circuits. The car was equipped with two No. 49 multipolar motors, fitted with the usual Westinghouse controller. The car was also equipped with an electromagnetic brake (Newell patents), which, in addition to braking the wheels, also magnetically grips the rail, and by an interesting system of levers, the effect on the wheel rims is not changed by the application of the track brake. The car was a handsome example of the most modern British pattern, constructed by George T. Milner & Company, and was mounted on Brill trucks. It was double-decked and could seat twenty-eight persons inside and thirty-six outside. The car was equipped with an electric-bell system for the passengers, inside and outside, and was equipped also with electric heaters. The working of the electric brake was also shown on other models exhibited, and there were also Baldwin trucks for light railway work. The Westinghouse electro-pneumatic control system for trains of cars was also shown by a full size working model of two cars equipped with complete apparatus, showing in train work the advantages of distributing the power among several motors throughout the train. It only remains to say that the car on the conduit system made regular trips during the whole period of the exhibition without mishap, and was generously patronized, nearly all visitors having a ride on it before leaving the hall.

DICK, KERR & COMPANY, THE ENGLISH ELECTRIC MANUFACTURING COMPANY, AND THE ELECTRIC RAILWAY & TRAMWAY CARRIAGE WORKS, LTD.—Moving to the right the next exhibit was that of the three companies mentioned, which was in the nature of combined exhibit, Dick, Kerr & Company acting as selling agents for the other two, and showing a most comprehensive collection of examples of permanent way construction and electric tramway rolling stock and accessories. Cars naturally formed a large part of the exhibit, four different types being shown, as follows: 1. Bogie vestibuled top seat for heavy city service, fitted with a Bellamy reversed staircase, and capable of seating sixty-four passengers. The car was mounted on Brill maximum traction trucks, and the motors and controllers were by the English Electric Manufacturing Company. 2. Bogie cross-bench car for high-speed summer suburban service, with a seating capacity of fifty-five passengers, mounted on equal wheel bogies, and with four-motor equipments, and equipped with air brakes and axle-driven compressors. 3. Four-wheel top-seat car of the improved Preston type, fitted with Bellamy reversed stairway, with a seating capacity of fifty-six passengers. 4. Four-wheel single-deck car, equipped with air brakes, with axle-driven compressor, and having a capacity of twenty-six passengers. Needless to say all these cars were built by the Electric Railway & Tramway Carriage Works, of Preston, and the whole electric equipment was supplied by the English Electric Manufacturing Company, of Preston. All were extremely well finished and thoroughly handsome samples of what the company is daily doing at its extensive Preston works. In addition to the cars a truck was shown fully equipped with motors and air brakes, the motors, controllers, etc., being of the Short system, and the brakes and the compressors being on the standard air-brake system. A number of samples of tramway permanent way was shown, varying from rails weighing 96 lbs. to the yard, with Dicker patent continuous joints, to rails weighing only 65 lbs. to the yard, spiked to 9 ft. x 9 ins. x 4½ ins. timber ties. Special truck work was also shown with points 7 ft. 6 ins. long, built from rails weighing 83 lbs. per yard, and various rail sections and rail joints added to the completeness of the exhibit. Finally the company showed a number of standard designs of poles, brackets, and all the necessary details for overhead erection, making a most complete and artistically arranged exhibit.



GENERAL VIEW OF EXHIBITION FROM ENTRANCE

ROBERT W. BLACKWELL & COMPANY, LTD.—In designing their exhibit Blackwell & Company evidently intended to show a sample of every device which enters into the construction of an electric tramway, only omitting engines and power houses, these being substituted, however, by admirable photographs and working drawings. Commencing with the permanent way, they

showed some samples of manganese steel frogs, switches and crossings, this metal being chosen on account of its extraordinary toughness and hardness, being particularly suitable for this class of work, which is subjected to excessive tear and wear. The "Chicago" rail bond was also shown in profusion, and also the "Crown" bond, which, it is claimed, is an improvement on the other. The Edison-Brown plastic bonds were also shown in an exhibit by themselves, with Harold P. Brown in attendance. Four trucks of the Peckham type were shown, namely, the "Standard" for heavy 18-ft. to 20-ft. cars; an "Extra Long" truck, with 30-in. wheels, the whole designed specially for long heavy cars; a swing bolster "Maximum Traction" truck, fitted with the latest pattern side frames, and a short wheel-base swing bolster truck, designed to take successively curves of 30-ft. radius or less. On this last truck was displayed the Price momentum friction brake, which is so constructed that it utilizes the energy of the moving car for power. A very complete exhibit of air brakes was also shown on the adjoining stand of the Christensen Engineering Company, of Milwaukee. The Hipwood-Barrett fender attracted a good deal of attention, though it failed to secure the prize offered by the association, who awarded it to an ordinary life guard. Four poles were erected at corners of the exhibit, each being different, one being a center pole and bracket for flexible suspension, a side pole and bracket for flexible suspension, an ordinary side pole and bracket, and Blackwell's standard pole and bracket. Samples of trolley wire and Ætna insulators were shown, as also two samples of conduits, one being of historic interest, having been laid by Mr. Blackwell in Allegheny City, Pa., in 1887. Various trolleys were shown, including the "Pivotal" Boston trolley, the Standard trolley, the Dwarf trolley, the Winslow trolley, and also the "Southampton" and "Dublin" types of inclosed spring trolleys. Switches and circuit breakers, junction boxes, P. & B. electrical compound incandescent lamps, and a trolley wagon took up most of the remaining part of the exhibit, though mention should also be made of the various steam devices shown, including the Bundy oil separator, patent steam traps, Siegrist lubricators, and a large number of specialties useful in electric power houses.

THE BRITISH THOMSON-HOUSTON COMPANY, LTD.—An excellent display of electric cars and various tramway devices was also shown by this company, who had an extensive space well located in the center of the hall. They showed a fully equipped car built by Hurst, Nelson & Company, of Motherwell, mounted on two Brill maximum traction bogie trucks, and equipped with two standard G. E. double motor rheostatic brake equipment. The car is fitted with the Hurst-Nelson reversed stairway, and with its open iron grill surrounding the outside seats, presented a very handsome appearance, as well as giving it the air of coolness. The other car was also built by Hurst, Nelson & Company, to the designs of J. Clifton Robinson, and was exhibited by the kind permission of the directors of the London United Tramways, Ltd., for which company the car was built. It had accommodation for thirty inside passengers and thirty-nine outside, and its interior was lavishly and luxuriously fitted up. The ventilators extend the whole length of the car, and electric push buttons are provided for the use of the passengers for communicating with the conductor. For the purpose of showing the electric equipment in detail, a standard Hurst-Nelson truck with extension springs was exhibited, on the axles of which were mounted two G. E. 58 motors, with inclosed gear cases, so arranged that the wheels were free to revolve, illustrating the complete control of the driving mechanism by the motorman. The motors were connected to a series parallel magnetic blow-out controller of the rheostatic-brake type, and showed the effectiveness of this method of electric braking. A number of automatic circuit breakers were also shown, as also resistance boxes, various trolleys, tramway recording wattmeter, electric heaters, feeder pillars, overhead material, magnetic blow-out lightning arresters, etc., etc. The company also showed a section of an underground conduit system, on which was mounted a truck equipped with contact plow, showing the method of raising and lowering the same in and out of the conduit. Altogether the exhibit was a most complete one, and showed in a clear manner the advances made in electric traction in the past few years. That it was appreciated was evidenced by the interest shown by the large number of visitors in constant attendance.

EXHIBIT OF THE BRITISH THOMSON-HOUSTON CO.

A. & F. MANUELLE, of London, showed a varied assortment of granites from their quarries at Aberdeen, Guernsey, Norway and Leicestershire, for paving purposes.

ALBION CLAY COMPANY, LTD., of Burton-on-Trent, showed some admirable samples of its stoneware conduits, arranged with circular ducts, provided with spigot and socket, and fitted with Stanford joints. The company also showed samples of its troughing for its solid system of laying cables, which is also made of stoneware, and formed with spigot and socket ends, and has, in addition, a longitudinal socket to admit of a cover being formed.

E. S. HINDEY, of London, showed some specialties in vertical boilers, horizontal steam engines, dynamos and pumps.

CHARLES CHURCHILL & COMPANY, of London, showed a most interesting and comprehensive collection of high-class American machine tools, weighing in all about 30 tons. These comprised planers, shapers, lathes, turret lathes, screwing machines, radial drills, boring mills, key-way cutters, universal milling machine, universal cutter grinder, track drills, track jacks, rail saws, rail benders, etc., etc.

ESTLER BROTHERS, of London, had a tastefully arranged booth in which they displayed hundreds of various samples of the well-known insulating material, "Ambroin." This material does not absorb moisture, nor does it deteriorate on exposure, and can be molded into any desired shape. It is used in all the overhead fittings exhibited by this company, which comprised a variety

of appliances used in the overhead construction for electric tramways. It has a very large use also in sparking shields and other insulating parts of controllers, controller handles, and, in fact, in almost any place where insulating material is used. They also showed some new forms of trolley standards for center or side running, and for top-seat or single deck cars. They showed, also, a trolley head of the swiveling type, fitted with a ball-bearing turntable, and also a number of samples of the Garton lightning arrester. A model of a conduit and surface contact system (Steudebach's combined) was also exhibited.

THE ROLLER BEARINGS COMPANY exhibited samples of roller bearings, as adapted to Peckham and Brill trucks, shafting bearings, trolley bearings, etc.

FREDERICK LELL exhibited some samples of steam separators, grease extractors, automatic exhaust valves, jet condensers, as well as a "Bemis" truck. He also showed some handsome photographs of the Ball & Wood engine.

EDWARD BENNIS & COMPANY, of Bolton, showed an interesting machine stoker and self-cleaning furnace at work. This

VIEW OF EXHIBITION FROM REAR OF HALL

furnace has been adopted by many of the tramway companies, as it raises steam rapidly, and any class of coal can be used.

G. F. ZIMMER, of London, had on exhibition models of the Kreiss patent swinging conveyor, which, by means of vibrations, conveys coal or other material with a very small expenditure in power.

DOCKER BROTHERS, of Birmingham, showed some samples of varnishes and paints suitable for tramway cars.

THE KLEIN ENGINEERING COMPANY, of Manchester, exhibited models of its patent water coolers, used in conjunction with condensing engines at power plants. Oil separators were also shown, and a number of interesting photographs, showing Klein's counter-current jet condensers in course of erection at the Liverpool Corporation's new electric power house at Lister Drive.

LE CARBONE showed samples of carbon brushes, which are the principal specialty of this firm, as well as carbon-contact pieces, carbons for arc lamps, crucibles, primary batteries and a number of articles in use where carbon is a necessity.

THE OHMER SYNDICATE, LTD., exhibited a ticket-recording machine, which is 5¾ ins. square by 1¾ ins. deep, and weighs about the same as the ordinary ticket punch. It is intended to be worn by the conductor on a belt, is loaded with a roll of blank paper, has a time clock on its face, and can issue up to 3000 tickets if necessary. It adds the cash taken, records the number of passengers carried, and exposes the figures to the conductor and passengers.

TANGYES LIMITED, exhibited a portable hydraulic wheel press, tested to 50 tons, for putting on and taking off one railway wagon or tramcar wheel at a time, taking solid wheels up to 27 ins. diameter, and spoke wheels up to 36 ins. diameter. They also showed a hydraulic rail bender, manufactured by themselves, a gas engine, an oil engine and a steam engine, all in operation, and also showed a quick-speed governor for steam engines, and a useful lifting tackle.

THE JOSEPH DIXON CRUCIBLE COMPANY made an exhibit of graphite for lubrication, graphite pipe-joint compound, silica graphite paint, graphite greases, graphite resistance rods and graphite dynamo brushes.

THE ST. HELENS CABLE COMPANY, of Warrington, had a booth tastefully ornamented with samples of its various cables and insulated wires for traction and lighting purposes.

BABCOCK & WILCOX, LTD., of London, exhibited a handsome model of their well-known boiler to a scale of one-eighth. To describe this exhibit would be, therefore, simply to describe the B. & W. boiler, the model being complete in the smallest detail, and being one of a number which the company is now making for its numerous branch offices. The model also showed a Babcock & Wilcox patent superheater, consisting of solid drawn-steel tubes, expanded at the ends into wrought steel cross-boxes.

JOSEPH OWEN & SON, LTD., of Liverpool, had a unique exhibit, comprising samples of every variety of English and foreign timber used in the bodies of tramcars and other vehicles, of which this company makes a special feature.

THE WORTHINGTON PUMPING ENGINE COMPANY, LTD., of London, showed a small compound pressure feed pump, a type largely used in power stations where high pressure is carried. The company also showed a number of photographs and white prints of Worthington pumps, heaters, and of various types of its self-cooling condenser.

S. Z. DE FERRANTI, LTD., of Hollinwood, Manchester, showed, in a neatly decorated space in the entrance to the hall, and not in the main hall proper, one of their well-known 50-light rectifiers, and a number of their high-tension oil fuses. They also showed a number of extremely handsome photographs, beautifully executed, of their engine and dynamo combination, both vertical and horizontal, central station switchgear, high-tension switchgear, high-tension dynamo switchgear, high-tension oil break switch, maximum capacity 500 amps. at 2000 volts, high-tension plug fuses and blocks, open type rheostats, and a number of other specialties. These photographs were of large size and well arranged, and made quite an interesting exhibit.

THE VACUUM OIL COMPANY, of Rochester, had an elaborate exhibit, under the management of its London office, of its specialties, such as cylinder and valve oils, engine, dynamo and shafting oils, and patent automatic sight-feed lubricators.

THE LORAIN STEEL COMPANY showed some interesting samples of track construction, such as has been used in Newcastle-on-Tyne, Liverpool, and many other cities. The exhibit comprised a number of rail joints, electric-welded joints, portable cross-overs. The company also exhibited a Dupont truck having a wheel base of 5 ft. 6 ins., and a length over all of 13 ft. 4 ins.

THE ELECTRO MAGNETIC TRACTION COMPANY, LTD., showed a working model of a new system of electrical traction constructed under closed conduit surface contact system. The system is yet in its experimental stage, and no actual work has yet been done.

MOSSBERG ROLLER BEARINGS, LTD., had a neat little exhibit showing the application of roller bearings in various ways. They showed a pair of carriage wheels fitted with their patent roller bearings, one motor, car and wheel similarly fitted, and a tramway car axle box, and a various selection of small straight and end-thrust roller bearings.

W. F. DENNIS & COMPANY, sole agents in the United Kingdom for Felten & Guilleaume, of Germany, had a very attractive exhibit in which they showed the "Neptune" type of rail bonds in various lengths, both solid and flexible. They also showed trolley wire of the highest quality, in long lengths, weighing over 500 lbs., with specially soldered joints of a strength equal to the wires before drawing. Paper insulated cables for feeders, with single concentric, bi-concentric and stranded conductors for

low and high tension, were also shown in various forms, and guard wires, span wires, commutator bars and various covered wires, and bronze wires of all description were exhibited.

THE CHLORIDE ELECTRICAL STORAGE SYNDICATE, LTD., of Clifton Junction, Manchester, utilized its space to the very best advantage possible, by arranging in a very attractive manner numerous samples of storage batteries, as used for pressure regulation on numerous electric tramways and railways throughout the world. The various examples of different sized cells at present working in connection with electric tramway systems in Great Britain were easily identified by the printed cards attached to each. It was evident from the thoroughness of this exhibit that the storage battery is now forming an important part in central-station equipment, both for lighting and power work, affording an excellent means of allowing the steam engines to work during a large part of the time at their most economical load. The steam plant in stations which are thus equipped requires only to be sufficiently large to develop the average load, the storage battery supplying anything in excess and storing up any surplus. Samples were also exhibited of small batteries for the

VIEW OF THE WESTINGHOUSE EXHIBIT

automatic lighting of carriages on electric railways in the event of a breakdown at the power station, and batteries for self-contained cars, auto-cars, etc.

THE BRITISH INSULATED WIRE COMPANY, of Prescott, Lancashire, had a very tastefully decorated booth, in which were mounted samples of B. I. W. patent paper-insulated cables, as used for tramways in Aberdeen, Glasgow, Manchester and many other important cities. The company also showed a sample of a three-phase cable, as made for the Isle of Thanet tramways. This cable is being used as a three-phase feeder to the sub-transforming stations, with rotatory transformers transmitting power over 10 miles, the continuous low-tension current being supplied from the sub-stations through ordinary tramway feeders. The three conductors are separately insulated with impregnated paper, then stranded up together, and finally lead-sheathed under a hydraulic pressure of 3 tons to the square inch. This cable is made for a working pressure of 2500 volts, and is tested up to 10,000 volts. Samples of the company's well-known solid system, disconnecting joint boxes, etc., were also exhibited, while its standard section pillars in use at St. Helens, Blackpool and other towns were also shown, these having mounted on them switches of the duplex-knife type, four-line plug fuses with shield, lightning arresters, etc., etc. All these devices are carefully insulated from the slate with ebonite bushes, as is also the slate from the cast-iron pillar, and each pillar is equipped with a telephone set and board of trade terminals.

THE ELECTRIC TRAMWAYS EQUIPMENT COMPANY, of Birmingham, had erected a most practical exhibition of all its British-made overhead line material, and had a large sign over its stand with the words, "British-Made Overhead Line Material," which attracted considerable attention, as it is practically the only house in Great Britain which is manufacturing such material exclusively. In the company's booth, which was tastefully decorated, were shown samples of the company's insulators of the following types: Straight-line suspenders, single and double pull-offs, car-house suspenders, bridge suspenders, and bracket arm suspenders. A sample of the flexible bracket arm suspender was also exhibited, and a number of cap and cone insulators in straight line, single and double pull-offs, etc. A large assortment of the various forms of strain insulators was also shown, made of the "Verus" insulation, which the company claims is the first, and so far the only, insulation for trolley lines made in England. These comprise Globe strains, Brooklyn strains, Globe terminals, Globe turnbuckles, etc., and, in addition, a number of bronze ears for straight work and for curves, the latter being of a heavy section, and arranged for suspending by two insulators, this company being the first to introduce this principle. In addition the company had various samples of anchor ears, splicing ears, feeder ears, and a large number of section insulators, frogs and switches, car-house frogs with movable tongues, and all kinds of overhead crossings fixed and adjustable, and, in fact, every piece of apparatus necessary for the complete equipment of overhead-line construction.

MILLER & COMPANY, LTD., of the London Road Foundry, Edinburgh, had W. Gordon, one of its directors, in constant attendance, who succeeded most admirably in making a very attractive exhibit out of its car-wheel specialties. An exhibit of such material is hard to describe, as it only showed chilled car wheels and chilled iron points, but these were arranged in such a manner as to give an admirable appearance, and evidently attracted a great amount of attention from the electrical engineers and representatives of the various authorities and corporations who were present. The exhibit of chilled car wheels was interesting, as showing a sample of some wheels which have run over 100,000 miles with horse cars. With electric motor car wheels, in which it is now doing a large business, its wheels compete with any wheel which is made either in this country or America. It also showed a working model of a system of chilled iron double shifting points, as supplied to the Naples Electric Tramways, a system which has proved thoroughly efficient in service, and which has no spring to be clogged or get out of order. It also showed a wheel press, designed to work either by belt or hand—or fitted with both systems—up to 150 tons total pressure. Another design was also shown which is supplied for specially heavy work, capable of a total pressure of 250 tons. These are designed for pressing on or off the wheels on to shafts, and have been supplied to a great number of tramway companies in this country, on the Continent and in the colonies. The machines are of simple design, made of specially strong material, and every press is thoroughly tested before it is dispatched from the workshops.

THE J. G. BRILL COMPANY.—In addition to the Brill truck, which this company presented for view under a number of cars in the exhibition, the company had at the exposition its very latest and most complete type of convertible car—that is a car which can be made either a closed car or an open car at will. The windows and sides of the car, when open, are carried into the roof and can be lowered or raised at will. The company also showed samples of its 27-G pivotal truck, the 21-E truck, and a maximum traction truck. Most of these trucks are in extensive use in Paris and Great Britain, and are being widely adopted for the new work which is being done; also some handsome bronze models of these trucks which attracted a great deal of attention, and which, being mounted on tables, were readily accessible and could be examined carefully with ease. The company also exhibited a sample of its "Dedenda" gong, fitted on a stand ready for operation, and a number of brake handles were also shown in different patterns.

THE BRUSH ELECTRICAL ENGINEERING COMPANY contented itself with exhibiting one large car fully equipped. It was a bogie vestibule car, arranged to seat forty-four passengers in two compartments, divided into two classes if desired, or into smoking and non-smoking, the entrance being in the middle. The car was mounted on bogie maximum traction trucks, and its principal dimensions were: 39 ft. 6 ins. long, 6 ft. 10 ins. wide. and 4 ft. 8½ ins. gage. Each truck was equipped with a four-pole iron-clad motor, with ventilated armature and laminated pole

pieces, and was rated at 25 hp. The field coils are wound on brass spools, are of easy renewal, and the bottom half of the motor is made to hinge downward, either with or without the armature bearings. A series panel controller with emergency electrical brake and interlocking handles was also shown, and the company's regenerative tramway controller was attached, by means of which the weight of a car descending a gradient can be utilized to generate the current and return the energy to the line. The company also had on exhibition its type H. D. 2 of controller with electrical service brake, on which is a series parallel con-

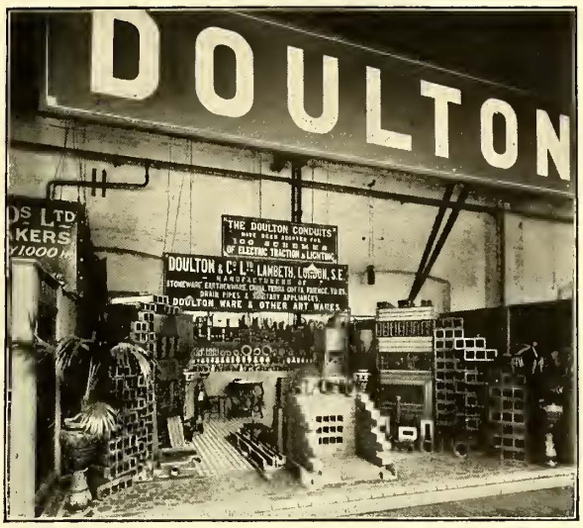


EXHIBIT OF DOULTON & CO.

troller with rheostatic brake, by means of which the speed of a car can be easily reduced, either gradually or suddenly, in case of emergency. The car, which was not equipped with top seats, attracted a lot of attention, and was favorably commented upon.

DOULTON & COMPANY, LTD., had an interesting exhibit tastefully arranged of its various manufactures in glazed stoneware conduits for electrical purposes. It also showed insulators and all kinds of stoneware and porcelain for electrical purposes, crucibles for electro-chemical manufacturing purposes, and a large assortment of tiles and faience now being extensively used in the walls and floors of power stations, where their cleanliness and durability render them particularly suitable. In addition, it exhibited also Doulton's patent water softeners and filters, which are now in successful operation in a large number of electric light and power stations.

CROSSLEY BROTHERS, LTD., had in operation two types of its well-known gas engines, viz.: Type S, giving 19 actual hp, and type O E, arranged for driving a dynamo for electric lighting without accumulators. Its latest type of oil engine, known as L L, was also shown, giving 2½ actual hp on a constant working load, and being equipped with all the latest improvements.

THE OHIO BRASS COMPANY, under the charge of A. G. Harwood, who has recently come across to represent the company in Europe, had a very handsome exhibit in the shape of a pyramid, displaying all the various insulators which it makes, such as trolley wire hangers and ears, strain insulators, section insulators, etc., etc. Surrounding the space was a brass railing, at the corners of which wood and iron poles were arranged, equipped with its well-known types of flexible pole brackets, one pole being equipped with a flexible bracket on which a suspension yoke was fitted for supporting two parallel trolley wires. The company also showed a great variety of section insulators, cross-overs of various styles and design for both round and figure 8 wire, and, in addition to the overhead material displayed, a variety of motor and car supplies, as well as a complete line of track bonding material, such as steel and copper bonding caps, channel pins and various styles of rail bonds. A number of adjustable track brush holders with steel wire track brooms and a Monarch track cleaner for the removal of snow, ice and dirt from tramway tracks also formed part of the company's exhibit.

MELDRUM BROTHERS, LTD., of Manchester, had an attractive space containing a sample of their well-known "Koker" mechanical stoker of the coking type, in combination with the well-known forced draft. They also exhibited the Meldrum "Simplex" destructor, as working in connection with the Darwen Electric Supply Station, where the town's refuse supplies all the power for the works. There was also shown a Beaman & Deas' destructor used for steam raising, and an econometer, an instrument for testing chimney gases, and thus readily discovering and remedying defective combustion.

ELLIOTT BROTHERS, of London, had an attractively fitted up booth in which they displayed a Board of Trade panel, with all the instruments for carrying out the tests required by the Board of Trade in connection with electric tramway undertakings. This board was complete with all the instruments mounted on it, and is similar to a number of such boards which have been built by Elliott Brothers to form part of traction switchboards. They also had a galvanometer and battery for testing the difference of potential existing between insulated returns and water pipes, and a number of Weston electrical measuring instruments of various designs and for various purposes. The exhibit also included a line of their various forms of recording wattmeter suitable for testing the current on motor cars, and showing in a graphic manner the amount of current taken at starting and when going on level, uphill or downhill. These instruments keep careful record of the fluctuations of the current, and are made also for recording volts. The paper speed in these instruments can also be regulated to be run out at 6 ins. per minute or 6 ins. per hour, and a large number of other useful instruments were shown, making a most handsome and interesting display.

HAROLD P. BROWN, of New York, exhibited the Edison-Brown plastic rail bonds, which seemed to attract a great deal of attention among the electrical engineers present. Mr. Brown himself attended to the exhibit, which, though really part of R. W. Blackwell's business, was of sufficient importance and interest to warrant a special space. He showed grooved rail joints and T-rail joints, all equipped with the plastic bonds, and a portable grinder and flexible shaft for applying rail bonds without drilling holes or weakening rails. He also showed a complete electrical testing apparatus for determining the conductivity of the rail bonds, rail joints, etc., the whole exhibit being most complete in every detail.

SMITH OF NEW YORK showed a complete line of headlights for electric and cable tramway carriages. Some of these were designed for the use of oil, though the majority were designed for electric lamps. He also had on exhibition incandescent clusters and combination center car lamps, many of these being of neat design and extremely useful, being adapted either for electric light or oil. He showed also a number of signal lamps and illuminating torches, self-contained and capable of giving a light equal

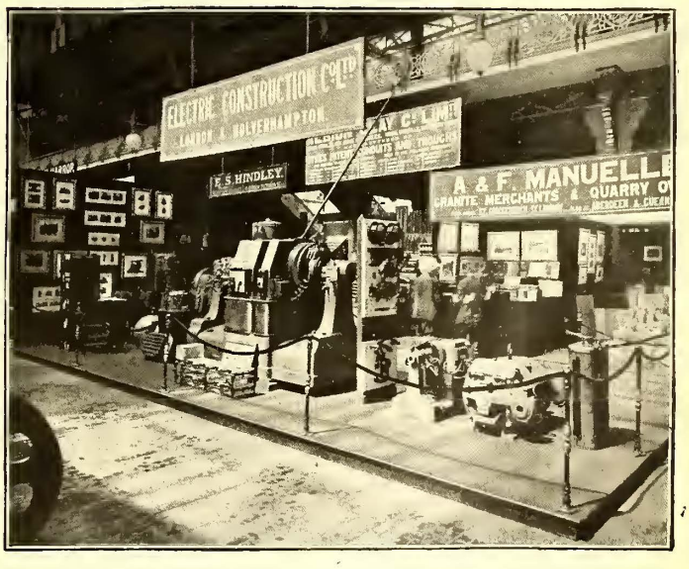


EXHIBIT OF THE ELECTRIC CONSTRUCTION CO.

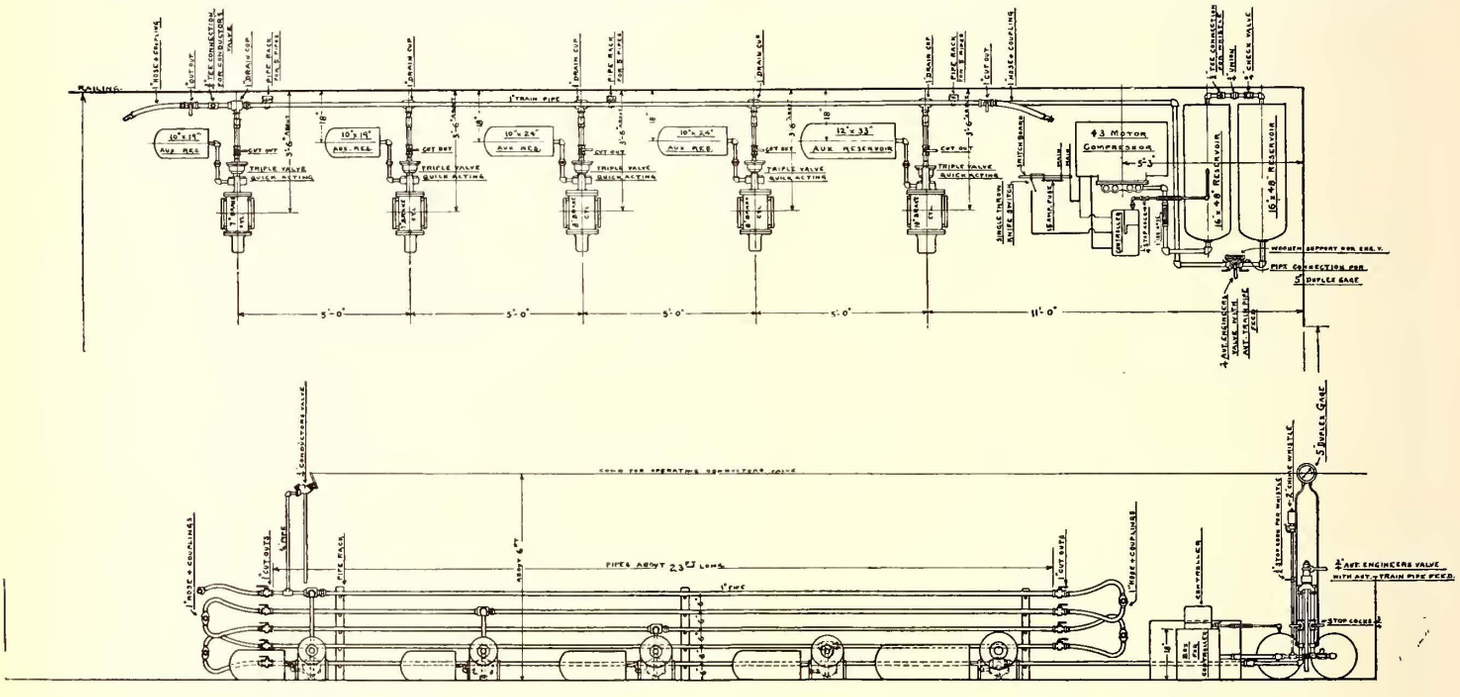
to 5000 cp, being specially interesting to railway and tramway engineers and contractors.

THE BRITISH GRIFFIN CHILLED IRON & STEEL COMPANY, LTD., had a handsome exhibit of chilled iron wheels, arranged in the shape of a pyramid, weighing 1 ton, and suspended from the center of a cast-iron test bar 12 ins. long by 1 in. square. In this company's space was also a pair of electric motor wheels which had been in service nineteen months and had run nearly 53,000 miles. One of these wheels was broken to show the fracture of the white hard iron of the chilled parts, changing very gradually into the tough gray iron of the body of the wheel. The company also showed standard motor wheels mounted on Griffin cold-compressed axles, center flange with double-tread wheel, American interurban type of wheels, Indian railway wheels

and a number of cold-finished axles in various stages of progress from the rolling mill to the finished axles.

THE BRITISH MANNESMANN TUBE COMPANY, LTD., showed a collection of standard poles as supplied by it for traction work. They are made from weldless steel tubing, and are supplied with scroll work or plain. They are made in one part or pieces, as required. The company also exhibited some samples of arc-lamp tests, as well as trolley poles, which are made of special steel with a very high elastic limit.

THE ELECTRIC CONSTRUCTION COMPANY, LTD., exhibited a 70-kw variable ratio transformer, now largely employed in the distribution of current on the Oxford system. Machines of similar construction are employed on the City & South London Railway, as reducers on the E. C. C. patented arrangement in which the high-tension pressure supplied is 1000 volts and the working conductors are 500 volts on the three-wire system. The arrangement of double field enables the ratio of the primary and secondary voltage to be varied within any desired limits, giving a high efficiency of conversion and compensation for line drop. The company also had on exhibition a tramcar motor of 30 hp, a good example of what British manufacturers can do in this line.



PLAN AND ELEVATION OF CHRISTENSEN EXHIBIT NO. 1

Stationary motors were also shown, capable of running continuously at a low temperature rise and of ability to withstand upward of 100 per cent overload for short periods. The company's exhibit also included an example of the company's trolley for side suspension, which is specially constructed for durability, lightness and the least possible risk of leaving the trolley wire or fouling the suspension brackets. Its regular switchboard apparatus was also exhibited, and the whole was supplemented by a fine series of photographs which conveyed an idea of the work which its shops are so well equipped for turning out.

THE ELECTRICAL POWER STORAGE COMPANY, LTD., showed various types of its well-known storage batteries and cells. First of all was the E. P. S. type, which is so thoroughly well known that it needs no description. Adjoining this were samples of the company's Faure King cells, specially adapted for traction work, and as used with the electric cabs in London and Paris. The company's "E" type is largely used for electric launches and also for train lighting in connection with Stone's system. The exhibit also included various types for stationary cells, which are largely used in Great Britain for railway and tramway generating stations. In addition the company showed a number of portable cells and batteries used chiefly for telephone, Roentgen ray, medical and dental work.

ASKHAM BROTHERS & WILSON, LTD., of Sheffield, had a most practical exhibition of its specialties for track construction, showing first of all a large show case containing assorted tool steel and also platelayers' tools of all kinds, such as picks, wedges, chisels, crowbars, hammers, etc. The company also showed some rail carts for the use of transportation of rails which are now a necessity with the long lengths and heavy sections which are now in use. It showed samples of its patent automatic spring points made of crucible cast steel, as supplied to Nottingham, Manchester and many other cities, as shown by a large map which it displayed. Adjoining these were movable points for junctions and cross-over roads, and crucible cast-steel crossings of various angles and sections. In another corner were also right-angle crossings, portable cross-overs for temporary track, while reconstructing, drain rails, drain boxes, springs, tires, wheels and axles and various types of joint plates and heel plates. Many samples of its special crucible steel castings for various purposes were also exhibited, as well as tiebars and fishbolts of wrought iron and mild steel. Another conspicuous feature was its patent points for cross-over roads on double lines of tramway, and, in fact, every possible piece of apparatus necessary for the complete equipment of track construction was included in the exhibit. Some very interesting protographs were also exhibited of special work which this firm has done in Sheffield, Leeds and other cities where complicated crossings have been constructed and work peculiarly difficult has been accomplished.

FRANK SUTER & COMPANY, LTD., sole agent in the United Kingdom for the Helios Electrical Construction Company, Ltd., has on exhibition some interesting samples of this well-known firm's construction. Firstly it exhibited a truck having a wheel base of 4 ft. 9 ins., the truck frame being supported on the axle boxes by means of spiral springs, and the car body being supported also on spiral and laminated springs on the frame, thus assuring quiet and easy running. Near these was also its car motor, the frame of which is cast in two pieces and arranged to open. Its controller was also exhibited, the contact cylinder of which rotates within a powerful magnetic field, which causes immediate extinction of all sparks. Its automatic maximum cut-out was also shown, and its overhead sliding contact gear which, owing to its great width, insures a reliable contact with the overhead wire. The reversing of the trolley rod is also saved, as by its elastic construction the gear changes its position automatically according to the direction in which the car is running. It also showed a complete line of overhead material with "Dirigo" insulation.

CHRISTENSEN ENGINEERING COMPANY, Milwaukee, had an exhibit of its own, although it was also represented by R. W. Blackwell & Co. It showed five different types of brakes. Exhibit No. 1 consisted of a motor-car equipment and train of four trailers with the Christensen quick-acting automatic air brake, with compressor type No. 3, provided with automatic controller, automatic engineer's valve and with automatic train pipe feed mechanism. Exhibit No. 2 represented a motor car and one trailer, with plain automatic air brake, motor compressor type AA1, with automatic governor and plain automatic engineer's valve. This exhibit was a duplicate of the equipment furnished the Cie. Générale de Traction, Paris, with the exception that the latter company is furnished with the axle-driven compressor in-

stead of the motor-driven. Exhibit No. 3 comprised one complete instruction stand representing the straight air-brake apparatus applied to a motor car. The compressor of this exhibit was also of type AA1. All the above exhibits were shown in complete operation. Exhibit No. 4 consisted of one portable air-compressor apparatus for furnishing compressed air for sand blast, air tools, air hoists, chippers, etc., etc. Exhibit No. 5 comprised various axle-compressor apparatus with governors, reservoirs and other air-brake apparatus, such as engineer's valve, triple valves, etc., which were arranged on tables for convenient inspection. Sectional parts of apparatus were also exhibited, showing the working of the parts clearly. The exhibit was in charge of the company's new European manager, W. A. Parker.

WITTING BROTHERS, LTD., of London, showed a very complete exhibit of the system as manufactured by the Electricité et Hydraulique Cie., of Belgium, and had at the exhibition standard trucks for light railways and tramways equipped with two standard tramway motors of 30 B. H. P., 500 volts, and 550 r. p. m. In this form of truck the end platforms are entirely independent of the car body. A Peckham truck was also shown equipped with similar motors. The exhibit also included a com-

VIEW OF ONE SIDE OF HALL

plete set of car fittings and electrical apparatus for handling cars, such as controllers, resistances, lightning arresters, canopy switches, etc., and various types of tramway motors of different horse-power and for operating at different voltages; also stationary motors of different sizes, both of the inclosed and semi-inclosed type, which are designed to operate at slow speed, having four poles with slotted drum armatures, with form-wound coils. The field-magnet coils are wound on bobbins, from which they are highly insulated by special waterproof and fireproof insulation; the complete coils are then slipped over the poles and kept in place by the extended pole shoes and by means of special bronze cheeks. It showed also various sizes of three-phase motors and single-phase Heyland motors, a 50-kw motor-generator, consisting of a 100-volt continuous current motor, driving a continuous current dynamo generating current at 500 volts. The two machines were rigidly coupled and mounted on the same bed-plate, and supplied power to various exhibits in the hall. It also exhibited a switchboard and various samples of cables manufactured by this company, and in addition it had an interesting collection of three-phase transformers of standard pattern, an electric percussion rock drill, automatic circuit breakers, arc lamps, switches and fuses, manufactured by the Electricité et Hydraulique Cie.

THE CONSOLIDATED CAR HEATING COMPANY, of Albany, showed an interesting collection of its various types of electric heating apparatus for tramway work, together with special switches and fuses, and special devices for work in connection therewith. The company drew particular attention to its temperature regulating switch, a device which allows the current to pass through either or both of the sets of the coils in its heater, thereby regulating the heat.

BERGTHEIL & YOUNG, of London, showed a complete line of trolley line insulators of the J. P. type, manufactured by the Johns-Pratt Company, of Hartford, Conn., the insulation being of molded mica. The company also showed samples of the Johns type of electrical heater, which provides a large radiating surface for the heat generated. It also had on exhibition a quantity of the "Noark" fuses of the inclosed type, capable of opening an electrical circuit at any of the various alternating or direct-service voltages in common use, without arc or flash, and at the same time of visibly indicating its condition.

WILKINS & COMPANY, of London, showed some interesting samples of wire ropes for various purposes. Chiefly interesting in this exhibit, however, were the ropes which it supplied for cable tramways.

HOLDEN & BROOKE, LTD., of Manchester, exhibited its specialties in steam separators, grease extraction, exhaust heads, steam injectors and other special steam and feed-water devices.

W. T. GLOVER & COMPANY, LTD., of Trafford Park, Manchester, exhibited a case of handsome samples of various kinds of its well-known cable, together with several large drums of lead-covered and steel-armored three-core cable for high-tension substation feeders, for polyphase systems, for either tramways or town lighting, and a large drum of single lead-covered cable for tramway feeders. It also showed a most interesting collection of joint boxes for single concentric, triple concentric, twin and three-core cable of all sizes, including patent closing connector to make T joint on to single cable without cutting the cable or using screw-fixed clamps. Various disconnecting, straight through and T boxes for single concentric and multi-core cables up to 1.5 sq. in. sectional area, with patent flexible links, were exhibited, together with other fittings used in cable connections. Samples also of patent solid ended flexible rail bonds with round and compressed strands were shown, and the whole exhibit was arranged in a most tasteful manner, some one of the company's engineers being in constant attendance.

FINALE

In addition to the exhibits already described, there were a number of other exhibitors of other machinery and machine tools and various appliances more or less applicable to tramway work, but which the space at our disposal prevents us from treating in detail. In the lesser hall were shown, also, a large number of novel seats designed for the tops of tramcars and omnibuses for the avowed purpose of keeping the seats dry in wet weather. It is impossible to describe them all, so that, perhaps, it will be sufficient to say that many were good, many were impracticable, but that nearly all had some points of merit. We have tried to give our readers a fairly accurate description of the chief exhibits, and if any of the exhibitors have been neglected, it is not from any desire on our part, but that they have been overlooked in the large number that were there. The exhibition, as a whole, was an immense success, reflecting the greatest credit on James W. Courtenay, the managing director, and A. M. Wilcox, the untiring secretary, and also on the exhibitors, who used the utmost diligence in getting their exhibits ready in time, and afterward keeping them in good order.

The World's Copper Output

The accompanying statement of the copper production of the world has recently been forwarded to the State Department by Vice-Consul Monaghan, at Chemnitz:

OUTPUT

Country	1898 Tons	1899 Tons	Increase P. Ct.	Decrease P. Ct.
Algeria	50	....	....	100.0
Argentine Republic	125	65	....	48.0
Australasia	18,000	20,750	15.3	....
Austria-Hungary	1,540	1,505	....	2.3
Bolivia	2,050	2,500	21.9	....
Canada	8,040	6,732	....	16.3
Cape Colony	7,060	6,490	....	8.1
Chile	24,850	25,000	0.6	....
German	20,085	23,460	11.3	....
England	550	550	....	....
Italy	3,435	3,000	....	12.5
Japan	25,175	27,560	9.5	....
Mexico	15,668	19,335	22.9	....
Newfoundland	2,100	2,700	28.6	....
Norway	3,615	3,610	....	0.1
Peru	3,040	5,165	69.9	....
Russia	6,000	6,000	....	....
Spain and Portugal	53,225	53,720	0.9	....
Sweden	480	520	8.3	....
North America	239,241	265,156	10.8	....
Totals	434,329	473,818	9.1	....

The London Firm of J. G. White & Co.

Announcement is made in London of the organization of J. G. White & Company, Ltd., as electrical, mechanical and civil engineers and contractors, with a capital of £100,000, divided into 5000—6 per cent cumulative preference shares of £10 each, and 50,000 ordinary shares of £1 each.

The directors of the company are: Chairman, J. G. White, Ph.D., president, J. G. White & Company, New York; managing director, O. H. Baldwin, M. E.; A. N. Connett, C. E., chief engineer; E. B. Wyman, director Deep Leads Electric Transmission Company; W. C. Burton, E. E., electrical engineer. The secretary and treasurer of the company is A. H. Beatty.

This company has been formed to take over the foreign business (i. e., all the present business outside of North America) of J. G. White & Company, Inc., of New York, and to carry on a general electrical, mechanical, and civil engineering and contracting business throughout Great Britain, the Continent of Europe and other parts of the world, excepting North America. No manufacturing business will be done by the company, so that its business will not compete in any way with existing manufacturing companies. By carrying out an independent policy, it is believed that the confidence of financiers, manufacturers and engineers generally can be secured and a very large business developed.

The company will have an unusually competent and experienced staff, not only of electrical, but mechanical and civil engineers as well, as will be seen below.

The company's chairman, J. G. White, was graduated Bachelor of Arts at Pennsylvania State College, 1882, and after three years' post-graduate work, largely in electrical engineering, was graduated Doctor of Philosophy at Cornell University in 1885. After two years in charge of the Department of Physics in the University of Nebraska, Mr. White formed a company to do electrical engineering and contracting, and has since been the controlling spirit and active head of the business. This business has been conducted throughout the United States under his present management and control continuously for thirteen years. During that period a large and growing business has been developed. The work done has included the partial or complete equipment of many electric railways, among the number being those in the following cities and towns: Baltimore, Md. (about 200 miles); Buffalo and Niagara Falls, N. Y.; Washington, Charleston, Asheville, New Orleans, Nashville, Omaha, St. Joseph, St. Louis, Kansas City, Salt Lake City, Spokane, etc. The business has also included the designing and installation of a number of electric plants for lighting, and the installation of, or consulting engineering work for, a large number of electric power plants. Among the latter were the Niagara Power Company, complete designing and building of transmission line; subways for the Cataract Power & Conduit Company, Buffalo General Electric Company and city of Baltimore, and transmission plants in Helena and Cripple Creek. The work now being carried out by J. G. White & Company includes the following: Washington, D. C., equipment of about 60 miles of electric road; Toledo, Ohio, to Detroit, Mich. (54 miles), complete engineering and construction of electric railway; Perth, Western Australia, consulting engineering and furnishing plant for tramways; San Juan, Porto Rico, complete engineering and installation of tramways and lighting plant; Alton, Ill., consulting engineering Alton Railway, Gas & Electric Company; Winston-Salem, N. C., consulting engineering Fries Manufacturing & Power Company, rebuilding and extending railway, etc.; Colorado Springs, Col., consulting engineering, rebuilding and extending railway, electric light plant and large new electric power plant; Victoria, Australia, consulting engineering Deep Leads Electric Transmission Company (3000 hp); Kalgoorlie, Western Australia, consulting engineering Kalgoorlie Electric Power & Lighting Corporation; State of New York, consulting engineering and valuation of properties for State Board of Tax Commissioners; St. Louis, Mo., consulting engineering Imperial Electric Light, Heat & Power Company, extension of plant, etc. During the past five years the company has also done a constantly increasing business in the forming of underwriting syndicates to finance electrical properties, all of which have shown most gratifying results. The properties financed in whole or in part included the following: Buffalo & Niagara Falls Electric Railway Company; New York Electric Heat, Light & Power Company, New York City; Helena Water & Electric Power Company, Helena, Mont.; Colorado Electric Power Company, Canyon City, Col.; Alton Railway, Gas & Electric Company, Alton, Ill.

The company's managing director, O. H. Baldwin, received the two degrees of Mechanical Engineer and Electrical Engineer in 1885 from Stevens Institute of Technology, since when he has had the following experience: In the employ of the Pennsylvania Railroad Company, maintenance of way department and motive power departments until March, 1886. With the Westinghouse Electric & Manufacturing Company from March, 1886, until September, 1889, on general construction work and operation of electric lighting and power plants. In 1889 he was sent from Pittsburgh to London to serve as engineer to the Westinghouse Electric Company, Ltd., and also to superintend the running of the Sardina Street station of the Metropolitan Electric Supply Company, Ltd. While serving in this capacity, Mr. Baldwin drew up the plans for the boilers and piping work for the extension of this station, superintended its erection, and operated the extended plant for one year. In 1892 he was appointed chief engineer of the Westinghouse Electric Company, Ltd., London. In 1894 he was appointed managing director of the company. Some time since Mr. Baldwin was given the additional appointment of assistant manager to the British Westinghouse Electric & Manufacturing Company, Ltd., and has been acting manager of the business of this large company, no manager having been officially appointed. Since 1890 Mr. Baldwin has had general charge of all the engineering work of both the Westinghouse Electric Company, Ltd., and the British Westinghouse Electric & Manufacturing Company, Ltd.

J G. WHITE

A. N. CONNETT

A. N. Connett, chief engineer of J. G. White & Company, Ltd., was graduated in 1880 as civil engineer, at Rensselaer Polytechnic Institute, Troy, N. Y. From Jan. 25 to July 3, 1881, he was in charge of the survey at St. Charles, Mo., for the river improvement works of the United States Government. From July 4 to Sept. 7, 1881, he was resident engineer at Cowden, Ill., for the construction of the Toledo, Cincinnati & St. Louis Railroad. From Sept. 12 to Dec. 3, 1881, he was assistant engineer Union Pacific Railway, in charge of division of construction work on the Oregon Short Line in Idaho. From Feb. 20, 1882, to March 30, 1884, he was principal assistant engineer to William E. Northern (deceased), a very well-known engineer and a president of the American Society of Civil Engineers. From April 1, 1888, to Sept. 12, 1888, he was assistant engineer, with Knight & Bontecin, at Kansas City, Mo., on the plans of the Twelfth Street cable line at Kansas City. From Sept. 14, 1888, to May 10, 1889, he was assistant engineer with the Bentley-Knight Company on the construction of conduit electric tramways at Boston and New York. From May 14, 1889, to March 1, 1890, he was principal assistant engineer on the plans and construction of the Seventh Street cable line, Washington, D. C., for the Washington & Georgetown Railway Company, and from March 1, 1890, to March 25, 1891, principal assistant engineer with the Baltimore Traction Company on the construction of the Druid Hill Avenue cable line. From March 25, 1891, to July 10, 1891, he was divisional engineer, Broadway Cable Railway, New York, in charge of construction of division from Fourteenth Street to Thirty-seventh Street. From July 13, 1891, to Sept. 15, 1896, he was chief engineer, Baltimore City Passenger Railway Company; built and designed for the company 21 miles cable road, including three power houses and two car houses, also 20 miles electric railway with one power house and two car houses. The last year with this company Mr. Connett acted as general manager in addition to his duties as chief engineer. From Sept. 15, 1894, to Sept. 15, 1896, he acted as chief engineer, Metropolitan Street Railway Company, Washington, D. C., designed and built 21 miles conduit electric railway with two power houses and one car house. From Oct. 1, 1896, to the present time, he has been chief engineer of the Compagnie Francaise Thomson-Houston. While in Paris Mr. Connett has had charge of the numerous and large installations which have been made by his company. These have included the surface contact tramway

at Monte Carlo, which has operated quite successfully, and was the first commercially successful tramway of this type in the world. Among his other installations the tramways at Nice, described last month, are of particular interest. In the central portion of the city the tramways are operated by conduit, while in the more outlying and suburban districts the overhead trolley furnishes power to the cars. This entire system is operated from a station some 22 miles distant, which is driven by water power. One of his most noted installations is the tramway of Paris, described in December, 1899, and which is an unusual and improved type of conduit, and which is now operating very successfully. His work in France has included other tramway installations, most of which have been built on the overhead trolley system, and his work has also included electric light and power installations.

E. P. Jones, mechanical engineer of the company, has had twenty years practical experience in mechanical engineering work, a large part of it having been in connection with mining machinery of various kinds. He was for seven years with the Union Iron Works, of San Francisco, the largest builders of mining machinery west of Chicago. Of this time he was draftsman for three years, chief draftsman for two years, and assistant superintendent for two years. He was later mechanical engineer of the Anaconda Mines, in Montana, for one year, and still later, chief draftsman of the Risdon Iron Works, of San Francisco, for nearly three years, this firm being the second largest manufacturer of machinery in the United States west of Chicago. In addition to the above, Mr. Jones spent four years in general construction, erection and operation of mining machinery, and had also two years commercial experience in manufacturing and selling machinery. All of the above experience was in the United States, and after this Mr. Jones went to Western Australia to enter the employ of Bewick, Moreing & Company, having been selected to carry out important mechanical work for this firm by its San Francisco correspondents. Mr. Jones remained with this firm for some fifteen months, and then established himself very successfully as consulting mechanical engineer in Western Australia, from which place he has just returned.

A. H. Beatty, secretary of the company, entered the services of Monkhouse, Goddard & Company, chartered accountants, of London and Newcastle-on-Tyne, in the year 1885, as junior clerk, and remained in the services of that firm until 1892. During the above period Mr. Beatty rose from the position of junior to that of senior clerk, and in this capacity was intrusted with many investigations, comprising auditing accounts, and examining into the financial position of various firms and companies, both in England and abroad. Since leaving that firm Mr. Beatty has acted as accountant in a number of important transactions involving not only commercial management, but also practically the superintendence of the mining, engineering and electrical work.

The company has certainly started under the most favorable auspices, and should secure a large amount of work in its chosen field.

Car Body Specifications

The cars used on the Southwest Missouri Electric Railway are described and illustrated elsewhere in this issue. As they possess a number of interesting features the full specifications are given herewith:

DIMENSIONS

	Feet	Inches
Length of car body over corner posts	30	6
Length of car over vestibules	40	2
Length of car over bumpers	41	2
Width of car body at sill, over plates	8	3½
Width of car body at belt rails	8	3½
Width of car body over water drip rails	8	4½
Height of car body from underside of sills to top of roof, not including trolley board	9	0
Height inside, from floor to top plate	6	3
Height inside, from top of floor to underside of upper deck ceiling	8	2
Height from track to underside of sills when car body is mounted on trucks	3	1

BOTTOM FRAMING

Side sills of very best quality long leaf yellow pine, size 4½ ins. x 7¾ ins. finished, re-enforced on the outer sides with steel plates; plates to be ⅝ in. thick, 7 ins. wide, extending full length of car body and around corners to door posts on ends in one continuous piece, and securely bolted to sills with oval head carriage bolts.

End sills of oak, size 7¾ ins. x 4⅞ ins. finished.

Cross sills of oak, size 6⅞ ins. x 2¾ ins. finished.

Diagonal braces of oak, size 4 ins. x 1¼ ins. finished.

Trapdoor framing to be arranged to meet the requirements of the ———— motor, for ———— two motors to each car, of type No. ———— and of ———— hp each.

Bottom framing to be also arranged to meet the requirements of the ———— double trucks, with wheels 33 ins. in diameter; wheel base of trucks ———— distance between centers of truck bearings ————; bolsters to be set back ———— from end of car body.

Gage of track 4 ft. 8½ ins.:

Bottom framing to be tied together with ⅝ in. round refined iron rods, one for each through cross sill, extending across the whole width of bottom frame and through side sills and plates, with thread and nut at each end.

Short framing and trapdoor framing to be also tied together with ⅝-in. round refined iron rods and plated where necessary.

Body bolsters to be made of 9 ins. x ⅞ in. and 9 ins. x ⅝ in. iron filled with oak, made to suit the requirements of the trucks and securely bolted to car body.

Truss Rods: Inside trusses to be made of 2 ins. x ½ in. refined iron, with 1-in. round ends with thread and nut. These trusses to be placed as high as possible and out into posts, and securely fastened to posts and sills.

Also truss rods of 1-in. round iron to be placed underneath side sills to support center of car, with turnbuckle in the center, and securely bolted to sills at ends.

Floor to be of best quality quarter-sawed yellow pine, ⅞ in. thick with 2½-in. face, tongued and grooved, closely laid longitudinally with car and securely nailed to bottom framing. Floor to be of two thicknesses, the lower layers being laid crosswise and the top floor to be laid longitudinally with car.

Trapdoors to be fitted with large wrought-iron handles, countersunk into trapdoors and bolted through.

All parts of bottom framing and under side of floor to be painted with brown oxide of iron paint, and all mortises and tenons to be thoroughly white-leaded when being put together.

BODY FRAMING

All posts, rails and other parts of body framing to be of best quality tough ash. Ventilator rails to be faced with oak on the inside and moulded.

Side of car to be framed for eleven windows on each side with straight siding below windows.

Ends of car to be framed for double doors, and one window at each side of door opening.

Posts to be well braced diagonal cross bracing between posts, made of oak ⅞ in. x 3½ ins. and tightly fitted. Outside of car below window to be sheathed with matched poplar sheathing vertically and well nailed to body framing, sheathing to be ¾ in. thick and 2 ins. wide on face.

Inner side of sheathing to be backed with best quality linen scrim well glued to sheathing, posts and bracing, and when the glue has become hardened the scrim to be painted with brown oxide of iron paint.

The joint between sill plate and sheathing to be covered with 1¼-in. x ¼-in. half oval moulding extending full length of body at sides, also on ends.

The joint between arm and rail and top edge of sheathing to be covered with 1¼-in. x ¼-in. half oval iron moulding extending full length of body and around corners to door posts on ends in one continuous piece.

Posts to be secured at bottom with strap bolts made of 1¼-in. x 5-16 in. iron, extending through sill with thread and nut at bottom. Strap bolts to have heel bent over on top and cut carefully into posts, and to be securely screwed to posts.

Posts to be tenoned, and sills and top plates to be mortised, drawbored and pinned, and all pinning to be done in such a manner that pins will draw tenons into mortises.

Top of posts to be provided with wrought-iron T-plates securely fastened to posts and top rails.

Side top rails to be of best quality yellow pine, size 4¾ ins. x 3 ins. finished, strengthened by a heavy letter panel made of ash 1⅛ ins. thick and 7 ins. wide, which is gained into top rail as well as posts.

Under drip rail to be 2¼ ins. x 2¼ ins. x ¼ in. angle iron, extending from corner post to corner post in one continuous piece and securely screwed to posts and letter panel.

Arm rail of ash, size 1¾ ins. x 4⅛ ins. finished.

Side posts of ash, 2¼ ins. thick, cut to pattern.

Corner posts of ash, 4 ins. thick, cut to pattern.

Diagonal bracing between posts of oak, size ⅞ in. x 3½ ins.

Truss plank at bottom, inside, of ash, size 1¼ ins. x 9 ins.

Door posts of ash, size 2½ ins. x 2¼ ins. Each door post shall be provided with one ⅝-in. round iron rod, extending from top of headpiece through to bottom of end sill, screwed to headpiece and let into door posts, and to have thread and nut at bottom.

ROOF

To be of the monitor-deck pattern full length of car. All parts of roof framing to be of best quality tough ash. Ventilator rails to be faced with oak inside and molded.

Lower ventilator rail of ash faced with oak, 2½ ins. x 4½ ins.

Upper ventilator rail of ash, size 2¼ ins. x 3¼ ins.

Ventilator munions of ash or oak, size 1⅜ ins. x 2¼ ins.

Side of lower deck carlines of ash, size 1⅛ ins. x 2 ins., cut to pattern, glued and tenoned into lower ventilator rail, and shouldered, glued and screwed to side top rail.

Center of upper deck carlines of ash, 1⅛ ins. x 1¾ ins., cut to pattern, glued and screwed to top ventilator rails.

Roof to be further supported by ten steel carlines, one over each intermediate side post, made of 1¼-in. x ⅜-in. steel, forged to shape of roof in one continuous piece and extending from side top rail to side top rail, with a foot at each end, which is securely screwed to side top rails. Steel carlines to be securely bolted to wood carlines.

Roof framing to be covered with matched poplar sheathing ½ in. thick and 3 ins. wide, closely laid and securely nailed to roof framing.

Outside of roof sheathing to be painted with brown oxide of iron paint, and then covered with No. 8 cotton duck, and outside of duck covering to be painted three coats of lead and oil paint before trolley board is placed in position.

Inner side of roof sheathing to be painted with brown oxide of iron paint.

The entire upper deck of roof to be covered with roof mats made of ash slats, placed on ash cleats laid in white lead, and securely screwed to roof framing.

TROLLEY BOARD

To be of best quality of white pine, made of two boards 1¾ ins. thick, 6 ins. wide and 11 ft. long, placed 4 ins. apart on center of roof, placed on ash cleats laid in white lead and securely screwed to roof.

All parts of trolley board and roof mats to be well painted with lead and oil paint.

Bolts to be provided for securing trolley pole base of stand, and to be located to suit the ———— base.

Roof mats to be placed on lower decks at diagonally opposite corners of car, also black steps on corner posts and grab handles on roof at same corners, of black.

PLATFORMS AND VESTIBULES

Platform outside knees of oak, 3½ ins. thick, 8 ins. wide.

Platform inside knees of oak, 3¾ ins. thick, 8 ins. wide.

Platform inside knees of oak, 2¾ ins. thick, 8 ins. wide.

All platform knees to be re-enforced with 5-in. x ⅝-in. iron plates extending full length of knees and securely bolted to same. Platform floor to be of best quality quarter-sawed yellow pine ⅞ in. thick with 2½-in. face, laid crosswise and securely nailed to platform framing.

Distance from top of car floor to top of platform floor 6⅞ ins. Platforms to be 4 ft. 10 ins. long from end of car body to outside of vestibule front at center of car, enclosed at front by stationary vestibule, with folding doors at both sides hung to vestibule corner posts, also folding gates for summer use. Vestibule to have three sash at front, the sash in center opening to drop, and all other sash to be stationary.

All framing parts of vestibules to be of best quality tough ash. Lower part of vestibule fronts to be sheathed with matched poplar sheathing, placed vertically same as on sides of cars, sheathing to be ⅝ in. thick and 2 ins. wide on face, and securely nailed to vestibule framing. Inner side of sheathing to be backed with linen scrim and painted same as on sides of car.

Inner side of vestibules to be finished in oak throughout, finish at bottom to be panel work, all finished in the natural color of the wood and varnish.

HOODS

To be of the street-car pattern. The bow to be of oak 1⅛ ins. x 1⅝ ins. steamed and bent to shape. The carlines to be of ash ⅞ in. x 1¼ ins. steamed and bent to shape, shouldered, glued and securely screwed to bow. Hood carlines against end of car to be of ash, 1¼ ins. x 1½ ins.

Hoods to be covered with matched poplar sheathing ⅜ in. thick and 2½ ins. wide, bent to shape and securely nailed to bow and carlines.

Outside of sheathing to be painted and covered with cotton duck, and outside of duck covering to be painted three coats of lead and oil paints.

Inner side of hoods to be painted same color as outside of car body.

Outer edge of hoods to be provided with an iron guard to prevent trolley pole from wearing out canvas covering.

SMOKING COMPARTMENT

Each car to have a smoking compartment at one end, 7 ft. 8¼ ins. long between end linings, with longitudinal side seats made of oak and varnished.

Partition between smoking compartment and balance of car to have a single sliding door, 25-in. opening.

Windows at each side of door opening in partition to be glazed with clear glass; also glass in door to be clear.

WINDOWS

Eleven on each side of car, and two at each end. Each window opening to have two sash, the upper one to be stationary and the lower one to drop flush with arm rail. All window openings at sides of car to be provided with a hinged casing covering space between sash and inside lining, which will close the opening both when sash are up and down. The lower outside end sash to be made to drop, and the inside end sash to be hinged and fitted with brass wire cloth.

INTERIOR FINISH

Interior finish of car body and vestibules to be of quartered oak throughout, of modern design and secured in place with solid black overhead screws.

End and side linings of oak, ¾ in. thick, with raised panels 9-16 in. thick.

Doors—
- Center rails of oak, 6½ ins. x 1 5-16 ins.
- Lower rails of oak, 8¼ ins. x 1 5-16 ins.
- Upper rails of oak, 4½ ins. x 1 5-16 ins.
- Side door stiles of oak, 4½ ins. x 1 5-16 ins.
- Center door stiles of oak, 4 ins. x 1 5-16 ins.
- Panel mutins of oak, 2 ins. x 1 5-16 ins.
- Raised panels of oak, 7-16 ins. thick both sides.

Sash—
- Bottom rail of oak, 3½ ins. x ¾ in.
- Top rail of oak, 3⅞ ins. x ¾ in.
- Side stile of oak, 2 1-16 ins. x ¾ in.

Deck sash—
- Lower rail of oak, 1½ ins. x ¾ in.
- Upper rail of oak, 1 3-16 ins. x ¾ in.
- Side stiles of oak, 1 5-16 ins. x ¾ in.

Transom sash in ends—
- Lower rail of oak, cut to pattern, 1¼ ins. x ¾ in.
- Upper rail of oak, 1 in. x ¾ in.
- Side stiles of oak, 1⅛ in. x ¾ in.

CEILING

Of three-ply birch veneer, plainly decorated and varnished. ceiling and ceiling moldings to be secured in place with screws, and ceiling moldings to be grooved on back to receive the lamp wires. Back of ceiling to be painted with brown oxide of iron paint.

DOORS

Automatic double doors at each end of car, made of oak with oak panels, hung at top with contra-twist door fixtures. Door in partition to be hung with hangers and track. Door openings at ends of car to be 40 ins. wide and 6 ft. 3 ins. high, and door opening in partition to be 25 ins. wide and 6 ft. 3 ins. high. All doors to have stationary glass.

SASH

All sash to be ¾ in. thick and made of oak.

DECK SASH

Eleven on each side of car, pivoted and made of oak. The ends of ventilator or monitor deck to be divided into three spaces, with pivoted sash in center opening and stationary glass in side openings.

GLASS

The glass in all windows and doors to be first quality double thick American window glass, imbedded in molded rubber on all edges to prevent rattling. Glass in deck sash to be double thick white chipped, with 1 in. clear edge and imitation bevel.

CURTAINS

All side and end windows, also outside of end door openings to be provided with curtains. Curtains to be made of Pantasote material, pattern "H" color 74, mounted on Hartshorn 1-in. spring rollers and fitted with the Burrowes No. 83 fixture at the bottom.

Curtains on outside of end doors to be made up in same manner as the other curtains, to be placed in a neat oak box over door opening with side pieces extending down to arm rail to form guides for curtain fixtures.

SEATS

There are to be eight (8) on each side of car in large compartment, six of which are to be of Hale & Kilburn's No. 80½ Walk-over pattern, and four stationary seats; the two stationary seats at end next to vestibule to be placed longitudinal with car, and the two stationary seats next to partition to be placed crosswise.

Cushions of all reversible and the two longitudinal stationary seats to be 33 ins. long and the two stationary seats next to partition to be 31 ins. long. Backs of all cross seats to be 22 ins. high, and those of the longitudinal seats to be of same height as side lining (13 ins.). All reversible cross seats to have grab handles on corner of back at aisle end, also movable foot rest and thumb latch on seat back levers. All seat cushions to be 18 ins. wide. All seat and back cushions to be covered with canvas-lined rattan with hard enamel finish. Space between center of stationary cross seat and the first reversible seat to be 37 ins. Reversible seats to be spaced 17 ins. between edges of seat cushions when passengers are facing each other, and 16½ ins. between edges of seat cushions when backs are all turned same way.

Aisle through center of car to be 20 ins. wide.

HAND RAILS

To be placed in smoking compartment only, supported by black ornamental brackets. Rails to be made of oak 1⅛ ins. diameter, with polished black ends. Each rail to be supplied with six (6) padded hand straps made of fancy leather and fitted with black buckle.

FLOOR MATS

Everett pattern, made of ash slats ⅝ in. thick, ¾ in. wide, placed ¾ in. apart, extending longitudinally in aisle full length of car and sunk flush with the floor.

TRIMMINGS

Of very best quality black metal, dead finish and secured in place with solid black screws.

GRAB HANDLES

Long vertical grab handles to be placed on posts at each side of each vestibule entrance, made of 1-in. steel-lined black tubing fitted into black end sockets, 36 ins. long, and securely screwed to posts with solid black oval head screws.

WINDOW GUARDS

Three bar window guards to be placed on outside of all end windows, made of ½-in. heavy black tubing filled with hardwood and secured in place with solid black screws.

SIGNAL BELLS

Two 6-in. steel conductor's signal bells to be supplied with each car, with necessary cords of 5-16-in. round oak tan leather extending through center of car suspended from ceiling with suitable black hangers with 13-in. drop.

REGISTER

One Meaker fare register of latest pattern to be furnished with each car, with necessary cords of 5-16-in. round oak-tan leather extending along ventilator rail at each side full length of car and onto both platforms, suspended by suitable brackets or guides.

WIRING

Car bodies to be wired for light and trolley circuits. Light circuits to be arranged for four single lights on each ventilator rail in large compartment, and two single lights in upper deck of smoking compartment.

All wiring material, sockets and switches to be furnished by the railway company.

HEADLIGHT

Each car to be equipped with one Wagenhals' electric arc headlight complete, arranged to hang on front of vestibule.

HEATERS

Each car to be equipped with sixteen electric heaters, type to be selected by the railway company.

SAND BOXES

Each car to be equipped with two (2) sand boxes—one at each end at diagonally opposite corners of car, placed under seats, arranged to operate by foot lever, and supplied with removable hose.

GONGS

Two 14-in. steel foot alarm gongs to be supplied with each car, one under each platform.

BRAKE STAFFS

One on each platform, 1¾ ins. round at the bottom, forged tapering to 1 in. round at the top, well braced, fitted with 12½-in. black ratchet brake handle and ⅜-in. twist-link Norway iron brake chain.

PLAFORM STEPS

Double steps at each platform entrance, sides of steps to be made of steel plate ¼ in. thick, with treads of ash ⅞ in. thick and 8½ ins. wide. Distance between end of car body and inside of platform crownpiece 38 ins. Distance from outside of car side to outside of platform knee 13 ins. Distance from top of platform to first step 11 ins., and from top of upper step to top of lower step 10½ ins. Distance from top of platform floor to underside of bottom step 24 ins. Distance from top of platform floor to top of car floor 6⅞ ins. Edge of bottom step to project 1½ ins. beyond side of car. Outer edge of step treads to be covered with iron molding.

DRAW-BARS

Extra heavy radiating spring draw-bar at each end of car, with necessary slides, all securely bolted to car body. Height from track to center of draw-bars when car body is mounted on trucks to be 22½ ins.

BUMPERS

Angle iron bumpers to be placed on front of vestibules, made of 6 ins. x 3½ ins. x ⅜ in. angle iron bent to same shape as vestibule front, and extending full width of same, projecting 6 ins. beyond front of vestibule and securely bolted to platform knees, which project out for that purpose. Height from track to center of bumpers to be 33½ ins.

MATERIAL AND WORKMANSHIP

All material entering into the construction and finish of these car bodies to be of the very best quality; all sills to be full length without splicing; mortises and tenons to fit each other tightly without false filling, and to be thoroughly white-leaded when being put together; all lumber to be of the very best quality and thoroughly well seasoned and dried; and all work to be done on a strictly first-class workmanlike manner.

CORNER POSTS AND HEADPIECE

To be securely tied together with an angle iron brace let into top of headpiece, corner post and side top plates. Outside of corner post, where it joins plate and headpiece, to be protected by a heavy iron plate.

Corner iron to be placed in corners of hoods where the bow joins the rear carline.

PAINTING

These car bodies to be painted in the best possible manner, lettered, ornamented and striped as desired by the railway company, and varnished throughout with Nobles & Hoare's railway varnish.

Outside of car to be painted in the following manner:

Two coats of pure white lead and linseed oil.

After second coat cars to be puttied and plastered where necessary.

Car to be rubbed with pumice stone and water until a perfectly smooth surface is obtained.

Two coats of flat body color, and if necessary an additional coat will be put on, depending on color used.

One coat color and varnish, on which striping and lettering will be done.

Two coats Nobles & Hoare's rubbing varnish, second coat to be rubbed with pulverized pumice stone and water.

Two coats Nobles & Hoare's railway body varnish. All striping to be done in gold. Lettering and numbering to be of same size and style as shown by photograph to be sent by railway company.

Roof of cars to be painted three coats of lead and oil paint, each coat to be allowed to dry before the succeeding coat is applied.

Inside work to be finished in the following manner:

All parts of inside woodwork of car and vestibule to receive one coat of oil filler, one coat of pure linseed oil, and three coats of Nobles & Hoare's rubbing varnish, last coat of varnish to be rubbed to a cabinet finish. No shellac to be used on any part of the cars.

INSPECTION

The railway company shall have the privilege of sending a representative to the shops of the car builders to inspect and examine the cars while being built.

TRUCKS, MOUNTING MOTORS AND INSTALLING ELECTRICAL EQUIPMENT

The Southwest Missouri Electric Railway Company to furnish and deliver free of any expense at the works of the car builders all necessary trucks, motors, wire, switches, sockets and all other electrical equipment for these cars, and the car builders to install same without any extra charge.

TIME OF DELIVERY

These car bodies to be delivered complete, f. o. b. cars Webb City, Mo., on or before ————, 1900, subject to delays caused by fire, labor trouble or any other cause beyond the control of the car builders.

The Adrian (Mich.) Street Railway is to be completely overhauled and reconstructed. A. P. Southworth, owner of the property, has succeeded in floating a bond issue of $25,000, and the company has received a new and favorable franchise from the city.

The Worcester Consolidated Street Railway Company has about completed the extension of its Market Street car house. The new addition will accommodate about sixty cars.

The J. G. Brill Company's Exhibit at the Paris Exposition

The J. G. Brill Company, of Philadelphia, has an exhibit of cars and trucks at Vincennes, and an exhibit of models and photographs in the American section of the Transportation Building on the Champ de Mars.

In the Transportation Building at Vincennes this company shows four types of trucks, a type of convertible summer and winter car, and a standard sweeper for meter-gage roads. One of the trucks is a No. 21-E truck of the company's standard pattern, mounted on 33-in. wheels, and having a 6-ft. wheel base and 3½-in. journals. The spring base of the truck is 14 ft. 6 ins. A No. 27 truck of standard type is also shown. It has 33-in. steel-tired wheels, and was built for standard gage, and for a car body having a weight of about 22,500 lbs. The truck itself weighs 9450 lbs., and is fitted with G. E. 55 motors. This is the type of truck specially recommended by the Brill Company for the very heaviest service.

There is also shown a No. 27-G truck, with a 4-ft. wheel base, and built for a gage of 4 ft. 8½ ins. The width in this case was restricted, so that it measured no more than 2 m at any point. The truck has 30-in. wheels, and is intended for a car body of sufficient size to carry eighty passengers.

A maximum traction, or No. 22 truck, fitted with 30-in. and 22-in. wheels, completes the exhibit of trucks at Vincennes. This maximum traction truck has a 4-in. wheel base, and is equipped with G. E. 52 motors. It is built for standard-gage tracks. The special feature of this truck, which attracts considerable attention from engineers, is the side pieces of the frame, which are solid forgings. These forgings, although an extremely difficult and intricate piece of work, have come out with perfect success, and are specimens of a high grade of workmanship. A number of these forgings are also shown unassembled. The maximum traction truck is also intended for a car body accommodating eighty passengers.

The greatest novelty of the Brill exhibit, to foreign managers, is a convertible car of standard type, mounted on a No. 21-E truck, with 33-in. wheels. The truck has a 7-in. wheel base, but is intended for meter gage. The spring base is 15 ft. 6 ins. The car has metal panels, both sash and panels sliding into the roof and making the car, when they are up, as completely open as the standard pattern.

The Brill Company also exhibits one of its standard sweepers for meter-gage roads. This sweeper, which was illustrated last month, has a 6-ft. wheel base, and is mounted on 33-in. wheels. The sweeper is arranged with two brooms and a scraper, to clean the track in front of the trail broom. It also has the usual wings for increasing the width of the space cleared. Aprons are dropped over the brooms to prevent the snow from being thrown on the sidewalk. Two motors are provided for propulsion, and one for driving the brooms. All the machinery, and what would ordinarily be the platforms, are inclosed so as to protect the men.

A swinging easel contains photographs of Brill cars and trucks in use in the United States, England, France and Germany, and a framed photograph gives a view of the company's works.

The Brill exhibit at the Champ de Mars is located in the American section of the Transportation Building, on the first main aisle when entering from the Avenue Suffren. The exhibit consists of four truck models in bronze, a swinging easel with photographs of the company's types of trucks and cars, and a photograph of the works. The four models, which are made to scale, comprise a No. 27 truck, a No. 27-G truck, a No. 21-E truck and a pair of maximum traction trucks, with frame mounted upon them, representing the floor frame of a car, and illustrating the working features of the trucks.

The photographs illustrate nearly every type of car used in America, and are of such size as to clearly show the peculiarities of American construction. There are shown, also, views of Brill cars and trucks in use in many foreign cities, which would indicate that the Brill Company does business in nearly all of the countries which have reached the state of civilization marked by the use of trolley cars. It will, therefore, not be a surprise when it is stated that in a number of the foreign sections in the Transportation Buildings at Vincennes and at the Champ de Mars are shown cars mounted on Brill trucks. In the city of Paris, Brill work is especially in evidence. In going to the Annex of the Exposition at Vincennes, for instance, one rides on Brill trucks, whether starting from the Bastille or from the boat landing at the Pont National, and when passing the Madeleine Church on one of the large double truck cars, one is carried on trucks from the same shops. It would lead too far, however, to mention all of the tram lines in Paris on which Brill trucks are used.

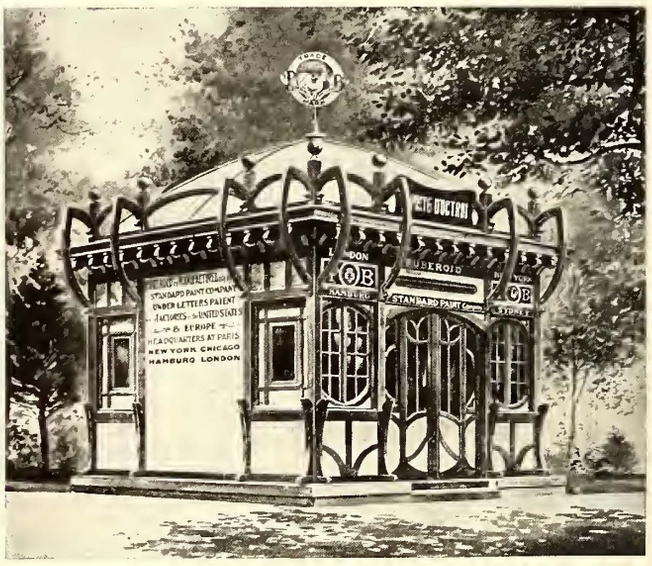
In a pamphlet prepared for the jury of the Exposition, it is stated that the Brill Works were founded in 1859, and that the beginning was on a very small scale, not more than four or five workmen having been employed, while the present number is 1400. The company manufactures annually 2000 electric cars and 9000 trucks, and the export business in 1899 exceeded f.5,200,000.

In England and on the Continent the Brill Company is represented by Maskell E. Curwen, whose headquarters are at 17 Victoria Street, Westminster, London, S. W. Mr. Mueller, the Exposition representative, has his headquarters at Vincennes.

The "P. & B." Paris Exhibit

Among the most novel of the American exhibits at the Paris Exposition is a pavilion erected by the Standard Paint Company, of New York. It is unique in construction and in its location at the Avenue d'Jena entrance. The inscription "Standard Paint Company," the American and European trade-marks and the various head offices—New York, London, Paris, Hamburg, Berlin and Sydney—appear on the front of the pavilion, while, surmounting the roof as a weather-vane, is the well-known "P. & B.," with the rooster trade-mark in gold. The trade-mark seems peculiarly fitting in a place so entirely Gallic in character, as the building itself is occupied by the officers of the Paris customs, which is indicated by the legend "Poste d'Octroi."

By special concession, after the French architects had themselves made successful use of P. & B. Ruberoid in the hallways and on the stairways of the chief operating building of the Exposition commissioners at No. 2 Avenue Rapp for more than a year before the Exposition opened, it was arranged that an ornamental pavilion, to be constructed inside and out, flooring, sides, ceiling and roof, of Ruberoid, should be erected for the use of French authorities in the Colonial section. Thus, a building purely American in material is being actually used during the term of the Exposition by the French Government. It is classified in the section of Architecture.



P. & B. PAVILION AT PARIS

The Ruberoid covering the exterior is decorated in imitation of gray birch, with pilasters in oak. The roof is Ruberoid undecorated. The interior walls, above the base of imitation wood, are tastefully painted in floral designs on a delicate background, as in fresco. The ceiling is panelled and the Ruberoid elaborately decorated in allegorical design, emblematic of the American, European, Asiatic and African continents. The flooring bears a tastefully colored border in Grecian design. Though Ruberoid was in service as a decorated flooring at the recent Brussels, Sydney and other expositions, the Paris decorations are of a higher artistic grade than has heretofore been attempted. The roofs of the exposition warehouses in the Rue Javelle are also covered with Ruberoid.

In the American section (Machinery and Electricity Department) the P. & B. electrical compounds, insulating varnish and tape are shown; in the Civil Engineering and Transportation Department are the well-known P. & B. insulating papers, roofing and other products of the Standard Paint Company.

The Neal-Jupiter Brake

James H. Neal, who is connected with the Boston Elevated Railway Company, and has already made several inventions, including the Neal electric headlight, has recently brought out another invention, which is claimed to answer all the requirements of an efficient and reliable brake. The United States Steel Company, of Boston and Everett, Mass., has acquired the right of manufacture, and is now making one of these Neal-Jupiter brakes—so called after the inventor and after the brand of steel manufactured by this company. A car of the Boston Elevated Railway Company will be fitted up and in running order before the middle of August.

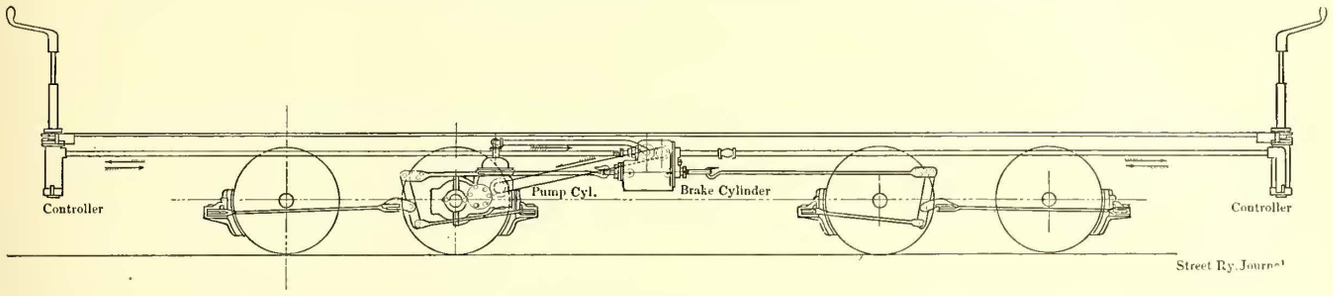


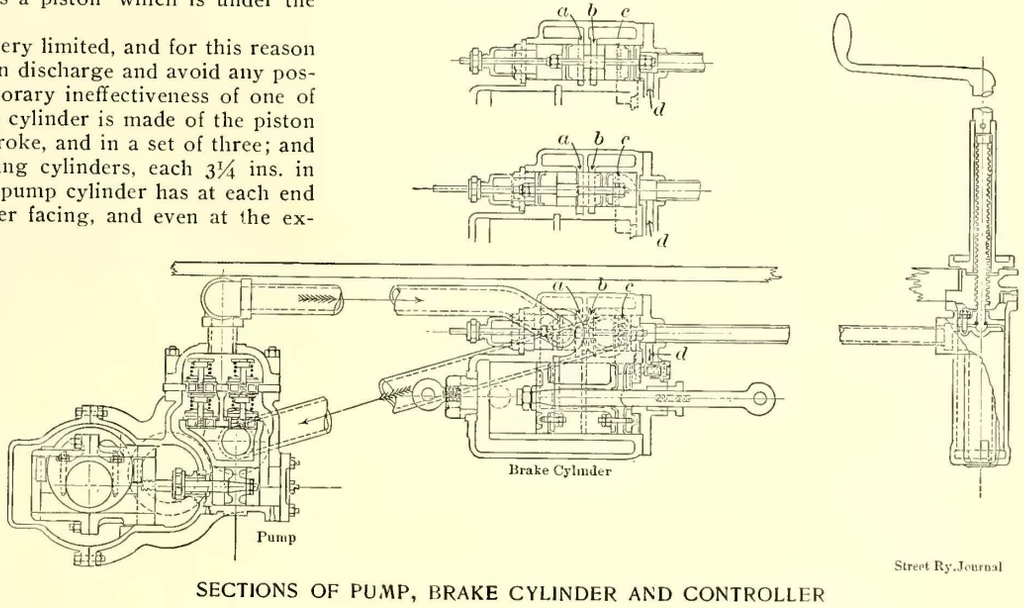
DIAGRAM SHOWING ARRANGEMENT OF BRAKE

Before mentioning the advantages claimed for this new brake, it will be well to refer to the drawings here given, and to give a description of it first.

The device consists essentially of a pump, or set of pumps, placed underneath the car platform, and operated continually by one of the car axles, to which they are attached. These pumps discharge into another cylinder, which actuates the brakes. The latter, called the brake cylinder, is connected by flexible piping to a third cylinder called the controller which has a piston which is under the direct control of the motorman.

The space underneath the car is very limited, and for this reason and also in order to get a more even discharge and avoid any possible trouble arising from the temporary ineffectiveness of one of the valves or other parts, the pump cylinder is made of the piston type—small in diameter, of short stroke, and in a set of three; and hence consists of three double-acting cylinders, each 3¼ ins. in diameter and 2½-in. stroke. Each pump cylinder has at each end one 2¾-in. metal valve, with leather facing, and even at the extremely high speed of 280 r. p. m., which corresponds to a car speed of 25 miles per hour, the velocity of the fluid through the valve seats is not excessive.

When the brakes are off, there is no pressure in the pump cylinders except that due to the friction of the fluid in passing through the valve seats and pipes; and for this reason the latter are also made large so as to reduce this friction to a minimum. When, however, the brakes are put on, the pressure rises perhaps 50 lbs., but the pump cylinders are made strong enough for 100 lbs. or more.



SECTIONS OF PUMP, BRAKE CYLINDER AND CONTROLLER

By reason of the same lack of room as mentioned before, there is not length enough under the car to operate the pump pistons by the usual crank, connecting rod and cross-head, and therefore the action is obtained by means of an eccentric of hard steel secured to the axle and pressing on slides, also of hard steel or bronze, which work in a cross-head, fastened to the piston rod; the whole being immersed in ordinary lubricating oil and contained in a closed tank.

To avoid freezing in cold weather, the working fluid selected is also oil, and a very limpid and white variety has been secured—free from any risk of fire.

From the pumps the oil passes into the brake cylinder, which is the effective part of the whole device, and consists of a lower cylinder, suspended to the bottom of the car by links and containing the brake pistons, and an upper cylinder containing a piston valve. The lower cylinder has two leather-packed pistons, one of which is connected to one brake rod, the other brake rod being fastened to the opposite end of the cylinder itself. The second, or loose piston so-called, is free, and in the ordinary action of the brake is inoperative, being held against the cylinder head by the pressure on the opposite face of this piston.

The brake cylinder has a port in about the middle of its length and extending half way around its circumference, and when the brakes are put on in the regular way, the oil, under pressure, comes in through this port and moves the brake piston, and so brings the brake shoes against the wheels by means of the same levers and rods as are now used in the ordinary hand-brake.

If, however, any accident happens to the pump and the brake piston fails to act, the motorman can force oil from the controller between the loose piston and the cylinder head, in a way to be hereafter described, and so bring the loose piston against the brake piston and put on the brakes by hand.

When the brakes are off the oil from the pumps does not enter the brake cylinder at all, but goes into the upper cylinder instead by one port and passes out of the same by another port, and so goes back to the pump. The upper or valve cylinder has really four ports, viz.:

1. In or about the middle of its length an entrance port *a* from the pump cylinder.

2. At one end an outlet port *c* leading into the brake cylinder between the cylinder head and the loose piston.

3. Between these two an outlet port *b* leading back to the suction of the pump cylinders.

4. In the cylinder head a port *d*, controlled by a check valve, which permits the passage of oil in one direction only. By this port, after the brakes have been put on by hand, the oil is brought back from the brake cylinder to the controller.

When the brakes are off, *a* and *b* are open and *c* is closed. When, on the other hand, the brakes are to be put on in the regular way, *a* is still open, but *b* is partly or wholly closed, *c* also being still closed. Oil is then forced by the axle-pumps into the brake cylinder and pressure is brought on to the fixed piston to move the brakes. If, however, for any reason, the pumps do not act, the motorman can move the piston valve over far enough to open *c*, *a* being still wholly or partly open and *b* still closed. He can thus force oil between the loose piston and the cylinder head and put the brake on by hand in this way, as before stated.

On the other hand, if any accident happens to the controller, or all the oil leaks out of the same, the valve cylinder is provided with a spring, which will force the piston valve back so as to close the port *a*, and the pumps will then force oil into the brake cylinder, and so move the fixed piston, and, in this way again, the car will be stopped automatically.

If for any reason the regular method of putting on the brake is only partially effective, the motorman can assist it more or less

by the hand-power. There are, in fact, four ways of applying the brake without recourse to anything except the single handle or lever in the grasp of the motorman.

1. The regular method, which requires only about one-eighth of a turn of the brake handle.

2. The direct hand-power method, which requires not over four turns of the brake handle to obtain the whole stroke of brake piston, and is likely to be used but rarely, if ever.

3. A combination of the first method with the second to a slight degree.

4. The safety method, which is instantaneous and also of very improbable occurrence.

The controller consists simply of a single-acting cylinder filled with oil and containing a piston fastened to the same rod to which the brake handle is attached. By means of the oil the motorman has a direct connection with the piston valve, and can move the latter, as before mentioned. The parts are so proportioned that the motorman has to exert a force of about 25 lbs. only on the brake handle in order to apply the brake by hand with a force of 50 lbs. per square inch on the brake piston; and in doing this he will have to take not over four turns of the brake handle to obtain the whole stroke of the brake piston; while it will take only one-eighth of a turn to close port *b* and put on the brake in the regular way, as before stated; and this with 5 lbs. only on the brake handle.

The principal advantages claimed for this brake are: The wheels are automatically kept from skidding, thus securing the maximum braking power. As soon as the wheels begin to skid the axle pumps will stop. Oil will then leak out of the brake cylinder through *b* into a reservoir provided. The pressure on the brake shoes will thus be reduced and the wheels started again by the momentum of the car; hence the pumps will start again, and pressure again be brought upon the brake blocks. So long, therefore, as the car moves at all, there will be a pressure upon the brakes.

If the pumps should fail to act, the motorman is still able to apply the brake by exerting his own strength on the brake handle in a way similar to and no more difficult than the present one.

If anything happens to the brake controller, so that the motorman has no command at all over the brake, the latter will be put on automatically and the car can be brought to a stop.

The mechanical and hand-power methods of working the brake are both operated by means of the same hand lever, so that in case of an emergency the motorman is not compelled to turn from his usual appliance to an unaccustomed one in order to stop the car.

The brake can be operated in four different ways, as stated above, and from either end of the car, so that, if the brake controller mechanism gives out at one end, that end can be shut off, leaving the car to be stopped from the other end.

It costs nothing to operate the brake, since there is practically no load on the pumps when the brakes are off, and when they are on the momentum of the car does the work of stopping it.

Test of an "L Special" Truck

A careful test of a Peckham "Elevated Special" double truck was made at the works of the Peckham Motor Truck & Wheel Company, Kingston, N. Y., on June 23, under the supervision of J. F. Morrison, superintendent and engineer of the South Side Elevated Railroad Company, Chicago, Ill.

The test made was of one truck frame, and resulted as follows:

Power applied,	20	tons,	1-8	in. deflection.
" "	30	"	3-16	in. "
" "	35	"	1-4	in. "
" "	40	"	7-16	in. "
" "	45	"	5-8	in. "
" "	50	"	15-16	in. "
" "	55	"	broke in yoke.	

Upon examination of the yoke it was found to be uniformly malleableized throughout, and contained no flaws.

The above test applied to one-side frames would be equivalent to a breaking strain of 110 tons for two-side frames used in the construction of each truck, or 220 tons for one car equipment of two trucks. This test shows that the trucks will safely carry from eight to ten times the maximum weight of the car and load for which they were designed.

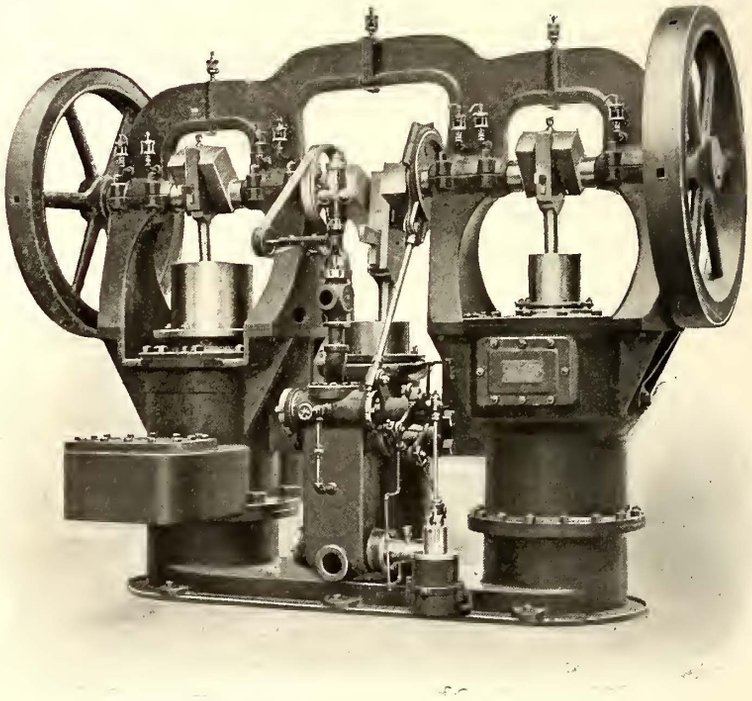
Consolidation of Supply Companies

The charter of the Miller-Knoblock Company, South Bend, Ind., being about to expire, the company has reorganized under the name of the Miller-Knoblock Electric Manufacturing Company, and will continue to make and sell commutators and armature coils.

The company has also consolidated with the Northwestern Electric Manufacturing Company, of Chicago, makers of insulated wire and the plant of the latter company has been moved to South Bend and installed in the commodious plant of the old Miller-Knoblock Company. The new company will, therefore, also produce all sizes of silk and cotton-covered magnet wire, and will make a specialty of coarse sizes of single and double cotton-covered wire for armature winding and field coils.

Combined Air and Circulating Pump

A description was published in the last monthly issue of this paper of the new combined air and circulating pump, recently brought out by the Conover Manufacturing Company, of New York. The accompanying engraving shows a general view of this pump, from which, with the sectional views published last month, a good idea of the arrangement of the various parts can be secured.



COMBINED AIR AND CIRCULATING PUMP

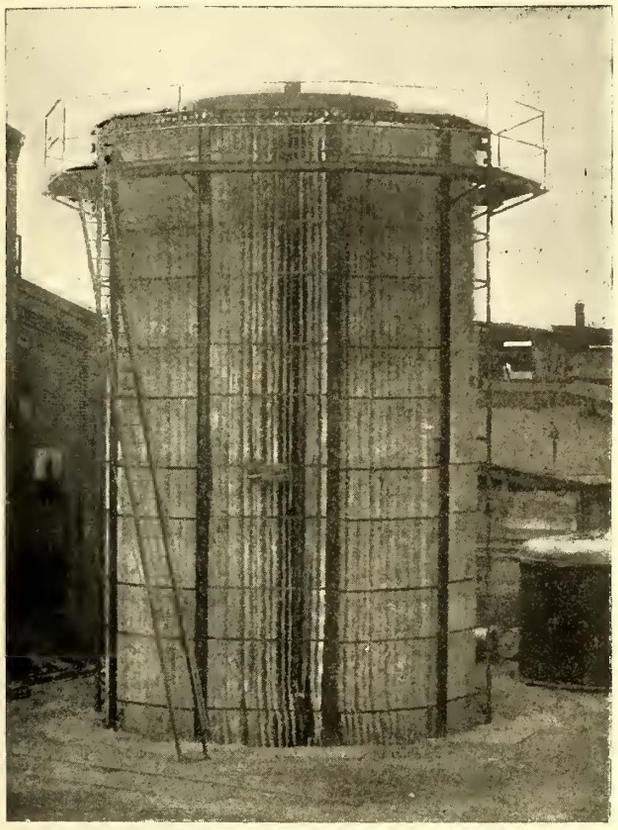
Electric Headlights

The use of electric headlights is growing so rapidly that the accompanying engraving showing the standard type of electric headlight, manufactured by the Dressel Railway Lamp Works, of New York, is of interest. This headlight is made of malleable iron, and is arranged to screw to the front of the dash, in which no hole cutting is necessary. The frame is so designed that the lamp can be easily cleaned or replaced, and is generally furnished with an 8-in. reflector, although it can be supplied with a 10-in. reflector if desired.

The Dressel Railway Lamp Works are one of the oldest manufacturing plants in this country, and have done a very large business in the steam railway field. The locomotive headlights made by this company are very extensively used, and many have adopted the headlight cases as their standard in connection with the Pyle National Electric Equipment. The Dressel Company manufactures nearly all varieties of headlights, signal lights and electroliers used by street railways, and has enjoyed an extensive reputation for the superior quality of its headlights, of which it makes a full line for both electric and kerosene service.

Fanless Cooling Tower

The wide adoption of cooling towers for condensing at points where a large supply of cool water is not available for this purpose has induced the Wheeler Condenser & Engineering Company, of New York, to give special study to the question whether a tower of this kind could not be devised to operate without an artificial draft. As a result of a long series of experiments, the company has finally



FANLESS COOLING TOWER

brought out the tower illustrated herewith, which is capable of giving practically the same result, without motive power, as the company's well-known Barnard inclosed fan-driven system.

The principle involved is the same as in the Barnard inclosed tower (which has been described in these columns), having the same wire cloth mats on which the water to be cooled is sprayed by means of perforated and slotted pipes. The outside shell, peculiar to the fan tower, has been entirely removed, thus leaving the mats exposed to the atmosphere on all sides. The tower is circular in form, with the mats radiating from the center; this arrangements utilizes all the natural air currents, and also those established within the tower itself.

All the mechanical means necessary to circulate air for cooling the water have been dispensed with, thus avoiding wear and tear—always associated with moving or operating parts. The great advantage of this type of tower is the absence of any motive-power requirements, which in turn increases the economy, as well as the general efficiency of the condensing plant.

The water distribution system is so designed that when a varying load is encountered, such as the operating day and night conditions of an electric station, one or more sections of the tower may be shut off. This feature is especially valuable, as any portion may be cut out and repaired or cleansed without interrupting the operation of the balance of the tower.

A gallery surrounds the upper works to facilitate inspection and cleaning when required, every portion of the water distribution system is accessible, and can easily be cleared of foreign matter.

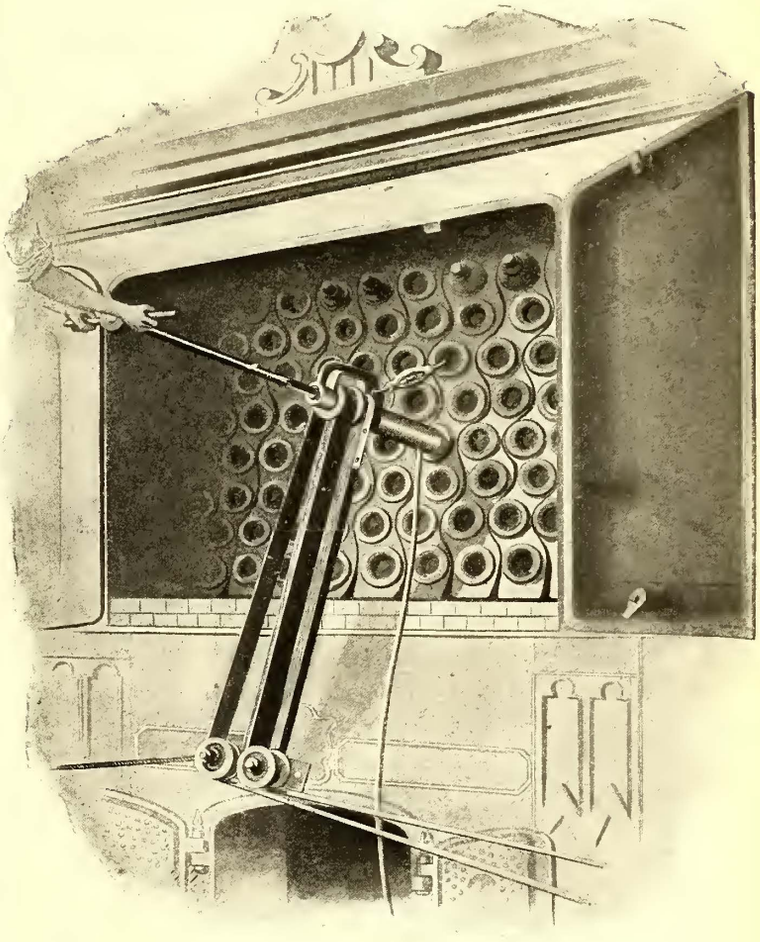
Particular attention has been given to the bracing of the whole structure, to provide against strains or exposure to wind pressures, all parts being of ample dimensions to insure great strength and durability. The fact that the average height of the tower is but 30 ft. recommends itself, especially when the tower must be located upon a roof structure, or in localities subject to high winds. When considering the question of a roof tower, it will be found that the weight per square foot of roof area is very low.

In extreme cases, such as great reductions in temperatures, or with very limited space, the company still recommends the Barnard inclosed fan tower, of which there is some 250,000 hp in use. The tower illustrated has a capacity of about 1000 hp.

Economy in Boiler Cleaning

The Weiland boiler tube cleaner, which is made by the Lagonda Manufacturing Company, of Springfield, Ohio, has been adopted in a number of steam plants with excellent results. A view of the cleaner is shown herewith, and illustrates very clearly the extremely simple manner of attaching and removing it from tube to tube or from one row of tubes to another. The machine itself is driven by either an electric motor, steam, gas or gasoline engine or any suitable power, and the manufacturers recommend about 5 hp, although they have driven it successfully with a 3-hp motor.

In preparing for its use it is only necessary to open the doors and remove the caps from the tubes, as with any cleaner. A platform is built in front of the boiler on which the operator stands. Attached to the cleaner is a swinging board with flange pulleys,



BOILER CLEANER

over which the belt runs, fitted to the bottom of it, and the belt, when the machine is in motion, is held tight. This board swings perfectly free, and it can be drawn down so that the belt is securely tightened when the machine is in motion, and loosened again when the operator desires to change from one tube to another. One man can readily handle it, and the time saved in getting ready to clean boilers is as much almost as is required in cleaning with some other devices.

A series of effective cleaner heads are used, by means of which the scale can be quickly and thoroughly removed from all the tubes, and the manufacturers state they are willing to undertake to remove with this machine the very heaviest scale that can be found in any water-tube boilers, having recently done very successful and satisfactory cleaning where the scale was so thick that only about 1 in. of opening remained. These machines are sold direct to users, or the manufacturers will take contracts for cleaning boilers of any style.

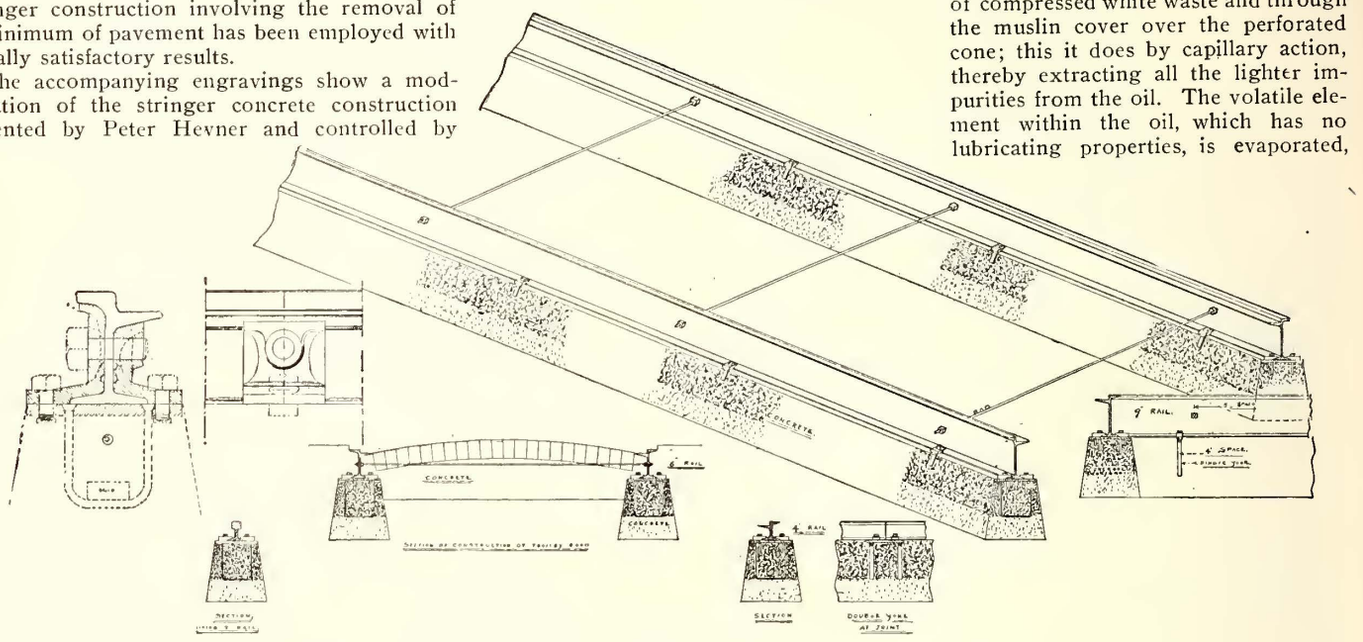
The Meriden, Southington & Compounce Tramway Company, of Meriden, Conn., has recently published a tasteful pamphlet containing views and descriptions of some of the most interesting points along its picturesque line.

Concrete Stringer Construction

The use of concrete without ties in track construction is one of the radical changes in that department of street railway work which have been accomplished since the introduction of electric traction. Concrete sub-construction has been adopted by railways in many of the principal cities of this country, and has proved perfectly satisfactory. In some cases, as is well known, the concrete is carried entirely across the roadbed, but in other cases a stringer construction involving the removal of a minimum of pavement has been employed with equally satisfactory results.

The accompanying engravings show a modification of the stringer concrete construction invented by Peter Hevner and controlled by the Indestructible Roadbed Company, of Philadelphia. As will be seen, the rails rest directly on a concrete prism, the depth of which depends upon the weight of rail, traffic to be carried, etc., and which can be laid in a narrow trench without interfering with the rest of the roadway. The rails are held to gage by tie rods every 4 ft. to 5 ft., as usual. The characteristic feature of the system, however, consists in the employment of U-shaped bolts, which are buried in the concrete when the latter is tamped in the trench, and are fitted with clips which fit over the base of the rail, holding the latter in position. The advantages of this construction over the ordinary construction in which the rail is set in concrete is claimed to be that it is much more easy to replace the rails. To do this it is necessary only to remove the nuts from the ends of the bolts and take out the tie rods, after which the rail can be replaced by an unworn section. The construction has been employed in Syracuse and elsewhere.

If desired, feeder conduits can be laid in the concrete stringer, which is usually 9 ins. wide on top, 13 ins. deep, and 13 ins. in width at the base.



CONCRETE STRINGER CONSTRUCTION

The Famous Oil Purifier

The rights to the Famous oil purifier, which has been employed in many power stations, have recently been secured by the Chicago Boiler Cleaner Company, of Chicago, which is now placing this device on the market. The filter is illustrated in section herewith, and depends for its operation on the use of a low initial heat by means of the air jacket and steam jacket combination embodied in this apparatus.

Exhaust or live steam is admitted into the steam jacket at the left-hand side, see engraving. The amount of steam admission is regulated by a globe valve placed in the inlet pipe in a convenient position close to the apparatus. In the drain or outlet of the steam jacket is interposed a water trap, to check the outflow, to insure a positive filling of the steam jacket with steam in the most economical manner. The relief valve prevents injury to the jacket by over pressure, as it opens at less than 1-lb. pressure.

The dirty waste oil is poured or led into the removable strainer, which retains all the coarser impurities; the oil then passes through the large area of fine straining surface (around the removable strainer), then down toward the bottom of the settling and refining chamber; the unsettled oil is always kept away from the filtering material by the deflecting shield which hangs in this chamber.

The proper waste oil refining and purifying temperature is safely and gradually communicated to the oil in the refining chamber by the steam jacket through the air jacket, thereby thinning the oil and making it bright and clear, and all the entrained water, carbon and suspended impurities are separated from the oil and precipitated on the bottom of the settling chamber, when they are readily withdrawn through the dirt faucets. In this manner the waste oil is first thoroughly strained, then positively settled and refined, and fully 90 per cent, it is claimed, of the impurities are extracted from the oil before it overflows into the filtering chamber. The oil then gradually filters through the large area of compressed white waste and through the muslin cover over the perforated cone; this it does by capillary action, thereby extracting all the lighter impurities from the oil. The volatile element within the oil, which has no lubricating properties, is evaporated, thereby refining the oil and making it a higher grade lubricant.

In the jacket system embodied in the Famous the settled and precipitated impurities are not stirred up by circulation, as no heat is applied under, or even near, the bottom.

As the cubic contents of the refining chamber are comparatively small, on account of the displacement by the filtering chamber, and also because the jacket prevents radiation, the initial heat communicated to the dirty oil by the extra large area of low heating surface presented by the jacket is so low that the proper refining and purifying temperature is obtained without injury to the lubricating properities of even the lowest grade of oil, and regardless of cold and hot-water changes.

FAMOUS OIL PURIFIER

The perforated cone presents a large area of filtering surface. The purified oil is delivered cold at the clean oil faucet.

Lifting out the removable strainer by the handles opens the entire refining chamber and filtering chamber, and the filtering material may be inspected or renewed without drawing off any oil or disturbing any part of the apparatus. The straining surface being placed around the side, and not on the bottom of the removable strainer, prevents clogging by the heavy and coarse impurities.

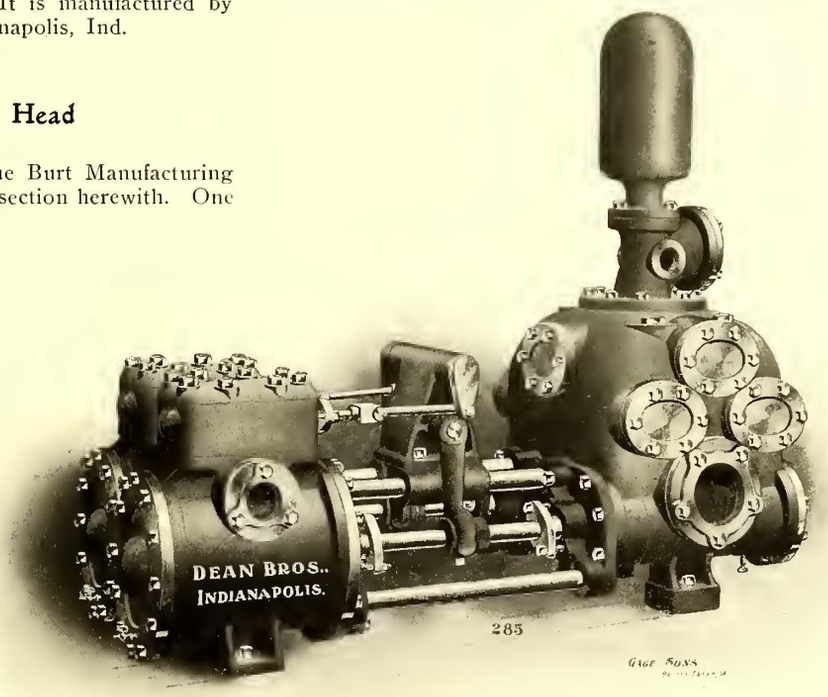
For use where steam is not available, as in rotary sub-stations, a modified form of filter is manufactured, in which the heat is secured by means of electricity. The Chicago Boiler Cleaner Company also supplies, without charge, an oil microscope by which the engineer can determine for himself whether the oil he is using is free from impurities or not.

A meeting of the stockholders of the Cleveland Electric Railway Company will be held on Aug. 9, when a proposition to increase the capital stock of the company from $12,000,000 to $13,000,000 will be voted upon.

A Modern Duplex Pump

The duplex pump has been in use so long that its principles are well understood by most engineers. The accompanying engraving shows the latest development of this type of pumps for heavy pressure and hard service. As will be seen, the steam cylinders and steam chests are heavy and strongly bolted. The frame is made with heavy polished steel stretcher rods. The water cylinders are extra heavy, and are cast in one piece. The hand-holes are large and valves are of moderate size.

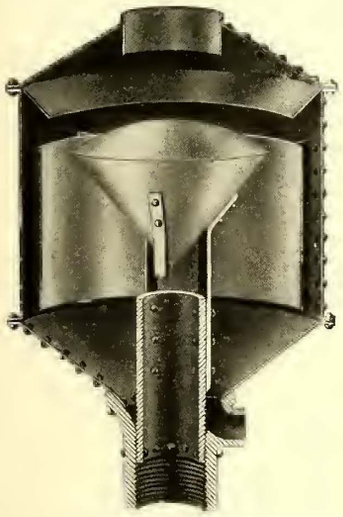
By skillful designing and careful workmanship a pump has been produced that will run under heavy pressure for a long period of time without repairs. The pump shown has 12-in. steam cylinders, 7-in. water cylinders, and 10-in. stroke. It is manufactured by Dean Bros. Steam Pump Works, of Indianapolis, Ind.



DUPLEX PUMP

New Type of Exhaust Head

A new type of exhaust head, built by the Burt Manufacturing Company, of Akron, Ohio, is illustrated in section herewith. One chief feature of the head is the absence of baffle plates. The exhaust steam, after coming in through the pipe, strikes the cone immediately over the inlet. This cone separates the steam into fine particles, condensing some of the vapor. The greater volume of steam rises up to the small projection extending around the top of the head, and is held there for an instant, causing the particles of water and oil to drop by force of gravity down between the double walls on the side and out through the drip below. The use of perpendicular sides gives the maximum cooling surface for the exhaust steam, while nothing but dry steam escapes from the outlet.



EXHAUST HEAD

The Burt exhaust head is made from extra heavy iron, lapped and riveted.

Convenient Curtain Holder

The Quaker City Car Curtain Supply Company, Ltd., of Philadelphia, has recently brought out a new pinch-handle cable holder for car curtains, which is illustrated herewith, and which is called the Victor holder. The chief claims made for the holder are that it holds the cable tightly and does not slip up, and that it does not wear out. The handle is very easily operated and kept in repair.

The Quaker City Car Curtain Supply Company is a new corporation, having been incorporated May 31, 1900, with Benjamin Conner as president, A. G. Shellenberger as secretary and treasurer, and William Daut as general manager. The company also manufactures curtains of all descriptions.

An Improved Fare Register

The accompanying illustration gives a general view of a register which has lately been designed. It is claimed for this register that it not only contains all the advantages found in similar appliances, together with many more that are peculiarly its own, but that it can be supplied to railway companies at a cost much below the present price of first-class registers. It has been called the "Monarch," and is made both single and double. The appearance of the round bronze case is handsome, and the workmanship of the mechanism within is of the best, although a specially designed bolt prevents the inspection of this latter feature by anyone but the proper authorities. Various ingenious interlocking devices in the trip-register mechanism prevent tampering with the number of fares already rung up, and a perfected "flag" device and catch prevent the bell from ringing except when both trip register and totalizer record. In the double form each register is independent, there being two separate bells of different tone. The case of the double is the same size as the single. Both trip registers count up to 1000 and the totalizer to 100,000. No seal is used on the case, as the precautions taken to prevent opening, turning back or in any way tampering with the mechanism have been thought sufficient guard against theft. The manufacturers of this new register are Neilsen & Bentson, New York. A. E. Neilsen, of the firm, has had many years' experience with some of the best makers of fare registers in the country, and is, therefore,

NEW FARE REGISTER

able to employ the very best practise in making the Monarch. The Morris Electric Company, 15 Cortlandt Street, New York, controls the device, which is sold only through that company.

The New Works of the Jewett Car Co.

The Jewett Car Company, on March 1, 1900, moved from Jewett to Newark, Ohio, where the company has now almost completed the erection of one of the largest street car manufacturing plants in this country. The buildings and yards are shown on the accompanying diagram, and cover about 10 acres of ground. Seven large buildings are now completed, and a drying kiln and a number of smaller buildings are under construction.

A side track from the Baltimore & Ohio and P. C. C. & St. L. railroads brings lumber to the yards, and gives the best facilities for making shipments of finished cars. At the west of the side track where the car timber is unloaded, is now being erected a very large drying kiln 40 ft. x 100 ft., and near this, on the opposite side of the track, stands a large building for storing dry lumber. Near the dry-lumber building is the machine shop, which is built in "U" shape, fronting 136 ft. on the transfer track. The south wing running back 176 ft. x 48 ft. wide, is equipped with modern heavy car-building machinery. This part of the machine shop is used principally for the heavy work. The north wing extends back 144 ft. x 48 ft., and is equipped with the most modern machinery for getting out interior finish. The rear end of this wing is used as a cabinet room.

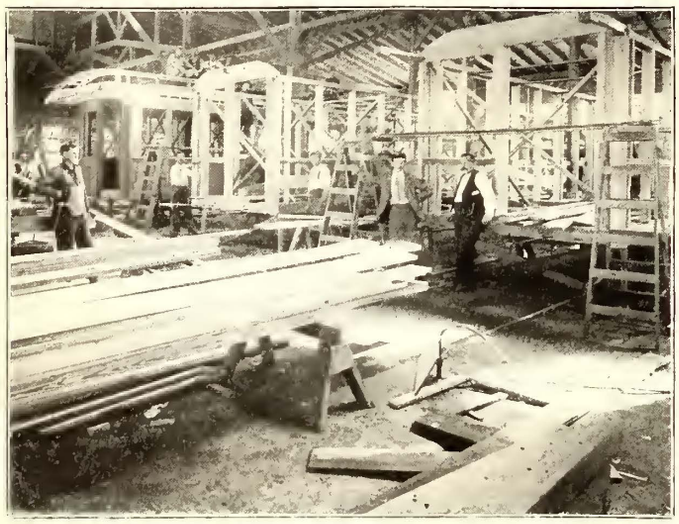
It will be noted that the above arrangement is such as to facilitate the handling of material. Cabinet work is in these departments prepared complete for erection. Between the two wings of this building is a dry kiln used for drying lumber for interior finish. This arrangement brings the finished lumber the nearest possible to the point where it is worked up.

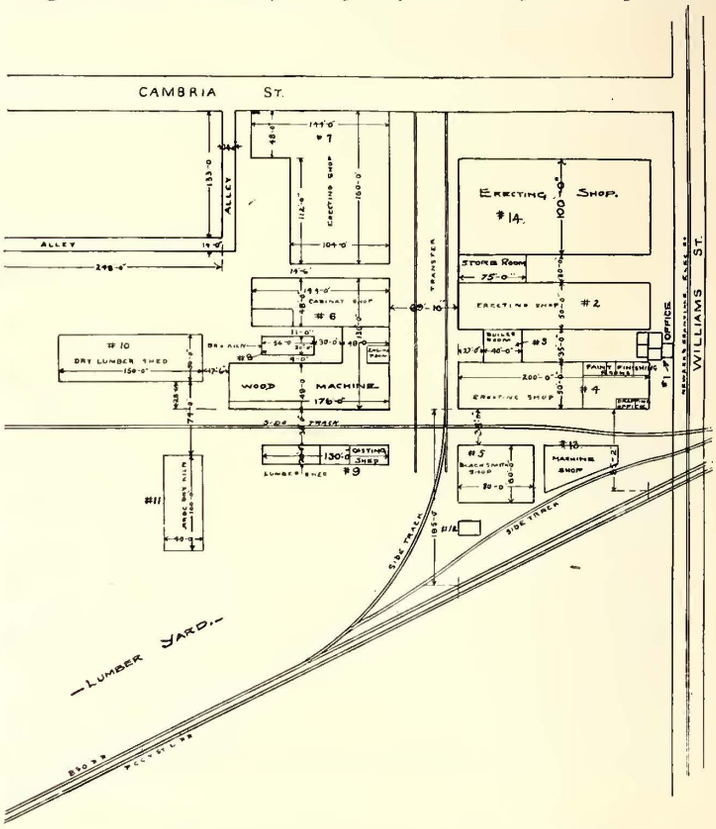
North and in line with the machine and cabinet shop is one of the erecting shops 160 ft. x 104 ft. with a wing 48 ft. square. This building has ten tracks laid in a cement floor. Here the cars are erected and painted ready for varnishing.

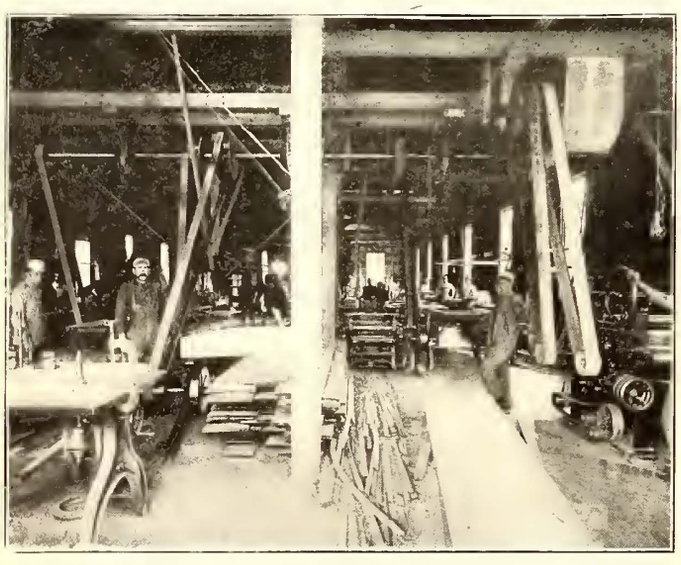
Along the front of the buildings named runs a 70-ft. electric transfer table, which is equipped with electric motor, and so arranged that cars are easily and quickly handled by electric power, either from one department to another or on to trains for shipment. Connecting with the transfer table on the east are two brick buildings, each of which is 50 ft. x 200 ft., roofed with slate. The north brick building is equipped with tracks and has a cement floor, making it practically dust-proof. The cars are transferred into this building for finishing and varnishing.

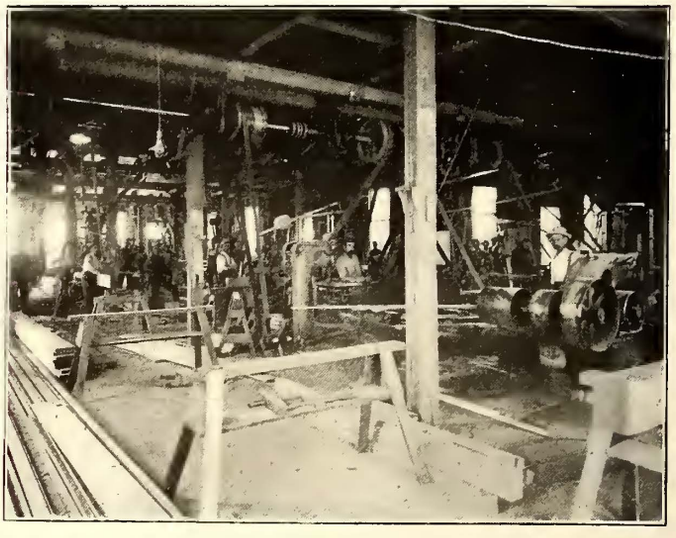
The south brick building is partitioned, half being used for a varnish room, where head linings, sash, etc., are finished. The remaining half of this building, being directly across from the machine shop where the body material is milled out, the lighter parts of the body material are taken to this department to be cleaned up, assembled and stored ready for transferring to the different erecting shops as needed.

At the northeast corner of one of the last-named shops is the









PLAN OF WORKS AND VIEWS IN THE SHOPS OF THE JEWETT CAR CO.

building used for storing bronze trimmings, screws, bolts, nails and other hardware for use in the construction of cars.

Plans are now being completed for another large erecting shop 100 ft. x 200 ft. This will be constructed of pressed brick, with self-supporting roof, covered with slate; it will have seven tracks; four of these will have pits for mounting motors and equipping cars ready for service. This shop will be equipped with an overhead traveling crane.

To the south of the buildings last named is the blacksmith shop 60 ft. x 80 ft., and there is now in course of construction an addition to be used for machinery purposes.

These buildings are so situated, being surrounded by three side tracks, as to make easy the handling and unloading of heavy material from the cars. The blacksmith and machine shop are equipped with the latest improved machinery, such as steam hammers, punches, shears, drill presses, bull dozers, bolt machines, lathes, forges, blowers, traveling crane, and pneumatic hoists.

The plant is complete in every respect. The shops are lighted throughout with electricity, and a complete system of water mains and sewers is now going in, affording ample fire protection, etc. The lumber yards and general yards are equipped with tracks and turn-tables to facilitate the handling of lumber.

The Jewett Car Company has long had an enviable reputation for turning out one of the best-built cars on the market. Now that its plant has grown to be one of the largest in the country, this reputation, backed by the facilities for turning out large orders rapidly, will be of great value. The symmetrical outlines of the company's cars, as illustrated herewith, will suggest to the reader the modeling after steam-coach designs.

The JOURNAL's correspondent found the company's shops crowded with work. Some 400 men are employed, and the force is rapidly being increased.

Among the orders on hand are thirty cars for the Alley L in Chicago, cars for the Steubenville, Mingo & Ohio Valley Traction Company; for Wichita, Kan.; Cincinnati, Lawrenceburg & Aurora; Detroit, Monroe & Toledo; Buffalo & Hamburg, and elsewhere.

The officers of the Jewett Car Company are: W. S. Wright, president, Wheeling, W. Va.; H. S. Sands, secretary, Wheeling, W. Va.; A. H. Sisson, manager and treasurer; Neil Paulson, superintendent.

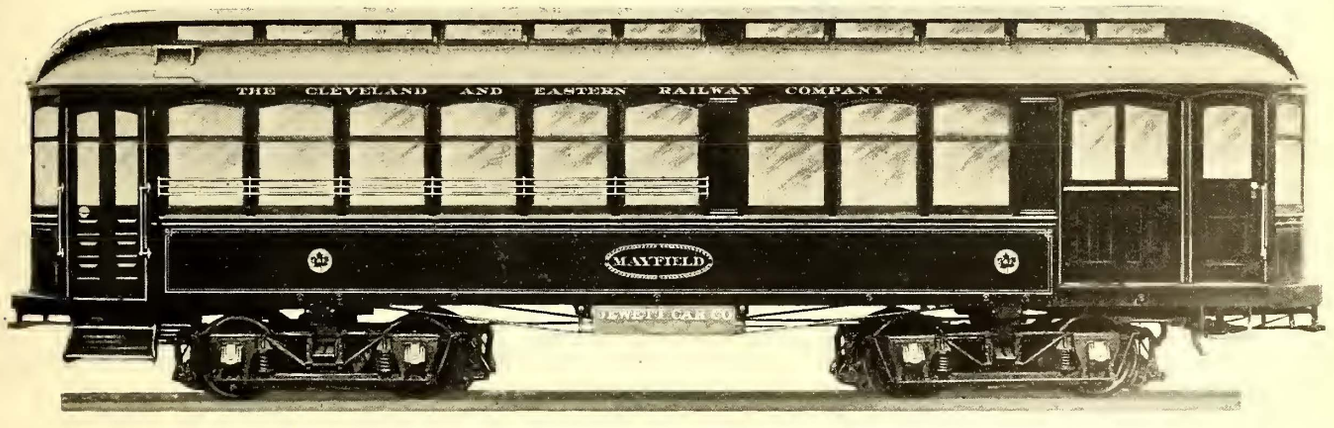
Large New Car Wheel Works

The Keystone Car Wheel Company has been incorporated under most promising conditions, and the works are now in process of construction. The capital of the company is $200,000, and the proposed plant will have a capacity of from 300 to 350 wheels per day. Extensions to the plant, however, can be made with little inconvenience and moderate outlay, as it is confidently expected that the output will soon reach 600 wheels a day. The present plans provide for a foundry and shop containing all the modern labor-saving devices, such as pneumatic hoists, automatic carriers, etc., to be erected near Homestead, Pa. The company has bought an exceptionally fine site of 10 acres on the Monongahela river adjoining the new works of the Haribson-Walker Company. The railroad facilities are extremely good, direct connection being had with the Baltimore & Ohio, Pittsburgh & Lake Erie, Pittsburgh, Virginia & Charleston, and the Union Terminal of the Pittsburg, Bessemer & Lake Erie Railroad. The works will also be within convenient distance of electric lines to Pittsburgh. The main building will be of brick 300 ft. long by 110 ft. wide, so arranged that longitudinal extensions may be made by merely removing the end walls.

The organizers and directors of the company are: Charles V. Slocum, formerly treasurer and manager of the Pennsylvania Car Wheel Company; William L. Elkins, assistant treasurer of the Consolidated Traction Company, Pittsburgh; William W. Lobdell, president of the Lobdell Car Wheel Company, of Wilmington, Del.; Louis B. Whitney, formerly of A. Whitney & Sons, of Philadelphia, the oldest car wheel manufacturers in the United States; Charles A. Otis, Jr., of Otis, Hough & Co., iron and steel merchants, of Cleveland, and son of the former president of the Otis Steel Company.

The officers are: President and general manager, Charles V. Slocum; vice-president, William W. Lobdell; treasurer, Louis B. Whitney, and secretary, John Howard Yardley, formerly vice-president of the Philadelphia Car Wheel Company and one of the organizers of the Pennsylvania Car Wheel Company. The new company has first-class financial backing, and its technical strength is assured by the personnel of the organization. The very best work will be turned out for both steam and electric

LONG CAR FOR SANDUSKY AND INTERURBAN RAILWAY CO.

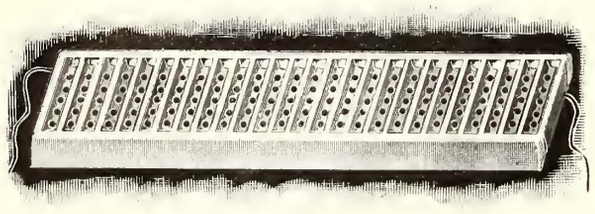


LONG CAR FOR CLEVELAND AND EASTERN ELECTRIC RAILWAY CO.

service, but a specialty will be made of street railway car wheels. President Slocum has always had remarkable success in the car-wheel business. At twenty-five he was business manager for Frederick Stearns & Company, Detroit, leaving that position to become treasurer of the New York Car Wheel Company, Buffalo. He resigned in 1898 to take an active part in the organization of the Pennsylvania Car Wheel Company, with which company he remained until last November. His brother, A. W. Slocum, who has been associated with him in most of his car-wheel ventures, will probably be connected with the new company.

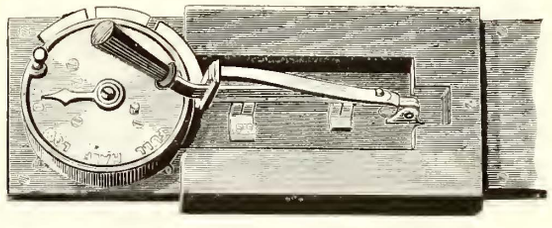
Electric Car Heaters

About this time of year the managers of street railways are looking around for an economical car heater. The National heater, the plate of which is illustrated on this page, is constructed on practical principles, and the manufacturers claim that, although it has a large radiating surface, the space occupied is a minimum.



FRAME OF HEATER

It is made from sheet iron, corrugated, and then heavily coated with white enamel. This assures perfect insulation and prevents deterioration. The heating resistance being imbedded in the enamel, it cannot corrode, or break and ground the heater. The wires are safe from mechanical strain, and as it takes the heater about thirty minutes to cool off after breaking the circuit they are practically under a process of annealing during that period. The



REGULATING SWITCH

heaters are made by the National Electrical Manufacturing Company, which also makes the regulating switch shown in the second cut. This device has a capacity of 25 amps. at 650 volts, and will allow three different degrees of heat to be obtained. Arrangements are made to prevent the operator receiving a shock, and a locking system prevents the changing of the dial until the switch is opened. Both of these specialties are being placed on the market by the Morris Electric Company, New York.

The American Bridge Company

The American Bridge Company has issued the following circular letter to the trade: "As a result of numerous conferences it has been deemed expedient to organize the American Bridge Company, incorporated for the purpose of designing, building and erecting bridges and all classes of metallic structures. The facilities at our disposal are such that we have every confidence that we shall be able to give you the advantage of very favorable quotations, and at the same time be enabled to avoid delays in delivery, which in the past have proved so vexatious in many instances. We solicit your inquiries, which shall have our very best attention."

Below will be found a list of the various bridge companies forming the consolidation, as follows:

American Bridge Works, Chicago, Ill.
Berlin Iron Bridge Company, East Berlin, Conn.
Buffalo Bridge & Iron Works, Buffalo, N. Y.
Carnegie Steel Company (Keystone plant), Pittsburgh, Pa.
Edge Moor Bridge Works, Wilmington, Del.
Elmira Bridge Company, Elmira, N. Y.
Gillette-Herzog Manufacturing Company, Minneapolis, Minn.
Groton Bridge & Manufacturing Company, Groton, N. Y.
Hilton Bridge Construction Company, Albany, N. Y.
Horseheads Bridge Company, Horseheads, N. Y.
Lafayette Bridge Company, Lafayette, Ind.
Lassig Bridge & Iron Works, Chicago, Ill.
New Jersey Steel & Iron Company, Trenton, N. J.
New Columbus Bridge Company, Columbus, Ohio.
Pittsburgh Bridge Company, Pittsburgh, Pa.
A. & P. Roberts Company (Pencoyd Iron Works), Pencoyd, Pa.
Post & McCord, Brooklyn, N. Y.
Rochester Bridge & Iron Works, Rochester, N. Y.
Schultz Bridge & Iron Works, Pittsburgh, Pa.
Shiffler Bridge & Iron Company, Pittsburgh, Pa.
Union Bridge Company, Athens, Pa.
Milwaukee Bridge Company, Milwaukee, Wis.
Wrought Iron Bridge Company, Canton, Ohio.
Youngstown Bridge Company, Youngstown, Ohio.

This list contains all the leading companies that manufacture bridge and structural work in this country, with the combined capacity of 600,000 tons per annum. The Pencoyd plant, of the A. & P. Roberts Company, also comprises one of the best and most complete rolling mills for structural material in existence, with a capacity of 200,000 tons per annum. This puts the American Bridge Company in a position to furnish all classes of bridge and structural work at an absolute minimum of cost, and in the very shortest possible time, and this has already been announced as the future policy of the company. No advance in prices will be made, but the cost of production will be reduced to an absolute minimum, and, judging from the known facilities of the various plants, the facts would seem to justify the statement.

The directors of the company are as follows: Percival Roberts, Jr., A. & P. Roberts Company (Pencoyd Iron Works),Pencoyd, Pa.; Alfred C. Case, Carnegie Steel Company, Pittsburgh, Pa.; William H. McCord, Post & McCord, Brooklyn, N. Y.; Charles M. Jarvis, Berlin Iron Bridge Company, East Berlin, Conn.; William H. Connell, Edge Moor Bridge Works, Wilmington, Del.;Walter Hawxhurst, Elmira Bridge Company, Elmira, N. Y.; Charles Macdonald, Union Bridge Company, Athens, Pa.; Frank Conger, Groton Bridge Company, Groton, N. Y.; James P. Kennedy, Youngstown Bridge Company, Youngstown, Ohio; Lewis S. Gillette, Gillette-Herzog Manufacturing Company, Minneapolis, Minn.; John F. Alden, Rochester Bridge & Iron Works, Rochester, N. Y.; Walter G. Oakman, Guarantee Trust Company, New York, N. Y.; J. P. Ord, General Electric Company, Schenectady, N. Y.; Robert Winsor, Kidder, Peabody & Co., Boston, Mass.; Robert Bacon, J. P. Morgan & Co., New York, N. Y.; Charles Steele, J. P. Morgan & Co., New York, N. Y.; Paul E. De Fere, 40 Wall Street, New York, N. Y.; Robert S. Green, 1 Montgomery Street, Jersey City, N. J.; J. W. Walker, Shiffler Bridge Company, Pittsburgh, Pa.; Abram S. Hewitt, Cooper, Hewitt & Co., New York, N. Y.; August Belmont, August Belmont & Co., New York, N. Y.

The majority of this board are practical bridge men who have in years past made a success of their individual companies. The financial end is unusually strong, being represented by firms and institutions of world-wide financial strength, thus forming a combination of practical and successful bridge men, backed by the strongest of financial resources.

The executive organization is made up entirely of men of large practical experience, headed by Percival Roberts, Jr., one of the leading rolling mill managers of the country. Joshua A. Hatfield has been appointed as assistant to the president, and will also have charge of the sales of the rolling mill products of the Pencoyd plant. The engineering department is in charge of Charles C. Schneider, formerly chief engineer of the Pencoyd Iron Works, of the A. & P. Roberts Company, with the title of vice-president, in charge of engineering.

The operating department is in charge of Charles M. Jarvis, formerly president of the Berlin Iron Bridge Company, with the title of vice-president, in charge of operating. As soon as contracts for any work are taken, they are immediately turned over to this department for execution, and consequently all the plants and erecting forces of the company belong in this department. At each plant is a manager, with full charge over all employees and the operations of that particular plant. All managers are under the direct charge of a general manager, James P. Kennedy, formerly president of the Youngstown Bridge Company. The erecting is also in charge of the operating department, and this is under William Wennas, as superintendent. Mr. Wennas has had full charge of all the Pencoyd erecting for a number of years, and gained a world-wide reputation but a short time ago for the economical and expeditious manner in which he handled the erection of the famous Atbara Bridge.

All the sales of the company are in charge of the contracting department. Railway contracting, highway contracting and structural contracting.

CURRENT NEWS

House Dynamited at St. Louis

A striker or strike sympathizers made a desperate attempt at dynamiting the house at 3750 Evans Avenue, St. Louis, on July 29. No. 3750 Evans Avenue and the adjoining house are conducted as boarding houses for Transit Company employees, and the object of the dynamite thrower was presumably to kill the occupants of the house, as the dastardly act was committed at 2 a. m. Both houses were badly damaged by the explosion, but fortunately none of the inmates was injured. This is one of the most brazen acts of the strike, and was very unexpected, as there have been no serious attempts at violence of late.

Hearing of the Suit of Sutro Brothers Against the Chicago Consolidated Traction Company Adjourned Until September

On July 27 the hearing of the suit instituted by Sutro Brothers, of New York, against the Chicago Consolidated Traction Company, seeking to force an accounting and a cancellation of the $6,750,000 mortgage given by the company on its property, was adjourned by agreement to the September term of the court. It was ordered that in the meantime there should be no transfer of the Chicago Consolidated Traction stock or any action taken effecting the transaction referred to in the bill of complaint.

Mr. Yerkes in London

C. T. Yerkes, of Chicago, has arrived in London, where he has gone to investigate the London transportation question at the request of an English syndicate, which holds franchises under past Parliamentary grants. D. H. Louderbach, of Chicago, representing Mr. Yerkes, is also in London. He arrived there several weeks before Mr. Yerkes, and has been studying the situation, in order to report on the outlook. Mr. Yerkes, in an interview, said: "If London desires a complete system of intramural traffic, I think we can give it. I have come here in an advisory capacity. It may be possible to establish a combination of underground lines in the city connecting with the surface lines outside, and thus afford the traffic facilities so much needed."

Massachusetts Electric Companies Absorb Another Road

At a special meeting of the stockholders of the Massachusetts Electric Companies, held July 30, it was voted to purchase the Lowell & Suburban Railroad and to ratify the purchase of the South Shore & Boston Railway. The basis of exchange of shares of the Lowell & Suburban was two shares preferred and 1½ common of Massachusetts Electric Companies' stock for one share of Lowell & Suburban Railroad. The basis of exchange of the South Shore & Boston was one share preferred and three-quarters of a share of common of Massachusetts Electric for each share of South Shore & Boston. It was also voted to pay the semi-annual dividends in July and January, instead of in June and December, as at present. President Gordon Abbott made the following statement: "The first fiscal year ends Sept. 30, and before the annual meeting on Nov. 7 a full report of the year's operations will be sent in to all the shareholders as follows: Gross earnings, $3,102,518, an increase of $293,053, or 10.4 per cent; operating expenses, $2,132,679, an increase of $44,781, or 2.14 per cent."

Chicago General Railway to the City on Municipal Ownership and Reduced Fares

On July 23, Charles L. Bonney, general counsel of the Chicago General Railway Company, laid before the Street Railway Commission a series of resolutions adopted by the directors of the company relating to the question of municipal ownership, and also to the specific condemnation of tracks owned and operated by the existing companies. One of the main features in Mr. Bonney's communication to the commission was a direct offer by his company to carry passengers between the Illinois Central Depot at Twelfth Street and the Chicago & Northwestern Depot at Wells Street, for 3 cents; also to carry trunks and packages for 20 cents each, on condition that the city authorities aid in securing permission for the Chicago General cars to run between the points named. Mr. Bonney is also authorized to secure legal adjudication of the right of his company to the use of the Chicago City Railway's tracks on Wabash Avenue, from Twenty-Second Street to Madison Street. General Counsel Bonney holds that by the ruling of the Supreme Court the exclusive right of any corporation to maintain ownership in the city's streets can be set aside at the behest of the people's law officers. The Chicago General's ultimate aim is to get terminal facilities in the downtown district.

Electrical Tramways in Barcelona

The United States State Department has received the following communication from Consul-General Lay, of Barcelona, regarding the electric tramways there:

"I give below the names of the directors and chief contractors of a tramway line about to be built between Barcelona and Horta, a distance of 4 miles. The name of the branch line will be the Barcelona & San Andres Railway, work to be commenced in June.

"Builders, Société Anonyme d'Entreprise Générale de Travaux at Liege, Belgium.

"President, Mr. Laloux.

"Director-General, Mr. Thouet.

"The chief contractor is F. H. Bagge, 14 Ronda Universidad, Barcelona, who imports his trucks, tubing for posts, and motors from the United States.

"The wire is to be supplied by Felten & Guilleaume, of Mulheim; rails, from Belgium; car motors, by General Electric Company, Paris; gas engines, Crossley, of Manchester; cars, from Saragossa, Spain; accumulators, Tudor; dynamos, Industrial Electrico, Barcelona.

"I find it very difficult to get any reliable information about projected roads, especially about those for which the equipment is being bought, as the directors, chief engineers and other officials of new tramways are foreigners, and have their headquarters in other cities. I would suggest, therefore, that our manufacturers write the Société Anonyme d'Entreprise Générale de Travaux, Liege, Belgium, in good time before the contracts are let at Brussels. The society is a very large one, and has built many miles of tramways in Europe, and is constructing lines in Russia, I understand, at the present time.

"In connection with the sale of electrical supplies and equipment in Barcelona, I would advise manufacturers of motors not used in connection with tramways and other small electrical appliances that their agents here must keep a certain stock of such articles on hand, as I am informed by several electrical importers of Barcelona that frequently English or German goods are sold because the purchaser cannot wait for better American-made articles, which take so long to come from the United States."

Report of the Interstate Commerce Commission

The Interstate Commerce Commission has just issued its twelfth annual report. This report gives some very interesting statistics of railways in the United States for the year ending June 30, 1899. From these statistics it seems that on June 30, 1899, the total single-track railway mileage in the United States was 189,294.66 miles, an increase during the year of 2,898.34 miles being shown. This increase is greater than for any other year since 1893. Practically all of the railway mileage of the country is covered by reports made to the Commission, the amount not covered being 1,759.98 miles, or 0.93 per cent of the total single-track mileage. The aggregate length of railway mileage, including tracks of all kinds, was 252,364.48 miles.

The number of railway corporations included in the report on the Statistics of Railways in the United States was 2049. Of this number, 1064 maintained operating accounts, 843 being classed as independent operating roads and 221 as subsidiary roads. The operated mileage of roads merged, reorganized, or consolidated during the year was 5846.35 miles. The corresponding figure for 1898 was 7220.42 miles.

EQUIPMENT

There were 36,703 locomotives in the service of the railways on June 30, 1899, or 469 more than the year previous. Of the total number reported, 9894 are classed as passenger locomotives, 20,728 as freight locomotives, 5480 as switching locomotives, and 601 are not classified.

The total number of cars of all classes in the service of the railways on June 30, 1899, was 1,375,916. Of the total number, 33,859

are assigned to the passenger service, 1,295,510 to the freight service, and 46,556 to the direct service of the railways. It should be understood, however, that cars owned by private companies and firms used by railways are not included in the returns made to the Commission. It appears that the railways of the United States used on the average 20 locomotives and 734 cars per 100 miles of line; that 52,878 passengers were carried, and 1,474,765 passenger-miles accomplished, per passenger locomotive; and that 46,303 tons of freight were carried, and 5,966,193 ton-miles accomplished, per freight locomotive. All of these items show an increase when compared with corresponding items for the preceding year ending June 30, 1898.

The number of persons employed by the railways of the United States, as reported on June 30, 1899, was 928,924, or an average of 495 employees per 100 miles of line. As compared with the number employed on June 30, 1898, there was an increase of 54,366, or 21 per 100 miles of line. From the classification of these employees it appears that there were 39,970 enginemen, 41,152 firemen, 28,232 conductors, and 69,497 other trainmen. There were 48,686 switchmen, flagmen and watchmen. The compensation of the employees of railways for 1899 represents 60 per cent of their operating expenses, and 40 per cent of their gross earnings.

The amount of railway capital outstanding on June 30, 1899, was $11,033,954,898. This amount assigned to a mileage basis represents a capitalization of $60,556 per mile of line. Of this amount of capital $5,515,011,726 existed in the form of stock, of which $4,323,300,969 was common stock and $1,191,710,757 preferred stock. The amount which existed in the form of funded debt was $5,518,943,172. This amount of funded debt was classified as mortgage bonds, $4,731,154,376; miscellaneous obligations, $485,781,695; income bonds, $260,048,753, and equipment trust obligations, $42,058,348. The amount of current liabilities not included in the foregoing capital statement was $554,330,022, or $3042 per mile of line.

The amount of capital stock paying no dividend was $3,275,509,181, or 59.39 per cent of the total amount outstanding. The amount of funded debt, excluding equipment trust obligations, which paid no interest, was $572,410,746. Of the stock-paying dividends 11.91 per cent of the total amount outstanding paid from 1 to 4 per cent, 7.84 per cent paid from 4 to 5 per cent, 7.41 per cent paid from 5 to 6 per cent, 4.21 per cent from 6 to 7 per cent, and 5.18 per cent from 7 to 8 per cent. The amount of dividends declared during the year ending June 30, 1899, was $111,009,822, which would be produced by an average rate of 4.96 per cent on the stock on which some dividend was declared. The amount of mortgage bonds paying no interest was $374,460,358, or 7.92 per cent; of miscellaneous obligations, $70,422,403, or 14.50 per cent, and of income bonds, $127,527,985, or 49.04 per cent.

The number of passengers carried during the year ending June 30, 1899, as shown in the annual reports of railways, was 523,176,508, showing an increase for the year of 22,109,827.

The average revenue per passenger per mile for the year ending June 30, 1899, was 1.925 cents. The revenue per ton of freight per mile was .724 cent.

For the year ending June 30, 1899, the gross earnings from the operations of the railways in the United States, covering an operated mileage of 187,534.68 miles, were $1,313,610,118, being $66,284,497 more than for the preceding fiscal year. The operating expenses were $856,968,999, the increase in this item being $38,995,723.

The income from operation, or the amount of gross earnings remaining after the deduction of operating expenses, generally designated as net earnings, was $456,641,119, an increase as compared with the year ending June 30, 1898, of $27,288,774. The average amount per mile of line for 1899 was $2435. The amount of income received from sources other than operation was $148,713,983. This amount covers the following items: Income from lease of road, $96,352,295; dividends on stocks owned, $20,104,521; interest on bonds owned, $11,334,690; miscellaneous income, $20,922,477. The total income of the railways, $605,355,102—that is, the income from operation increased by the income from other sources—is the item from which fixed charges and analogous items are deducted in order to reach the amount available for dividends. Total deductions from income amounted to $441,200,289, leaving $164,154,813 as the net income of the year available for dividends or surplus.

The amount of dividends declared during the year, including $80,114 other payments from net income, was $111,089,936, leaving as the surplus from the operations of the year $53,064,877, the corresponding surplus for the year ending June 30, 1898, being $44,078,557.

The total number of casualties to persons on account of railway accidents during the year ending June 30, 1899, was 51,743. The aggregate number of persons killed as a result of railway accidents during the year was 7123, and the number injured was 44,620. Of railway employees 2210 were killed and 34,923 were injured during the year covered by this report.

Street Railway Legislation in Massachusetts

The Massachusetts Legislature, which has just adjourned, enacted a large number of street railway measures. It may be said, however, that with one or two unimportant exceptions, no legislation was passed which was particularly inimical to the street railway interests of the Commonwealth. The enactment of the street railway act of 1898 has resulted in so much that was laudable that it has been found necessary to make no very serious changes in general laws.

Perhaps the most important bill passed was that requiring all street railway cars, purchased, built or rebuilt, to inclose their platforms during January, February, March, and October, November and December. A provision was added by the street railway committee, which exempts the city of Boston from the operation of the act, unless after a hearing the Railroad Commissioners decide that public safety will not be endangered by the use of vestibule cars.

A bill was passed which permits the Metropolitan Park Commission to grant locations in public reservations for metropolitan boulevards, parkways, etc.

A large number of bills were offered on petition to permit the formation of street railway freight companies. All of these bills were adversely reported by the committee, however, and in their place a bill was reported to provide that all street railway companies might become general carriers of merchandise, baggage and freight, subject to the same liabilities and restictions as pertain to railway corporations. This general bill was not desired by the street railway companies, as a whole, and as a result all attempts to substitute bills for special railway freight companies were defeated and the general bill was itself killed.

A bill was passed to provide that all uniformed letter carriers should be furnished free transportation on street railways.

Another bill passed provided that every street or elevated railway company shall transport scholars of the public schools, traveling to and from school, at a rate not exceeding $2.50 for one hundred rides. The companies now furnish one hundred tickets for $3, and it is proposed to test the constitutionality of this act, by proceedings brought by some bondholder of one of the larger roads against the corporation.

A compulsory bill was enacted to give the new Plymouth & Sandwich Street Railway Company the right to run upon the tracks of the Plymouth & Kingston Company, the Railroad Commissioners to determine the terms, conditions and compensation if the interested corporations fail to agree.

An attempt was made by several municipalities to secure the repeal of the Street Railway Act of 1898, or else the repeal of that portion of it which provides that municipalities must clear snow and ice from the streets through which the tracks run, but all these attempts proved abortive.

A resolution was enacted providing that the Railroad Commissioners shall consider the matter of requiring street railway companies to pay a proportion of the cost of the abolition of grade crossings in certain cases. This resolution was reported as a substitute for a bill which provided that the street railway companies may pay 5 per cent in all cases.

There was a disagreement over permitting the Webster & Worcester Street Railway Company to act as a common carrier of baggage, express and mail in the city of Worcester, in the towns of Auburn, Oxford and Webster. The matter finally went into the hands of a conference committee, which failed to agree, and therefore the bill fell through.

The law in relation to the use of street sprinkling apparatus on electric railways was amended so that the companies themselves can operate these cars in certain cases.

A bill was passed permitting the Amesbury & Hampton Street Railway Company to lease its roads and property to the Exeter, Hampton & Amesbury Street Railway Company, a foreign corporation.

There was a great deal of discussion over the joint use of tracks by railway companies entering Boston, the attempt being to secure compulsory legislation which would permit the new Boston & Worcester road to enter the city of Boston through Brookline. The bill, which was reported, was favored by all the Massachusetts companies, excepting the Boston Elevated, which opposed it on the ground that there would be great congestion in Boston, if outside railways were permitted to come within the 5-cent limit.

The result was that a general bill was passed, applying to all outside cities, but that the city of Boston was exempted.

The West Roxbury & Roslindale Street Railway Company was authorized to purchase the franchise and property of the Hyde Park Electric Light Company. The result of this is to permit this company to go into electric lighting.

A general bill was passed permitting receivers to sell the property, locations and franchises of street railway companies. There was quite an opposition to this measure, on the ground that a franchise was something which should revert to the municipality in case a street railway became insolvent, but the opposition was futile.

The time for building the Boston, Quincy & Fall River Bicycle Railway was extended to Dec. 31, 1901. If 20 miles are built by that time, all rights of the company shall be extended for one year more, in order that the full line may be completed.

The Lexington & Boston Street Railway Company was given permission to operate over private property in Billerica, Bedford and Lexington.

The Greenfield & Deerfield Street Railway Company was incorporated, notwithstanding the very earnest protest against such action by sentimentalists, who feared that the beauty of the main street of Deerfield would be effected by the location of a street railway through it.

A bill was passed which permits the Boston Elevated Company to have the right of appeal if dissatisfied with the estimate of the County Commissioners or the Aldermen of Boston as to damages for takings in constructing their road.

Among the street railway companies incorporated were the Phillipston Street Railway Company, to operate in Athol, Phillipston and Templeton; the Worcester & Gardner Street Railway Company, to operate in Worcester, Holden, Rutland, Hubbardston, Gardner, West Boylston and Princeton; the Winchendon Street Railway, to operate in that town only; while the town of Sunderland was permitted to subscribe for capital stock of bonds of the Amherst & Sunderland Street Railway Company, which was given an extension of time in which to construct in Sunderland.

A number of street railway companies were given permission to act as common carriers of parcels, United States mail, etc., among them the Gardner, Westminster & Fitchburg; the Palmer & Monson, the Norton & Taunton, and the Interstate Consolidated.

Patent Decision on Trucks

An important decision was rendered last month in the Circuit Court of the United States for the Southern District of New York in the case of John A. Brill vs. Third Avenue Railroad Company. The suit was brought for the infringment of claims 1, 2, 9, 10, 11, 12, 14, 17 and 27 of letters patent No. 478,218, applied for June 26, 1891, and issued on July 5, 1892, to George Martin Brill for an improvement in car trucks. These claims are as follows:

1. In a motor truck, the combination, with a stationary frame supported upon the running gear, said frame having sections extending outwardly from the axle, of a movable frame supported upon said truck, spiral springs located between the movable and stationary frames, and elliptical springs located between the extended sections of the said rigid frame and movable frame, substantially as described.

2. In a truck, a spring-supporting frame supported upon the running gear by saddles and having sections extending outwardly from the axles, a movable frame having like extensions, spiral springs located between the saddles and movable frame, and elliptical springs located between the spring-supporting frame and the movable frame, substantially as described.

9. In a truck, the combination of two frames, one stationary and supported upon the running gear, the other movable, and a plurality of springs located between the stationary and movable frames, some of said series being adapted to be compressed by the downward movement of said movable frame subsequent to the compression of other of the series, substantially as described.

10. In a truck, the combination of two frames, one stationary and supported upon the running gear of the truck, the other adapted to be moved toward said stationary frame, springs located between the ends of both frames, and springs otherwise disposed between the two frames, the end springs being adapted to be compressed subsequent to the compression of the other springs, substantially as described.

11. In a truck, a stationary spring-supporting frame having at its ends elliptical springs rigidly secured thereto, in combination with a movable frame supported by springs other than said elliptical springs, said movable frame being provided with devices for engaging said elliptical springs, the elliptical springs being adapted to be brought into action subsequent to the springs supporting the movable frame, substantially as described.

12. In a truck, a spring-supporting stationary frame mounted on the running gear of said truck, said frame being composed of a plurality of bars contiguously disposed, a saddle secured to the outer sections of said bars, an elliptical spring, the lower section of which rests upon said saddle, and a second saddle disposed over the first, and the spring secured to the first saddle, a movable frame, spring supported upon the stationary frame and having devices for guiding the upper section of the elliptical spring, substantially as described.

14. A truck having running gear and a frame, and spiral springs for supporting the car body, supplemented by elliptical springs adapted to co-act therewith, the spirals being adapted to be compressed prior to the ellipticals, substantially as described.

17. The upper chord having the depending cap 45, with downwardly extending legs 46, and elliptical springs held on the side beams, adapted to move in said cap, substantially as described.

27. In a truck, a stationary spring-supporting frame mounted on the running gear of said truck, having outwardly extending sections and elliptical springs secured to the stationary frame, and a movable frame, having a device for guiding the upper portion of the elliptical springs, substantially as described.

One hundred and eighty-one infringing trucks were purchased by the defendant from the Bemis Car Box Company, of Springfield, Mass., which, it is admitted, "is defending the present suit for the Third Avenue Railroad Company."

The decision was rendered by Judge Shipman, and is quite an extended one.

After reviewing the difficulties of supporting a long car on a short wheel base, the judge says: "The gist of the invention consisted in combining with frames of the truck and the spiral springs another class of springs, viz., elliptical springs, between the car body and the extensions of the independent frame. The elliptical springs are slower in their action than the spiral springs, and neutralize the longitudinal oscillation of the car body. Mr. Akarman, a practical trolley railway superintendent, stated the result and the reason of it, as follows: 'From a practical observation my opinion is that the combination of an elliptic and spiral spring, as applied in trucks of this type, breaks the rhythm of motion or interrupts it. In trucks with all spiral springs, or, I should think, if it were possible to construct a truck having all elliptic springs, the rhythm of motion is perfect, the springs acting in unison. In the truck, as previously described having the combination of elliptic and spiral springs, the rhythm is broken and the result is that the galloping or rocking motion is done away with.'

"This leading feature of the invention is described in claims 1 and 2, which do not contain the limitations of the invention described in the next paragraph. A second and minor feature of the invention described in claims 9, 10, 11 and 14, is such an arrangement of the elliptical springs with the car body that they 'will not come into play until after the axle-box springs have begun to compress, and the action of the spiral springs in lifting the car body is continued after the elliptical springs have ceased to act.' The elliptical springs are not depressed until the car body or one end of it has become depressed by the weight of the passengers or some other cause, when this slower motion interposes and checks the continuation or increase of oscillation.

"Upon the question of the novelty of the invention described in claims 1, 2, 11, 12 and 14, the defendant's expert puts great stress upon letters patent No. 409,993, dated Aug. 27, 1889, to Benjamin F. Manier. One object of Manier was to prevent oscillation, and to accomplish it he employed an extended spring base and mounted the body springs forward of the axles. He said that oscillation was noticeable in cars mounted on trucks wherein the body springs are on both sides of the axles and near the center of the truck, and that the mounting of the body springs forward of the axles he considered a special feature of his invention. The springs, or the kind of springs, which he was to use, are no part of his invention. He says: 'Preferably I employ spiral springs *G*, as shown in Fig. 1 for supporting caps *I*, but, if desired, the elliptic spring *g* could be employed, as shown in Fig. 3, or other forms of springs may be used as found convenient and desirable, the particular form of spring not forming part of present invention.' Manier's invention was entirely apart from that of Brill, and had no conception of its character. The only ground upon which the expert can place his theory is that in Fig. 3, the two different forms of springs, spiral and elliptic, are shown, and upon this drawing the entire superstructure of anticipation is built. Manier's invention was not designed, nor adopted, nor used for the performance of the function performed by Brill's device, nor was the way to accomplish Brill's result suggested by Manier's invention." —(Topliff vs. Topliff, 145 U. S., 156.)

The judge then refers to earlier patents claimed by the defendants to anticipate the Brill patent, notably the Bird, Diehl, Vose and Peckham patents, but these were held by the judge not to be anticipations. He then concludes:

"The only remaining question is that of patentable novelty. It has already appeared that the gist of the invention is described in claims 1 and 2. The necessity for a remedy against the pounding of the car, the importance of the result, the adoption of the invention by experienced railway superintendents, the number of previous attempts at a remedy and the barrenness of their results go far to show that the work of an inventive mind was required and was active in the invention. The testimony of the defendant's expert itself, as he goes through the history of the art and thereby points out what the patentee's combination did, as compared with previous efforts to do something, shows that the patented improvement was patentable. The result of the minor invention of claims 9, 10, 11 and 14 was important, although upon first inspection its marked importance does not appear, but it perfected the general invention of the first two claims. The combination shown in claims 12 and 27 was patentable. The simple combination in claim 17 of the uppper chord, with its depending cap and down-

wardly extended legs and elliptical springs, does not appear to me to have have been patentable.

"Let there be a decree, with costs, for an injunction against the infringement of claims 1, 2, 9, 10, 11, 12, 14 and 27, and for an accounting if it is asked for."

Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

UNITED STATES PATENTS ISSUED JULY 22, 1900.

654,274. Railway Switch; M. O'Dowd, Chillicothe, Ill. App. filed Oct. 27, 1899. The invention comprises a pitman and tie-bar, the tie-bar being provided with a wrist pin, while the other member is provided with a hole to receive the wrist pin. The pitman is provided with a hooked nose adapted to enter a recess in the tie-bar, the nose and recess being so shaped that the pitman can rotate about the axis of the pin within the required range for the operation of the switch without causing a separation between the nose and the recess. This coupling is intended to dispense with bolts and nuts.

654,327. Automatic Switch; T. S. Savage, Oakland, Cal. App. filed April 19, 1900. The switch point is held in one position by a spring; the car wheel depresses a lever and moves the point against the spring.

654,348. Trolley Harp; E. G. Johnson, Brigantine, N. J. App. filed Feb. 16, 1900. The wheel is mounted on an elongated axle, along which it may assume any position, a tendency to run in the middle of the axle being supplied by springs bearing against each side of the wheel.

654,352. Car Seat; W. M. Norcross, Philadelphia, Pa. App. filed May 6, 1899. The back, seat and a foot rest on each side are connected with each other by a system of levers, which effects the adjustment of each part to its proper position when the back is shifted from one side to the other.

654,448. Trolley Base; H. S. Goughnour, Johnstown, Pa. App. filed Sept. 23, 1899. An arrangement of torsion springs with the base of the pole whereby a "low" base is obtained.

654,452. Railway Frog; C. F. Kress, Jr., Johnstown, Pa. App. filed Dec. 28, 1899. A railway frog composed of girder-rails and a central metal chock cast to said rails, said rails having their head portions fitted and abutted to form the entire wear surface of the frog, and the cast metal chock filling the entire space between the underneath abutted portions of said rails.

655,574. Trolley Track for Electric Railways; V. Koch, Scranton, Pa. App. filed Feb. 24, 1900. A crossing constructed from a circular plate integrally made with projections thereon corresponding to the ends of the rails of the trolley track, and adapted to be joined therewith for the purpose of completing the electrical circuit through the said track.

New Publications

Derrah's Official Street Railway Guide of Eastern New England. 248 pages. Illustrated. Price (by mail), 20 cents. Published by Robert H. Derrah, 53 Devonshire Street, Boston.

The excellent work which Mr. Derrah is doing in developing the trolley excursion business in New England should form a model for similar efforts in other parts of the country. Mr. Derrah has shown how the publication of a well illustrated and excellent guide book, showing how interesting points can be visited by trolley, running times of the cars, fares, etc., will, to use a very old expression, fill a long-felt want. The guide for this year is the fifth annual of its kind to be issued by the publisher, and contains a fine portrait of H. M. Whitney, who, as the author says, is largely responsible for the commercial development of the trolley system. It also contains an excellent map of Eastern New England with the trolley lines. The guide is published with the approval of the street railway managers, whose traffic must undoubtedly be largely stimulated by its publication.

PERSONAL MENTION

MR. W. BARRON, manager and purchasing agent of the Brantford Street Railway Company, of Brantford, Ont., is dead.

MR. ROBERT DUNNING, formerly master mechanic for the Buffalo Railway Company, has been appointed master mechanic for the Washington Traction & Electric Company, of Washington, D. C.

MR. J. J. COLEMAN, formerly general manager of the St. Louis Transit Company, has been appointed assistant to the president of the Washington Traction & Electric Company, of Washington, D. C., to superintend the operation of the lines in the district.

MR. C. O. BRUNNER, treasurer of the Bethlehem Iron Company and Bethlehen Steel Company, completed, on July 12, his fortieth year of service. The occasion was marked by the presentation to Mr. Brunner of a silver pitcher and salver and a handsome cane from his fellow members of the staff of the two companies.

NEWS NOTES

LITTLE ROCK, ARK.—The City Council has adopted the Mayor's recommendation in regard to the operation of the Little Rock Traction & Electric Company, and has also adopted a resolution providing that if the company does not comply with the charter, relative to putting the system in first-class order within ninety days, that the Council will proceed at once to nullify the franchise and declare the property a public nuisance. The Mayor's message to the Council was as follows: "I deem it my duty to urge upon you the necessity of taking some decided action relative to the franchise of the Little Rock Traction & Electric Company. The numerous derailments and the inconvenience to and the hardships imposed on the general public July 4, because of the very poor physical condition of its force and rolling stock, has caused such universal condemnation that it amounts to a demand upon us to take action, inasmuch as all former petitions to this company have been ignored. I would therefore recommend that the city attorney be instructed to apply to the United States Court to have the receiver make the necessary improvements within a reasonable time, and in the event this is not done that he at once take steps as may be necessary looking to the annulment of the contract between the city and said street railway company."

BRIDGEPORT, CONN.—The fare between Bridgeport and New Haven via the Bridgeport Traction Company's and the Winchester Avenue Company's lines is to be reduced to 25 cents. At present it is 35 cents, pay as you go, or 30 cents if you buy your ticket in advance.

BRIDGEPORT, CONN.—The Bridgeport Traction Company is now repainting and overhauling its entire winter rolling stock. A force of forty men are employed on the work, and the work will be completed by the season for the withdrawal of the open cars. The body of the cars being redecorated is painted a medium chrome yellow, while the lower portion under the windows is a cream white. Upon this is inscribed the words "Bridgeport Traction Company." The platform gear and trucks are Venetian red, while the body is finished with heavy stripes of deep orange and narrow lines of Tuscan red and black. The car number is in silver, shaded in Tuscan red.

WASHINGTON, D. C.—A car of the City & Suburban Railway jumped the track at the corner of Second and R Streets northeast on July 21, injuring several persons.

WASHINGTON, D. C.—Since the fatal accident to one of the city firemen, due largely to the electric cars stopping on the far side of crossings, the question of reverting to the old plan of stopping on the near side has been considerably agitated by the local press and the citizens, and there is a strong probability that the District Commissioners will shortly issue a notice to the effect that the electric cars will stop at all street cossings on the near side.

WASHINGTON, D. C.—The District Commissioners lately transmitted to the street railway companies here a list of proposed stopping places for the street cars on certain routes taken by the apparatus of the fire department in answering alarms of fire. The companies have replied to these communications, setting forth their reasons for not stopping at some of the points designated by the Commissioners, and agreeing to stop at the others. The exceptions noted are all based on excellent reasons, and no doubt the Commissioners will agree with the street railway companies and modify their requests accordingly.

ATLANTA, GA.—The Atlanta Railway & Power Company is now giving transfers on its lines up to 11 p. m. Heretofore no transfers have been issued after 8 p. m.

LA SALLE, ILL.—The City Electric Railway Company and the city officials are at loggerheads. The authorities have prevented the company from erecting new poles along its route, and have also tampered with the company in other respects. J. R. Burrows, as receiver for the company, is seeking an injunction to prevent further interference with the operations of the company.

CHICAGO, ILL.—A fire in one of the cars of the South Side Elevated Railroad Company on July 14 came very near causing a serious disaster. Soon after the train, carrying 150 passengers, left Eighteenth Street, fire was discovered in the center of one of the cars, and the passengers immediately became panic stricken, despite the efforts of the guards to quiet their fears by telling them that the fire was nothing more than smoke arising from a blown out fuse. Many passengers attempted to jump from the train, but were restrained by the guards, who assured them that the fire would not get beyond control even if it could not be put out.