Street Railway Journal

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SYSTEM OF THE METROPOLITAN STREET RAILWAY COMPANY OF KANSAS CITY.

During the past three years the Metropolitan Street Railway Company, under which name nearly all of the cable and electric lines of Kansas City, Mo., and Kansas City, Kan., have been united, has made very extensive improvements on its property for the purpose of increasing its value, reducing the cost of operation and maintenance, and providing first class accommodations for the vastly increased traffic. The city in Missouri and that in Kansas are under separate municipal governments, but for business and commercial purposes constitute one community. The combined population in 1890 was 171,000, and both sections of the twin-city are rapidly increasing in size. They are noted for their immense stock and meat packing interests, their yards and packing houses being second only to those of Chicago in the volume of business done. Kansas City in Missouri has a population of about four times that of Kansas City in Kansas, and is the second largest city in the state. The residential and business districts of the two cities are on the sides and the summits of steep hills, while the manufacturing industries and railroad yards are located near the river. This condition leads to the early introduction in the city of cable railways, so that at present there is considerable cable mileage in operation.

The system of the Metropolitan Street Railway Company comprises 136.53 miles of single track, as follows:

Cable lines, miles of single track	62.76
Elevated electric lines, miles of single track	16.14
Surface " " " " " "	54.63
Horse lines, " " " "	2.98

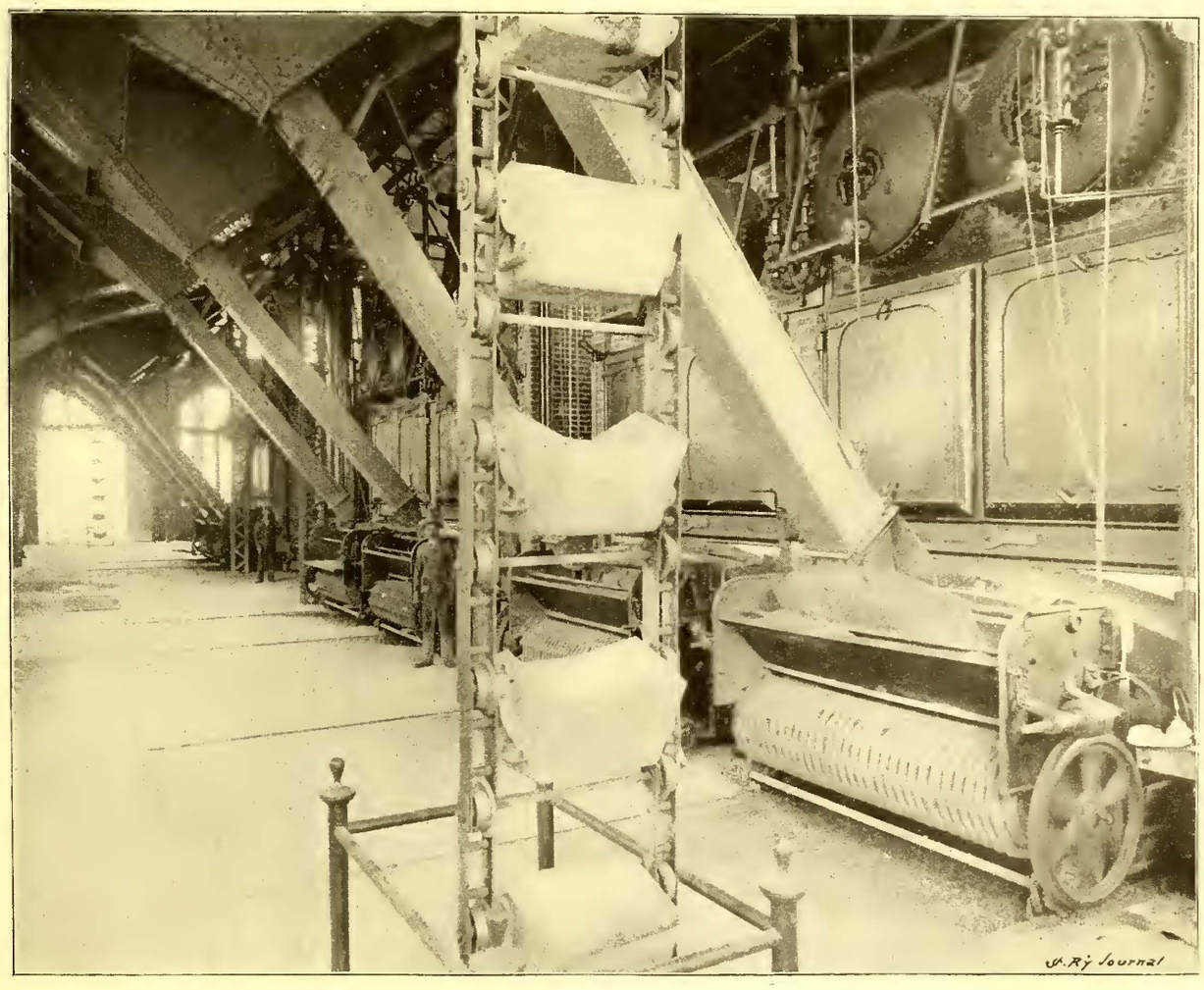


FIG. 1.—INTERIOR OF BOILER ROOM, CENTRAL AVENUE POWER STATION—KANSAS CITY

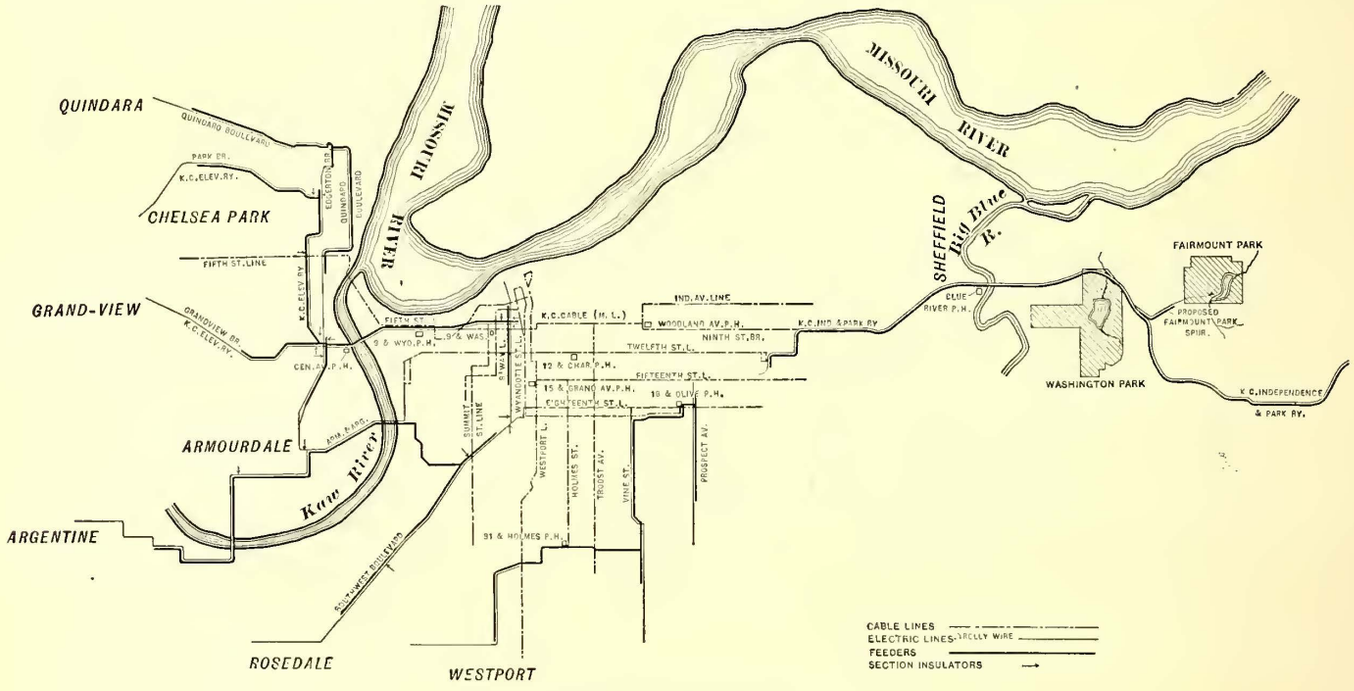
For the operation of this system the company has seven cable power stations and four electric power stations, two of the latter being installed in the cable stations. The plan of the system with the location of the several stations is given in the map on page 68.

A study of the situation at Kansas City, as will be seen by this map, gives a very good idea of the relative advantages, so far as station concentration is concerned, of the cable and electric systems. Were the cable lines

equipped with electric power, they could probably be operated from one station, even without the use of high potentials and rotary transformers, being all in one section of the city. Instead, the station equipment is divided into small units, as shown by the following table:

STATION	LINE OPERATED	ENGINE AND SIZE
Eighth and Woodlawn power house.	Kansas City cable, except Summit Street division.	One Reynolds-Corliss tandem compound engine 26 ins. and 40 ins. × 72 ins. One Wright automatic engine 28 ins. × 48 ins. (Reserve.)
Fifteenth Street and Grand Avenue power house.	Grand Avenue cable including Westport and Fifteenth Street branches.	One Reynolds-Corliss engine 36 ins. × 48 ins.. and one 32 ins. × 48 ins. (Reserve).
Thirty-first Street and Holmes Street power house.	Holmes Street branch of the Grand Avenue cable, also Rosedale Avenue electric.	One Reynolds-Corliss 24 ins. × 48 ins. and 125 k. w. Westinghouse generator.

As will be noticed from the above list, the company has been able to reduce the number of its stations by operating one, *i. e.*, that for the Summit Street cable by means of electric power, This line has a length of 4.34 miles measured as single track, and was formerly operated by a 24 in. × 48 in. Wright automatic cut-off engine. This engine has been cut out, and the power from the motor is transmitted to the original cable machinery by a belt 36 ins. wide passing over a 34 in. pulley on the motor to a 24 ft. pulley on the cable machinery. The management of the company reports that the cable machinery has been operated more successfully and satisfactorily by the motor than it was with the engine, and with greatly reduced cost. The figures given later in connection with the cost of producing power at the Central Avenue power station from which the power is transmitted, shows that $659.29 average per month is safved by using the electric motor power. The current for operating this motor is



Scale, 10,000 ft. = 1 in.

FIG. 2.—MAP OF LINES OF METROPOLITAN STREET RAILWAY CO.

Eighteenth and Olive Streets power house.	Eighteenth Street cable, and also the Vine Street and Prospect Avenue electric lines.	Two Hamilton Corliss 30 ins. × 72 ins. (one as a reserve), also operates 125 k. w. railway generator.
Twelfth and Charlotte Streets power house.	Twelfth Street cable.	Two Hamilton-Corliss 28 ins. × 16 ins. (one as a reserve).
The Big Blue River power house.	The Kansas City, Independence & Park Railway.	One Wright automatic 28 ins. × 48 ins. and one Reynolds-Corliss 24 ins. × 48 ins., also a 450 k. w. and 250 k. w. G. E. generators.
Ninth and Wyoming Streets power house.	The Fifth Street cable line; also acts as reserve electric power house for the west side of the city.	Two Hamilton-Corliss 28 ins. × 60 ins. (one as a reserve for cable) and two 24 ins. × 48 ins. Smith, Biggs & Rankin engines and two Armington & Sims engines for electric.
Ninth and Washington Streets power house.	The Summit Street cable.	Three hundred k. w. four-pole electric motor driven from the Central Avenue power house distant 8855 ft.
The Central Avenue power house.	The electric lines in the western part of the city.	One Reynolds-Corliss tandem compound 30 ins. and 60 ins. × 48 ins. and a Walker 1200 k. w. generator. Duplicate equipment is being put in,

carried from the Central Avenue power house, a distance of 8855 ft. over a weatherproof, insulated copper cable of 1,000,000 c. m. area on the positive side. On the negative side the current returns over 1670 ft. of 1,000,000 c. m. cable composed of both insulated and bare copper. This cable is tapped to the iron structure of the Kansas City Elevated Railway which forms the remaining 7185 ft. of the negative conductor

The Central Avenue power house, which is a most modern plant and is the most important station of the company, is located on Central Avenue and on the west bank of the Kaw River. The building is a brick structure with steel framework. The engine room is 144 ft. long and 63 ft. wide; the boiler room 144 ft. long and 51 ft. wide, and the height both is 33 ft. 7 ins. from the top of foundations to the under side of the bottom chords of the roof trusses. The unloading shed is 41 ft. long and 20 ft. wide. The steel framework consists of steel columns supporting steel roof trusses, rigidly bound together with longitudinal struts and sway rods. The roof covering is slate laid on wood sheathing supported by steel channel purlines. A 30 ton traveling crane is supported on longitudinal plate girders in the engine room. The station is surmounted by a self supporting steel stack, 175 ft. high and 10 ft. 6 ins. in diameter. It has a clear flue space of 8 ft. 4 ins. inside the brick lining, and is located between the boilers in the center of the boiler room, making the shortest possible smoke connections.

Steel coal hoppers, holding 1000 tons of coal, are located

in front of the boilers in the boiler room. Two of the hoppers directly in front of the stack are used as ash receivers. The coal from the car in the unloading shed is shoveled by hand into the receiving hoppers, from which it is carried in conveyors, operated by a small engine, to the coal hoppers overhead. From the coal hoppers it is delivered by gravity through a chute to the stoker hoppers. The conveyors also carry the ashes from the ash pits into the ash hoppers and from the hoppers the ashes are conveyed by gravity through a chute to the cars.

The boiler room contains six 250 h. p. Babcock & Wilcox boilers with wrought steel headers and capable of carrying 200 lbs. pressure. The boilers will give 3000 boiler horse power at 15 lbs. evaporation when the engine is operated compound condensing. They are equipped with chain grate stokers, making the firing almost smokeless and automatic. Provision was made in this room for 1600 additional horse power. There is also in this room one 3000 h. p. Berryman feedwater heater and two Worthington boiler feed pumps.

The coal handling machinery was furnished and erected by the C. W. Hunt Company. From the car in the unloading shed the coal is shoveled by hand into the receiving hoppers, then the conveyor carries it under the boiler room floor to the end elevator, thence to the coal hoppers overhead where a horizontal conveyor distributes it throughout their length. From the hoppers it is fed by gravity into the stoker hoppers. The vertical conveyor also carries the ashes from the ash pits and delivers them into the two center hoppers located in front of the stack, from which they are drawn by gravity directly into the receiving car in the unloading shed. By this arrangement the fuel and refuse ashes are handled only once. The conveyor driving machinery is located in the boiler room roof trusses, the trusses being designed especially heavy to carry this conveyor machinery and its load.

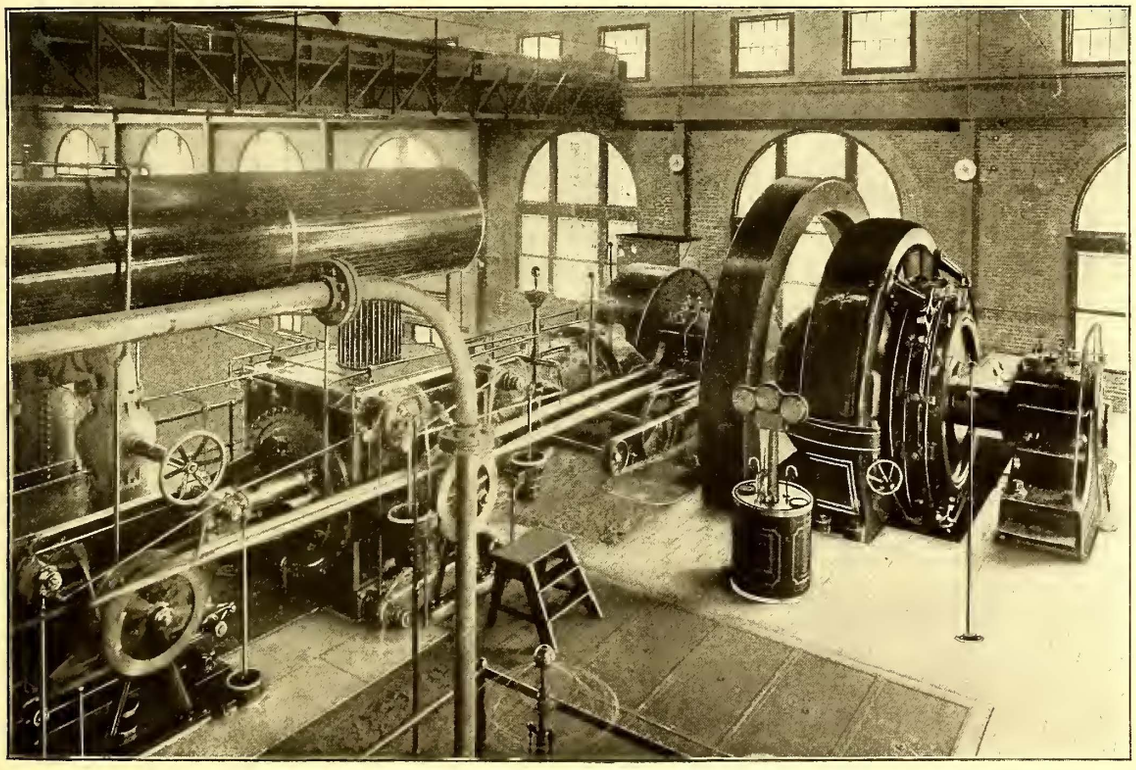


FIG. 4.—GENERATOR AND ENGINE

The steam pipe system consists of one 16 in. header having extra heavy fittings with bent pipe and large radius, connecting the drums of the boilers to the header. The peculiar arrangement of piping with long sweeps makes it flexible and abolishes the use of expansion joints.

The engine room contains one Reynolds-Corliss tandem compound condensing engine with cylinders 30 ins.

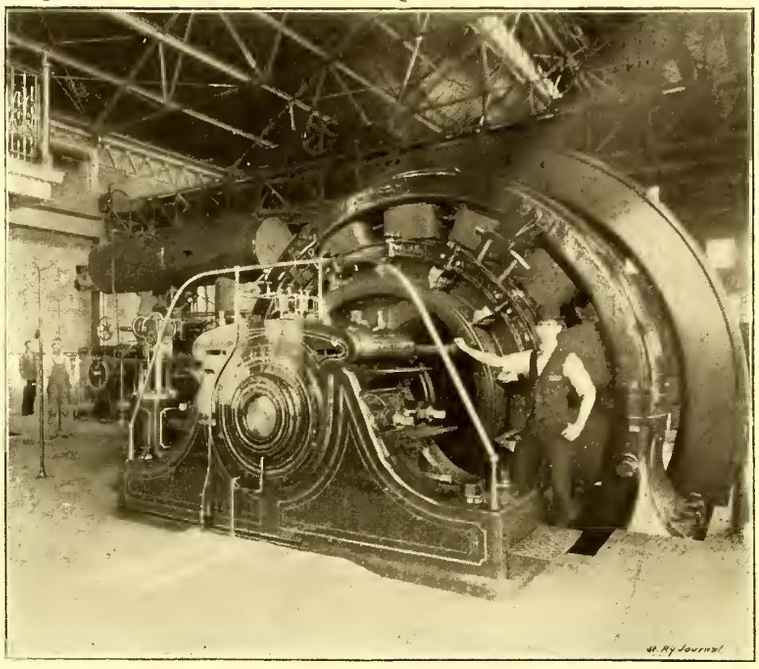


FIG 3.—GENERATOR

and 60 ins. × 48 ins. The main shaft is 24 ins. in diameter and the main journal is 22 ins. × 42 ins. The flywheel is 208 ins. in diameter and weighs 12,000 lbs. The engine has an automatic stop valve operated by a special governor which is set to operate when the engine runs five revolutions above speed. This governor acts and closes the valve, shutting off the steam in the main pipe, preventing any possibility of the engine running away and wrecking itself as well as the building.

The air pump and circulating pumps are driven by an engine with Corliss valve gear. Water is taken from the Kaw River through a 20 in. suction pipe passed through the condenser and returned to the river through a 24 in. pipe.

The generator, which was furnished by the Walker Company, of Cleveland, O., is directly connected to the engine and runs 80 r. p. m. It has a rated capacity of 2400 amps at 550 volts and is guaranteed to work at 50 per cent overload for a period of five hours. The armature is 10½ ft. diameter and the field frame contains fourteen pole pieces.

The switchboard consists of two generator panels, one wattmeter panel and twenty feeder panels, manufactured

by the General Electric Company. The feeder panels are supported by a steel gallery in the engine room. This gallery and the stairs leading to it have an ornamental iron railing, which together with the switchboard panels adds to the fine appearance of the engine room. The framework of the switchboard and gallery has been erected for two generators and six feeder panels in addition to the above number, which provides for increasing the size of the switchboard in the future without increasing the size of the gallery. Sufficient space in this engine room has been allowed for extending the gallery to double its present size.

The wattmeter and generator panels are located on the engine room floor under the gallery which supports the feeder panels. The wattmeter panel contains one 8000 amp. Thomson recording wattmeter and the quick break switches for controlling the lights in the power house. The generator panels are equipped with Weston illuminated dial ammeters, of a capacity of 4000 amps., automatic circuit breakers of the magnetic blow-out type and with a

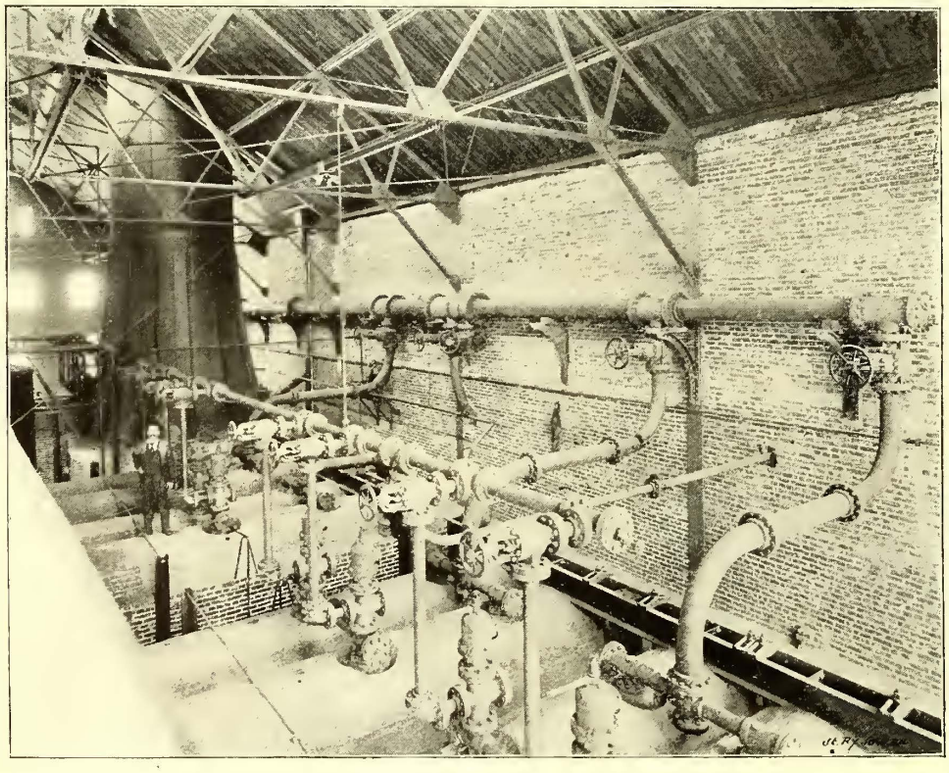


FIG. 5—PIPING OVER BOILERS

capacity of 8000 amps. for breaking the circuit in case of an overload, and main switches of the quick break type with corresponding capacity. To the left of the generator panels supported on a hinged frame are two Weston illuminated dial voltmeters, which have been calibrated together. One is for indicating the potential of the line, the other is arranged with plugs for taking the potential of the generator before cutting it in on the line. The feeder panels are equipped with round pattern Weston ammeters, automatic circuit breakers and quick break switches. Electric bell signals are also used to give an alarm when any of the circuit breakers is opened for an overload.

The generator is connected to one of the generator panels with three 800,000 c. m. rubber covered cables for the positive connection and three for the negative. The other generator panel is used for receiving the current from the Ninth and Wyoming power house and delivering it through the wattmeter to the feeder panel. The Ninth and Wyoming power house with its number of smaller type machines is maintained to supply current for the "Owl" train service, and lights during the latter part of the night, also to supply current in case of an accident to any of the machinery of the new plant.

The feeder panels are divided up as follows: seven panels for the Kansas City Elevated Railway, three for the West Side (Quindaro Boulevard) line, two for the Armourdale and Argentine line, three for the South West Boulevard, two for the Wyandotte Street line, one for the Summit Street line, one for the 400 h. p. motor which drives the cable machinery at Ninth and Washington Streets power house and one for the Broadway line, which will be changed from horse to electric power this year. Arrangements have been made for mounting wattmeters on the feeder panels, one for each road in order to accurately arrive at the power furnished to each of the various lines separately, and the proportion of the cost of operating the power house can be charged against the lines according to the amount of the power consumed.

On the back of these panels is a long bus bar running the full length of the board to which eight 800,000 c. m. cables from the main wattmeter are attached. Short bus bars connecting the panels for each road together are mounted above the long bus bar, and connections will be made from the long bar through the meters to the short bars. The feeders running from the feeder panels out to the various sections on the different lines range from 300,000 c. m. to 1,000,000 c. m. with a total area of 7,786,000 c. m. and all are calculated sufficiently heavy to operate 50 per cent more cars in case the travel demands them. The twenty large feeders are carried from the panels to and along the wall on porcelain insulators in a neat and systematic manner, then through the openings in the wall where they leave the building and are carried on iron poles to the elevated railway structure at which point they branch for the various roads. The longest feeder carrying current from the power house is to the west end of the Armourdale and Argentine lines, which transmits power to cars 28,300 ft. from the power house.

The negative bus bar, which is 2 ins. in diameter, is supported on insulated hangers under the gallery floor about 4 ft. back of the generator panels. Four 1,000,000 c. m. cables are carried from the negative bus bar through brass tubes, down to and through the engine room floor into the basement, then through a duct under the street to a column of the elevated railway structure. They are carried up the column on the structure then branch in different directions to the several roads.

Each feeder and generator panel is furnished with lightning arresters, all terminating in one ground plate, which consists of 72 sq. ft. of No. 16 gage sheet copper. This ground plate is buried 16 ft below the basement floor on top of the coarse stratum of sand, which is from 8 to 10 ft. below low water mark in the river. The plate is so connected that the return currents cannot pass over it to the generator except at such times as lightning may momentarily cause the generator current to pass over the discharged points of the arresters, thus reducing the action of electric currents on the plate to a minimum and insuring at all times the proper ground connections for the lightning arresters.

This plant is now furnishing current to operate seventy-seven cars daily on 55 miles of electric and 4½ miles of cable track.

The result of the combined efficiency of the machinery of this house is very clearly proven by the expense of operation. While the average kilowatt hour output is not large at times the current output reaches from 2500 to 3250 amps.

The following kilowatt hour output and cost of operating was taken as an average per month from the months of July, August, September, and October, 1897.

Kilowatt hours output	310,338
Engineers, oilers and firemen	$ 471.77
Repairs to engine and machinery	83.35
Oil and waste for engine	40.94
Fuel	870.55
Water	26.91
Miscellaneous	19.09
Total	$1,512.61

The above figures show that the average kilowatt hour is produced for $.004874.

The economical results of operating the cable machinery at Ninth and Washington Streets power house with electrical motive power as compared with steam per month are as follows:

OPERATING WITH THE ELECTRIC MOTOR

Elec. current for motor, 64,468 k. w. hrs. at $.004847	$312.48
Motorman	50.00
Oil and waste	2.50
Water for rheostat	1.25
Repairs for motor and electric apparatus	
Total	$366.23

OPERATING WITH STEAM PLANT

Engineers, firemen and oilers	$ 295.00
Repairs on engine and machinery	58.00
Oil and waste	21.45
Coal	604.55
Water	46.52
Total	$1,025.52

The above figures for operating by electric motor are taken as an average per month from the cost of operating during the months of July, August, September and October, 1897, and those for operating with the steam plant are taken as an average per month for the year of 1896. This shows that $659.29 average per month is saved by using the electric motor power.

During this year the company will install in the Central Avenue power house another engine and generator of the same capacity as already described. The excavation for the foundations is under way.

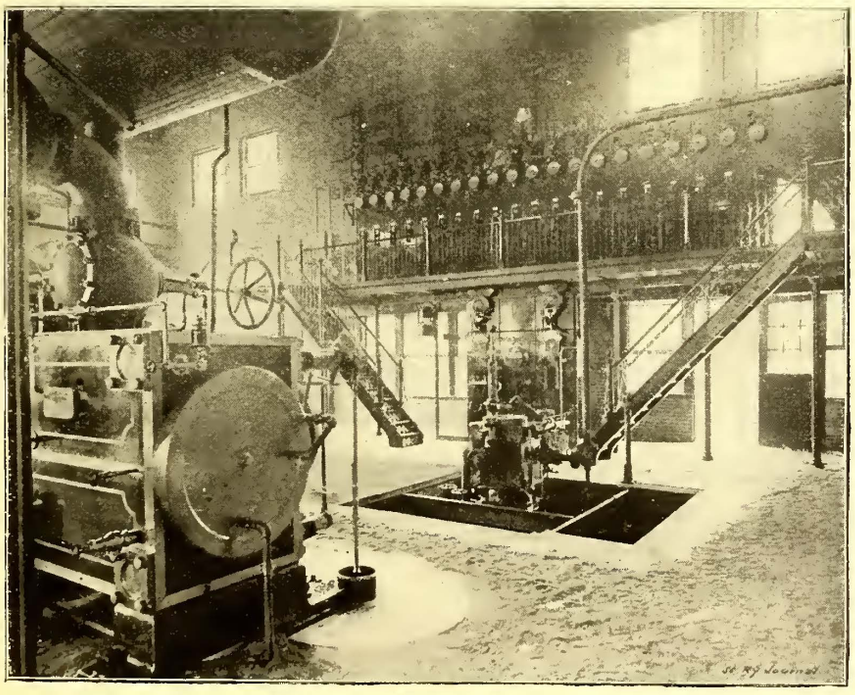


FIG. 6.—SWITCHBOARD IN CENTRAL AVENUE POWER STATION

For its track work the company has employed a most substantial construction. In its new work 60 ft. rails are used, ranging in weight from 83 lbs. on the Independence Avenue branch of the Kansas City cable, which was rebuilt in 1896, to 103 lbs. on the Kansas City Elevated Railway, the Southwest Boulevard Railway and the Wyandotte Street line. Johnson rails were used in this new construction. The relaying of the rails on the Kansas City Cable line was a most interesting undertaking as the work was executed without interference with the train service. This was successfully accomplished on 5 miles of the track on the main line and the portion on the Independence Avenue branch of the system.

FIG. 7.—TRACK CONSTRUCTION ON THE WYANDOTTE STREET LINE

For its rail joints the company has installed a considerable number of cast welded joints with excellent results. In September, 1897, 1721 cast welded joints were installed on the old rails on the Troost Avenue branch and 3255 on the old rails of the Grand Avenue cable tracks, including a portion of the Westport and Fifteenth Streets branches.

The Wyandotte Street line is one of the latest lines built by the company, having been completed May 1, 1897, and represents a number of novel features in track construction. The track is of 103 lb., center bearing Johnson girder rails laid in concrete. The larger portion of the street is paved with asphalt in which trenches 20 ins. wide and 12 ins. deep were dug and the rails laid in on small wooden supports at intervals of 10 ft. After the tracks were surfaced on the blocks, the trenches were filled in with concrete made of Portland cement and finely crushed rock thoroughly tamped around and under the rails. On the top of the concrete, granite paving blocks were laid next to the rails and the asphalt paving replaced to meet the granite blocks. The rail joints are all cast welded and also bonded with No. 0 copper bonds. The two rails of each track are bonded together every 500 ft. and all four rails every 1000 ft. in the usual manner.

The overhead and span wires are supported on iron poles set in concrete; the poles are located inside of the curb line on each side of the street. The feeder lines for the South West Boulevard and the Wyandotte Street lines contain 222,559 lbs. of copper in the positive and return feeders.

The principal shops of the company, including the machine, wood working, paint and electrical, also the storeroom for supplies, are located in the Twelfth and Charlotte Streets power house. The shops are equipped with the latest improved machinery for speedily executing all repair work, building new and rebuilding old cars and making all classes of repairs to the electrical machinery and apparatus. The machinery in the shops is driven by a 30 h. p. electric motor. Trolley wire has been put in over the tracks, and all motors and car equipments are tested before they are turned out for service. The electric current for lighting, testing and power purposes is obtained over a feeder wire from the Central Avenue power house, a distance of 13,256 ft.

While much has been accomplished in new construction during the past two years, considerable remains to be done. The Broadway line, which has 2.98 miles of single track on which the horse car service was discontinued Aug. 7, 1897, will be electrically equipped this year. The plans for a double track electric line from Washington Park to Fairmount Park have also been completed and the work will commence as soon as the weather will permit. This line will have 13,054 ft. of single track and will be operated as a branch to the Kansas City, Independence & Park line.

Illinois Street Railway Association

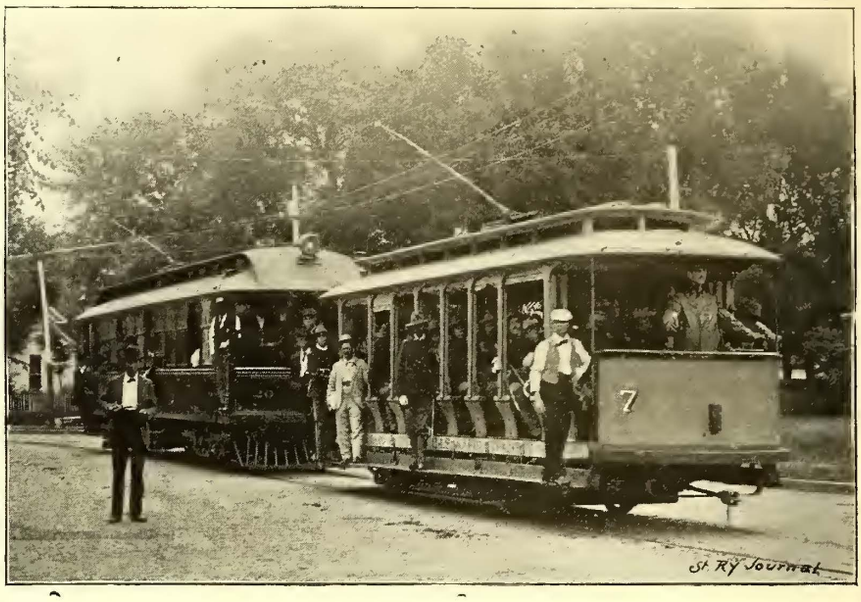
In response to an invitation addressed to the street railway companies of Illinois, representatives from all parts of the state met at the Great Northern Hotel in Chicago, Jan. 5, and formed the Illinois Street Railway Association. The following named officers were elected: president, W. H. Patterson, Bloomington; vice-president, D. B. Sherwood, Elgin; secretary and treasurer, T. J. Minary, Springfield; executive committee, W. H. Patterson, C. K. Minary, D. B. Sherwood, W. L. Ferguson, Decatur; B. F. Harris, Champaign; Walter Barker, Peoria, and W. F. Brennan, Chicago.

The constitution as adopted set forth as the aim of the association the closer affiliation of all street railway companies in the state for the purpose of improving methods of construction and maintenance of railways. It is intended to hold yearly meetings, when papers will be read upon recent improvements and devices in track construction, correct appliance of motor power, electric equipments and economic devices which will tend to lessen the expense of street railway operation.

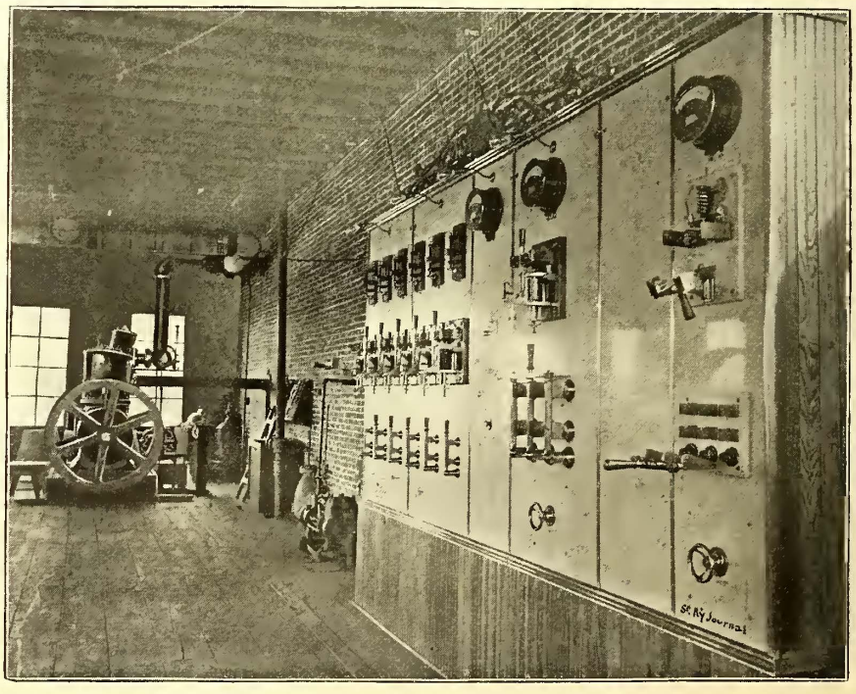
The following companies are members of this association: City Electric Ry. Co., of Decatur; Central Ry. Co., of Peoria; Peoria & Prospect Heights Co.; Urbana & Champaign Ry. Gas & Electric Co.; Chicago General Ry. Co.; Bloomington City Ry. Co.; Danville Gas Electric Light & Street Ry. Co.; Chicago City Ry. Co.; Elgin City Carpentersville & Aurora Ry. Co.; Aurora Street Ry. Co.; Springfield Consolidated Ry. Co.; Kankakee Electric Ry. Co. The next meeting will be held in Chicago the third Wednesday in May, 1898.

The Waterloo & Cedar Falls Suburban Railway

In the Eastern and Middle States electric interurban railways have long since ceased to be a curiosity, and even across the Mississippi where in comparison with the older states the country is sparsely populated, this method of joining towns and villages is becoming popular. The Waterloo & Cedar Falls (Ia.) Railroad is some 9 miles long, connecting the towns named. First projected in 1895, actual work was begun in May, 1896, and cars were running twelve months later. The line parallels the Burlington & Quincy and Illinois Central railroads, and the company intends carrying freight as well as passengers, although the passenger business to the resorts along the route will be of the most importance.



OPEN AND CLOSED MOTOR CARS—WATERLOO, IA.



SWITCHBOARD—WATERLOO, IA,

The country through which the line runs is rough and more beautiful than one would imagine exists on the Western plains. The route winds along the Cedar River for much of the way, at times close down to the level of the water and again on a ridge far above it. The names,

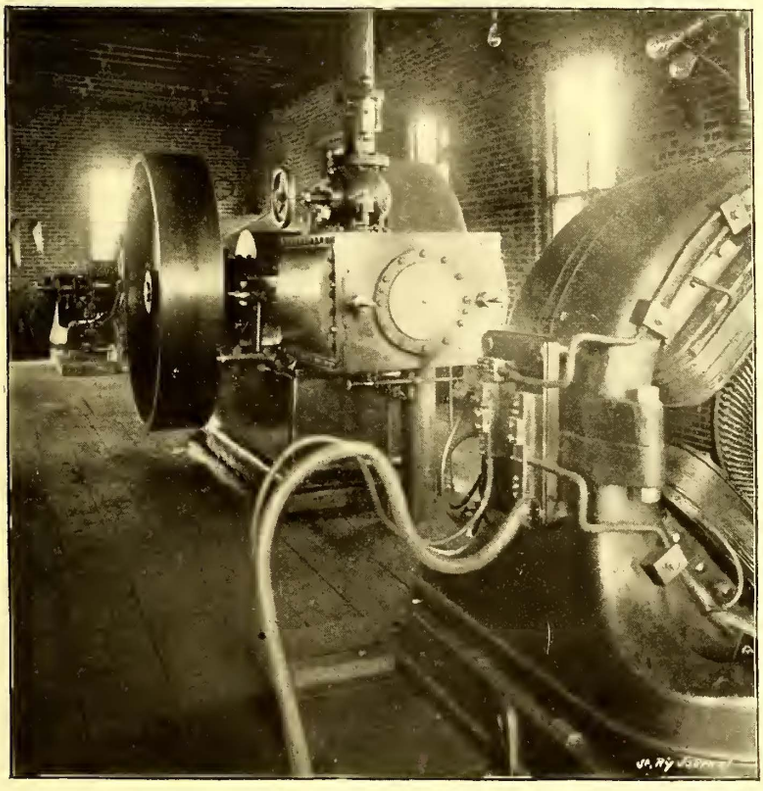
alone, of the various points of interest along the way tell something of the scenery; there are Cedar River Park, the Islands at Sans Souci, Russell's Glen, the Cliffs, and Bluff Park.

The right of way near the river required considerable rock filling, and a total of eight bridges was built; the largest of these is a three span steel bridge 315 ft. long across the Cedar River. The seven wooden bridges, with one exception 150 ft. long, are small and were built to avoid earth fills.

The grades are long and gradual, the heaviest not over 7 per cent. Although the roadbed is substantially built for heavy service, the line is laid with 56 lb. rails; these are on cedar and oak ties and ballasted with gravel. The trolley wire is for the most of the way suspended from span wires; bracket construction is, however, used at a few places. The poles are all of cedar.

At the Cedar Falls end no franchise for a trolley line could be obtained, so the cars enter the city over the tracks of the Great Western Railroad, running about a mile on the steam road, which necessitates running on exact schedule time. At the Great Western depot connection is made with the Cedar Falls & Normal Electric Railway, which is operated with Patton motors.

It was originally the intention to build the road down the west side of the river, and the power house was erected on this side near the Waterloo end, as it supplies power to the local railway as well as to the interurban line; later it was decided to build on the other side of the river, which makes the power house at a considerable distance from the road. Lines joining the extremities of the road, and the extremities with the power house form a triangle with its longest side pointing towards Cedar Falls. With these conditions to meet the feeders are carried on two separate pole lines and extend in a straight line from the power house to the connection with the road. The longest feeder is 4½ miles and all are of No. oooo wire. The Great

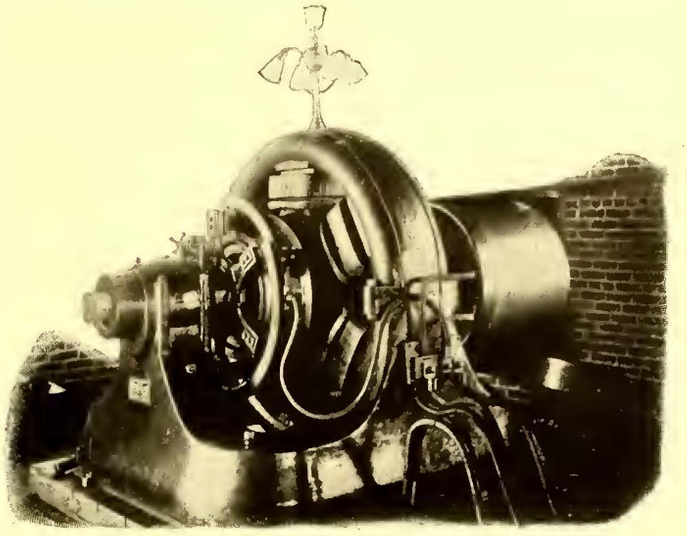


INTERIOR OF ENGINE ROOM—WATERLOO

Western Railroad delivers coal at the power house door, and a small stream near by supplies water for the boilers. The firm of Foster & Louis installed the new machinery in the power house and was contractor for most of the equipment.

There are two engines; a 250 h. p. Fischer, belted to a 150 k. w. Triumph railway generator, and a Westinghouse engine belted to a 100 k. w. generator of the same make.

The valves in the Fischer engine, which is shown on this page, are double ported for both admission and



GENERATOR—WATERLOO

exhaust. The governor is of the flywheel type and governs the speed very closely. The cylinder clearance is very low as in all of this type of engine.

The generator embodies the latest features of improved dynamo design. The armature is of the iron clad type, thoroughly ventilated by air passages both parallel and at right angles to the shaft. The conductors are of solid bar copper of rectangular section laid in slots insulated from the core with mica and held in position by hardwood keys, obviating the necessity of bands. There are no joints of any kind in the armature winding except the connections to commutator.

The commutator bars are of the best grade of copper, insulated from each other and from the shells with pure India mica. The shells are of steel and so constructed as to rigidly support the bars, at the same time permitting free circulation of air to the interior and absolutely preventing the possibility of any oil reaching the insulation. The poles are laminated, being built up of No. 24 B. & S. gage sheet steel. The series and shunt fields are wound on separate forms, highly insulated and held in place by a cast iron keeper. The design as a whole is graceful and shows a careful attention to detail.

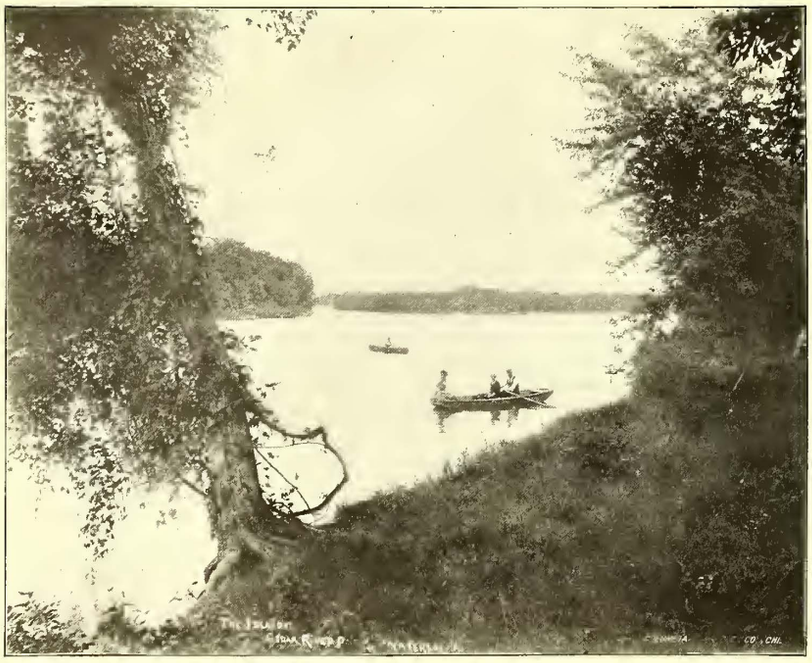
The test of street railway service is severe and this generator has on several occasions been subjected to sudden overloads, in some instances exceeding 50 per cent of the rating of the machine without the slightest sparking or indication of strain.

The second engine is a Westinghouse of 150 h. p. and belted to a 100 k. w. generator of the same manufacture. A third generator will furnish power for sale throughout Waterloo. There is sufficient room for doubling the present equipment.

The switchboard is of white marble, divided into six panels—two generators and four feeders handsomely framed. It is fitted with Triumph rheostats, Weston instruments and Cutter circuit breakers, and was built by The Triumph Electric Company.

Four 42 ft. Pullman cars, two motors and two trailers make up the rolling stock; these are fitted with rattan seats set crosswise, Westinghouse air brakes and electric heaters. The local Waterloo line has eight single truck cars, and connection with the interurban line is made at West Waterloo where passengers for the interurban change

cars. The fare between the two cities is fifteen cents, graded into three divisions: from Waterloo to Cedar River five cents, Cedar River to Bluff Park five cents, Bluff Park to Cedar Falls five cents. A half hour service is maintained. The population of Waterloo is about 8000 and that of Cedar Falls about 3000. In round figures the cost

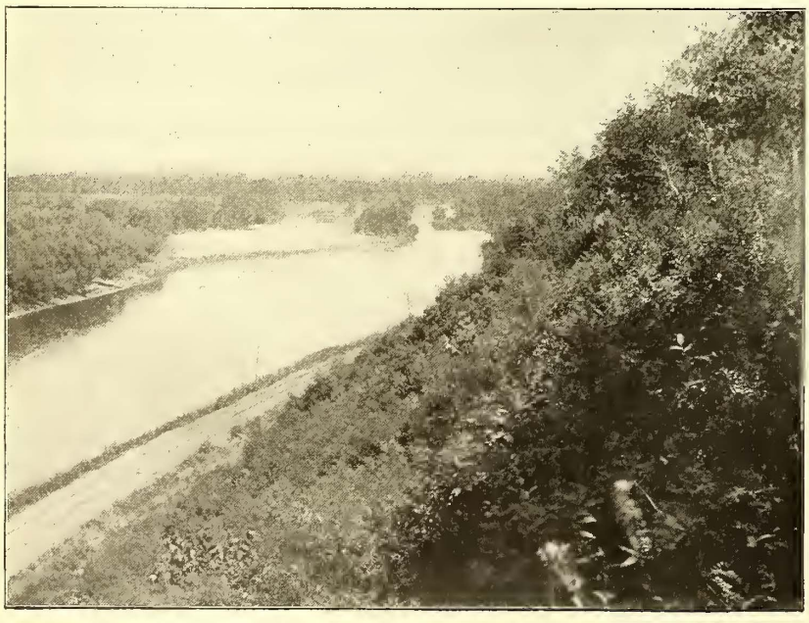


VIEW AT SANS SOUCI ON CEDAR RIVER

of the road was $165,000. The line is running very satisfactorily and carrying large number of passengers.

A Drawbridge Safeguard

Whenever current is carried under a drawbridge, by means of a cable, overhead feeders should be provided,



LOOKING UP CEDAR VALLEY

and made fast to the bridge in such a manner that they can be quickly connected to the main feeders in case of failure of the submarine cable. To this end, cut-out boxes should be erected at either end of the bridge, and the bridge feeders fitted with contacts that can be quickly bolted on when the cable is cut out. This greater security will often prove valuable.

Electric Railway Motors

By Geo. T. Hanchett

VI—Bearings and Bearing Lubricants

The bearings in a street railway motor are very important parts in its construction. In modern motors they consist for the most part of cylindrical shells which are lined with some good friction metal. These shells are sometimes of one piece and are slipped over the end of the shaft, and sometimes they are in halves and doweled together. Axle bearings, of necessity, are always in halves, for it is obviously out of the question to press off a car wheel every time it is desired to install a motor.

Some of the early motors, notably the W. P., and some of the Curtis "A" motors, used brass shells. These were of metal about ⅛ in. thick, in the case of armature bearings, and were allowed to wear to $\frac{1}{16}$ in. before they were thrown away. They were very satisfactory so far as running qualities were concerned, but they are expensive to maintain both on account of the relatively expensive metal which is used and the fact that each bearing shell required to be machined before it could be used, therefore babbitt bearings have come now into almost universal use.

In the selection of a babbitt metal, it is very common for street railway men to go by price. They know that a 6 cent metal is next to worthless, and they argue or rather act upon the supposition at least, that if 18, 20 or 25 cents a pound is paid that they are sure of getting something that is satisfactory.

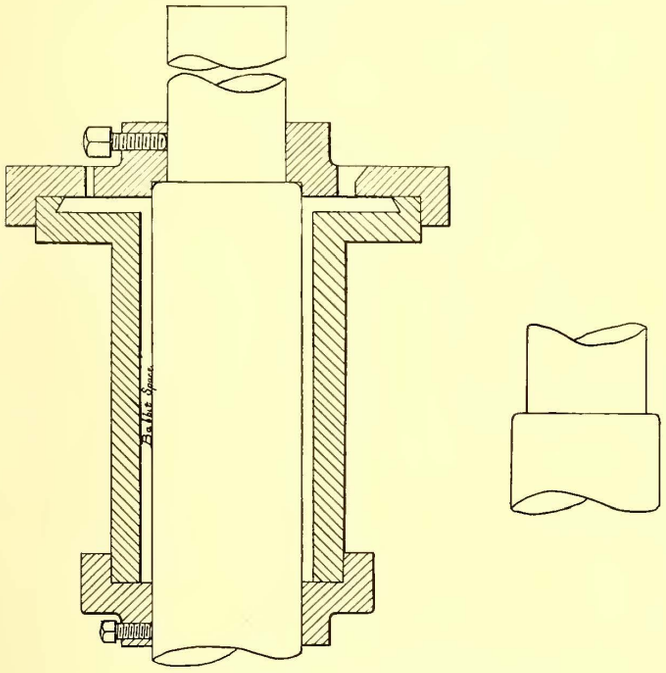
Now it is one of the tricks of the engineering trade to make up a metal which will form a moderately good bearing, give it an imposing name and sell it at a high figure; and a few words as to the nature of Babbitt metals may not be out of place.

The substance which is largely used as a filling in the composition of cheap metals is lead. This has the effect of making the metal too soft to stand mechanical stresses, and a bearing babbitted with a metal containing too much lead will fail by the metal squeezing out at the ends after the fashion of putty, and it may be added that this happens very soon after the bearing has been put into service. A common test, therefore, has been to take a stick of the bearing metal and see if it will make a mark on white paper. The assumption drawn if such be the case, is that the metal contains too much lead to be suitable. In the opinion of the writer, any bearing metal containing lead is unfit for railway use.

The United States Navy department made a series of exhaustive tests on the various bearing metals in the market. These tests were strictly comparative, genuine babbitt being taken as the standard, and it was found that no metal equaled it in either wearing or antifriction properties. Many of these patent compounds were assayed and it was found that the all-around excellence of the bearing metal was in almost direct ratio with the proportion of tin that it contained, and genuine babbitt being almost pure tin with just enough copper to make it tenaceous and just enough antimony to make it flow nicely, stood at the head. Such a mixture is worth in the neighborhood of 25 cents a pound and varies according to the market, and all of the patent metals which were assayed by the Government were found to be of less value, figuring from the prevailing prices of the respective metals they contained. This seems to show that anybody who pays over 25 cents a

pound for bearing metal of any kind, is paying for royalty and reputation and not for car mileage. Anti-friction metals, like genuine babbitt and others of lower grade, should be melted very carefully. If the heat be applied too rapidly, some of the metal will oxidize and be skimmed off as dross, thus altering the proportion of the mixture. The metal so lost generally comprises the hardening medium and renders the resulting alloy much inferior; thus it is possible to make a specious test to the disadvantage of a really good bearing metal. Just before pouring a bearing, the metal should be thoroughly stirred, for the heavier components tend to exist in the greatest quantity in the bottom of the mass, and unless this precaution is taken the bearing will not be made of the true mixture.

In casting babbitt bearings, it is very important that the various lots of metals be kept separate. Each batch of shells should be marked by some private mark, showing the lot from which they were cast, and when those



FIGS. 1 AND 2.—MANDREL AND CAPS APPLIED TO SHELL FOR CASTING BABBITT

shells are returned to be rebabbitted, the old babbitt must be kept in a lot by itself and not mixed with new, even though it is supposed to be of the same quality. The reason for this is that the babbitt may have been carelessly heated and poured, and its quality materially altered as before described, in which case mixing it with new babbitt will seriously deteriorate the value of the entire melting.

If the old babbitt is to be used again, it should be melted and used by itself. It is well to reject the babbitt from bearings which have prematurely ground out, on the supposition that the metal was overheated or not properly stirred in the pouring. The addition of one worn out shell of burnt babbitt might seriously injure 50 lbs. of good metal. It is obviously experimental to mix different grades or makes of anti-friction metal, and it is very probable that the resulting mixture will be inferior in quality to either of its components.

There are two methods which are much used to make babbitt metal bearings. The first is to cast them carefully on a mandrel of the proper size, and the second is to cast them with a mandrel that is a few sixty-fourths of an inch small and ream the bearing to size. If carefully done the latter is the preferable method, but too often the work of reaming is so carelessly performed that it would be better to cast the bearing to size in the first place. A reamed surface has the advantage of exposing a clear metal surface free from oxidation and supposedly better adapted for friction, but the difference is slight and the real value of reaming consists in the high mechanical accuracy of fit. Large hand reamers are very expensive, and frequently the lathe is called into service for this purpose. In such a case the finishing chip should be very light, the carriage should be set to a fine feed and the tool should be so shaped that it will take off a chip after the manner of a hand scraper, thus leaving a smooth polished surface and one not filled with tool marks.

Reamed bearings and possibly hand scraped bearings are advisable for armatures where the speed is high, but unless the work is very carefully done it is labor wasted, for the plain mandrel cast bearing will prove superior to a poorly machined one.

The oil grooves should be chipped in after the bearing is reamed, as they are liable to interfere with the action of the cutting tools. Usually all that is necessary in the line of oil grooves are two marks cut with a U-nosed cold chisel, crossing each other diagonally, the grease orifices being at their intersection.

If the bearing is to be cast and not reamed, the mandril may be made out of a piece of shaft, of the same size as the shaft, on which the bearing is to finally operate. The mandrel may then be smoked in a torch flame so that a thin layer of soot will give the bearing clearance, and prevent the mandrel from sticking. The better way, however, is to use a mandrel $\frac{1}{64}$ in. large and give it a light coat of oil, just sufficient to make it greasy, but not enough so that the melted metal will sputter and bubble when poured upon it. The common procedure is to make two collars, which may be secured to the mandrel by screws as shown in Fig. 1. These serve to center the bearing upon the mandrel and hold it in position while the metal is being poured. The bearing shells themselves should be exceptionally free from grease and oil, so that the babbitt will stick to them. For this purpose they may be washed in a strong solution of ordinary washing fluid or potash, which will effectually cut the grease and remove it. When thoroughly dry and cleaned they are ready to be babbitted.

The shells and the mandrel should be slightly warmed, almost hot enough to be inconvenient to handle, and the grease ducts and the edges of the mould should be stopped by wads of clay. The bearings should then be poured in a vertical position, preferably through a hole in the collar, though it is common to pour them on the sides through one of the grease ducts. The latter method has the disadvantage that any imperfection in the pouring appears on the bearing itself while with vertical pouring, imperfections, if there be any, are more likely to occur at the ends where they will not do any particular harm. As soon as the metal is set, the mandrel should be cooled as rapidly as possible by taking off the collars and dipping the end in cold water, still allowing the bearing to remain hot, and presently it can be easily driven out with a raw hide mallet. Care should be taken that the ends of the mandrel projecting from the bearing are smaller than the bearing itself, and that any sharp edges where the size changes, be carefully rounded, for if the mandrel is not driven straight out, such edges are liable to damage the finished surfaces. In casting these cylindrical bearings a very slight taper will be of assistance in removing the mandrel. The difference in diameter in the bearing ends should not exceed $\frac{1}{64}$ in. and it is best to get along without a taper, if possible, unless the bearing is to be subsequently reamed.

The metal should be heated just enough to run freely. The rule should be that the metal be just hot enough so that when it is poured it begins to solidify at the bottom, just after the pouring is finished. If any cooler, irregularities in the pouring will fill the bearing full of notches, and if any hotter, the composition of the metal will be altered, invariably to its detriment. To avoid oxidation, the babbitt should not be kept melted any longer than absolutely necessary. Similar precautions are to be observed in cast brass bearings. Brass can be so badly burned that it can be broken with the fingers, giving a black, cakey fracture and yet such burned brass can be brightly polished and externally will appear thoroughly suitable. Therefore in selecting brass for casting bearings, old bearing brass may be used provided that it has not been remelted too many times, and its fracture appears satisfac-

tory. But, as is the case with babbitt, it is better to keep track of the lots of metal and after they have been used four or five times to reject them for bearings. Old babbitt, of course, is valuable only as junk, but old brass can be advantageously used for many small castings employed in railway work.

Split bearings are commonly cast on a half mandrel placed on a flat surface and covered by the bearing shell. Such a mandrel is quite expensive to make, and its use may be avoided by making up a half shell with a highly infusible lining, such as very hard brass, and machining it to exact dimensions. This prepared shell may be used in connection with the shell to be babbitted with the two collars, and the ordinary mandrel as described in the method of pouring cylindrical bearings. The edges of this dummy shell should be oiled slightly to prevent the babbitt from sticking.

In babbitting brass bearing shells which are sometimes used on axles and occasionally on armatures, the surface to which the babbitt has to adhere should be tinned with rosin or soldering acid. This adhesion is not possible in the case of cast iron shells, and therefore the latter should be thoroughly cleansed, as has been described, and liberally provided with grip holds drilled in diverse directions. A well babbitted bearing when dropped from a height of 6 ins. on to the bench, will sound like a solid piece of metal, and if the work be poorly done such a fall will produce a brief buzzing sound like that of a cracked bell.

The lubricating of street car motor bearings is preferably grease. It is not a clean lubricant, but it is what might be called a dusttight one, for dust and flying particles will find it much harder to work into and grind out a bearing which is lubricated by grease than one which is lubricated by oil, therefore grease is almost universally used on street railway motors. Oil is sometimes advisable on interurban and elevated roads where the journals are very heavy, and where liability of trouble from dust and grit is very much reduced.

Another advantage of grease is that its viscosity very much reduces the chances of its being thrown out of the bearings and over the windings. In elevated railway work where oil is superior for mechanical reasons, this trouble of flying lubricant is largely experienced and has proven a substantial practical difficulty. There are more different lubricating compounds than there are anti-friction metals and that is saying a great deal. It seems to the writer that almost every conceivable substance has been tried. Powdered lead, lime, rosin, salt, soaptone, caoutchouc, sulphur, beeswax, carbonate of soda, gutta percha, ivory dust and asbestos are only a few of the many materials which no one would suspect could be beneficially used in any lubricant, but which have been nevertheless employed as components in the preparation of lubricating compounds.

It is not possible to lay down any rigid rule for lubricants. The temperature and load conditions have much to do in determining it and these are liable to vary. It may be better to use a lighter grease in winter than in summer, in fact this is often done and practical experiment is the best guide. Greases containing graphite or soapstone or similar ingredients are better suited for gears and parts where rubbing is not continuous. Animal oils or tallows are liable to contain acids, which should be neutralized with soda or caustic potash according to some approved formula. Vegetable oils are liable to be of a drying variety, that is, they will thicken and gum on exposure to atmosphere and they should not be used in a lubricating compound to such an extent that this property proves objectionable. A vegetable oil will carbonize on a bearing at a relatively lower temperature. Lubricating compounds known to contain a percentage of vegetable oils should be tested severely before being approved. A carbonized vegetable oil in a bearing produces a surface of about the same texture as a sawed piece of carbon, and it enormously increases the friction both by its roughening and its filling up the clearance so that the axle binds.

Axle grease for the most part consists of animal tallows the acids of which have been neutralized with soda.

The formula for common railway grease suitable for axle boxes and bearings is as follows: melt 200 lbs. of tallow and stir in 150 lbs. of palm oil, boil, and then allow to cool until about 90 degs. F. Stir continuously. Then strain it into a solution consisting of 60 lbs. of soda dissolved in 3 gals. of water, stirring the two together. Another axle grease is as follows and suited for summer use. tallow, 450 lbs.; palm oil, 250 lbs.; sperm oil, 27 lbs.; crystalized soda, 108 lbs.; water, 1220 lbs. The lubricant should be heated and melted in one vessel to about 180 degs., and the water and soda heated in another till just below boiling point. They should then be run together and stirred until cold. The slower the cooling process the harder the product. For winter use 75 lbs. less tallow and 8 lbs. more sperm oil, 6 lbs. more soda and 10 lbs. more water. In those greases where soda and other basic alkalies are so largely used, they not only neutralize the acids in the fats, but they unite with a considerable percentage of them, forming soft soap, which frequently forms a principal component of axle grease.

Another grease suitable for gears is graphite one part; lard, four parts, to which a very small quantity of camphor has been added.

There are many good axle greases now offered on the market, and one or two of them are of such admitted excellence that they have become standard.

Railway motor bearings are almost identical in shape as manufactured at present, but there is one point that deserves mention before leaving the subject, and that is, the interchangeability of the bearings of a motor. It is obvious that the pinion bearing has much more strain imposed upon it than the commutator bearing, and good design dictates that it should be longer, but on the other hand, bearings that are interchangeable are a great convenience. Provided this interchangeability is not secured at the expense of mechanical design, that is, the pinion bearing is made too short and the commutator bearing too long, it is preferable to have the bearings interchangeable. It is plain, however, that for this to be, the commutator bearings must be longer than is absolutely necessary, and this will often make the motor so long across the axle that it interferes with the brake rods. Indeed, the length of the motor bearings is frequently limited by the space to spare, and in several cases—notably that of the W. P. 50 motor in which the commutator bearing is scarcely longer than its diameter—the bearings have been sacrificed. Therefore, it is usually better practice when space is so limited to make the pinion bearing the larger.

Work on the Boston Subway

Following the requirements of the law, the Boston Transit Commission has prepared and submitted to the City Council its third annual report for the year ending Aug, 15, 1897. The report treats of progress of the work on the subway and on the new bridge to Charleston. The report says: "During the year ending Aug. 15, 1897, there has been expended on the subway $2,038,033 making a total expenditure of $3,718,513. The total expenditure on the Charleston Bridge, still uncompleted, has been $324,801, making a grand total of $4,043,313. Eighty-seven per cent of the total mileage of the subway has been completed and about 7 per cent more is under contract or ordered to be built directly by the engineering department. If it were not for the uncertainty in regard to the part north of Haymarket Square, the whole subway might be ready for use early in the spring.

Of the work north of School Street, the report says: "The work has been done largely at night and on Sundays, in order to minimize the inconvenience to street traffic, and to avoid unnecessary interference with the services of pipes and conduits. Work on sewer changes has been carried on both by day and by night, a considerable part of it by tunneling."

The Chester Park Shops of the Cincinnati Street Railway Company

The consolidation of the street railway companies in Cincinnati into one system made it a matter of economy to bring the repair shops of the various lines into one. This necessitated new buildings, and a site was selected well outside the city, at Chester Park, a pleasure resort owned by the company. Here it is intended not only to make repairs, but to build cars as well. Cincinnati is a city of hills, and with the double trolley in use here the demands on the repair department is much larger than usual.

Aside from the shop power house, which is of brick, the buildings are built of quarry faced limestone and present an extremely neat and pleasing appearance. They cover nearly eight acres of ground and are one story high with the exception of the office which has the draughting rooms overhead and a clock tower at the corner. There is a good deal of wood in the interior construction. The posts and trusses supporting the roofs are all of wood. The posts are prevented from checking or cracking by having a center ventilating hole bored their entire length; this is an expensive operation, but has effectually secured the result sought. In designing the plant Bert L. Baldwin, mechanical engineer for the company, and Pat Leen, superintendent of the shops, visited a number of repair shops and nearly all of the large car shops of constructing companies in the West, since the intention is not only to repair, but to build new cars as well.

FIG 1.—CHESTER PARK SHOPS—CINCINNAT

FIG. 2.—MACHINE SHOP

A spur of the Cincinnati, Hamilton & Dayton Railroad runs the length of the rear, and the plan of the shops contemplates the receiving of raw material on this side, and passing it along through successive rooms until the finished car is turned out in the front; thus, on one side of Mitchell Avenue, which divides the buildings into two sections are the dry lumber shed, the carpenter and mill shop, the cabinet shop, erecting and repair shop, and finally the paint shop; on the other side of the street in the same rotation are the blacksmith shop, brass foundry, machine shop, armature room, supply depot and car house.

The shops are heated throughout by an elaborate hot air system; six fans placed in the most advantageous positions, as regards length of distributing pipe, direct connected to small engines, force air over 45,000 ft. of 1 in. steam coils. The fans move 300,000 cu. ft. of air per minute; the shops contain about 5,500,000 cu. ft. of air space; thus the air is changed every twenty minutes. The hot air is distributed through galvanized iron pipe. The coils are heated partly by exhaust steam from the engines, and partly by live steam from the boilers. The water of condensation is returned to the power house through a single main connecting with all the coils. The fans are run in summer for ventilating.

As there is so much wood used in the construction of the building, extreme care has been taken to provide fire protection. There are forty fire plugs on the grounds; near the desk of the foreman of each department is a gong, and signs in different places instruct all workmen to respond immediately to the ringing. The workmen are to be given a course of instruction in the handling of the fire apparatus.

A telephone system, with receivers for the foreman of each department puts the whole works in connection with the superintendent's office.

In every department there are neat toilet rooms and a locker for each workman. A duplicate key for each locker is kept in the office to guard against the workman losing his key or leaving it at home. These are hung on a board and properly numbered. All parts of the shops are well lighted, not only by windows in the sides, but by rows of skylights; to supplement these

on short or dark days are some 100 arc and 700 incandescent lights.

The power house contains three engines: a Buckeye, Eclipse and Hamilton-Corliss. One Brush, three Thomson-Houston and three Card dynamos furnish light and power.

BLACKSMITH SHOP

This is 107 ft. × 90 ft.; the room is scarcely more smoky than any other, owing to its being fitted with Buffalo forges, which have an adjustable hood instead of the ordinary flues, and from the hood the flue leads down into the forge again; here it divides and a part of the smoke and gas passes out to the open air and a part returns to the fire. It is a curious fact that no smoke ever makes its way to the outside air, but whether this is consumed in passing the second time through the forge is undetermined. The equipment is as follows:

12 forges.
2 punches.
1 steam hammer.

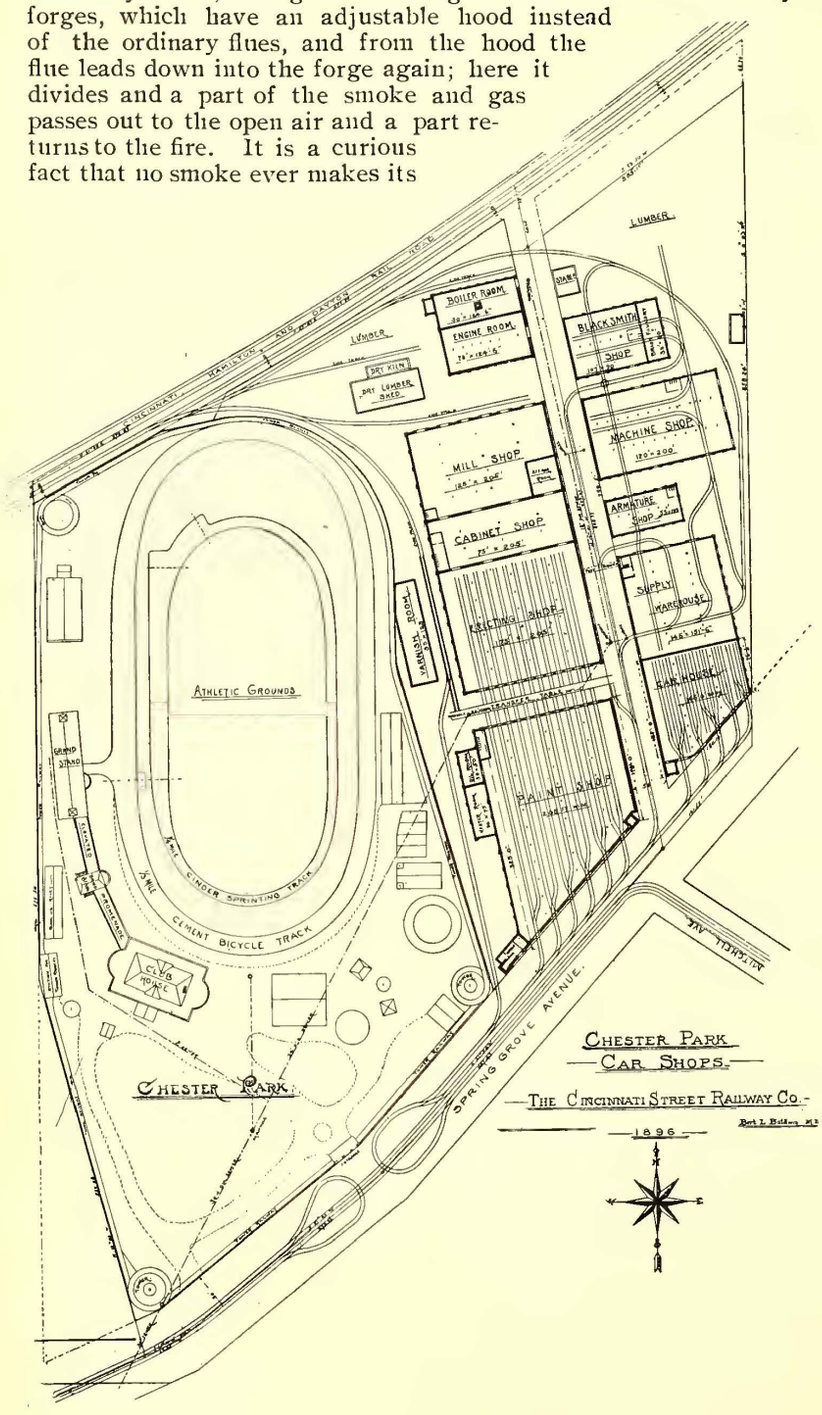
Adjoining the blacksmith shop is the brass foundry with a capacity of 14,000 lbs. of brass castings per month.

MACHINE SHOP

An alley way divides the blacksmith shop from the machine room. This department contains:

3 drill presses,
1 bolt cutter,
8 engine lathes, largest 42 in.,
1 grindstone,
1 planer,
1-150 ton wheel press,
2 boring machines,
1 shaper,
2 milling machines.

The shops are so recently opened that there are not many of the small devices peculiar to individual shops.



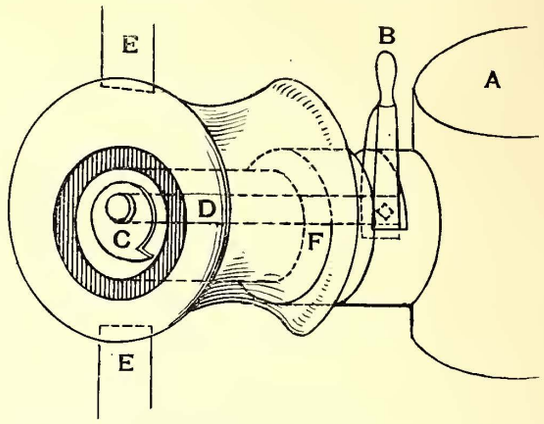


FIG. 3.—LATHE FOR SMOOTHING BOTH ENDS OF TROLLEY WHEEL

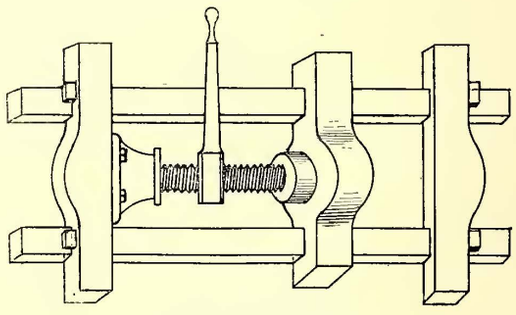


FIG 4.—HAND PRESS

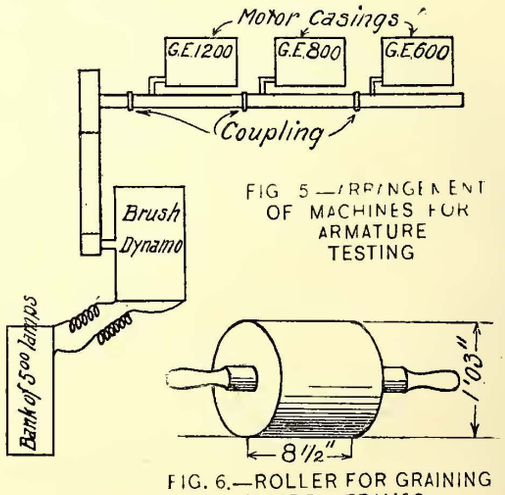


FIG 5.—ARRANGEMENT OF MACHINES FOR ARMATURE TESTING

FIG. 6.—ROLLER FOR GRAINING WINDOW FRAMES

On account of the double trolley system, the time of one man is continually employed in machining trolley wheels. After being caught in the chuck the wheel is bored and smoothed by two tools of a turret lathe; the operation of the lathe is as follows (see Fig. 3):

A is the turret of a turret lathe. The wheel is held in the chuck, *E E*, and bored in the ordinary way, and the side of the hub nearest the turret, *A*, is smoothed in the ordinary way. Then the turret is revolved and the truing tool is slipped through the hub, bringing the trued face of the hub up against the shoulder, *F*. The part, *C*, is now actuated by the lever, *B*, the center of *C* is not the center of the spindle. The cutting edge of *C* is thrown out past

the circumference of the spindle and cuts and trues the side of the trolley wheel hub farthest from the turret, *A*, and the process leaves the trolley wheel hub of the same length as the spindle from the shoulder to the end, which is the same as the correct width of a finished hub.

In one corner of the machine room is the tin shop whose machinery consists of two power shears, the longest of which is used for cutting sheet iron for dashboards.

ARMATURE ROOM

Here, as in all other departments, there is the general air of roominess, and the best appliances for turning out rapid work. One feature is a lathe for binding armatures. A press improvised from a jack screw and homemade frame as shown in Fig. 4, serves a number of purposes. The taping machines are of the General Electric pattern. By making its own coils the company has been able to reduce the cost more than one-half. In one corner of the room is a jack-shaft belted to a Brush dynamo (Fig. 5) and used for testing armatures. The bearings of the jack-shaft are three different sized motor casings of General Electric pattern corresponding to the types of motors in use on the road. A finished armature to be tested is then placed in the casing of its own size and geared to the jack shaft as if in actual service. The dynamo terminals are joined to a bank of 500 incandescent lamps connected in the usual way and making it possible to throw any desired load upon the motor to be tested.

Beyond another alley is the supply depot, an interior

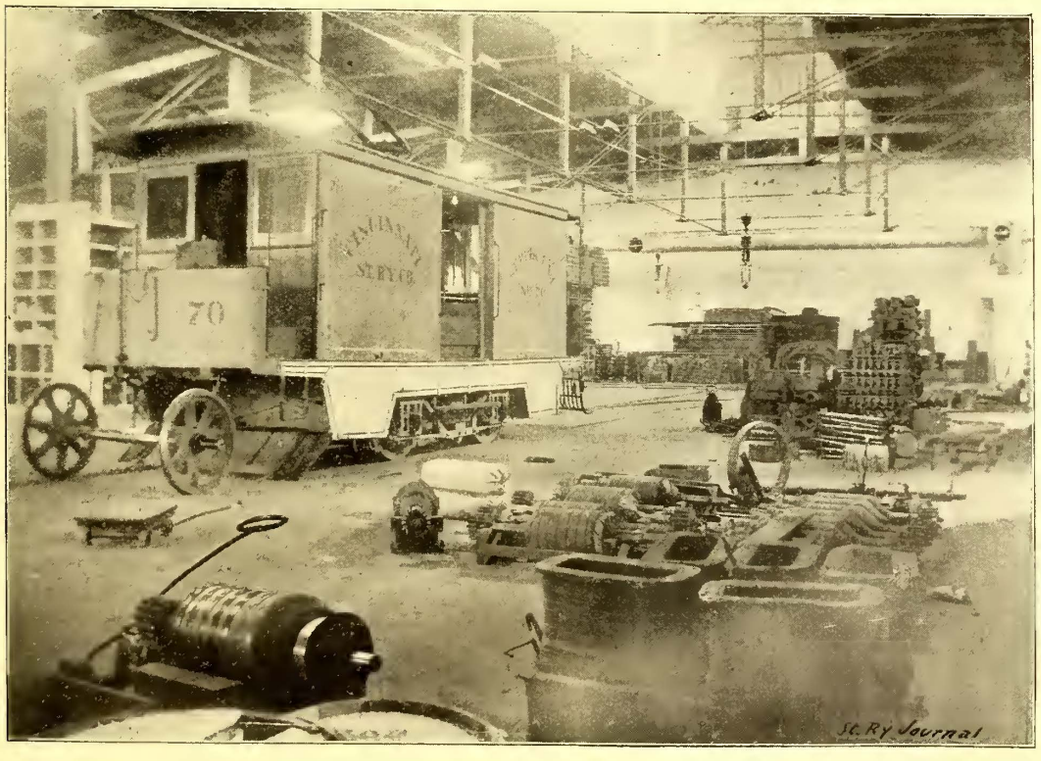


FIG. 8.—SUPPLY CAR AND SHIPPING ROOM

view of which is shown in Fig. 8. From here the supply car leaves twice a day for a trip to each one of the eleven car barns located in different parts of the city. The supply car shown in the cut has an ingenious method of carrying wheels. The latter are seized by a rope and tackle and drawn up under the front platform on the inclined slide which is shown as dropped in the engraving. When the wheels are thus stored, the hinged slide is raised and fastened above the track. The car is fitted at each end with a compartment of this kind. Adjoining the supply depot is the car house where completed cars and those awaiting repairs are stored.

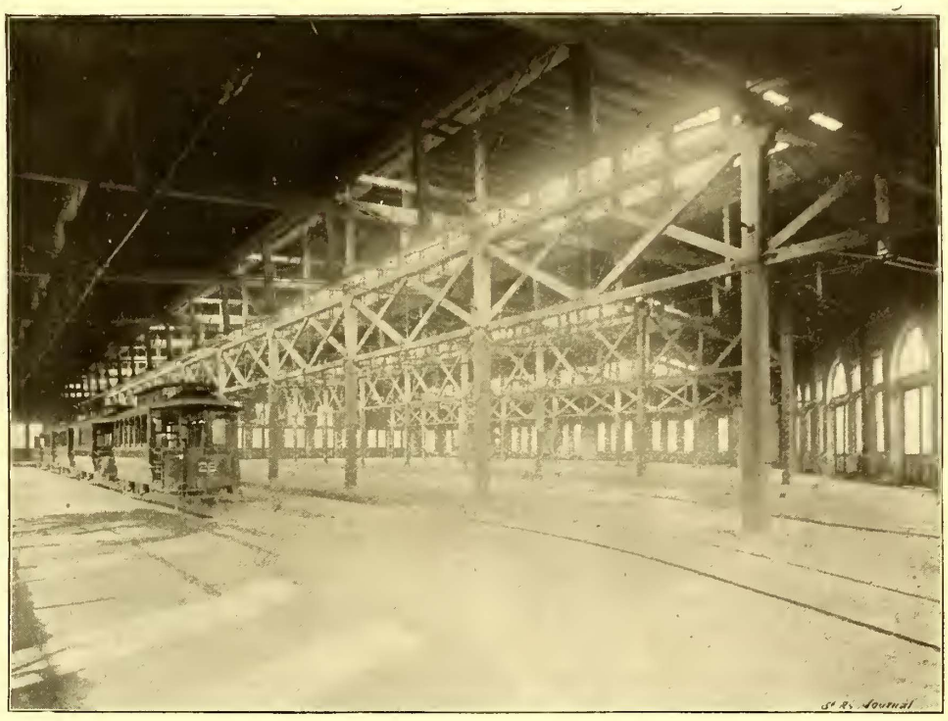


FIG. 7.—PAINT SHOP

CARPENTER SHOP AND MILL ROOM

Returning again to the rear of the buildings, and on the west side of Mitchell Avenue is the carpenter and mill shop. It is 205 ft. × 125 ft. and the twenty-five machines do not crowd it; a team and wagon can deliver lumber to any machine. These are:

1 large double cylinder planer,
1 small pony planer,
1 cut off saw,
1 24-in. hand planer,
1 heavy surfacer,
1 self feed rip saw,
2 variety saws,
1 double circular saw,
1 large band saw,
1 small band saw,
1 scroll saw,
1 double headed friezing machine,
1 single headed friezing machine.
2 graduated stroke mortising machines,
1 triple boring machine,
1 triple drum sander,
2 tenoning machines,
1 variety woodworker,
1 knife grinding machine,
1 heavy moulding machine,
1 light " "
1 grindstone.

The majority of these machines were made by the J. A. Fay & Egan Company.

The most important are: a heavy surfacer for reducing rough lumber to finished sizes, from 26 ins. wide and 10 ins. thick down to the smallest pieces of wood stock entering into car construction, and a heavy triple drum sander or polishing machine for finishing all exposed surfaces.

The latter is capable of polishing the finest veneers, and is one of the most valuable labor saving pieces of mechanism introduced in street car construction. Another important tool is a band resawing machine for reducing plank to thin material rapidly and accurately, and at the same time reducing the waste in saw kerf to a minimum. Other time saving tools are: a triple boring machine, with quick adjusting spindles, capable of boring holes of three different diameters without the need of changing bits, and a double circular or revolving saw, peculiarly adapted to the pattern department, because of the range of work it performs and the convenience in quickly changing from ripping to cross cutting, mitering, bevel sawing and *vice versa*.

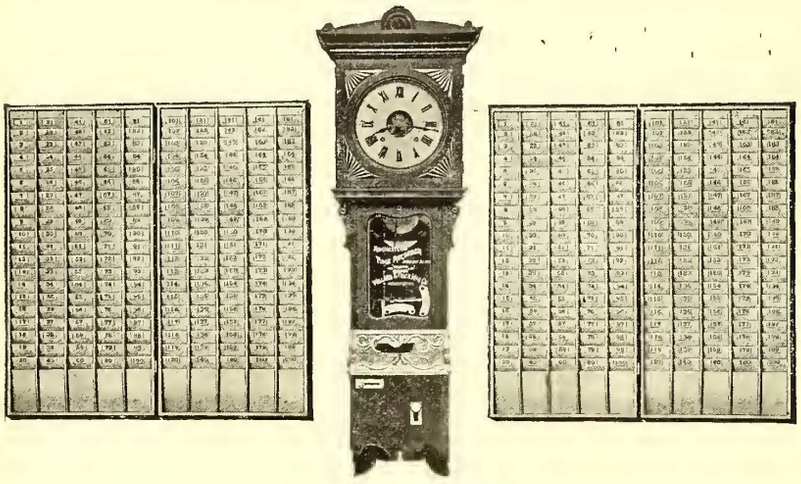


FIG. 9.—TIME RECORDER

Under the same roof with the carpenter shop is the cabinet room and the erecting shop. At one side of the former, is a small room partitioned off and containing steam coils in forms for bending boards for the curved parts of car bodies.

The erecting shop has a series of twelve tracks continuous with those in the paint shop and from which it is separated by an open space. Between these buildings the twelve tracks are connected with a transverse track on which runs a transfer car shown in Fig. 11. This car is operated on the double trolley system, as is the entire Cincinnati Street Railway. The conductors, are, however, underground, two open slots reaching down to them.

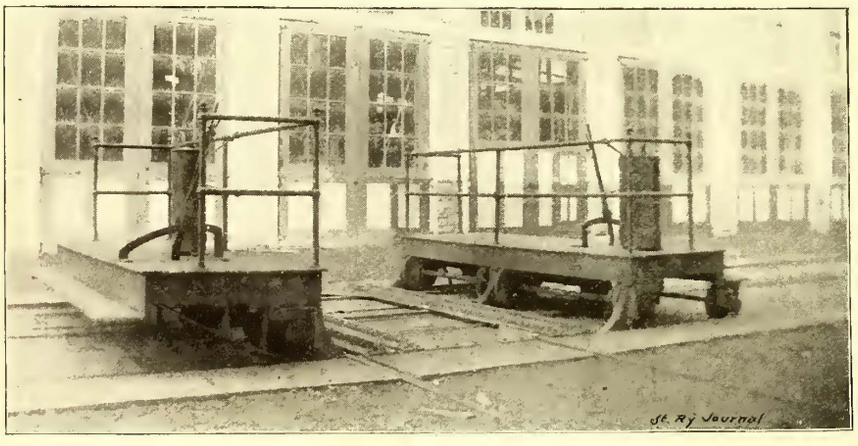


FIG. 11.—TRANSFER TABLE AT ERECTING SHOP

THE PAINT SHOP

This is the largest room in the shops and affords space for ninety cars. From fifteen to thirty-five men are employed in this department, and it is expected to turn out 1000 cars per year. The floor is cement throughout as are also the floors of the pits. The pits both here and in the erecting shop are supplied with hot air pipes for thawing out and drying the cars.

One of the special devices for painting window frames may be of interest; instead of finishing them in the natural wood as is usual, the weather beaten frame after being smoothed is given several coats of paint. A highly polished mahogany board is then covered with a dark paint, which is immediately removed with a leather scraper. A heavy roller (Fig. 6) covered with rubber is then run over the board and picks up the paint left in the grain. This is immediately transferred to the window frame by running the roller over it; the effect is that of the natural wood and it is much more durable than if finished in the natural wood.

Week ending, January 15, 1898

No. 239

Name, Henry Martin

Day		In	Lost Time Out	Lost Time In	Out	Total
M	A.M.	6 24			12 00	5
	P.M.	12 55			6 1	5
T	A.M.	6 58			12 5	5
	P.M.	12 57			6 10	5
W	A.M.	6 57			12 5	5
	P.M.	12 56			3 28	2½
T	A.M.	6 55			12 3	5
	P.M.	12 50			6 7	5
F	A.M.	7 30			12 3	4½
	P.M.					
S	A.M.	6 56			12 5	5
	P.M.	1 3			6 5	5
S	A.M.					
	P.M.					

Total Time, 52 hrs.
Rate, 18 00
Total wages for week, $15 60

FIG. 10.—TIME SLIP

From 170 to 200 men are employed; all enter the same door, those working on the opposite side of Mitchell Avenue reaching their places through an overhead passageway. At the entrance is a Rochester time recorder (Fig. 9), made by the Willard & Frick Manufacturing Company. Upon arrival and departure each workman takes his card from the rack, drops it in the slot of the time clock, and pushes down a lever till a bell rings, and the exact time is recorded. There is a rack on either side of the clock and the printed card is placed in its proper place in the second rack. Thus the time occupied in registering is reduced to a minimum, as the line of employes is constantly moving from one card rack to the other. Fig. 10 is a reduced facsimile of the time card; there is no transferring of the record to time book, the card alone being utilized in making up the pay roll.

Electric Cars Cross the Brooklyn Bridge

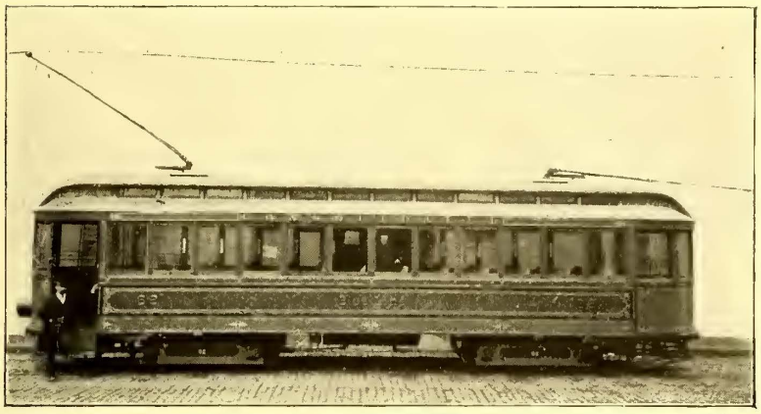
The formal opening of the Brooklyn Bridge for the use of the electric street railway systems of Brooklyn took place on Saturday, Jan. 22, and a representative of the STREET RAILWAY JOURNAL had the pleasure of riding on the first electric car to make the journey. Three special parlor cars of the Brooklyn Heights Railroad Company, the Nassau Electric Railroad Company, and the Coney Island & Brooklyn Railroad Company made the round trip, starting from the City Hall, Brooklyn, at about 10:30 A. M. The round trip was accomplished in about 12 minutes and the opening was pronounced a complete success in every particular. The cars were filled with the officials of the Brooklyn street railway systems, representatives of the press and invited guests. The passage of the cars was welcomed with cheers at both ends of the line, and it was evident that their advent was highly popular. One loop is finished, and three others will be completed shortly; meanwhile a few cars will be run over the Bridge each day to familiarize the motormen with the situation.

IT is stated that an electric railway is to be built from Goshen through Chester and Washingtonville to Newburgh, N. Y.

A NUMBER of capitalists are negotiating for the purchase of the Peru & La Salle Railway, La Salle, Ill.

New Car in Atlanta, Ga.

The accompanying engraving illustrates one of two new double truck interurban cars which have just been



CAR MADE IN ATLANTA

completed at the car shops of the Atlanta Consolidated Street Railway Company. The car body is 42 ft. over

INTERIOR OF ATLANTA CAR

all, vestibuled and electrically heated. Pivotal trucks are used with 33 in. wheels and equipped with air brakes. The total weight of the car is about 15 tons. The electrical equipment of the car consists of two No. 34 Steel motors, having a rated output of about 50 h. p. each.

As will be seen the car is graceful in outline and being attractively painted presents a neat appearance on the street. The car, as will be seen, carries two trolley poles, one at each end, the rear one only being employed. This gives greater ease in handling the pole from the rear platform.

An Interurban Freight and Express Line

The Mahoning Valley Railway Company which operates an interurban line between Youngstown, O., and Warren, Pa., has gone very extensively into the freight and express business, and the resultof this experiment will be of great interest to street railway managers. The distance from Youngstown to Warren is about 15 miles and there are two other good sized towns along the line. Five miles from Youngstown is the town of Girard, and 5 miles from Girard is that of Niles. The road is thus divided into three nearly equal divisions with a good sized center of population at the terminals of each division, and a more or less thickly inhabited country alone the line.

The company uses a special freight car which is shown herewith. This car is 33 ft. in length over all, and was built by the St. Louis Car Company. It is mounted on McGuire adjustable maximum traction trucks, and is equipped with Westinghouse No. 49 motors. The platforms are not separated in any way from the car, but the entire space is used from end to end, and a small partition, 36 ins. high, is placed just back of the brake and controller to prevent packages or other articles from interfering with the operation of the brake or controller. A small room is partitioned off, which is known as the ice box This is 8 ft. long and 5 ft. wide, with a slide door. The floor of the ice box is higher next to the door; that is, it slopes towards the inside of the car which not only takes care of the drainage, but the ice piled up in the room tends to lay away from the door so as not to interfere with its opening and closing. The ice box is not intended as a refrigerator, it being left open at the top, and the company carries in it not only ice, but beer and other articles. When handling ice, however, the room is a great convenience. This car makes three trips a day from Youngstown to Girard, Niles and Warren, and return, carrying packages, freight and express matter. The express contract is with the American Express Company. The rates charged for each package or box averages between five and ten cents for each 5 mile division, but special rates are made to large shippers or on large quantities. The company does not distribute packages or freight matter, except to points located immediately on its line. It has delivery stations or depots in each city where packages or freight matter can be left for shipment over the line or delivery from the line.

The general manager of the company has the following to say regarding the profit in an interurban freight and package service: "As to the profits of operating an express and freight service on an interurban line, I think it depends largely upon the conditions of the territory in which the line is located; that is, the natural relationship between the towns located on the line. Although we cannot claim to be doing what might be termed a profitable business, as the business on our road is comparatively new, yet, we feel that it will grow. Warren is the county seat of Trumbull County, and Youngstown is the county seat of Mahoning County, and all the conditions seem to tend to considerable business between the cities. As to the amount and character of articles carried on our line, the character includes every variety, in fact everything that people eat, drink and wear. Our principal customers are

FREIGHT AND EXPRESS CAR—YOUNGSTOWN

wholesale grocers, meat dealers, brewers, icemen, merchants and traveling men. We also carry furuiture, baby carriages and household goods."

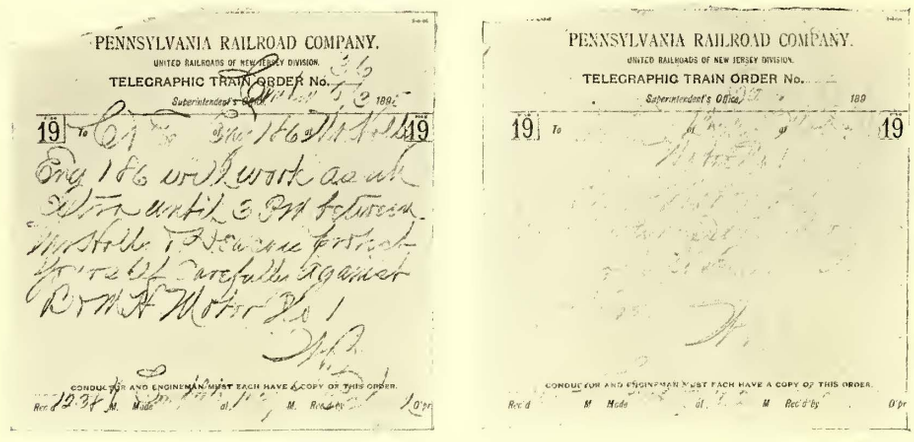
LETTERS AND HINTS FROM PRACTICAL MEN.

The First Electric Train Order

New York, Jan. 12, 1898.

Editors Street Railway Journal:

While engineer of the Burlington & Mt. Holly Traction Railroad the author came into possession of the photo-


PENNSYLVANIA RAILROAD COMPANY.
UNITED RAILROADS OF NEW JERSEY DIVISION.
TELEGRAPHIC TRAIN ORDER No.
Superintendent's Office, 189
19 To 19
CONDUCTOR AND ENGINEMAN MUST EACH HAVE A COPY OF THIS ORDER.
Rec'd M. Made at M. Rec'd by

PENNSYLVANIA RAILROAD COMPANY.
UNITED RAILROADS OF NEW JERSEY DIVISION.
TELEGRAPHIC TRAIN ORDER No.
Superintendent's Office, 189
19 To 19
CONDUCTOR AND ENGINEMAN MUST EACH HAVE A COPY OF THIS ORDER.
Rec'd M. Made at M. Rec'd by

ORDERS FOR FIRST ELECTRIC TRAIN

graph taken on June 3, 1895, from which the accompanying cut is made, and the originals of the two fac-similes shown of train orders, which are valuable contributions to the historical records of the development of electric railroading. It will be noted that they are both dated June 3, 1895, and therefore antedate by at least seventeen days any train orders for electric trains of which he has knowledge.

If such be the case the road running from Burlington to Mt. Holly in New Jersey is the forerunner and foremost of all electric railroading under steam railroad conditions.

Frederick W. Darlington.

Street Railways in Georgia

Atlanta Railway Company,
Atlanta, Ga., Jan. 8, 1898.

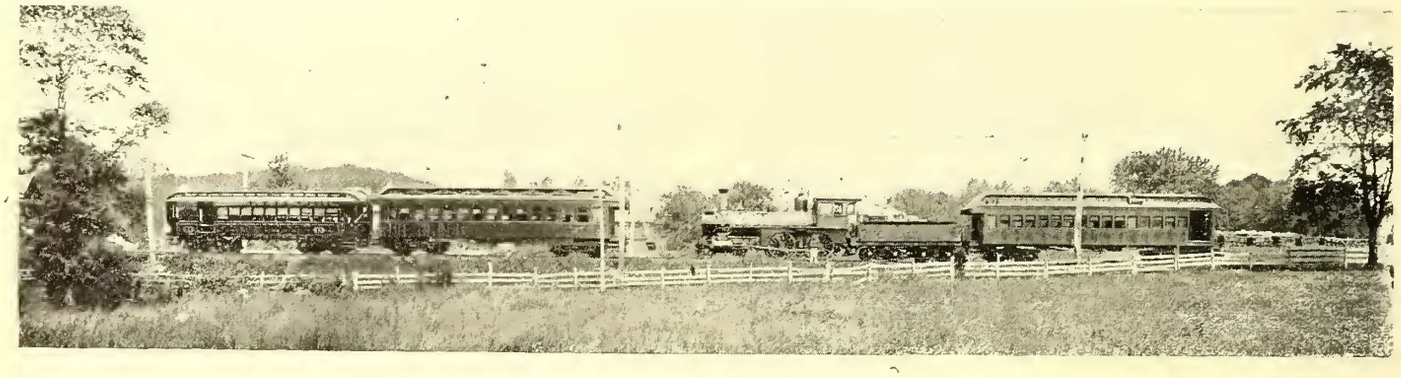
Editors Street Railway Journal:

Up to the adjournment of the legislature the street railroad situation here was, to say the least, rather peculiar. Two governmental bodies seemed determined to be recognized, and while both were objectionable to the railways, they were, at the same time, rather opposed to each other.

For several years as regularly as the legislature has met, some member of that verdant body has endeavored to introduce a bill placing all street and interurban railways under the control of the State Railroad Commission. Last year, as usual, the bill was introduced, and, while its passage was not secured, it came nearer to becoming a law than ever before. Exactly what benefit either the state or the individual will derive from placing the roads under state control the most persistent advocate of the measure could not tell. It may be that the supporters of the bill anticipate that in some mysterious manner the state may be benefited, as has been the case in other states (?) or may be they only expect to increase the list of public offices without seriously interfering with the street roads.

There are other phases in the railroad situation in Georgia, however, which are more annoying, than interference by the rural legislators. Early in 1897 the epidemic of "cheaper railroad fares" which has so demoralized some sections of the country, reached Georgia, and apparently found a firm foothold. The first move made by the authorities in this direction was in Atlanta, the capital city and, in many respects, the leading city of the state. For purely political purposes the Mayor of that flourishing city, in conjunction with a "putty" council, passed an ordinance compelling the various car lines to grant free transfers to the different branches of their systems. The ordinance was passed and became effective some time in August, and then trouble began.

One of the roads accepted the city's mandate and carried out its provisions to the letter, one road did so par-



ELECTRIC AND STEAM TRAIN AT MT. HOLLY—VIEW TAKEN JUNE 3, 1895

tially, but the Consolidated, the largest in the city or state, refused absolutely to conform to the law, and through the Old Colony Trust Company, trustee under its mortgages, obtained an order from the United States Court prohibiting the city from enforcing the ordinance. Since that time the war has been waged merrily enough, but nothing decisive has been accomplished.

In the fight the Consolidated Company takes the position that the city has no power or authority to dictate to it at all as regards the matter of fares. It claims further that the mere matter of obtaining transfers is not the real object in view, but that behind it, ill concealed, the city desires the power to regulate and control the charges for transportation. In other words it declares that if the city were allowed to enforce this proposed ordinance it would be in a position to further disturb the revenues of the company whenever it might strike the fancy of the municipal officers.

The position of the Consolidated is strong, and while it is fighting alone, every street railroad in the state is vitally interested, for undoubtedly the result either way it may be decided, will have a direct bearing on every city and every railroad in the entire state.

S. H. Bennett, Sec. and Treas.

Accident Blanks in New Orleans

CANAL & CLAIBORNE RAILROAD COMPANY,
NEW ORLEANS, Dec. 2, 1897.

EDITORS STREET RAILWAY JOURNAL:

Thinking that perhaps it would be of interest to your readers to know the methods employed in the Claim Department of the Canal & Claiborne Railroad Company, of New Orleans, I enclose you the blank forms used in this connection, which are self explanatory.

Immediately after an accident occurs, the conductor and motorman are required to report the same orally to the first inspector that they pass upon the lines of the company. At the first starter's station they hand in a pencil "Memorandum Report" (Form 1), giving the general

FORM NO. 1.

MEMORANDUM REPORT.

Date.....Time.....M
Car No.....Line.....
Place.....
Remarks.....
(Signed).....No.....

features of the accident. From this information the starter is enabled to take such steps in regard to the accident as may seem to him advisable. The inspector immediately after receiving information and arriving at the place of a personal accident, notifies the general offices of the company together with the company's physician, and the hospital service, if this has not previously been done by the conductor.

Form No. 2 covers the usual report made by motormen and conductors in regard to accidents. This is always prepared in copying ink by conductors and is signed by the motormen, previous to leaving car in station at night after turning in the car.

FORM NO. 2 (Four Pages)

(PAGE 1)

ACCIDENT REPORT NO. . . .

Car No.....Line.....Speed.....
Direction of Car.....No. Passengers.....
Date.....Time.....M
State of Weather.....Coudition of Track .....
Place of Accident.....
Distances in paces, or steps, from front of car when stopped, to the place of accident.....paces. Measurement made by.....
Witnessed by.....
Address or witness.....
Name and address of person injured.....Color.. .....
Was injured person removed from place of accident? If so, where?.....
License number and kind of vehicle damaged.....
Direction of vehicles.....Speed.....
Name and address of owner of vehicle.....
Name and address of driver of vehicle.....
Accident mentioned orally to inspector.....at.....M.

(PAGE 2)

New Orleans.....189.....

CANAL & CLAIBORNE RAILROAD COMPANY.

GENTLEMEN:

We report the following accident, which took place in connection with our car this day:

.....
.....
.....
.....

We certify that the above is a true statement of the occurrence,

.....
Conductor Badge No..... Motorman Badge No.....

(PAGE 3)

WITNESSES

(1) Name.....
Address No.....Street, between
.....and.....
(Spaces for names and addresses of ten other witnesses follow.)

(PAGE 4)

INSTRUCTIONS

Conductors of the Canal & Claiborne Railroad Company will report any accident to any car or vehicle belonging to the Company, or any other Company or person, which occurs within fifteen paces, or steps, of the tracks or cars belonging to the Canal & Claiborne Railroad Company, **no matter how trivial.**

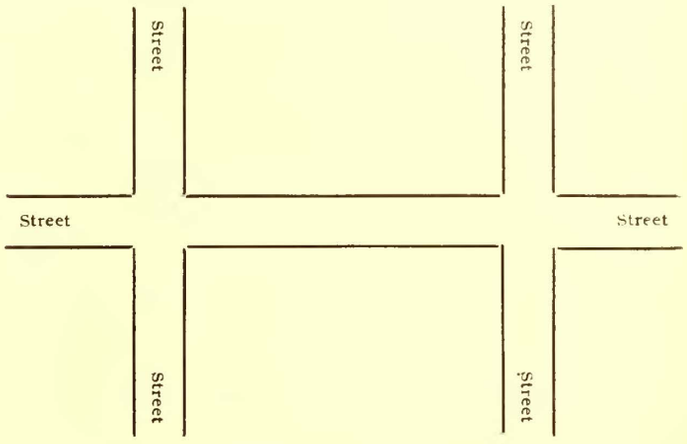
The most important duty of employes in case of accidents is securing the names and addresses of the largest number of witnesses possible. For this reason the motorman will go on the sidewalk with the conductor, and do everything in his power to obtain the names and addresses of the most intelligent and reliable witnesses he may see. In case of a serious personal accident when persons who saw the accident will not give their names, Conductor will, allow the Motorman to take the car back to the station alone, while Conductor will stay with the witness and follow him until he obtains his accurate name and address. In taking the addresses of witnesses conductors will find out between what streets, and also the number of residence.

Employes must not, under any conditions, tell anyone who their witnesses are in case of accident, or make any statement with reference to the accident, except to an Official of the Company.

Conductors and Motormen must co-operate in every way possible.

Accident Reports must be filled out in ink and handed in before the Conductor and Motorman leave the station after turning in car.

Memorandum Reports must be made out immediately after the accident, and left at the first station passed.



Employes after having an accident must mention the same orally to the first Inspector that they may pass on the lines of the Company.

Conductors will fill in the diagram above, showing the exact location of car or cars, vehicle or persons connected with the accident, naming the streets and cross streets.

The first page of this report covers every possible point of information which may be desirable in connection with almost any accident. The second page gives sufficient space for a very detailed description of the accident, so far as it can be given by the motorman and conductor in charge of the car. The third page contains spaces for eleven different witnesses, it being the policy the company to obtain the largest number of witnesses possible in any accident case, since through a large number of witnesses and the most reliable witnesses that can be obtained, the company has its only protection from blackmail instituted by vulture-like lawyers who surround the accident cases of railroad companies. On this blank, it will be noted, is a diagram showing the streets and cross streets. In this the conductor traces the location of the tracks and the position of the car or vehicle, with all measurements. As this diagram is made at the time of the accident, it puts in the most reliable and concrete form the best information that can be obtained in connection with the accident. Of course, in a report of this kind it can hardly be expected that the conductors will make a finished drawing or anything approaching to it; however it serves to give convincing information to a jury, since the conductor and motorman are always able to swear that the circumstances as shown in the drawing were the exact conditions, and that the diagram was prepared at the time of the accident. The instructions included on this page are sufficiently self explanatory.

FORM NO. 3. (Four pages)

(PAGE 1.)

CANAL & CLAIBORNE RAILROAD COMPANY.

Inspector's Report No.....

NEW ORLEANS, ...189..

MR. JOS. H. DEGRANGE, President,

DEAR SIR.—

I certify that I have examined into the following accident

Car No.....Line.....
Conductor.....Badge.....
Motorman.....Badge.....
Date.....Time.....M
Place.....
.....
Name and address of person injured.....
.....
.....
Color.....Age.....Occupation.....
Was injured person removed from place of accident, aud if so where?.....
.....
Physician notified (time and place) Time..... Place.....
Circumstances of injured person (wealthy, medium, poor?).....
Married or single?.....Who is dependent on person for support?
.....
Wife living?.....Husband liviug?.....
Children living?.....How many?.....
Ages of children.....
License uumber and kind of vehicle damaged.....
.....
Name and address of owner of vehicle.....
.....
First heard of accident at.....M, through.....

Below is a diagram showing exact location of car or vehicle or person, connected with accident, with reference to tracks, street and cross streets:

Form No. 3 is prepared by the inspectors and assistant claim agent, who interview all witnesses and prepare all final information in this department in connection with the accident. The headings that are shown on the first page of this form are inteuded to sufficiently cover all desired iuformation which would be of any service to the company, in defending a claim instituted by injured parties. On the second page of this form a blank page is left for a careful, detailed drawing showing, as is stated on the page, the location of car or vehicle or person connected with the accident, with reference to tracks, street and cross streets. This drawing is made up from the preliminary drawing prepared by the conductor (Form No. 2), and also from additional information which is obtained from witnesses by the inspector after thoroughly looking up the case.

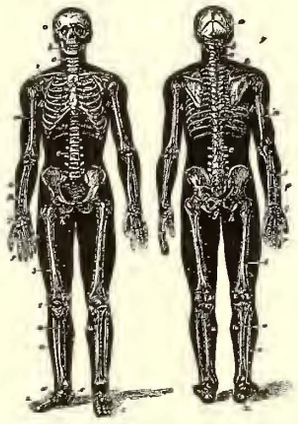
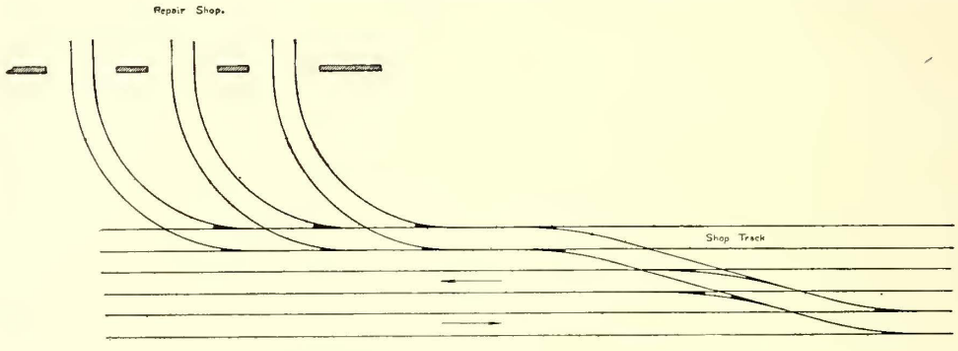


DIAGRAM SHOWING LOCATION OF INJURIES



PROPER ARRANGEMENT OF CAR HOUSE ENTRANCE CURVES

Form No. 4, we believe, is entirely original with the Canal & Claiborne Railroad Company, and was suggested by the company's physician, Dr. Jos. T. DeGrange. The various headings on the first page are intended to cover all informatiou which would be useful in defeuding an accident case, looking at it from the physician's standpoint. The second page contains two cuts (see above); these blanks are made up in detail and are meant to be analogous to the statements in Form No. 2 and Form No. 3, only from a physician's standpoint of consideration.

Form No. 4. (Four pages.)

(Page 1).

CANAL & CLAIBORNE RAILROAD COMPANY.

Physician's Accident Report No .....

Name of person injured.....
Address of person injured.....
Color.....Age.....Occupation.....
Physical and mental condition.....
General condition at time of accident.....
Date of accident.....Time.....M.
Place of accident.....
Date of physician's first examination.....Time.....M.
Place of first examination.....
Number of calls after first examination.....
Car No.....Line.....
Conductor.....Badge No.....
Motorman.....Badge No.....

(Second page contains diagrams of human body given above, third and fourth pages space for a full report by the physician).

Immediately after an accident, the physician examines the injured person,and notes carefully all points of injury. These are located exactly upon the figures as mentioned so that at any future time if a claim is brought against the company for injuries, this report, which was made on the day of the accident, may be passed to a jury to show the exact location of injuries, thus refuting any false claims that may be made for injuries other than those actually sustained. Pages three and four are left blank for the physician's complete descriptiou of any points otherwise not covered in the report.

All of these reports are printed and written in copying ink, and the copy book kept in the offices of the company, while all of the original data are turned over to the attorneys of the company, and filed in special files prepared for these cases.

G. H. Davis, Gen Man..

A Poor Piece of Engineering

Steelton, Pa., Jan. 11, 1898.

Editors Street Railway Journal:

Referring to letter in the January number, entitled "A Poor Piece of Engineering," the danger which a "facing switch" involves is rarely appreciated until attention is called to it by some such accident as that related by J. F. H. If this had been a left hand crossover, the accident might easily have been attended by loss of life, as has been the case in at least one case of which I have knowledge.

While the plan which J. F. H. proposes does away with the facing switch, it is still far from a convenient one to operate. To enter house from the main track farthest from house, requires three reversals of the movement of the car. From the nearer main track requires two reversals. In the plan shown herewith, all facing switches are also eliminated, and only one reversal is required to reach the house from the farther track, and two from the nearer.

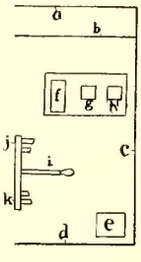
Chas. A. Alden.

Ingenious "Booster" Connections

Philadelphia, Pa., Jan. 5, 1898.

Editors Street Railway Journal:

"Making the most of things," is the street railway man's watchword now-a-days, and the man who really can make the most of things generally comes out pretty near the top. In a power house not long since, I found a very ingenious arrangement of the generators, whereby one, or three, might be used as the very fluctuating travel demands.



In the drawing, the line is shown, the several divisions being designated as follows: *a* and *b*, branches; *c*, main line, and *d* an extension of the main line 3 miles long and beginning about 5 miles from the main power station in which were three units; *f*, a modern direct connected generator running at 90 r. p. m. and having an output of 1300 or 1400 amps. The smaller generators, *g* and *h*, were of the type of five or six years ago. At *e*, another station was located which could start one of the older generators at will.

This company operates about 160 cars, and has a sea-side resort at the end, *d*, and travel varies from a full load for all the units, to a small load for generator, *g*. In the main power station, connections are such that the three generators can all be operated in multiple, or as travel demands, the liue, *b*, can be put on unit *g*, and the main line and branch, *a*, operate from *f* and *e*. By another combination, the generator, *h*, can be connected up as a "booster," and the main line, clear to and including *d*, may be operated from unit *f*, and the booster, *h*, without the use of the generator at *e*.

The connection of the generator, *h*, is through the switch, *i* (shown in detail), and when the lever, *i*, is thrown in contact with *j*, the generator is running in multiple with the others, but when the lever is thrown to *k*, the connec-

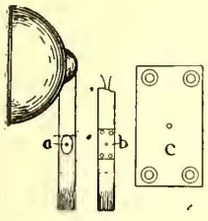
tions are such that the machiue becomes a "booster," and works in that capacity with whatever feeders may be connected with it. The switch connections are such that either of the branches can be "boosted" or isolated to a single generator at will. JAMES F. AUSTIN.

Headlight Contacts

NEW YORK, Jan. 15, 1898.

EDITORS STREET RAILWAY JOURNAL:

Some of the electric headlights used on trolley cars take curreut through a pair of brass contacts placed one on either side of a hardwood plug which supports the lamp when it is in position in front of the car. One of these reflectors is shown by the drawing, and current is taken through the oval brass contact shown at *a*, in the engraving; the other contact is on the opposite side of the wooden plug.



I have found that the connections are bettered by using a large plate, as shown at *b*. The wires lead down through holes in the wooden plug, and care must be taken not to cut them while cutting away the wood to receive the larger plate, which is shown in detail at *c*, the screws iu each corner being countersunk enough to surely prevent them from ever touching the spring contacts in the lamp holder.

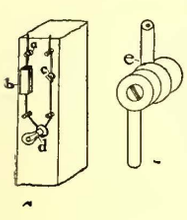
F. H.

Fire from Using Old Wire

OMAHA, Neb., Jau. 12, 1898.

EDITORS STREET RAILWAY JOURNAL:

A case of fire from the use of second-hand wire has just been brought to my notice, aud the manuer of the occurrence is so likely to happeu in any power house, that all electric workers should know of it. The situatiou was about as shown iu the drawing herewith. The car sheds were lighted by lamps placed five in series, in the manner usual to railway lamps, and each lamp was dropped down on a post as shown at *d*, in the illustration. A fuse box was located at *b*, and the usual switch at *c*, for use when the lamp *d*, had to be renewed or when for any reason it was necessary to cut out the series of lamps without going to the regular controlling switch.



The trouble occurred at *a*, and the post was set on fire at that point, supposedly by an arc which formed between the ends of the wires which were found to be broken at this point. In the investigation it was found that the wires used for putting up these lamps had been used before for some temporary purpose, and it is supposed that at the point of bending around the small insulator, shown in detail at *e*, the wire had become so strained that it gave way soon after it was put on the post, aud, being held only by the insulation, an arc was formed as the wire got jarred enough to separate the ends to arcing distance. A good deal of care should be taken, when using second-hand material, to make sure that it will not fail in some manner that may increase the fire risk, or damage the business of the company by causing awkward delay on the lines. R. M. PETERSEN.

Some Points on Poor Car Construction

CHICAGO, Jan. 3, 1898.

EDITORS STREET RAILWAY JOURNAL:

When passing a car if you see that a mortise is too wide for the post so that the tenou does not entirely fill it, it is safe to conclude that the work is poor. Some builders will say that such a thing is impossible, that no one does such poor work or at least "it is never done in our shops." There are a few shops where it is uot done, but there are five or six shops in the country where one may stick a strip from a visiting card into the mortise alongside almost any of the posts. Neither good glue joints nor careful workmanship in finishing a car will make up for such a slighting of work in the car framing.

In putting in wood screws the hammer is often used instead of the screwdriver. This appears a trifling matter, but a screw driven with a hammer has a small hold on the wood, in many cases not more than that of a wire nail. As the strength and durability of the car depend on the care with which the joints are made, it is clear that the use of the hammer instead of the screwdriver is a great detriment to the durability of the car.

It is said that from the nature of the case, the modern motor car cannot last as long as the old horse car. Managers are to some extent accepting this as truth and are arguing that workmanship will have little to do with their durability. Cars are supposed by this class of managers to last for a short time only under any circumstances.

Poor cars, poor tracks and the general ignorance of all builders in regard to what was needed in motor cars have been the causes which have produced such ideas. With more experience it has been found that the rapid destruction of a motor car is not a necessity.

A hard riding truck will do much toward shaking a car to pieces, and so will a bad track. With good workmanship, however, a car of the modern types will show a long life even in motor service, while a car in which the framing has been carelessly put together will not, and cannot, in the nature of things, endure more than eighteen months without showing signs of punishment. A car of this kind will be in a bad way structurally before the paint and varnish show much need of retouching.

Splices in the rails and plates are inexcusably bad workmanship, and the impossibility of keeping water away from these joints is among the objections to them. The common experience of all car builders is that the joints open under the influence of strain and wet. Roofs are not usually kept in such good repair as to exclude water at all times from the plate while the rails and other long sticks are exposed more or less to water. Against this there is only the protection of paint in some cases, and varnish usually. Neither the one nor the other are waterproof. Only a little dampness is needed to start a glued joint and the stick after a few wettings is practically in two pieces.

Loose mortises, hammer driven screws, aud spliced rails and plates are among the principal points of poor construction which send a car to the scrap heap with great rapidity. Green lumber also is among these and is one of the things that all car builders claim they never use. Probably no green timber ever goes into a car as such. But there is such a thing as seasoning wood so rapidly that its strength is but a small fraction of what it should be. Steam boxes highly heated will take the moisture from a stick of timber or a plank in a surprisingly short time, and with the moisture they remove the strength very effectually. Steam dry houses are very useful. They are, in fact, indispensable. They are, however, most useful in finishing the air seasoning, which should take several years. I have not found so much trouble with the actual greenness of the stock used in cheap cars as might have been expected. It was always dry, but its strength was often a minus quantity. Quickly seasoned stock is just as dry to all tests as the best lumber in the world, but there its virtue ends.

R. M. JOHNSON.

The True Cost of Motive Power

KINETIC POWER COMPANY,
NEW YORK, Jan. 25, 1898.

EDITORS STREET RAILWAY JOURNAL.

In your November, 1897, issue, you published the "Report of the Committee of a Standard System of Accounts," covering a very exhaustive treatment of the classification of electric railway accounts, etc. I wish to sug-

gest that a different classification of items of maintenance cost would be better. For instance, as there are other systems of motive power, it would be decidedly preferable to arrange these maintenance cost items, which constitute motive power cost, in an independent classification for the purpose of comparison with other power systems. If there were no other power systems, perhaps this would be unnecessary, for in that case, the investor, who knows what he invested, finds it perhaps sufficiently interesting to know how much he gets out of the investment.

In the Committee Report referred to for illustration in class "A," on page 772, repairs and renewals of track and roadway and electric track construction, buildings and improvements are all classed together, while it would seem that certainly a part goes to permanent improvement of property and some to motive power. In class "B" repairs and renewals of steam plant, electric plant and "*cars*," among other things are massed together, and most of this class "B" obviously relates to motive power, but the repairs and renewals of "cars" relates to general operating expenses and not to motive power. Following out this idea there are numerous inconsistencies but time and space now forbid.

I maintain that, strictly speaking, the motive power cost of a railway system contemplates every item of cost of every element going to the development, transmission and maintenance of the particular power *at* the place of use or application, namely, at the motor car wheel.

From the last Railroad Commissioners' Report of Massachusetts the following motive power items are taken, for the West End Street Railway Co.: Repairs of electric line construction, $201,171.78; repairs of electrical equipment of cars, $184,432.48, renewal of horses, $17,877; harness, shoeing, veterinary, etc., $16,718.50; provender, $36,608.82; cost of electric motive power at power house, $715,762.28. Total, $1,172,570.86. Total car mileage during the year, 25,841,907. Motive power cost as per above figures per car mile, 4.58 cents.

From the New York Railroad Commissioners' Report are taken the following motive power items of the Brooklyn Heights Railway Company, for year ending June 30, 1896: Operation at power house, $94,848.19; fuel, $86,951.98; trucking, $7,106.38; hired power, $3,313.44; repairs of overhead construction $39,543.81; repairs of electrical equipment of cars, $176,698.44; repairs of steam plant, $23,941.09; repairs of electrical plant, $3,317,79. Total, $435,721,12. Total passenger car mileage, 21,500,745. Motive power cost per car mile as per above figures is a fraction over 2 cents.

It is obviously certain that there are many items of true motive power cost omitted from the above showing of both roads. It is equally certain that were all the elements of cost included, the real motive power cost for each would be upwards of 6 cents per car mile.

From the same New York Report, I find the following items of motive power cost of the Manhattan "L" Railroad, for the year ending June 30, 1896: repairs and renewals of locomotives, $244,993.68; repairs and renewals of shop machinery and tools, $9.372.76; stationery and printing, $1,897.71; other expenses, $77,074.08; fuel for locomotives, $825,490.26; water supply for locomotives, $86,508.03; oil, tallow and waste for locomotives, $24,197.89; other supplies for locomotives, $2,804.85; total, $1,272,339.26; passenger train miles during the year, 9,827,702. Most trains consist of one locomotive and either four or five cars. Assuming each train to consist of four cars and locomotive, weighing, without passengers, as follows: each car 15 tons multiplied by 4 equals 60 tons; adding weight of locomotive, 20 tons; total, 80 tons weight of train without passengers.

Motive power cost of each train mile as above in round numbers is 13 cents, and each car (averaging over 16 tons) mile $2\frac{3}{5}$ cents.

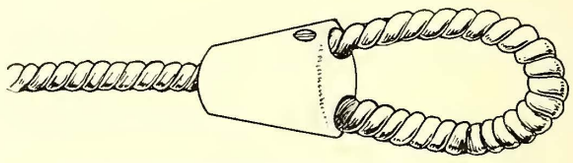
Evidently there are wrongly included items in the Manhattan case and that the converse is true respecting each of the above electric roads.

With horse roads it was the practice, and rightly, to include veterinary, blacksmithing, hospital service and depreciation of horses as well as labor at stable, provender, water, etc. If depreciation and interest upon added cost of electrically equipped roads are properly figured into the motive power cost, the excessive cost of operating electric roads will be still further shown.

It should be remembered that the cars of the Manhattan are much heavier than the electric, and that Manhattan transit speed greatly exceeds the electric, which means greater draught upon power. Arthur P. Dodge.

A Trolley Pole Rope Kink

The accompanying sketch shows an ingenious way of making the loop on the end of the trolley pole rope for holding the trolley pole. The rope is usually attached to the pole by an ordinary knot, but the latter often becomes jammed, and to loosen it often takes time. As will be



DEVICE FOR LOOPING TROLLEY ROPE

seen, the device consists of a brass sleeve with a screw device for holding the end of the rope. The free end of the rope then slips easily through a second hole in the sleeve, so that it can be drawn up tight. The device is an invention of John Wright, of the company's car shop force at Glenwood.

Street Railway Accidents*

By Henry A. Robinson

Accidents on street surface railroads, with their accompanying expense, are a nightmare to the practical operating railroad man. To the sensitive president, who is keen and alert to obtain the best workings of his system, it stands in the light of an unspoken criticism of his theory and efforts. To the treasurer, careful of the contents of his strong box, the payment of the adjusted claims day after day, seems simply short of a larceny from his person. The general superintendent meantime tries to conceal his disgust at the futility of his efforts to carry out in a practical, workable form, the theory which his president has advanced for his guidance. Whatever joy may arise out of the circumstances seems to be reserved for the lawyer for the injured party and his chief medical adviser.

Complain as we may of the great increase of accidents on street surface railroads during the past few years, and their continuance at the present time, we must concede that they are necessary evils of the situation developed by mechanical traction, but must at the same time, endeavor as best we may to repress and diminish them. There may possibly be something to be thankful for in the comparison between the losses sustained by our larger steam railroads with those of the steam roads, as the case is plainly in favor of the city lines. The late accident at the crossing of the Pennsylvania Railroad and the Philadelphia & Reading Railroad in southern New Jersey, known as the Atlantic City disaster, resulted in payments to the injured of $800,000, while the largest sum to be paid by the Metropolitan Company for the result of accident to a single person, or any number of persons in a single disaster has not exceeded $15,000.

The great extent to which the accident business has grown during several years under the active operations of that class of lawyors known as the "Ambulance Bar," is evidenced by the report of the West End Railroad of Boston, which, by its Annual Reports, spent in each of the years 1896 and 1897, $325,000 in efforts to satisfy the demands of the injured.

The numerous suits which are instituted against the company are largely the work of the lawyer who devotes himself to the study of this class of business, and has become a specialist in his line. To his activity and hustling capacities is due the expenditure of at least one-half the amount paid annually on the accident account. As an evidence of the ingenuity of this class of persons, an instance took place within the confines of the city of Brooklyn, where, within one hour an a half after the person was thrown from a car, a law suit was started against the company. An investigation of the case demonstrated that while the injured person was lying upon the floor of the drug store, being attended by the druggist's clerk, the druggist himself was at the telephone advising a doctor and a lawyer of the facts of the case. The united and active efforts started a law suit within the time above mentioned.

* Abstract of paper read before Metropolitan Street Railway Employes' Association of New York.

To make a proper presentation of a subject, a writer ordinarily has recourse to the literature gathered by earlier writers on the subject, but the rule fails when applied to the subject of accidents, and I am obliged to resort to a simple statement of the causes of and situations under which the street car accidents arise. To be sure, you will find many a paper by learned railroad officials on the best method of settling accident cases, but you will search indefinitely for a practical treatise on how to prevent them. Perhaps this lack of written authority on the part of officials comes from a wish to cover up undesirable details, which are reflections on the service, or from a desire to conceal a financial loss. In my opinion, however, the condition arises chiefly from the great difficulty of knowing how to deal with the many and varied conditions that surround particular cases, which in many cases paralyze the operator and leave him in a state of ignorance and doubt.

Prior to 1893, the intelligent minds which manage the practical affairs of our company saw that with the introduction of mechanical traction there would be a great increase in the number of accidents which would occur on the new lines of travel. The congested character of Broadway, the narrowness of Lexington Avenue and Fifty-third Street were the strongest indications that undesirable results were sure to follow, particularly as the speed of cars was increased to give the public a semblance of rapid transit. The accident work then, and for many years prior, had been handled by the superintendents of the various individual roads, with the assistance of the road inspectors. This was a system well enough in its way for a few scattered cases, but wholly inapplicable to the work of a large system. A new plan was formulated, and its products are the Claim and Investigating Departments of the present day, as well as a systematized Legal Department under which the court work is carried on. A short synopsis of the work these departments are expected to perform may not be uninteresting.

I. Investigating Department.—Under our system, the men, as you know, are expected to report at once to the accident clerks of their respective divisions, who take their statements and the names of such witnesses as the conductor has been able to obtain. These reports are sent to the head office and distributed intelligently among those investigators best fitted to look up the particular case. While the witnesses' statements are being taken, the medical examination of the injured party is held, and the results of both injuries are turned over to the Claim Department.

II. Claim Department.—The latter department, when properly equipped with information, is now in a situation to deal intelligently with the injured party or his lawyer. Of course, the first demand from a person who has received an injury is, so far as its size is concerned, a wholesale strike. The patient is decorated or surrounded with all the necessaries of the sick room and the requirements of a cripple. He calls on you with a hand or foot done up in ancient cloths which are dipped in liniments and smell like a traveling hospital; he wears an old shoe with a piece cut out for comfort, while his limping frame is assisted by a cane or crutch. His tale of woe is punctuated by groans of pain, which seems to be visible on every lineament of his countenance. Investigatons of many of these cases show that the crutch and painful expression are both laid aside when the patient leaves the Cable Building, while the money demand diminishes extraordinarily as the time of settlement is extended from week to week.

An investigation of our accident claims for July, August, September and October, 1897, discloses the following percentages of the total accidents chargeable to each line.

Broadway cable	21	per cent.
Columbus Avenue cable	17	" "
Lexington Avenue cable	17	" "
Lenox Avenue electric	8	" "
Horse Lines.		
Belt Line	7	" "
Green Line	4	" "
Sixth Avenue	4	" "
Twenty-third Street	3	" "
Avenue C	3	" "
Fourth Avenue	3	" "
Eighth Avenue	3	" "
Seventh Avenue	2	" "
Metropolitan Crosstown	2	" "
Thirty-fourth Street	1	" "
Chambers Street	1	" "
Fulton Street	1	" "

Of the total number of accidents on the Broadway, Lenox Avenue and Belt Line Divisions one-fourth occurred on open cars, on the Lexington Avenue Division, one-third, and on the Columbus Avenue Division one-sixteenth.

MOVING CAR CASES

As to those cases which we designate as moving car cases, the claims are about equally divided between mistaken efforts of passengers to get on the car while in motion, or to alight from it before it has come to a standstill. I regret to say that most of the cases of personal injuries while getting on cars, take place at the various terminal points or transfer stations which do the largest amount of business. With the rush and hurry of numerous passengers pushing and crowding each other, I have no doubt that a large number of cases are due to their own carelessness. It is very difficult, on the crowded divisions, at transfer points, to determine whether all the passengers are safely on the car floor or platform. Numerous passengers frequently appear from behind the rear platform and get on the step in time to be thrown off just as the car gets in motion. It would seem from a fair consideration of a number of the cases that such accidents are not the conductors' fault although when submitted to the consideration of juror, the conductors are uniformly found to be to blame.

The large number of claims presented by ladies are claimed by them to have occurred by reason of the starting of cars before they have safely reached the ground. I regret to be obliged to say that personal experience and the testimony of a large number of disinterested people demonstrate the fact that the efforts of the passengers to reach the ground are too frequently discounted by the conductor, and the traveler thrown in the street through his efforts. I cannot too firmly impress upon you the necessity of giving passengers ample time to leave the car and secure a firm foothold before the starting signal is given. It is fortunate for the company that the injuries which passengers sustain are rarely serious, although there are numerous cases of grave injury where the passenger has become disabled for life through the conductor's carelessness. Many of these cases arise from the fact that the signal is given while the conductor is in the car and in a position where he is unable to see the step.

THE ELEVATED PILLAR CASES ON NINTH AND COLUMBUS AVENUES

The company is exposed to a large number of cases by persons who receive injuries from coming in contact with elevated pillars. The courts have fortunately held that the Ninth Avenue Company, having laid its tracks in the street before the elevated road was built, was not responsible to passengers who received injuries from contact with these pillars while changing seats in open cars. The class of cases, however, which arise from a too sudden starting of the car where the rear platform is near an elevated pillar, and as a result of which, the passenger is thrown against it, are of an entirely different character. The company is fairly censurable for failure to allow passengers sufficient time to get inside the car body, and must necessarily be responsible for the mistake of a too speedy starting. There is also a class of cases where passengers have been brushed off the cars by wagons standing along the street, and in such cases the company has been exonerated from blame, as the courts have held that passengers should not take passage under such circumstances.

CROSSING STREET ACCIDENTS

This is a very serious class of accidents, with which the Law Department has great difficulty in dealing. The rights of the foot passenger and the railroad company at street crossings are equal; that is to say, the company has no superior right over a foot passenger. The conditions in the middle of the block between street crossings are somewhat different, but the accidents occurring by reason of people being struck between the streets are so infrequent as to eliminate the question from consideration. I regret to say that the courts of this state are not consistent in their decisions as to the rights of foot passengers at street crossings. They formerly held that a foot passenger must look up and down the street and use such care as the circumstances required to avoid contact with a car. They have departed from this theory to such an extent, that the following ridiculous situation is frequently presented: an elderly lady will swear that she left the east sidewalk of Lexington Avenue, and before stepping from the sidewalk she looked both ways, up and down Lexington Avenue and could not see any car within two or three blocks; she starts from the sidewalk and takes three steps forward when she is immediately knocked down by a cable car, the gripman of which, she, of course, says, has failed to ring his bell. The courts have submitted this question to the jury, to say whether the foot passenger was properly careful under the circumstances or not, and their action in the minds of many people, although legal, is not common sense. The proper legal rule or guidance for gripmen would seem to be that they must ring their bell before approaching street crossings and slow down their car. Even under such circumstances, the jury may be allowed to say whether they should not have done something else, but no other general rule of conduct can be laid down.

Under the head of crossing cases I wish to call the attention of both conductors and gripmen to the large number of cases which occur at the rear end of cars. Passengers alighting from cars on the right hand side pass quickly around the end of the car and are promptly struck by a car coming in the opposite direction. If the bell of the moving car is ringing and the speed somewhat diminished, the courts have held consistently that the company is not liable for the accident. To escape from this result the injured party under the guidance of his counsel always swears that the moving car was running at a high rate of speed, and the bell not ringing, and this situation presented by him carries the case to the jury for their consideration. The injuries arising under these circumstances are, as a rule, severe, resulting in broken legs or arms, fractures of ribs, dislocations of hips and other serious results. Permit me therefore again to impress upon you the necessity for the great care in situations of this kind, and ask your assistance in minimizing as far as possible the undesirable results which follow.

Under this title (crossing cases) I must call your attention for a moment to persons who cross hastily in front of one car and find their progress cut off by cars coming in the other direction. When in is this position, they are frequently hit by the stanchions, or by the handles of one of the cars, and are tossed against and under the second bar in such manner as to require a very sudden stop to save them. In the case of Davenport vs. R. R. Co. (106 N. Y., p. 9) it was there held as a matter of law that a person knowing the dangers of this position between cars passing in opposite directions, in assum-

ing it took the risk of the situation, and the company was not liable for the injuries which he sustained.

However, this rule favorable to the railroad has been somewhat departed from in the later cases, and the tendency of the courts now seems to be to allow a jury to say as a question of fact whether the person is or is not negligent in running over in front of an approaching car into the dead track between cars. With this legal situation to confront the grip or motorman, the only course to persue seems to be to bring the car to a standstill, if possible, before the citizen is reached or at least make proper efforts to slow down.

This rule, though beneficial to the public, can scarcely be observed in the cases of those Broadway policemen who habitually stand between passing cars, and at the same time get the traffic along the road in "Rapid Transit Style."

WAGON ACCIDENTS

Substantially the same legal doctrines apply to the drivers of wagons as are applicable to passengers crossing at the crosswalks. When a wagon and a car are approaching each other at right angles, the rights of the driver of the wagon are equal with those of the railroad company. In the wider streets of the city there would seem to be but little excuse for right angle collisions between cars and vehicles, while upon those narrow streets like Lexington Avenue where the wagons frequently drive from the side streets at great speed a fair consideration of the hundreds of cases would seem to me to exempt the gripman from liability. Under this category, allow me to call the particular attention of the drivers and gripmen of cars operated under elevated roads, to the dangers of the situation. I regret to say that a great burden is thrown upon the company by reason of the many serious accidents which have been occasioned by cars running into wagons and jamming them against the elevated pillars. Strange to say, the injuries received by drivers of wagons under such circumstances, are frequently of the most serious character, and they have resulted in many law suits involving responsibility for the death of the drivers.

Those classes of accidents which arise from colliding cars and defective machinery are those for which the company is plainly responsible to its passengers, although the best efforts are sometimes used to prevent the results. The numerous accidents which have occurred by running into open switches, both on cable roads and horse roads, as well as the rear end of wagons on the track ahead, are as a rule, inexcusable, and the superintendent's conduct in administering severe discipline for the breaches of the rules which he has used, is to be highly commended.

There are a large number of incidental claims which seem to arise from the magnitude of the business, for which the company is quite responsible, but which could be avoided by particular care on the part of conductors, and under this head I include the injury to passengers' fingers caused by dropping the seat backs or the side poles and the shutting of doors during the winter. The burning of passengers' clothing by the falling of the heads of matches which are used for the purpose of lighting the lights in the cars are of frequent occurrence and should be avoided.

Without burdening you further with the details of this business, let me present the following important matters to your consideration and ask your strict observance of them:

First.—Always report to the Accident Clerk the occurrence of any accident, whether you have procured the name of the injured party, or witnesses, or neither, or whether in your opinion the injured party has sustained any injury or not. The presence of these records on the company's files is of great assistance in determining whether the law suit which follows is what is popularly known as a "strike," or whether some accident occurred to the claimant.

Second.—Always give a truthful account of the happening of an accident. In cases where the company is liable, it must pay a claim sooner or later, and as it can compromise and settle the claims cheaper in their early stages than after a litigation lasting two or three years, it is highly desirable that it should be done. The company has no intention or desire of avoiding any just responsibility, and it seeks an opportunity of adjusting and compromising such claims as are fairly honest in their appearance, and which can be discharged by the payment of a reasonable sum of money for expenses.

The care which should be exhibited to passengers varies with the circumstances of the case, but I feel sure, with the great intelligence displayed by employes, and the interest, which, as a rule, they exhibit in their business, with the results of their careless actions towards passengers in contemplation that the accidents will diminish and the company receive great benefits from their interested efforts.

The Relations between the Customer, Consulting Engineer, and the Electrical Manufacturer*

By S. Dana Greene

The subject which I have chosen for this paper is an eminently practical one, and I shall endeavor in my remarks to call attention to certain causes of friction which at present exist between the parties in interest and to suggest certain remedies which may serve to bring about a better understanding and to lessen this friction, which is, in my opinion, entirely unnecessary.

The manufacturers of apparatus and the manufacturers of current are dependent upon each other to a large extent, and their relations should be close and friendly. The consulting engineer, as in other engineering trades, is a necessary and proper connecting link between the two, and I can say frankly that I believe he has a proper and permanent field of usefulness. Broadly speaking, his function is to see that his client who buys apparatus and installs it, selects first that system best suited to his particular local conditions, and then, in purchasing, secures the best (not necessarily the most) for his money. It is equally the duty of the consulting engineer to learn what the manufacturer can reasonably be called upon to make, to consult with him freely and to obtain the benefit of his experience; to give him credit for work well done, and to insist that bad work shall be promptly corrected. Many consulting engineers, especially those who have recently commenced practice, seem to think that it is improper for them to consult with the manufacturer, or to examine his plant, or to ask him for information or advice. Their idea seems to be that, by so doing, they may be accused of partiality or undue bias, or with lack of proper care for the interests of the purchaser; or they may feel that it is derogatory to their own dignity as independent engineers. The inevitable result is that specifications often contain provisions which are a source of annoyance and expense to the manufacturer and purchaser alike, and which have no compensating advantages, from either the engineering or commercial standpoint. In fact, some of these provisions are impossible or impracticable of fulfillment; and in such cases the honest manufacturer who wishes to meet the specifications and guarantees required, finds himself forced to ask the engineer or the purchaser (sometimes both) to modify them. This is a proceeding which is always difficult and delicate to undertake, and often results in friction and trouble for all concerned. I am satisfied that if every consulting engineer would take advantage of opportunities as they occur, to visit manufacturing establishments, see the work there in progress and confer with the engineers, he would find himself well repaid for the visit, and his own work and practice benefited thereby. I am equally satisfied that no reputable manufacturing establishment would refuse admittance, but, on the contrary, would welcome such visits as beneficial to both parties. The day of mysterious methods of manufacture carried on behind closed doors, is passed in the electrical business, and I appeal with confidence for an endorsement of the opinions just expressed, to those consulting engineers who have already tried the plan suggested. I have said that I thought the engineer would find himself repaid by such visits. I think, also, that he will find himself in a better position to advise his client intelligently. A purchaser usually knows little or nothing of the relative technical merits of apparatus, and his final decision is governed largely by price and by paper statements and guarantees, which may mean much or little. The consulting engineer who has seen the apparatus in process of manufacture can advise not only as to whether the various bids comply with the specifications, but also what make or makes of apparatus are, from their design, construction and factory inspection and test, most likely to give the least trouble and expense in continuous service.

Some engineers seem to measure their value to the purchaser by the length of their specifications, and some of these formidable documents strike terror to the heart of a busy man confronted by a deskful of mail. The specifications not only specify what the conditions of service are, what apparatus is required and what tests shall be applied to it for acceptance, all of which are quite proper; but also how it shall be built, which is another matter. The electrical manufacturers of this country, following the admirable precedent which has given American manufactured products (particularly machinery) a world wide reputation, have endeavored to establish standard lines of apparatus, whenever the permanency of type and the size of the demand warrant it. This practice not only tends to reduce cost (and with it price), but also enables the purchaser to secure quickly and at a minimum of expense, duplicate parts which are really duplicates and which can be fitted without the aid of a skilled mechanic. It is the American system of standard lines of machinery and interchangeability of parts, which has stood the test of time and which holds its own against all competitors. This system, however, is possible only where the same article is manufactured in quantity, since the expense of designs, drawings and patterns, special tools, jigs, dies, etc., is prohibitive unless spread over a large production. On the other hand, if special apparatus is required, it means a relatively large expense for these items, which cannot be charged to a standard product, and which thus constitutes a handicap to both the manufacturer and the purchaser. A machine is "standardized" only after long experience, both in manufacture and service, and other manufacturers (the builders of engines, trucks, etc.), as well as the users, are invariably consulted before such standardization. It would appear to be to the interest of both seller and buyer to use such standard machines wherever and whenever possible; and yet it seems to be a fact, that the demand for special machines is increasing, rather than decreasing, as apparatus becomes more generally standardized. To prove this I can cite the experience for the past year of one manufacturing company, with which I am familiar. During this period, the designing engineers were called upon for estimates on special apparatus, as follows:
Direct current:

Number of estimates	300
Number of kilowatts of apparatus involved	31,000

*Abstract of paper read before the New York Electrical Society, Jan. 12, 1898.

Alternating current:

Number of estimates	300
Number of kilowatts of apparatus involved	131,700

These estimates were all embodied in formal propositions; besides these were between two and three times as many preliminary estimates required to answer inquiries of customers, which the engineers had to prepare.

This was in addition to their regular work on standard lines of apparatus, of which there are over thirty. Some of this work was undoubtedly due to new developments in the business and to new methods and inventions, a condition which, although unfortunate from the manufacturing standpoint, must exist for many years to come; but a great deal of it was also due to the fact that specifications call for special apparatus, or methods of construction, where standard apparatus and methods would do equally well. This experience I find is common among electrical manufacturers, and I attribute it largely to lack of touch between the manufacturer and the engineer drawing the specifications, whether he be regularly employed by the purchaser, or retained in an advisory capacity. Let the engineer see more of the manufacturer and his work and let him hold the latter responsible for results, as determined by proper tests, leaving the details of construction where they belong, in the manufacturer's hands.

This brings us to another phase of the subject, viz., the tests and guarantees prescribed by specifications. Omitting from consideration matters which, as already stated, belong properly to the designer and builder, such as current densities in the windings or in brushes, methods of insulation, kinds of material, etc. etc., the tests necessary to determine a machine's quality (and hence its value to the purchaser) are few in number and can be enumerated under the headings of efficiency, heating, regulation, sparking and insulation. If the requirements under these five headings were formulated under some general rules, and if the methods of tests to determine results were uniform, the work of the consulting engineer and the manufacturer would be vastly lessened. Such, unfortunately, is not the case, and specifications on these points vary widely both as to requirements and as to the method of test. It seems proper to call attention to some of the points which most frequently give rise to misunderstandings and disputes.

1. *Efficiency.*—The proper distinction between electrical and commercial efficiency is not made. The latter is what interests the purchaser and it should always be specified. A clear statement of what losses must be included to determine it, and also a general statement of what constitute reasonable and proper commercial efficiencies in well designed machines would be of great service. Such a statement should show the necessary difference between carbon and copper brushes, and between the voltages most commonly used in direct current work, viz,. 125, 250 and 500 volts, as well as between machines of various sizes. The formulation of such information on alternators is more difficult, but all manufacturers have certain standard lines of these machines and it is quite possible to make some intelligent general rules.

Electrical manufacturers are sometimes required to guarantee the combined efficiency of generator and engine (or other prime mover). This is clearly unfair and shifts the direct responsibility of guarantee from the maker of the prime mover, where it properly belongs.

2. *Heating.*—For all ordinary conditions of service, the safe heating limits for continuous full load operation can be determined with a fair degree of accuracy. The commutator heats more than any other part of the machine, particularly with carbon brushes, a fact which is often ignored. Sometimes the heating is measured by thermometer, sometimes by increase in resistance. There should be one uniform method followed. Overload guarantees (ranging from 25 per cent to 100 per cent) are sometimes required for a period within which the ultimate temperature of the machine is reached, and the necessary capacity of the machine is thus increased as certainly as though a larger machine were specified. It would seem that the time duration of overload tests should bear some relation to service conditions. If the service requires a 50 per cent overload for eight hours or more, a larger machine is evidently necessary.

3. *Regulation.*—Specifications frequently call for a straight line compounding curve, a condition which is practically impossible until we discover a magnetic material which has a straight line saturation curve. Another common requirement in the case of lighting generators, is that a drop of, say, 2 per cent in speed shall not affect the e. m. f. more than 2 volts, which is also an impossible condition, even with a separately excited generator. A reasonable margin in either case, having due regard to the service for which the generator is intended, should always be allowed.

4. *Sparking.*—Modern design, and the use of carbon brushes, have greatly reduced the trouble from sparking, but machines are sometimes called upon to stand excessive overloads without sparking, which can be accomplished only by using a larger machine or by a distortion of design, which is bad practice. Any good machine, with carbon brushes, should be able to stand a variation from no load to full load without movement of brushes and without noticeable sparking; it should also stand a reasonable overload, say, 25 per cent, without injurious sparking.

5. *Insulation.*—This is a cause of frequent trouble and annoyance. The common practice is to specify an insulation resistance of so many megohms, regardless of the size of the machine and the voltage and condition of service. Considering the fact that this resistance varies inversely as the area of surface to be insulated, and considering the enormous variations in size, shape, voltage and service requirements of different machines, it is evident that such a test is impracticable and means little or nothing. Insulation resistance is largely a question of dryness, and if an armature be baked for a sufficient length of time, almost any resistance within reason can be obtained. I have known a large 400 k. w. lighting armature to measure a megohm resistance, as required by specifications, after several days' baking (which, by the way, permanently injures the structural strength of the insulating material) and yet it showed practically no resistance when it reached its destination, because it had been in the rain and dampness for a week or more, and the large surface naturally afforded an excellent lodging place for moisture. A day's run in a weak field, with the armature short circuited, quickly brought the insulation up again.

The only proper way to insure good insulation, with reference both to the material used and the method of construction employed, is by a high potential test applied when the machine is reasonably dry. This test should be intelligently gaged by the voltage of the machine and the service required. Thus a high potential test of 1000 volts is ample to detect any insulation weakness in a 125 volt lighting generator, while a 5000 volt test is ample for a 1000 volt alternator, allowing proper factor of safety in each case. Recent careful investigations have developed the fact that the only correct way in which to determine the proper high potential test for any given machine is to consider jointly the time duration of test, the current frequency and the voltage of machine. As the latter rises, the margin between it and the test voltage necessarily decreases on account of the liability to permanent injury of the insulation when subjected to excessive voltages. Because 5000 volts is found to be a proper test voltage for a 1000 volt machine, it by no means follows that 50,000 volts is proper for a 10,000 volt machine, or that the apparent factor of safety should be the same as the voltage rises. There should be a careful formulation of proper high potential tests for different classes of apparatus, based upon scientific investigation and tests, and it is believed that it would not be a matter of any great difficulty to formulate such a schedule.

We come finally to the commercial requirements which have gradually found their way into specifications, and which are sometimes onerous and unfair. Perhaps the most important of these is the question of shipments. It is not uncommon for shipment to be specified by a certain date, under a forfeiture of so many dollars a day for each day's delay thereafter, and the award of the contract is often largely affected by such promises. The manufacturer starts the work in his shops, and if the time is short he is apt to work overtime. About the time the apparatus is ready for shipment, and without any previous warning, word comes to withhold shipment because the purchaser is not ready to receive it. There were recently fifteen carloads of apparatus lying in the yards of one of our manufacturing establishments, besides a number of large machines stored in the shipping and testing departments, which had been made on time contracts and held at the last moment by request of the customer. It is difficult for one not in this end of the business to realize the resulting demoralization throughout the shops, and it is a condition which could easily be remedied by the exercise of more foresight on the part of the purchaser and his engineer. In all cases where a penalty for delay in shipment is imposed, it is fair and reasonable to ask that a similar bonus should be awarded if shipment is made in advance of promised date, or if the purchaser is unable, through no fault of the manufacturer, to receive the apparatus on that date. It is sometimes required that the consulting engineer shall have full access to the shops at all times while the apparatus is in production. Such permission is impracticable if proper shop administration and discipline are maintained, and these visits should be made at certain specified stages of the work. It is, of course, always proper for an engineer to be present when the apparatus is finally tested.

A clause is commonly found in specifications providing that the consulting engineer shall be sole judge of the true intent and meaning of the specifications; and in case of any dispute thereunder, his decision shall be final and binding. It is true that this clause is common to architects' and builders' contracts, but it is doubtful whether it could be enforced at law, in case of a dispute as to facts, and it certainly seems fair that in case of such a dispute, where the two parties honestly disagree, provision should be made for a third disinterested party to act as arbiter.

While there are many contracts executed which involve one or more of the provisions (technical or commercial) mentioned above as liable to cause trouble, and where no trouble is experienced, due to the common sense and good judgment of both engineer and manufacturer, still the cases where trouble does arise are not infrequent, and the best specification is one so fair and so clear that no dispute or misunderstanding can arise, except with malicious intent, and which requires no arbiter to interpret its true intent and meaning.

In conclusion, let us hope that the customer, the consulting engineer and the manufacturer will, in the future, consult each other more freely and frankly, by personal interview or by correspondence; and that all of them will unite in indorsing any intelligent attempt to standardize such tests and technical requirements of electrical apparatus as are matters of common usage in our daily business intercourse.

THE Chicago & Desplaines Valley Electric Railway Company, Chicago, Ill., has been incorporated by Henry G. Foreman, Charles D. Evans, Philip H. Gray, William H. Hulbert and Clayton E. Crafts, of Chicago. Capital stock, $1,000,000.

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One of the well-known interurban electric railway lines in Ohio has commenced the display upon its cars of the weather bureau signals. The Government forecasts are indicated in the usual way, by flags, which are carried on the hood of the car. The plan is a novel one, and easily put into practice; at the same time it is a great convenience for persons living along the line of route, and would tend to popularize the cars, especially in the outlying districts, where the Government signals or posted notices are not easily accessible.

A paper in another part of this issue offers some suggestions on the proper relations between the customer, the consulting engineer and the electrical manufacturer. There is no doubt but that a better understanding between these departments would often result in economy to the first and better satisfaction to the last. Mr. Greene takes the ground that the customer and the consulting engineer should specify what they wish, but should leave to the manufacturer the question as to how to make it, and points out the evident truth that slight variations from standard apparatus will often add greatly to their cost without securing any material improvement.

The prospects for the construction of an underground rapid transit railway in New York City seem to be as changeable as the proverbial weathercock. A short time ago, when the courts authorized the construction of the line upon the filing of a $15,000,000 bond by the contractors to guarantee the proper fulfillment of the provisions, it was reported that several syndicates were prepared to bid for the franchise. During the past month one of these syndicates—the Metropolitan Street Railway Company—announced that it had decided not to engage in the enterprise, and the Rapid Transit Commissioners confessed that the prospects of the construction of the line are exceedingly vague. In the meantime the Manhattan Railway Company has publicly declared, through its president, that it will equip its lines with electric power, discarding the present antiquated steam dummies. Undoubtedly, the company is also ready to make certain extensions, provided it can make satisfactory arrangements with the Municipality for street rights. No announcement has been made as to the details of the electrical equipment, and whether individual cars will be equipped or locomotives will be used.

Most of the different state legislatures are again in session, and it is safe to say that during the next few months the usual proportion of bills inimical to street railways will be introduced. Among them, the old familiar "No Seat, no Fare," ordinance will probably receive its annual resuscitation in many capitols, and its passage will be urged with all the eloquence of the average legislator, who will hold up, as an example to be followed, the better practice of the foreign tramway companies, who are allowed to carry only a certain number of passengers on each car. Few representatives of the great American public, however, would be willing to conform to the French method of enforcing this rule—of taking their turn in *waiting* for a seat when the cars are full. During the busy hours of the day in Paris, persons are often obliged to wait a long time for a car in which is an unoccupied seat. The temperament of the average American under these conditions can easily be imagined. Those who advocate the passage of a "No Seat, no Fare" bill are usually the ones who will force themselves into an already crowded car when another car going in the same direction, and with plenty of room, is following only a minute or half a minute behind.

During the last month an attempt was made by some of the daily papers in New York, which make a specialty of sensations, to create the impression that the Brooklyn Bridge would be seriously endangered by the use upon it of electric cars. The theory was advanced that the return current would travel over the metal structure of the bridge, which would depreciate through electrolysis. This, it was urged, would be particularly true at the anchors of the bridge where the current left the structure to pass to the

earth in its return to the power station. Those who use the bridge structure, however, we venture to predict, need have no fear on this score. In the first place, all the metal parts of the bridge are thoroughly painted, so that there is little or no danger that the return current will pass from the circuit prepared for it in the rails to the bridge itself. Again, the anchors are deeply imbedded in solid concrete, and by it are about as completely insulated from the earth as they could possibly be by any means. Any destructive action of the current by electrolysis is caused, of course, only at the point where the current leaves the metal conductor, and not at the point where it enters the conductor. After the cars have been placed in operation on the bridge, therefore, careful potential measurements can be made at points on the bridge structure to determine whether there was any leakage to the latter from the rails. If these measurements should show any leakage, it would be an easy thing to connect the bridge by a metallic circuit with the negative bus bar, but it is safe to say that no such protection will be necessary.

In the discussion of Philip Dawson's paper on Electric Traction before the (London) Institution of Electric Engineers, one of the speakers is reported to have denounced with vigor and point "American haphazard methods. Their standards are no standards at all; they go full speed ahead and then have to go astern." There is possibly some basis for this criticism. Nearly the entire burden of experimentation in electric traction has fallen upon America, and it is inevitable that there should have been much duplication of plant in the progress of an industry from birth to what we might call now, perhaps, middle age. Nevertheless, there is one element in the case which is too frequently overlooked by the more conservative engineers and tramway managers both here and abroad, and that is that the pioneers in the industry who have gone ahead courageously and put in the best apparatus known at the time, have frequently made enough money by doing so to purchase more improved apparatus as it has come out. This is true not only where there has been competition, and where the lines equipped with the better motive power have gained traffic at the expense of their more conservative competitors, but also in cities where there has been no competition, for the development of the "riding habit" in American municipalities through the introduction of electric traction has been one of the marvels of the American financial world. Sooner or later this feature will, of course, be understood more generally abroad, but meanwhile "conservatism" will, no doubt, plume itself upon its wisdom, while somewhat forgetful of certain advantages of "progressiveness."

Considerable diversity of practice exists as to the rules permitting smoking by passengers on street cars. So long as horse cars were in service, the question was a very simple one, because smokers were usually permitted to use the front platform, and with open cars they can, of course, be confined to the rear seats. But experience has shown that with an electric car, it is not advisable to allow passengers to ride on the front platform where they can disturb the motorman and interfere with the proper performance of his duties, so that with closed cars the practice has been either to allow smoking on the rear platform or forbid it altogether. The question, of course, is one of satisfying the largest number of the road's customers, and comes down to that of whether the greater number of passengers will be attracted or repelled if the practice be permitted on the rear platform. Upon this point there is a wide diversity of opinion. The Metropolitan Street Railway Company, of New York, and the Brooklyn Heights Railway Company forbid it altogether on their electric and cable cars, while it is allowed on the rear platforms of its cars by the Consolidated Traction Company, of New Jersey, and the Nassau Company, of Brooklyn, and on all the lines in Baltimore. In the latter city the cable lines operate closed grip cars and open trailers, and smoking is allowed on any part of the trailers as well as on the rear platform of the grip and motor cars. The proper method of dealing with this question depends entirely on local conditions. Where long runs are made, and especially in the case of an electric line in competition with a steam railroad line, considerable traffic can undoubtedly be secured by making provision for the smoking passenger contingent, and where long double truck cars are used, it is often advisable to have a 10 ft. compartment in the rear end of the car for smokers, as is done on a few lines now. Where large platforms are employed, smoking can even be permitted on the rear platform without seriously inconveniencing the other passengers, and should this not be deemed advisable, we think that where cars are run under frequent headway, it would sometimes be good policy to run every fourth or fifth car as a smoker. One advantage of this plan would be that older cars could be used for this purpose without exciting unfavorable criticism.

Power Distribution from a Central Station!

The problem of supplying power to a large and widely ramifying electric railway system is always somewhat puzzling, the more so that it lacks at present any general solution. With the very successful introduction of alternating apparatus for power transmission has come, however, a strong tendency to rely upon it as a sort of panacea for the ills of distribution. Indeed it has already been productive of excellent results and promises so well as to deserve very respectful consideration. Fundamentally, however, all power transmission is to be regarded as a necessary evil, brought upon us by the exigencies of extended service. Intrinsically, it is always desirable to generate power near the point of utilization, and this rule is only to be departed from when economy or commercial necessity makes such departure highly desirable. In railway work the motors have to be distributed over a wide area and power must be delivered to them with the utmost economy and regularity. The general methods by which this requirement is carried out in practice are at present substantially three in number—viz., distributed stations, boosting by boosters or storage batteries and power transmission to rotary converters. A road often outgrows the point where it can be properly supplied directly at the usual voltage, and its management then has to face the concrete personal problem of so modifying its plant as to deliver the necessary power in the cheapest and most effective way.

Now the key to the whole situation is the relative cost of power in large and in small stations under approximately equal conditions. If it be possible to generate power in a single large station at a price which will more

than compensate for the added expense of delivering this power over long feeding lines to the general conducting system then the case is a clear one for power transmission. If the saving by generation on a large scale is comparatively small, separate stations should be established. Data on thoroughly modern plants of different sizes are unhappily scarce, and those at hand generally ignore interest and depreciation, which are of vital importance.

Perhaps the most careful estimates yet given are those of Dr. C. E. Emery who certainly must be regarded as an authority on steam power. He has calculated the cost of 24 hour-power per horse power year in a first class modern steam plant of about 500 h. p. to be a trifle less than $40. In a 20,000 h. p. plant this figure is reduced to a little less than $30. The reduction of these figures to a basis of electrical output would not materially alter their ratio. Taking up the matter from the electrical side and considering the best available data from existing plants it appears feasible to deliver electrical energy at the bus bars for, say, 0.8 cent to 0.9 cent per kilowatt hour in cases of good load line at an average output of, say, 1000 k. w. Better results are sometimes claimed, perhaps with reason. With an output of 10,000 to 15,000 k. w. some economies would be possible, but it would be rash to assume in railway work a better figure than 0.6 cent to 0.7 cent. Roughly, then, we are justified in saying that in passing from an output of 1000 k. w. to one of ten or twelve times that amount, we have no right to expect a saving in greater ratio than 3 to 4, while in most cases or with less disparity of output 4 to 5 would be a much safer assumption. In point of fact on the Boston system, which affords about the best opportunity of comparing stations of different capacity under similar conditions, the ratio in question is considerably nearer unity. The meaning of these figures is that whenever the net loss in transmitting power over a feeding system reaches 20 or 25 per cent, auxiliary stations are economically preferable to large single stations in the present state of the art. By net loss we mean not only the actual energy wasted, but the increment of cost due to added interest depreciation and labor involved in the transmission. Now, as an engineering fact, the net loss due to boosters or rotary convertors is usually quite as great as the figures mentioned. When the output is reckoned in thousands of kilowatts, the load lines of a single station and those of several independent stations fall remarkably near together, and the saving due to change of capacity is rather evenly balanced, or often over balanced, by the losses in transmission. In fact, if the scale be turned in favor of transmission, adequate reason must be found in local rather than general conditions. To find in a large city several equally desirable sites for power stations is not always easy, and the questions of cost of real estate and coal supply may have to decide the question in favor of a single station when otherwise several stations would be more desirable. On the other hand, as the total output decreases the chance for profitable transmission of power increases until at 1000 k. w. or so it becomes of commanding importance.

These problems are continually arising in the promotion of extensive systems and the consolidation of the railway companies of a city under one management, and as soon as power for handling dense traffic has to be furnished even a couple of miles from the station, they demand immediate solution. We wish to impress upon our readers the necessity for great caution in such exigencies. First, last, and always, study your local conditions, for with the uncertain balance which we have pointed out, these conditions will generally determine how power should be generated and delivered. If power transmission become desirable the particular method employed will generally be dictated by the local load conditions, and cannot be settled by *à priori* reasoning. Finally avoid putting too many eggs in one basket, and however your stations may be arranged, see to it that they can adequately re-enforce each other.

Meeting of the Executive Committee of the American Street Railway Association

A meeting of the Executive Committee of the American Street Railway Association was held in Boston, Jan. 26, to arrange the details of the annual convention of the Association in Boston this fall. There were present at the meeting President A. E. Lang, Secretary Penington, and Messrs. Rigg of Reading, Pa., McColloch of St. Louis, Moore of Trenton and Goff of Fall River. Those who were absent were Messrs. Roach, Wyman, Connette and Ely. The officers and Executive Committee were most hospitably entertained in Boston by the local committee, and while there completed arrangements for what will undoubtedly be the largest and most important convention in the history of the Association. President Lang, Secretary Penington, and the members of the Executive Committee have entered upon the preliminary work with great activity, and will see that no steps are spared to secure the success of the meeting.

The first step decided upon was to fix the date of the convention, which it was decided will be held on Sept. 6–9 inclusive. The chief reason for selecting this date was that it was impossible to secure any hall in Boston, suitable for the exhibits, during October. A resolution will be presented at this meeting for an adjourned meeting to be held at the time specified in the constitution, at which meeting the business transacted and officers elected at the September meeting can be ratified.

The exhibits will be located in Mechanics' Institute, which is an ideal place for them, and undoubtedly the best convention hall which has ever been used for the meetings of the Association. There will be 60,000 sq. ft. of space available, with plenty of power.

The charge for space in the hall will be 10 cents per sq. ft. as formerly, and all exhibits will be confined to the Hall, none being allowed at the hotel. The Hall is close to the tracks of the Boston & Albany Railroad, and the New York, New Haven & Hartford R.R., so that receipt of heavy articles intended for exhibit will be easy.

The chairman of the exhibit committee is C. S. Clark, of 8 Oliver Street, Boston. Mr. Clark is secretary of the Massachusetts Street Railway Association and is connected with the Lowell Lawrence & Haverhill Street Railway Company. The chairman of the local committee is R. S. Goff, president of the Globe Street Railway Company, of Fall River.

The hotel which will be selected as the headquarters of the Association has not yet been definitely determined upon, but will be announced very shortly.

The following subjects have been announced for papers at the annual convention, subject to possible additions and change:

Maintenance and Equipment of Electric Cars; To What Extent Should Street Railway Companies Engage in the Amusement Business; Underground Electric Roads—Their Construction and Management; Carrying of United States Mail Matter on Street Railways; Comparative Earnings and Economy of Operation between Single and Double Truck Cars for City Use; How to Care for the Return Current; Inspection and Testing of Motors and Car Equipment by Railway Companies.

The Montana Power Company

BY L. D. TANDY

The Montana Power Company, which was organized Aug. 10, 1897, will have, when ready for practical operation, a plant that will rank among the finest in the United States, not only from an engineering, but from a financial, standpoint. The plant was projected, financed and built upon a different basis from any other of a similar character in the country, the entire proposed output having been contracted for before ground was broken. Thus the problematical feature as to the income to be derived from the enterprise, was eliminated. The disposition of the power was made on a basis of five to ten year contracts, and at remarkably good prices for both the Power Company and the customers.

The coal used in the city of Butte is bituminous, from mines at Rock Springs, Wyo. Its high price ($3.60 per ton) and poor quality constitute one reason why its use for the generation of steam power is expensive; another important factor in the high cost of steam power at Butte is the scarcity of water. The only way in which water can be obtained for condensing is from the city mains, and its cost, under such conditions, is, of course, prohibitive. It is consequently necessary to run all steam plants noncondensing, although the load factor of many of them is such as would make condensing a great source of economy.

The promoters of this company in drawing up the preliminary plans, decided to employ only the best material and apparatus obtainable, without any of the embellishments, ornamental rather than useful, frequently in cluded in projects of this character. The first step was to secure the best available engineering advice, and J. T. Fanning, of Minneapolis, Minn., and M. S. Parker, of Great Falls, Mont., were chosen. A careful investigation was then made of the various types and manufactures of apparatus suitable to work of this kind, with a view to the selection of the best hydraulic and electrical machinery that the present market affords.

Location.—The power station is located on the Big Hole River, 20.6 miles distant from the City of Butte, Mont. This distance is the total length of the transmission line, which is run in practically an air line from the power station to Butte.

Water Rights.—The water rights of the company are broad and cover three storage reservoirs above the main dam, as well as a location for an additional power station about 2 miles below the present one. Should it be found necessary, the capacity of the existing plant may be increased by building this second station on the latter site, utilizing the tail water of the present plant by carrying it through an open flume or pipe.

FIG. 1.—DAM LOOKING UP STREAM

FIG. 2.—DAM LOOKING DOWN STREAM

In California, where the laws for the protection of irrigation interests require that the normal flow of the stream be sustained, flood water only can be reserved, or stored. The storage of water in Montana, however, is not restrained by legislation, and when the loads are light the water can be stored for use when heavy demands for power are made on the station. The lowest flow in the Big Hole River ever observed was 20,000 miner's inches, and that after a phenomenally dry season.

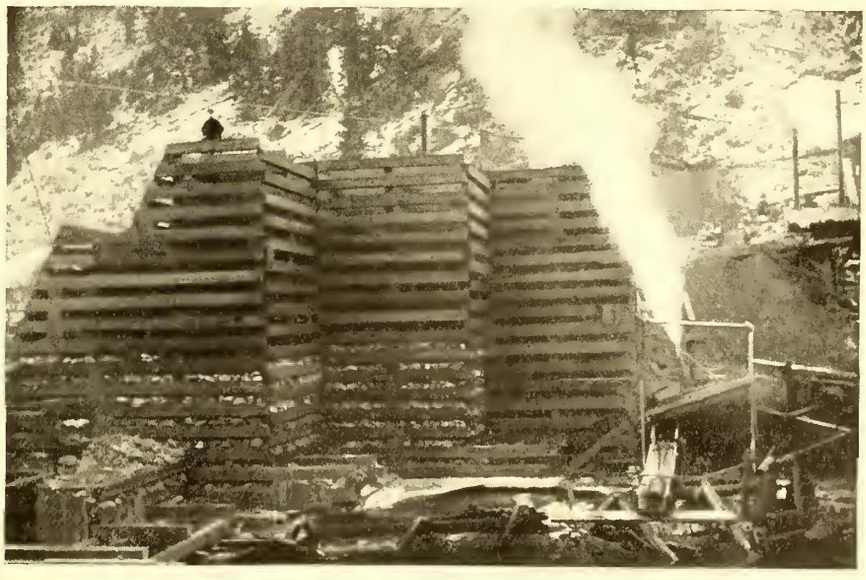


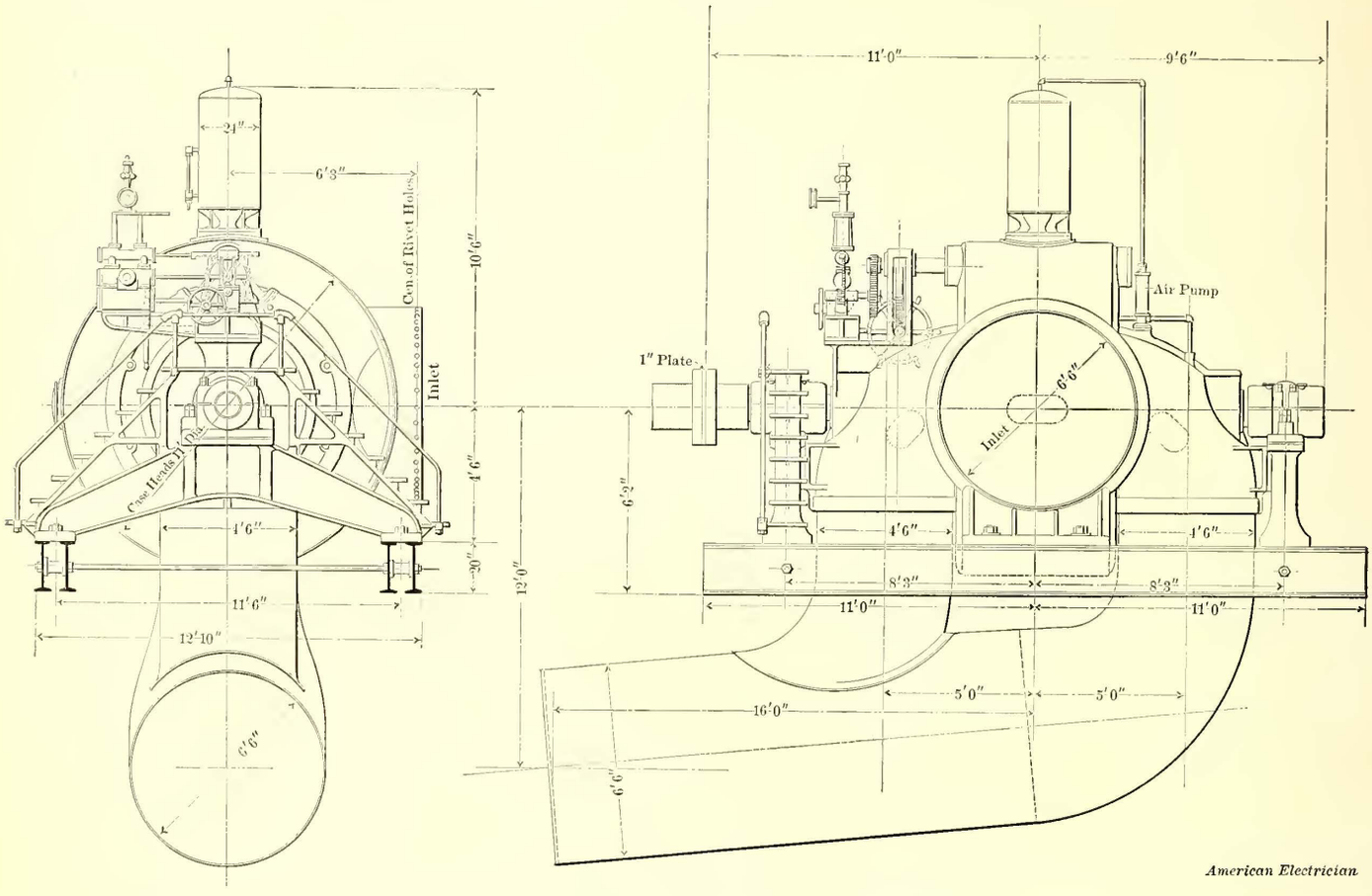
FIG. 3.—CRIB CONSTRUCTION

Dam.—The main dam (Figs. 1, 2 and 3) is a crib the largest of its kind in the country, being 102 ft. wid at the base and 57 ft. high at the spillway. The total length at the crest is 450 ft., the spillway alone being 200

ft. wide. On the power station side the dam will rise to a height of 12 ft. above the spillway. 10 in. × 12 in. Montana pine and fir timber in 12 and 16 ft. lengths, held together by 42 in. drift bolts is used in the construction of the crib. (Fig. 3.) The foundations rest upon bed rock, and the crib is filled with concrete to a point 8 ft. above the bed of the river, the remainder of the crib being filled with broken granite.

2,100,000,000 cu. ft. of water. This will secure ample reserve for heavy demands during exceedingly dry seasons.

Power Station.—The station, which is not yet completed, will be strictly fireproof and built of granite and concrete. The main building is located on the south side of the river, adjacent to the dam. Its ground dimensions are 125 × 78 ft., and the transformer room 50 ft. × 30 ft. The water for operating the wheels will be supplied to them from a forebay in the rear of the station. This forebay is 350 ft. long, 15 ft. wide and 23 ft. deep, and the effective head will be 60 ft. By the use of a forebay instead of a pipe, better regulation will be secured, as all ramming will be eliminated. The connection between the wheels and the forebay will be through a 72 in. penstock, 55 ft. long.



American Electrician

FIGS. 4 AND 5.—DETAILS OF TURBINE AND GOVERNOR

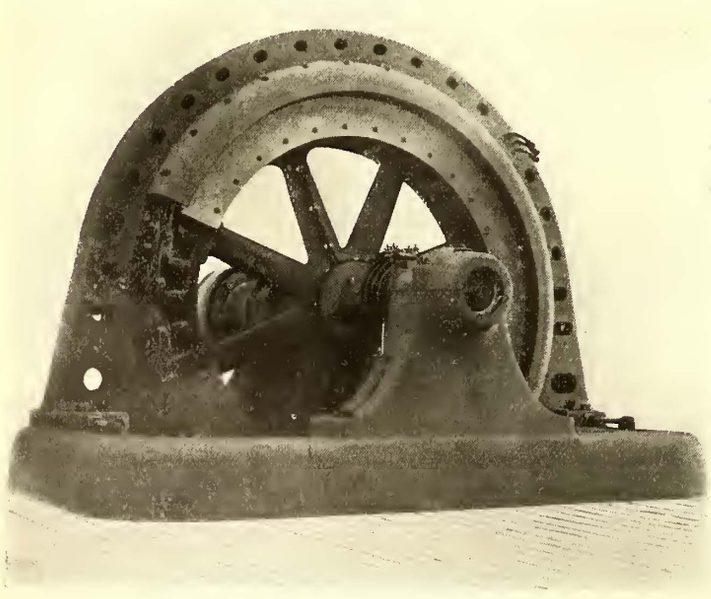


FIG. 6.—TYPE OF GENERATOR

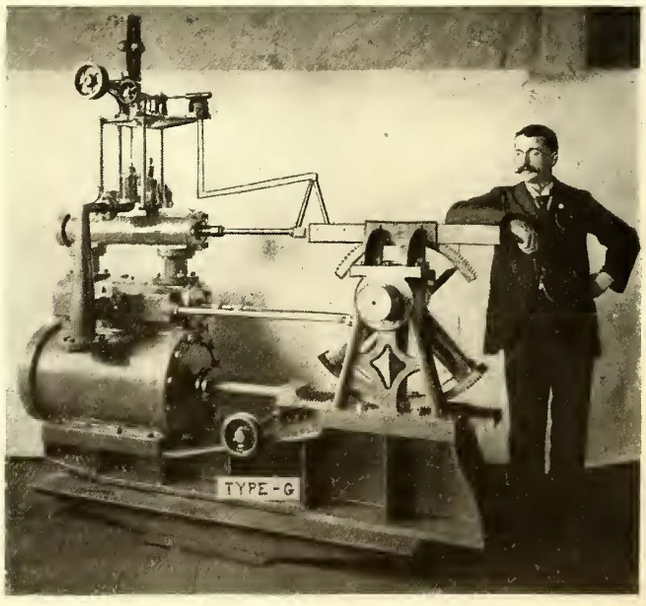


FIG. 7.—WATER WHEEL GOVERNOR

Two storage dams have been built, one 25 and one 28 miles up the river from the main dam, and a site has also been located for a third. These dams are 30 and 40 ft. high, respectively, and are built on the same general plans as the main dam.

The storage dams and the main dam will impound

All foundations, both for the water wheels and generators, are on bed rock, and the space between them under the floors will be utilized as a cable tunnel. The roof will be of latticed steel girder, the contract for which and all the other iron work used having been placed with the Gillete, Herzog Company, of Minneapolis, Minn. Three traveling cranes will be installed, two of 16 tons capacity each, running the full length of the main building, and one of 5 tons capacity in the transformer section. These cranes will be furnished complete by the same company.

The building is exceptionally spacious, and is designed to receive five 1000 h. p. units, space being provided for an engine to be coupled to the fifth unit. Neither the fifth unit nor the engine, however, will be installed at present. This engine is designed for use only in times of excessively heavy loads, or when the water supply is abnormally low.

FIG. 8.—AIR BLAST TRANSFORMER

Water Wheels.—The James Leffel Co. will furnish the water wheels for both the generators and exciters. There will be four 66 in. double turbines of the type shown in Fig. 9, directly coupled to the generators and developing 1200 h. p. at an effective head of 660 ft. while running at 180 r. p. m. These wheels are commonly known as the Niagara type and are of the same general design as those which have been installed for the Hydraulic Power & Manufacturing Co. of Niagara—the Cliff plant. Fig. 5 shows the details of the wheel and governor construction, the drawings from which the above cut was made have since been slightly changed, in that the intake will be from the above wheel where the air chamber is shown, instead of at the side. Two 36 in. single wheels will be *directly coupled* to the exciters.

Governors.—The Lombard water wheel governor, will be used to secure the necessary regulation, one on each of the generator wheels. From the results obtained with this governor on the Leffel wheels at Niagara, a regulation somewhat better than 2 per cent will be obtained on the heaviest fluctuation. Fig. 7 shows the governor in detail. The wheels driving the exciters will be governed by a simple mechanical governor. A special feature of the Lombard governors for this plant is that the water which actuates the primary cylinder is filtered, thereby eliminating any trouble from clogging of the cylinder or parts, with sediment in the water. Otherwise they differ in only one important detail from the Stoddard types of governors built by the same company, there being no pumping system connected with these governors, and the circulating system being filled with water under flume pressure instead of oil under tank pressure.

In this particular plant the governor builders have specially designed the bed, ratio of gearing and connections in such a manner that the design is integral with the water wheels, of which the governors really become a part, as may be seen from the accompanying line drawings. These governors not only regulate the speed of the whole plant, but also start and stop the plant without manual effort. There are four units like the one shown in the illustrations.

Electric Equipment.—The entire electric equipment, both of the power company and of the companies utilizing the power, will be furnished by the General Electric Company, and will consist of four three-phase generators, of a capacity of 1000 h. p. each, at their rated load. The generators are revolving field machines having forty poles, and a speed of 180 r. p. m., which gives a periodicity of sixty cycles. The current will be generated at a potential of 800 volts. The generators are practically the same in construction as other machines of the same company built to meet similar conditions, varying only in the number of poles and the speed. The revolving field will be 10 ft. in diameter over all and will weigh 23,500 lbs. A good idea of the general design of the generators can be had from Fig. 6 opposite. All the mechanical construction in these machines is based on a safety factor of twenty, ensuring absolute safety even in case of a runaway at the full spouting velocity of the water.

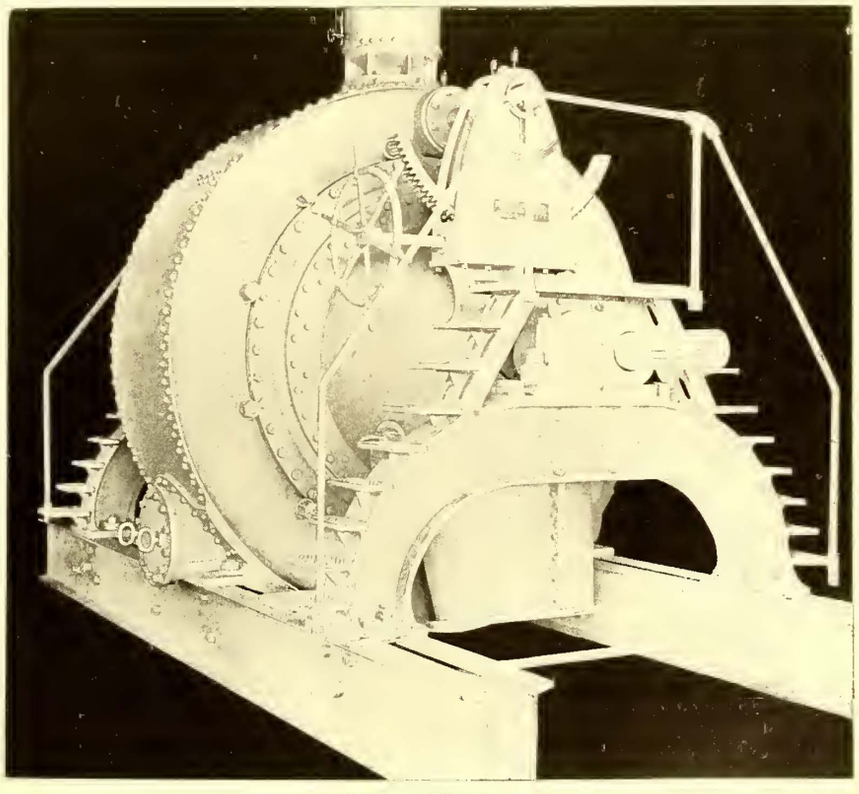


FIG. 9.—TURBINE

There will be two exciters of the multipolar type, having each a capacity of 100 k. w. at rated load, and one exciter can furnish sufficient current to excite the five 1000 h. p. generators. They will be entirely independent in their operation, being directly connected to individual water wheels running at 600 r. p. m. and will operate at a potential of 125 volts.

The step-up transformers will be of the air blast type, 12 in number and of 250 k. w. capacity each and connected in delta. The current will be delivered to the low tension side at 800 volts and increased to 15,000 volts.

In the substation in Butte 2640 k. w. capacity in step-down transformers will be installed of the same design as those in the main station, but of various sized units best adapted to the several uses for which they are to be employed. The high tension side of these transformers are wound for 13,250 volts and the low tension side for 2200.

Both the main and substation will be provided with

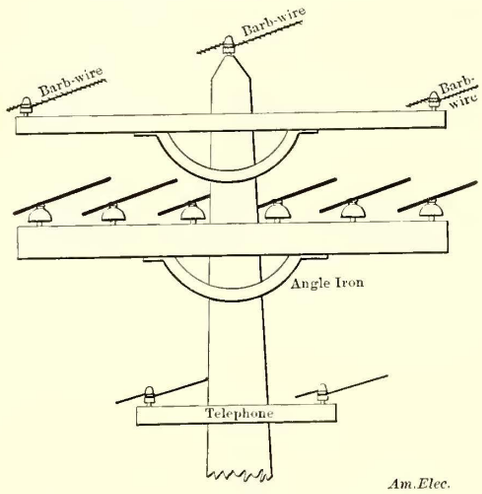


FIG. 10.—POLE OF TRANSMISSION LINE

two electric blower sets for circulating the air through the transformers.

The switchboard will be made of blue Vermont marble and consist of 15 panels, divided as follows:

4 generator panels, 1 main station panel, 1 paralleling panel, 4 high tension transformer panels, 1 exciter panel, 2 line panels, 2 low tension transformer panels.

The high tension portion of the main station switchboard will be located in the transformer building in a position where the attendant at the main switchboard can see it at all times.

The panels will be equipped with all of the latest improved instruments, and the station protected with General Electric lightning arresters. All generator and low tension transformer leads will be carried under the floor between the generator foundations, and will be accessible at all times for inspection, as there is ample room for a man to walk through the entire length.

Transmission Line.—The transmission line will be 20 6 miles long. The poles will be of Oregon fir varying in length from 33 ft. to 60 ft., with a minimum diameter of 12 ins. at the top, the average length being 40 ft. They are set 105 ft. apart or fifty poles to the mile, and have three cross arms, two 10 ft. 6 ins. in length and one 3 ft. in length. The two upper or long cross arms are provided with a curved angle iron brace bolted to the pole and the under side of the cross arms. On the top of the pole and on the end of the cross arms are glass pony insulators on which barbed wire is strung for lightning protection. Glass insulators were used for this purpose to prevent friction and consequent breaking, as is usually the case when the barbed wire is attached by staples. The upper arm is used exclusively for this barbed wire line.

The second or middle arm is provided with six pins to accommodate two three wire circuits. The lower or short arm is for a private telephone line.

The insulators were furnished by the Imperial Porcelain Works, of Trenton, and are of the "Redlands" type. They have all been subjected to a test of 70,000 volts before and after glazing (see Fig. 12). The weight of each insulator is 5½ lbs., the diameter 6¾ ins. and the height, 4⅞ ins. The surface distance from the wire to the pin is 13 ins.

The line will consist of six wires of No. 1 B. & S. gage, of soft drawn copper. The copper from which this wire was drawn is the product of the Butte mines and is the first wire for transmission purposes drawn by the Waclark Company.

The transposition of the wires is accomplished between five pole spaces or 525 ft. The transposition is made in such a way that each leg of the circuits crosses each of the other two legs, and the circuits, as a unit, also cross each other. In making the transposition a third cross arm is used.

The two circuits can be used in multiple or independently, as desired, and each circuit is capable of carrying the full load if necessary. With the two circuits in parallel, the line loss is less than 7 per cent.

Cost.—In this interesting feature this plant shows a remarkably low cost. The entire cost, including the two storage dams and the step down transformer equipment for the substation, will be $400,000.

Among the large contractors for power are the Butte General Electric Company, the Butte Consolidated Street Railway Company, the Butte Reduction Works, the Colorado Smelting Company and the Montana Ore Purchasing Company.

The first named company has 27,000 incandescent lights connected, all to be operated from the power company's circuits. In addition it will install a rotary converter to furnish current to its 550 volts direct current power circuits, and three 100 h. p. induction motors, each of which will be connected to a 125 light arc dynamo. The Butte Consolidated Street Railway Company has arranged for two rotary converters of similar size and capacity, for the supply of current to the city street railway system. The Butte Reduction Works will install one 325 h. p., 440 volt, revolving field synchronous motor, one 15 h. p. induction starting motor and two 150 h. p., 440 volt induction motors. The Colorado Smelting Company has contracted for two revolving field, synchronous motors, one of 300 h. p., 164 revolutions and the other of 300 h. p., 450 revolutions, both on the 440 volt circuits, and three 15 h. p. induction starting motors. The Montana Ore Purchasing Company, will install one 300 h. p., revolving field, synchronous motor and two 100 h. p. induction motors.

From the above the interesting fact will be noticed

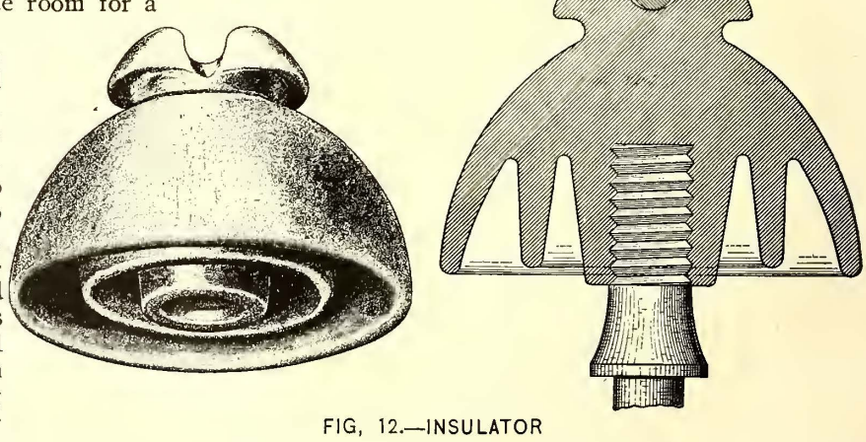


FIG. 12.—INSULATOR

that the load in the Montana Power Company's station is divided between synchronous and induction motors and a non-induction load of incandescent lamps, and consequently the most satisfactory results are expected.

It is stated that a number of New York capitalists propose to buy the electric light and gas plants, and the electric railways of Battle Creek and Kalamazoo, Mich., the new electric railway now in process of construction between Battle Creek and Kalamazoo, the electric light plant of Albion, the electric railway and lighting plant at Jackson, and the electric railway of Lansing.

Important Changes Proposed in Pittsburgh

Owing to the changes in organization in Pittsburgh, by which several of the most important companies in that city have been consolidated during the past two years, the two largest companies in that city—the Consolidated Traction Company and the United Traction Company—are contemplating important changes in their power houses.

The Consolidated Traction Company, as stated last month, has at present four power stations, with an aggregate capacity of 8700 amps., and two storage battery stations, with an aggregate capacity of 1000 amp. hours. Fortunately for the plans of the company for new construction, the present power stations were installed four or five years ago, and the apparatus is, for the most part, old fashioned, so that no comparatively new material will have to be "scrapped." In consequence, the engineers of the company have been free to adopt the latest and most modern methods of power generation. As a result, G. F. Greenwood, the chief engineer of the company, has drawn up plans for a most substantial station and power apparatus. Both the building and the apparatus are designed on quite novel lines, and will, it is claimed, effect a revolution in station construction. Mr. Greenwood, whose work is always original, has also decided to employ a modification of the three-wire system for power distribution, as will be explained later on.

The new power station of the company will be located on the Allegheny River, at the foot of Twentieth Street, at a point about central to the system. A diagram of the locations of the present stations and new station was given last month in the article on the storage battery system of the company. The situation is at the side of two railways, and has dock facilities on the Allegheny, so that its facilities for the receipt of fuel are excellent. The station will be fireproof throughout, by which is meant that no wood will be used in any part of it, not even in the roof. The foundation will be concrete throughout, the outside walls of brick with steel skeleton, and the roof of steel and concrete arches.

The engines are of an entirely novel type, and will be built by the Pennsylvania Iron Works Company, according to the specifications of the company's engineer. They will be of the horizontal cross compound type, with cylinder, 30 ins. × 54 ins. × 48 ins. stroke. They are exceedingly compact, and it is claimed they do not occupy as much space as would a cross compound vertical engine of the same capacity. The cylinders are not bolted to the bedplate, but are of the overhanging type. This, it is believed, will avoid the strains on the bedplate due to the expansion and contraction of the cylinders from their alternate heating and cooling. The valves are of the Corliss type, with releasing gear.

The crank rod is forged in one piece, the bearings being adjusted by special devices. The main journals are extra large, and the bearings are 20 ins. in diameter and 40 ins. in length; this may seem very wide for a 90,000 lb. flywheel and a 44,000 lb. armature, but the engineers of the company prefer to distribute the bearing wear over a large surface, believing there is much less danger of the shafting wearing the bearings to a dangerous degree. The crosshead is of steel, and the adjustment is made by wedges and screws. The adjustment of the crank rod is also by wedges. The condenser pump is driven from the crank, and is differential and double acting. The pump cylinders are 30 ins. in diameter by 10 ins. stroke. The upper portion of the piston rod is not of uniform diameter, but that passing through the stuffing box is of larger diameter than that on the piston itself. In this way the displacement caused by the entrance into the cylinder of the upper part of the rod causes the maximum effort of the engine in driving the pump to be exerted in the beginning of the stroke of pump, and the effort on the engine to be reduced at the ends of the engine stroke, when the power is less.

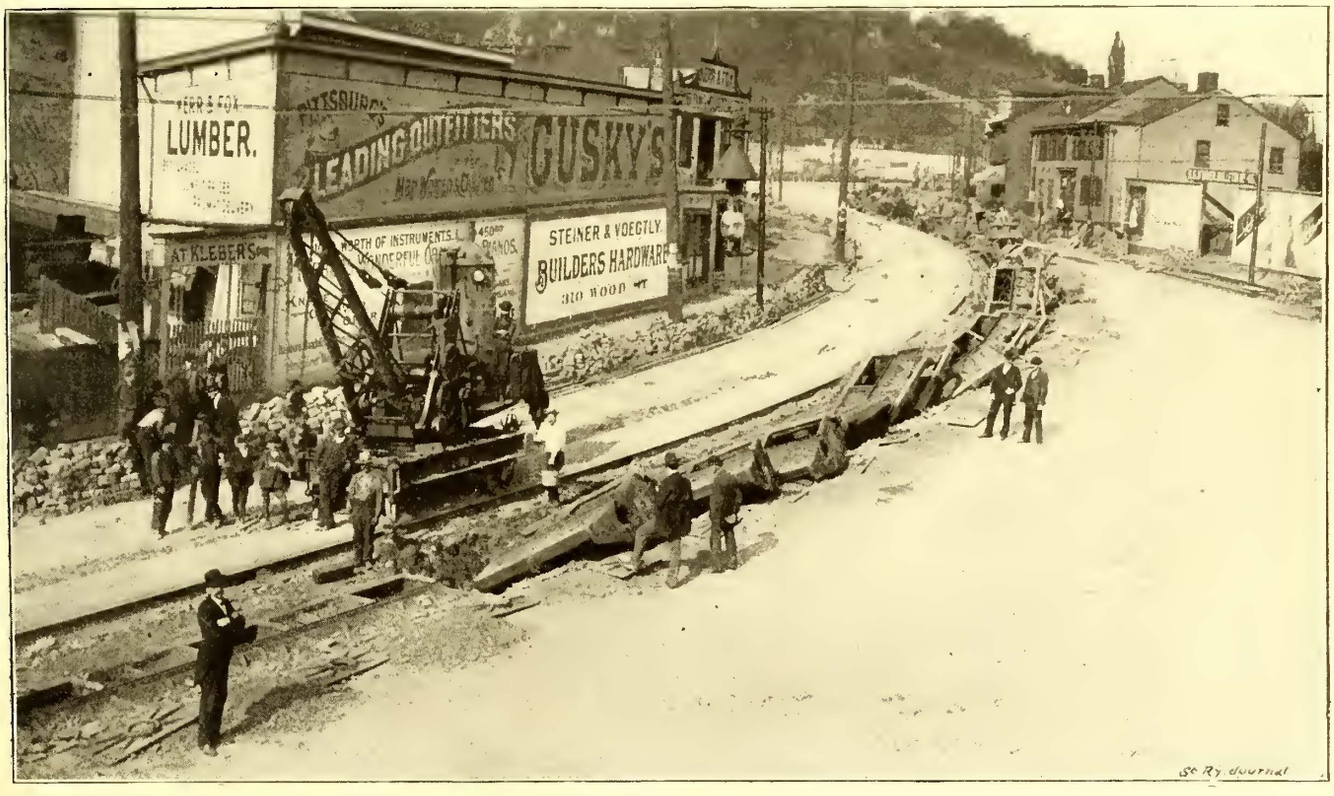


FIG. 1.—REMOVING CABLE CONDUIT IN PITTSBURGH PREPARATORY TO ELECTRICAL EQUIPMENT

The method of current distribution, as stated, will be on the three wire system. The Allegheny lines, and those in the western part of the city of Pittsburgh, where the line has overhead crossings with other lines, will be on the positive side of the system; and the lines in the eastern part of the city, where there are no crossings with foreign lines, will be made the negative side of the system. Each side will be run at 500 volts, and to secure proper balancing, certain sections of line will be so arranged that they can be switched on to either the positive or negative bus bars. The tracks which will form the neutral side of the system will, of course, be connected to a neutral bus bar.

A diagram showing the general arrangement of the system, as proposed, is given in Fig. 2. The position of the stations is such that the feeders can as a general rule be economically connected to the trolley wires at the ends of the lines. Could this be done absolutely, it will be seen that every car, no matter what its position on the line, would be

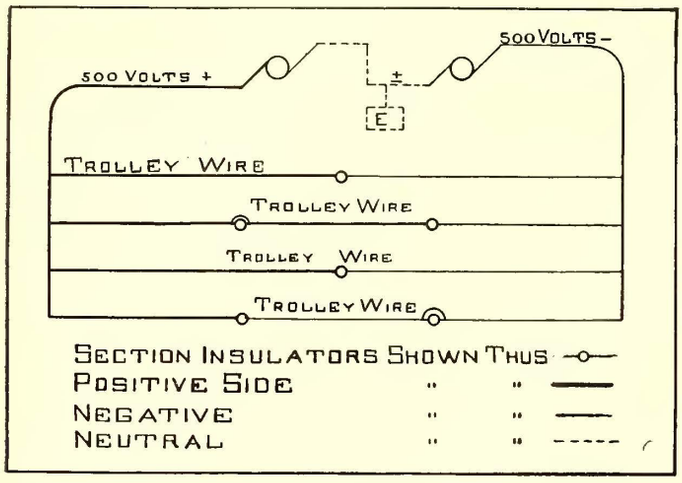


FIG. 2.—DIAGRAM TO ILLUSTRATE METHOD OF CONNECTIONS—PITTSBURGH

equidistant (measured through its feeders and return) from the source of supply. Consequently the potential at all points on the line will be the same. In other words the ordinary method of wiring lamps for constant potential, in buidings will be applied to railway work. To ensure a constant potential, however, due to the fact that an absolute adherence to the plan outlined would not be most economical, on account of the additional distance which the feeders would have to be carried, the company will

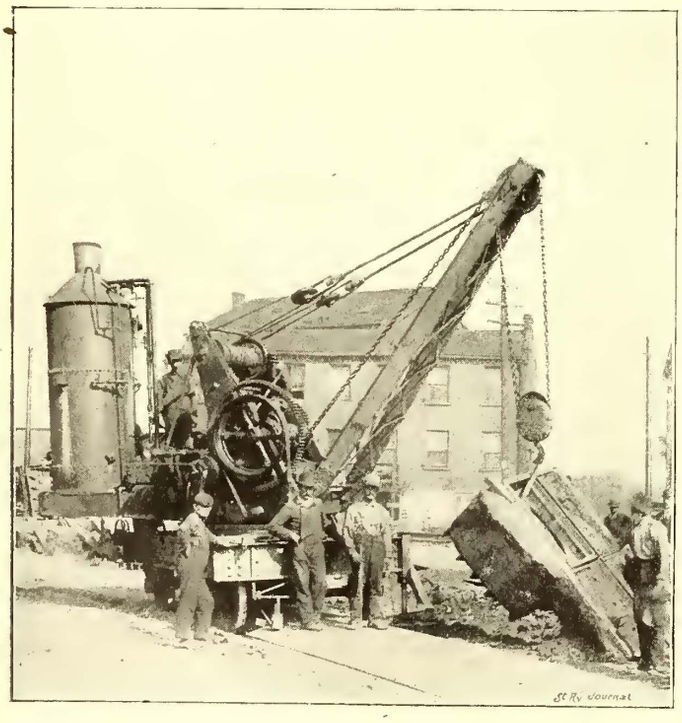


FIG. 3.—DERRICK FOR REMOVING DISCARDED CABLE CONDUIT

employ storage battery station auxiliaries on each side of the system and located toward the end of each section.

In addition to the important changes outlined in regard to the generation of power, the company under Mr. Greenwood's supervision, has been making extensive improvements in its track, including, among other work, the complete removal of the old cable conduit. This was necessarily an extensive undertaking and in this work the the company employed a special traveling derrick, shown in Figs. 1 and 3, for removing the old cable concrete, after it had been broken up by blasting.

Average Rides per Capita in Small Towns

In the following table an attempt has been made to show the number of times that the entire population has been carried by the street railway systems in a number of towns in New York, Massachusetts and Pennsylvania, ranging in population from 20,000 to 40,000. It will, of course, be understood that the figures are not absolutely correct, as the latest population figures obtainable are for 1890, while the number of passengers carried is for 1896. The table is sufficiently correct, however, to give a fair idea of the actual conditions.

In a number of cases it has been impossible to obtain the actual number of passengers which were carried within the city limits, as several of the roads operate lines to outlying districts. This fact undoubtedly accounts for the high averages of Harrisburg and Chester, Pa. The Harrisburg Traction Company operates a line to Steelton, between which town and Harrisburg there is a great deal of traffic, while Chester is located a short distance from Philadelphia, and there is, of course, a great deal of travel between Philadelphia and Chester. It is interesting to note the great difference in the average rides per capita in Yonkers and Long Island City. The high average in Long Island City is undoubtedly due to the influence of the numerous shore resorts located a short distance from the city on Long Island Sound. Yonkers has no such resorts, and furthermore a great many of her business men do business in New York City and travel back and forth by steam road, the street railway companies in this way losing considerable traffic. It should also be mentioned that the number of passengers carried for Cohoes, N. Y., does not include the passengers carried on the Troy City Railway, which road runs through Cohoes.

City	Population 1890	Passengers Carried	Average Rides per Capita
Erie, Pa.	40,634	5,433,565	134
Harrisburg, Pa.	39,385	6,506,517	165
Binghamton, N. Y.	35,005	3,381,652	96
Yonkers, N. Y.	32,033	2,062,085	64
Lancaster, Pa.	32,011	2,705,556	84
Elmira, N. Y.	30,893	2,665,505	86
Long Island City, N. Y.	30,506	7,086,017	232
Altoona, Pa	30,337	3,132,518	103
Auburn, N. Y.	25,858	977,877	38
Gloucester, Mass.	24,651	2,393,956	97
Newburgh, N. Y.	23,087	1,640,000	71
Cohoes, N. Y.	22,509	541,667	24
Poughkeepsie, N. Y.	22,206	1,829,022	82
Fitchburgh, Mass.	22,037	2,148,723	98
Oswego, N. Y.	21,842	542,029	25
Kingston, N. Y.	21,261	1,527,387	71
York, Pa	20,793	1,175,421	57
Chester, Pa.	20,226	4,485,282	222

The Ohio Street Railway Association

The association of street railway companies in Ohio has recently been reorganized, and the title of the Ohio Street Railway Association has been adopted in place of the former title of the Ohio State Tramway Association.

Ohio contains a great many miles of street railway, and more are being built each year, and the officers of the association believe that they can make it one of the best and most progressive in the United States.

The by-laws have also been changed, so that the fee of admission in the association is $10, with dues of twenty-five cents for each regular car operated, but the dues are in no case to exceed $15 per annum. This will enable any street railway in the state, large or small, to become a member of the association, and the officers expect it will soon include all of the railroad companies of the state.

Open Questions before the Committee on a Standard System of Street Railway Accounting

By A. O. KITTREDGE, F. I. A.

The action of the Association of Street Railway Accountants at Niagara Falls last October, on the report of the special committee on a standard system of accounts, was to refer back to the enlarged committee the whole question, with various recommendations and suggestions. In a sense, therefore, everything is still open, and yet the agreement on certain parts of the report, as evidenced by the discussion in the convention, was so complete as to amount to an approval of the committee's recommendations. On other points there was sufficient difference of opinion expressed by those who took part in the discussion to show the expediency, if not the necessity, of keeping the questions open until they have been more thoroughly considered.

Two reasons influenced the action of the convention in the disposal of the report. To have formally adopted and approved all or even a part of the recommendations of the committee would have savored of arbitrariness and would have given these companies who are not yet represented in the association the opportunity to decline membership, simply because some of the plans adopted did not entirely conform with their ideas, and because, further, they would be in a sense endorsing these plans by becoming allied with the organization. Since the membership of the Accountants' Association at present includes a comparatively small portion of all the street railway companies of the country, it was deemed wise to leave the general question open for at least a year, or until such time as an enlarged membership would give added force to any recommendations that might be formally adopted. The other reason, as already indicated, was a difference of opinion on various important points.

The committee's report, it will be recalled, divided the accounts of expenses of operation into four classes, namely: A. Maintenance of Way and Structures; B. Maintenance of Equipment; C. Conducting Transportation, and D. General Expenses. The first question that arose at Niagara Falls was as to the sufficiency of these divisions. Should there be four, as suggested by the committee, or more? Quite a discussion followed with reference to the first subdivision, Maintenance of Way and Structures. Several members argued for a division of this into two groups—one Maintenance of Way and the other Maintenance of Structures. The vote on this was one of the first taken with respect to the report, and it was preceded by careful explanations that the vote in any event would only convey to the new committee the sentiments of the Association and in no respect would it be an adoption of the report. At the end of a discussion that lasted nearly an hour, the vote showed that those in favor of the committee's recommendation largely outnumbered those in favor of dividing this head.

That there are strong arguments for separating into two groups the accounts gathered in the A division was very frankly admitted, even by those who voted in favor of keeping the accounts in a single group. Some of these arguments were presented, but the discussion did not extend to a point to be exhaustive. The difference in the character of buildings used by different roads was referred to, but I do not recall that any reference was made to the character of the buildings employed by the same road at different periods of its existence, taking the company, for example, first at the beginning of its operations, and then as we find it housed after a time, when a considerable accumulation of profits has been made. True it is that the roadway is similarly improved, under like conditions, sometimes even to the extent of complete reconstruction. There is a limit, however, to what is done in the roadway itself, determined by well defined rules of economical operation. In the matter of buildings, there is an influence exerted by the environment of the structures that is altogether different in character. As the towns and cities grow, and as the lots about the structures first erected by the railway company come to be covered with buildings of the better class, there is the disposition, if not the necessity, when it comes to rebuilding, to construct upon a handsomer and more elaborate scale than mere use would require, with certain features of architectural decorations that would not have prevailed had not the surrounding land been covered with good structures. This would seem to indicate that the two accounts, or two divisions of the one general account, do not always progress upon parallel lines.

The committee making its report laid down at the outset, in very precise terms, the principle which had guided it in arranging the classification of accounts submitted. It recognized that certain expenditures have to do with the physical condition of the property, while others are strictly operating expenses. This general rule was referred to repeatedly in the discussion, and the application of it, or rather the testing of certain questions by reference to it, made clear various points which otherwise would have been difficult of adjustment. Some of the members, however, appeared at times to be confused in the effort to discriminate between repairs and renewals, even after other distinctions had been made clear.

The subject of depreciation was not directly acted upon, although one speaker referred particularly to what is done in European practice, and one of the members from Canada also dwelt upon the importance of making proper reserves for depreciation of plant, and the committee mentioned it as something yet to be considered. After dividing expenditures into the two general classes named, one having to do with the physical condition of the property and the other relating merely to operations, there still remains for the consideration of the association, it would seem, a monthly charge into expenses of operation of an amount equal to the estimated depreciation of plant, thus establishing the suggested reserve.

Street railway accounting, which at best is comparatively new in its applications, has come into existence following the classified work of the steam railroads, and under the auspices of the several State Boards of Railway Commissioners. The laws creating these bodies, which make their own rules, were passed with special reference to the steam roads. It transpired in the discussion at Niagara Falls that in various respects the conditions and requirements of electric lines and steam roads are unlike, and that even in the mere classification of expenses, variations must be made from a general rule in order to be equally fair to each of the two systems. For example, in the matter of the removal of ice and snow. On the tracks of an electric line through an asphalted street in the city, it is one thing, whereas in a valley among the mountains or on the broad prairie, in the case of a steam road, it is quite another thing. The removal of snow and ice, from the standpoint of those having to do with steam roads, is practically the same as repairing a washout, which has taken away a portion of the track. Therefore it is classified as a maintenance. On the other hand, in the case of a track through a city street the removal of snow and ice is something else entirely, for in such a case there is no destruction of track; instead there is an obstruction to operation. Therefore it would appear, as certain members claimed, it properly belongs with electric lines to the Conducting of Transportation.

However, all the tracks of electric lines do not run through asphalted streets in cities. With the wider extension of electric lines, the conditions under which many of them are operated are very much more like those of the steam roads, and that leads to this suggestion, that in this regard, as well perhaps as in some others, the application of fixed rules ought to be varied according to the conditions of the roads, that no hard and fast rule, arbitrarily dividing roads into two classes—steam and electric—can be made to answer. This is one of the points upon which a conference with the State Boards of Railroad Commissioners will very probably be had.

The wide diversity of conditions under which electric railways are operated, for example, some of them making their own power, and maintaining, therefore, extensive steam power plants, others buying their power from other railway companies or special power companies, and still others obtaining their power from their own water power plants, was strikingly brought out in the discussion in the convention, with the result of suggesting this thought, that inasmuch as these differences are perhaps fewer in number and less sharply defined at present than they will be a little later as the industry is still further developed, alternative classifications in the standard system would be expedient, thus adding to the elasticity of the form, as devised by the committee. It is very probable that special power plants will increase in number, and that with power to be bought at reasonable rates still more lines than at present will find it profitable in the future to buy power. With water power more and more utilized for the operation of electrical plants, the supply from this source is likely also to be an increasing quantity. The discussion in the convention referring to this point, it would seem, no more then touched upon what it is expedient to consider before completing the details of a standard system.

Park properties and amusements in the neighborhood of the terminals of street railways have exerted an important influence in the past upon the business of the many roads which have successfully employed them, and are likely to be an important factor in the development of various properties for some time to come. The discussion of this point in the convention developed a radical difference of opinion concerning the particular accounts that should receive the charges in way of expenses and the credits in way of income. While this matter was discussed at considerable length, the result reached was so indefinite, that it also seems to be a point that will surely come up for further consideration whenever the general scheme is again under debate. In the estimation of some members, parks and amusement schemes in general are only features of advertising and in the accounts are to be treated as such. Advertising, however, ordinarily considered, is an outright expense without anything remaining upon which an inventory value might be placed. In the case of parks, however, there are real estate values, buildings and various improvements which also have a value in themselves, and in this respect are unlike anything that is ordinarily classed as advertising. Hence the complication of the question.

The treatment of power sold was a point on which at the outset some in the convention had opposing ideas, and that part of the report which referred to this matter was one of the few that were really modified by the convention. It was very generally agreed, after the question was fairly understood, that the cost of the power sold, irrespective of the price at which it is sold, should be subtracted from the cost of power produced. If a profit is made on the power sold, it is to appear under the proper head in Income Account. This principle is likely to be still further exploited in view of still other branches of manufacture in which railway companies sometimes engage.

Analogous to this question, and one which was very briefly treated at the convention, is that of stores of materials on hand. Different plans of caring for stores and keeping the accounts of stores were referred to in the discussion, but such a diversity of opinion was shown to prevail that some definite recommendation upon this point is likely to be included in the next report that is submitted.

It transpired in the discussion that various items very common in the accounting of street railways were entirely omitted from the classification submitted by the committee. Some of these were of a character to be considered unimportant in themselves, and others of a kind to readily find places as sub-heads under one or another of the general divisions presented. Still others, however, were of more importance in character. Among the latter may be mentioned the treatment of the cost of leased cars, wherein the rental paid may be regarded as something in lieu of repairs that would be made if the company owned the cars. Another item was bridge rentals, and tolls on bridges, which street railway companies are frequently required to pay. Still other items were the heating of car houses and the cost of experiments, more or less of which, it is to be supposed, are in progress at all times among the larger and more enterprising companies. Electrolysis, a difficulty in the nature of damages to adjacent property that has not yet been fully investigated, and that so far has not come before the courts for adjudication, and which is costing companies in various parts of the country a good deal of money, was still another of the items that members suggested should be considered by the new committee. Various modifications in verbiage, and in a few cases the substitution of one name for another, were likewise suggestions that were made in discussion, all of which will no doubt be considered by the committee, or come up for discussion at later meetings.

The trailer to the committee's report referred to certain items of expenditure to be substracted from ascertained earnings instead of being charged up among the regular expense. The question of the necessity of this treatment of a certain class of expenditure and the expediency of this method, which in a sense is opposed to the usual rules and methods of modern accountancy, are points that no doubt the committee will consider at length before making its report. It would seem that the plan of making deductions from determined results in this way had its original precedent in the necessity of bringing into the account certain items that otherwise would have been omitted, These deductions also include certain items which in many cases are not so readily provided for in the going accounts of a company as to be easily taken care of by anyone save those who have had special experience. But better methods, it would seem, are readily available.

The trailer came before the convention at a late hour, when no one felt that there was time to spare for exhaustive discussion. The committee merely explained that it had not used the term "Fixed Charges," but instead preferred the expression "Deductions from Income." The deductions mentioned are taxes, including all taxes on real and personal property used in the operation of the road, franchise taxes, taxes upon gross earnings and capital stock, car licenses. and wagon and vehicle licenses. There was mentioned also the deduction for interest, including interest on funded debt and interest on floating debt.

In the abstract it would seem, as above indicated, that this method of treating certain expenses is a makeshift, and that thorough and adequate classification would make proper provision for all these expenses in the going accounts, so that every balance sheet —the thought being that balance sheets should be shown as often as once a month—would show the actual condition of the company at that date, without anything to be brought in subsequently. If the form of annual report required to be filed with the state officers demands this sort of treatment of the items specified, then the reports must be so constructed until such a time as the better accounting of the companies demonstrates to the authorities that the items can be better and more logically arranged.

Evidently some of these points were in mind at the time the committee prepared its report, for there are enumerated among the questions left open for the consideration of the new committee, the following: the pro-rating monthly of the yearly expense of water, taxes, insurance, interest, or any other charge that it would be desirable to pro-rate; the method of making charges in operating expenses; the extent that detailed and statistical information should be furnished; the annual charge for depreciation; and the creation of a sinking fund therefor, with the amount so set aside put into a safe interest earning investment.

However, we look at it, very much has been done by the original committee on a Standard System of Railway Accounts, more perhaps than was ever before accomplished in the same length of time by any similar committee entrusted with the accounting problems of a great in-

dustry. Their work so thoroughly done has also served to show how much more there is that it is expedient to do.

The new committee will begin its work under most favorable auspices, having on the one hand the benefit of the investigations made by those of its members who composed the original committee, and on the other hand the comprehensive discussion of the convention to which the report was submitted, and its cordial approval of the method pursued and general results produced. Street railway accountants throughout the country are more alive at present to the importance of the work which this committee has in hand than ever before, and are likely the present year, therefore, to assist in the effort far more than they were able to assist in what was done last year.

Notes on Street Railway Accounting

The committee now in charge of the important work of a standard system of accounts is composed of the three street railway accountants constituting the original committee, namely: C. N. Duffy, of St. Louis; W. F. Ham, of Brooklyn, and J. F. Calderwood, of Minneapolis, together with two new members, H. L. Wilson, of Boston, and H. J. Davies, of Cleveland. Some little discussion occurred in the convention with respect to the composition of the committee for the present year. It seemed to be the opinion of the original committee that it would be advantageous to the association to have the committee for the present year made of new timber, their argument being that in a sense they had exhausted their own thought upon the subject. This suggestion, however, did not find favor with the convention, as was shown by the assertion of one member that if an entirely new committee were appointed it would probably result in the presentation of an entirely new report a year hence. This fact is alluded to as showing how, from one point of view at least, every question connected with the subject of standardization of accounts was regarded by the convention as still open. However, the wisdom of the convention insisted that the old committee be continued so that there need not be an entirely new report prepared. The compromise offered by one of the members of the old committee, that it be somewhat reinforced was readily agreed to.

* * *

Concerning the selection of additional members of the committee, one special consideration was brought to the attention of the convention, which was to the effect that the membership of the committee should be geographically distributed in a way not only to be representative, in the sense of bringing to bear upon its work an intimate acquaintance with methods prevailing in different parts of the country, but also to be in position to exert an influence upon the various State Boards of Railroad Commissioners, under whose general auspices much of the accounting work of street railways must be done, and the ultimate decision of which must be taken into account in settling many of the questions now remaining open. The suggestion was also made that for effective work the committee ought not to be made too large. Accordingly, it was increased from three to five, and, as will be seen by the list just given, is composed of men residing in Massachusetts, New York, Ohio, Missouri and Minnesota, respectively.

* * *

The new committee has had no meeting as yet. Comparatively little has been undertaken, so far, even by correspondence. In fact all of its members are too busy at present with annual statements and other features of work peculiar to the turn of the year, to have any time to devote to this subject. Three of them have been personally superintending the installation of the standard system for their companies. Further, the foundation of the committee's work has been lacking until very recently. The verbatim report of the discussion at the Niagara Falls convention did not reach the members of the committee until December. It was the first communication conveying to them officially the suggestions and recommendations made by the convention.

* * *

The following suggestions of discussions for the purpose of helping the work of the committee on standardization are made by Mr. Calderwood, a member of the committee:

"Start a discussion of the best manner of collecting the items of both labor and material and of bringing them up to the classification of accounts. This work necessitates both books and sheets of special rulings. Start also a discussion of what form of statement best brings the true condition of the cost of operation to the attention of the practical street railway operator. What we most need now, in connection with our classification, it seems to me, is a standard form for each of our different statements. As a fact, every road has almost an endless number of printed forms; forms that in many cases, when carefully analyzed, present a beautiful conglomeration of unreliable statistics that, as a fact, are of little or no practical benefit, and which tend to confuse rather than to enlighten. There are two fundamental and practical statements which, to my mind, are of benefit to every street railway operator. Underlying both of these statements is this fact, that the cost of operation is made up of two items—labor and material. The first of these two divisions—labor—constitutes at least 80 per cent of the entire cost. The first statement, therefore, should show minutely, a classified comparison of pay rolls, comparing one pay roll with another, and the pay rolls of one month with another. For the second —materials—I would suggest two statements, one showing the classification of the accounts and costs of the articles purchased the items of which would come through the purchasing agent. The second would be a material statement coming from the storekeeper, showing the classification and cost of material delivered. These last two statements taken together, are very important because they enable the management to compare their purchases with the actual consumption and thereby keep a check on surplus stock. These several comparative statements of labor and material are to my mind the keynotes to economy in operation. In comparison, all other statements in connection with operation are mere auxiliaries."

* * *

"The proof of the pudding is in the eating," is the way in which Mr. Calderwood introduced the announcement that on Jan. 1, his company would change its accounting classification to conform to the standard system promulgated by the Street Railway Accountants' Association.

* * *

A letter received late in December from C. N. Duffy, secretary and treasurer of the Citizens' Railway Company, St. Louis, with reference to the use of the recommendations of the committee by the companies in his charge, gives the following interesting facts:

"On Jan. 1, 1898, I shall put into operation the standard system of street railway accounts as recommended by the Street Railway Accountants' Association at their convention held in Niagara Falls, in October last. The thirty-nine operating expense accounts as scheduled, I shall condense into sixteen ledger accounts, carried on the ledger, being the number of ledger accounts I have always used, and 169 items carried on a 'Distribution of Operating Expenses Book,' for the purpose of showing fully and completely the detailed and statistical information, as has always been my practice. I have found it entirely practical and comparatively easy to adapt my system of accounts to conform with the system recommended by the Accountants' Association to the permanent committee. The system can be conformed to without disturbing any system now in use, without discarding the ruled account books and without any expense further than the cost of the necessary printed instructions and the 'Distribution of Operating Expenses Book.' It is not necessary to change the accounts, thereby rendering a comparison of the operation of the road in 1898 valueless and impossible as compared with 1897. At least I have not found it necessary to make such changes. Objections of this kind would be the only ones possible against adopting and using any standard system. Any addition or changes that may be finally made by the permanent committee can easily be conformed to by pursuing the same general method that I have made use of."

* * *

Other prominent companies which have adopted the system include the following: Cleveland Electric Railway Company, Union Depot Railway, Missouri Railway and Lindell Railway, all of St. Louis; the Toledo, Bowling Green & Fremont Railway Company, Toledo; the Hamton Street Railway Company, Hamilton, Ont., and the United Traction Company, Pittsburgh, Pa.

LEGAL NOTES AND COMMENTS*

Edited by J. Aspinwall Hodge, Jr., and George L. Shearer, of the New York Bar

The Courts and Street Railways

Some recent statutes and a number of decisions recently rendered by the courts are food for reflection, especially to any one who takes a broad view of the legislative and legal controversies in which street railways are involved. We have recently seen equity judges, both at trial term and in appellate courts, passing upon many questions which would seem to be without the purview of a legal training and beyond the legitimate functions of a judicial, in distinctiou from a legislative, body.

The Constitution of the United States provides that the executive, judicial and legislative functions of the Government shall be exercised by entirely distinct departments. In various forms these restrictions upon the powers of each department have found their way into the state constitutions. In New York, for example, Article 3, Section 1 of the Constitution provides that "the legislative power of the state shall be vested in the Senate and Assembly;" aud this has been construed by the highest court in the state to mean that the sole power to legislate is vested in the legislature and it shall have absolutely no other power.—(*People v. Keeler, 99 N. Y. 476; 2 N. E. Rep. 620; People vs. Webb, 5 N. Y. Supp. 855.*) It has also been held that this power to legislate cannot be delegated. So where an act was passed providing that it should uot become a law until approved by a vote of the people, it was held to be unconstitutional, on the ground that the representatives of the people had had placed upon *them* the responsibility of legislation, and they could not get rid of this duty by delegating the power, even to their own constituents who had placed the responsibility upon them.—(*Barto v. Himrod, 8 N. Y., 483.*)

With these general propositions in mind it is, at a first glance, rather surprising to read the opinions of judges who are passing upon the expediency of building overhead or underground tunnels through great cities, determining whether or not it is proper to have certain tracks laid across the entrance of a great interurban bridge; deciding as to how far it is expedient for the city to issue bonds for the construction of municipal rapid transit facilities; passing upon the question of the necessity of gates at street crossings to preserve the safety of the public; determining whether street railroads should be compelled to cross the tracks of a steam road in a village at grade, by an underground tunnel, or by an overhead construction.

Manifestly, the first answer one would be likely to make, to the question as to whether the determination of these questions were the exercise of legislative or of judicial functions would be that they were strictly legislative.

The street railroads in every state are materially interested in the decision of the question as to whether various decisions of the lower courts of such questions are to be held valid by the courts of last resort; and, of course, if these questions are purely legislative then any statute providing for their determination by the judicial department of the government is unconstitutional.

The tendency of recent legislation and judicial decisions is to give to the courts the determination of many of these questions, and to uphold that course when its constitutionality is attacked.

There is much to be said on both sides. One of the priucipal reasons for sending these matters to the courts for determination, is one of the best arguments in favor of so doing. It arises out of the fact that the men on the bench are, ordinarily, men who can be better trusted to decide fairly between the public and the railroad companies, and to decide less affected by extraneous considerations than are the ordinary state legislators. They are further removed from politics, are less under the control of bosses and the influence of large corporations, and what they do they have to give a reason for, and their reasons, oftentimes, have to be reviewed by higher appellate tribunals. Experience, too, has shown that on the whole their decisions in such matters are equitable.

On the other hand, it is contended, and with much force, that the questions thus passed upon by the judges, are questions, the proper determination of which depends upou special training, far removed from that required by the practitioner at the bar or the judge on the bench. He should know the law and how to apply it and all its intricacies, but he is not a trained engineer or experienced railroad man or an expert on electricity or steam power, and what is true of a single judge is even truer of a bench of judges. It is said with justice that the sending of such questions to the courts tends to divert the judges from their specialty—the study of law in which they should be wholly occupied.

The expediency of the method of determining these questions by judicial authority has little bearing upon the decision of the constitional question involved; except that officers of street railways will need to consider carefully the question of expedieucy before deciding in any given state which side of the constitutional question they would prefer to take before the courts.

A judge in Connecticut, who,recently, under a statute, passed upon some of these questions was overruled by the appellate tribunal on the precise ground which we have stated, to wit, that it was an attempt to legislate by the court instead of by the only duly and constitutionally authorized body—the legislature.

In Pennsylvania, during the month, a decision in a case affecting the necessity or propriety of a grade crossing is typical of the decisions in that state which have been affirmed by the higher courts. (*Perkiomen R.R.* v. *Collegeville Elec. St. R.R. et al.*) There the learned judge discusses all the questions which would ordinarily be considered by the village authorities; passing upon them under the act of 1871, which provides that a town council cannot establish a grade crossing unless the courts approve of it.

In New York, the constitutionality of a somewhat similar statutory provision was directly called in question, and the court decided adversely to the contention that the act was invalid. (*People* v. *L. I. R. R. Co., 134 N. Y. 506.*) The court says: "No legislative power was given to the "court. But the statute made the erection and operation "of gates by railroad companies at places coming within "those mentioued, dependent upon the necessity of them "for the safety of travel upon the streets, to be ascer-"tained and determined in the manner provided; and when "the order is so made by the court, the statute is effectual "to enforce the compliance with it. The creation of the "power to determine the necessity of such safeguards at "intersection of railroads with streets was legislative, and "the exercise of the power so given is judicial. The re-"sult of the latter in the manner prescribed is the condi-"tion upon which the application of the statute is made "effectual. And whether or not there may be any better "or more reasonable method of accomplishing it, is solely "a legislative question."

One thing is very clear, that there is or should be a limit to the power of the courts to exercise these, at least, *quasi* legislative functions, for if it were broadly held that the legislature could pass any act, leaving the question as to whether the surrounding circumstances made it necessary or expedient for the act to become operative, then it is obvious that they might insert such clauses in all their statutes as to practically place the duty and responsibility upon the courts of legislating upon all questions ordinarily brought before the legislature. It seems also certain that this line can never be clearly defined, but much may be done to check the tendency, when it has reached a reasonable limit, beyond which it seems now very likely to go.

H.

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

CHARTERS, ORDINANCES, ETC.

ILLINOIS.—A street car corporation accepting a franchise, which requires the payment of certain license fees, is bound to pay such fees, though other corporations operating cars in the same city are required to pay less fees.

A city council in granting a franchise to a street car company may impose such license fees as, in its opinion, the public benefit may require, under Const. art. 11, § 4, prohibiting the granting of such franchise, without the consent of the city authorities, and 1 Starr & C. Ann. St. p. 1263, § 3, providing that such consent shall be on such conditions as the city authority "shall deem for the best interests of the public."—(Byrne v. Chicago Gen. Ry. Co., 48 N. E. Rep. 703.)

MICHIGAN.—Where a city has the power to enforce forfeiture of a street railway company's franchise for failure to pay a tax, and the company confesses its inability to pay such tax, and the mortgagee of the company stands ready to advance the necessary funds in case a receiver be appointed with power to borrow money, the appointment of a receiver upon the prayer of the mortgagee is proper, not as foreclosing the mortgage, and giving the mortgagee possession before the redemption period has expired, but as a means of preserving the property for the benefit of all concerned.

Where a street railway company filed a bill to restrain the city from enforcing forfeiture of its franchise, a mortgagee of the company, being impleaded, can, by cross bill, pray that a receiver be appointed for the company, with power to borrow money, and apply it to prevent the forfeiture, the subject matter of the bill and cross bill being substantially the same, and the relief sought by the cross bill being germane.—(Union St. Ry. Co. v. City of Saginaw, 73 N. W. Rep. 243.)

LIABILITY FOR NEGLIGENCE

ARKANSAS.—While the traveling public and street cars have equal rights to use the public streets, street cars, ex necessitate, have a right of way on their tracks; and although this does not give them a right to exclude the public, in case of conflict the individual traveler must yield.

A charge to the jury that "though you may find from the evidence that the plaintiff was to some extent negligent, yet if the defendant did discover, or by reasonable diligence might have discovered, the negligence in time, by using ordinary care to have prevented the injury, and failed to do so, it would be responsible to him in damages," is erroneous, as making the defendant liable in case the plaintiff was guilty of contributory negligence.—(Hot Springs St. Ry. Co. v. Johnson, 42 S. W. Rep. 833).

MASSACHUSETTS.—Where a duly authorized railway track was built, and maintained in a highway in a proper condition, the town authorizing the same is not liable for an injury to a traveler caused thereby.

A town is not liable for injuries received by a duly authorized street railway track, if it was constructed in the proper manner, though such construction, which was necessary to its operation, might be an obstacle to travel.—(Fowler v. Inhabitants of Gardner, 48 N. E. Rep. 619).

NEW YORK.—A physician's carriage was drawn up close to the curb, but so near to the track of a street railway as to barely permit a car to pass if the carriage remained motionless. He entered the carriage and took up the reins, when a car approaching from behind collided with the carriage. *Held*, even assuming that there may have been some slight motion of the carriage, that he was not guilty of contributory negligence.—(Tarler v. Met. St. Ry. Co., 47 N. Y. Supp. 1090).

MICHIGAN.—The fact that a street railway company was operating its cars by means of electricity, contrary to the terms of its franchise, cannot be raised in an action against it for injuries to a person on the street.

Where a girl passed behind a street car without looking for the approach of a car on the other track, of which she had knowledge, and was struck by it, it was not error to charge that if the suit was brought for the injury of an adult person the court could take it away from the jury.—(Hine v. Bay Cities Con. Ry. Co., 73 N. W. Rep. 116.)

NEW YORK.—In an action to recover damages from a surface railway company for alleged negligence, resulting in the death of plaintiff's dog, which got under a moving car in some unexplained manner, *held*, that the mere fact that the car was, at the time of the accident, running at an excessive rate of speed, not shown to have been the cause of the accident, did not establish negligence on the part of the company.—(Dettmers v. Brooklyn Heights R. Co., 48 N. Y. Supp. 23.)

NEW YORK.—At the trial of an action to recover damages for an injury due to a collision between plaintiff's vehicle and a surface car, it appeared that plaintiff saw the car approaching while 300 ft. distant. Defendant's request for a charge "that the defendant was not guilty of negligence for failing to ring a gong at the point in question" was refused. *Held*, that, as the only object of ringing a bell is to apprise travelers of the approach of a car, the refusal was error.—(Huber v. Nassau El. R. Co., 48 N. Y. Supp. 38.)

WASHINGTON.—After alighting from one car, plaintiff was struck by a car coming from the opposite direction. The gripman on the latter at the time was engaged in conversation, and did not see plaintiff, although plaintiff was in plain sight, and he did not ring the bell, or slacken speed, although the car was on a popular crossing of a populous city, and another car from the opposite direction was at the time passing said car. He could have stopped the car in from 5 to 12 ft. *Held*, that defendant was guilty of negligence.

Plaintiff was on a crowded street car. He signaled conductor to stop, but the conductor did not see the signal, so plaintiff stepped off while his car was in motion, and was struck by a car going in the opposite direction. At the time he stepped off, he was prevented from seeing down the track by reason of the crowded condition of the car, and he heard no bell or other warning. *Held*, that, although the accident happened on an unobstructed street, in daylight, plaintiff was not guilty of contributory negligence as a matter of law.—(Smith, Union Trunk Line, 51. Pac. Rep. 400).

NEW YORK.—A foot passenger was injured, in crossing a city street, by a loose rail of a surface car track. It appeared by several witnesses that the track had been carefully inspected that morning, and appeared all right until shortly before the accident occurred, when the absence of two spikes was seen, and at once reported to the track master, who had it repaired promptly and within an hour after hearing of it, but not until the accident had happened. The locality was always crowded with heavily loaded trucks, which might have sprung the rail. The track was comparatively new, and was well laid. *Held*, that the facts rebutted any presumption of defendant's negligence.

Williams and O'Brien, JJ., dissenting.—(Casper, v. Dry Dock E. B. & B. R. Co., 48 N. Y. Supp. 352.)

MINNESOTA.—Whether a pedestrian is guilty of contributory negligence in failing to look and listen before attempting to cross the track of a street railway is, as a general rule, a question of fact for the jury, to be determined from all the circumstances of the particular case; but the circumstances may be such, and the evidence as to those circumstances so conclusive that the court should say, as a question of law, that he was guilty of contributory negligence in failing to look and listen. *Held*, this is such a case.—(Terien v. St. Paul City Ry. Co. 73 N. E. Rep. 412.)

NEW YORK.—In an action to recover damages for an accident due to the alleged negligence of the defendant in running one of its cars, testimony that the car was "going fast" was objected to by defendant, and the objection overruled. *Held*, no error.

The court refused defendant's request to charge that: "If the jury believed that the car * * * was running at a moderate and proper rate of speed, and if at the time the child first started to cross the tracks the car was so close to the place where she was struck and run over that it was impossible for the car, under any circumstances, to be stopped before running over her, then the verdict should be for the defendant." *Held*, error.—(Ehrman v. Nassau Electric Ry. Co. 48 N. Y. Supp. 379.)

MINNESOTA.—Plaintiff, who had previously been a perfectly healthy woman, was thrown against the seat of the car by the jolt consequent upon its derailment, and sustained a fracture of a rib; the rib penetrated the tissue of the lung causing frequent hemorrhages and finally blood poisoning. *Held*, that a verdict for $2500 was not excessive.—(Donnelly v. St. Paul City Ry. Co. 73 N. W. Rep. 157.)

ILLINOIS.—Where, in an action by the driver of a horse car for injuries sustained in a collision with a cable car, the court submits a special interrogatory as to whether plaintiff, by the exercise of ordinary care, could have avoided the collision, it is not error to refuse to submit other interrogatories as to mere evidentiary facts.

A witness was not competent to testify as to whether there was a general custom, with respect to priority, between the horse and cable cars, when he had no knowledge about the matter at the time of the accident.

Evidence as to such custom in other cities was inadmissible.

The testimony of a witness for defendant that on the morning of the accident he saw nothing unusual about the speed of the cable cars, if inadmissible, was harmless.

The admission of evidence that a witness had seen cars running at the usual rate of speed, stopped in 20 or 30 ft., was not prejudicial error.—(Chicago City Ry. Co. v. Taylor, 48 N. E. Rep. 831.)

NEW YORK.—A complaint alleged that, while plaintiff was driving his cart across a city street, his horses took fright at the rapid approach of one of defendant's cars, and that the cart was thrown against the curb, and plaintiff precipitated to the ground and injured. No collision was charged. At the trial the judge refused to exclude plaintiff's evidence that the car struck the cart wheel, on the ground that it was a mere incident to the cause of action set forth in the complaint. *Held*, no error.

SAME—CONTRIBUTORY NEGLIGENCE.

If the driver of a cart, while coming up out of an excavation at one side of the street, looks more than 65 ft. up the street, to the point where the tracks of a surface car company turn in from another street, and no car is in sight, he is justified in assuming it safe to drive across the tracks.—(Walsh v. Atlantic Ave. R. Co., 48 N. Y. Supp. 343.)

NEW YORK.—In order to render applicable the rule that, as between trolley cars and other vehicles, neither has any superior or paramount right of way where a street crosses an avenue on which is the line of the railway, it is not essential that the street opening off from one side of the avenue should be literally a continuation of that which opens off from the opposite side. It is sufficient if one is, in effect, a continuation of the other.—(Brozek v. Steinway R. Co., 48 N. Y. Supp. 345.)

Patent Decision

A patent case was decided last month by Judge Wheeler in the Circuit Court for the Southern District of New York. The case was that of the Sprague Electric Railway & Motor Company vs. the Union Railway Company, et al., and was on the alleged infringement of letters patent No. 324,892, relating to a method of suspending the motors on the truck.

The following is Judge Wheeler's opinion in full:

OPINION

This suit is brought upon patent No. 324,892, dated Aug. 25, 1885, and granted to Frank J. Sprague for an electric railway motor consisting of a field magnet journalled on the axle of the driving wheels at one end, and hung upon a spring from the truck, or the carbody, at the other, and carrying the armature shaft upon its pole pieces parallel with the shaft of the driving wheels, and connected to them by gearing. The specification as to this arrangement says:

"The armature being carried rigidly by the field magnet, these two parts must always maintain precisely the same relative position under every vertical or lateral movement of the wheels or of the carbody; and as the field magnet which carries the armature is itself centred by the axle of the wheels to which the armature shaft is geared, the engaging gears also must always maintain precisely the same relative position. At the same time the connection of the entire motor with the truck is through springs, so that its position is not affected by the movements of the truck on its springs."

The claims in question are:

2. The combination of a wheeled vehicle and an electrodynamic motor mounted upon and propelling the same, the field magnet of said motor being sleeved upon an axle of the vehicle at one end, and supported by flexible connections from the body of the vehicle at the other end, substantially as set forth.

6. The combination with a wheeled vehicle, supported upon its axles by springs, or an electro-dynamic motor flexibly supported from such vehicle, and centred upon the driving axle thereof, substantially as set forth.

9. The combination with a wheeled vehicle, of an electro-dynamic motor centred upon the driving-axle thereof at one end, a spring support for that end of the motor from the truck or body of the vehicle, and relieving axle wholly or partly of dead weight, and a spring support for the other end of motor from the truck or body of vehicle, substantially as set forth.

This patent was before the Circuit Court of Appeals for the Eighth Circuit in Adams Electric Railway Company *vs.* Lindell Railway Company, 77 Fed. Rep. 432, which was brought upon patent No. 300,827, dated June 24, 1884, and granted to A. Wellington Adams for improvements in electric motors, against structures made according to this patent as infringements. The position of Sprague's invention with reference to prior structures, inventions and patents is there well and comprehensively set forth by Judge Sanborn in the opinion of the Court; and the decree dismissing the bill appears to have been affirmed because, in short, Sprague's invention was independent of Adams'. And if Sprague's patent was for merely hanging and centering one end of the motor of a carriage upon the axle of the driving wheels, and suspending the other by a spring from the body of the vehicle, or the truck, it would be shown from that case to be wholly lacking in novelty, and void. He was not a pioneer here, and could have a valid patent for only what was new in his method of making the power of the electrical current turn the driving wheel. No one had before, however, hung a field magnet at one end upon the axle of the driving wheels, and at the other upon a spring from the body of the car, or the truck, and an armature axle upon the pole pieces of the magnet, parallel with and geared to the axle of the driving wheels for driving a car by a current of electricity. This combination simplified greatly the required structures, improved their results, and came into immediate use. The invention of it seems to well support these claims of the patent.

The defendant's structures differ in some respects from those of the patent, but have all these parts working together in the same relation to each other, for the same purpose and producing the same result. They are altered by the addition of a joint in the motor, and of another spring to help carry it, but not by dispensing with any of the parts; they are improved upon but not departed from. The defendant's improvements are not made independent of, and clear from Sprague's, but upon his; and his patent appears to be infringed by this taking of his invention to improve upon.—Decree for Plaintiff.

S. H. Short, vice-president of the Walker Company, expressed himself in regard to the decision as follows:

We do not regard Judge Wheeler's decision as affirming that the Walker motors are an infringement of this patent and consider the decision for the plaintiff as based upon a misunderstanding of the construction of our motor. As will be noticed, the Court defines the Sprague system as that "of a field magnet journaled on the axle of the driving wheels at one end, and hung upon a spring from the truck, or the car body, at the other, and carrying the armature shaft upon its pole pieces parallel with the shafts of the driving wheels, etc."

This describes the original motors in which the armature shafts were carried upon the pole pieces which was done by means of a brass bracket connecting the two poles of the bi-polar motor then in common use. The Walker construction is clearly not covered by the mechanism thus defined, because the armature shafts are not carried upon the pole pieces but upon the motor frame itself. On the contrary the pole pieces are entirely independent of the armature supports and are perfectly free.

Referring now to the broad claims of the patent Nos. 2, 6, and 9, in which the general principle of suspending a motor flexibly on a car axle and truck are claimed. The Judge clearly points out from the case of Adams Electric Railway Company v. Lindell Railway Company that these points are not patentable on account of prior inventions and expressly states that "if the patent was for merely hanging and centering one end of a motor off a carriage upon the axle of the driving wheels, and suspending the other by a spring from the body of the vehicle, or the truck, *it would be shown from that case to be wholly lacking in novelty and void.* He was not a pioneer here, and could have a valid patent for only what was new in his method of making the power of the electrical current turn the driving wheels."

The Court in then defining what was the invention expressly declares that it was a combination of a flexible method of suspension "and an armature axle upon the pole pieces of the magnet, parallel with, and geared to, the axle of the driving wheels for driving a car by a current of electricity." This combination is of course not present in the Walker equipment.

We have the most eminent legal opinions that our construction in no way infringes this patent. We do not regard the point as of great moment, however, and could easily dispense with the construction claimed in the patent if it should seem desirable. The truck springs themselves come between the motor and the wheels and axles and truck, and are amply sufficient to give the necessary flexible support to the electric equipment.

Annual Report of the Chicago City Railway Company

Menard K. Bowen, general manager of the Chicago City Railway Company, was elected last month president, succeeding in that position George H. Wheeler. W. B. Walker was elected first vice president, and Joseph Leiter second vice-president. The following directors were elected: George T. Smith, Samuel W. Allerton, M. K. Bowen, D. G. Hamilton, Joseph Leiter, William B. Walker, George H. Wheeler.

The following figures are given in the annual report:

REVENUE CAR MILES RUN.

		Per. ct.	
Cable lines	12,562,610	51.532	1,345,580 dec.
Horse lines	198,860	.816	427,830 "
Electric lines	11,616,530	47.652	1,598,510 inc.
All lines	24,378,000		

NUMBER OF REVENUE PASSENGERS CARRIED.

		Per. ct.	
By cable lines	41,444,636	43.342	4,990,775 dec.
By horse lines	691,051	.723	2,183,580 "
By electric lines	53,485,425	55.935	7,556,552 inc.
By all lines	95,621,112		

An increase over the previous year of 382,197.

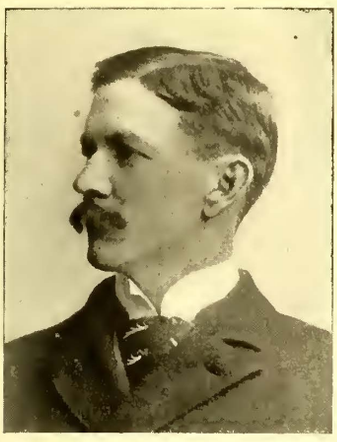
Passenger receipts per day	$13,098	$ 88 inc.
Expenses per day	7,969	164 dec.
Net receipts per day	5,128	252 inc.
Net loss on horse lines for the year	13,365	5,144 dec.

Cost of operating, per car mile.	1897. Cents.	1896. Cents.
Cable lines	10.706	10.540
Horse lines	24.096	25.889
Electric lines	13.051	13.467
All lines	11.932	12.126

The secretary's report for 1897 was as follows:

	1897.	1896.
Passenger receipts	$4,781,055	$4,761,945
Miscellaneous receipts	35,461	46,921
Total earnings	$4,816,516	$4,808,866
Operating expenses	2,908,982	2,977,208
Bonded interest	207,877	207,877
Depreciated account	50,000	181,568
	$3,166,860	$3,366,654
Net earnings.		
Earnings applied to dividends	$1,649,656	$1,442,212
Dividend paid, 12 per cent	1,440,000	1,289,787
Surplus	$ 209,656	$ 152,425
Capital stock, 1896		$10,750,000
Capital stock, 1897		12,000,000

Mr. Bowen, the new president, is undoubtedly one of the most competent and one of the best known street railway managers in this country. He was born in 1858 in Jefferson Barracks, Mo., and received his early education at St. Louis University but later took a course in engineering at the Washington University in St. Louis. At the age of nineteen he entered the Government service as assistant engineer on a triangulation survey of the Mississippi River. He was afterwards appointed assistant engineer of the jetty work in the harbor at New Orleans. Mr. Bowen was engaged for some time after this in surveying and steam railroad work. He commenced his street railway career in Kansas City as chief engineer and superintendent of construction of the Kansas City Railroad. After leaving Kansas City Mr. Bowen was engaged for about a year in New York City and then accepted the position of superintendent with the Chicago City Railway Company. After discharging the duties of this office for four years his ability and faithful service were recognized by his directors and and he was promoted to the general managership. This was only a year ago and now the highest honor in the gift of the corporation has been bestowed upon him. One of the most valuable features that Mr. Bowen has introduced since his connection with the Chicago City Railroad Company has been the weekly meeting with the different heads of departments. In this meeting, which is usually held on Friday, Mr. Bowen meets the foremen and chiefs of all the departments of the road and encourages them to make suggestions regarding their work and to criticise any feature which they think should be changed. In this and in other ways Mr. Bowen keeps in close touch with all the employes of his system and to this practice is undoubtedly due a great part of his success as a street railway manager. Mr. Bowen's host of friends throughout the country will wish him all possible success in his new position.



M. K. BOWEN

Changes in Boston

At a meeting of the stockholders of the Boston Elevated Railway Company (leasee of the West End Street Railway Company) held Jan. 3, 1898, the following gentlemen were elected directors for the ensuring year: Frederick Ayer, Wm. A. Bancroft, Samuel Carr, T. Jefferson Coolidge, Jr., Wm. Endicott, Jr., William A. Gaston, Charles J. Paine, F. H. Peabody, Robert Winsor, James M. Prendergast and Jacob C. Rogers; and a few days later the following officers were elected: William A. Gaston, president; William A. Bancroft, vice-president; William Hooper, treasurer, and John T. Burnett, secretary and clerk of the corporation. C. S. Sergeant, formerly general manager of the West End Company, will be retained by this company with enhanced duties and emoluments. It is expected that the company will move its offices from the cramped and narrow rooms in which a portion of the business of the West End Company has been carried on for more than ten years to the spacious quarters in the Converse Building, now in process of erection at the corner of Milk and Pearl Streets, a few doors below the building now occupied. The company will occupy eight of the ten stories in the building, thus affording ample space for the immense work which the company will have to carry on and allowing it to concentrate its entire force, which is now scattered around in no less than five buildings all over the city, into one building. The new building is considered an excellent location for the offices of the company. The rooms are well lighted, airy and cheerful, and equipped with all modern appliances of the most approved character.

WILLIAM A. BANCROFT

William A. Bancroft, who has been elected vice president of the Boston Elevated Railway Company, was born Apr. 26, 1855, in Groton, Mass., and is the son of Charles and Lydia Emeline (Spaulding) Bancroft. He attended the public schools and the Lawrence Academy in his native town, and afterwards Phillips Exeter Academy, from which he was graduated in 1874. He matriculated at Harvard College in 1878, and was graduated from the Law School. He was admitted to the Suffolk bar in 1881. When in college he became noted for his athletic prowess, and was captain and stroke oarsman of the victorious Harvard University crews of 1877, 1878 and 1879.

Thirteen years ago he started in the street railway business as general superintendent of the Cambridge Railroad. It was a horse railroad and it was in competition with the Charles River Railway Company. About fifteen months after this he became general superintendent of the two street railways which were united under the name of the Cambridge Railroad.

During that time he had very good success in the operations of the two companies and a number of changes were made that were for the advantage of the public, the companies and the employes.

After the West End Street Railway Company absorbed the Cambridge Railroad, he was appointed general roadmaster of the entire system, superintending the first construction of the electric lines of the West End Company. As a street railway superintendent his administration was eminently successful, and his energy, firmness, tact and organizing ability at the time of the great strike in 1887 brought him into prominent notice. In 1890 he left the street railway service with the good will of its employes and returned to the practice of law. In the fall of 1881 he was elected a common councilman and the following year was elected a representative to the legislature, and was re-elected in 1883, and again in 1884. In the fall of 1890 he was chosen an alderman and in the following year was re-elected. He served as president of the Board and chairman of the Finance Committee during both years. Elected mayor in 1892, he served for four successive years as chief executive. In 1893, while mayor, he was made an overseer of Harvard College, and in the same year presided over the Republican State Convention at which Governor Greenhalge was first nominated. In 1894 he was elected president of the New England alumni of Phillips Exeter Abademy, which position he still holds.

In March, 1896, he became counsel of the Boston Elevated Railway Company, and in January, 1897, was elected vice-president and managing director, and from now on he will direct the management of this company which has recently leased the West End Street Railway Company with its 305 miles of track.

NEWS OF THE MONTH

A PETITION is being circulated among the citizens of Binghamton, N. Y., to prevent the Binghamton Railroad Company from using salt upon its tracks to remove snow and ice. It is urged by a number of citizens that the use of salt destroys the sleighing on the business streets of the city.

THE Pennsylvania Railroad is making experiments with an electric locomotive on its branch at Atlantic City, N. J., with the view of doing away with the steam locomotives now in use.

THE Metropolitan Street Railway Company, of Kansas City, Mo., is about to adopt at its different power houses an arrangement for destroying the smoke coming from the smoke-stacks. This is in obedience to an anti-smoke ordinance passed by the Kansas City Council.

IT is stated that North Tonawanda, N. Y., will soon have electric power from Niagara Falls. The Tonawanda Power & Conduit Company expects to be able to deliver the Falls power to customers by May 1.

A BILL has been introduced in the New York Legislature providing that five cents is the maximum rate of fare to be charged by street railway companies within the limits of cities of 1,500,000 inhabitants or more.

A PECULIAR accident occurred recently on the Fourth Avenue cable line of the Metropolitan Street Railway Company of New York. Smoke was seen issuing from the cable slot at Twenty-third Street, and on investigation it was found that the entire conduit for a block was full of fire and smoke. It is supposed that the oil troughs over which the cable runs caught fire in some way. Traffic on the line was suspended until the blaze had burned out.

IT is stated that the Illinois Street Railway Association, newly organized, has prepared a bill for submission to the Illinois Legislature making the life of all street railway franchises in the state, ninety-nine years.

A BILL permitting the consolidation of the Eckington & Soldiers' Home Railway Company, the Maryland & Washington Railway Company and the Belt Railway Company, all of Washington, D. C., has been introduced in the Senate.

Ever since Thomas M. Jenkins became manager of the Cincinnati, Newport & Covington Railway Company it has been the custom of that corporation to offer cash prizes ranging from $5 to $25 to its various employes each year, for carefulness, tidiness and good demeanor. The annual distribution was recently made.

At a meeting of the Engineers' Club of St. Louis, on Jan. 5, a paper was read by Richard McCulloch, entitled "An Historical Sketch of Street Railways." The development of the street railway from the first road in New York City in 1832 was traced. The early experiments, with mechanical traction, and the history of the pioneer roads were given, and the general improvements in street railway construction was traced down to the present time. The local history of the St. Louis roads was then taken up, and a short sketch of the omnibus lines which preceded the street railways was given, and the history of the early horse railways was outlined. The first cable roads and the early electric roads were described, and the paper closed with a review of the present condition of street railways.

Work on the San Gabriel Power Company's plant, near Azusa, Cal., is being pushed very rapidly in every department—nearly 500 men being now employed. The power will be transmitted to Los Angeles, and it is stated that contracts have already been signed in that city for all the power that company will be able to supply.

It is stated that a bill is about to be introduced to the Kentucky Legislature making it compulsory for the street railway companies in all cities of the second class in Kentucky, to operate cars between the hours of 6 and 8 A. M. and 5 and 7 P. M., for the benefit of working men and to charge but a 3-cent fare during these hours. This bill will affect cities of the size of Covington, Newport, Lexington, etc.

The Metropolitan Street Railway Company, of New York, has placed on trial a number of fenders on its electric lines.

United States Consul Bell, writing from Sydney, New South Wales, says: "The general outlook of business is more favorable; the seasons are better, the crops good, the tendency of general business is improving, and American dealers are surely enjoying a fair share of the increased prosperity. Our manufacturers have secured the contracts for the machinery of Sydney, and have stipulated to furnish 2000 tons of steel rails for the new railway lines."

The Board of Railroad Commissioners, of Connecticut, has is sued an order that the platform of the enclosed cars of the Norwich Street Railway Company be protected by glass fronts within sixty days from the date of the order, during the months of December, January, February and March of each year; and that in future, when the company shall purchase closed cars, the cars shall have platforms fully vestibuled with glass fronts and sliding doors of glass.

The general manager of the New York & Queens County Railway Company of Long Island City, N. Y., has recently issued an order prohibiting, under penalty of dismissal, any employe of the road boarding or living at a hotel, or a saloon, or at a restaurant which has a liquor store annex. To enter a saloon while on duty is also punishable by dismissal, and any employe detected in the act of drinking alcoholic liquors during his business hours, will be summarily discharged.

The employes of the Union Traction Company, of Philadelphia, are planning a large reception to take place Tuesday, March 1. Many of the officials of the company have signified their intention of being present and are aiding in every way to make the affair a success.

The growth of street railways in Vermont has been remarkable since electricity was introduced. Previous to the year 1894 there were but two street railways in the state, and these were operated by horses. These roads were in Burlington and Rutland. The close of the year 1897 finds seven electric railways in operation with 50 miles of track and an equipment of 48 cars; two roads being built, with 14 miles of track completed and 11 miles in process of building, and two roads projected, with a mileage of 34 miles. This aggregates 109 miles of electric railway built, in process of construction, and projected.

The Rodgers fifty year franchise law has been repealed by the Ohio Senate, and the Bramley substitute, with an amendment offered by Senator Wolcott, adopted in its stead. This does away with the right of city councils to grant franchises to street railway companies, upon consolidation, for a term of fifty years. By the amendment of Senator Wolcott the repealing bill also provides that if two roads consolidate only one fare can be charged for a continuous ride over the consolidated lines. By the law as it now stands city councils can grant franchises to street railway companies for a period not to exceed twenty-five years.

A conference has been held by the street railway companies of Cleveland and the post-office authorities in regard to the placing of U.S. mail boxes on a large number of cars in that city. It is stated that boxes will be placed on the rear dashboards of the cars, where they will be within convenient reach of passengers and also of pedestrians who may be near a car when it stops. The boxes will be emptied at the end of each trip and in this way a very quick and frequent collection of mail matter can be secured. Cars carrying boxes will have special signs to distinguish them from others.

The following list of the electric railways which have been projected in the state of Michigan will be of interest as showing the revival of business activity in the West. The lines under consideration are as follows: from Detroit to Toledo, 50 miles, with two companies figuring on it and one of them claiming to have acquired most of the necessary right of way; from Bay City through Wisner, Akron and Columbiaville, to Sebewaing, 30 miles; from Lansing, through St. John's, Maple Rapids, Pompeii, to St. Louis, 53 miles, with ultimate extension to Midland, the company has already been incorporated; from Lansing, through Danville, Birkett's and Unadilla, to Dexter and Ann Arbor, 70 miles, this company has been incorporated; from Detroit to Romeo, 33 miles; from Hart, through Hesperia to White Cloud, 35 miles; Detroit to Pontiac, by way of Redford, and the lake resorts, 30 miles; from Pontiac to Flint, 42 miles, right of way already secured; from Bay City through Saginaw, Caro, Sanilac Center and Crosswell to Lexington, 90 miles, with a probable extension down the lake shore to Port Huron; from Kalamazoo to Battle Creek 25 miles, right of way secured and work will be begun this season; from Dundee to Monroe, 17 miles; from Lambertsville to Toledo, 18 miles; from Coldwater to Union City 13 miles; also from Coldwater to Fremont, O.; from Benton Harbor east 10 miles, then one branch to Allegan, 60 miles, and another to Cassopolis, 40 miles. The latter road is partly graded, but the company has become involved in litigation.

Another instance of rapid street railway construction occurred at St. George, S. I., N. Y., recently. The Midland Railroad Company and the Staten Island Electric Railroad Company have both been trying to secure possession of South Street, St. George. At midnight the Midland Railroad Company set 250 laborers to work and by torchlight 1000 ft. of double track were laid. At 5 A. M. the construction work was entirely completed and a car was running on the afternoon of the same day.

The Brooklyn Heights Railroad Company is fitting up an old frame building adjoining one of its car sheds, as a club room and meeting place for its employes on the Flatbush Avenue line. It is intended to fit up the interior of the house in a most comfortable style. A director of the company has donated a pool table and several residents of Flatbush have promised to donate a complete gymnasium, while the railroad company will furnish plenty of reading matter. The employes of the road are very enthusiastic over the plan.

The National Association of Manufacturers, held its third annual meeting in New York City on Jan. 25, 26 and 27. The meetings were attended by large crowds and the convention will undoubtedly have a marked influence on the development of American manufactures during the coming year. A grand banquet was held on the evening of Jan. 27, at the Waldorf-Astoria, at which President McKinley made an eloquent address.

The annual ball and vaudeville entertainment of the Third Avenue Railroad Employes' Mutual Relief Association was held at the Lexington Opera House on Friday evening, Jan. 28, 1898. An excellent vaudeville entertainment was provided and the affair was a very pleasant one in every way.

Prizes for Conductors

The Lindell Railway Company of St. Louis, Mo., has offered a number of prizes to the conductors on its lines for the best set of answers to a long list of questions about the proper duties of a street railway conductor. These questions are as follows:

1. What do you consider the four chief requirements of a conductor in the order named?
2. What is your duty respecting the handling of the bell cord?
3. Who has charge of the car and to what extent?
4. In case of an accident, what is the conductor's duty?
5. What is the substance of the rule which the conductor is required to read frequently and to his motorman occasionally?
6. Under what circumstances are motormen permitted to pass persons waiting to board the car?
7. In case your car is a little behind time how would you make up the same?
8. What is your position on the car when not engaged in collecting fares?
9. What is your duty when ladies and children and infirm people board or leave the car?
10. During any difficulty or altercation with a passenger what should you strive to do?
11. To what extent are you permitted to use tobacco while on duty?
12. State the rule respecting passengers smoking on the car?
13. State substance of rule respecting expectorating in the car, or on the car floor?
14. What are the small windows on the roof of the car placed there for?
15. During cold weather when should the rear door be permitted to remain open?
16. During dusty weather what do you consider the best preventive from dust entering the car?
17. Would you expect to retain the good opinion of our patrons, and your employers, if you addressed the passengers in a rude or ungentlemanly manner?
17A. Have you ever been reported or reprimanded for ungentlemanly conduct?
18. What is the limit to number of passengers on platform when there are seats vacant inside?
19. Why should the passageway from car door to step be kept clear?
20. What is your duty before giving the signal to start?
21. Why should the trolley never be pulled down unless the motorman has shut off the current at the controlling switch?
22. Why should all collections be completed and fares registered before your car arrives at a transfer station?
23. Name all bell signals?
24. Are you thoroughly versed in the use of the telephone?
25. How would you secure a connection with the telephone station required?
26 In case of a blockade along the line, whose duty is it to notify the office?
27. What is your duty when discharging passengers if you see them attempt to cross the street after leaving your car?
28. What is your duty respecting the examination of the car assigned to you, before leaving the car shed?
29. What is your duty respecting the examination of car before taking the same from relief conductor?
30. In what condition should the car be left before entering the car shed?
31. State regulation respecting the transportation of employes?
32. How much change should each conductor provide himself with?
33. Under what conditions are you permitted to eject a passenger from the car?
34. What is your duty when the trolley wire is down?
35. What is your duty in case of injury to person or persons?
36. If a bill of large denomination were tendered and you could not return proper change, what course would you pursue?
37. If a person whose statement you did not question should inform you that he or she had no money with which to pay fare, what course would you pursue?
38. Why are some of the poles along the line painted with a single white band?
39. Why are some of the poles along the line painted with a double white band?
40. Why should cars be evenly spaced after a blockade, and not started up together and run in bunches?
41. What is the advantage to the public in having cars operated according to schedule time and on spaces equally divided?
42. What are the rules of the company respecting the carrying of large packages, bicycles, glass and dogs?
43. What would you limit the size of a package permitted to be carried on a car?
44. Why are conductors prohibited from holding the bell cord while the car is at a standstill?
45. What would be your duty after signaling the motorman to stop and before reaching the crossing or stopping place, a passenger should attempt to leave the car before the same has been brought to a stop?
46. In discharging and taking on passengers how would you expedite the same—that is to say, where a number of passengers desiring to get off and others anxious to get on at the same time?
47. How should the time on the stand at each end of the road be occupied?
48. Should your car be derailed or from any cause blockade the crossing of a steam railroad, what would be your first duty?
49. Why should a sharp lookout for passengers be at all times maintained?
50. Over what division would you instruct passengers to reach the following points, and at what street would you direct them to get off? (Here follows a long list of local names.)

MOTORMEN.

1. Having been assigned a car by the foreman of your division, what should be your first duty before taking the same out of the shed?
2. Who is supposed to have charge of the car?
3. What are your duties as motorman from the time you take charge of the car until the time you turn the same in, or deliver the car to your relief man?
4. What are your duties with reference to running over railroad crossings, frogs and switches?
5. How would you cross a railroad crossing, crossover, frogs and switches (with the brake set or released)?
6. What are your duties with reference to handling your car down grade?
7. In running through water to what advantage should motors be operated?
8. What are your duties in case your car gets beyond your control in going down a grade?
9. In case your car wheels slip in making a grade, what method should you apply to obviate same?
10. What are your duties in case power is shut off respecting starting up?
11. Under what circumstances are you permitted to reverse your motors?
12. In case it becomes necessary to reverse the motors, what is your first duty?
13. In what manner would you replace a fuse?
14. In case a second fuse blows in succession, what is your duty?
15. If a commutator acts badly, or other electrical troubles present themselves and either motor becomes uncontrollable, what means would you take to ascertain or locate same?
16. What are your duties with respect to occupation of your time while the car is on the stand?
17. What would you do in case your controller becomes unmanageable with the current on and set, and not being able to turn cylinder in a backward or forward position?
18. Where are the contact switches located for the purpose of cutting out motors on various types of motors?
19. To what extent is the motorman responsible for the operation of the car?
20. Under what circumstances are you permitted to pass persons desiring to board your car?
21. In passing persons desiring to board your car, what is your duty?
22. When approaching a car on opposite track that has been brought to a stop, what is your duty?
23. Why should you reduce the speed of car on approaching a switch point?
24. Why should the car clear the cross-street before bringing the same to a stop?
25. Should your car be derailed or from any cause blockade the crossing of a steam railroad, what would be your first duty?
26. Why should you ring the gong when a vehicle is ahead of your car and alongside of the track?
27. What do you consider the most economical method of operating the controller switch handle?
28. Explain the path of the current from the time of leaving the generator at the power house to its return thereto?
29. Why should the trolley never be pulled down whilst the current is applied?
30. Under what circumstances would you operate your car faster than time points named on time table?
31. In what condition must your car be left in the car shed?
32. What is your duty should you find the trolley wire down?
33. Do you consider it more important to get away as quickly as possible in the event of accidents in order to maintain your car on time, or to remain and render all assistance possible?
34. Before bringing the car to a stop on up grade with a slippery rail, when would you begin dropping sand?
35. Before making stop on slippery rail, how should sand be used to prevent flat wheels?
36. Should sand be used on a dry rail?
37. Should sand be used on a clean wet rail?
38. Can a car be brought to a stop in the same distance under all conditions of the rail?
38A. In what distance could you bring your car to a stop on a level, or slightly down grade, car being operated at rate of 10 miles per hour, condition of track dry, and clean rail?
39. What is your duty with respect to the rail ahead of your car?
40. In case a car does not start after stopping on a dirty rail, what means would you take in overcoming same?

41. In what position should your controller handle be with respect to the motors, running down grade?

42. If any electrical trouble presents itself with the motors and becomes uncontrollable from the controllers, what effort would you put forth in checking same?

43. In what manner should you handle your controller in building up the motors to full speed?

44. What are your duties with reference to brakes before bringing your car to a dead stop?

45. What is your duty to avoid further destruction when a ring of fire presents itself passing around a commutator?

46. Name the two chief requirements of motormen?

47. Why should a sharp lookout be at all times maintained on the rail when the car is in motion?

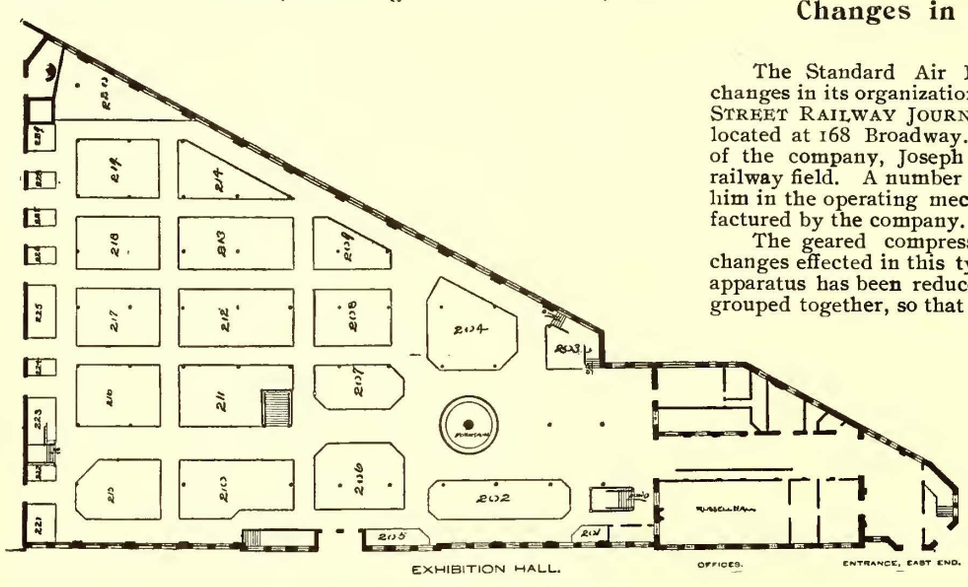
48. What tools and appliances are motormen to have on the car at all times?

49. What are the bell signals?

50. Why are motormen and conductors not allowed to enter a car in the car shed, other than the car assigned to them?

Convention Hall at Boston.

As stated elsewhere, the Executive Committee of the American Street Railway Association, at its meeting in Boston, last month, selected as the Hall for the exhibition of exhibits, the Mechanics Institute. This contains a much larger floor space for exhibits than any exhibition hall in the history of meetings of the Association, and is well located near the western and southern railroads, so that heavy pieces of machinery can be quickly transferred from flat cars to the exhibition hall. The accompanying engraving gives a ground plan of the hall.



PLAN OF CONVENTION HALL.

Round Corner Seat-End Panel

It is at this season of the year that general managers are beginning to think of getting the summer equipment into order and of making specifications for new summer cars. In order to do away with the many objections to the cross-seat open car the J.G.Brill Company has introduced a round corner seat-end panel for which it is claimed that it will obviate all of the objections to the ordinary seat-end panel.

In this departure the end of the seat is so rounded that the inside end of the curve stands at a point directly over the outside edge of the sill. The top of the iron panel is bent to a horizontal curve which fits the round end of the seat. This imparts a double curve to a considerable portion of the panel. In this way the ears of the panel, instead of striking out at right angles to the passageway and forming sharp corners, are turned back out of the way and an easy curve substituted. This panel has been adoped as standard by a number of roads including the Metropolitan Street Railway Company of New York City.

A Tasteful Calendar

One of the most attractive calendars that has ever come to this office is the one issued by the Vose Spring Company, entitled "The Pierrot calendar." It is in the form of a crescent, upon which are a number of attractive figures of children, the calendars for the months being on stars surrounding the crescent.

Important Meeting in Texas

Ir has been decided to hold an international meeting of the Texas Gas & Electric Light Association, the Texas Street Railway Association, and the gas, electric, street railway and power men of Mexico, at Laredo, Tex., on March 9, 10, 11, and 12, 1898. A large attendance is assured, and several valuable papers will be presented. The Mexicans especially, who are connected with the lighting, street railway and power plants of Mexico, have evidenced great interest in the proposed meeting, and the Mexican Government, through its department of Foreign Affairs, and through the Mexican Consul at San Antonio, expressed interest in and tendered offers of assistance as far as possible for a successful meeting.

Among the papers to be read at the different sessions are the following: "Meter *vs.* Flat Rates," by J. R. Cullinane of Denison; "A Chapter on Accidents," by Geo. B. Hendricks of Fort Worth; "Use and Abuse of Electrical Machinery, Apparatus and Appliances," by Harry L. Monroe, Dallas; "Car Bodies: Their Maintenance and Repair," by Frank E. Scovill of Austin; "Trucks and their Maintenance," by George D. Hartson of Dallas; "Rail Bonding as a Power Saver," by H. C. Chase of Houston; "An Electric Furnace, Calcium Carbide, Acetylene Gas and Other Forms of Gas," by J. D. Cox of Galveston; "Ties: Their Life and Preservation," by D. D. Willis of San Antonio, and a number of others.

A large hall has been engaged for convention and exhibition purposes and good hotel accommodations will be provided.

Changes in an Air Brake Company.

The Standard Air Brake Company has made some radical changes in its organization, as mentioned in the last issue of the STREET RAILWAY JOURNAL. The office of the company is now located at 168 Broadway. The newly appointed general manager of the company, Joseph R. Ellicott, is well known in the street railway field. A number of improvements are being introduced by him in the operating mechanism of all types of brakes now manufactured by the company.

The geared compressor will be made a standard, and by the changes effected in this type of machine, the weight of the whole apparatus has been reduced about 175 lbs. All parts will be closely grouped together, so that the piping under the car will be reduced to a minimum. The improvements in the way of simplicity which have been introduced will have an important bearing on the increased life of the apparatus. As an instance it may be stated that one of the company's improved axle geared compressors has been in operation on a car during the past fifteen days, and in this time no less than 25,000 service applications of the brakes have been made. In spite of this there is absolutely no wear to be seen, which is due entirely to a special automatic arrangement for disconnecting and placing at rest the operating mechanism of the compressor when a predetermined maximum pressure has been reached. The compressor remains inoperative until the next application of the brakes is made, when the operating mechanism is automatically thrown into engagement and air is compressed to replenish what has been used in making the previous stop, which means only a few minutes' work on the part of the compressor, when it is again thrown ont of engagement.

The motor compressor device manufactured by this company has been meeting with marked success both at home and abroad. Improvements, however, are being constantly made from time to time.

Arrangements have been made for the manufacture of their brakes at Hoboken, N. J., directly under the supervision of the company's engineers. With the improvements in simplicity of the apparatus which have been adopted, the cost of maintenance has been reduced to a minimum while the service will be more effectual.

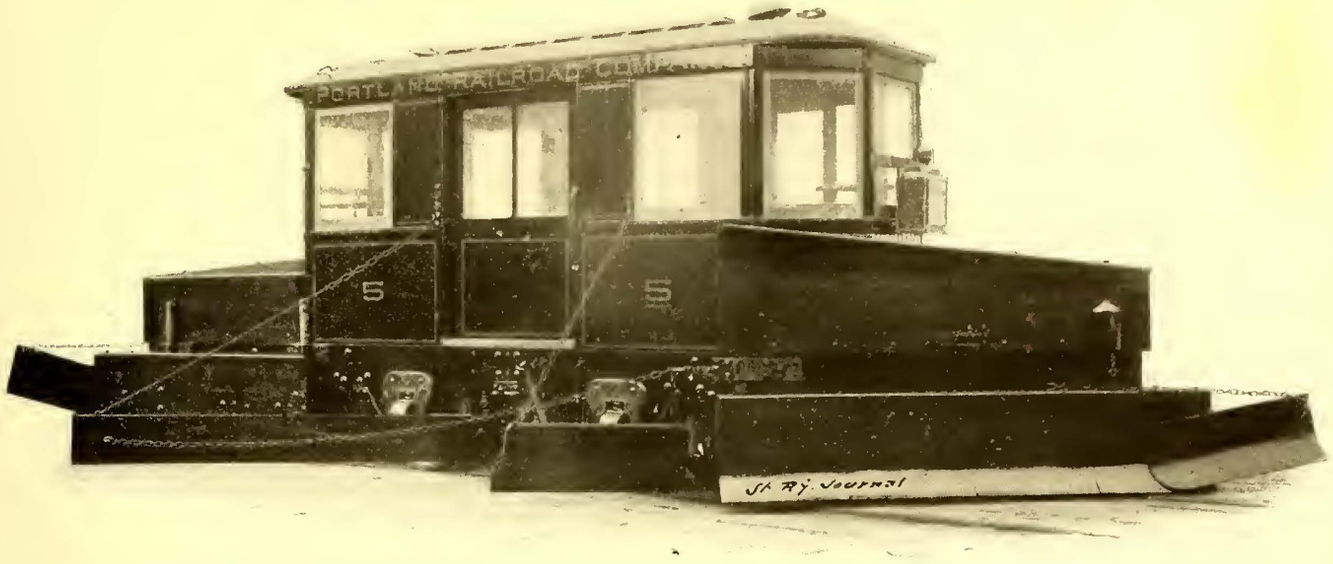
Calendars For 1898

During the last month a number of fine calendars have been received at the office of the STREET RAILWAY JOURNAL in addition to those acknowledged last month. Among the companies from whom calenders have been received are Central Electric Company, Standard Varnish Company, Alfred F. Moore, R. D. Nutall Company, Peckham Motor Truck & Wheel Company, Vose Spring Company, and J. P. Sjoberg & Company.

THE Sandusky, Norwalk & Toledo Railway Company, Sandusky, O., has been incorporated with a capital stock of $1,000,000 to construct and operate a railroad by electricity or other motive power from Sandusky through Erie, Huron, Sandusky, Seneca, Hancock, Wood, Ottawa and Lucas Counties to Norwalk and Toledo, and to generate electricity for use as either heat, light or power. The incorporators are Clark Rude, A. J. Stoll, Henry B. Fowler and W. E. Guerin, Jr., of Sandusky, and W. W. Graham, of Norwalk.

A Heavy Snow Plow

An interesting form of nose plough built for the Portland (Me.) Railroad Company by the J. G. Brill Company, is shown in the accompanying illustration. It is of the largest, heaviest type made for a street railroad. The box or car is entirely enclosed and is mounted on a very heavy floor frame, to which jaws are bolted for carrying



SNOW PLOW FOR PORTLAND, ME.

the boxes. The side sills and end timbers are 4 ins. × 12 ins. A double set of end timbers were used in this plow in addition to heavy diagonals, and the side sills run continuously from the point of the plow back. The length is 16 ft. and the width 6 ft., and the stationary shear rises to the level of the window sill nearly 6 ft. from the track. This unusual size and weight was designed to meet the excessive snow fall of the east, and the whole plow was built strong enough to withstand the heaviest usage in deep hard drifts. For this purpose the shear was carried in very strong guides, the lower edge of the blade being rounded in such a way as to make the plow hug the track. Heavy wings and scrapers of unusual length are provided so as to throw light snow far enough away to prevent it from falling on the rails.

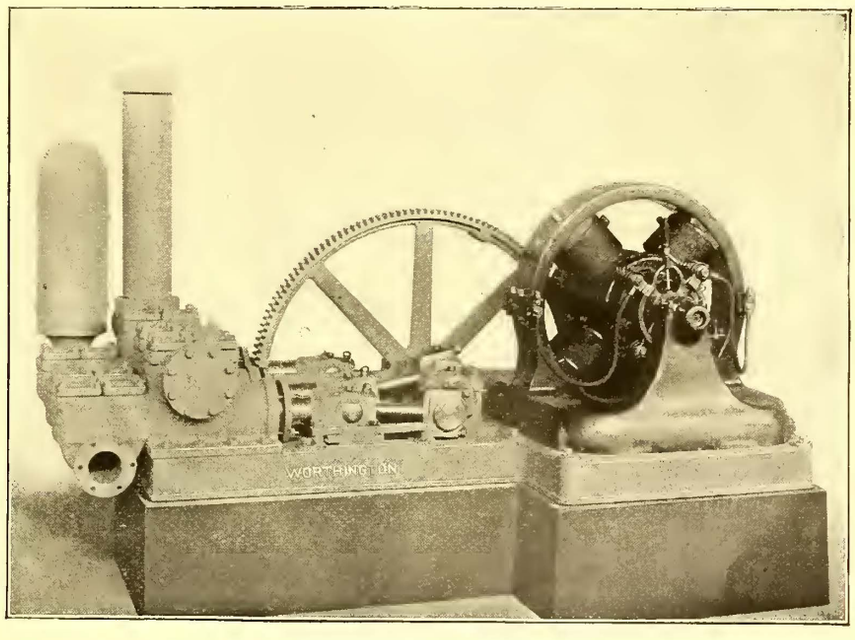
The motive power consists of two G. E. 1000 motors. There are two sand boxes and the usual conveniences within the house. The shears are raised and lowered with a hand wheel operating a worm gear, and the diggers and scrapers are raised and lowered with a lever. The plow is mounted on 33 in. wheels. The bay window ends have stationary sash, except in the center section where the sash drops.

A Triplex Electrically-Driven Pump

In the accompanying illustration is shown a triplex electrically-driven pump, which is claimed to be different in several features from anything heretofore placed on the market. Two of these machines have recently been installed at the new station of the Brooklyn Edison Electric Light & Illuminating Company for feeding the boilers. They are driven by specially wound low speed motors, the connection being made by a single reduction of cut spur gears; that is, the spur wheel carried on the pump shaft meshes directly with a raw-hide pinion carried on the armature shaft. This does away with the counter shaft and high speed gears ordinarily used, and gives a neater looking, more compact, and practically quiet running machine. The air pumps and circulating pumps at this station are also electrically driven; the boilers are rated at about 2500 h. p., and carry 165 lbs. steam pressure. The fact that electricity should be used for the auxiliaries in preference to steam, is very convincing evidence of the growing popularity of the electric pump. Formerly it was thought that the electric current could only be used to advantage when steam was not available or had to be brought through a long line of pipe from some distant plant, but engineers have since learned by experience that no pumping installation should now be made without first considering the possible advantages of electricity for motive power, even where steam is readily obtainable.

Consolidation of Air Power Companies

The American Air Power Company, of New York, has just been formed with a capital of $7,000,000, by the consolidation of the American Air Power Company, of New Jersey; the General Compressed Air Company, of New Jersey, and the Compressed Air Power Company, of New York. The two companies first named are those which have been engaged in developing the Hardie motor. The third company, namely, the Compressed Air Power Company, of New York, controls the Hoadley-Knight motor. It is the intention of the new company to put several compressed air motors into actual operation where they will meet all the difficulties of city traffic and in this way to prove just what can be effected from this motive power. It is understood that the principal experiments will be carried on in New York City. The company has also shipped two motors to Copenhagen, Denmark.



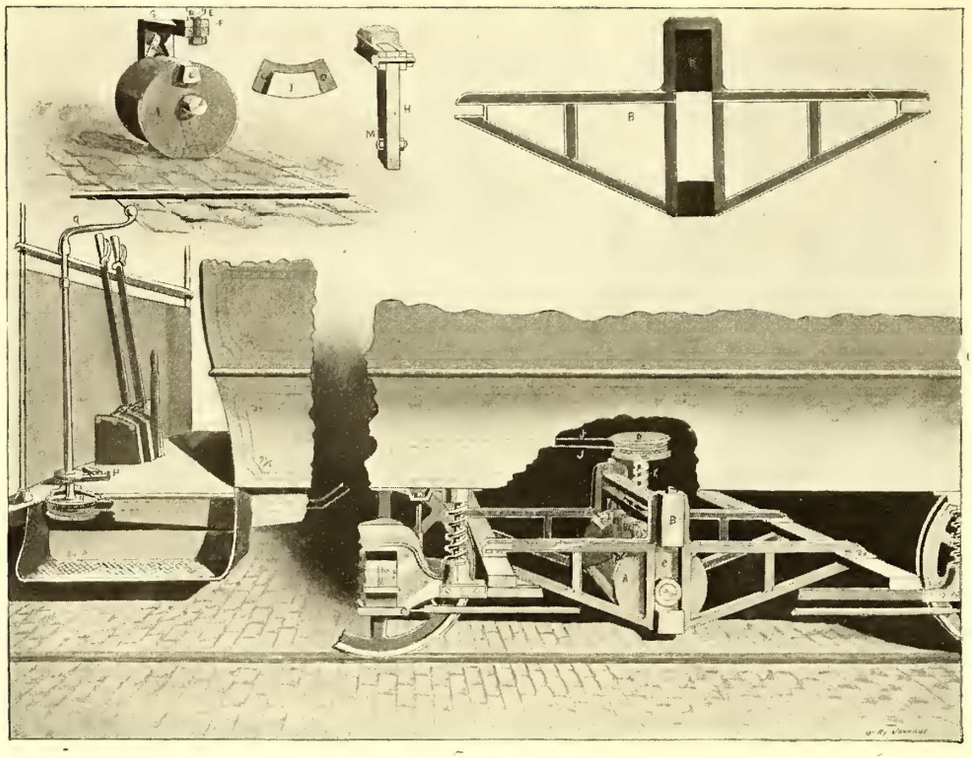
TRIPLEX ELECTRIC PUMP

Report of the Pennsylvania Street Railway Association

The report of the sixth annual meeting of the Pennsylvania Street Railway Association held at the Hotel Allen, Allentown, Pa., Sept. 1 and 2, 1897, has just been issued. The pamphlet contains a verbatim report of the meeting, together with a list of members and officers and the constitution and by-laws. Robert E. Wright is president of the association.

An Emergency Pavement Brake

The demand for an efficient emergency brake that will stop a car quickly under all conditions seems to have been met in the device illustrated herewith. This brake is entirely independent of the wheel brakes and operates as a drag upon the pavement. The action is semi-automatic both in application and release. The illustration shows the device as it appears in actual service on a cable car, portions of the car, in the drawing, being cut away for the purpose.



EMERGENCY PAVEMENT BRAKE

The brake proper consists of an eccentric spool or cylinder mounted in a cast steel frame and supported by the channel beams of the truck near the middle of the car to one side of the grip. On an electric car it is mounted between the motors and supported from the suspension bars. In application the spool is lowered by means of the screw till the bottom side comes in contact with the roadbed, when, by the motion of the car, it is turned half way over, raising the frame and truck about 2 ins., and bringing nearly the whole weight of the car upon the heavy steel brushes or springs which are clamped in place near the shaft of the spool, the trunk being cut away for the purpose. When in action, as shown by the small figure, the cam ends of the spool rest upon the paving and support part of the weight, while they act as runners to assist the load over rough and uneven places.

The brake is released by turning the screw in the opposite direction, the weight of the car assisting, when as soon as the spool is lifted from the paving, it rights itself because of the extra metal on the short radius side, the trunk of the spool being cast full on this side. The action of the brake is the same in whichever direction the car is moving.

The spool, *A*, is of cast steel, including the journals, which are placed 2 ins. out of center, and is about 18 ins. in diameter and the same in length. For heavy electric cars it is made somewhat longer. The bearings of the spool are supported in a box-like case, *C*, which is designed to move up or down in the guides provided on the inner surfaces of the supporting frames, *B*. On each end of the spool lugs, *L*, are cast which, as the spool revolves, come in contact with swinging dogs, *K*, which are placed in chambers on the inner faces of the case, and check the revolution so that the springs are held in action on the paving. The cam ends of the spool are provided with removable insets *I*, made of wrought or malleable iron, and which take all the wear at the point where the spool comes in contact with the paving when in action.

The springs, *H*, are about 8 ins. long and are built up of twenty-two tempered steel plates each $\frac{1}{16}$ in. in thickness and 2 ins. wide, so that the cross section is 2 ins. $\times$ $1\frac{3}{4}$ ins., but can bend 2 ins. or more without setting. The free ends of the springs are provided with a slotted hole through which passes a bolt, *M*, which is designed to hold the plates firmly together.

The screw, *E*, is 3 ins. in diameter and the threads have a pitch of 2 ins. It operates through the nut, *G*, which extends across the top of the frame and is rigid with it. The lower end of the screw is turned down and passes through a slotted hole in the top of the case and serves to lower and lift the spool. The case is mounted loosely in the guides so that the cylinder can tilt to conform to the pitch of the paving either to or from the rail. The screw has sufficient range to allow of the brake operating equally well with the paving above or below the track rail.

The screw is revolved by means of a small wire rope that is attached to pulleys, one on the head of the screw, *D*, and the other on the lower end of the brake spindle, *N*, beneath the platform. One revolution of the spindle serves to apply the brake. No power is exerted by the motorman either in application or release, except so much as is necessary to lift the spool from the paving.

All the parts are of cast steel except the screw and the springs, and are very durable. The wearing parts are small and are easily replaced. Should it be desirable to employ the brake as a drag on long down grades, the screw can be partially released after application, and the brake held in contact with the paving for any distance.

The operation of the device is sure under all conditions of track, as the weight is so great that it cuts through mud, ice, or snow. This device is not designed to replace the wheel brakes, but is for use in slippery weather or on steep grades, when for any reason the wheel brakes fail to check the speed of the car, or when a quick stop is desired. The brake does not injure the paving whether it be of wood, asphalt, brick or granite. The inventor of the brake is C. B. Fairchild.

Early and Modern Gear Cutters

Some reminiscences of an interesting character were published last month from Mr. Patterson, of Salt Lake City, in regard to the early history of the Nuttall Company. The growth of this company has been continuous since its establishment, and has paralleled that of electric railway development.

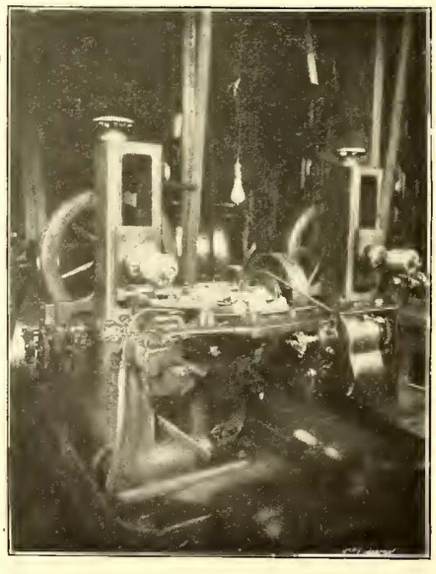


FIG. 1.—EARLY GEAR CUTTER

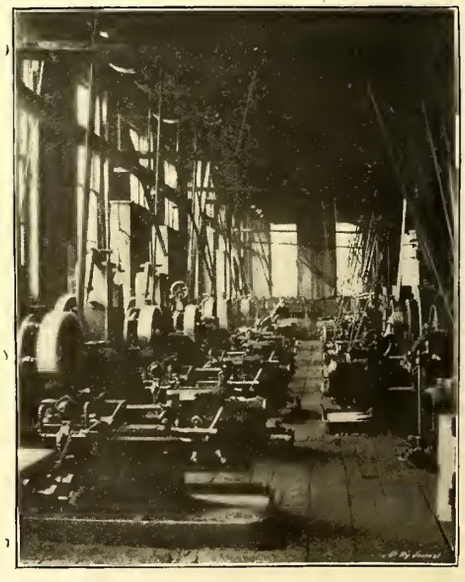


FIG. 2.—INTERIOR OF NUTTALL WORKS

The accompanying illustrations show the first machine built for its works to cut the only kind of gears then in use—cast iron—

with an output of from three to five gears per day, and some of its modern machines.

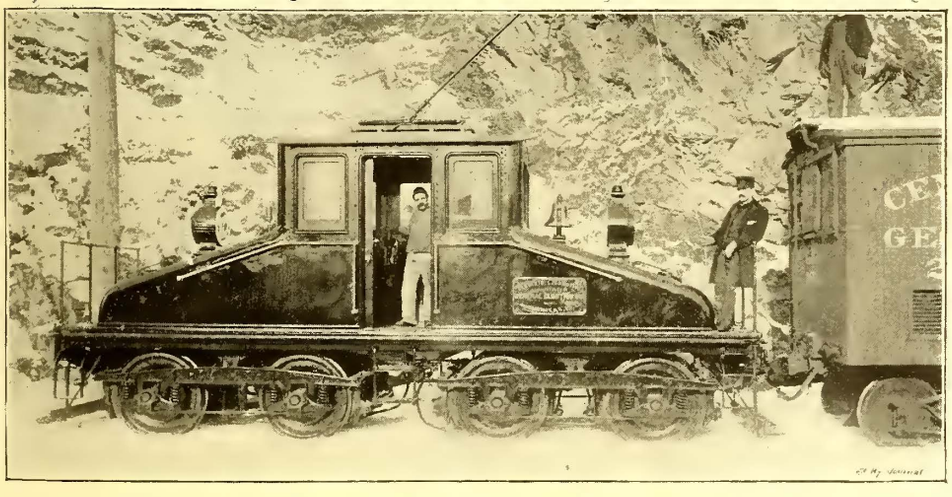
The title of "pioneers" is claimed by this company not only because of its being early in the field, but because in the improvement of designs, in the use of high grade metals and in the adoption of improved methods of construction the company has always taken a foremost position. These efforts have led to a reduction in the cost of manufacture as well as a lower cost to the consumer. By keeping in close touch with the practical users of its work, courting criticism and making use of practical suggestions, the company has built up for itself a high reputation, as its present plant, comprising thirty gear cutters, shown in Fig. 2, which naturally could not be made to show the enormous auxiliary equipment that goes with it, amply testifies.

Electric Freight Locomotive

Reference was made in the last issue to the use of electricity for switching freight cars on a short line of road at Hoboken, N. J. The road is known as the Hoboken Shore Road, the full name being the Hoboken Railroad Warehouse & Steamship Connecting Company.

At Hoboken, which is on the Hudson River directly opposite New York, berth five lines of Transatlantic steamers, viz., the North German Lloyd, The Hamburg American Line, The Thingvalla Line, The Netherlands Line and the Scaudinavian Line. The docks are very extensive, and previous to the laying of the Hoboken Shore Road, all merchandise, intended for shipment outside of Hoboken, had to "trucked" from the wharves to the railroad, or lightered to other wharves in New York, Jersey City or Brooklyn. By the construction of this connecting road heavy cost and delay incident to trucking has been replaced by the light cost of immediate trans-shipment from the steamers into freight cars and a speedy delivery to the main lines of the great railroads. This connecting road is about 2 miles long, and runs along the west water front of the Hudson River from the wharves of the Hamburg-American Line in Hoboken, as far as the main tracks of the Erie and West Shore Railroads in Weehawken. It is a double track road. The question of motive power was settled in favor of electricity, not only on account of its greater advantage, but also because it would have been impracticable to have made use of a steam locomotive along such a street as Hudson Street.

An electric locomotive, was, therefore, ordered from the General Electric Company, and was put into regular service Jan. 4. It was coupled to a train of eight loaded freight cars, with an aggregate weight of 295⅝ tons, which it hauled and pushed with ease, "kicking" each into position on the difierent wharves, and switching these again into full train, which it hauled off to the Erie Railroad. The difference between its operation and that of the steam switching engine is very noticeable. The electric locomotive responds instantaneously to the slighest movement of the handle of the controller, and starts without jerk or noise, tightening up the couplings uniformly or coupling the cars together so gently that no blow or shock could be perceived.



ELECTRIC LOCOMOTIVE AT HOBOKEN

This locomotive resembles in appearance the B. & O. electric locomotive and its dimensions are as follows:

Length over all	29 ft.
Width over all	8 ft.
Heighth over trolley stand	13 ft.
Wheel base	5 ft. 6 in.
Truck centers	12 ft. 9 in.
Total weight all on drivers	57,000 lbs.
Drawbar pull	10,000 "

It is mounted on two four wheeled trucks, each axle carrying a General Electric 2000 motor rated at 135 h. p. giving the locomotives a total of 540 rated h. p. As it is operated in open streets its speed is 8 miles an hour, when hauling a heavy load. The motion of the armatures is communicated to the wheels through single reduction gearing of low ratio. The motors are combined four in series, or each two in series parallel, but never four in parallel.

Operation through the open streets precluded also the use of any third rail system or other system of surface contact, and as the high cost of a subterranean conduit was prohibitive, the current is taken from an overhead wire of 00 gage suspended from span wires

INTERIOR OF LOCOMOTIVE CAB

strung between octagonal cedar poles, set on each side of the line. In two places a system of overhead bracket coustruction is employed.

Each end of the locomotive has an automatic coupler and a small railed platform for the brakeman in charge of the trolley pole. The cab is of iron and resembles closely a double cab, such as is used on American locomotives, with a sloping tender shield at each end. Windows on all sides of the cab allow of an uninterrupted view on all directions. Entrance to the cab is gained through sliding doors on each side. The interior of the cab is a comparatively large and well lighted room lined with stained cherry, with polished nickel and brass fittings. On each end shield is a headlight, in addition one shield carries the whistle, the other the bell. Beneath the shields are placed the resistances, air tanks, sand boxes and tool chest.

At one end of the cab is a series parallel controller with magnetic blow-out, an air brake handle, and two valves of a compressed air sander by which sand is blown beneath the wheels. In front of the motorman is the air brake gage and a circular dial ammeter reading to 500 amps., and above him fastened to the ceiling of the cab is an automatic circuit breaker set to blow at 500 amps. The air brakes are operated by a single cylinder pump driven by a 3 h. p. iron clad bipolar slow speed motor. The operation of the governor and pump motor is automatic.

At the luncheon which followed the trial trip two interesting speeches were made F. LeBau, general freight agent of the West Shore Railroad, pointed out emphatically the usefulness of such a road as the Hoboken Shore Road in facilitating the transport of merchandise directly from the steamships to any part of the country, and of the rapid switching electric locomotive, by means of which the freight cars could be handled more easily and more expeditiously than with the ordinary steam drill engine. W. J. Clark, of the General Electric Company, in an interesting talk full of reminiscences of the early days of the street railway struggle, said:

"Ten years ago, the development of three things made electric street railways practicable and profitable. These were the under running trolley, the carbon brush, and the modern method of motor suspension. The development of three other things now renders the general application of electricity to standard railroads both possible and probable. These are the safe breaking of heavy currents, high voltage for their transmission and methods for their application to almost any load on any portion of a line. Other features are being developed that will seriously affect the result; not the least is the Sprague system of multiple control, increasing the flexibility of the already most elastic of all transportation agents, and while the economy of electricity has already been thoroughly demonstrsted in performing the same service as by steam or animal traction, so far as

passenger service at least is concerned, something beyond the mere question of economy has now to be considered, to wit: accomplishment by electrical methods of what would be entirely impossible with steam. The first steam railroad man within my range of acquaintance to fully grasp this idea is John Lundie, the consulting engineer of the Illinois Central Railroad Company, who has set a pace on acceleration that would not have been dreamed of two years ago, and the schedule which he has mapped out for the contemplated electrical equipment of the suburban lines of his company involves

WORKS OF DORNER & DUTTON CO.

a rate up to 40 miles per hour in twenty seconds. That this is practical has already been demonstrated. In fact so high a rate of acceleration has been made as 43½ miles per hour in twenty seconds, so that the practicability of Mr. Lundie's plans have been thoroughly demonstrated. This is for passenger service. In another direction even greater changes may be prophesied, which will come from the adoption of electricity in standard railroading, viz: the lengthening of freight trains and the consequent reduction in that most important feature of operating expense, transportation wages. The advantages of electricity will have so thoroughly demonstrated themselves in the directions suggested that instead of main steam lines with electric feeders, in ten years will it be a question of electrically o erated main lines with steam feeders through the sparsely settled districts, and a more extended system of suburban and interurban electric roads in densely populated districts also feeding the main lines. The electrical engineer has much to learn from the steam railroad man and must constantly rely upon him for suggestions as to the best methods of making practical applications of electricity. The American transportation man and the American electrical engineer should go hand in hand, continuing to lead the world as they now do in all transportation problems. The American engineer has won conquests abroad as well as at home, not the least is the solution of the problem of electrical equipment for the Central London Underground Railway, the most important of this character that has yet been accomplished. The American engineering plans were selected on account of their merit in the face of the severest competition from every European electrical manufacturing company, and no greater tribute can be paid to American engineering methods than to state that 80 per cent of all the railway apparatus used in Europe is designed in America, so that the American engineer stands to-day head and shoulders above those of any other country. With the encouragement of the co-operation of American railroad men, he is bound to revolutionize the entire method of transportation within a comparatively short space of time, so that American railroad methods will then, as now, be in advance of those existing anywhere else on the face of the earth."

JUDGE WHEELRR has decided to grant permission to the Bridgeport Traction Company, Bridgeport, Conn., to extend its lines to Stratford, Oronoque, Huntington and Shelton.

Truck for Heavy Service

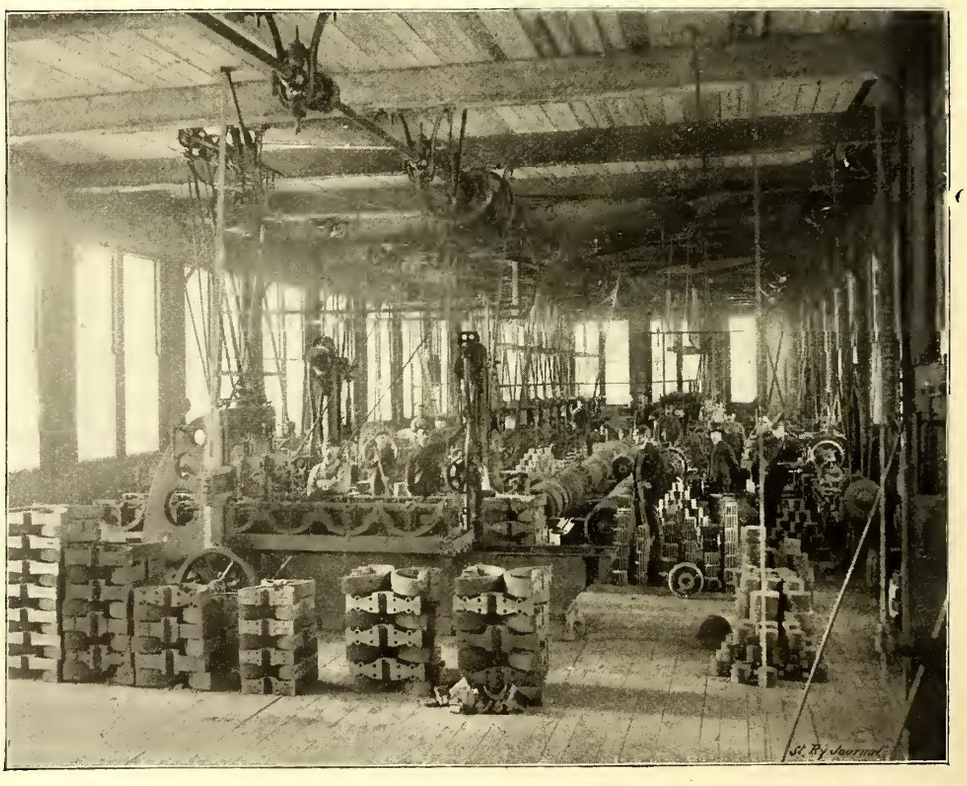
A truck for elevated and heavy electric service has recently been placed upon the market by the McGuire Manufacturing Company. This truck is quite novel in design, snd consists of a combination of steel side frames with malleable iron pedestals riveted thereto, which permit the use of four helical or coil springs over each journal box. This arrangement allows the steel side plate and the malleable iron pedestal thus riveted together to pass between the springs and come down to within 2 ins. of the top of the journal box. The company thinks that the use of four coil springs is better than one heavy double coil spring, as is usually employed. It is claimed by the manufacturers that this truck possesses unusual strength, owing to its peculiar and compact construction, and also that it is very easy riding. It has been used in steam railroad service for some time, but has only recently been adapted to electric service.

The simplicity of the truck and the small number of parts which it comprises, render it not liable to get out of order and very easy to repair. The feature of having the load rest directly on the springs over each journal box relieves the truck, the motor and the car of any heavy pounding effect due to uneven track coustruction. John W. Cloud is the inventor and patentee of this new truck.

A Large Gear Plant

In the accompanying illustrations are shown views of the plant in which the Dorner & Dutton Company manufactures its gears and pinions. The engraving below shows a portion of the gear room. This building is 40 ft. × 160 ft. and has three floors with a tower. The tower floor is used for wheel fitting, for heavy work and for storage. The second floor is used for gear cutting. The gear room is fitted up with the very latest appliances and is equipped with thirty machines. The Dorner & Dutton Company was one of the first manufacturing companies in the country to undertake the making of gears and pinions for street railway motors. The company has therefore passed through all the experimental stages and now has one of the best plants in the United States for cutting gears and pinions.

The gears are made from open hearth steel and also from malleable iron by a new process, whereby the gear is made malleable



INTERIOR OF MACHINE SHOP

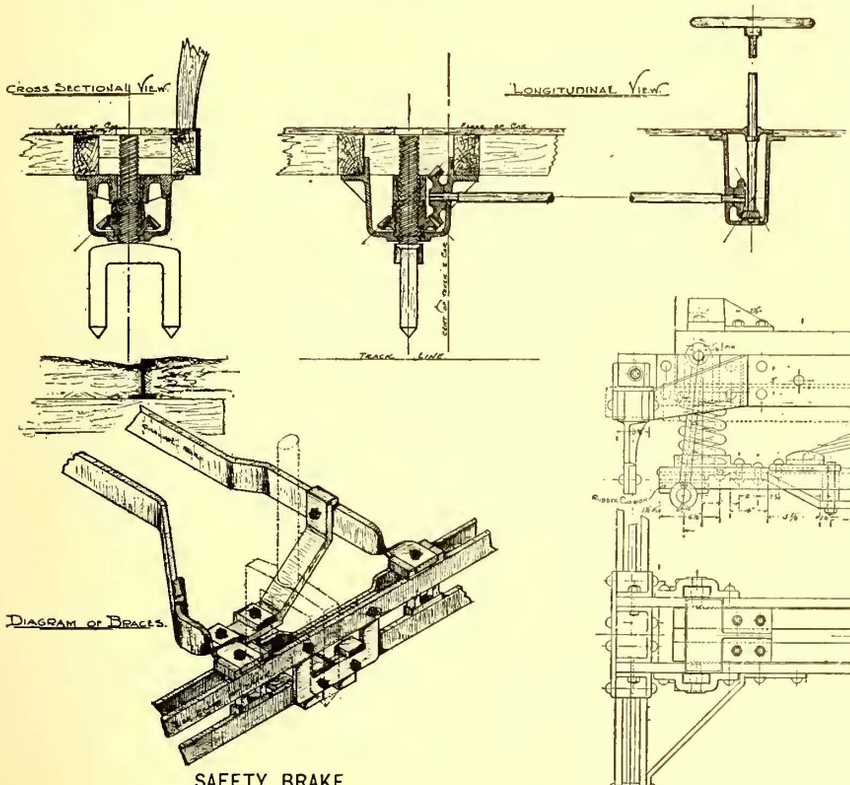
throughout, nearly as good as steel, although steel is considered by experts to be the ideal material. The Dorner & Dutton Company also makes gears from ferro steel, if desired, but does not recommend this material. Pinions are cut from hammered steel, and the company thinks this process much better than rolling or pressing. This company also manufactures pinions of rawhide with brass plates.

The Dorner & Dutton Company keeps a large stock of standard gears and pinions on hand at all times and has excellent facilities for getting out large orders quickly.

A Safety Brake

The accompanying illustration shows a new type of emergency brake which has been designed by B. L. Kilgour, electrical engineer of the Cincinnati Street Railway Company, and the brake is now in use on the lines of that company. The brake is designed to be used principally for stopping a runaway car on a severe grade, and has been tested on a number of the steep grades in Cincinnati.

The main feature of the device consists of a massive fork surmounted by a threaded shaft all made in one single forging. The forks are made of 2½ in. × 2½ in. wrought iron, and the screw is about 3¼ ins. in diameter with a triple thread. This fork passes through a miter gear nut which causes the fork to run up or down when rotated. As will be seen from the illustration, the gears are connected up so as to be worked from the front platform by turning a hand wheel. The gears are housed in a watertight cast iron box set about the center of the car and under one side till, a heavy cast iron yoke, taking the strain of the gear nut and transferring it to the bottom of the car when the fork is pressed down into the ground. The lower end of the fork passes through a system of heavy braces secured to the side frames of the truck and to the channel bars, which are made rigid to take the strain caused by forcing the brake into the ground. As will be seen, the fork enters the ground with one prong on each side of the rail, thus helping to hold the car in case it should jump the track, and prevent it from going over any embankment.



SAFETY BRAKE

At first thought it might appear that the brake would simply wreck the truck and the car body by such a terrific strain being thrown on them, but from actual use of 350 safety brakes in use, only one or two accidents have occurred, and then it only amounted to a bent fork or a brace being sprung, no damage whatever being done to truck or car body. The gearing is so proportioned that the motorman can by turning the hand wheel exert a downward pressure of about 3000 lbs. on the fork, which, it is claimed, is not enough to have a tendency to derail the car.

Swing Bolster Double Trucks Nos. 14A and 14B

As is well known to readers of the STREET RAILWAY JOURNAL, the Peckham Truck Company has recently completed and placed on the market a full line of double trucks for electric cars. These trucks, some six or seven in number, have been carefully designed for all conditions of electric railway service, from light city and suburban to that required under the heaviest electric locomotives. While necessarily differing from each other in certain details, the trucks have a number of features in common, so that they make one harmonious system.

In an article in the STREET RAILWAY JOURNAL for October, 1897, the general features of each were carefully described, but the space then at disposal did not permit of a careful discussion of the principles of each truck. It is the intention of the present article to take up more in detail than was then possible two of these trucks, leaving a discussion of the others for future issues. The two selected for this purpose are the "14A" and the "14B," which are designed by Mr. Peckham expressly for high speed suburban and elevated railway service. The trucks are very similar, except that the latter is designed with a short wheel base. This has two advantages: it permits its easy passage around curves of short radius, and, what is equally important, it allows it to swing between the sills of a narrow car.

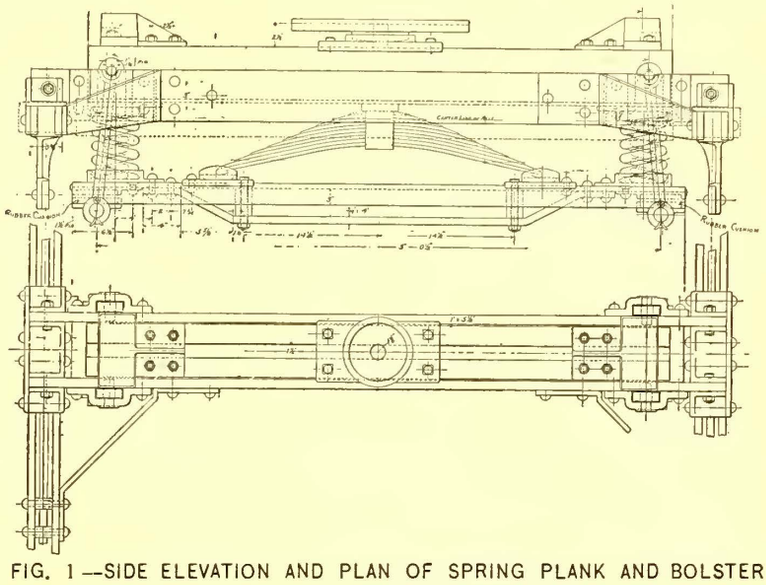


FIG. 1.—SIDE ELEVATION AND PLAN OF SPRING PLANK AND BOLSTER

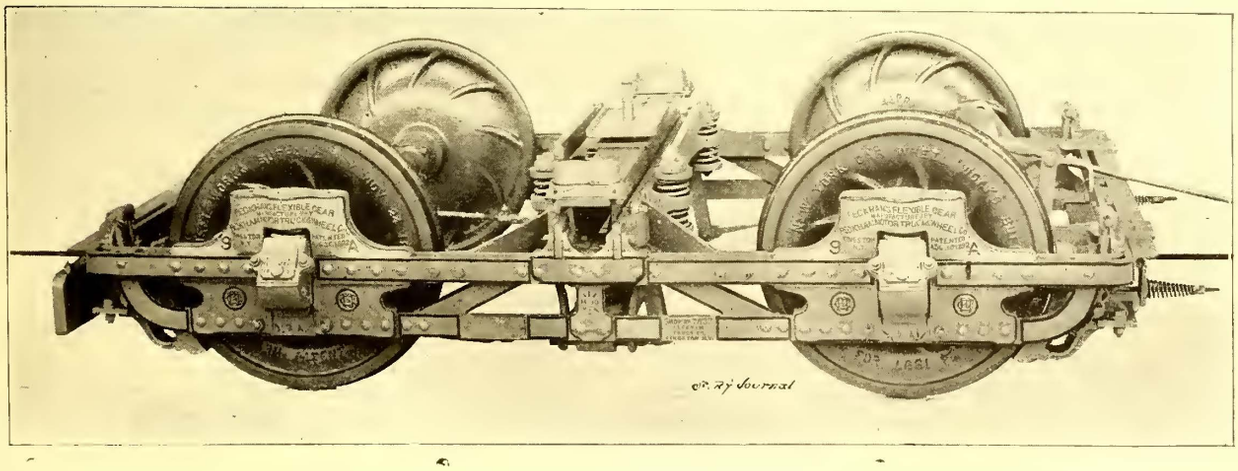


FIG. 2—NO. 14A DOUBLE TRUCK.

Referring first to Fig. 1, showing the half section and end elevation of the spring plank, it will be seen that one object in its design is to keep the car body at a minimum height, to allow of easy ingress

and egress to passengers. Another advantage of a low bolster is that it permits the use without raising the car body of strengthening trusses under cars which were originally built for side bearing double trucks.

The construction of the truck will now be described in detail. The bolster is composed of two channels set on edge and held together by cover plates, a female swivel plate and spring caps. This bolster is carried on the spring plank by means of a spring system consisting of one half-elliptic and two spiral nest springs. The side bearing plates attached to the car bolster bear upon the cover plates and admit of a limited rocking motion of the car, governed by the stiffness of the spiral nest. These nests are adjusted to suit the weight of the car body to be carried. The spring plank is composed of a channel iron braced by a flat truss bar of 4 ins. × ¾ in. steel.

The spring plank is supported by four links through the medium of square rubber cushions 3 ins. × 4 ins. and 1½ in. thick.

The truck frame and truck rigging are clearly shown in Fig. 1. As will be seen, the frame is kept in square not only by the regular cross bar, but by angle braces between the truck frame and the transom bars, adding greatly to the rigidity of the structure.

The brake rigging is fitted with flat beams and M. C. B. shoe heads and double levers. The equalizer or floater secured to the head of these levers is fitted with a segmental piece on which the rod leading to the sway bar on the middle of the car works through a roller, thus providing for an even application of the brakes when running over a curve. The upright levers, as can be plainly seen, move in guides, which prevent them from striking the wheels.

The "14 B" truck, as stated, is similar in general lines to "14 A" truck, except that it is designed with a short wheel base for railways with short radious curves and narrow bodies, requiring some change in its make-up. If desired, the wheel base can be

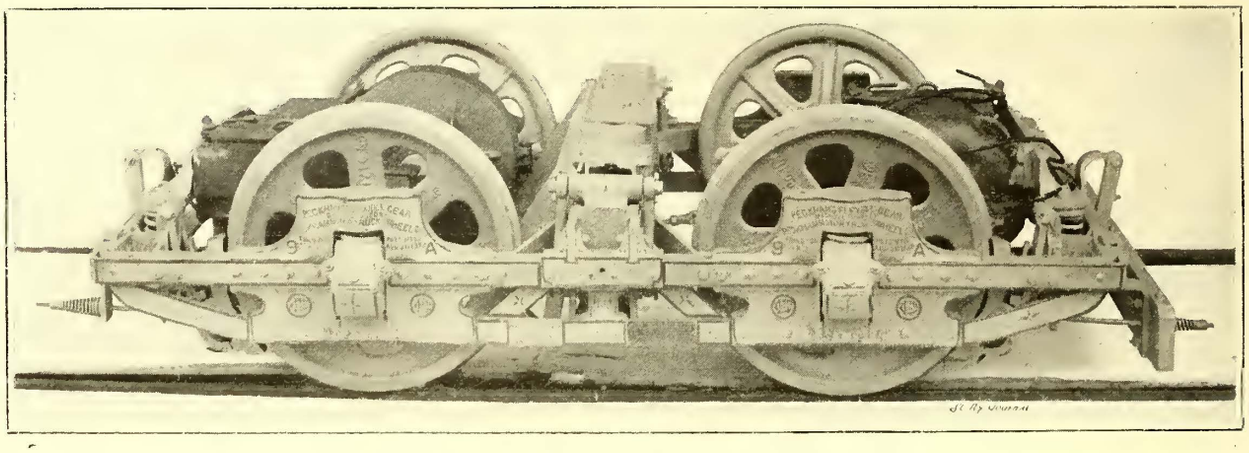


FIG. 2.—NO. 14B SHORT WHEEL BASE DOUBLE TRUCK

The effect of the introduction of rubber in this way between the spring plank and the truck frame accomplishes two important results, viz.

1. It takes up the minute vibration transmitted from the track to the truck frame, and which would not be absorbed by the more rigid spring system. One effect of this is that it prevents the rattling of the glass in the sashes. This is the chief cause of the noise in a loose car, and the effect of the rubber cushions in reducing this is striking.

2. It deadens at the same time the sound caused by the successive blows of the wheel upon the inequalities of the track, and prevents their transmission through the continuous metallic circuit to the car body.

The rubber cushions are carried below the spring plank, so that the space they occupy does not decrease the length of the latter. The springs supporting the bolster on the spring plant include both spiral and elliptic springs. Practice has shown that the combination of these two styles of springs gives a softer riding system than when one style is used throughout.

As will be noticed, the links, when the car is at rest, are not vertical, but are inclined at a slight angle outwards. This construction accomplishes a very important purpose in railway operation, the result being a very much easier riding car on curves. The reason for this will be appreciated when the movement of the spring plank upon curves is considered. The centrifugal force of the body on rounding a curve will tend to throw the bolster and spring plank to the outside of the curve, bringing the inside links to a vertical position and the outside links to a more oblique position, lowering the end of the bolster nearer the inner rail and raising that nearer the outer rail. This will cause the car to tilt in on the inside of the curve, accomplishing the same result as would be caused by the elevation of the outside rail according to usual curve formulas, in case the spring plank and the car axles kept in parallel planes. The advantages of this in ordinary city construction are apparent, because in city streets the elevation of the outside rail demanded in proper railroad construction to overcome the centrifugal force, is inadmissible owing to the necessity of keeping the rails flush with the street surface.

The truck frame of the No. 14 A is the characteristic Peckham form of a double upper and single lower bar, forming a cantilever bridge truss. This is reinforced in the center by diagonals, which transfer the load carried by the transoms directly to the yokes. The pedestals are all made extra heavy, and all parts are riveted together with a power riveter. The pedestals rest on boxes through the medium of a spiral spring on each box which will depress a distance of $\frac{1}{1000}$ in. under from 3 lbs. to 10 lbs. pressure, the stiffness being varied according to the weight of the car for which the truck is built. This with the rubber cushions and bolster springs makes a series of three sets of springs between the car body and the wheels. Each series, as will be seen, is of a different class or character of spring. In consequence, each spring will correspond to different periodicities of vibration, insuring ease of riding under all conditions.

made as short as 45 ins., but the Peckham Company does not recommend a shorter wheel base than 4 ft. 6 ins., when the truck is used on a standard 4 ft. 8½ in. gage. But on a 3 ft. 6 in. gage, a wheel base of 45 ins. can be used without difficulty. The side frame and the swing bolster are the same as in "14 A" and all parts are interchangeable with it. The method of hanging the motors is different, however, as these are placed on the outside of the axles instead of inside, as with the "14 A" truck. The practical result of this construction is to make the truck run very steadily, as the motors being suspended at the extreme end of the truck, counterbalance each other.

This is the only short wheel base swing bolster double truck which has a ceuter bearing bolster. It is also the only short wheel base swing bolster double truck built to carry two motors.

Personals

Mr. C. D. Wyman was re-elected general manager of the New Orleans Traction Company at the annual meeting of the directors last month.

Mr. Herman W. Falk, president of the Falk Manufacturing Company, has taken his family for an extended European trip. Mr. Falk will make this a combined business and pleasure trip.

Mr. S. Roy Wright has severed his connection with the West End Street Railway Company, of Denver, Col., and has accepted the position of secretary of School District No. 1, of the state of Colorado.

Mr. H. P. Bradford, who has been general manager of the Cincinnati Inclined Plane Railway Company for the last five years, spent a short time in New York last month on a pleasure and business trip.

Mr. A. E. Lang, president of the American Street Railway Association, Capt. Robert McCulloch and Secretary T. C. Penington, spent a few days in New York last month on their return from a meeting of the Executive Committee in Boston.

Mr. E. H. Keating, chief engineer of the city of Toronto, has tendered his resignation to take effect Feb. 1. Mr. Keating will immediately accept the position of resident manager of the Toronto Street Railway. Mr. Keating has been city engineer of Toronto for nearly six years, and has filled the office with great credit to himself.

Mr. J. W. McFarland has been appointed superintendent of the Chattanooga Electric Railway Company, of Chattanooga, Tenn. Mr. McFarland has been interested in street railway work since 1888, and in the electric lighting business since 1880. His many friends will wish him abundant success in his new position.

Mr. Charles S. Pease, formerly general superintendent of the Interior Conduit & Insulation Company, of this city, has assumed charge of the Stirling (Water Tube) Boiler Company's interests at New York, vice Mr. F. A. Scheffler, who has resigned to accept general superintendency of the Sprague Electric Company.

Mr. Fred. Wardwell, formerly connected with the Danbury & Bethel Street Railway Company, of Danbury, Conn., has resigned his position with this company. Mr. Wardwell was for some time connected with the street railway system at Minneapolis and St. Paul before going to Danbury, and has therefore had considerable experience in street railway engineering work.

Mr. C. D. Shepard, formerly superintendent of the Bristol & Plainville Tramway Company, has resigned and will take a position with the Palmer & Munson Electric Railway, as general superintendent and will have charge of the building and equipment of this road, which is to be 7 miles in length. Mr. Shepard has been with the Bristol & Plainville Tramway Company since it began operation, and has given valued service. He is a skilled electrician and thoroughly versed in his business, having worked his way up through various grades of service, beginning as a mere lad with the Hartford Street Railroad.

Mr. Warren L. Murray and Gardiner W. Kimball, who have for some time been connected with the eastern office of Westinghouse, Church, Kerr & Company, will hereafter be connected with this company's Pittsburgh office. On the eve of their departure for Pittsburgh the engineering force of Westinghouse, Church, Kerr & Company tendered a farewell dinner to Mr. Murray and Mr. Kimball, which proved a most enjoyable affair in all respects. The dinner was planned a surprise for both guests, and was held in one of the private dining rooms of Mouquin's Fulton Street restaurant. Mr. Murray has been in the employ of Westinghouse, Church, Kerr & Company for fifteen years, and Mr. Kimball nearly as long, and the New York office felt great regret at their leaving the east in the call of duty.

Obituary

J. WILLIS KETTLESTRINGS, purchasing agent for the North Chicago Street Railway Company, died in Chicago on Dec. 25, 1897. Mr. Kettlestrings leaves a widow and four sons.

MR. JOHN S. PUGH, of the John Stephenson Company, died on Jan. 27th, of hemorrhage of the brain. Mr. Pugh, who was a son of Mr. D. W. Pugh, is well known among street railway managers, with whom he was very popular, and will be greatly missed by them. Mr. Pugh had a long experience in the street railway field, having been apprenticed by his father to the John Stephenson Company in 1872. In 1885 he joined the firm of Pugh & Russell, manufacturers and dealers in street railway supplies, and this firm later on became the general selling agents of the Stephenson Company. A large and profitable business was built up, but the firm was dissolved in 1889, and Mr. Pugh entered the service of the Baltimore Car Wheel Company, with which he was connected until 1894. He then became associated with Messrs. Dorner & Dutton, of Cleveland, but soon after severed his connection with this firm to again represent the John Stephenson Company. He was thirty-nine years of age, and a grandson of John Stephenson, the original car builder.

OLIVER BLACKBURN SHALLENBERGER died at Colorado Springs on Jan. 23, 1898. Mr. Shallenberger was born at Rochester, Beaver County, Pa., in 1860. He was graduated from the Naval Academy at Annapolis, but in 1884 he resigned from the Navy and entered upon electrical work at Pittsburg. He invented many things in the course of his electrical career of fourteen years. Many of the efficient devices for central lighting stations were originated by him. In power transmission work he rendered aid of practical value. His electric meter is known the world over. It was adopted by the British Government Board of Trade as the standard instrument for accurate measurement of electric currents. Since 1891 Mr. Shallenberger had worked chiefly at his own laboratory in the town where he was born, acting as consulting electrician for the Westinghouse Electric & Manufacturing Company. He spent a good deal of time lately in Colorado, hoping to obtain relief from consumption. He is survived by his wife, a son and a daughter.

MR. BURR KELLOGG FIELD, vice president of The Berlin Iron Bridge Company, died at his home in Berlin, Conn., on Thursday morning, Jan. 13, after an illness of less than a week. His death was so sudden and his sickness so short, that few of his friends were aware that he was ill. Burr K. Field was born in May 1856. He entered the Sheffield Scientific School, of Yale University, in 1874, and was graduated in 1877 as a civil engineer. Immediately after graduation he commenced practical work among the railroads of the west. His principal experience was in connection with the laying out and building of the Northern Pacific. In 1883 he accepted a position as assistant engineer of The Berlin Iron Bridge Company, of East Berlin, Conn. His advancement in The Berlin Iron Bridge Company has been very rapid, and at the time of his death he occupied the position of vice president with general charge of all the sales. Since his connection with The Berlin Iron Bridge Company its business has been much extended and its sales have increased very rapidly year after year. Mr. Field was an indefatigable worker, not only for the company which he had so faithfully served, but in everything he undertook.

AMONG THE MANUFACTURERS.

The Fitchburg Steam Engine Company, of Fitchburg, Mass., is building a 600 h. p. cross compound engine for the Fitchburg & Leominster Street Railway Company.

The Tight Joint Company, of New York City, has recently issued a catalogue of high pressure hydraulic fittings and flanges. The catalogue contains considerable valuable information for use in designing hydraulic plants.

The Washburn & Moen Manufacturing Company's branch office at Houston, Tex., is sending to its friends a neat leather pocket book for holding change. This little gift will be appreciated by all who are fortunate enough to secure a sample.

M. G. Hubbard, Jr., chief engineer of the McGuire Manufacturing Company, has been appointed its representative in the East in place of E. P. Morris, whose other business has grown so large as to preclude his giving the necessary time to the truck business.

The Eagan Company, of Cincinnati, O., has just made a shipment of twelve car loads of wood working machinery to the Russian Government at St. Petersburg. This is probably the largest export shipment of such machinery ever made and speaks well for the enterprise of this progressive concern.

E. J. Spencer, agent for the Safety Insulated Wire & Cable Company, of St. Louis, Mo., has recently secured a contract for this company for all the conductors, inside wire cable, and underground cable for lighting and power at the Trans-Mississippi and International Exposition to be held at Omaha.

Wm. S. Turner, consulting and constructing electrical and mechanical engineer, has moved his office from No. 1 Nassau Street, to 120 Liberty Street, New York. Mr. Turner has had a long practical experience in electrical construction work, and has built and equipped a large number of the street railway systems of this country.

W. R. Garton has severed his connection with the Central Electric Company, of Chicago, and will shortly open an office in that city. He will devote his entire time and attention to his personal interests, and to that of manufacturing companies which he will represent. His temporary address will be 5741 Indiana Avenue, Chicago.

J. L. Howard & Company, of Hartford, Conn., is the only firm that has placed upon the market a sliding door for street car vestibules. This door is known as the "Agard" door, and seems to have completely solved the problem of a vestibule door. This device has been in use on the lines of the Hartford Street Railway Company for some time.

F. H. Newcomb, manufacturer of uniform caps, has moved his New York office from 11 Washington Place to 13 Astor Place. This firm has recently received a number of orders for caps from street railway companies, among them being orders from the Oil City Railway Company, of Oil City, Pa.; the Main Street Railway Company, of Jacksonville, Fla., and the Hagerstown Railway Company, of Hagerstown, Md.

The Oriel Glass Company, of St. Louis, Mo., manufacturers of bent glass, report that they have received a large number of contracts for bent glass this season. Among other shipments this company furnished the bent glass for the Astoria Hotel, of New York. When this order was completed, the Oriel Glass Company received an excellent letter complimenting them upon the thoroughness and good appearance of their work.

The Hilles & Jones Company, of Wilmington, Del., has issued a very complete catalogue of the machine tools which it manufactures. The catalogue contains a large number of fine full-page half-tone illustrations of the many different styles of machines which the company carries in stock. This pamphlet is not intended as a general catalogue, but presents a few of the more recent designs which Hilles & Jones have placed upon the market.

J. A. Fay & Company, of Cincinnati, O., have recently secured the contract for twenty-six wood-working machines for the new car shops of the John Stephenson Company, at Elizabeth, N. J. J. A. Fay & Company have also been awarded the contract for all the wood-working machinery for the new Lima shops of the C. H. & D. Railroad. This firm also recently equipped the car shops at Sormova, Siberia, and Psver, Russia, with their machinery.

A. W. Wright has recently accepted the position of president of the American Railway Construction Company, of Chicago, and will give its affairs from now on his personal attention. Having had thirty-one years' experience in engineering work, he is thoroughly familiar with the different problems of street railway construction. Mr. Wright has superintended the putting in of about 5,000,000 cu. ft. of concrete and his company will make a specialty of this kind of work.

The Falk Manufacturing Company, of Milwaukee, Wis., received the highest kind of testimonial recently to the value of its

well known cast welded rail joint. This joint is used extensively with the Chicago City Railway, which employs about 60,000 of these joints. During December, 1897, the Chicago City Railway Company reported a track maintenance charge of only $1 per mile, and during the present winter only fifteen joints out of the total number have broken.

The Q. & C. Company, of Chicago, Ill., has just issued a new catalogue of its car door equipment and general railway specialties. The car doors manufactured by this company are growing in favor with general managers, and their use is being largely extended. The manufacturers claim for this door that it is substantial in construction, moderate in price, effective in service and extremely economical in cost. It is made of the finest grade of malleable iron with anti-friction bearings.

The Cahall Sales Department of Pittsburgh in February, 1897, contracted for the installation of about 1200 h. p. Cahall-Babcock & Wilcox type of boilers in the power station of the New York & Staten Island Electric Company, which then contained some boilers of another make. The electric company shortly doubled this order and now has given the Cahall people not only a third order but also a contract to change over all the boilers in its power station into the Cahall type.

Broomell, Schmidt & Company, of York, Pa., have recently issued a neat catalogue containing illustrations and description of the American fuel economizer for heating and purifying feedwater for steam boilers by utilizing the heat in the flue gases. This appliance is a strong and symmetrical apparatus which possesses the essential features of simplicity, durability, accessibility and ease of duplicating and repairing, and the manufacturers claim it will save 10 or 20 per cent in the coal used.

W. T. Van Dorn, of the W. T. Van Dorn Company, of Chicago, is greatly encouraged as to the outlook for business for 1898. The Van Dorn automatic coupler is now thoroughly well known throughout the street railway field, and is not only the standard on the principal street railways of the United States, but is the only coupler which is used on the cars of the various electric elevated roads. Mr. Van Dorn has recently taken an eastern trip and reports that he has secured several orders.

Gus. Suckow, general manager of the Vose Car Spring Company, has recently returned from an extended trip and reports business as excellent. Mr. Suckow has been connected with the Vose Car Spring Company for twenty-one years and is regarded as an authority on the subject of car springs. He has been engaged in all departments in the manufacture of springs, and has reached his present position of general manager of this company through his technical ability and attention to business.

The Wells Light Manufacturing Company, of New York, reports that its business for November and December, 1897, was the largest that the company has had since its incorporation, and the prospects for the coming months are equally as good. The Wells light is now coming into very general use upon the street railway systems of this country for use in night construction and heavy metal heating. For these purposes its portability, power and automatic action make it invaluable. Over 12,000 of these lights are now in use.

The Electric Storage Battery Company, of Philadelphia, Pa., has just issued its new catalogue for 1898. This catalogue contains a large amount of very valuable information upon the subject of storage batteries, and will be found of interest to street railway managers throughout the country. The catalogue contains a number of half-tone engravings showing several of the installations of storage batteries that this company has made. The catalogue also contains a long list of the many different plants where electric storage batteries are in use.

The John Stephenson Company, of New York, reports that work is progressing rapidly on its new works at Elizabethport, N. J., and that in two or three months the company expects to be able to have everything in running order there. The works are well situated for the receipt of supplies, and the shipment of cars, both by rail and water, and it is thought that in their new location the company's greatly increased facilities for manufacture together with its present high reputation for the manufacture of the highest class of cars, that the company will be better able than ever before to fill the demands made upon it.

E. P. Morris, of New York, has established a number of foreign connections and will make a specialty in the future of purchasing electrical material of all kinds for foreign contractors and tramway companies. He has already enjoyed considerable business of this kind, and expects with his new connections, which include the United Kingdom, France, Germany and Spain, to do a large business. Mr. Morris from his long experience in actual construction and railway supply business, and his intimate knowledge of the needs of the railway and tramway companies, is specially fitted for business of this character.

A. L. Fenton & Company, of New York City, report that prospects for business are good. This company manufactures the Eureka anti-friction metal which is guaranteed to be a strictly first class material, and which is especially adapted for high speed and heavy engines and dynamos, for use in paper mills, steam shops, street railway plants, and for every description of mechanical bearings where an anti-friction metal is required. It is claimed by the manufacturers of this metal that it will last longer, run cooler, and will need less attention than many of the anti-friction metals upon the market.

The Hazleton Boiler Company, of New York City, has issued its new catalogue for 1898 under the name of the "Generation of Power." The catalogue contains in addition to a full description of the Hazleton Boiler a number of useful tables and articles on the combustion of coal, generation of steam, feed pipes, etc. The tabular matter has been well selected and carefully edited, and is taken largely from the works of well known authorities on this subject. The catalogue will be sent on request. Many improvements have been made in the Hazleton boiler which not only increases its efficiency, but also improves its appearance.

J. P. Sjoberg & Company, of New York City, report that their plant is now running on full time. This firm makes a specialty of supplying the entire woodwork for car bodies, finished in parts, ready to construct cars of any style. In this way a company desiring to build its own cars can buy a part or all of the woodwork already planed and fitted. This firm also has considerable advantage in shipping cars to foreign countries, as it can ship the car bodies "knocked down" and can thus save about 90 per cent of the freight charges. J. P. Sjoberg & Company have recently equipped all the cars of the North Hudson County Traction Company with vestibules, and have also put a large number of vestibules on the cars of the Consolidated Traction Company, of Jersey City.

E. F. de Witt & Company, of Lansingburgh, N. Y., manufacturers of the de Witt common sense sand box, are receiving a number of very complimentary letters from their customers. Among these is one from the Chicago General Railway Company which reads as follows: "The common sense sand box has been in operation on our cars for the past four years and we think it is giving better service than any sand box we know of. When additional equipment is required you will certainly get our order, which is perhaps as strong an endorsement as you could receive from us." Another letter from the Butte Consolidated Railway Company, of Butte, Mont., reads: "We have been using your sand boxes about two years. We are well pleased with them."

The Sessions Foundry Company, of Bristol, Connecticut, has recently secured a number of important contracts for iron castings for the coming year, among them being a renewal of its previous contract with the Providence Steam Engine Company, well known makers of the Greene engine. This is very heavy work and when business is good, amounts to many tons per pay. The Sessions Foundry Company's business for the past year has been the largest in its history and from present indications will be considerably larger the coming year. It is interesting to note that this company recently melted 91½ tons of iron in one day, and could easily have run off 100 tons or more, had it been making sufficiently heavy work.

The Duval Metallic Packing Company, of New York City, has received a number of very complimentary letters, among them being one from the National Carbon Company, of Cleveland. This letter reads as follows: "We still have the packing in use which you furnished us in 1894 and it is giving good satisfaction. We do not anticipate that a further supply will be required for some little time to come. We expected to get five years' wear out of it when we bought it; and we see no reason to think that it will fall short of our expectation." The Duval Metallic Packing Company is receiving a number of orders for this packing from street railway companies, as this product is well adapted for use in street railway power stations.

The Columbia Machine Works, of Brooklyn, N. Y., report that their business in railway supplies has more than doubled within the last few months, and their large plant is full to overflowing with good orders. This business was established less than five years ago and its rapid growth has been most unusual. It is believed that the great increase of business is due to the fact that nothing is permitted to go out of the factory unless it is first class, and should anything be shipped accidentally which is not up to the standard required, a cheerful replacement free of charge holds together the bond of friendship between the consumer and the factory. This company carries in stock a full supply of nearly everything that can be called for, for replacement on a street railway system.

The International Air Power Company, of New York, is about to send a representative to Europe to arrange for placing a compressed air system in operation in Birmingham. The compressor and car equipments are now ready for shipment from the works of the American Wheelock Engine Company. There will also be sent with the above equipment a compressed air auto carriage; also an autotractor truck, both being now completed at Worcester. The compressor is of the Hoadley-Knight type, driven by a Wheelock engine, and is of the same type as the engine operating the compressor built for the Metropolitan Traction Company, of New York City. The endorsement of the Hoadley-Knight compressed air system by Messrs. Elkins, Widener and Dolan, the well known street railway men, will command attention from the street railway managers throughout the world.

The Lidgerwood Manufacturing Company, of New York City, has just completed a new design of electric hoist and cable railway at the lime quarry of the S. E. & H. H. Shepherd Company, of Rockport, Me. This hoist is equipped with two G. E. 1200, 500 volt railway motors controlled by G. E. K 11 controllers. The apparatus is built for lifting a load of 10 tons, the average load being 4 tons. The power is obtained from a railway circuit at 4 cents per horse power. The cable railway is 700 ft. long and is suspended

from two very substantial towers, one 55 ft. high and the other, the main hoisting tower, 65 ft. high. This is the third plant in Knox County, Maine, that has adopted electricity in preference to steam for hoisting purposes. They all use G. E. 500 volt railway motors with series parallel controllers.

The Berlin Iron Bridge Company, of East Berlin, Conn., has the contract for a new draw bridge over the South Shrewsbury River, in Monmouth County, N. J. This bridge is to be 180 ft. in length and 40 ft. wide. The Berlin Company has the contract for both the substructure and superstructnre. Among the extensive improvements now being made by the Benjamin Atha & Illingworth Company, at Harrison, N. J., is a new steel building known as the Tower Building. This building is 30 ft. sq. and about 40 ft. high. Thirty-five feet above the ground is a circular trolley track carried by the roof trusses. The framework of the building is of steel throughout, and the siding and roofing of corrugated iron. The complete contract for furnishing and erecting this building has also been given to the Berlin Iron Bridge Company.

The Sprague Electric Company, of New York, has secured the contract for motors to be installed in the new works of the John Stephenson Company, Ltd., Elizabethport, N. J. This is a large and important contract and some forty-eight motors will be utilized, ranging from 3 h. p. to 40 h. p., mostly large size machines. The motors will be of the well known Lundell type and will be direct connected, belted or coupled to the latest types of wood working machinery. As is generally known, the Lundell motors are of the inclosed type and are admirably adapted for use in wood working machinery establishments where, of necessity, the atmosphere is filled with dust. Several large size Lundell direct connected exhaust fan outfits will also be included in the equipment. The plant will be one of the largest of its kind in this country and will be equipped exclusively with the Lundell motors.

The Filer & Stowell Company, of Milwaukee, Wis., is now building a 500 h. p. cross compound engine for the city of Jacksonville, Fla. This engine is to be used in electric light plant. This company is also building two siugle engines for electric light plant for the city of Donaldsonville, La., and a 1000 h. p. tandem compound engine for the new flour mill of the Eckhart & Swan Milling Company, Chicago. The Filer & Stowell Company has just shipped two large cross compound engines for the new plant of Swift & Company, of St. Joseph, Mo.; a single cylinder engine for the Minnesota elevator being erected on Goose Island, Chicago, by Armour & Company; a 300 h.p. tandem compound engine for the Riverside Fibre Company, Appleton, Wis.; a siugle cyliuder engine for electric light plant at Port Gibson, Miss., and another for electric light and water works plant for the city of Brookhaven, Miss.

The Hoppes Manufacturing Company, of Springfield, Ohio, manufacturers of live steam feed water purifiers and exhaust steam feed water heaters, reports several large orders recently received through its Philadelphia office from the following concerns: The New York Sugar Refining Company, Long Island City, N. Y., three special live steam feed water purifiers aggregating 3750 h. p., also from the same company, three exhaust steam feed water heaters of 4500 h. p. capacity; The Union Traction Company, Philadelphia, Pa., 3000 h. p. live steam feed water purifiers. The Springfield office also reports sales to the Deering Harvester Company, Chicago, Ill., for 2500 h. p. live steam feed water purifiers; repeat order from the Proctor & Gamble Company, Ivorydale, Ohio, for 1000 h. p. purifier; Louis Sands, Manistee, Mich., 1000 h. p. purifier; Thomas & Smith for the Chicago Public Library, four special live steam feed water purifiers of 300 h. p. each.

Elmer P. Morris, of New York City, manufacturer's agent for electrical material, has issued an unusually complete catalogue of the long line of electrical material for which he is agent. This catalogue will be found extremely valuable to street railway managers and purchasing agents when ordering supplies, as good illustrations are given of each article, together with a complete price list. The catalogue contains descriptions of insulators, cars, turnbuckles crossovers, headlights, trolley fixings, gears and pinions, and poles of various kinds. It also contains illustrations of the McGuire Columbia heater, fan motors, electricial instruments, and McGuire trucks and sweepers. Elmer P. Morris is now agent for all these materials and carries a complete line of them in stock. The catalogue contains a special description of the Morris ear, which was designed to meet the demand of some form of suspension for the trolley wire, which would absolutely prevent the wire from falling.

A. S. Littlefield, of Chicago in one of the most tasteful announcements ever issued to the trade, states that he has severed his connection with the American Railway Construction Company, of which he was president, and has organized the North American Railway Construction Company for the purpose of building electric railways especially, and also to do a general contracting business. The announcement states that the " new " company can hardly be called such except in name as Mr. Littlefield has always had charge of the affairs of the old company. Mr. Littlefield is one of the best known men in western railway circles, having been for many years and is still, the Western representative of the Johnson Company. He is also president of the American Improved Rail Joint Company which has been putting in cast joints in Chicago, Kansas City, St. Louis and other places. Emmet M. Fry, who has had charge of the construction of many important western lines, is the general superintendent of the new company. The organization is complete and competent to undertake all classes of railway construction.

The Walker Company, of Cleveland, O., is now building at its Cleveland works a 1600 k. w. direct connected generator for the Union Railway Company, of New York City. This, with the two now being completed for the Brooklyn Heights Railroad Company, will make three of these 1600 k. w. machines finished in as many months. In addition to this generator for the Union Railway Company, the Walker Company is building for them forty double No. 4A street railway equipments. The equipments are to be fitted with the new type "S" solenoid blowout controller which has attracted so much attention. The current for these motors will be fed to the line from a Walker switchboard, now being built at New Haven. The Metropolitan Street Railway of Kansas City, which is now operated by a 1600 k. w. Walker generator, is about to increase its plant by the addition of a generator of 1200 k. w. capacity. The foreign shipments during the next few months will include one hundred double 3 S street railway equipments with 200 controllers, for Dresden, Germany; six double 3 N equipments with type "S" controllers, and two double 3 N equipments. Besides these railway motors and accessories there will be one 150 k. w. belted railway generator with its switchboard and a 75 k. w. belted booster for Japan, also with a switchboard. This makes over 7500 h. p. in street railway motors alone that are being built at the Cleveland works, to say nothing of the horse power output in generators.

The Siemens & Halske Electric Company of America has just obtained the contract for the new municipal lighting plant at South Norwalk, Conn. This plant will be of interest to the engineering fraternity generally, as it is to be run on the straight 220 volt two-wire system for arc and incandescent light as well as power. While a large number of these stations have been put in abroad, there have been comparatively few installations of the kind here, except for isolated plants. The New England business of the Siemens & Halske Company has been very satisfactorily increased during the past year, one of the most notable contracts being for the Boston City Hospital. Another plant is being installed in the new theatre at Springfield, Mass., in which lights for the entire edifice as well as some adjoining buildings will be furnished from two 75 k. w. machines running at 100 r. p. m. Still another theatre plant has been running for several months at the Academy of Music, Fall River, Mass., while one of largest orders secured, and now in satisfactory operation, is that for a large manufacturing plant, in which motors ranging from 10 to 100 h. p. in capacity, (aggregating a total of about 1000 h. p. full load capacity), with 100 Manhattan lamps and several hundred incandescents, are operated from a single set of bus bars at 220 volts, current being furnished by two machines of 400 k. w. capacity each, with a smaller one for night service. The generators in all the above mentioned plants are of the standard Siemens & Halske external armature type, while a large number of internal armature belted machines in both the slow and moderate speed types for generating and power service have been installed in Boston and vicinity during the past few months.

New Publications

STREET RAILWAYS OF GREATER NEW YORK. Published by Redmond, Kerr & Company, of New York City.

This pamphlet gives in a very concise form full information regarding all the street railway systems included in the Greater New York District. Operating statistics for the year ending June 30, 1897, are given in most cases, together with a complete statement of capital stock and funded debt. A map of the Metropolitan Street Railway System is included in the book.

HANDBOOK OF STREET RAILWAY LOCATION. By John B. Brooks. Published by John Wiley & Sons. 146 pages. Pocket form, morroco. Price, $1.50.

This book is one long needed, and gives in handy form the formulæ and methods for laying out straight track and curves, as well as the principal tables used in railroad location. Especial attention is given to the subject of compound curves and the use of them as transition curves. The writer is the professor of civil engineering in the State College of Kentucky, and the book should be found very useful to constructing engineers.

ENGINEERING AND ARCHITECTURAL JURISPRUDENCE. By J. C. Wait, M. C. E., LL. B. Published by John Wiley & Sons, N. Y. 905 pages. Cloth, $6.; sheep, $6.50.

The author, who is a practical engineer, took the occasion, while acting as instructor in engineering at Harvard University, to take the full course in the Harvard law school to fit himself as a specialist in engineering law. His book is a valuable one and should be of considerable assistance to both engineers and those who award contracts in pointing out the methods of avoiding litigation as well as showing the rights of the respective sides when disputes occur. One particularly useful section of the book is that relating to Contract Stipulations in which the proper wording of clauses to cover specific purposes is given.

MECHANICAL DRAFT. Published by B. F. Sturtevant Company, Boston, Mass.

This is a work that will be of great value to all who are interested in the economical production of steam. The book contains the accumulated experience of over a quarter of a century, and to its preparation has been devoted nearly two years of the most careful study and investigation by Walter B. Snow, a steam engineer of

very high standing. It is published in pursuance of the established policy of the B. F. Sturtevant Company to thoroughly inform the engineering public regarding the specific principles and applications of the various systems which it has presented, but the book is very much more than a mere catalogue. The book contains chapters on the composition, weight and bulk, and different properties of water and steam, together with chapters on combustion, efficiency of fuels, efficiency of steam boilers, and the different forms of mechanical drafts.

Trade Catalogues.

CATALOGUE No. 5. Published by Elmer P. Morris, of New York City. 108 pages. Illustrated.

MACHINE TOOLS. Published by Hilles & Jones Company, of Wilmington, Del. Forty-four pages. Illustrated.

FITTINGS AND FLANGES. Published by the Tight Joint Company, of New York. Eighty-five pages. Illustrated.

THE AMERICAN FUEL ECONOMIZER. Published by Bromell, Schmidt & Company, of York, Pa. Forty pages. Illustrated.

ELECTRIC STORAGE BATTERIES. Published by the Electric Storage Battery Company, of Philadelphia. Forty-eight pages. Illustrated.

CAR DOOR EQUIPMENT AND GENERAL RAILWAY SPECIALTIES. Published by the Q. & C. Company, of Chicago. Thirty-two pages. Illustrated.

List of Street Railway Patents Issued

U. S. PATENTS ISSUED DEC. 21, 1897, to JAN. 11, 1898, INCLUSIVE.

DEC. 21.

CAR FENDER.—Anthony F. Barro, New York, N. Y. No. 595,869.

CAR SIGNAL.—Christopher C. Jones, Savannah, Ga. No. 596,030.

DEC. 28.

ARRANGEMENT FOR PREVENTING ACCIDENTS ON RAILWAYS.—Hermann Burmann, Breslau, Germany. No. 596,047.

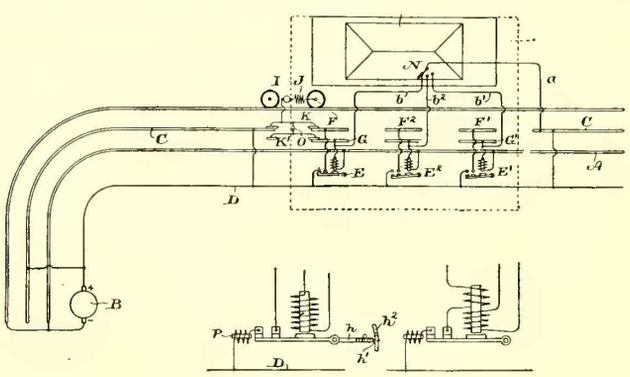
ELECTRIC RAILWAY.—Eben C. Crocker, Bridgeport, Conn. No. 596,054.

ELECTRIC SIGNAL BELL FOR STREET CARS.—James P. Orr, Pittsburgh, and Thomas F. Galvin, McKeesport, Pa. No. 596,085.

TROLLEY.—Antonio Travaglini, Philadelphia, Pa. No. 596,131.

ELECTRIC RAILWAY.—Wm. B. Potter, Schenectady, N. Y. No. 596,182.

In an electric railway, the combination of a third or main working conductor connected with a source of supply, the continuity of



PAT. NO. 596,182

which is interrupted at predetermined points, a conductor section located between adjacent ends of the main working conductor and insulated therefrom, a movable vehicle, a contact shoe carried by the vehicle arranged to complete the circuit between the conductor section and the source of supply, and means located in any convenient place, for controlling the current supplied to the conductor section irrespective of the operation of the vehicle.

TROLLEY BASE CUSHION.—Wm. G. Wagenhals, Dayton, O. No. 596,193.

CAR FENDER.—George Wiemers, Brooklyn, N. Y. No. 596,196.

TROLLEY RAIL.—Wm. A. P. Willard, Jr., Hull, Mass. No. 596,224.

TROLLEY RAIL FOR ELECTRIC ROADS.—Wm. A. P. Willard, Jr., Hull, Mass. No. 596,225.

CAR BRAKE.—Henry Schenck, Pittsburgh, Pa. No. 596,339.

TRAMWAY SWITCH.—Henry M. Hume and Frederic T. Hume, New York, N. Y. No. 596,368.

RAILWAY SWITCH.—St. John Girardeau and Richard J. Murray, Galveston, Tex. No. 596,422.

JAN. 4.

CAR FENDER.—George Hipewood, Boston, Mass. No. 596,592.

CAR VENTILATOR.—Thomas C. Bright, Kansas City, Mo. No. 596,650.

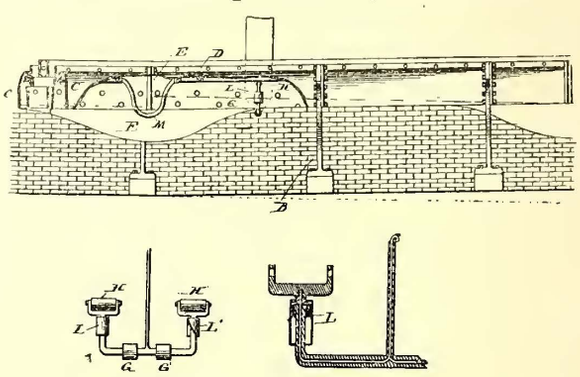
TROLLEY GUARD.—Herman J. Vogler and Alfredo Flores, San Antonio, Tex. No. 596,926.

JAN. 11.

CAR VENTILATOR.—Ebenezer S. Perry, New Bedford, Mass. No. 597,019.

ELECTRIC RAILWAY CONDUIT SYSTEM.—Ralph F. Thompson, Alexandria, La. No. 597,036.

An electric railway conduit system, consisting of a conduit provided with air and water tight chambers, one on each side of the



PAT. NO. 597,036

trolley slot and secured to the yokes; said chambers being provided with insulators, trolley wires, partitions and curved projections.

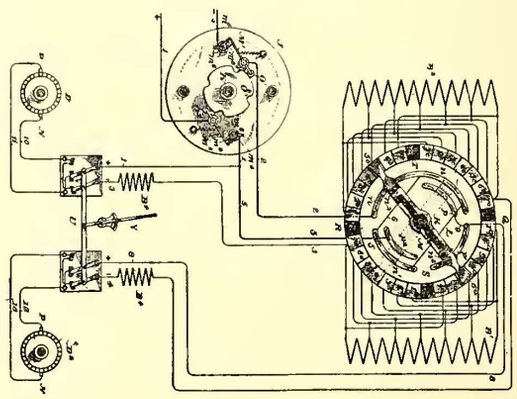
ELECTRIC RAILWAY MOTOR.—Chas. J. Van Depoele, Lynn, Mass. No. 597,156.

As a means of controlling electric motors, and in combination, a circuit interrupting device adapted to interrupt the circuit of the current supply at a number of points simultaneously, and a current changing device effecting relative changes in the circuits of the translating device during the time that the current is so interrupted.

AUTOMATIC FENDER FOR TROLLEY OPERATING ROPES.—Charles F. Wilson, Brooklyn, N. Y. No. 597,159.

ELECTRIC RAILWAY.—Hosea W. Libby, Boston, Mass. No. 597,202.

In a railroad an electric conductor supported by the side of the rail a T-piece consisting of a number of sections insulated from each



PAT. NO. 597,156

other and supported by springs from the web of the rail and spring contact pieces consisting of two disks of hard rubber, a cylinder of soft rubber and a metal rod passing through the center.

CAR FENDER.—John Megown, Youngstown, O. No. 597,303.

CAR FENDER.—Paul Jones, Cincinnati, O. No. 597,216.

CONTROLLER FOR ELECTRIC CARS.—John C. Henry, Denver, Col. No. 597,374.

The method of braking electric cars consisting in changing the armatures of two electric motors propelling said cars, from parallel to series connection, increasing the magnetization of the fields of said motors as the current in the armature decreases, due to retardation of the speed of the motors, and then short circuiting the armature of the motors under separately excited fields.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of fifteen cents. Give date and number of patent desired. THE STREET RAILWAY PUBLISHING COMPANY, HAVEMEYER BUILDING, NEW YORK.