Street Railway Journal.

Vol. XII. *NEW YORK AND CHICAGO, DECEMBER, 1896.* *No. 12.*

THE ELECTRIC RAILWAY OF VARESE, ITALY.

The town of Varese, in Northern Italy, noted as a resort of tourists and a place of pilgrimage, has recently laid down an electric street railway of modern American type, and one more name is added to the growing list of Italian cities which have adopted the swift and cleanly electric car.

Varese is a city with a population of some 12,000 inhabitants, situated on the Southern slope of the Alps, about thirty-one miles from Milan with which it is connected by the North Milan Railroad. It commands a magnificent view to the south of the fertile plain of Lombardy, as far as the Appenines, and from the elevated places in its vicinity of the placid waters of Lakes Maggiore and Como on the east and west, while to the north the view embraces the snow clad Alps.

FIG. 1.—TRAIN ON CURVE, VARESE ELECTRIC RAILWAY

Varese is a country resort of the wealthy Milanais, as well as a busy manufacturing town and is greatly frequented by tourists and pilgrims. The principal object of attraction is the Sanctuary of the Virgin known as La Madonna del Monte, situated on a lofty hill known as the Sacro Monte, about 3½ miles northwest of the city. It is said to have been placed there by St. Ambrose to commemorate a victory over the Arians. On the road which leads to the Sanctuary on the summit are small chapels decorated with frescoes and stucco groups, which chapels represent the fifteen mysteries of the Rosary. In the vicinity of the last chapel is a beautiful fountain and a colossal statue of Moses.

The Sanctuary is the goal of large bodies of pilgrims constantly visiting it, but the journey thither has always been difficult and many projects were promulgated for providing the pilgrims with some means of rapid transit. Indeed on few projects has so much labor been expended as on the rapid transit scheme connecting Varese with the Sacred Hill.

The first was presented as far back as 1884, and contemplated a plain steam road which should start from Varese and, taking a winding course, allow of a view of a large variety of scenery. This project was rejected, the possible returns not appearing large enough to warrant the expense. In 1888 another scheme was mooted, covering a simple steam road from Varese to Robarello, 2½ miles distant, and a rack railroad, Abt system, from Robarello to the Sacro Monte and the Campo dei Fiori. This met the same fate as the first, and another immediately took its place, this time for a horse car line from the North Milan station at Varese to Robarello and a cable road from the latter place to the Sacro Monte. This met with greater favor than the first and the formation of an operating company was begun, the expense of the road being estimated at about a million lire. The money, however, could not be raised, and the Abt system again came into favor, a franchise being requested from the Ministry of Public Works, covering simple adhesion steam traction from Varese to Robarello, 3 miles, and a rack road to the Campo dei Fiori, 2½ miles. The latter station is on an elevation of 3300 ft. above the sea level. The estimated cost of this road was placed at 1,600,000 lire. This project was eventually again abandoned.

In 1890 a new idea was mooted by the Cronaca Brealpina, the Varese Journal and Alessandro Feretti, the cable road engineer, embracing an electric road from Varese to Robarello and a cable line thence to the Sacro Monte. This project captured the public idea, and subscriptions to a company were requested, but subscriptions having also been raised to the company backing the Abt system, a "fatale dualismo" acted as a brake on the scheme. The steam road people looked to the tourists for their returns, the others to the pilgrims, one to the scenery, the other to the shrine. Eventually a compromise was made on the combination.

In 1892, after excursions into the law courts, on the part of the early promoters, a Belgian syndicate tried to push through a plain steam road project, but without success.

Matters dragged along until 1892, when the executive commission which had been appointed finally gave its vote in favor of electricity, and negotiations were entered into with Schuchert & Company, of Nuremberg, who had proposed an installation at a cost comparatively low. 1892 and a good part of 1893 passed, however, and still no definite result was attained. In August of that year the Nord Milano Railway offered its aid, provided the terminus of the road was located at its station, and the subscribers gave their approval to an electric line from Varese to the Prima Cappella, and requested that the Schuchert proposal be submitted to an impartial engineer for examination and report. It was unfavorable, and a lively polemic started once more.

New commissions were appointed, and in August, 1894, a final plan was adopted, the plans and estimate of the French Thomson-Houston Company being substituted for those of Schuchert & Company. In December, 1894, the Società Anonima Varesina was definitely formed to construct and operate the line.

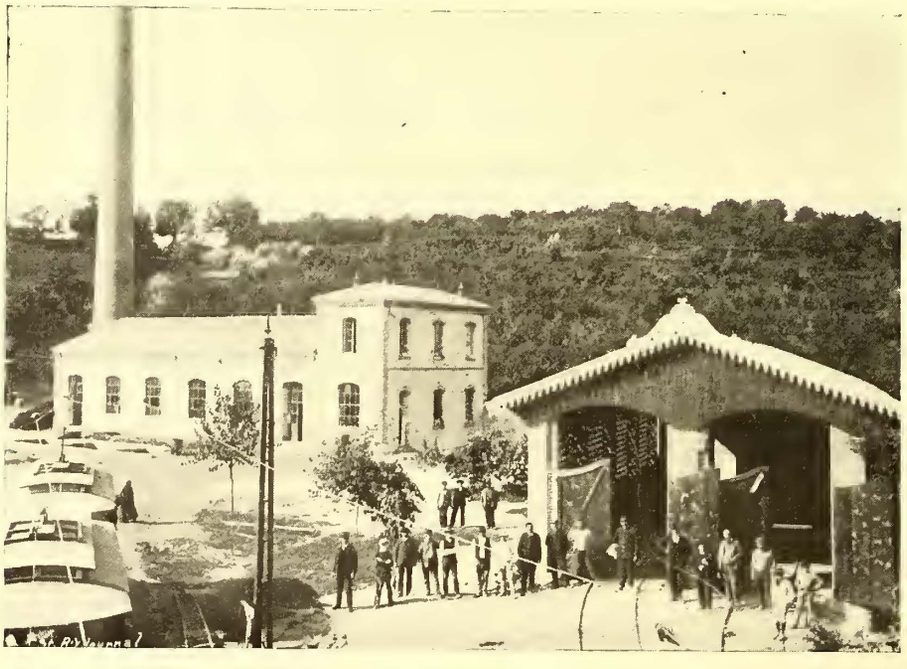


FIG. 2.– STATION AND CAR HOUSE AT ST. AMBROZIO.

The work was placed in charge of engineer Rigoni Guglielmo and the line was laid out to embrace all the natural beauties of the views around the Sacro Monte. With the small capital at his disposal he has succeeded admirably.

The total length of the line is three and one-half miles. The line is single track with turnouts and is laid with Phœnix rail, seventy pounds to the yard, through the city from the North Station to Piazza Bescavia, and from that point to the Prima Cappella in Vignole rails, forty-two pounds to the yard. The guage is 3 ft. 6 ins. and the line is all up grade, the maximum grade being 7.20 per cent, on a short stretch between Robarello and Prima Cappella,

FIG. 3.—NORD MILANO RAILROAD STATION AND TERMINUS OF ELECTRIC RAILWAY.

while a heavy grade of seven per cent is also encountered between the power house and S. Ambrozio. The minimum curve has a radius of 25.5 m. or 81.25 ft.

The overhead wire is suspended at a height of twenty feet above the roadway. It is supported by span wires strung between latticed iron poles or suspended from ornamental rosettes fixed to the walls of the houses on narrow streets. Outside the town the trolley wire is suspended in places from an arched latticed iron pole. A telephone wire connects the termini with the power house, and runs parallel with the trolley wire. The return is laid down with the care characterizing European installations, the supplementary wire having an unusually large diameter.

The power house is at the foot of the hill of S. Ambrozio. The boilers are of the Cornwall type, from the shops of Franco Tosi of Legnano. Two are now in place, space being reserved for a third. They supply steam to two vertical 100 h. p. high speed engines, also of Tosi make, running at 350 revolutions. These are belted to two General Electric multipolar generators each of sixty-two kilowatts capacity at 500 volts, running at 920 r. p. m. The switchboard is of the familiar panel type, carrying the usual measuring controlling instruments and protective devices.

To the right of the station is the car house. The rolling stock comprises four trolley cars and four trailers, each trolley car having a capacity of forty passengers, twenty-four seated and sixteen on the platforms.

The electric equipment consists of two motors to each car, with the usual series-parallel controllers. The brakes are three in number, one a shoe brake, one a rail brake, and the third an electric brake, the multiplicity of brakes being adopted on account of the severe grades over which the cars have to run. The trailers are open cars with less seating capacity than the trolley cars. Each is provided with a powerful shoe brake. The cars are hand-

some in appearance, and solid in make, built by Machi Brothers, of Varese, the trucks by Miani & Silvestri of Milan.

The line was opened for public traffic on Sept. 7, 1895, twelve days before that of Rome, amid general rejoicing, which was warranted, in view of the difficulties through which the project had passed.

The speed of the cars is four miles an hour in the city and outside as high as fourteen miles. They run under a headway of twenty-five minutes and cover the distance from the Stazione Nord to the Prima Cappella in thirty minutes. The line is divided into three sections, and the fare for each is twenty centesimi (four cents) going up and ten centesimi (two cents) descending. The first section terminates at the Rotonda, the second at Robarello, and the third at the Prima Cappella. Thus the ascending fare is twelve cents, the descending six cents.

FIG. 4.—VIEWS ON THE LINE OF THE VARESE ELECTRIC RAILWAY.

The Englewood-Chicago Electric Railway.

Ever since the consolidation of the storage battery interests on this side of the Atlantic about a year ago, the representatives of those interests have been anxious to have an extended test made of their batteries for traction work. All previous storage battery installations for street railway service in this country have been made, the manufacturers of batteries claim, under adverse conditions. The batteries have not contained all of the present improvements, owing to the fact that the patents have been under litigation and consequently that no one company has been able to manufacture the best form of plates, and during the patent warfare more attention was paid to legal matters than to electrical and mechanical improvements in the batteries themselves. The results secured abroad, however, coupled with the great call for an electric system which can avoid the use of overhead wires, have infused the present storage battery manufacturers with the wish to demonstrate the merits of their system under favorable conditions.

The franchise of the Englewood-Chicago & Electric Railroad Company was recently on the market and a company was organized to take hold of the matter and to build and operate the road. This company while being in no sense the same as the electric storage battery company, yet succeeded in placing the majority of its bonds among the stockholders of the latter on condition that storage batteries should be used as motive power on the new road. Some of the officers of the storage battery company are directors of the street railroad company, but the two are so separate that if the batteries fail to prove an economical means of transportation they will be abandoned and the street car line run on the old overhead system.

The plant is interesting, not only on account of its use of storage batteries, but also because of novel features in the station construction and operation.

The Englewood & Chicago Electric Railway Company is the owner of six franchises for occupying streets in the southwestern part of the city of Chicago and adjacent territory. In all, these franchises cover thirty-five miles of street, on about half of which double track is to be placed. The northern terminus of the Chicago & Englewood Electric Railway is at Sixty-third Street and South Park Avenue.

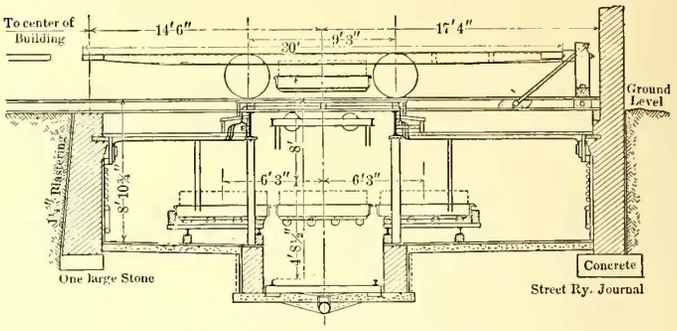


FIG. 2.—SECTION OF PIT.

The main line of the road will run generally in a southwesterly direction through Park Manor, Auburn Park, South Englewood, Washington Heights, Blue Island to Harvey, with branches west to Morgan Park, and east to Rosedale, Kensington, Pullman and West Pullman.

Up to date about 21½ miles have been laid in the most approved manner. Johnson eighty pound, seven inch girder rail has been used, placed on eight foot ties, under which is a roadbed of six inches of the best gravel. Brace tie plates are employed throughout, four to each rail. Tie rods are placed at every joint to prevent spreading. This has been thought necessary on account of the weight of the cars and the high speed at which they are to be operated. A considerable portion of the line was laid on new streets, many of which had to be paved.

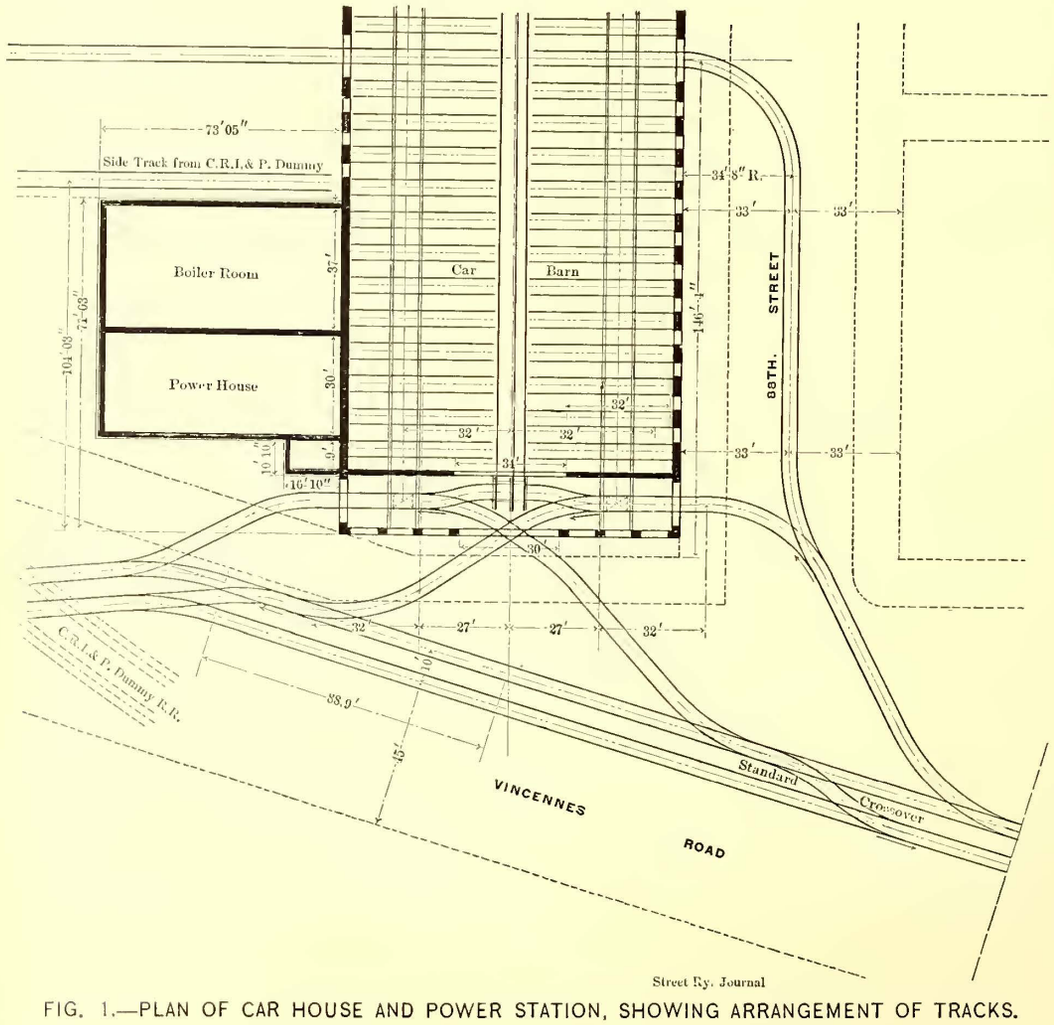


FIG. 1.—PLAN OF CAR HOUSE AND POWER STATION, SHOWING ARRANGEMENT OF TRACKS.

The power house and car house are situated 5½ miles from the north end of the line, where the company has purchased property of two acres in extent. They are in one building 175 ft. × 102 ft., and of brick and stone with pitch and gravel roof. The present capacity of the car house is twenty-eight cars, but when extended, as contemplated by the plans, it will be 258 ft. long × 102 ft. wide and will hold comfortably the fifty cars ultimately intended to be in service. These are to be stored on tracks running transversely to the building as shown in Fig. 1. These tracks will be served by a large electric transfer table running the entire length of the building and connecting with the outside, as shown.

The arrangement of the machinery in the power house is shown in Figs. 3 and 4. The complete engine and generator equipment of the engine room will comprise four 250 k. w. Walker generators, one 500 h. p. and two 250 h. p. Willan's engines, the latter being manufactured by the M. C. Bullock Manufacturing Company. Of this equipment, the four generators and the two 200 h. p. engines are put in place at present, the remaining large

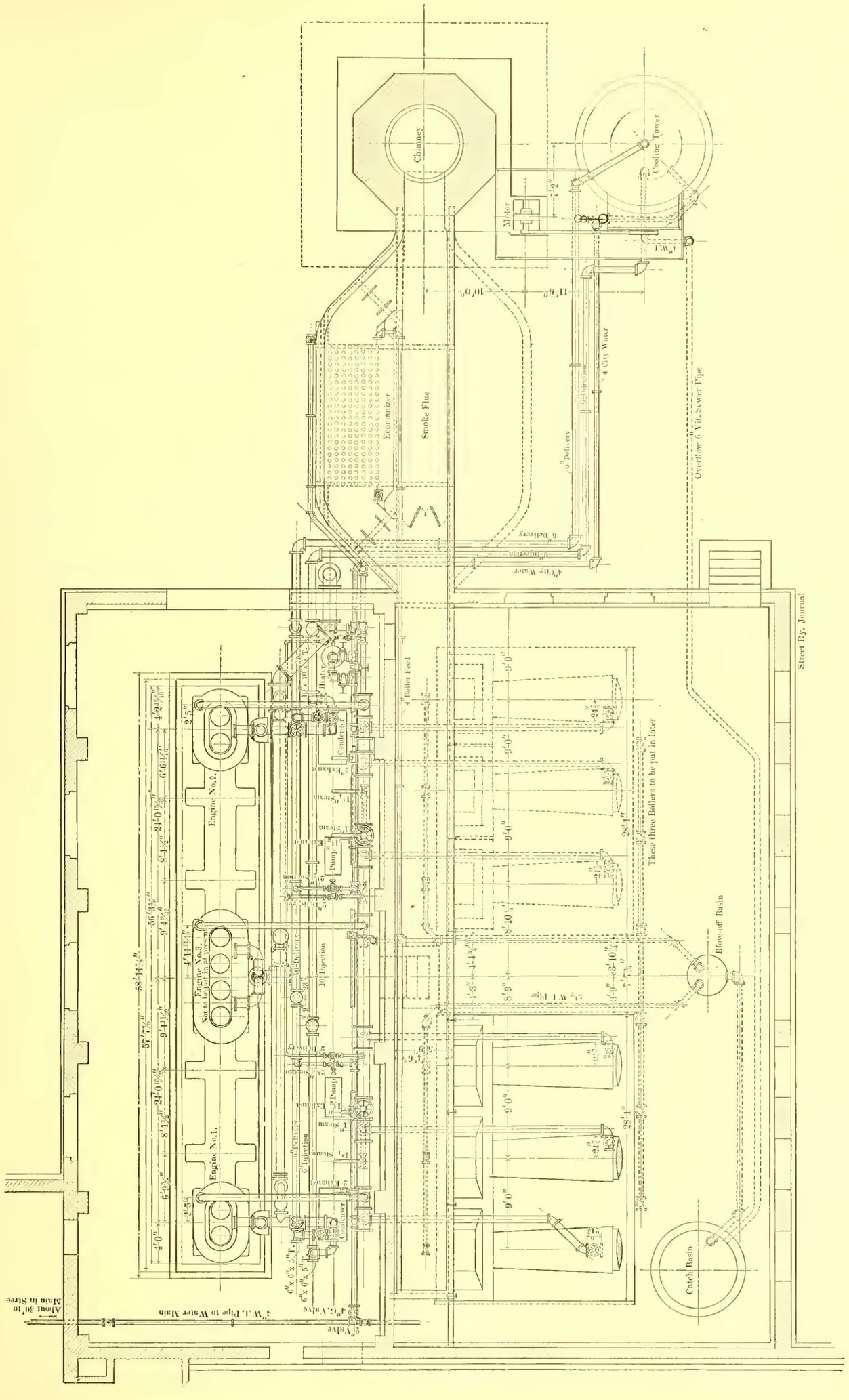


FIG. 3.—PLAN OF POWER STATION—ENGLEWOOD & CHICAGO RAILWAY

engine to be put in later, when the demands of the power house make this increased power necessary.

The engines and generators are directly connected, the armatures being supported on hollow shafts with a solid shaft inside attached to suitable couplings so that any one of the generators may be run from either engine. This arrangement of shafting, which is shown in Fig. 6, was supplied by the Arnold Electric Power Station Company, which controls the patents on this method of power transmission. The engine room is also equipped with a 7½ ton traveling crane.

The boiler room at present, is supplied with three 200 h. p. Heine boilers and space is left in the boiler room for three additional boilers. The boilers are equipped with Roney mechanical stokers. Coal is shoveled directly from the cars on a side track outside the boiler room on to an iron platform in front of the boilers. From this platform, it may be easily shoveled into the hoppers of the stokers.

The stack is of steel and self-supporting and was built by the Variety Iron Works. It is 150 ft. high and 7 ft. in diameter and has a brick base extending 20 ft. from the ground, into which the smoke flue enters.

The plant is to be run condensing, and as it was impossible to obtain condensing water in the location selected for the power house, a cooling tower, furnished by the H. R. Worthington Company, has been put in to cool the water after it has gone through the condensers. This cooling tower consists of a steel shell 12 ft. in diameter and 30 ft. high, filled with vitrified sewer pipe placed on end. The water is pumped to the top of the cooling tower and sprayed over the sewer tile, falling through them to a tank below. A blower is provided at the base of the steel shell to force a draught of air up through the tile. The temperature of the water is sufficiently lowered by the evaporation, so that it may be used over again in the condenser, and a vacuum of twenty-five inches is guaranteed by the company furnishing the cooling tower and condenser.

A diagram of the switchboard is given in Fig. 8. There are four generator panels corresponding to the four generators and one motor panel, from which is controlled the motor circuits running to the two battery transfer cars, the transfer table and other motors in the building. Three of the generators will run continuously while the batteries are being charged; one at 150 volts, one at 170 and one at 190. There are three bus bars on the switchboard to carry these three different pressures, the object being to charge the batteries first on the lowest voltage, then on the middle voltage and finally complete the charging on the highest voltage. Each generator panel carries, with a 250 volt Weston voltmeter, one recording ammeter, one 1500 ampere Weston ammeter and an underload and overload circuit breaker. There is also a three-way switch on each panel so that any machine may be switched to either of the bus bars, it being possible to change the voltage of the generators by means of the field rheostat. On the motor panel will be noticed a seven point switch which has been designed so that the motor circuits may be run from any one of the three bus-bars or any one of the four generators.

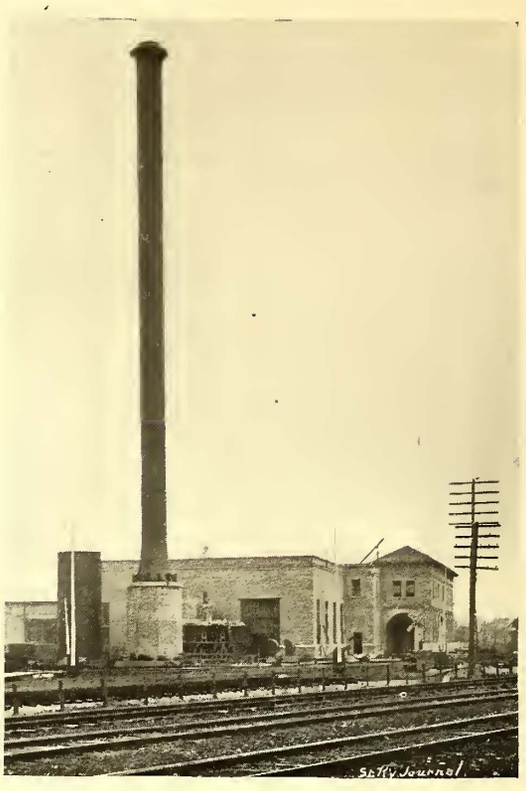


FIG. 5.—EXTERIOR OF POWER STATION.

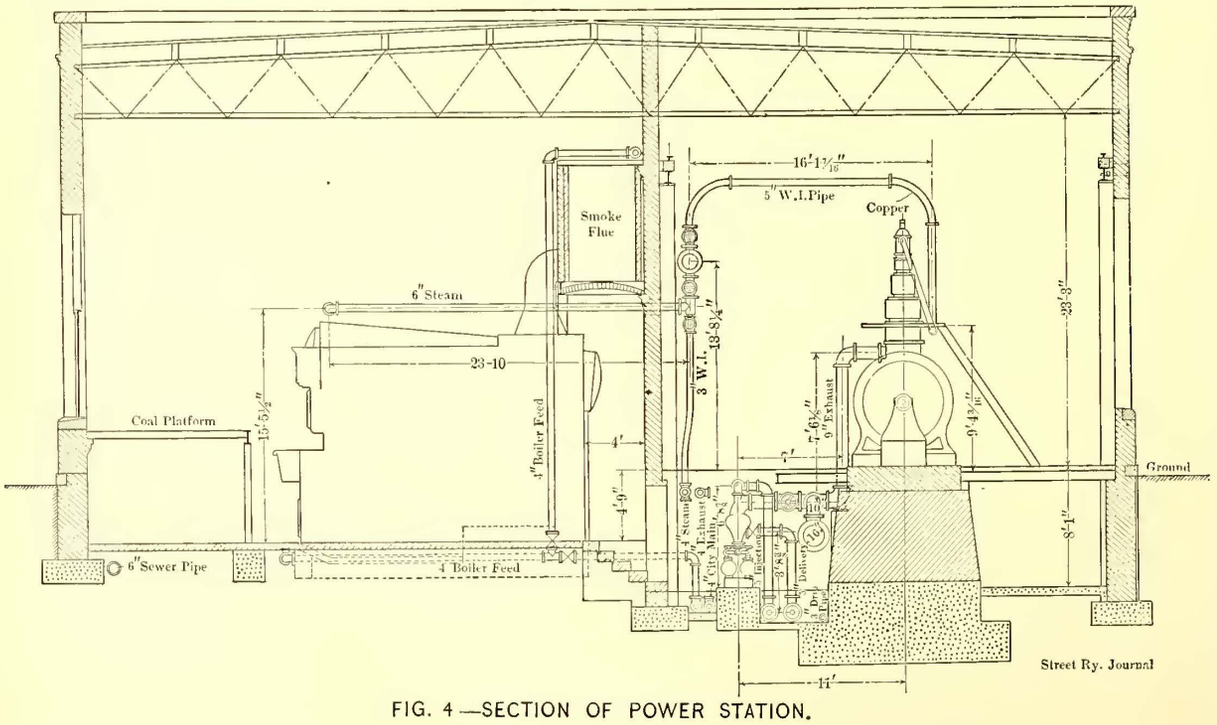


FIG. 4.—SECTION OF POWER STATION.

The main feeder wires in the car house have been so laid out that the potential between the positive and negative mains is constant at any point in the building. This is accomplished by running the positive wires clear around the building and the negative wire the full distance in the opposite direction. The batteries are charged in multiple across these mains.

A novel device has been designed to indicate when the batteries are fully charged. It is practically an ammeter with an attachment which makes contact and completes the circuit through an incandescent lamp, when the current drops to twenty amperes. The object of this is to indicate to the attendant when the battery has been sufficiently charged. When the battery is first put on the charging

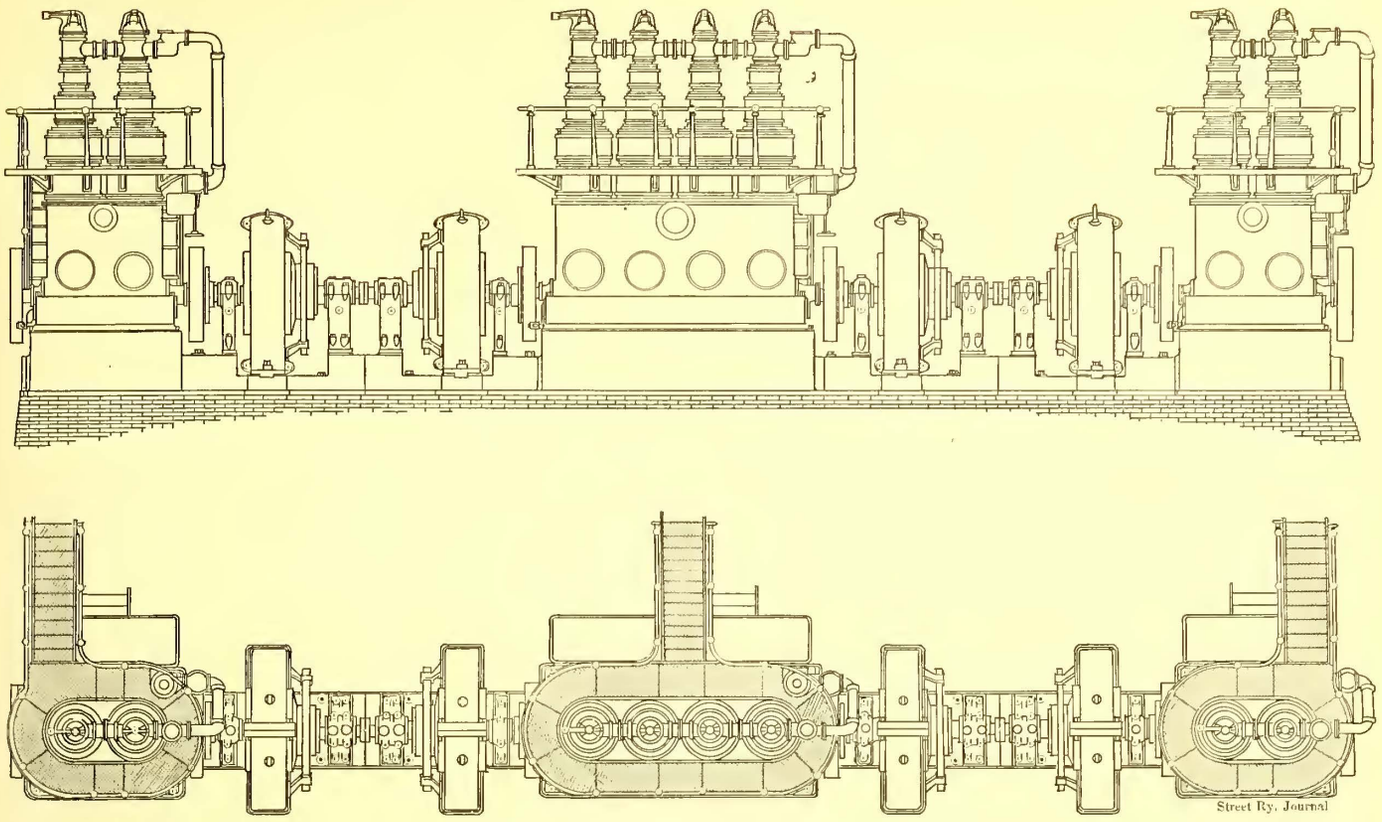


FIG. 6.—PLAN AND SECTION OF ENGINES AND GENERATORS.

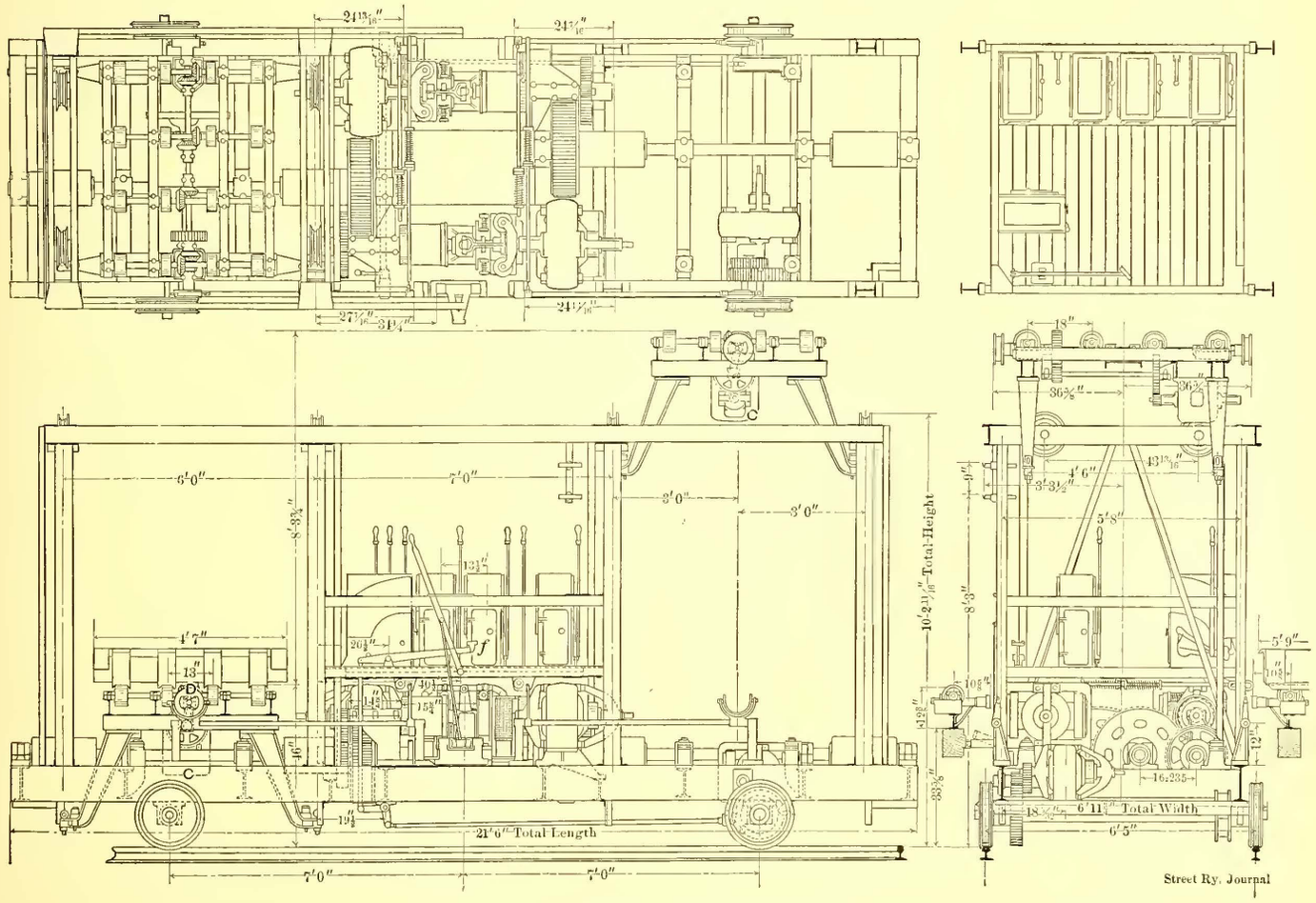


FIG. 7.—ELECTRIC TRANSFER TABLE.

circuit, the e. m. f. of the cells being low, the amount of current is correspondingly large, but as the batteries become charged, their e. m. f. rises, consequently the amount of current becomes gradually smaller until it reaches the point at which the lamp is set to light up.

connect the shaft operating these rollers to the shaft on the transfer car, so that the battery tray is completely under the control of the operator. The operation of changing the batteries on the car is then as follows: a fully charged battery is first placed on one of the elevators. The table

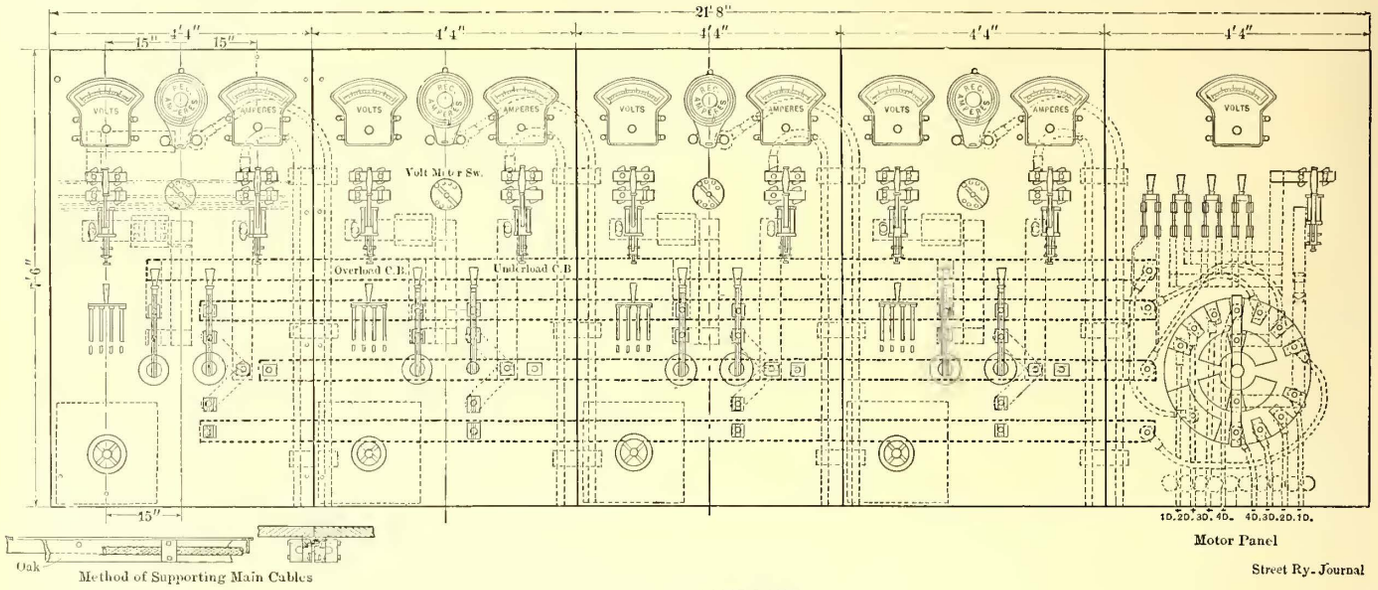


FIG. 8.—SWITCHBOARD.

The best method of handling the batteries and of placing them on and removing them from the cars was a problem which was made the subject of much thought and study. The plan adopted is one in which all work is mechanically performed and one in which, therefore, the labor element is reduced to a minimum. From the plan of the car house, shown in Fig. 1, it will be noticed that the tracks in front of the car barn are so arranged that the cars may be run through the front arcade of the building. Here the batteries are exchanged. The car is run over a pit which allows the discharged battery to be removed and a new one put in its place. This operation requires but one or two minutes so that the delay is very slight. The cars are then run on to their storage tracks in the car house by means of the transfer table operating in the center of the building.

Fig. 2 shows a transverse section through one side of the basement of the car house where the batteries are placed for charging. The battery elevating and transfer table shown in Fig. 7 runs directly under the center of the cars as they stand in place in the car barn and at right angles to the cars on the track. This elevating and transfer table, which is one of the most important features of the plant, was furnished by the Shaw Electric Crane Company. It is equipped with five electric motors controlled by the operator who stands in the center of the table.

is then run under the car whose battery is to be replaced and the discharged battery removed by the second elevator. The table is then run ahead and the charged tray brought directly beneath the car and elevated into position.

The battery tray is of well-seasoned oak. The corners are secured by malleable iron castings, and the tray is supported underneath by four five-inch channel irons, the ends of which are bent up and formed into hooks which suspend the battery tray from cross bars on the truck. The tray contains seventy-two battery cells connected in four sets of eighteen cells each. By means of connections on the controller, these four sets are connected in starting the car, first in multiple, then in series-multiple, and

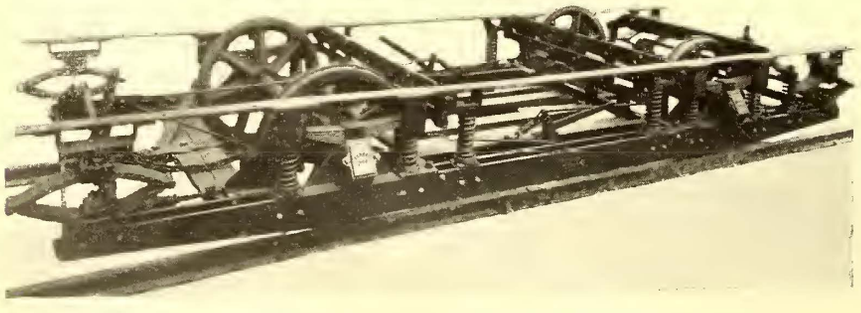


FIG. 9.—DU PONT TRUCK FOR STORAGE BATTERY CARS.

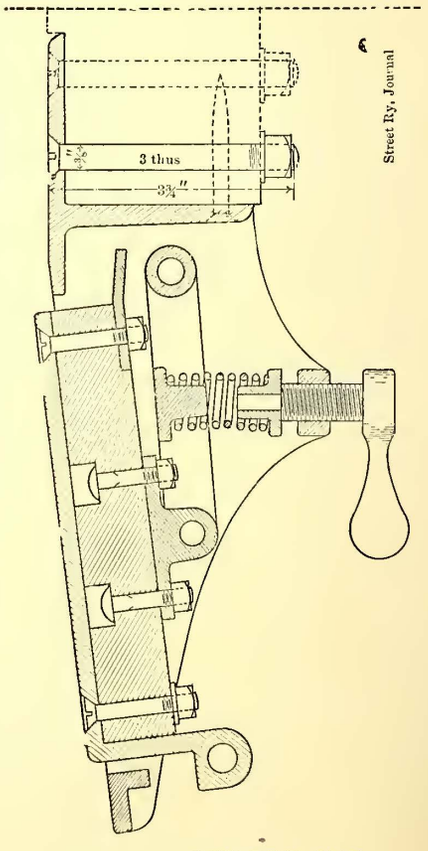


FIG. 10.—BATTERY TRAY CLIP.

The battery trays are carried at each end of the table on rollers, supported on a frame which is raised or lowered by an electric mator. The rollers are connected by means of skew-bevel gears to an electric motor so that by turning the rollers, the battery is moved on or off the table. The charging tables, shown at each side of the elevator car, are also fitted with similar rollers, and a clutch is arranged to

finally in series with the necessary intermediate transition points.

There are four sets of contact plates fastened on the sides of the tray and connected to these four sets of batteries. When the battery tray is elevated to position on the cars, contact is made automatically to the controller wiring through spring contact plates fastened to the car

sills and shown in detail in Fig. 10. Spring contact plates are also provided at the sides of the charging tables in the basement of the car barn, so that when the battery trays are placed on these tables, contact is automatically made, and the batteries are at once ready for charging.

The batteries to be used are of the "9 T" type, chloride accumulator, manufactured expressly for the street railway service by the Electric Storage Battery Company. There are seventy-eight cells of battery on each car, which when in service will give a total of about 140 volts. One important feature of this battery is the high

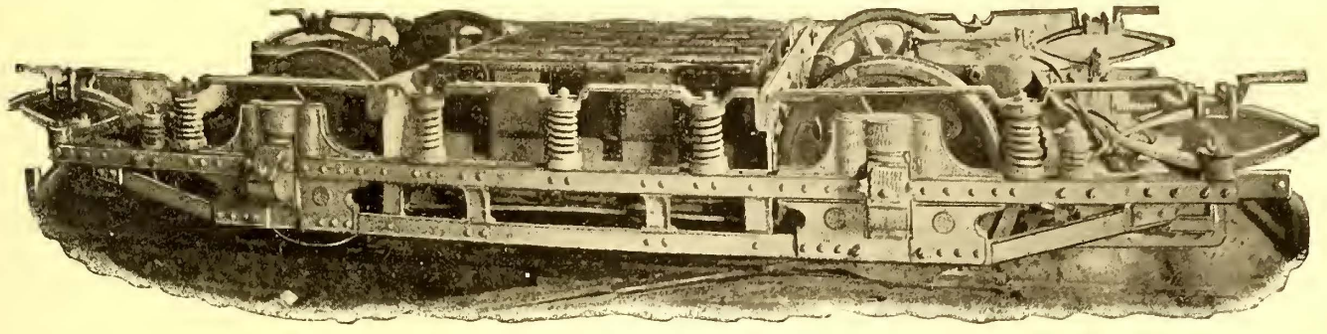


FIG. 11.—PECKHAM STORAGE BATTERY TRUCK.

efficiency at high or intermittent rates of discharge, the battery giving in capacity at a two hour rate of discharge 80 per cent. of what it would give at a ten hour rate. Exhaustive tests seem to show that the maintenance of this battery will be very low.

The present equipment of cars will consist of twenty open, and twenty closed vestibule cars, built by the St. Louis Car Co. Some of these are mounted on du Pont trucks and some on Peckham trucks. The cars are thirty feet over all. The seats in the closed cars are longitudinal, and the open cars are of the ordinary ten bench type. Each of these cars is equipped with a fifty horse power Walker motor, with a controller made up especially by the Walker Company for storage battery operation.

The officers of the company are: J. C. Shaffer, president and treasurer; Walter Olds, vice-president; Charles F. Griffin, secretary; G. Herbert Condict, general manager. The above are also directors, and in addition, Isaac L. Rice, W. W. Gibbs, and Herbert Lloyd.

Material assistance was given by J. H. Vail and B. J. Arnold, as consulting engineers during the period when the construction of the roadway and power plant was being planned.

Hugh Hazelton has been the assistant to the general manager during the construction of the plant, and H. B. Quick has been in charge of the track work. The contractors for the track work were C. E. Loss & Company, Chicago.

Opening of a New New Orleans Line.

The Canal & Claiborne Railroad Company, of New Orleans, put its new electric equipment in operation during October. The event was celebrated by a trip made on the electric cars by the officials of the company, the engineers, and a number of invited guests, and terminated with a banquet at the offices of the company.

THE Aurora & Geneva Railway Company, of Aurora, Ill., put its line in operation Oct. 24. The line is seven miles in length, and extends between the cities of Aurora and Batavia. At present two thirty-six foot cars, mounted on Brill maximum traction trucks and equipped with G. E. 1000 motors are employed. All the construction was carried on under the direction of D. A. Belden, manager.

New Track Construction at Rochester.

The Rochester (N. Y.) Railway Company has recently installed one mile of double track, which is of a very substantial character, and represents the company's idea of a desirable standard track for a macadam street on a line upon which there is a good deal of traffic.

The earth is first excavated to a depth of sixteen inches, or ten inches under each rail. A bed of concrete is then laid surrounding the ties, which are spaced three feet centers. The rail employed weighs seventy-eight pounds to the yard, and is six inches high. It is laid in sixty foot lengths. The joints are six bolt, and are connected with the Brown plastic bond. Tie plates are employed under every other tie.

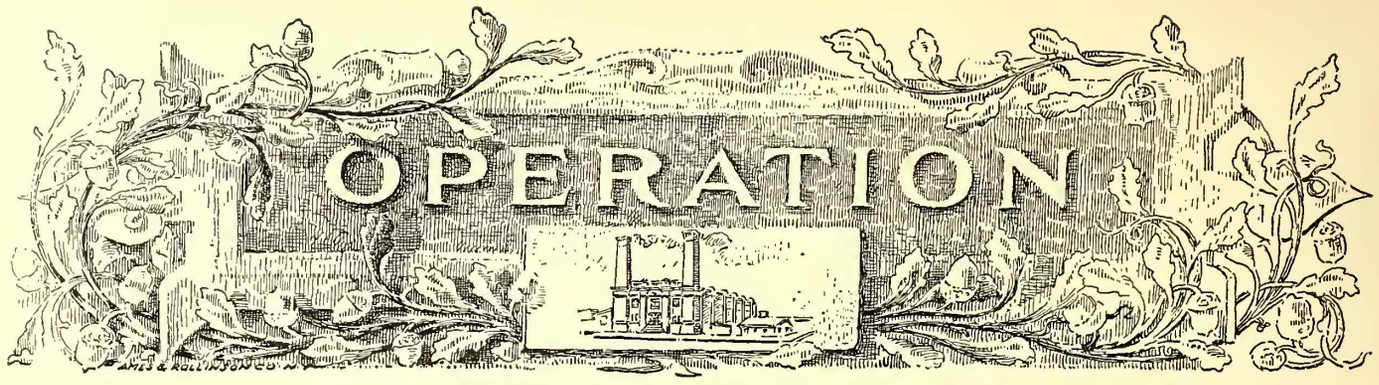
New Electric Line in Santa Barbara.

The electric line of the Santa Barbara Consolidated Electric Railway Company was put in operation Oct. 1. The Consolidated Company has lately purchased all the tracks, property and franchises of the Citizens' Street Railway and the Santa Barbara Street Railway Company, consisting of 6½ miles of track, formerly operated by animal power. The station is equipped with Ideal engines,

FIRST ELECTRIC CAR IN SANTA BARBARA.

General Electric generators and Oil City boilers. Crude oil, costing delivered 2¼ cents per gallon, is used for fuel.

The first car was operated by Miss Miller, daughter of the president of the road. Next came a car with the city officials and their guests, and, third, a car containing the Santa Barbara Military Band, with a trailer which was one of the most novel and striking features of the celebration. It was a platform car decorated with bunting, and standing upon it were two venerable mules, one white and one black, wearing wreaths of roses. These animals have been in the service of the company since 1876, and on one side of the car appeared the statement, "This is our last trip."



Blanks and Forms in Storeroom and Wages Accounting.

The system of storeroom and wages accounting employed by the Rochester Railway Company, and introduced by the general manager, F. O. Rusling, is the result of careful study and the experience of a number of years, and while seemingly very complete and effective, is also extremely simple. The basis of the system throughout is to keep a careful record of all supplies received and issued and the labor employed in each department, from which the cost of all construction and repair work done by the company can be readily determined. The storeroom is made the center of the system, all supplies being received at the storeroom and issued therefrom only upon requisition.

The storeroom is a commodious apartment adjoining the offices of the company, and is strictly under the control of one person—the storekeeper—no one being allowed to take articles therefrom except through him. Along the walls are arranged a large number of compartments of different sizes, and there is a central rack which also contains a large number of compartments. Each is devoted exclusively to holding a supply of one particular article. To avoid trouble which might be caused by applying different names to the same article, a storeroom catalogue has been compiled by Mr. Rusling. This is one of the most complete publications of the kind which has probably ever been attempted, and contains the name of every separate article which is employed by the company in the operation of its line and duplicates of which would be kept in the charge of the storekeeper. The elaborate and careful way in which this catalogue is made out can be seen from the reproduction of two pages from it, shown in forms 1 and 2. The catalogue is of pocket size and contains 142 printed pages including an index. A considerable number of blank pages are also bound in throughout the book and upon these additional articles, which may be bought from time to time and which are not given in the catalogue, can be entered. Copies of this catalogue are placed in the hands of the superintendent, department foremen and others who may have use for it.

As will be seen each has a designating letter and number by which it is always referred to in requisitions upon the storekeeper and in the storekeeper's accounts. These letters and numbers correspond with letters and numbers

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PINIONS.

C 184	Pinion: Rawhide:		Westinghouse.
C 53	" "		W. P. 30.
C 123	" "	Intermediate:	Short.
C 72	" Steel.		G. E. 800.
C 121	" "		Short.
C 183	" "		Westinghouse.
C 52	" "		W. P. 30.
C 124	" "	for single red.	Short.
C 122	" Steel	Intermediate:	Short.

PINION BOXES.

C 8	Pinion Box: Babbitt:	Single flange:	W. P. 30
C 6	" " Brass:	Single flange "	
C 7	" " "	Double flange "	
C 128	" " Armature:		"Short."
C 145	" " "	Babbitted:	West.
C 78	" " "	Babbitt lined.	G. E. 800
C 130	" " Intermediate:		"Short."

PINION CHECK PLATES.

C 9	Pinion Check Plate:	W. P. 30.

PIPE.

H 19	Pipe: Iron:	½ in.	
H 9	" "	¾	
H 14	" "	¾	
H 4	" "	1¼	
H 5	" Gas: Iron	1½	
H 10	" " "	1½	

PLUMBAGO.

F 115	Plumbago.	

88

PEDESTAL PARTS.

E 50	Pedestal Bolt:		D. & D.
E 100	"		McGuire.
E 30	"	¾ in.:	Bemis Imp.
E 6	"	casting. 24-6	Bemis.
E 39	"	"	Bemis Imp.
E 135	" Spring:		Diamond.
E 130	"	9 in.	McGuire
E 131	"	No. 80.	"

PHOSPHOR BRONZE.

A 67	Phosphor Bronze: Strip:		½ in. wide No. 10: B. & S.
A 60	"	" Strip:	½ wide. No. 14: B. & S.
A 59	"	" Strip:	11-16 wide. No. 21: B. & S.
A 58	"	" Strip:	¾ wide. No. 14 B. & S.
A 66	"	" Strip:	¾ wide. No. 15: B. & S.
A 62	"	" Strip:	1 wide. No. 18: B. & S.
A 56	"	" Strip:	1 wide. No. 19: B. & S.
A 57	"	" Strip:	1 wide. No. 19: Helmet B. & S.
A 61	"	" Strip:	1¼ wide. No. 18: B. & S.
A 65	"	" Strip:	1⅜ wide. No. 14: B. & S.
A 80	"	" Wire:	No. 18 Stubs.
A 63	"	"	" No. 19. B. & S.
A 50	"	"	" for G.E.800. No. 16 B. & S.

PIKE POLES.

B 100	Pike Pole:	15 ft

PILOT BOARD PARTS.

E 24	Pilot Board casting:	26-11: R.:	Bemis
E 23	"	26-11: L.	"
E 42	"	" Bracket:	Dorner & Dutton

FORMS 1 AND 2.

ROCHESTER RAILWAY COMPANY.

STORE ROOM.

Please issue the following material for .....

QUANTITY	ARTICLE	PRICE	CLASSIFICATION	BOX NO.

Date, ... 189....

Received by ..... *Foreman* .....

FORM 4.

ROCHESTER RAILWAY COMPANY.

STORE ROOM.

Date, ... 189

Purchasing Agent: *Req. No.* .....

Please order the following Material for .....

QUANTITY.	ARTICLE.	Date Ordered	WHOM.

Approved,

..... *Storekeeper* .....

Supt.

FORM 5.

250

Date When Received	Quantity or Weight	Name of Article	Req. No.	From Whom Received	Address.	Freight	Express.	Cartage.	Expense Total.	Remarks

FORM 3.

on each compartment in the storeroom so that it is very easy to supply any article which may be called for, and a high grade of help is not needed by the storekeeper.

As all articles are received by the storekeeper records of them are entered in a large blank book, the upper part of a page of which is shown in form 3. As will be seen, this record provides for keeping account of all charges paid on the articles, whether received by freight or express, and for carting, the condition in which they are received, etc. Articles are issued from the storeroom upon requisition (form 4) filled up by the foremen of the different departments, the cost being entered by the storekeeper for future use. These slips also serve as receipts for the latter. When the supply of a certain article is exhausted, the storekeeper makes requisition upon the purchasing agent upon form 5. In case goods are received for immediate use outside of the storeroom, the foreman in charge of the work fills out form 6, which is sent to the storeroom and properly entered in the books of the storekeeper, both as supplies received and issued.

STORE KEEPER. _____ 189

ROCHESTER RAILWAY CO.

We have received to-day from

The following articles:

On my order of _____ *(Date.)*

Foreman,

Department.

N. B.—Foreman will fill out this blank and forward to Store Keeper at once on receipt of Goods. Attach all Memo. Bills or Delivery Slips.

FORM 6.

Month of 189 SUPPLIES ISSUED FROM STOREROOM

	GENERAL.			OPERATING.					REPAIRS.										
DATE	2	5	7	10	11	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1																			
2																			
3																			
4																			
5																			
&c																			

49

Month of 189 ROCHESTER RAILWAY COMPANY.

CONSTRUCTION.									ROCHESTER AND IRONDEQUOIT R. R. REPAIRS						TOTAL	
28	29	32	33	34	35	36	37	38	11	18	20	23	24		AMOUNT.	DATE
																1
																2
																3
																5
																6
																7
																8

FORMS 7 AND 8.

The cost of all supplies issued from the storeroom is entered in a blank book in the storekeeper's office, the headings of which are shown in forms 7 and 8 which represent opposite pages. The numerals from 2 to 38 at the top of each vertical column indicate the use to which the supplies are put, according to the schedule of expenses published at the end of this article.

The cost of all repairs performed or other work done in the repair shop is kept in a book, opposite pages of which are shown in forms 9 and 10, in which the cost of the material used is kept on one page, and the labor expended on the same repair, on the opposite page.

TIME BOOKS.

Different time books are provided for each of the following departments: conductors, motormen, machine shop, barn foremen, power house, track, office, miscellaneous.

These time books are uniform in size, and are indexed according to the employe's name, and arranged as shown in form 11. Each page contains space for keeping a record of six employes, and as they are manifolded the man's time can be entered for fifty-two weeks before a new book is opened.

Space is left for entering the rate per week, hours employed and amount paid for each day, as shown by the vertical columns. As there are eight horizontal divisions under the space devoted to each employe, the division of his work in the different eight departments of the company's service can be indicated. Thus, if a part of a mechanic's time is expended in the repair shop and part in the power station, these would be entered separately under the appropriate numbers for each week. The rate is made conspicuous, so that any change in the rate can easily be detected by the general manager or bookkeeper, and time is kept to the twelfth part of an hour, or 2½ minutes either way. To facilitate calculations of the pay rate for fractions of an hour, blue print tables have been printed, showing the amount in cents for five minutes' time at the different wages paid per week by the company. The time books of the company are two in number, and as will be seen from the forms, a record of alternate weeks is kept in each. The object of this is to facilitate the clerical work. One time book is kept at the office of the foreman of each department and the other in the office of the main bookkeeper, so that the records are entered by the former during the week and returned to the bookkeeper at the end of the week and the second book received from him.

MATERIAL USED

DATE RECEIVED	ORDER NO.	QUANTITY	ARTICLE	PRICE	TOTAL	DATE RECEIVED	ORDER NO.	QUANTITY	ARTICLE	PRICE	TOTAL

99

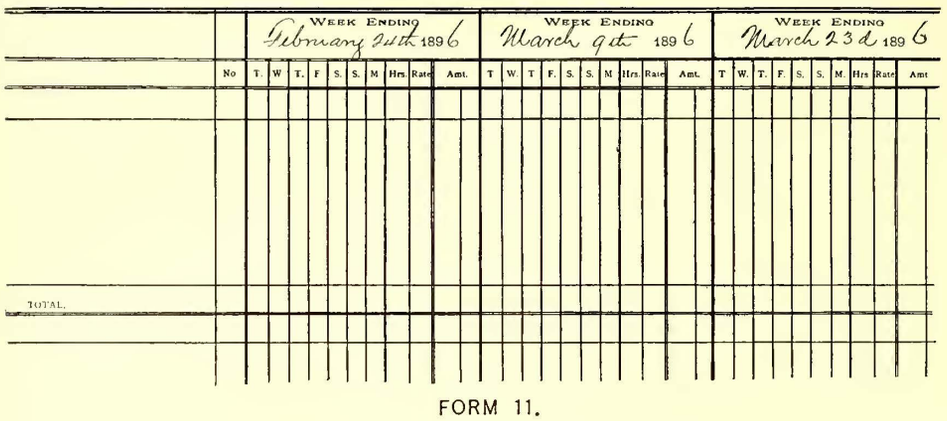
TIME EXPENDED

NAME	DATE COMPLETED	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL HOURS	RATE PER HOUR	TOTAL

FORMS 9 AND 10.

The form of time book giving the general distribution of wages is shown in forms 12 and 13. These pages are 15½ ins. × 21 ins., and they are filled out from the department time books. The vertical columns show out the different divisions of accounts in which labor is an element. Spaces for two weeks are shown, but each page covers a month and spaces are left for six weeks as parts of six weeks may occur during a month of thirty-one days. Space is left for a summary at the bottom of the page. The totals for each month with summary for a half year are entered in a similar page at the back of the same book.

The company also keeps a record of each motorman and conductor in two books called the Employment Record Books. In one is entered the date when engaged, nationality, age, previous occupation, etc. In the second a full record of good deeds and misdeeds. This is written up from detectives' records, inspectors' reports, citizens' communications, etc.



FORM 11.

the supervision and general management of the road. Clerks in general office.

(2) *Office Expenses.*—All stationary, books, paper, stamps, pens, pencils, printing, blanks, circulars, statements, storehouse office supplies (used in the general and storehouse offices), together with the cost of heating and lighting the general offices.

(3) *Insurance.*—Insurance on all property of the company.

(4) *Legal Expenses.*—Salaries, fees, expense of attorney, witness fees and other court expenses.

(5) *Injuries and Damages.*—Persons injured, property damaged, wages of disabled persons, medical attendance, wages of claim agents and clerks, and wages of car men while on this business.

(6) *Contingent Expenses.* — Traveling and other expenses of general officers and assistants, telephone and telegraph expenses, etc.

(7) *Miscellaneous.*—All other expenses not mentioned above.

OPERATING EXPENSES.

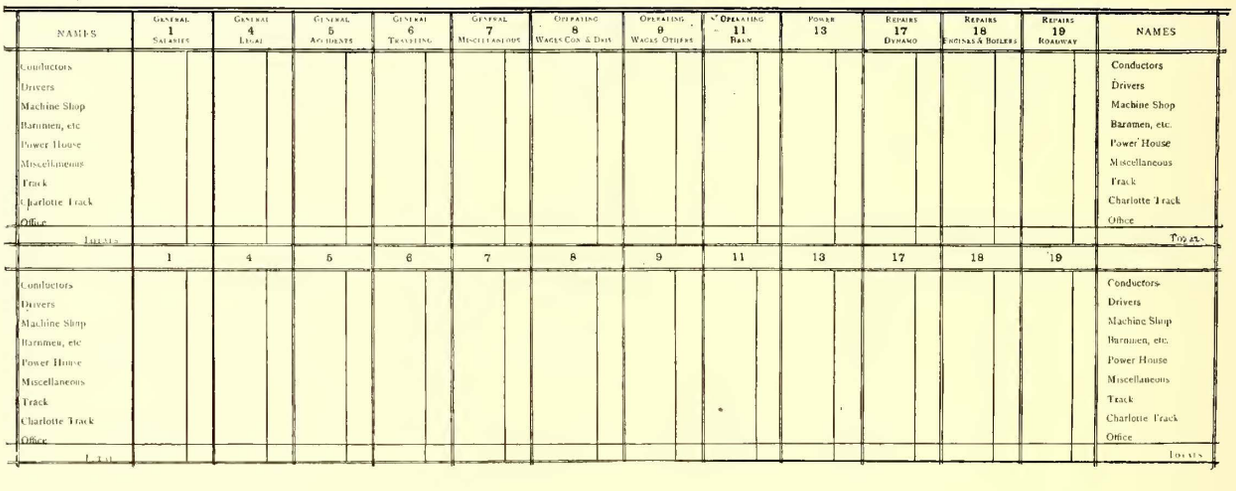
Car Service (Transportation).

(8) *Wages of Car Men* — Conductors, drivers.

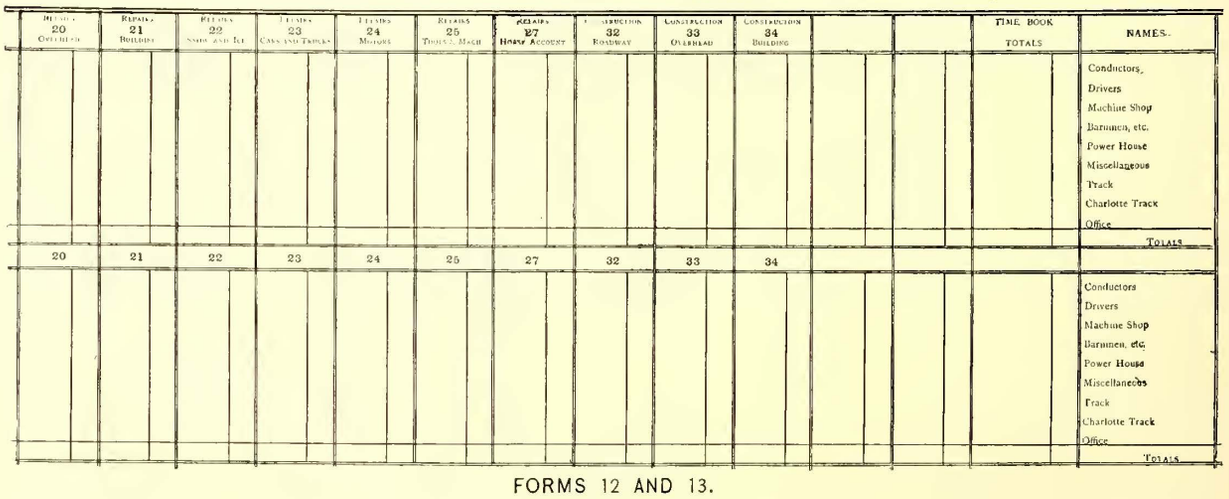
(9) *Wages of Others.* — Superintendent of car service, starters, aids, inspectors, track cleaners and others employed on car service not mentioned.

99 896

DISTRIBUTION OF WAGES



ON BOOKS OF ROCHESTER RAILWAY COMPANY. 98



FORMS 12 AND 13.

While the system described may seem to some to be somewhat complicated, in practice it has not proved to be so, and all the book-keeping at the head office is performed by one man.

The division of accounts employed is shown by the accompanying table:

GENERAL EXPENSES.

(1) *Salaries.*—Officers in charge of departments whose jurisdiction extends over entire road. Heads of departments connected with

(10) *Supplies.*—Cost of signs, tickets, advertising, oil, waste, rags, flags, fuel for heating cars, transportation charges on the same, brooms, dusters, carbon brushes, lamps, fuse links, trolley and register cords, carmen's buttons and badges, and all other material used on cars other than material used on repairs.

(11) *Car House Expenses.*—Shed foremen, shifters, cleaners, oilers, wipers, watchmen, and such other employes that do not work on repairs of cars, material, fuel and lighting for car house sheds, oil and carbons for lamps, brooms and other material used in the care of car houses.

Power House Expenses.

(12) *Fuel.*—Cost of fuel used in power house, transportation charges on same.

(13) *Wages.*—Engineers, firemen, coal-shovelers, dynamo men, boiler cleaners and others employed in power house, except when employed upon repairs.

(14) *Oil, Waste and Packing.*—Oil, grease, rags, waste, carbon brushes, and all other material used in the daily operation of the power house.

(15) *Other Supplies.*—Such as water used and supplies not mentioned above.

(16)

Repairs.

(17) *Dynamos and Appliances.*—All labor required for the repairs of dynamos, switchboard and station instruments, all material required for the repairs of dynamos, switchboard, station instruments, or any new part purchased to take the place of an old part to make the number good, and tools required for this work.

(18) *Engines and Boilers.*—All labor required for the repairing of engines, boilers, pumps, belts, steam fitting. All material required for the repair of engines, boilers, pumps, belts and steam fitting, or any new part purchased to take the place of an old one to make the number good, and tools required for this work.

(19) *Roadway Repairs.*—Wages of roadmaster, track foreman labor, watchmen, pavers and other laborers engaged on track repairs and renewals. Cost of new rails laid, cost of transportation on same, less value of old rails taken up. All expenditures on account of repaving, cost of paving blocks, sand, cost of transportation on same, cost of tools, supplementary wire, channel pins, rail bonds, repairs of wagons used on repairs of tracks.

(20) *Overhead Repairs.*—Wages of hurry-up department, repairing foreman, lineman, laborers while engaged in overhead or underground line repairs, and repairs of wagons used on this work, cost of wire, repairs and renewals of poles, pole brackets, trolley switches, guard and feed wires, underground conduits, with all the appliances for insulating and suspending this work.

(21) *Building Repairs*—All labor required for the repairs of buildings and fixtures, all lumber, iron, paint, tools and repairs of wagons used on this work.

(22) *Removal of Snow and Ice.*—Wages of men employed for the removal of snow and ice, tools used for this purpose, use of wagons and salt on this work. All labor and material required for repairs of snow-plows, scrapers and repairs of sleighs used on this work.

(23) *Repairs Car Bodies and Trucks.*—Wages of men employed on all wood and iron work of cars, painting, varnishing, upholstering cars, labor repairing trucks, all material such as wood, iron bolts, nails, painting materials required for the repairs of cars, brake shoes, axle boxes, springs, truck braces, brakes, pilot or life guards, sand boxes, wearing collars, renewals of wheels and axles, split collars, dope and oil cups, used for repairs and renewals.

(24) *Motor Repairs.*—Labor of all men employed while repairing armatures, fields, commutators, switchboxes, rheostats, cut-out switches, brush holders, trolleys, wiring cables, lightning arresters, gears, pinions, motor bearings, and all material necessary for this work or any new part to take the place of an old one to make the number good, also tools required for this work.

(25) *Repairs of Tools and Machinery.*—All labor required for the repairing of woodworking and iron machinery, shafts, belts and material necessary for this work and any new part purchased to take the place of an old one to make the number good, cost of lubricants and waste, all used in the shops of the company.

(26)

(27) *Horse Account.*—Wages men taking care of horses, hay, grain, bedding, brooms, horse shoeing and material for same, repairs, harness, etc.

Note: This item, No. 27, to be equitably distributed between items Nos. 10, 19, 20, 22 under Operating and Repairing Accounts, and items Nos. 32, 33 under Construction Account.

CONSTRUCTION EXPENSES.

(28) *Superintendence and Organization Expenses.*—Salaries of superintendent of construction, assistants, wages of clerks and others employed in the office of this department; expenses of office furniture, fuel, lighting, supplies for the office, miscellaneous and personal expense of superintendent and assistants while on business, stationery and printing for this department; also all expense of organization not coming under the following heads:

(29) *Engineering.*—Wages and expenses of engineers, draughtsmen and helpers on preliminary or construction work.

(30) *Law Expenses.*—Includes all expenses necessary for legal services employed for construction only.

(31) *Right of Way.*—Salaries and expense of right of way agent and assistants, together with payments of rights of way, easements, franchises and pole rights.

(32) *Track and Roadway Construction.*—Includes expense of grading, surfacing, ballasting, ditching and paving, cost of rails, rail chairs, ties and stringers, tie rods, joint fastenings, track spikes, frogs and switches, supplementary wire, tie wires, channel pins, rail bonds, solder and miscellaneous track material, also cost of distributing and laying same, with the supplementary wire and its connections.

(33) *Overhead and Underground Construction.*—Cost of poles and setting, putting up trolley wires, feed and guard wires, including cost of wire and all devices necessary for overhead construction; also all necessary construction for underground work.

(34) *Building Construction.*—Cost of buildings, car houses, stations, offices, storehouses, power house, repair shops, wharves, coal sheds, etc.; also furniture and fixtures for the same and real estate required for this purpose.

(35) *Power Station Equipment.*—Cost of steam plant, engines, boilers, pumps, piping, shafting and belting, dynamos, switchboard equipment, together with installation of the same.

(36) *Car Equipment.*—Cost of cars built or purchased, including cost of trucks, wheels, motors, upholstering, painting, lettering, varnishing, etc.

(37) *Tools and Machinery.*—Cost of tools and machinery for repair shops, car houses, etc., and expense of setting and placing in running order.

(38) *Snow Plows and Sweepers.*—Cost of snow plows and sweepers built and purchased, including electrical equipment for the same, etc.

Recent Extensions in Chicago.

The Chicago City Railway Company has added largely to its electric mileage this season by the building of new lines and extensions. A large amount of track has been relaid mostly with sixty foot rail. The Falk cast weld joint has been put in on nearly the whole system. The company is erecting a new power station at Forty-ninth Street and Oakley Avenue which will be from 8000 to 10,000 h. p. capacity, and in a measure a duplicate of its Fifty-second Street plant. The company has purchased a number of cars this season and has lately ordered several more.

The new Union elevated loop is about completed. The Southern side of the loop has been delayed owing to litigation, but the foundations for the structure are now being put in on Van Buren Street and work will probably be continued now until completion. Work is progressing on the power station which will be of 5000 or more horse power.

The South Chicago City Railway Company has built a new loop extending on Sixty-fourth Street and Stony Island Avenue to Sixty-third Street and Madison Avenue, and has added a new unit of 500 k. w. capacity to its power station. The company is also getting some new cars from the Pullman Company. These cars will be single truck, but cross seated and of the new Pullman convertible type.

This road and the Hammond, Whiting & East Chicago Electric Railway are now controlled and operated by the same parties. The latter company has built during the year about nine miles mostly with eighty pound T rail; has overhauled its entire line and in connection with the South Chicago City Railway Company gives thorough car service from Sixty-third Street south to Whiting, 11½ miles, and from Sixty-third Street to Hammond, fourteen miles. Connection is made at Sixty-third Street and Madison Avenue with the Illinois Central, "Alley L" and Chicago City Railway for downtown. This company has purchased a large number of new cars this season and is about placing an order with the Pullman Company for several more which will be of the new convertible type.

The Calumet Electric Street Railway Company has constructed during 1896 about ten miles of double track, using eighty-three pound Johnson sixty foot rails: This gives us up to date between eighty and eighty-five miles of track and the company has something like fifteen miles under its ordinance to build next year.

The company has purchased during the year 105 car bodies, twenty-three electric equipments, and has installed a 1200 h. p. Buckeye engine, which is doing first-class work. The traffic receipts have been largely in excess of last year.

Piece Work in Repair Shops.

C. F. Uebelacker.

Some time ago the writer was brought face to face with the fact that the shop facilities with which he was attempting to handle the maintenance of equipment for his company were entirely inadequate. The amount of equipment and the mileage was continually on the increase and there was no prospect of an immediate increase in the size of the shop.

The problem before him was to make the necessary repairs on upwards of six hundred cars in a shop where the pit room would accommodate sixteen cars at a time, and in addition to making the regular running repairs, to carry on a very considerable equipment business.

The first step, of course, was to improve the facilities for handling the various parts with an eye to expediting the work. This effort was however very poorly seconded by the workmen. They seemed to consider each innovation as simply a scheme to lay off men and consequently were very loath to find any virtue in improved machinery.

Previous experience showed that the amount of work turned out could not economically be increased by increasing the shop force, and yet the progress made was barely sufficient to keep down the running repairs and allowed no margin or reserve force to take care of emergencies. Under these conditions it was determined to make an entirely new departure; in other words, to pay for repair work in proportion to the amount done by each man rather than in proportion to the time spent on the work, or to put it plainly, to adopt a piece work system.

There were several reasons which seemed to point to the advisability of such an experiment. First and foremost, it would excite the self interest of the men; it would encourage those who were capable to exert themselves to turn out the maximum possible amount of work; it would quickly point out those who for any reason were incapable; it seemed only fair that a man should earn in proportion to what he accomplished rather than be paid a certain fixed rate irrespective of whether his work was better or worse than that of his next neighbor engaged in a similar employment.

The men doing repair work were obliged to work in crews. Where it was to the interest of each man to make the amount of work turned out by the crew a maximum, the men would work more in unison, there would be less discussion as to whether A should hold a monkey wrench, while B held a crowbar and put forth more actual exertion. The men in each crew would quickly recognize that the leader's instructions must be carried out without comment and without discussion in order to save time. The piece work system would make it to the advantage of the men to discover and repair all the trouble possible, inasmuch as they would be paid in proportion to the number of operations they performed. In other words, they would inspect more closely and more sharply.

The final consideration which presented itself and which is probably the most important of all was that the spurt made by men on piece work would in turn influence the day workers with whom they came in contact, and that the whole pace of work in the shop would be accelerated by the example set by the piece workers.

Having finally decided to adopt the piece work plan, the next question was to work up the price list. As said before, the character of the pit work renders it necessary that at least two and sometimes three men should assist one another, consequently it was decided to pay the men engaged upon this class of work by the crew of three individuals, assigning to each man from the total amount earned an amount proportional to his rating on day work.

The problem then arose of working up a price list for work, which in the nature of things would never twice in succession involve exactly the same amount of labor. The records of day work cost were looked up, and carefully checked against each other wherever an individual operation such as the removal of a pair of wheels or an armature could be separated from the rest of the work. It was found that despite the variation due to rust, dirt, etc., a very uniform price could be deduced, which also corresponded to that which seemed suitable from experience.

By taking different operations of this kind which involved the same minor operations, such as the removal of bolts, etc., in different proportions, there were finally produced a set of basic prices for operation, which, put together would constitute the various jobs to be done. For instance, the removal of a pair of wheels from a certain class of truck involved the removal of the brake beam, brake rod, journal straps and the jacking up of the car at one end, also the removal of the bolts securing the axle caps on the motor. Thus this would figure up to the removal of a certain number of bolts and a certain number of cotter pins and the jacking up of the car, and the price for this operation was set in proportion. In some cases, as, for instance, the replacing of field coils, an additional allowance was made for fitting. The amount of this additional allowance was, of course, a matter entirely of experience and judgment, and could not be figured from first principles. In most cases, however, a very good estimate could be made of the proper price to assign an operation by summing up the basic operations of which it was composed.

A couple of weeks' work of this description finally built up a price list, of which the following portion, comprising the operations on repairing motors will give a fair idea.

PIECE WORK PRICE LIST FOR MOTOR SHOP.

Controllers.

101. General overhauling includes
Taking out and replacing drum,
Taking out and replacing wipers (11),
Taking out and replacing springs (11),
Taking out and replacing caps,
Straightening bent cover,
Replacing worn out handles,
Blowing out and inspection of connections in controller, canopy-switch, fuse box and cut-out box.
102. Exchange drum.
103. Exchange reverse.
104. Exchange top (cast iron).
105. Exchange pawl (in addition to price of 102).
106. Exchange foot (in addition to price of 107).
107. Exchange back.
108. Exchange blow magnet coil.
109. Exchange and fitting broken cover.
110. Replacing and adjusting wiper.
111. Replacing and adjusting back-spring.

Armatures and Fields.

201. Replacing armature.
202. Replacing field coils (each).
203. Replacing and adjusting brush holder and brushes (included in 201 and 303).
204. Replacing and adjusting G. E. brush holder yoke.
205. Replacing brush spring.
206. Replacing connecting board.
207. Replacing dust pan or cover.

Inspection.

301. Inspecting wheels (each).
302. Inspecting trolley.
303. Inspection of armature clearance, blowing out and P. & B. painting.

Bearings.

401. Replacing armature bearings.
402. Fitting bearings on exchanged armature (each).
403. Fitting axle bearings (new) (each).
404. Axle bearing wick.

Trolley.

501. Replace worn out wheel and spindle.
502. Replace worn out rope.
503. Replace pole.
504. Straighten pole.
505. Replace base.
506. Replace canopy switch.
507. Replace canopy switch handle.
508. Replace fuse box.
509. Replace fuse box plug.
510. Replace cut-out box.
511. Replace cut-out box plug.
512. Replace three light cluster and lamps.
513. Replace single socket and lamp.
514. Replace lamp switch and plug.

GEARS AND PINIONS.

601. Replace pinion (arm in place).
602. Replace gear (under car).
603. One-half gear case taken down and replaced (included in inspecting No. 303).
604. Replace gear pan (whole).
605. Putting gear on axle when removing from car.

MISCELLANEOUS ELECTRIC.

701. Replace motor.
702. Replace motor frame.
703. Making screw connection.
704. Making soldered connection.
705. Replacing diverter.
706. Replacing diverter spool.
707. P. & B. eables (under car).
708. Stripping W. H. frame.
709. Assembling W. H. frame.
710. Cleaning and painting.
711. Replaeing motor with motor lift (as distinguished from same operation (701) performed with crane).

Having finished the price list, the next step was to work out a system for supervision and recording of the work done.

In the departments where no crew work was required, this was, of course, simple. Here a man, instead of writing down on his time card so many hours, received from his foreman when assigned to a given job, a card on which was written in ink, the price list number of the job assigned him, the foreman at the same time entering the man's name in his book against the job in question.

On the completion of the job after it was inspected and pronounced O. K., the man returned his time card to the foreman, who signed it, entered the amount in his time book and returned the card to the workman as a voucher. Thus if a man retained his cards he had a record of the work which he had done, which was a duplicate of the time book. When, however, it came to the question of caring for the work of the crews, the matter became more complicated. In order to insure unity in the work, one man in the crew was appointed its leader, and he drew a proportion slightly in excess of that of the other two men.

The question immediately arose as to what to do in case one man of the crew should drop out before the completion of a given piece of work, to fill his place. This was gotten over by paying in such cases the men who had worked through only a portion of a job by the hour. For instance, supposing that A, B and C composed a crew, and that after four hours' work on a given job, C was taken sick and dropped out, and his place was filled by D, who worked three hours with A and B in order to complete the job. From the total amount earned by the crew would be deducted four hours day labor for C and three hours day labor for D. This amount being credited to C and D, the remainder would then be divided between A and B in proportion to their rates. The same method was pursued in cases where an apprentice was a member of a crew, i. e., the amount due him for the number of hours he worked was deducted from the total amount earned by the crew who were credited with the remainder in due proportion.

It was from the start evidently necessary that the assigning of all work and the decision as to what work needed to be done, must be placed in the hands of an inspector. Accordingly it was arranged that upon the assignment of a car to a given crew, the inspector should look it over and write down on the crew's time card the numbers from the piece work price list of the different operations which needed to be performed, at the same time making a copy of this time card in his note book. As the work went on, should the men composing the crew find any additional operations necessary, they reported them to the inspector who after personal examination added them on the crew's time card and in his note book. When the car was completed it was turned over at once to a road inspector who with the crew leader made a trip of about a mile on the road to ensure that everything worked properly when in motion. Upon his return, if he made a favorable report the crew's time card was O. K'd and passed on to their credit in the time book. If, however, his report was unfavorable, the crew had to take the car back over the pit and make such alterations as were necessary without receiving additional compensation; it being considered that it was part of their duty to insure the correctness of all work done.

Of course, there were cases when this would have been unjust, but by adhering rigidly to the rule that no exception should be made by any person lower in authority than the foreman of car repairs, the number of these exceptions soon became very small, whereas the prospect of having to take back and go over again a car which they had once turned out as completed made the men very particular about the perfection of the work they did. Any chance of carelessness in the decision of the inspector was reduced to a minimum by sending out with him the leader of the crew which had turned out the work.

So much for the system which has grown up. It was partly laid out beforehand, and it is partly the result of experience. The prices assigned came remarkably close, very few changes being made, and such as were made were mostly in the line of reductions.

The wages of the men were increased slightly by the change, about ten per cent on an average. There was, of course, at the first start off, a very strong feeling amongst them against the introduction of this system, as it was quite evident beforehand that, if successful, it would make a decided reduction in the force.

It was consequently put in operation with one crew at a time in order to carefully watch its workings before any radical change was made. In this way the change was gradually made, and without any serious trouble. A few men at once became careless, and worked only with a view to piling up a big credit on the payroll and hoodwinking the inspector if possible. A few discharges and sharp lessons corrected this tendency, and the old and valued men were the ones who finally profited by the change.

To come now to the results of the change, let us take, for example, first the motor shop or pit room in which all of the repairs to motors and trucks are made.

During the last month in which day work was the rule, the force in this department consisted of sixty-six men. As before remarked, there was no room to accommodate any more crews than were at that time working. The men seemed to be working hard, one could see no unnecessary delays, yet there was that lack of ambition which is the general curse of day work. So many hours mean so much money to the older workmen who have lost the expectation of obtaining better positions. Even the younger men are more or less affected by this example set them by their elders.

In the month just past, the force working in the shop just spoken of had been reduced to forty-five men, and where sixty-six men previously, working seven days in the week and frequently putting in overtime, had turned out an average of $11\frac{8}{10}$ cars repaired per day under the day work system, these forty-five men on piece work, working five and one-half days per week had turned out $12\frac{4}{10}$ cars repaired per day. This, of course, shows on the pay roll. Taking an average through the whole shop of painting, woodworking, armature repairing and pit work, about half of the total being on piece work, with the sixty-six men turning out $11\frac{8}{10}$ cars repaired per day, the cost per car was $19.25 for labor, whereas with the forty-five men turning out $12\frac{4}{10}$ cars the cost was $15.14 per car, certainly a very desirable difference in favor of the piece work plan.

Aside from the actual reduction in cost, it will be seen that the shop was turning out $12\frac{4}{10}$ cars a day when worked only to two-thirds its capacity as a structure under piece work rules, while under day work, $11\frac{8}{10}$ cars per day was its total economical capacity.

A very good example of this increase in capacity was given on a piece of rush work in equipping which came up during the past summer. A lot of twenty new open cars arrived one Thursday afternoon about five o'clock, and as they were much needed for service the following Sunday,

a request was made to turn out as many of them as possible before that time. Saturday night at seven o'clock saw the whole twenty of them wired, mounted on their trucks, equipped and on the road, the ordinary repairs having been kept up at the shop in the meantime.

The question has been frequently brought up, whether the piece work causes the men to be more careless, and consequently increases the number of failures on the road. Figures would seem to prove otherwise.

During the months of May, June and July, 1895, when the day work system was in vogue, there was on an average, one case of trouble for every 1203 car miles run, whereas for the same months during 1896, after the piece work system had been established, there was only one case of trouble for every 1380 car miles run, certainly an improvement over the preceding year.

Probably the most noted change in costs and capacity was in the paint shop where the number of cars turned out every week rose from three and one-half or four on day work to six and seven on piece work, while the force was cut from twenty-five men to eighteen, and the cost of labor per car from a little over $60 to about $40.

These figures speak for themselves. There can be no question but what the men will do more work when they know that they are paid in proportion to the amount of work they do. Piece work at the same time furnishes an incentive for the good man to do his best and for the lazy man not to loaf. Any soldiering is considered rather a subject for ridicule amongst the men than an indication of superior shrewdness as is frequently the case on the day work plan.

While it is not practicable to introduce piece work into every branch, the example of dilligence set for the day workers by the piece workers has a marked effect on the amount of work turned out by them. It is also very noticeable that when a man who has been working on piece work is temporarily put on day work, the habits of activity which he has formed stay with him, and his work goes along with the same rush and vim as before.

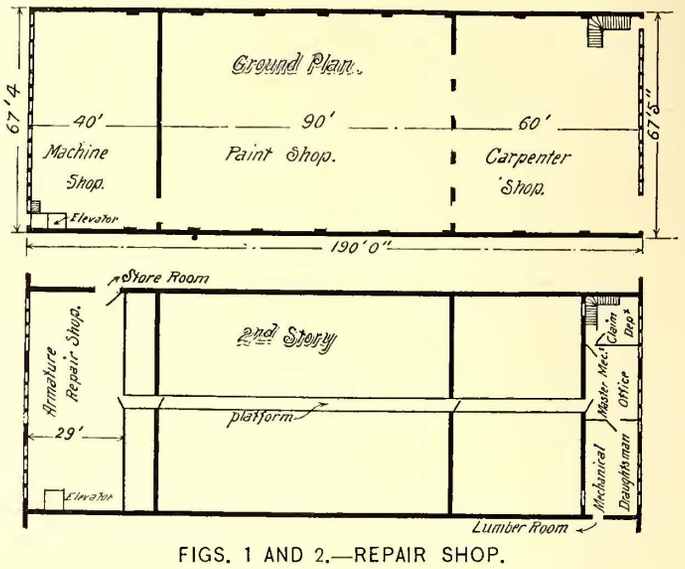
Opposed to these advantages are the increased difficulty and labor in keeping time, and the increased inspection necessary. That these disadvantages are more than offset by the advantages, the figures above quoted plainly show.

Repair Shops of the Rochester (N. Y.) Railway Company.

New repair shops have recently been put in operation by the Rochester Railway Company. They are located close to the main office and car house of the company, near the center of the city, so that economy of floor space was an important consideration in their design. They occupy a ground space of 67 ft. 4 ins. × 190 ft. and extend from State Street to Otsego Street. The building, which is two stories in height, is of brick. The lower floor is divided into three departments, extending the entire width of the building: the carpenter shop, 60 ft. deep; the paint shop, 90 ft. deep, and the machine shop on Otsego Street, 40 ft. deep. The first two are separated only by sliding doors, and tracks lead in from switches in State Street so that cars can be brought in to any point in the carpenter or paint shops. As will be seen, all three rooms are lighted from the roof, the paint shop being entirely open to the roof skylights.

A handy method of bending panels is employed in the carpenter department. As illustrated in Fig. 3, a sheet iron shaper, bent to the form of the lower concave panel of a car, is attached to the wall and so arranged that it can be kept heated by gas. Another gas jet keeps the glue hot. The floor is of brick, keeping it cool in summer and warm in winter. The sawdust and shavings are taken up from this room by an air blast in the corner and are stored in a compartment near the lumber room from which they can be easily removed.

The third department, or machine shop, in the rear is equipped with the usual tools used in street railway repair shops. The company makes most of its overhead line parts and a large number of its other supplies, including commutators. Drop forged sections are used mostly, but cold drawn are considered more desirable. The commutator segments are first assembled in a ring, which is screwed up cold. The ring is then placed in a baking oven where it is left for some time and then removed. The shellac in the mica softens under the influence of the heat, and when the ring is removed it can be again screwed up.



FIGS. 1 AND 2.—REPAIR SHOP.

After it has cooled off and contracted it is screwed up again. The commutator is then placed in a lathe and dressed up.

Tracks lead from the paint shop into the machine shop. The transportation of armatures and other heavy equipment parts is done on trucks, pushed either by hand or drawn by horse power. These trucks run to all parts of the machine shop floor or on to an elevator by which they can be hoisted to the second floor where the armature repair shop is located. The truck for hauling armatures by horse power holds twelve armatures.

Adjoining the machine shop is the blacksmith's shop with three forges, steam hammer and babbitt furnaces. The exhaust fan for the forges takes air from near the ceiling so as to remove the smoke and give better ventilation to the room.

The armature repair shop, which is directly over the machine shop, is equipped with a traveling railway extend-

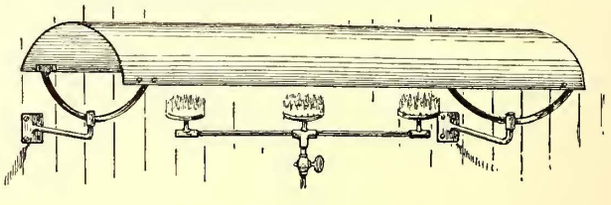


FIG. 3.—PANEL FORMER.

ing all around the room so that no handling of the armatures is required from the time they are taken from the car until they are replaced upon it. A runway extends from this machine shop to the master mechanic's office, passing over the paint shop. The master mechanic's office opens on one side to the stairs and on the other to the mechanical drafting room, which in turn opens into the lumber room. The latter, which is in charge of the storekeeper, has only one entrance. It was formerly used for other purposes and had several windows, but these have been bricked up, with the result that the company saves $6000 annually in insurance premiums.

THE tracks of the St. Louis & Suburban Railway Company, between the downtown terminus, Sixth and Locust streets, and Sarah Street, have been put in first class condition. All the joints have been cast welded, and the old crossings and curves replaced with new ones.

LETTERS AND HINTS FROM PRACTICAL MEN.

Railway Matters in Hungary.

HUNGARIAN RAILWAY TRAFFIC COMPANY,
BUDAPEST, HUNGARY, Sept. 25, 1896.

EDITORS STREET RAILWAY JOURNAL:

In the midst of the general movement which is now taking place in all the countries of Western Europe toward the development of railway systems, it will not be without interest to cast a glance at the present situation in Hungary.

The total number of miles of track built in the empire of Austria-Hungary in 1894 amounted to 29568 km. (18,333 miles) of which 44.7 per cent was constructed in Hungary. In 1894, the Hungarian railroad system had a length of 13,142 km. (8148 miles) an increase over the preceding year of 4.3 per cent against 6.5 per cent in 1895, when 866.8 km. were opened to traffic.

According to the official report of 1894, the ownership and administration of these roads can be divided as follows:

	Per cent of whole.	Under State administration.	Investment per mile.
State ownership	54.7	100%	$40,896.00
Private ownership . . .	10	81.5%	42,189.20
Light railways.	35.3	76 %	12,900.00

The entire passenger traffic was 2,028,891,744 persons, the total freight carried was 40,789,754 tons. The rolling stock consisted of 2106 locomotives, 4297 passenger cars and 49,038 freight cars, representing an investment of $59,286,159.60. The capital invested in the whole railway net amounts to $415,143,262.40. The average annual return on this investment was 3.6 per cent. According to the latest statistics the total length of the lines in Hungary average

46 miles per 100,000 inhabitants and
6.5 " " 100 sq. miles of territory.

The possibilities of the profitable construction of additional trunk lines being small, investment is seeking for a possible field in light or "secondary" railways. During the last year not less than 150 different concessions for such roads were granted, comprising 3800 miles of track. As our railroad law (1888, IV) contained several clauses prejudicial to the extension of private enterprises in this field, we attach great importance to the declaration made by Mr. Daniel, our Minister of Commerce, that the Government intends to change the present law in a radical way after the members of our Board of Trade have finished their investigations in this matter. We expect that the early future will open well as regards railway building, if the question, as to what the light railway bill now contains, will be satisfactorily settled by the Legislature during the coming session. Yours truly,

RUDOLF MOCSARY, Secy.

THE sand car of the Third Avenue Railroad Company of New York, a description of which was published in a recent issue, is being employed regularly by the company and is giving excellent results. The car possesses a number of novel features.

A Solution to Mr. Mahoney's Piping Problem.

GREENVILLE LIGHT & CAR COMPANY.
GREENVILLE, MISS., Sept. 12, 1896.

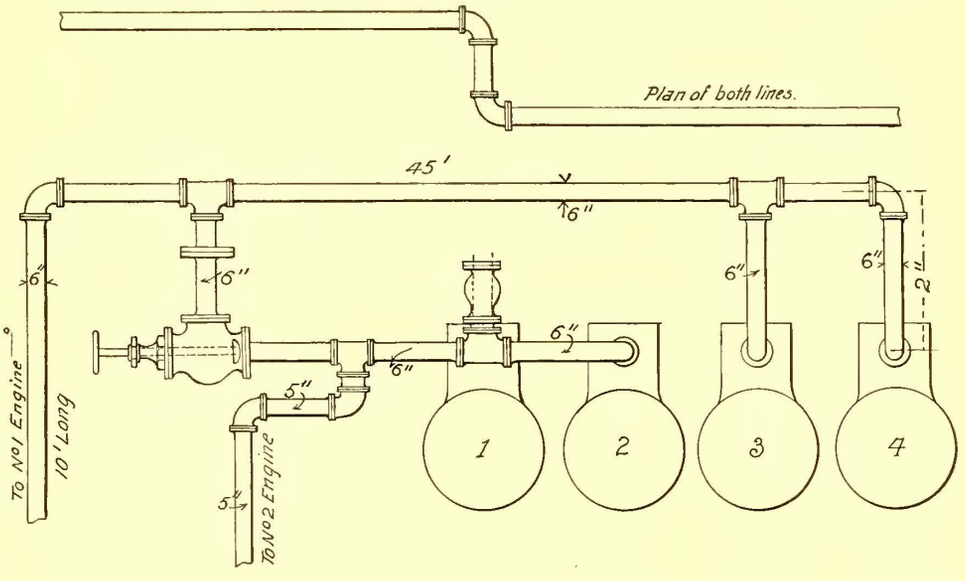
EDITORS STREET RAILWAY JOURNAL:

Referring to Mr. Mahoney's article in your June issue, I will give as a reason for the vibration of his steam pipe, what is generally termed "Bucking." Now if I understand him, he had all of his boilers going except No. 2. While I would suppose he has a valve on this No. 2 boiler next to dome, yet his diagram does not show it. However, we will suppose it has and that it is closed (the boiler being out of service).

Now this six inch pipe which connects Nos. 1 and 2 boilers is out of service, so to speak, and it becomes a sort of receiving tank, for the steam naturally backs up into this pipe and condenses, and it is the action of this steam against the water in this pipe which causes the vibration.

Now if Mr. Mahoney, instead of closing the angle valve, will just partially open this valve next to dome on No. 2 boiler, the pressure of steam will drive that water into the boiler. Then he can close the valve again, and hi trouble will be at an end. With this system of piping he is liable to have the same trouble on No. 4 boiler.

I do not like this system of piping, for if there is anything like a load on the engines there will be considerable vibration, unless the pipes are well braced, because when



the ports are open and the engine is taking steam the steam is, of course, traveling at a high rate of speed toward the engine. Then when the cut-off takes place, this speed is suddenly checked. This must cause a shock to be felt on the steam pipe because this system of piping leaves no means for the shock to distribute itself. It simply goes in one direction. Yours truly,

JNO. B. MULLEN.

Removing Sand on Track.

NEW YORK, Nov. 2, 1896.

EDITORS STREET RAILWAY JOURNAL:

The writer recently rode some little distance into the country on one of the suburban trolley lines near this city. Before leaving the town the car was completely stalled upon a bad ground due to sand on the track. This did not occur again, but it very nearly did so several times. Between wheel and rail arcs were incessant

and very dazzling. An obviously essential condition of electric railway practice is continuous, solid and clean contact of current collectors of both trolley and bearing wheels. Here was a flagrant violation of a fundamental principle.

This necessarily causes rapid depreciation of track and rolling stock. As a bad circuit will spark a commutator more easily by aggravating causes which will be almost negligible with a good circuit, such will quickly depreciate dynamos and motors also. Again the troublesome fluctuations of load in traction work, which also increase depreciation, are seriously aggravated by this constant make and break of circuit. But that is not all, for every arc, which is instantly followed by a closure of the circuit, makes a momentary electric weld which extra energy is required to break.

By means of a brush in front of the wheel and a small sprinkler in front or behind the brush, the track can be kept clean, and the wheel can make the proper electric contact with the rail. As the cost is nominal, it is strange that more companies operating over dusty roads do not employ these devices. Yours truly,

James H. Bates, M. E.

Power House Records at Rochester, N. Y.

The accompanying tables, I and II, show the expenses and output of the power station of the Rochester Railway Company during the months of May, June, July and August, 1896. As will be seen, the record is a good one,

Table I.

Power House Expenses of Rochester Railway Company for May–August, 1896.

	May.		June.		July.		August.	
	Mat'l	Labor	Mat'l	Labor	Mat'l	Labor	Mat'l	Labor
Dynamos	$ 95.42	$ 48.22	$ 145.99	$ 26.51	$ 13.22	$ 4.80	$ 62.12	$ 1.40
Engines	760.65	284.25	318.65	211.97	118.45	206.57	315.11	191.82
Oil and Waste	246.69	——	283.10	——	228.30	——	354.91	——
Water	339.00	——	27.67	——	141.53	——	146.21	——
Light	79.00	——	75.00	——	77.50	——	77.50	——
Coal	3250.00	——	3298.81	——	3347.81	——	3242.53	——
General Exp.	——	2049.24	——	1977.03	——	2079.37	——	2076.31
Total	$4770.76	$2381.71	$4149.22	$2215.51	$3926.81	$2290.74	$4198.38	$2269.53

Summary.

Material	$4770.76	$4149.22	$3926.81	$4198.38
Labor	2381.71	2215.51	2290.74	2269.53
Interest	650.00	650.00	650.00	650.00
Insurance	75.00	120.00	75.00	75.00
Grand Total	$7877.47	$7134.73	$6942.55	$7192.91

Table II.

Power House Records of Rochester Railway Company for May–August, 1896.

	May.	June.	July.	August.
Total E. H. P. hours	611.963	594.376	634.983	613.532
Average per day	19.740	19.812	20.483	19.791
Cost per motor car mile	1.86	1.72	1.59	1.78
Cost per car mile	1.82	1.65	1.47	1.69
Cost per E. H. P. hour	1.28	1.20	1.09	1.17
Cost for fuel per E. H. P. hour	.53	.555	.527	.528
Cost for labor per E.H.P. hour.*	.334	.332	.327	.338

* Independent of repairs.

especially so from the fact that the power station was built several years ago, and does not contain any improvements introduced since that time. Short belted generators, fifteen in number, are used exclusively. The engine equipment consists of one 500 h. p. and two 350 h. p. McIntosh & Seymour engines and three 350 h. p. and three 180 h. p. Ball compound condensing engines. The kilowatts are measured by wattmeters. The steam generating plant consists of Babcock & Wilcox boilers. River water is used for feedwater, and before being pumped into the boilers is passed through a Hoppes feed water heater and purifier. The price paid for coal, delivered, is $2.35 per ton of 2000 lbs.

Table III shows the watthours consumed in operating cars on the Rochester Railway and Rochester & Irondequoit Railway, between 6 and 7 A. M. and 6 and 7 P. M. during the first seven days of September. The cars of the latter company are running about half the time from a separate power station belonging to the company, so in the table given allowance has been made for this circumstance.

Table III.

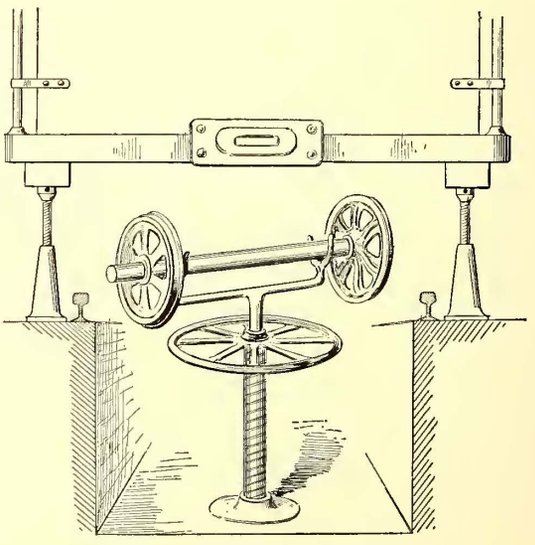
Watt Hours in Operating Cars on Rochester Railway and on Rochester & Irondequoit Railway, between 6 and 7 A. M. and 6 and 7 P. M., Sept. 1-7, 1896.

Date.	Day.	A. M. Cars Out. Motor	A. M. Cars Out. Trailer	A. M. Kilowatt Hrs.	P. M. Cars Out. Motor	P. M. Cars Out. Trailer	P. M. Kilowatt Hrs.	Condition of Weather.	Temperature.
Sept. 1	Tues.	100	——	735	107	5	885	Fair	63°
" 2	Wed.	100	——	650	108	3	845	"	74°
" 3	Thurs.	100	——	625	104	3	705	Cloudy and windy	65°
" 4	Fri.	100	——	670	110	10	935	Fair	61°
" 5	Sat.	102	——	635	123	3	1085	Rained all day	61°
" 6	Sun.	1	——	20	122	17	1020	Fair	66°
* " 7	Mon.	100	——	565	132	29	1135	"	69°

* Labor Day

Motor Wheel Lift.

The method employed by the Metropolitan Railroad Company, of Washington, D. C., of removing wheels from cars is illustrated herewith. At a point in the middle of one of the pits is located a screw revolving in a socket, set in the bottom of the pit. The screw is turned by a



MOTOR WHEEL LIFT.

hand wheel and at its end is swiveled a two arm bracket suitable for receiving the axle.

The car is then run over the pit until the axle to be removed is directly over this device. It is then jacked up. By means of the wheel the bracket is then raised until the axle rests in the bracket and the wheel is lifted clear of the track. The axle is then turned at right angles to its former position and parallel with the rails, when it is lowered to the bottom of the pit.

LEGAL NOTES AND COMMENTS.*

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

Instances of the Law of Negligence Applied to Cable and Trolley Lines.

The books are full of cases which hold that there is a duty devolving upon one who attempts to cross a steam railway track to look and listen, and that that duty, does not apply to one who crosses a street or a horse railroad track. Since the introduction of the cable and the trolley the question as to whether cars operated without horses in the street were to have applied to them the rule applicable to steam railroads or the rule applicable to horse railways has been involved in some doubt, but the tendency of the decisions is indicated by one of the cases which appear in our notes of cases *infra*. (*Smith* v. *R. R. Co., 46 Pac. R. 136.*) There the Supreme Court of Oregon, after admitting that there is a conflict of authority, announce that the doctrine which "seems to be supported by authority and "reason, at least with reference to electric and cable railways, is that it is presumptive negligence on the part of "a pedestrian to attempt to cross a track without looking or listening." We refer our readers also to a recent case in New York, where other cases are reviewed, and where the same tendency is shown. (*Thompson* v. *R. R. 145 N. Y. 196.*)

Another case dealing with an incident of the use of the trolley is reported in our notes, *infra*. (*Clarke* v. *R. R. Co. 41 N. Y. Supp. 78*) and is at once novel and interesting. The facts proved by the plaintiff, upon which his complaint was dismissed at the trial, were that the defendant operated its cars by a current passing over the trolley wire and through the motor of the car to the wheels and the rail, and that the plaintiff, an expressman, drove his horse across the track, and as the horse's foot hit the rail, the horse fell upon the track and died a few minutes after. The plaintiff seizing the horse's collar received a shock, which distorted his hands and produced in them a sensation of numbness that lasted several weeks. Evidence was also introduced as to the value of the horse.

The appellate court, held against the contention of the defendant, who sought to sustain the dismissal and ordered a new trial. The defendant claimed that no negligence was proved on the part of the railroad company, since the expert evidence amply warranted the inference that some suppositious third parties, *e.g.*, persons engaged in the stringing of telegraph, telephone or electric light wires, might have caused the accident, which could not have occurred unless some of the current had escaped from the trolley wire, either through imperfect insulation or through the possible carelessness of such third persons. The appellate court, however, citing the leading English case (*Byrne* v. *Boadle, 2 Hurl and C 722*), where Chief Baron Pollock says: "It is the duty of persons who keep "barrels in a warehouse to take care that they do not roll "out," held that the plaintiff had proved *prima facie* negligence on the part of the railroad company, which it was at liberty to rebut, but unless it showed how their current escaped and that it was not through the negligence of the company, it must be held liable.

Patent for Street Car Fenders Sustained.

In a case recently decided by Wheeler, J., in the United States Circuit Court for the Eastern District of New York, a very broad patent is sustained, which is of importance to street car companies operating trolley and cable roads. (*Johnson* v. *R. R. Co., 75 Fed. 668.*) The patent was issued in 1891, and describes "an improved life guard "in the form of a platform projecting from the ends of the "car, over the track, and on which a person may fall and "be carried along without injury until the car can be "stopped." The court holds that, while the contrivance "is so simple as to seem to have been almost obvious, "without invention, to any one familiar with the subject," yet that "the want of such a thing so long, and these "patents, show that it had to be sought out with more or less mechanical skill." The patents referred to are others which the court thinks are far more complicated than the one in suit, having to be set in motion by the hitting of the person by them, and none of them having the "simple, "projecting, horizontal platform, upon which a person is "likely to fall, be carried and saved."

The claims of the patent are somewhat inartistically drawn, are only two in number, and are as follows:

"[1]. The combination, in a street car, of a life guard, consisting of a substantially U-shaped frame and a wire screen stretched across the frame from side to side, substantially as set forth. [2]. The combination, in a street car, of a life guard, consisting of a substantially U-shaped frame, a cross bar secured thereto, and a wire screen stretched across the space formed between the frame and cross bar, substantially as set forth.

The court finds some difficulty with the words "wire screen" which arises from the fact that the railroad company, which was sued for infringement in the action, did not use a wire screen, but one made of flat sheets of iron, but the learned judge comes, finally, to the conclusion, although, apparently, with some hesitation, that, although the wire screen is expressly mentioned in both claims, yet none of the cases seem to compel him to hold that the claims are not infringed "by any screen in that place but one "made literally of wire," since the device used by the defendants and that described in the patent "are practically "the same, for the purpose required."

PATENTS.

UNITED STATES CIRCUIT COURT.—The conception of a life guard for street cars, consisting of a simple skeleton platform, or yielding material, projecting in front of the car, as near as practicable to the ground, and upon which a person may fall and be carried along without injury until the car stops, *held*, notwithstanding its simplicity and apparent obviousness, to involve patentable invention, in view of the complicated devices which preceded it, and he length of time such a device was needed before it was forthcomtng. (Loom Co. v. Higgins, 105 U. S. 508, followed.)

SAME—LIMITATION OF CLAIMS—INFRINGEMENT.

The express mention, in a patent for a street car life guard, of a "wire" screen stretched upon the frame of the guard, *held* not to limit the patent to a screen made literally of wire, and that a screen of iron slats was an infringement.

SAME—STREET CAR LIFE GUARDS.

The Johnson patent, No. 454,214, for a life guard for electric and cable cars, construed, and *held* valid and infringed.—(Johnson v. Brooklyn Heights R. Co., 75 Fed. Rep. 668.)

LEGAL TENDER FARE, EJECTION.

GEORGIA.—A genuine silver coin of the United States, distinguishable as such, though somewhat rare, and differing in appearance from other coins of this government, of like denomination and of later dates, is nevertheless a legal tender for car fare, and a passenger ejected for refusal to make payment otherwise than by tendering such a coin is entitled to an action for damages. See Railroad Co. v. Morgan, 18 Atl. 904, 52 N. J. Law, 60.

That the conductor declined to receive a coin of this character because he, in good faith, believed it was a counterfeit, will not relieve the railroad company from liability.

There being evidence tending to show that in ejecting the passenger the conductor used to him insulting language, and was "very impolite and gruff," the court was not unwarranted in charging the jury upon the law of vindictive damages.—(Atlanta Con. St. Ry. Co. v. Keeny, 25 S. E. Rep. 629.)

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

CHARTERS, FRANCHISES, POWERS, ETC.

COLORADO.—Street railway companies own two lots in a city block, which front on the streets on opposite sides of the block, and are separated at the rear by an alley extending across the block at right angles to them. By an ordinance the companies were granted permission to build and operate double tracks through the block, over their lots and the streets bounding the block, so as to form a loop for the lines *Held*, that the owner of a lot and hotel adjoining one of the companies' lots cannot maintain an action to enjoin the companies from constructing the tracks, on the ground that they will create an obstruction of his right of ingress to and egress from his hotel by way of the alley, street, and sidewalk crossed by such tracks, his remedy at law being adequate.—(Haskell v. Denver Tramway Co., 46 Pac. Rep. 122.)

PENNSYLVANIA.—Act May 14, 1889 (P. L. 211) §§ 1, 4, provide that the articles of association of a street railway company shall state the streets upon which the railway is to be constructed, and that the act of such company authorizing any extension or branch shall name the streets on which the same is to be laid. Section 18 authorizes said companies "to cross at grade, diagonally or transversely, any railroad operated by steam or otherwise." *Held*, that a street railway chartered under this act has no right to construct and operate its road across the lines of a steam railroad company, without the latter's consent, at a point where the steam railroad is not crossed by a street or highway.

A steam railroad company has such a substantial property interest in its right of way, as well as in land which it holds in fee, as to entitle it to an injunction against a street railway company which threatens to span such property with a viaduct for the transportation of electric cars over complainant's tracks without authority.—(N. C. Ry. Co. v. H. & M. El. Ry. 35 At. Rep. 624.)

PENNSYLVANIA.—Const. art. 16, § 7, provides that "no corporation" shall issue stock except for money, etc., actually received, and that fictitious increase of stock shall be void. Act 1887, No. 44, entitled "An act to enforce section 7 of article 16 of the constitution, against railroad corporations," provides that no "railway corporation" shall issue stock for less than its par value, which shall be actually paid in cash. *Held*, that street railway companies were included in the statutory prohibition.

Under Act 1887, No. 44, § 4 (providing that on complaint of any stockholder of any railroad corporation, or of two reputable citizens, it shall be the duty of the attorney general to institute proceedings to enforce the act which prohibits the issuance of stock by railroad corporations for less than its par value paid in cash), the attorney general has no discretion, where the complaintants show a prima facie case, to refuse to institute proceedings.—(Cheetham v. McCormick 35 At. Rep., 632.

UNITED STATES CIRCUIT COURT.—After the consent of owners of property abutting on a street to the construction of an electric railway on the street had been obtained, it appeared that a part of such proposed street, distant from both ends of the railway, had never been dedicated or laid out as a street. *Held*, that there was no consent to the construction of the line on those parts of the supposed street which had been properly laid out and dedicated.

In Illinois a city has no power to give to a street railway the use of a street, unless a majority of the frontage of abutting owners consent thereto.

The fact that the city council has passed an ordinance permitting such use does not preclude inquiry as to whether the signatures to the consent were genuine.

An abutting owner may restrain by injunction the use of a street by an electric railway company under an ordinance which was invalid because passed without the consent of the abutting owners.—(Beeson v. City of Chicago, 75 Fed. Rep. 880.)

NEW YORK.—The Common Council of New York City, by resolution, authorized defendant to lay a railroad track on certain streets, and required it keep in repair the space between the tracks. A subsequent resolution authorized defendant to extend its road along certain other streets, but did not state that the extension was on the terms as were contained in the first resolution, nor did it make any provision as to keeping the space between the tracks in repair. *Held*, that defendant was not required to keep in repair the space between the tracks, as extended.

Nor did another resolution adopted at the same time as such subsequent resolution, providing that another railroad company, on paying to defendant one-half of the cost of a certain portion of its track, and of keeping it in repair, from time to time thereafter, and also half of the cost of the repairs, from time to time, of the extension, should have the right to use the track and run its cars thereon, show an intention that defendant should repair the streets between its tracks on the extension of its road.—(City of New York v. Eighth Ave R. Co. 39 N. Y., Supp. 959.)

OHIO.—An agreement to substitute electricity for horses as a motive power on a street railway, since it gives the public benefit in the shape of rapid transit, is a consideration sufficient to support a contract increasing the rate of fare.—(City of Cincinnati v. Cincinnati St. Ry. Co., 2 Ohio N. P. 298.

OHIO.—A street railroad company is not entitled to an injunction to prevent the operation of another company's cars over tracks in the street in which it has a right of use, unless plaintiff was not a party to the appropriation proceedings, and has a real interest in the tracks.

A street railroad company will not be enjoined from crossing the tracks of another street railway.—(Metropolitan St. Ry. Co. v. Toledo Electric St. Ry. Co., 11 Ohio Cir. Ct. R. 664.

NEW YORK.—Laws 1890, c. 565, § 92 as amended by Laws 1892, c. 676. which provides that public notice shall be given of the time and place when an application for consent of the local authorities to the construction of a street railway will be considered, by failing to provide when and how the hearing shall be had, leaves that matter in the discretion of the board.

Laws 1896, c. 565, § 92, as amended by Laws 1892, c. 676, provide that, where application is made to the local authorities for consent to build a street railroad, such authorities shall publish notice thereof daily, if in a city, for at least fourteen days, in two of its daily newspapers, and if in a village or town, for at least fourteen days, in a newspaper published therein, if any there shall be, and, if none, then daily in two daily newspapers, if there be two—if not, one—published in the city nearest such village or town. *Held*, that the statute does not require daily publication of the notice in the village or town where no daily paper is published, but publication for the prescribed length of time in a weekly paper in the village where no daily paper is published is sufficient.—(Secor v. Board of Trustees of Village of Pelham Manor, 39 N. Y. Supp. 993.)

PENNSYLVANIA.—The consent of the borough, if necessary to enable a street railway company to change from horse power to an electric trolley system, will be presumed from the acquiescence of the borough in such change for five years, so far as to preclude an individual, in a suit against the company for personal injuries, from claiming that the maintenance of such system is negligence *per se*.

Though the right of a street railway company, even to that part of the street occupied by its rails, is only in common with that of other travelers, its right to use an ordinary and usual appliance upon the track to repair the overhead wire is, for a reasonable time, paramount.—(Potter v. Scranton Tr. Co., 35 At. Rep. 188.)

NEW YORK.—Under Const. 1895, art. 3, § 18, providing that where property owners refuse to consent to the construction of a street railroad in the street on which the premises abut, the court may appoint commissioners to determine whether the railroad ought to be constructed, "and their determination, confirmed by the court, may be taken in lieu of the consent of the property owners," the only action that the court can take is to confirm a report in favor of the construction of the road, and it has no power to set aside an unfavorable report, or to review the determination of the commissioners.—(*In re* East River Bridge Co., 38 N. E. 283, 143 N. Y. 249, distinguished. *In re* Nassau El. R. Co., 4 N. Y. Supp. 334.)

LIABILITY FOR NEGLIGENCE.

WISCONSIN.—In an action for personal injuries due to the collision of an electric car with a sleigh in which plaintiff was riding, it appeared that the horses became frightened at the noise made by the car while it was yet some distance away. As the car approached, the motorman saw that the horses were frightened, and turned off the current, and applied the brake. The horses backed towards the sidewalk, throwing the rear end of the sleigh upon the track, where it was struck by the car, which could not be brought to a stop quick enough to avoid it. The car, when first seen, was about 175 ft. away, and when the brakes were applied it was about eighty feet away. *Held*, that the facts did not justify an inference that the motorman was negligent.—(Eastwood v. La Crosse City Ry. Co., 68 N. W. Rep. 651.)

INDIANA.—A street railway company is not liable to a passenger injured by a fall when alighting, it being caused by the pushing and jostling of passengers, and by a passenger stepping on her dress, and the conductor being at the time on the ground, lifting said passenger's child from the car.—(Furgason v. Citizens' St. R. Co., 44 N. E. Rep. 936.)

ILLINOIS.—In an action by a gripman on a cable car for injuries received, it appeared that after he had discovered that a slide bar under the grip car had fallen down he notified a "starter" of the fact, and that such starter ordered a wrecking crew to repair the defect, and ordered plaintiff to proceed with the car. Plaintiff was struck in the head by the handle of a brake which was set in motion by a second falling of such slide bar. It appeared that the starter had authority to start and stop all cable trains, and had authority to keep them at a certain distance apart, and that the gripman and other employes on such trains were in the habit of obeying him. *Held*, that he had apparent authority to order plaintiff to go on with the defective car, and that an instruction that where a servant is injured by reason of an order improperly given by one acting for the master, and who is clothed with apparent authority in that respect, the master is liable, and that it is immaterial whether the person making such order was known as a "foreman," or by some other title, was not objectionable as an unwarranted extension of the apparent authority of the starter. 57 Ill. App. 440, affirmed.

In such case the question whether the gripman and the starter were fellow servants was for the jury.—(West Chicago St. R. Co. v. Dwyer, 44 N. E. Rep. 815.)

ILLINOIS.—The fact that defendant's street car was suddenly started as plaintiff, in the exercise of ordinary care and diligence, was attempting to alight, after having signaled the conductor her desire to do so, does not, as a matter of law, render defendant liable, the question of negligence being for the jury.—(Chicago City Ry. Co. v. Dinsmore, 44 N. E. Rep. 887.)

OREGON.—A person who, in the daytime, and in a place where the view is unobstructed, attempts to cross a street railway track immediately in front of an approaching car, without looking to see whether a car is near, and is struck and injured, is guilty of such contributory negligence as will bar a recovery for the injuries.

When a passenger on a street car steps from the car to the street, the relation of passenger and carrier ceases.—(Smith v. City & S. Ry. Co., 46 Pac. Rep. 136.)

NEW YORK.—A collision between plaintiff's tandem bicycle and defendant's horse car was caused by the negligence of plaintiff, where plaintiff, while going along the side of the track, suddenly turned across the track a few feet in front of the approaching car. —(Lurie v. Met. St. Ry. Co., 40 N. Y., Supp. 1129.)

NEW YORK.—Where a horse, on stepping on the rail of defendant's electric car track, received a fatal shock, the mere happening of the accident is enough to raise a presumption of negligence on the part of defendant.

The maxim of *res ipsa loquitur* relates merely to negligence prima facie, and is available without excluding all other possibilities.—(Clarke v. Nassau Electric R. Co., 41 N. Y., Supp. 78.)

KANSAS.—A street railway has not exclusive rights to the use of its tracks and ground covered by it, and is constructed and operated on the theory that it is not an additional burden on the highway, but is merely an additional use contemplated when the street was laid out. This necessitates a liberal construction in favor of the rights of the public, and the law is averse to concede any exclusive rights to the portion of the street to railway companies, except where the necessities of the case demand.

Where one acts erroneously through fright or excitement, induced by another's negligence, or adopts a perilous alternative in the endeavor to avoid an injury, threatened by such negligence, or when he acts mistakenly in endeavoring to avoid an unexpected danger, negligently caused by the defendant, he is not guilty of contributory negligence, as a matter of law.

A personal injury from a single wrongful act of negligence is an entirety, and affords ground for only one action. In that action recovery may be had for all damages suffered up to the time of trial, and for all which are shown to be reasonably certain or probable to be suffered in the future; and, when these are the necessary and proximate result of the act complained of, they need not be specially averred, but are recoverable under the general allegation of damages.—(Edgerton v. O'Neill, 46 Pac. Rep. 206.)

IOWA.—In an action against a street railway company for personal injuries, the fact that plaintiff was negligent in attempting to cross defendant's track in front of a car approaching from behind, in a collision with which plaintiff's wagon was overturned, will not prevent a recovery for injuries received on account of defendant's negligence in restarting the car after it had come to a full stop after the collision, and again striking the wagon as plaintiff was attempting to extricate himself.

Where there is evidence that the car was restarted after the collision, the question whether defendant was negligent in so doing is for the jury.—(McDivitt v. Des. Moines St. R. Co., 68 N. W. Rep. 595.)

CONNECTICUT.—An electrical street railway and light company constructed its railway in such a manner that the support and span wires, which passed over the trolley wire, might become dangerous by contact with the trolley wire, unless properly insulated. Plaintiff, a lineman of the company, received an electric shock from taking hold of a support wire, due to the fact that a span wire, which was not insulated, had come in contact with the trolley wire. *Held*, that a finding that the company was guilty of negligence rendering it liable for the injuries received by plaintiff was proper.

An electrical railway company, operating its cars by the overhead trolley system, is required to use every reasonable precaution, known to those possessed of the knowledge requisite for the safe treatment of electricity as a motive power, to provide against the danger of injuries to its employes.—(McAdam v. Cent., Ry. & El. Co., 35 At. Rep. 341.)

WASHINGTON.—In an action for personal injuries, where the court has charged that of the several grounds of negligence alleged "there is no evidence before you which would permit you to consider the same, except the allegations as to the speed of the car and as to the failure to ring the bell. You are therefore instructed not to consider any of the allegations of negligence in the complaint, except these two"—a general verdict for plaintiff cannot be sustained, against special findings that the accident would have happened had defendant's car been running at a rate at which prudent men engaged in like business as defendant would run a car; that when the motorman first saw plaintiff, or could have seen him, plaintiff was but twelve feet from defendant's car; and that after that the motorman used reasonable prudence to stop the car.—(Pepperall v. City Park Transit Co., 45 Pac. Rep. 743).

PENNSYLVANIA.—Plaintiff, while walking in a public highway, was injured by the breaking of a wire cable used by the defendant street railway company to control its cars on a steep incline. There was evidence that the cable, which had become weakened by use, had broken once before, and had been hastily repaired on the morning of the accident, and used without being tested. *Held*, that the question of negligence was for the jury.—(Musser v. Lancaster City St. Ry. Co., 35 At. Rep. 206.)

PENNSYLVANIA.—A motorman seeing a child under four years old running diagonally across a street on which was a car track, brought the car nearly to a stop, when the child was about five feet from the track and ten feet in front of the car, and then, when the child turned from the track, looking at her brother who was following, and not at the car, he released the brakes, and let the car go forward on a down grade, whereupon the child suddenly turned, and ran in front of the car. *Held*, that the question of the motorman's negligence was for the jury.—(Woeckner v. Erie El. Motor Co., 35 At. Rep. 182.)

NEW YORK.—In an action for injuries received by collision with defendant's street car at a crossing, alleged to have been caused by defendant's negligence, plaintiff may show, as a circumstance bearing on the question of negligence, that the bell on the car was not rung as it approached the crossing, though plaintiff does not allege that the negligence consisted in the omission to ring the bell, or give warning of the approach of the car.

It is a question for the jury whether it is negligent for a person to attempt to drive across a street car track twenty feet in front of an approaching car.—Coyle v. 3rd Ave R. Co., 40 N. Y. Supp. 362.)

MISSOURI.—In an action against a street cable railway company for the death of plaintiff's decedent, caused by a collision with a buggy in which deceased was driving, it appeared that deceased, on seeing defendant's car, turned to the right, in which direction there was not room for a buggy to pass between the tracks and the street curb, whereas, if he had turned to the left, the accident could have been avoided. *Held*, that it was reversible error to admit, over defendant's objection, a city ordinance requiring vehicles, when meeting each other, to keep to the right, as it had no application to a meeting between a street railway car and a buggy.

To entitle an expert to be asked as to within what distance a cable car could have been stopped, the conditions existing at the time must be incorporated in the question.

The fact that deceased was signaled by defendant's watchman to cross the tracks of defendant's cable road did not relieve deceased of the duty to use ordinary care for his protection from approaching trains.

Negligence of defendant's flagman stationed at the crossing of two cable street railways in signaling a person to cross the tracks is not "negligence in operating the car" (Rev. St. 1889, § 4425); and therefore, when the negligence of the flagman is relied on, in addition to the alleged negligence of defendant's gripman, it is error to instruct solely for the penalty imposed by such section.—(Culbertson v. Met. St. Ry. Co., 36 S. W. Rep. 834).

NEW JERSEY.—While a car of a street railway company was stopping at a street crossing to receive and discharge passengers, a boy of the age of seven years and eight months, who was walking across the street from behind the standing car, was struck and killed by another of its cars, passing from the opposite direction. The evidence tended to prove that the boy's view of the approaching car was obstructed until he had passed the standing car; that no bell or gong was sounded by the approaching car, which was going at the rate of six miles an hour; and that the boy did not look for an approaching car before entering upon the track, where he was struck almost immediately upon stepping upon it, and carried a distance of thirty or forty feet before the car could be stopped. Upon the trial of an action for damages against the company for negligently causing the death, the trial judge refused motions to nonsuit, and to direct a verdict, on the alleged grounds that there was no proof of negligence on the part of the company, and that contributory negligence was established on the part of the plaintiff's intestate, and ruled that the questions of negligence and contributory negligence were for the jury. *Held*, that the judge committed no error in so ruling.—(Con. Tr. Co. v. Scott, 34 At. Rep. 1094).

NEW YORK.—Plaintiff owns a street surface railroad crossing West Street, in the city of New York, extending along Christopher Street, and terminating at Christopher Street Ferry. The defendant company operates a road along West Street, and claims the right at the junction of West Street and Christopher Street to construct a spur, so as to connect its tracks with the ferry at the foot of Christopher Street, thus paralleling for some 250 ft. the tracks of the plaintiff company for many years constructed and in operation. The defendant has obtained a license from the dock department for its proposed construction, and also claims to justify the same as being a necessary siding, turnout, or connection within the grant of the Belt Line charter, which defendant company has absorbed, and upon the basis of which defendant company is proceeding. Plaintiff brings suit for a permanent injunction against this construction, and moves for an injunction *pendente lite*. Upon argument of this motion, it was stipulated that the decision of the court should operate as a judgment upon the merits in favor of the party for whom the same might be rendered. *Held*, that the action of the defendant would constitute a public nuisance, as well as an invasion of plaintiff's private right; that, under section 102 of the railroad law, the defendant cannot construct a railroad in the same street where the tracks of the plaintiff are located without obtaining its consent; that sections 90-110 of the railroad law likewise forbid such construction; that the proposed construction of the defendant company would not constitute a mere adjunct and accessory of its authorized line; that the defendant could derive no authority for its proposed construction from the department of docks; and that the plaintiff is entitled to judgment, with costs.—(Central Crosstown R. Co. v. Metropolitan St. Ry. Co., 40 N. Y. Supp. 1095.)

STREET RAILWAY JOURNAL

DECEMBER, 1896.

PUBLISHED MONTHLY BY
THE STREET RAILWAY PUBLISHING COMPANY,
HAVEMEYER BUILDING,
26 CORTLANDT STREET, NEW YORK.

WESTERN OFFICE:
MONADNOCK BLOCK, CHICAGO, ILL.
EUROPEAN OFFICE:
39 VICTORIA STREET, WESTMINSTER, LONDON, ENGLAND.

Long Distance Telephone, "New York, 2664 Cortlandt,"
Cable Address, "Stryjourn, New York."

TERMS OF SUBSCRIPTION.

In the United States and Canada. . . . . $4.00 per annum.
In all Foreign Countries, per annum. . . . . $6.00 / £1 5s 0 / 31 fr
Subscriptions payable always in advance, by check (preferred), money order or postal note, to order of C. E. WHITTLESEY, Treasurer.

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All matters intended for publication in the current issues must be received at our office not later than the twenty-second of each month.

Address all communications to

The Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

WE describe in this issue a street railway installation which is almost or quite unique, at least in America, in that from the very inception of the enterprise it has been the intention of its owners to use the storage battery system throughout. In times past we have seen numerous more or less successful—more or less disheartening—experiments with a few storage battery cars sandwiched in between many horse cars of large systems. Such experiments do not prove anything, for it is not only impossible to separate out the operating expenses of the storage battery cars from those of the horse cars, but it is likewise impossible to get any true measure of the cost of motive power *per se*, since the power plant of such small installations costs more in coal, labor and incidental expenses than would be the case with a station specially designed for charging storage batteries on a large scale. In Chicago, however, nothing will apparently be wanting to make the test conclusive (for a road operating under conditions found there) either for storage batteries or against them. Any saving of investment or of operating expenses of the power station plant due to the absence of widely fluctuating loads and the need of providing large reserve capacity in the plant to take care of the maximum loads, will be fully realized and can doubtless be expressed in figures after sufficient experience in operation; the efficiency of the batteries themselves can likewise be readily determined and shown by figures; the reserve power of the batteries and their ability to take their cars into the stations at all times and in all conditions of weather can be proven; and finally the life and depreciation percentage of the battery itself—always the most questionable feature of storage battery traction—is likewise capable of determination, though with more difficulty and only by a considerably longer experience. It is claimed for the batteries which will be under trial at Chicago, that they embody the best features of nearly all former types of cell and that they are a great improvement over any single type previously used on street railway cars. We sincerely hope that this is true and that the experiment in Chicago will show that there is genuine economy, at least over animal traction, in the storage battery system, for if this is demonstrated beyond a doubt, there is no question that there is a place for storage batteries.

NO invention in the line of engineering appliances is more urgently needed at the present time than an instrument, or instruments, for locating the wastes of power which take place between the coal pile and the bus bars of an electric railway power station. Until within a comparatively short time there has been no way whatever of testing such a power station with widely fluctuating loads or of getting any factor of economy whatsoever except the utterly crude and unscientific one of pounds of coal per car mile or per ton mile. Any measurement of electrical output by means of fifteen minute, five minute, or even one minute readings of amperemeter and voltmeter through the day are so evidently worthless as to be almost ridiculous when the wide fluctuation of load occurring in a single instant is taken into account, together with the varying "personal equations" of the readers of the instruments. Today, the condition is a little better because of the possibility of measuring by wattmeters the total station output, and although it is doubtful if close accuracy can be obtained in wattmeter measurements in railway stations on account of the inertia of even the most delicately balanced and lightest wattmeter armatures, still, comparative daily or monthly results in the output in watts per pound of coal are nearly accurate and highly valuable, and a distinct gain is made over the cumbrous method of instrument readings. But when it is sought to know whether or not the engines, dynamos, or steam piping are doing their work properly we meet with difficulties which, with present inventions, seem almost insuperable. Indicator cards are of some value, perhaps, in showing faults of valve setting, but not nearly as much so as in cases where loads are more steady, while the impossibility of indicating a railway engine in order to determine its average and its maximum power exertion is clearly recognized, together with the consequent impossibility of determining by test the commercial efficiency of generators in service. The only way at present of obtaining any valuable results whatever in testing power stations, lies in special night tests with water rheostats where the load can be made steady enough to obtain

true indicator cards. If some genius—and the difficulties of the problem are such as to lead us to say on mature deliberation that *genius* is necessary—can devise an instrument to obtain an *average* indicator card, or, better yet for some purposes, a continuous record showing the complete indicator cards of each stroke, he will earn the gratitude of engineers. To our mind it is really a surprising thing that the economy in coal consumption of our best stations is as low as it is, considering the fact that our engine builders must be working somewhat in the dark in such matters as demonstrated quickness of valve action, effect of inertia in moving parts, etc.

A Business Revival.

The election is over—the forces of conservatism have triumphed—and the majority vote against the most dangerous financial heresy which has threatened this country's prosperity for many years is nearly or quite a million. The country drew a long sigh of relief on November 4, and victors and vanquished alike, with a cheerfulness and submission to the will of the majority which is the well known characteristic of the true American, promptly set to work to take advantage of the increased business prosperity promised by the Republican party. Almost every large wholesale and jobbing house in the great trade centers started their travelers "on the road" before the week had passed, and almost immediately, orders for goods to replenish stocks came flowing in by every mail to head offices. Gold appeared once more in circulation and was presented at the different sub-treasuries all over the country to exchange for the more convenient legal tenders, and such was the volume of this hoarded gold and the general confidence in the permanent safety of the treasury's condition that for some time such exchanges were actually refused by the treasury officials merely on account of the bother and trouble of counting the money. The treasury reserve which has been kept, only with the greatest difficulty and by means of large bond sales, anywhere near $100,000,000, the amount required by government precedent for the redemption of greenbacks, has now risen to about $130,000,000, and is still increasing, the expectation being that it will at least reach $140,000,000 before going backward. This is due, in part, not alone to increasing confidence, but also to trade balances unusually favorable to this country for this time of year.

The manufacturing centers quickly caught the contagion of "better times" and during November the newspapers have been full of items regarding the starting up of mills and the increasing of the force of those already in operation. According to careful compilations made by the New York *Journal of Commerce* and *Commercial Bulletin*, 383 manufacturing establishments started up between Nov. 3 and Nov. 21, and 291 establishments in addition increased their forces.

Again, to illustrate the feeling of buoyant confidence that is now general among all classes, the results of recent municipal bond sales which have taken place since election may be cited, notably that of the New York City bonds offered shortly after election, for which the bids amounted to eleven times the amount of bonds offered, although in July, bids for certain bond issues amounted to only one-third of the amount offered, and in August there was only a slight oversubscription, all bids being at exceedingly low prices.

All these things tend to make it nearly certain that, barring accidents, we are to have a period of brightening prospects, fair prices, and general prosperity, which will be a welcome relief to the long drag of depression which has been in its effects almost more disheartening and hard to bear than a short sharp panic would have been. And when in addition to this favorable manufacturing and trade outlook it appears that crops abroad are small; that the world will need all our surplus wheat, and much of our corn, at the highest prices which have ruled for several years; that our own crops, including cotton (for which there is always a good market) are large; it certainly looks as though prosperity would reach every class of our population.

The manufacturers of street railway apparatus of all kinds will not only feel the effects of the generally brightening skies, but will have special cause for thankfulness in this Thanksgiving season. So far from there being any indication that an end to electric equipment has been reached, it is true that every day sees new fields waiting to be filled, new customers for what is already standardized and for what can be readily developed upon demand. In the first place, existing street railway systems will still require a large amount of apparatus and material before their plans will be fully carried out. Twelve hundred miles of horse railway track and over 5000 horse cars are yet in operation, and all, or nearly all of these must inevitably be superseded by some improved motive power; 600 miles of track on which are operated nearly 4000 dummies, coaches and other cars equipped for operation by various motive powers should probably be placed in the same category. A large proportion of the present equipment of our electric railways is with the older types of apparatus which must, as rapidly as possible, be replaced with the more modern forms, and the general supply parts always required by operating properties call for a not inconsiderable factory output.

In the second place, the elevated railway systems of Chicago are committed to electricity, and equipment is now going on as rapidly as possible, while in New York City there is no question that the Manhattan Company must and will adopt electric traction immediately, and it is fully expected that the first contracts will be given out during the coming year. In Brooklyn, electrical equipment may be postponed for some time because of the financial burdens already loading down these properties, which may make it difficult to obtain the necessary money for the additional investment, but sooner or later, electricity is bound to come. In Boston an elevated railway system is apparently assured. Outside of these cities we do not look for much further elevated work, at least for the present.

With the increase in the population density of our great cities and the constantly increasing difficulties of transporting the people as rapidly as they wish to go, underground railways, particularly in cities like New York and Boston, appear to be necessities, and in spite of the so far abortive efforts of the Rapid Transit Commission of New York, it is probable that sooner or later an underground railway will be in operation by electricity through Manhattan Island calling, of course, for immense amounts of apparatus and materials of all kinds. Boston, with the steady persistence and comparative rapidity of action in matters of municipal improvement which characterize that progressive New England city, has already nearly

completed its combined subway and tunnel line between important terminal points so as to relieve the extreme congestion of its principal streets. Here, however, there will be little new market for electrical apparatus, as the present trolley cars of Boston will run in the subway instead of over their present routes. In steam railroad tunnel work electric locomotives are surely destined to supersede steam locomotives, and here again is an inviting field for manufacturers.

The experiments in electric traction in railroad suburban service have met with such success that a field of almost incalculable extent has here been opened to electrical engineers and manufacturers. We believe that nothing—even the indisposition of steam railroad companies themselves—can prevent the early adoption of electricity for all suburban service. The competition of parallel lines will bring this about if considerations of relative economy do not, for one of the most profitable portions of the business of many steam railroad companies is rapidly slipping away and must be regained if financial results are to remain anywhere near as large as has hitherto been obtained. It will be some time, however, before we shall see long distances of 100 miles or more covered by electric passenger and freight trains in regular railroad service, but it is by no means impossible that even this may ultimately come about on some such lines as those between New York and Philadelphia and Boston and Providence, etc.

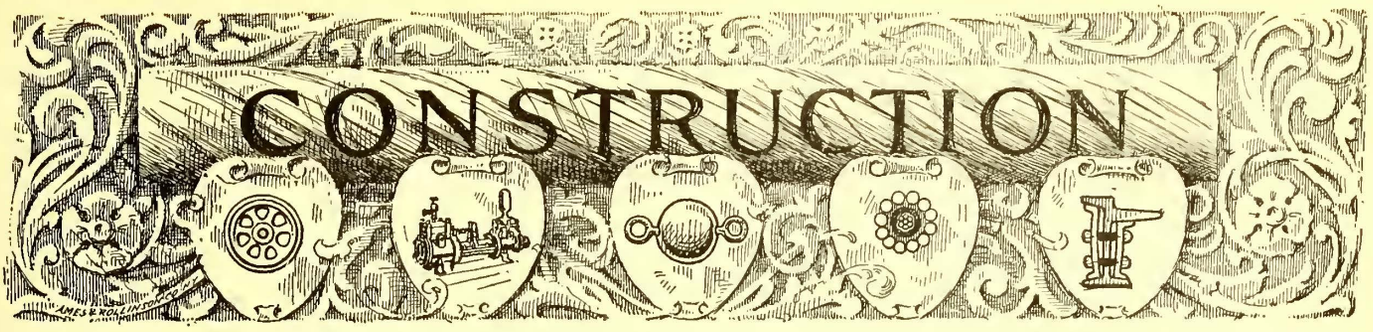
But when we look away from purely American markets to those of other countries, American manufacturers have reason to feel that "The world is mine oyster, which I with sword will open." Everywhere America is acknowledged as being in the forefront in electric and cable traction matters. Engineers, managers and "deputations" have been coming for the last two years to this country to study our methods and to compare them with those found in foreign cities, and the result is that American types of engines, dynamos, motors, trucks, car equipment and station material, and line appliances are preferred to all others in the market, and would be purchased even at a considerably higher price. It happens however, curiously enough, that in spite of the high cost of American labor, our manufacturers can, if necessary, compete with the best foreign work on even terms as regards prices, for our high priced labor is so efficient and we are turning out our product in such quantity for the home market that the cost of the finished article is in most cases less than that for which exactly the same thing can be manufactured abroad. When, in addition, it is remembered that the principal articles entering into the equipment of electric railway apparatus are protected by foreign patents as well as American, and that we have a long start of Great Britain, Germany and France in practical experience in electric traction on a large scale, it may easily be believed that the export movement which has now assumed such large proportions is not a merely temporary matter to cease when foreign manufacturers copy our models and gain our experience, but is likely to be, if we are wise, a permanent one. No more striking example of "sending coals to Newcastle" has recently occurred than the replacing of British built engines in the Bristol (England) Electric Tramway line by American engines. The Bristol Company is one of the old established English corporations and without American affiliations of any kind. Its prejudices would naturally lead it to choose British material wherever it could possibly be done. Its original installation was made with engines which have taken high rank at home and in the British colonies for efficiency and practical working. Nevertheless, in an increase of station power which has been made necessary by the unexpected development of traffic on the electric lines of Bristol, these engines are being replaced by direct coupled units purchased in America. This change is naturally regarded with consternation by British builders, and in an editorial in the London *Electrical Review* a most lugubrious picture is painted of the future of British manufacturers in this particular line of work, and it is frankly conceded that "the Americans have the pull of us in all matters concerning electric traction, a pull that it will require some years to make up."

In further proof that Americans are to have a large share of foreign business the fact may be cited that during the past year, and particularly within the past two months, representatives of foreign engineers, contractors, and even manufacturers, have sought agencies for American goods and have conceded the impossibility of entering into competition with us on most articles which we manufacture for electric traction purposes.

The time is ripe for action in this foreign business and the opportunities for entering the field should be grasped with no uncertain hand by every manufacturer whose product can stand in competition with others, in our home manufacture both as to quality and price. The business is usually one of "spot cash" or "cash on bill of lading." It should not be difficult to make foreign connections which will secure a market without the necessity of establishing special agencies or branch offices on the other side. It goes without saying that business cannot be done by printed matter or other correspondence. Personal attention is absolutely necessary, but as a rule it is, of course, far better to make arrangements with those familiar with local conditions, than to send Americans abroad to form their acquaintances and overcome as best they may the local prejudices against dealing with foreign houses.

In general, therefore, with all these new markets opening up, and the old ones increasing their demands, it appears to be certain that our manufacturers will have busy and prosperous years in the immediate future, and that 1897 will show a far better record both for gross business and for profits than has been the case for the past two years.

About eighteen or twenty months ago, the Metropolitan Street Railway Company, of New York, opened a new crosstown line on Thirty-fourth Street from river to river, put on clean and beautiful cars, lighted them by Pintsch gas, and ran them by horses, on a fast schedule. They started with a time interval of six minutes between cars, but the cars soon became so crowded that many would-be passengers were left to walk, and the time interval was reduced by successive stages to one minute at which it remained for some time. It soon became evident, that even more cars must be ordered. The mechanical difficulties of increasing the service, however, were considerable, and an attempt was made, after some study of the situation, to divert the traffic from this particular crosstown line by offering transfer privileges on the Fifty-ninth Street crosstown line. In the first month of the new arrangement 160,000 transfers were issued at Fifty-ninth Street and this has since risen to 330,000 per month. Nevertheless, there has since been an increase of 65,000 passengers per month in the traffic seeking to go by way of Thirty-fourth Street, and the management has been finally forced to put on more cars and overcome the difficulties as best it might.



Street Railway Roadbed.

By Mason D. Pratt.

V.—Special Work—Curves.

It would be safe to assert that there has never been built a street railway system that has not had a piece of track that required some special preparation other than that given to plain, straight track, before it could be laid in place. Most systems have a considerable percentage of their trackage made up of curves, crossings, switches, etc. In nearly every case these curves and crossings have to be made specially to fit given locations, and hence the term "special work."

In tracks made with rails of five inches or under, all curves over 500 ft. radius, may be "sprung in" as the construction proceeds; and if the track is otherwise well laid the alignment may be depended on to remain good. But with all heavier rails, particularly girder rails, no curves under 1000 ft. radius should be laid without first

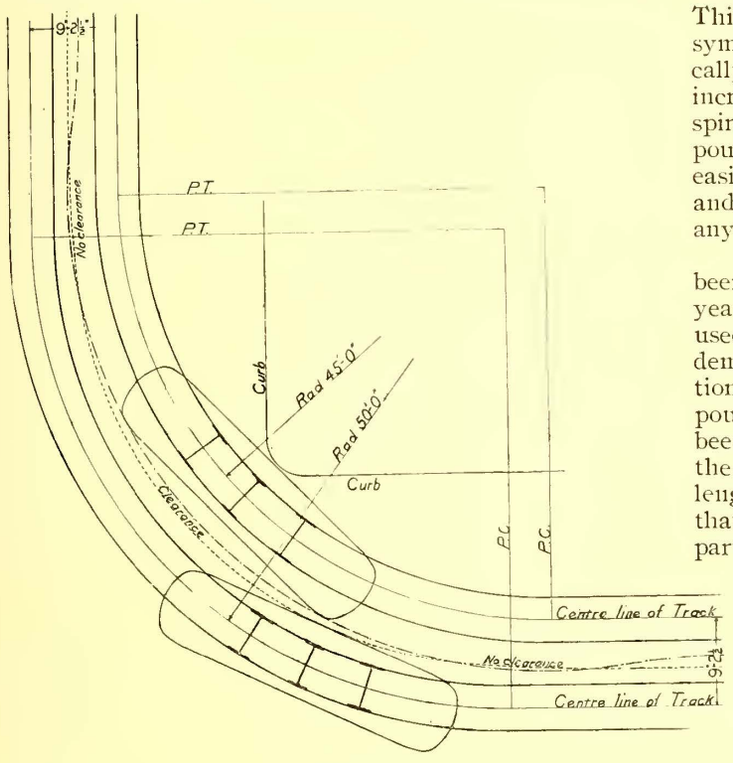


FIG 101.

curving the rails with a portable bender; and for those under 300 ft. radius the rails should be put through a power machine. In no other way is it possible to avoid angular joints. The writer is familiar with several cases, and one in particular, where a piece of track was laid with seven inch girder rail, in which there are several curves varying from 400 ft. to 1000 ft. radius, which were sprung in. It was laid by a skillful trackman and engineer and paved in brick. The alignment when new was fine, but after one year's traffic under a five minute headway, the joints began to show themselves by a slight angle in the line and a perceptable jerk of the car in passing. It would therefore seem the better practice to avoid the habit of "springing in" light curves.

Street railway curves are always designated by the radius and not by the degree of curvature in hundred foot chords, as on steam roads. The chord method is not generally used in laying them out, except where they approach the dimensions of steam road curves. And aside from other inconveniences, it is manifestly impossible to designate curves by that method when the radius is under fifty feet—a 180 deg. curve.

COMPOUND OR EASEMENT CURVES.

With the higher speeds that have come with mechanical power, it is desirable to have easier running curves than the simple circular curves heretofore commonly used. This may be obtained by "compounding", i.e., starting with a long radius curve and increasing the curvature, or shortening the radius, at intervals till the desired curvature is reached for the central portion of the curve. This is done at each end, making usually a curve which is symmetrical about the radial line at its center. Theoretically the most satisfactory curve is a spiral with constantly increasing curvature such, for instance, as the hyperbolic spiral or the logarithmic spiral. But practically a compound curve as described above is better; for it is much easier to figure, and if the compounding is properly done, and the curve properly laid, it will be impossible to detect any difference in the motion of the car in passing either.

As to the method of compounding curves, there has been a considerable improvement within the last three years. At first three center and five center curves were used, all arcs being about the same length. But as the demand for greater refinement arose, a close approximation to the true spiral was obtained in the adoption of compound curves made up of arcs of five feet or less It has been very clearly shown* that on three center curves—and the same is true of compound curves having arcs of greater length than the wheel base with large changes in radius—that the ends of the car follow a peculiar path which imparts a jerky motion rather unpleasant to the passengers. Of course the motorman with one handle on the controller and the other on the brake, has a considerable influence over the manner in which the car passes around a curve; and with a little effort—or the lack of it—he may knock into a cocked hat the greatest refinements of the engineer and track layer.

CAR CLEARANCE.

On a double track road it is well to have the curves so laid out as to allow cars to pass on them, although on most roads there is a rule against it, both on account of the greater liability to accidents, as well as to prevent a heavy drain on the power station. But to meet the cases where rules are not always followed, as well as where there are none, collisions of cars may be prevented by a little more care in designing the curves. In working out an easement for any given case, the outside dimensions and wheel base of all cars to be used must be determined. The most

*C. A. Alden in *Engineering News*, Oct. 15, 1896.

convenient method of plotting the curves is to have the outline of a car's horizontal projection cut from cardboard or transparent celluloid, with the position of the center of the axles shown, or the center of trucks in the case of double truck cars. Having laid down a curve with its center line, the space that the car will occupy will be found by placing the template at successive positions on the curve and marking the outer corners and the inner side at the center. Fig. 101 very clearly shows the overhang on a pair of simple curves. It will be noted that there is clearance at the center, due to the fact that the curves are not concentric—a very common way of laying curves. But at the ends the cars overlap, and if they attempted to pass at those points, there would be a collision. In Fig. 102 it is shown how it is possible to compound the curves to obtain clearance all the way. In this diagram note that the compound curve has the same position at the center as the simple curve, and will therefore fit the same location. To obtain this it was necessary to cut down the center radius but 4 ft. The car used is a 33 ft. body on a six wheeled "radial" truck. But the principle involved is the same with any cars. If cars of more than one kind are to be used, of course they should all be tried and a curve found that will suit all. This method may also be used to great advantage in laying out car house curves, locating posts and poles, or to clear any fixed obstruction.

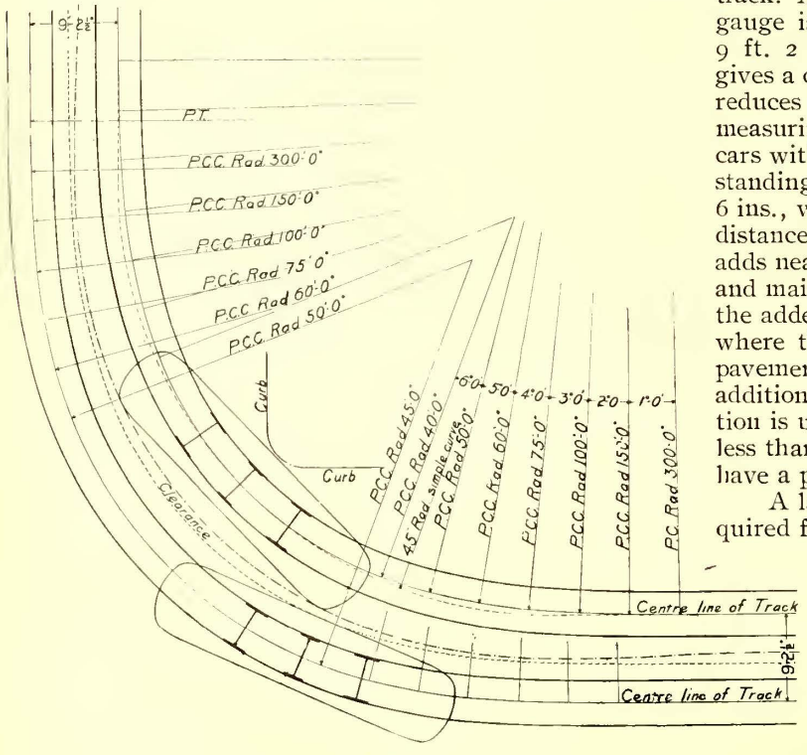


FIG. 102.

The several factors that enter into the problem of overhang and car clearance are:

The length and width of cars and the shape of their ends.

The wheel base.

The distance between track centers on tangent.

The curvature.

The elevation of one rail above the other.

In addition to the first two, which relate to the car, should be mentioned the rigidity with which the body is attached to the trucks laterally. If there is any swing of car body there will be danger where small clearances have been figured on; but this is largely under the control of the motorman.

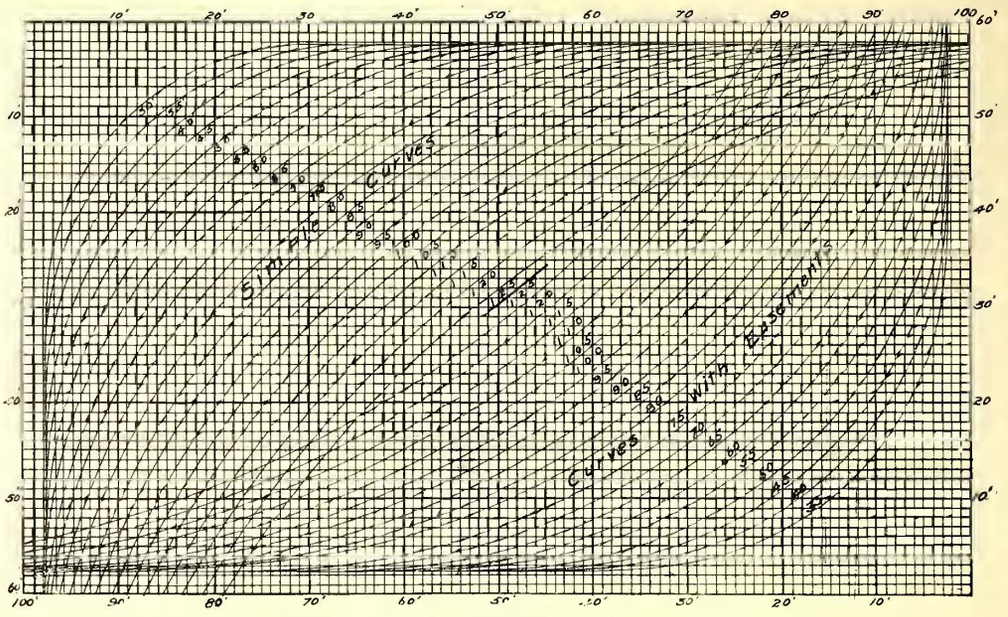


FIG. 103.

The third item, or distance between trucks, plays a very important part, not only on curves, but on straight track. A very common distance on standard (4 ft. 8½ in.) gauge is 4 ft. from back to back of head, giving about 9 ft. 2 in. center to center. With ordinary cars, this gives a clearance on straight track of 12 in. to 18 in., and reduces possible clearances on curves to a minimum. Cars measuring 8 ft. and over are coming into use, while open cars with running boards are even wider; and with people standing on the step, there would be a clearance of about 6 ins., which is entirely too small. I would recommend a distance on centers of not less than 10 ft. To be sure, this adds nearly 550 sq. yds. of pavement per mile to be laid and maintained, but the company will be fully repaid in the added security to its passengers and cars. In cases where the railway company is made responsible for the pavement over the entire width of street this question of additional cost will not arise. Where center pole construction is used, the center to center distance should be not less than 12 ft., and then care should be exercised not to have a pole anywhere near a curve.

A large percentage of the short radius curves are required for angles approximating 90 degs., and the accompanying diagram (Fig. 103) will be found of much value in selecting the proper curve to be used.

The curved lines indicate the inside rail of a single track curve, and the edge of the diagram the center lines of track. To illustrate its use, suppose we have to pass around a corner with a double track curve, the streets are 40 ft. and 60 ft. between curbs and the tracks are 10 ft. between centers, making the center of the track in one case 15 ft., and the other 25 ft. from the curb. Following the 15 ft. and 25 ft. lines to their intersection, we find it to be just inside of a 60 ft. radius curve; showing that to be the largest radius that could be used in the given case.

In designing curves there are numerous other things to consider, chief among which are sewer and water manholes. The position of the former may often be changed by going down three or four feet and building up on a slant. It is seldom possible, however, to alter a water man-

hole, or stop-cock plug, and they sometimes prove annoying, and require some nice work in compounding. Then there are sewer intakes, lamp posts, telegraph, telephone and electric light poles, and the shape of the curb corner itself; and the question of dodging or removing them to be settled. The direction of flow and amount of surface drainage should also be considered, for it will not do to obstruct or divert it to the damage of abutting property. All of these points require the careful consideration of an engineer.

GUARD RAILS.

On curves of 300 ft. radius, and under, it is not safe to depend entirely on the bearing of the flange against the gauge line of the outer rail to keep the cars on the track, and a guard rail on the inner or short side of the curve should be used. The guard is from ¼ in. to ½ in. higher

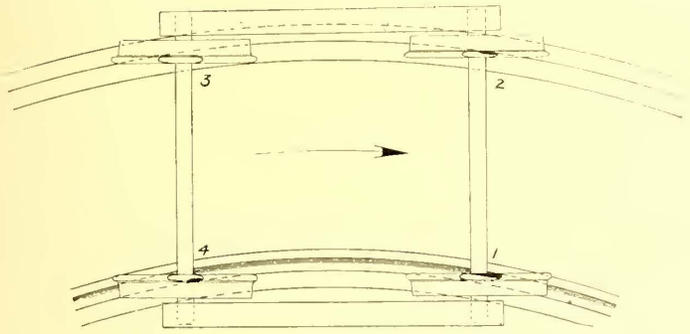


FIG. 104.

than the head of the rail, and with its broader bearing against the back of the inside wheel flange, prevents derailment. There are many who think that curves from about 100 ft. radius down should have a guard on the outer or long side as well, on the ground that the rear wheels have a tendency to run off on the inside of the curve. There is such a tendency, but it is so slight and so nearly overcome by other forces that it does not require the services of an outer guard to keep them on. An experience with several thousand curves built with single guard and used by cars of all conditions and gauges has tended

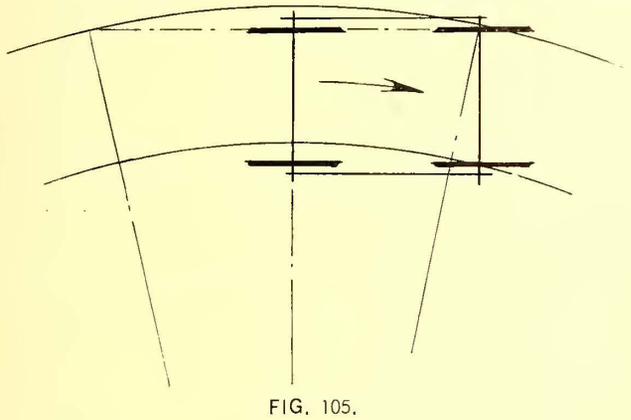
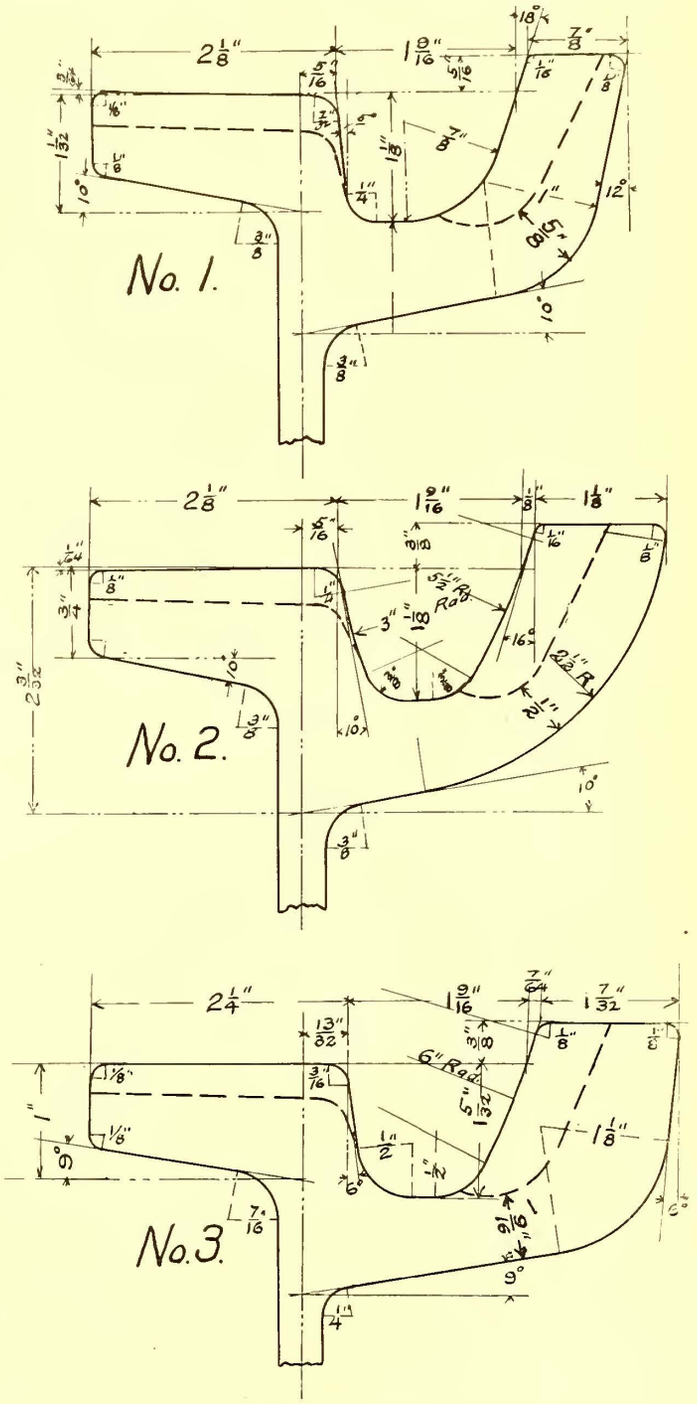


FIG. 105.

to confirm this latter proposition. There are two decided benefits to be derived from the use of but one guard, namely, a saving in first cost of the curve, and a continual saving in power required to move cars around the curve, due to an avoidance of additional flange friction.

Fig. 104 shows very clearly the position a rigid four wheel truck assumes in traversing a curve. The shaded portion of each flange represents that which is below the top of the head of the rail, and the black portion of same the part of the flange in contact with the rail, the arrow indicating the direction of travel. The truck is guided almost entirely by the inner front wheel (1) and the flange of its mate (2) is in contact only when the gauge of track and truck permit. Wellington shows that when not restrained by the flanges, the rear pair of wheels will follow the forward pair in the manner shown in Fig. 105, i. e., with the rear axle on a radial line. On a 35 ft. radius curve the distance of the rear wheels from the gauge line, would be about 7 ins., and on a 100 ft. curve, 2½ ins. It is apparent therefore that the duty imposed on the rear wheel flange is simply to keep that portion of the truck a few inches away from its normal position—a condition that may be illustrated by a pendulum held to one side by the pressure of a finger. As the angular distance is small, so is the force required but a small percentage of the weight of the pendulum. Now if the pendulum be swung in a circle about its normal position, the centrifugal force



FIGS. 106-108.

will sustain it away from the vertical. So with a car, while the tendency of the rear wheels to climb the inner rail is comparatively small of itself, it is counteracted to a greater or lesser extent, depending on the speed, by the centrifugal force acting through the car. All of which goes to show that an outer guard rail is more of a hinderance than a necessity.

Within the last three years the form of the groove in guard rails has undergone a decided improvement. There are shown herewith the three sections of solid guard

rails in use at the present time (Figs 106-7-8). The idea in all is to have a form of groove that will best fit the wheel flange, and present its full face to the wear of the flange. Since the exact shape of the groove depends upon the size and shape of the wheel flange, the diameter of the wheel, the wheel base and the radius of the curve—all variable factors—it is manifestly impossible to have a different guard rail to suit every condition. The manufacturers have therefore settled on a form which is best suited to the average conditions. A careful comparison of the figures will show that there is practically no difference in the contour of the groove. As the shape of the groove was determined in a different way by each, it is interesting to note the closeness of the results. The method pursued by No. 3 was to fill the groove of an old curve with plaster of Paris or clay and run a car around, noting the form of groove made by both front and rear wheels, and a number of trials were made under different conditions. The manner in which No. 2 made the determination was by the use of quarter size models which were pivoted to a fixed center and run over a clay track. Sections of the groove formed were carefully cut and dried, and the final section was the result of a large number of observations. The test is more fully described in the Street Railway Journal for June, 1895, page 399. No. 1 was determined by observation of numerous worn guard rails, from which wooden templates were taken and compared. It was noticed that no matter what the original form of the groove had been, the worn groove assumed a definite shape, depending largely on the radius of the curve. On each section is shown in dotted lines the portion worn away in service. The shape of the worn groove was taken by a template from a curve in use, and it is assumed that when the groove is worn to a width of 2 ins., and the head cut down $\frac{5}{16}$ in., it is time to renew. A study of the three sections in relation to this line of wear may possibly reveal the idea involved in the form of the outer portion of the guard in each case.

A New Use for Old Cars.

A new use for old horse cars has been discovered at Cripple Creek, Col. A number of short cars were recently purchased at Denver, from the Woeber Bros. Car Company, and have been fitted up as restaurants. They have been placed side by side, the ends and seats removed, and chairs and tables introduced. Others have been spliced together and used for sleeping purposes, small shops, etc.

Niagara Power for the Buffalo Railway System.

On Nov. 16 at one minute after midnight power from Niagara Falls was received in Buffalo, being transmitted by electricity over a line distance of twenty-six miles. One thousand horse power is now in use propelling the electric cars on several of the important lines of that city. The delivery of the current was made six months before the date set in the franchise granted by the municipal council of Buffalo, June 1, 1897, before which date 10,000 h. p. is to be ready for delivery within the city limits. A further stipulation in the franchise, calls for the additional capacity for delivery of 10,000 h. p. per annum for each four years thereafter.

The hastening of the period of delivery was due to the exigencies of the Buffalo Street Railway Company, whose traffic has grown rapidly during the past year and which would probably otherwise have had to increase its power plant by the addition of two 400 k. w. units to care for the extra winter work. The operation of their system by Niagara power has long been a pet project of the managers of the Buffalo Railway Company, and on condition that the distributing company delivered Niagara Power in Buffalo by Nov. 16, the first order was given for 1000 h. p.

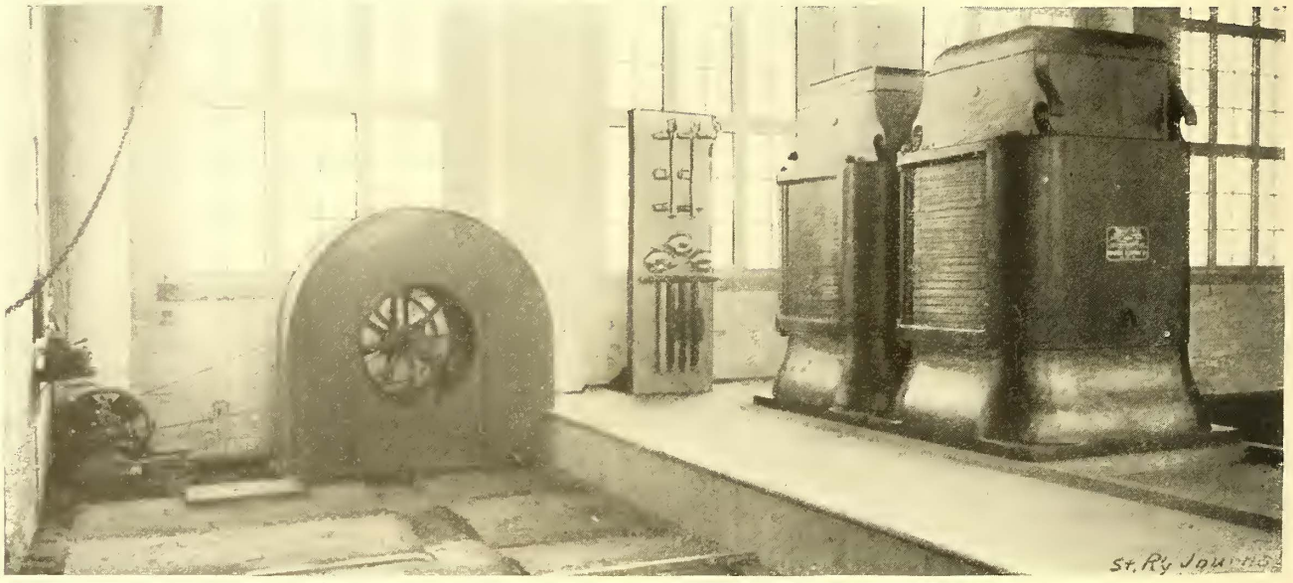


FIG. 1.—INTERIOR OF STEP-UP TRANSFORMER STATION—NIAGARA.

In the exploitation of the power of the Falls in Buffalo, three companies are concerned, two of which are offshoots of the first, the Niagara Falls Power Company, which generates and disposes of the electric power. The Cataract Construction Company, attends to all the construction work in connection with the power, and the Cataract Power & Conduit Company controls its distribution within the limits of Buffalo.

In deciding on the transmission the question of the phases, which has been agitating the electrical fraternity for so long, has practically been settled so far as the transmission of power from Niagara is concerned. The two phase system was that selected for the generation of the power and its distribution in the vicinity of the Niagara Power House. When it became necessary to transmit the current any distance, the three phase system of the General Electric Company was decided to be more economical, dispensing as it does with a fourth wire. It was consequently selected, and the capacity of the first line fixed at 5000 h. p. at 11,000 volts.

On Aug. 14 the work of constructing the line was begun by the White-Crosby Company, sub-contractors under the Cataract Construction Company. Two hundred men, divided into six gangs, were set to work—two starting from the Falls to Tonawanda, two from Tonawanda working towards the Falls, and two from Tonawanda

towards Buffalo. The line commences at the transformer house, a gray stone, one story structure, erected on the side of the supply canal, or forebay, opposite the power house. For about eighteen miles it runs along a special right of way, 30 ft. wide, purchased by the Niagara Falls Power Company. As this right of way could not be secured through the center of some of the farms, its course in some places is somewhat tortuous. Five miles of the line run along the Erie Canal, the right of way for which was granted by special legislative enactment. Three miles are within the city limits of Buffalo itself.

The pole line, which was fully described from plans of the engineers in the August issue of the STREET RAILWAY JOURNAL, is illustrated in Fig. 6. The poles are of shaved cedar, painted white, ranging in height from 35 ft. to 65 ft., according to the locality, and set 60 ft. to 75 ft. apart along one side of the 30 ft. strip. They are set 6 ft. to 8 ft. deep; some simply placed in the clayey ground and tamped, while others, in moist and soft earth, are set in concrete. Room for another line of similar capacity is left along the right of way. Complete transposition of the wires is effected every five miles, and at each of these five points on the line two poles, 5 ft. higher than the rest, are set. In turning sharp angles, double poles with double cross arms are used, and each pole is guyed to the bottom of the opposite pole by a ¾ in. wire.

FIG. 2.—INTERIOR OF STEP-DOWN TRANSFORMER STATION—BUFFALO.

Each single pole carries three cross arms, the two upper for the transmission wires, the lowest for a telephone circuit. The transmission cross arms are of yellow pine, 12 ft. long × 4¾ ins. × 5¾ ins. Each arm will carry six insulators, three on each side of the pole, but three only are now in place screwed to wooden pins. On the outer end of each upper arm are two 18 in. iron pins on which is strung a galvanized barbed iron wire, which, grounded every fifth pole, serves as a lightning arrester.

The line consists of three conductors of bare copper, of 350,000 c. m. cross section, each conductor being a nineteen strand cable. These conductors are strung on porcelain insulators of heavy pattern. These insulators, which have also been described in these columns, are illustrated in Fig. 5. They have the appearance of large inverted soup bowls, with a cap having a longitudinal groove with two wings and a special drip-way on the upper surface. Beneath they have two deep annular grooves, to prevent any moisture connecting the outside of the insulator and the supporting pin, and causing a ground. Each insulator weighs about 12 lbs., and before acceptance was subjected to a test of 40,000 volts alternating. Failure in the smallest degree insured rejection. It is interesting to note that in all the long distance transmissions of power in the United States, no question has arisen of using oil insulators, which at the time of the Lauffen experiment were considered as indispensable. Porcelain insulators of the double and triple "petticoat" pattern have alone been used. The conductors lie in the longitudinal grooves and are tied to the wings.

The total length of the line is twenty-six miles, and as the three phase system demands the use of three circuits the total length of conductor is seventy-eight miles, the cable for each mile weighing about 5200 lbs. With a transmission of 1000 h. p. at 10,000 volts the total drop is 11.4 per cent.

The last 4200 ft. of the line is underground, through a subway consisting of twelve ducts of vitrified tile laid in four layers of three each, each duct having a diameter of 3 ins. in the clear. The twelve ducts are surrounded on all sides with four inches of concrete as a maximum protection, and the top of the concrete is 18 ins. below the surface. This conduit is laid along the canal bank, at an average distance of 14 ft. from the canal itself, and has sixteen manholes.

The overhead line from Niagara dips to a terminal house and is connected through lightning arresters to the underground cable, which runs along a short tunnel connecting the terminal house with the first manhole of the conduit.

The underground cable is insulated with $\frac{9}{32}$ in. thickness of rubber, then braided and sheathed with a heavy lead armor. This cable was tested to 40,000 volts for acceptance, and to 30,000 volts for experiment. It is said to have withstood the latter test without revealing weakness in the insulation.

The conduit continues as far as the transformer house—a small one roomed brick structure, built in the rear of the Niagara Street power house of the Buffalo City Railway Company.

The course of the current begins at the great 5000 h. p. generators, revolving in the power house at Niagara, whence it issues two phase at 2200 volts and passes to the main switchboard. That portion intended for Buffalo is led in lead covered cables over the bridge between the power house and transformer house across the canal, where the cables are connected to the two phase low potential switchboard. From this they descend into an airtight chamber in which are built the transformer supports. In this room, large enough for a man to move about in comfortably, all connections between the low tension two phase lines and the step-up transformer wires are made, the cables being supported by large porcelain insulators on iron brackets.

The "step-up" transformers in position number two, the third not being at present necessary. They are massive pieces of electrical apparatus and are rated at 936 k. w. each. They represent the latest practice in transformer design, are the largest yet constructed and are of the air blast type. The maintenance of transformers of large capacity at a temperature non-injurious to the insulation was

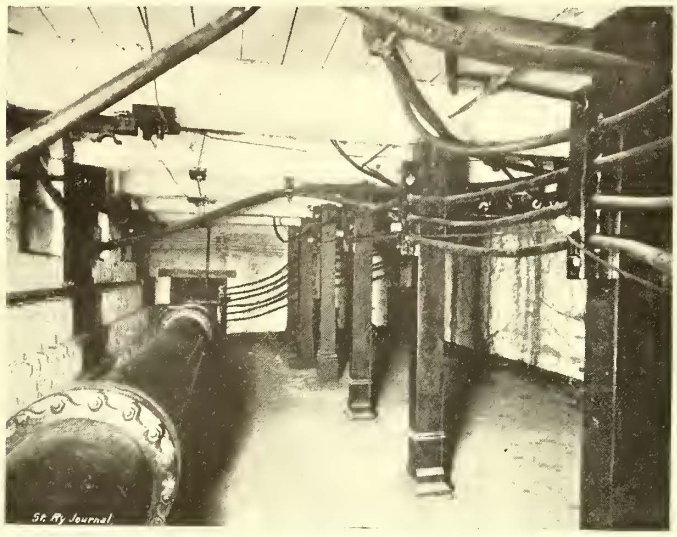


FIG. 3.—METHOD OF BRINGING IN FEEDERS AT BUFFALO STATION.

a problem which has been solved by the installing company in a satisfactory manner. Into the airtight chamber beneath the transformers air is forced by a sixty inch blower, driven by a five horse power multipolar direct current motor. The coils of the transformers are arranged with the major axes in a vertical plane, and two main passages are provided—one through the iron of the core, and the other through the spaces between the coils. Through the open cast iron pedestals on which the transformers stand a blast of cool air passes directly into the main air passages and thence into a number of minor air ducts in the transformer. The admission of the air is regulated by dampers, which may be adjusted independently either for the coils or the core. This air blast arrangement increases the size of the transformer, but has the great advantage of making it clean and accessible and more convenient to handle than any oil cooled transformer could be.

The step-up transformers are 94 ins. high and have a base measurement of 64 ins. × 56 ins. Each weighs 25,000 lbs. They raise the pressure from 2200 volts to 11,000 at present, but are designed to allow the pressure of the current to be raised to 22,000 volts by a change in the connection. They stand on frustrums of rectangular pyramids mounted on an iron framework and are encased in suitable iron frames, the frame being provided on the top with cast lugs by which they may be readily handled with the traveling crane which runs along the roof of the transformer house.

It is in these transformers that the two phase system is abandoned. From them the current issues in three phases. The connections are brought out at the bottom, and continue to the high tension marble switchboard for connection to the transmission lines. The equipment of this board is of special design to permit of the handling of the high voltage current without danger. Each conductor from the transformer is connected to a single pole switch of quick-break type, mounted on heavy insulating pedestals, and separated from its neighbor by a barrier of marble, much higher than the closed switch and about one inch thick. These three switches control the output of any two of the 935 k. w. step-up transformers which may be connected for either 11,000 or 22,000 volts. Each conductor has its fuse carrier of special type designed for this transmission. Each carrier is twenty-four inches long and is forced into contacts mounted like the switches on large insulating pedestals. Each has two handles, and the construction is such that they can be removed from the board for the insertion of new fuses without danger. The high tension switchboard also carries current indicators and voltmeters. From this switchboard the conductors pass to a small extension building where they are connected through lightning arresters to the overhead wires leading to Buffalo.

The transformation of the current at the Buffalo end of the line is effected in three "step-down" transformers, constructed similarly to those used to step-up the pressure, and cooled by the same process, the centrifugal blower being driven by a two horse power motor. The line enters the small building outside the railway company's power house, from the underground conduit, through lightning arresters and is connected to the high tension switchboard which is a duplicate of that in the transformer house at Niagara. From the switchboard the conductors are brought into the transformers from the top and the current issues in three phases at about 370 volts pressure, through conductors which pass through the airtight chamber from beneath the transformers.

Three of the four step-down transformers are set up. Each is 32 ins. high with a base measurement of 47 ins. × 36 ins. and weighs 7000 lbs. The current is turned into

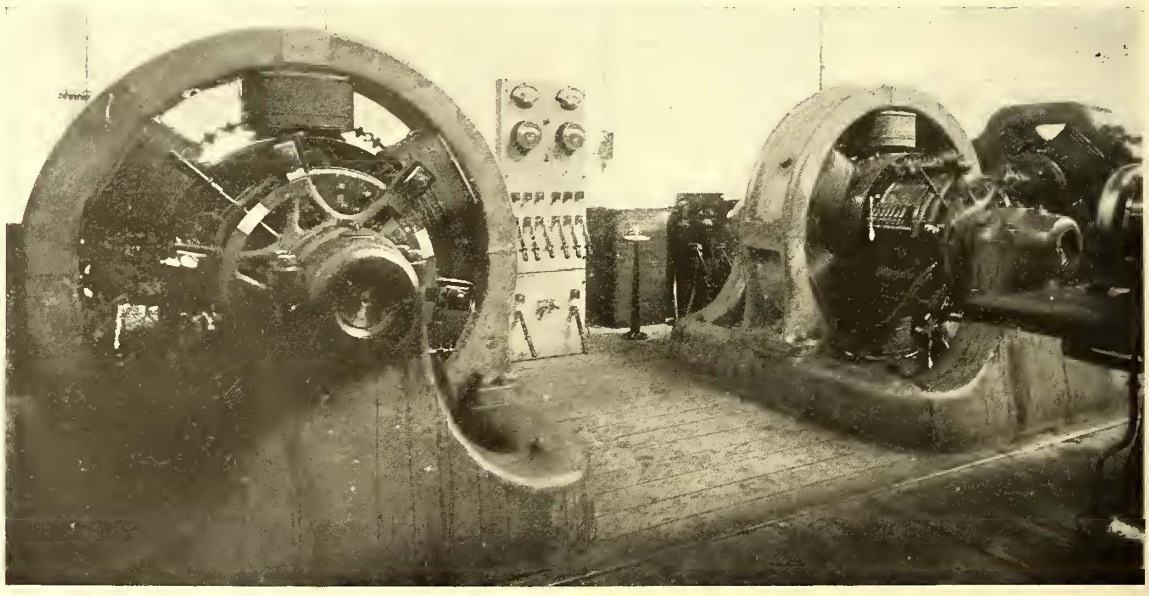


FIG. 4.—DIRECT CURRENT TRANSFORMERS AT BUFFALO STATION.

them at 10,700 volts or 21,400 volts pressure, and issues at the pressure just mentioned.

From the transformers six cables, that is, three for each three phase circuit are carried through the wall of the step-down transformer house up to the main floor of the railway power station above. Here they are connected to the switchboard equipped with six knife blade switches, one for each cable, ammeters, etc., a field switch

and two switches connecting to the main bus bars of the railway switchboard. From the board the two three phase circuits run to two rotary converters, each of 500 h. p. capacity. These converters are six pole machines and by

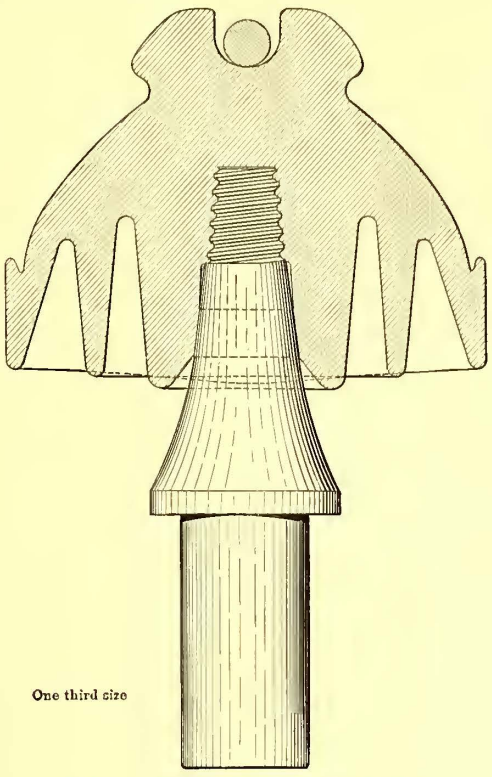


FIG. 5.—SECTION OF INSULATOR.

their operation the three phase, 370 volt, alternating current is changed into direct or continuous current at a voltage of 500 for connection to the feeder lines of the railway company. The armature of the converter is fitted with three alternator collector rings on the side nearest the switchboard, while the other carries a commutator similar to that of the ordinary direct current dynamo. The three phase current is brought to the brushes and enters the armature. As soon as the necessary speed is reached, as indicated by the voltmeter, the main switch on the board is closed and the direct current passes from the commutator brushes to the main buses of the railway switchboard. The converters may also be started by direct current taken from the lines, and the direct current from them can be thrown either to the board for operation in parallel with the generators now in operation in the power house or directly to the feeders.

The lightning arresters of the Wirt type have been especially designed for heavy voltage transmission work and are single pole. They consist of a strip of marble upon which are mounted eleven cylinders giving one air gap space $\frac{1}{32}$ in. for each one thousand volts with an allowance of twenty-five per cent rise in the potential. In the action of the arrester the large metal cylinders serve to chill the arc so that on reversal of the current the arc is extinguished, no dependence being placed upon any non-arcing property of the metal to put out the arc. In order to limit the current on short circuit, and thus the heating effect, a special solid graphite rod of low non-inductive resistance is used. The arresters are similar to those used on the Big Cottonwood transmission at Salt Lake City, which have effectually protected the machinery in many severe storms, and are now being used extensively in transmissions where high voltages are employed.

The carrying capacity of the present three phase circuits at 10,000 volts, is 5000 h. p.; at 22,000 volts, 10,000 h. p. The capacity of the pole line therefore, is 40,000 h. p., at the higher voltage. A second pole line will be erected to transmit 40,000 h. p. more, as soon as the demand for light and power and heating purposes in Buffalo, and surrounding district warrants the extension.

At Niagara Falls an extension of the power house equipment is already under way. The output of the present 5000 h. p. generators, three of which are in constant operation, is already taken and distributed to the factories of the Carborundum Company, the Calcium Carbide Company, the Niagara Falls Paper Company, the Pittsburgh Reduction Company, the Niagara Falls Chemical Company, to the Niagara Falls & Buffalo Railway, a line of electric cars running between the two cities, and other lines in Niagara. Another wheel pit of similar depth to that already in use, is being excavated as a continuation. It will be three times as long, i. e., 430 ft. × 20 ft. and will contain, when equipped, seven additional turbines with penstocks and turbine shafts. Seven additional 5000 h. p. generators will be operated by these turbines, and the complete plant will have a total output at full load of 50,000 h. p.

The success of the transmission, so far as the operation of the cars is concerned, was demonstrated on Nov. 19, when the transmitted current was turned into the Main Street feeders of the Buffalo Railway Company.

The successful transmission of the power of the Falls to Buffalo, is to be made the occasion of a great celebration to be held both at Niagara and Buffalo on Dec. 15.

Lamps as Danger Signals.

The Denver Tramway Company has introduced the practice of installing red lights at the approaches to steam railroad grade crossings and at other dangerous places along the line. In this way there is no danger of a motorman at night approaching a dangerous place at a too high rate of speed. At the crossings the danger signals are supplemented by the usual derailing switch devices.

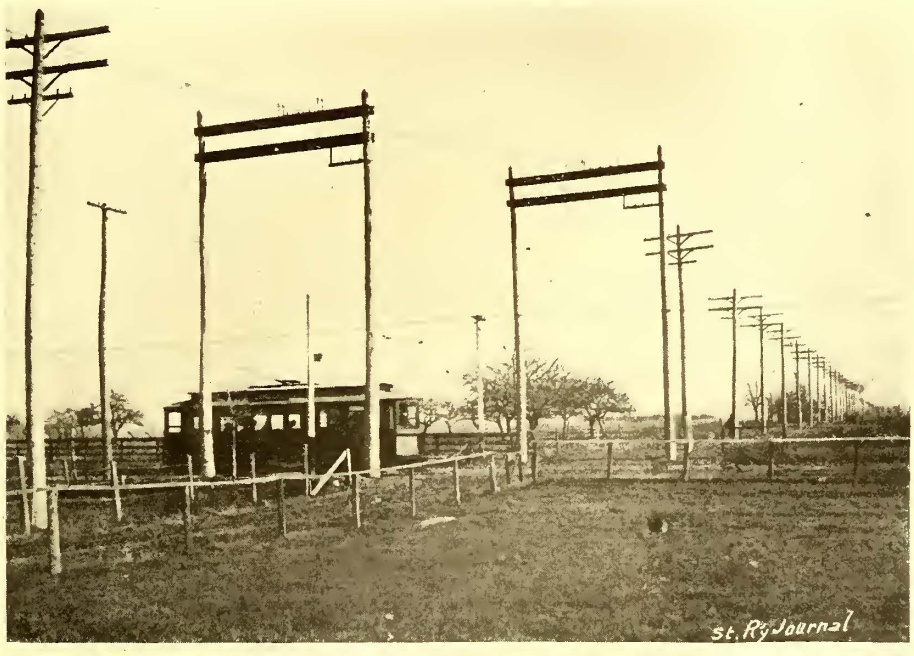


FIG. 6.—VIEW OF TRANSMISSION LINE.

THE city corporation of Sheffield, England, has taken over the tramway service from the local company, and has commenced the operation of cars under municipal control.

The Electrically Welded Continuous Rail.

By Richard Eyre.

The day has passed for elaborate argument in favor of the theoretical advantages of the continuous rail for street railroad practice. So, also, has the day in which the drawbacks from expansion and contraction were considered impossible to overcome. The progressive manager now knows that a continuous track need not be a letter S upon the arrival of the dog days; need not have an inordinate amount of breakage under the influence of the first cold snap.

These theoretical fears were not mere "bug bears." They were real dangers founded upon good theory and confirmed by years of steam railroad experience. Like all other forces of nature, however, there are methods by which these forces may be controlled and in this case the methods are simple enough. The warping of track as the resultant of heat is now shown to be entirely prevented if the track is buried in the roadbed, even though the latter may not be a particularly substantial one. The breakage expected to result from the tensile strains caused by winter has, it is true, shown itself to a greater or less extent, but there has been more than enough evidence collected to show that only a little more strength, or uniformity of strength, in the joints is needed to meet the highest strain given in our variable climates.

Steel has a coefficient of expansion of about .000006, that is, each degree below the temperature at which the rail was joined will tend to shorten the rail .000006 of its length. If the temperature in winter falls 100 degs. below that at which the weld was made, the whole track will be put to whatever tensile stress is needed to elongate the rail $100 \times .000006$, or .0006 of its length. From experiments made in the Johnson Company's testing room with a number of test pieces cut from the head of the Johnson section 78–225, the average of 17,500 lbs. per square inch was found to be the stress required to elongate the steel .0006 of its length. For a rail section weighing ninety pounds to the yard, the winter's pull, when at its highest, would then be 157,500 lbs.

The electric welded continuous rail in the past has had a higher breakage than was consistent with the best conditions of track construction. The best records, for obvious reasons, were made when the welding was done in autumn weather. Of the work done in summer, each year has shown some improvement over the year before; but even that done in 1895 showed some breaks. We have seen that 157,500 lbs. is a high estimate of the maximum tensile strain to which the rail will be subjected. Tests of track welds have generally shown over 250,000 lbs. and often nearly up to 400,000 lbs. What then is the reason that electric welds have shown this breakage? Believing in the necessity of a good continuous rail, and further believing, for reasons shown later, that a welded track is the only continuous rail of real value, time and money have not been spared to answer this question correctly and to find the proper basis for such changes as will make the electric welding commercially what it is theoretically, the ideal track.

The first track welds were made in Johnstown and in Boston in 1893. They were made by welding two U bars about eight inches long to the web of each rail at a distance of about four inches from the joint. With this system most of the breaks seemed to be the result of shrinkage strains. The web of the rail, where welded, had been heated quickly to an intense heat, while the head and flange and surrounding web were comparatively cold. As, then, the heated portion was cooling it was surrounded by a zone of nearly cold metal becoming heated from the weld. The strains left in the steel were such that the break often appeared as if a clean disk of the web, still united firmly to both U bars, had been cut out of the rail.

Finding the breakage too high, the season of 1894 ushered in with a new style of weld. Chocks, 1½ ins. in width, fitting the rail neatly, were welded to each side of the rail at the joint. With this weld the entire section of the rail was heated, and fear of shrinkage strains avoided. Furthermore a larger welded surface was presented and it was expected that when the chocks were upset the hot metal, squeezing in between the ends of the rails, would make a butt weld. Work was done with this method in Brooklyn, Boston, Cleveland, and St. Louis. The breakage, although a decided improvement over that of the first season, was still too high, but it was believed that the style of weld was the proper one. The undue breakage was thought to be caused largely by the lack of proper line voltage, and before the next season, arrangements were made to negative this fault.

This difficulty was remedied by the use of a "booster," consisting of a dynamo and motor, whose armatures are on the same shaft. The entire current from the trolley passes through the dynamo armature; thence part goes to the motor and part to the rotary transformer before described. Both dynamo and motor are shunt wound, and the strength of the field of the former is regulated by a small rheostat. In this way the current is kept at a fixed voltage of 500. Any sudden fluctuation in line voltage is at once neutralized by the dynamo tender, who merely moves the handle of the rheostat correspondingly.

During the winter of 1894-95 another addition was made to the apparatus with the intention of curing the breakage problem, and while it has since been discarded, it has not been without its use in pointing out the best method for track welding. This was a track compressor, which consisted of a cylinder ten inches in bore, and a plunger, both of which could be wedged to the rails. The power was supplied by a hand pump, giving a hydraulic pressure of 3000 lbs. to the square inch. The machine was intended to compress each rail longitudinally by opening up the butted joints and placing a "dutchman" between them. By making the weld with the rail under compression, the cold of winter would only relieve this compression, without giving the usual tensile strain. This strain was afterward discarded because of various mechanical difficulties, details of which are not of great general interest.

During the summer of 1895 welding was done in Brooklyn and Detroit, and the breaks were fewer than ever before. But as they were not yet low enough to admit the claim of a perfect track, extensive experiments were undertaken during the following winter to discover what changes should be made, to obtain a track strong enough to stand the heaviest strain of winter, and as smooth as the rest of the rail, retaining, meanwhile, the perfect electrical return that the welded track had always given. A book might be written of the statistics gathered in these experiments. To save expense and time, the first work was done on small bars and it was shown that while a good electric weld was nearly as strong as the normal steel, it was decidedly brittle. This was proved to be the result of the coarse crystalline structure, induced by the high temperature which a weld reaches without receiving any subsequent forging. This was discouraging, for to weld a high heat must be given, and it is obviously impossible to give a rail *in situ* any forging of practical value.

All methods of heat treatment known to the art, and some rather unique new ones were then tried to cure this brittleness, in the presence of which it was felt that a continuous rail must be more or less treacherous. Here a discovery was made. If only the high heat crystallization was to be fought, the cure was simple. A mere reheating to about a bright cherry red returned the steel to its normal condition. But a high heat alone does not make a weld; the pieces must be pushed together while hot. This, it was found, so scattered the grain of the steel that it made the weakness and toughness permanent. No heat treatment could overcome it. A weld cannot be made—and others who are interested in so-called welding processes might remember this to advantage—without some mechanical pressure, so this was again discouragement.

Next were tried various methods of welding which would bring the final temperature down to such a point that the upset would not do this harm. Fluxes of all sorts, various alloys, unusual mechanical methods of welding—all had their share in the trial. This is not the place to give detailed results of these experiments, for they do not enter into the new track weld. It is sufficient to say, however, that much of value to him who welds in the shop was discovered. Welds of Bessemer steel bars ¾ in. square were made that could be bent cold 180 degs. in the weld without fracture. Good practical welds were made at a temperature as low as cherry red. The methods, however, were impossible to imitate on a high rail section in place in the street, so that for the end in view discouragement was again the result.

Finally, it was discovered that if dies were clamped about the pieces to be welded, close to their ends, in such a way that the heated portion could be closed between them with very heavy pressure, so as to form a thin flattened collar all about the weld, excellent results could be obtained. The experiments were made on 1¼ in. square bars of six per cent carbon Bessemer steel. The strength of these welds (even with the collars cut off) invariably exceeded the strength of the normal bar and the toughness was such that the bars could be bent cold in the weld 250 degs. and over. He who doubts the value of this showing is asked to bend a cold Bessemer steel bar of the same size and per cent carbon and note the result. No heat treatment was necessary, as the pressure exerted on the metal in flattening it between the dies, left the steel in as fine grained a condition as in the rolled piece. It seemed as if it might be barely possible to put this method into actual service in the track, so efforts were then made to this end.

After some months of alternate hope and discouragement, complete success was attained and the track weld of to-day is, therefore, a high pressure butt weld of rail to rail. This is a simple enough sort of weld, it may be said, but many obstacles had to be overcome before the way was clear for its commercial application. A brief description of the making of such a weld on the street will probably be of interest.

First of all the rail ends and those portions of the side where the electrical contacts are to be placed must be cleaned. This is done by a sand blast apparatus placed on a small covered car with canvas at the end to protect passers-by from the flying sand. The apparatus consists of an air compressor, run by belt from a five horse power motor, an air chamber to prevent a fluctuating pressure and the cleaning apparatus where any clean sand can be used. The sand is blown through a hose and nozzle at a pressure of twelve pounds and in a few minutes has taken away every vestige of scale and dirt and the car passes on to the next joint.

The clean joint is now attacked by men who place about it the necessary clamps and contacts. The current is to be passed through the joint diagonally. A copper contact is, therefore, placed on the head side of one rail and another on the inside of the abutting rail. These contacts loosely fit the rail section. Directly opposite each contact are placed steel chocks of the same shape. These contacts, after serving their electrical purpose, must be used in conjunction with the steel chocks, as the dies before described. They must therefore be pushed toward each other when the pressure is put into the hot metal. To this end small pieces are bolted through the splice bar holes of the rail behind the contacts and chocks, so that as the rail moves, the dies will move with it, flattening the hot metal between them. Above and below the rail are now placed clamps, the upper one to prevent undue distortion of the head of the rail, the lower one to prevent the flanges from losing electrical contact with the copper contacts by buckling when warm.

Tests have shown that this joint is much stronger and tougher than any continuous rail joint ever before attempted. With apparatus new, incomplete, and unfamiliar to the operators, some striking figures have been obtained. Welds have been made of 6 in. rails, which could not be broken at the limit, 400,000 lbs., of the testing machine in which they were pulled. It was shown conclusively that 350,000 lbs. could be considered the minimum strength of a complete weld. It is unquestioned in the writer's mind that by the time all apparatus has been completed and men are trained to the work, nineteen welds out of every twenty made commercially will stand from 400,000 lbs. to 600,000 lbs. tensile strain. These welds when fractured show the same small grain which is found in the rolled section and the value of this will be readily appreciated by anyone familiar with the characteristics of steel. Compare with the above figures the highest strain to which the track will be subjected—157,500 lbs.

Cast iron joints, so far the only competitor of electric welding, have proved themselves to have merit and have given good value to the street railroad manager, but their adherents will hardly claim theoretical perfection for them. They have had, in commercial use, a somewhat smaller percentage of breaks than the electrically welded joints of the past, and yet the strength of the old electric welds was generally much above that of the cast iron. This is because the casting process is a comparatively simple one, similar in its operations to well known foundry practice. The electric welding has been almost in the nature of pioneering. There was little literature to guide the manager, and there were no operators to whom the work had been a trade. Yet the work required skill and a comprehensive grasp of its technique. It had to depend upon electrical power—often fickle and variable. It had also, let it be acknowledged, to pin its faith to steel made more or less brittle by overheating, which might part occasionally under ridiculously light loads.

Such has been the past, but such is not the outlook. With the pressure butt weld, overheating is not to be feared; lack of uniformity is no longer a danger. Given the pressure, the requisite heat and good common sense knowledge of the work, and the result must be an evenly strong and tough product.

Much more can be said on the strength question, but there are other questions to be considered in determining what sort of continuous rail is the best, some of which are of even greater importance. Already the danger from breakage has been treated at too great length, because hitherto it has been the worst foe of track welding.

The ideal track must be absolutely smooth at the joints and must stay smooth. Nothing can meet this qualification as can the pressure butt weld. The metal is the same there as at any other portion of the rail and the pressure given it corresponds so closely to that of rolling that the hardness of the steel is practically the same. There is but one precaution necessary and that is to smooth off the bulge made by upsetting. This bulge, by the way, is useful, for in case the track to be welded is old and already low at the joints, the bulging fills the lower portions to the proper level. A straight edge laid on the joint with this weld should, and does, fit neatly.

It is probable that the most important requisite for an ideal track is that the electrical resistance must be no greater at the joint than at any other part of the rail and that the process of time must not, either by electrolytic or mechanical action, increase this resistance appreciably. There is one deterioration, and but one, to which an electrically welded joint may be subject. This is breakage across its entire section. If this should happen it is known at once and the joint can be repaired and, if necessary, bonded. Outside of this the butt weld is an absolutely ideal bond. On account of the upset which it receives when the weld is made, its cross section is larger and its resistance therefore lower than any other part of the track. Being of the same metal throughout, there can be no electrolytic action.

So far the attempt to weld steam railroad track has not been made. But can one doubt that it will come? In the case of the steam road, with rails laid above ground, there must be, of course, special arrangements to prevent warping. This, however, is a mechanical problem that presents no great difficulty. The same troubles, with the

exception of the electrical ones, are present in the steam railroad construction of to-day as are found in street railway track. The inevitable tendency, therefore, will be toward a continuous rail.

In the firm belief that the passenger should not be subjected to the jolting he receives to-day, that streets should not be excavated at short intervals merely to lessen the evil of low joints, that equipments should not be allowed to pound themselves to pieces on a rough track, that power should not be thrown away and water and gas pipes destroyed by the weakness inevitable with copper bonds, and, finally, that a pressure weld of rail to rail is the one simple, obvious and perfect method of stamping out these difficulties, this article has been written. And it is not only the merits of the electrically welded track which force the belief that present troubles will ultimately find their resting place in it, but also because it must be more economical than any other method of connecting rails.

A Novel Electric Railway in Fairmount Park, Philadelphia.

One of the most novel electric railways in the country, that in Fairmount Park, Philadelphia, Pa., was opened on Nov. 10. It is the new road of the Fairmount Park Transportation Company, and runs entirely within Philadelphia's famous park. The idea of putting a railway into a public park was a novel one, and so at variance with the park idea that the way in which the project has been carried out without a great destruction of the natural scenery and an incongruous mingling of the railway and the beauties of nature is of considerable interest.

The idea of the road was suggested by the fact that, on account of the enormous size of the park but few persons ever had time to penetrate the most beautiful portions which lie at miles distant from those points where the street railway cars discharge their passengers. The park is among the largest in the world, extending for miles along the banks of the Schuylkill and embracing about fifty square miles of country.

The line of the road was laid out to penetrate some of the most distant and unknown portions of the park and make a great loop, so that passengers would be able to reach all portions from the different stations. The park commissioners had the good sense to make several demands upon the engineers in regard to grades which have resulted in almost completely hiding the permanent way from the eye of the visitor who rides in a carriage, or who rambles across the lawns and through the woods.

On reaching the park the visitor's first surprise is to find the cars standing in the edge of the lawn with almost nothing suggesting a railway in sight. There is, it is true, the usual overhead work, but on the ground, instead of the roadbed and ties, only two railheads are seen stretching away through the grass. The greensward stretches smoothly into the shallow ditches and across the roadbed without a break, covering ballast and ties completely from sight. From one end of the park to the other there is no grade crossing of even a foot path. The line dips sharply under many of the carriage ways, giving one a feeling of going down into the ground; it winds along valleys, clings to the hillsides, follows up and down ravines, and is as utterly unobtrusive as two lines of iron could be on the landscape. Conforming so closely to the contour of the land and having so many steep grades and sharp curves there are few embankments or cuttings that are even noticeable features in the landscape until one is close upon them.

Out of sight under the smooth sod, however, is an excellent roadbed. The metal is a T rail, 90 lbs. to the yard, and the ballast is of broken stone, with ties spaced 24 ins. centers. Although just finished the surface of the line is exceedingly perfect, and it strikes one as a sensible feature that the rails have been laid so as to give the wheels a full bearing across the whole width of the head.

The equipment of this road, which consists of sixty cars, was furnished by the J. G. Brill Company. Fifty are of the 38 ft. open type, 8 ft. wide, seating seventy-two persons, and ten of the 32 ft. closed type, 8 ft. wide over sills, seating forty-four persons. The cars are all mounted upon Brill Perfect trucks, style B. They are all designed to take a 60 ft. radius curve with ease. The cars are all fitted with Sterling brakes, and the company is putting on electric brakes which are not yet in operation. The platforms are flush, the timbers extending directly through. This is possible as passengers are picked up only at stations. At present half the cars will be operated as trailers, the motors (G. E. 1000, four to a car) being ample for the purpose.

A noticeable feature of the equipment is the ease with which the cars ride the curves. To the passenger there is no jolt nor side swing upon passing the sharp curves, but merely a smooth change in the direction of motion. In the long curves or tangents the car runs so smoothly that walking or standing is as easy as upon the earth. The starting of the cars is much more of a shock than the entrance upon a curve. To sum up, the cars seem to ride more easily and with less side motion than the cars on any steam roads in the country. In the short radius curves the side motion is practically inappreciable.

The car house of the road is in a ravine and is almost entirely concealed by trees. The building itself is sunk ten feet in the ground so that the roof is but little above the surrounding surface At the end where the building looks out toward the river a tremendous bank of earth has been raised thirty or forty feet high upon the outside. It contains perhaps 20,000 cu. yds. and not only is a safeguard against the possible escape of a car if it should break through the wall of the building, but completely hides the structure from the river. This building also contains rooms for offices and will have space for shops, etc. It is a handsome brick structure quite as creditable as many of those already erected for ornamental purposes within the park.

A short distance below the car house is situated the engine and boiler house. This building is also much below the surrounding level and from a little distance is entirely hidden from sight by the tree covered banks. The stack is only as high as the roof of the house itself. The boilers are vertical, Berry pattern, made by Wetherill, and the house is so arranged that the cars can be run directly over the roof of the fire room and discharge the coal in front of the boilers. There is no wheeling of coal necessary. American economizers are used. The ashes are taken out—or will be—by a conveyor.

On the side of the house next the river is the engine room. This is light and handsome and has space for five engines. There are now two engines in place and in operation, one is being erected and the foundations are ready for a fourth. The engines are of Corliss type, tandem compound, and were built by Robert Wetherill. The engines run at 90 r. p. m. and generate 750 h. p. each. Each engine is directly connected to 500 k. w. General Electric generators, 910 amperes. On a recent Sunday when some 36,000 passengers were carried, one engine easily furnished all the power needed.

The whole floor of the engine room is commanded by a Sellers traveling crane, the bridge of which has a capacity of twenty tons. On it are a pair of electric trolleys, each of which can lift fifteen tons. The engines are low pressure, and discharge steam into a Blake condenser. The water for boilers and condensers is drawn from the Schuylkill, the boiler house being so low as to bring the water within reach of the suction pipes.

The power house is at the present moment in an unfinished condition inside, and even the exterior is by no means complete. It can easily be seen that it will be a very handsome structure. It is of brick, but from its location will escape the attention of park visitors.

The stonework of bridges, buildings and retaining walls is most beautiful and solid. The bridges are of a great variety of styles. Some are of iron, a few of stone, others of stone and brick combined. One skew arch is particularly interesting to the engineer. A bridge is in progress across the Schuylkill. When it is finished the road will cross the river and form a main line of connection between two sections of Philadelphia, which are now almost entirely cut off from each other by the intervention of the park.

The road is run as a loop. The cars run in one direction only. For a short distance at the lower or Philadelphia end the tracks lie parallel, but for the remainder of the distance they are widely separated. There are numerous platforms at various points of interest and at places where visitors most easily reach the railroad. The whole line will be enclosed by a wire fence of twisted flat steel.

The scenery along the line is, even at this season of the year, magnificent. Some portions of the line are much higher than the famous Belmont. The whole line has been so planned that the most inaccessible portions of this beautiful pleasure ground will be easily reached from the different stations. The opening of the Schuylkill bridge will also open a section of the park which is now rarely visited by pedestrians.

From the steady patronage which the road has had at this late season of the year it appears evident that the traffic at the opening of the season will be very large. By its charter it must run from the first of May to the end of November of each year. The opening so late in the year was for the purpose of having the whole equipment in running order for the opening of the season in 1897.

Extensive Electric Railway in Germany.

The Upper-Silesian Steam Railway, which passes through the whole industrial district of Upper-Silesia, Germany, has determined to equip its entire line with electric locomotives in place of steam power, which is now used.

The electric traction will be introduced at first on the lines running through Gleiwitz, Zabrze, Königshütte, Beuthen, Deutsch Piekar, and on the Königshütte, Kattowitz, Laurahütte, Königshütte line. For these two lines thirty motor cars and a corresponding number of trailers will be provided. The freight trains, as well as the passenger trains, will be operated by electricity.

The cars will be mounted on two swivel trucks of 785 mm. gauge. Each of the four axles will be driven by an 18-20 h. p. motor. Walker apparatus will be used. The motors will make 315 r. p. m. when running at five miles per hour. Four motors will be used on each car, with a No. 4 motor controller at each end. 120 motors will be required. The gauge mentioned in English dimensions is thirty-one inches, and to mount the motors in the usual way a special design was required.

The contractors are Felix Singer & Company, of Berlin, and the whole length of both lines is about 20½ miles.

Electric Traction Under Steam Railway Conditions.

At the 109th meeting of the American Institute of Electrical Engineers, held in New York, Oct. 21, and in Chicago, Oct. 28, a topical discussion on the subject of "Electric Traction Under Steam Railway Conditions" was held, and was participated in by a large number of members.

Dr. Charles E. Emery opened the discussion with the results of a careful investigation made by him upon the general subject, stating at the outset that there is no question that electric traction under steam railway conditions is feasible, the real problem being whether or not it will pay. Present applications of electricity in this larger field prove the former proposition, but not the latter. The greatest practical efficiency of an electric system between the engines at the central station and the rails would be sixty per cent, and the probable actual efficiency not more than fifty per cent. One horse power in the central station can be developed for 2 lbs. of cheap coal, equivalent to 4 lbs. per net horse power at the locomotive, which would compare with an average of 6 lbs. required by the ordinary steam passenger locomotive of to-day. The saving in coal due to electric passenger traction will therefore be one-third the present expenditure, but the saving in cost of coal, on account of the possibility of using poorer qualities in the central station than are necessary with the locomotive, would be fifty per cent. For freight engines there would be a somewhat greater saving, calculated by Dr. Emery at 55 per cent, and for switching engines there would be a saving of 66⅔ per cent.

For railroads running through a coal region the total cost of coal is about 9 per cent of the total operating expenses, so that the proposed saving is equivalent to, roughly, 5 per cent of the entire operating expenses. As electric locomotives will necessarily be as heavy as steam, the only saving in train weight would be that of the tender. Another saving would be made in doing away with water. Considerable savings have been claimed for electricity on other grounds, such as in repairs to locomotives, labor in operating them, weight and cost of locomotives, particularly when applied under a car, repairs to track and bridges, etc., but in Dr. Emery's opinion any savings along these lines would be compensated by other elements of expense, so that taking all things into account, the net direct saving would not exceed 6.56 per cent.

Dr. Emery presented the results of careful calculations based on the operating expenses of a railway system comprising nearly 2700 miles of road and operating 1800 motors. The net locomotive horse power required for operating this road was estimated at 140,000 h.p. considered as continuously operated, and power station requirements become therefore, 280,000 h. p. All the freight, passenger and switching engines in service were assumed to be distributed evenly over the road, and no special requirements for suburban service were taken into account—this in order to make it possible to use the actual averages given in the railroad report. By this generalization the trains were assumed as separated about 7½ miles, independent of direction over the whole length of the road for every hour in the year. The generating plants and transmission lines were worked out on the basis of 150 h. p. per mile, which exceeds the estimated average by 44 h. p., the excess being made in order to provide for concentration which would inevitably occur. Each train is estimated to require an average of 400 h. p. on the track, and 800 h. p. at the station. To obtain the economy due to fairly large stations, they are assumed to be placed forty-five miles apart, while at the two intermediate points transformers and rotary converters are located so that the feeders are supplied at every fifteen miles.

It is assumed that 6750 h. p. is installed at each main station, and 2250 h. p. at each substation. To avoid overestimates the cost of horse power per steam and electric plant at main stations is assumed as only $80 per horse power, with $20,000 for buildings, and for apparatus in the substations, $10 per horse power, and $10 200 for building and the copper in the high tension lines. The low tension copper is worked out on the basis that half way between the main and substation, two trains may meet each requiring 1000 h. p., and that a uniform section of copper sufficient to carry 7½ miles the current required required for half this power at an original tension of 700 volts, and a drop of twenty per cent would be ample for the whole length of the low tension lines. On this basis the cost for copper at thirteen cents per pound for the low tension conductors will be $12,386 per mile of road, and the cost of pole line and bonds in main track for return current will be $5000 per mile of road, while the total cost of the electric generating and transmission plant will be $31,057 per mile, the annual interest on which at five per cent is $1553 per mile. If the service of the 1800 steam locomotives can be furnished by 1500 new electric locomotives at $10,000 each, the cost will be equivalent to $5556 per mile of road, requiring $278 annual interest per mile, so that the total interest on steam and electrical plants, including locomotives, will be $1831 per mile.

The operating expenses of the stations for 365 days and twenty-four hours per day is $28.59 per average main station horse power per year, including repairs, insurance, taxes, and renewals, but excluding coal and interest (for reasons presently to be seen). This figure is equivalent to $3031 per mile of road, and the total extra expenses for the electrical equipment, including interest, thus become $4862 per mile of road. Now the operating expenses of the road using steam amounted to $15,187 per mile. Of this, as previously stated, 6.56 per cent or $996 per mile would be saved in coal consumption by the use of electricity, while $4862 per mile would be added for extra operating expenses and interest on electric plant, so that the net additional expense entailed by the use of electricity as a substitute for steam, is $3866 per mile per year.

On the basis of operating expenses at fifty per cent of the gross receipts, Dr. Emery finally concludes that the gross receipts must be increased 12.75 per cent by the introduction of electricity over the whole length of the line in order that the road may pay the same dividends as before. He does not believe it probable that this increase will take place over the whole length of a 2700 mile trunk line, but he does believe that within the radius of suburban traffic such an increase is not only probable, but the cost of operation may be expected to be reduced in greater proportion than stated, so that the application of electric traction will pay from the outset, while these considerations will apply to even longer distances on railroads like the New York, New Haven & Hartford where the passenger business furnishes the larger proportion of the income.

It will also be possible to make a better showing for electricity if high tension transmission is used throughout, but even with a 10,000 volt system the saving would be but $486 per annum in interest, and the gross receipts would have to be increased 10.2 per cent instead of 12.75 per cent. Dr. Emery predicts that the high speed electric locomotive of the future will, like the steam locomotive, be a structure independent of the train, that the motors will be hung on a frame independent of the driving wheels, and the motors as well as the driving wheels will be connected by side rods. To obtain proper room under such conditions, larger driving wheels will be employed than the wheels of an ordinary car. This will so extend the wheel base that it will not be safe to run at high speeds without a leading truck similar to that of an ordinary locomotive, and in fact the electric locomotive will in all its general features be a steam locomotive without the boiler with motors substituted for the steam cylinders. In this way, and probably in no other can the flexibility of the present steam locomotive be obtained.

Dr. Emery concludes that on the whole, although the application to the whole length of long trunk lines does not seem practicable under present conditions, there is no doubt but that the industry will grow in the future as certainly as in the past.

Charles K. Stearns sent a communication giving some of the results obtained by the Nantasket Beach electric line of the New York, New Haven & Hartford Railroad. The following table, though incomplete, gives some idea of the operation of the electric station during July, 1895 and 1896.

	JULY, 1895.	JULY, 1896.
Hours run	605⅓	546¼
*Average electric horse power per hour	245	349 1/10
Pounds coal burned	629,575	571,100
Coal per electric horse power hour	4.24	2.99
Average trains per day	148.1	68
Average cars per train	2.1	2
Maximum cars per train	7	2
Train miles	32,803	44,173
Passengers	267,143	
Tons passengers	18,700	
Tons, dead load	162,089	
Tons total load	180,789	
Per cent paying load to dead load	10.2	

*During July, 1895, power was furnished by the station to operate the Hull Street Railway,, the average of which was 30 h p. by a separate wattmeter. Consequently, the average power for the railroad was 215 h. p. 349 h. p. in 1896 includes about 40 h. p. furnished the Braintree & Weymouth Street Railway, so that the power for the railroad amounts to 309 h. p.

Mr. Stearns does not consider the present arrangement of the third rail as satisfactory, particularly at night when the different crossings are emphasized by darkness in the cars, the third rail being cut out at all crossings, and the cars passing over them by their own momentum. The third rail is now laid alive the entire length, and the danger to careless persons coming in contact with it is considerable, although legally the public is not allowed on the right of way and probably has no recourse. It seems advisable to adopt a system where the conductor, if of the third rail type, is alive at points only where it is actually used, or, at least, to divide the line into blocks, so that one train only will be in a block at a time. Another objection to the present installation is the connection by lead covered cables between the ends of the rails at crossings and stations which brings about an unnecessary surface leakage from the rail to the lead covering.

The insulation resistance in 1895 was 140 ohms and the average leakage 4.7 amperes. The line consists of 577 Georgia pine poles, the trolley wire being fastened to angle iron cross arms which are bolted to the poles by two ¾ in. through bolts. No insulators were used. No information has been obtained regarding the leakage under varying weather conditions on the third rail which is carried on 3500 points of support.

The 6.86 miles of double track are equipped with overhead trolley wire and 3.64 miles of double track in addition is equipped with the third rail.

Charles H. Davis discussed in a communication the various features of the general problem, his conclusions being that for long lines infrequent service where freight is a large proportion of the business and where centers of population are far apart, the steam locomotive is the only paying method of today, as the first cost will be less as well as the total expenses.

H. Ward Leonard criticized some points in Dr. Emery's remarks, particularly that of the cost of conductors for the low tension portion of the system which seemed to be excessive. The al-

ternating current should be used for the transmission system and continuous currents for the propulsion of motors. Mr. Leonard gave some information regarding the Heilmann locomotive, concerning which he stated that the expected efficiency at sixty miles per hour was forty-seven per cent between drawbar pull and indicated horse power in the cylinder. In obtaining this efficiency ninety per cent is assumed for the engine, ninety-five per cent for the generators, ninety-eight per cent for the conductors (in the locomotive itself), and ninety per cent for the motors.

George S. Strong criticized Dr. Emery's statement that 6 lbs. of coal is the average requirement for a steam locomotive, and said that Mr. Westinghouse had given it as high as 8 lbs. He himself had tested a number of locomotives that ran as low as 3 lbs. and has today a locomotive built and ready to run on which he is prepared to guarantee a horse power for 2 lbs.

Much energy is wasted, he said, in the locomotives of today. On some roads it is the regular practice to burn 225 lbs. of coal per square foot of area, an entirely unnecessary and wasteful custom. Locomotive boilers are running today in this country which are giving ten pounds evaporation from a temperature of 212 degs., and there is no trouble in getting this temperature for feedwater on a locomotive. There are abundant ways of using exhaust steam to give it, and locomotives are running in regular service that are giving a horse power on twenty pounds of water. This efficiency is very close to that of the best stationary engines, and the saving in the use of electricity referred to by Dr. Emery does not seem borne out by facts. Moreover, steam railroads are not spending money on experiments, nor making investments to save operating expenses, as they care less about efficiency than about immediate expenditures.

The best locomotive engines of to-day will do their work with the lowest grade of coal which can be bought in the market, they make no smoke, throw no cinders, and make no sound from the exhaust, they meet all the conditions and requirements that an electric locomotive could do, the only advantage that the latter possesses being that it would give an even pull on the drawbar, an even pressure on the rail, and would not throw any cinders or make any smoke. Such a locomotive engine could be built for $12,000, and would give 2000 i. h. p., and is able to take, for example, an eight car train over 200 or 300 miles at an average of 61½ miles an hour for the whole distance, including eight stops and five slow-downs.

A. E. Kennelly said that if economy were the only factor in passenger transportation, the great Atlantic steamers would not increase their expenses every year by putting more and more horse power on board ships, and if it can be demonstrated that an electric locomotive can safely carry passengers at 100 or 120 miles per hour, there is a large field open for it on the lines of high speed. Steam railroad schedules have improved very little during the last twenty years, and cannot probably be further increased to any great extent.

C. F. Uebelacker referred to some features of coal and power transmission from the coal fields to manufacturing centers as having a bearing on the transportation problem, and believed that in the storage battery will be found the solution of many transmission and transportation questions in the larger field of work.

Elias E. Ries said that on the elevated railroads of New York and other large cities, the substitution of electricity for steam locomotives ought to commence immediately, as the conditions were ideal for economy and superiority of service. We are not at present, generally speaking, in a condition to compete, commercially, with the steam locomotive in long distance or trunk line roads. There is an important element of economy in coal consumption, but this is compensated for by other items of expense. The limits of the substitution of electricity for steam will not, however, have been reached when the elevated roads and the short interurban surface lines are equipped, but with the development of higher transmitting electromotive forces and more simple methods of conversion than those which are now practicable to be used, we shall be in a position to attack the problem of general electric locomotion on trunk line roads.

Considering the problem of the New York elevated railroad system, Mr. Ries thinks that the distance of transmission is so small that no alternating or converting currents of any type are necessary, and that a 600 volt direct current would do the work. It would be desirable to supplement the direct line distribution by means of secondary batteries of comparatively moderate capacity carried permanently in the locomotives of the trains. It has been estimated that of the total amount of energy developed by the steam locomotives on the Third Avenue railway, fifty-nine per cent of the power expended on a round trip is used in starting, twenty-four per cent in lifting, and only seventeen per cent in traction. That means that eighty-three per cent of the total power expended is consumed on account of stoppages and grades of which nothing is recovered, but, on the contrary, the waste is augmented by the further use of steam to apply the brakes. It is within the power of electricity to save a very large proportion of this wasted energy by the use of storage batteries which would be charged on down grades or in approaching stations and would also save as a braking power in operation.

F. W. Darlington stated that the storage battery experiment on the Third Avenue elevated road would not produce any results of value in considering trunk line work. On the elevated roads the trains run on momentum part of the time, and part of the time they are accelerating their speed as rapidly as possible. This is quite different from steam railroad conditions where power is put on and stays on during an entire run over a section. This power requirement has been found to be nearly constant after speed is once attained even if there are considerable grades. One important factor in the problem of steam versus electricity is found in the necessity of getting up speed rapidly. On the Mount Holly branch of the Pennsylvania Railroad, results have been attained in accelerating trains by electric locomotives which could not be duplicated by any steam locomotive on that division of the Pennsylvania Railroad.

The discussion in Chicago was carried on by Messrs. H. M. Brinckerhoff, Professor Stine. M. Coster, W. D. Ball, J. R. Cravath, C. L. Brown, and Rugg, and a number of interesting features were brought out.

Limiting Grades for Adhesion.

F. Denizet, in a recent issue of *Annales des Ponts et Chaussées*, discusses the limits of grades that can be ascended and safely descended by motor cars which depend upon the contact between the wheels and rails for adhesion. The article is abstracted in the current publication of the Institution of Civil Engineers of London, from which the following is taken:

With the introduction of the system of overhead-wire electric traction, the gradients on which adhesion railways are constructed have increased considerably, and in America inclines of eight per cent are now common, while for short distances gradients of twelve per cent are not unknown. This M. Denizet ascribes to two causes: first, to the gain in tractive power obtained by the use of motor cars; and secondly, to the reduced dead weight of the motive apparatus. If P be the dead weight of the motor car, and p the useful weight, v, the speed; i, the grade; k, the relation between the power of the motor and the dead weight P and K, a constant, the author gives the formula:

$$\frac{P}{p} = \frac{k v i}{K - k v i} \quad \text{(i.)}$$

from which he concludes that if k can be reduced, either v or i can can be proportionately increased; that is to say, a steeper gradient can be ascended at the given speed, or the given gradient climbed at an increased speed.

M. Denizet, however, devotes most of his attention to the consideration of the limit of gradient that can be safely descended. In his opinion, cars on an urban railway should be always capable of stopping within a length of not more than thirty-three feet. While admitting that with shoe brakes or by reversing lhe motors a somewhat better effect can be obtained than with slipper-brakes bearing on the rails, he considers it safe to take all methods of braking as ultimately equivalent to sliding the car on the rails. He then obtains the following equation for the length, E, traversed by the car after the brakes are applied, and before coming to rest:

$$E = \frac{b^2 \sqrt{1 + i^2}}{2g\,(f - i)} \quad \text{(ii.)}$$

where b = the velocity at the moment that the brakes are applied;
f = the coefficient of friction between the brakes and the rail;
g = the acceleration of gravitation;
i = the grade (the tangent of the inclination to the horizon).

And from this, assuming $f = 0.14$, he obtains the following safe speeds:

3¾ miles per hour down a grade of 12 per cent.
5 " " " " 10 "
6¼ " " " " 8 "

He discusses the possible value of f, but concludes that it should not be assumed higher than 0.14.

The conclusions arrived at are that with gradients steeper than five per cent:

1. The brakes should be of quick action and strong construction.
2. They should be in duplicate, in case of the failure of one.
3. The rails should be kept as clean and dry as possible, and sanding apparatus should be provided.

With these precautions the following speeds are perfectly safe:

5 miles an hour on a 6 per cent grade from 1650 ft. to 1970 ft. long.
3¾ " " " 8 " " " 660 " 980 "
2½ " " " 10 " " " 330 " 450 "

On steeper gradients the author recommends the employment of cable or rack in preference to adhesion, while on longer grades he thinks the car should be brought to rest at intervals not greater than 1650 ft., 660 ft. and 330 ft. on grades of six per cent, eight per cent and ten per cent respectively.

Electric Locomotives on the Brooklyn Bridge.

The electric locomotives recently installed for switching purposes on the Brooklyn Bridge are giving excellent results. The new cars push a load of 150 tons, and attain a speed of ten miles an hour in about 200 ft. The time required to transfer a train is thirty-five seconds, which is considerably better than that of the former steam motor cars.

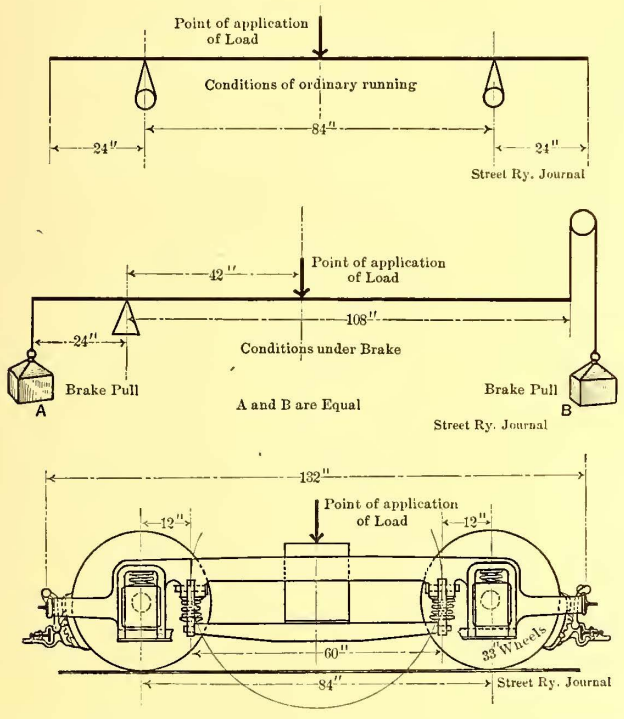
At a citizens' meeting held in Torrington, Conn., recently, to promote the interests of an electric railway between Torrington and Winsted, a committee consisting of O. R. Tyler, James Alldis, Thomas W. Bryant, W. S. Lewis and F. F. Fuessenich was appointed to make surveys for the road, and apply to the Legislature for a charter.

SCIENCE · ENGINEERING · INVENTION ·

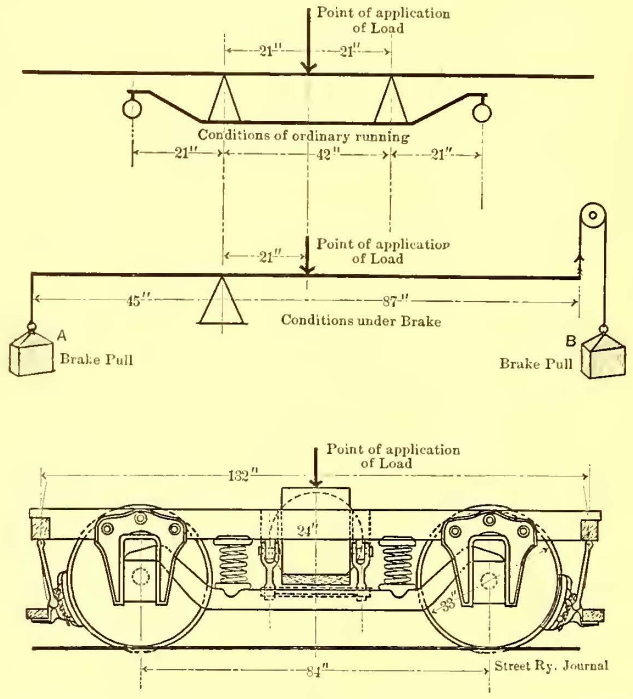
The Brill No. 27 Truck.

By W. E. Partridge.

The actual experience which has been gained during the last fifteen months with the Brill No. 27 truck shows that it has very many valuable features which were not anticipated when its principles first underwent analysis. As compared with the ordinary swing beam, equalized passenger trnck, it shows very marked and decided advantages. As all steam railroad men know, the ordinary pivotal passenger truck is the result of long and careful experimentation, and has been considered the most efficient carriage for carrying the end of a car that has yet been devised. How many were its advantages and how greatly it could be improved upon had not been understood or even dreamed of until the introduction of the No. 27 truck. The ease of riding on tangents and the freedom from swing when taking curves were points that were demonstrated when the new truck first went into service. In some fifteen months of use the first pair of trucks sent out have a record of having never left the rails. Thirty trucks which have now been running for nearly six months have shown a similar record, while on the same road ordinary pivotal trucks have left the rails repeatedly. The reason for this derailment is not far to seek, since the road runs its cars very fast, and on account of entering a town at one end and a city at the other, is obliged to use narrow flanges and very narrow treads to avoid the paving which projects above the tram rails. An analysis of the construction of the No. 27 truck shows why it sticks to the rails so persistently, and also develops weak points in the ordinary passenger truck which have never before been even suspected.



FIGS. 1–3.—NO. 27 TRUCK UNDER OPERATING CONDITIONS.



FIGS. 4–6.—M. C. B. TRUCK UNDER OPERATING CONDITIONS.

The new truck also proves itself extremely steady under the action of the brake. The ordinary kicking up, or lifting one end of the truck frame while the opposite end drops, accompanied by a chattering of the brake shoes and an exceedingly uncomfortable jerking during the stops, is entirely removed with the No. 27 truck. In fact, it does away with what has long been recognized as the weak point of all equalized pivotal trucks, whether running on steam, street or elevated roads.

The accompanying diagrams show the constructive features of the two kinds of trucks, Figs. 1, 2 and 3 belonging to the No. 27 or "perfect truck," and 4, 5 and 6 being the ordinary Master Car Builders' standard four wheel truck. Figs. 1 and 4 show the conditions of ordinary running in the two types, the triangles representing the positions of the springs, and the small circles the journals. In Fig. 4 the springs are seen to be in the center of the equalizing bar, with the journals at the outer end. The journals in rising, therefore, go contrary to the ordinary theory, and by compressing the spring, shirk the load, the ratio of leverage between the spring, the journal and the center of the truck being as one to one. The spring virtually has to carry the load at the outer end of a lever. It is, in fact, in the precise condition of a spring in a testing machine. The outer end of the lever can rise and fall with a comparatively weak impulse, and at the same time put a very large stress upon the spring. Referring to Fig. 1 we find that the load rests directly over the journals, and the rise and fall of the journal interposes no leverage between the journal and the spring which carries the load. The difference in action between these two is that in the ordinary truck the wheel may rise, as at a joint, frog or switch-point, and for the instant be free from the full pressure of the load. This being the case, any side strain or side motion can easily deflect it and throw it off from the rail. In other words, it being controlled by leverage rather than directly by the load itself, there are moments when it is much more susceptible to a side motion than it would be if it carried the load upon the spring directly over the journal bearing. In running around curves, the natural jumping of the truck may leave the wheel for an instant without the pressure of the load upon it, and it can be forced sidewise by the jerking action of the body with considerable readiness.

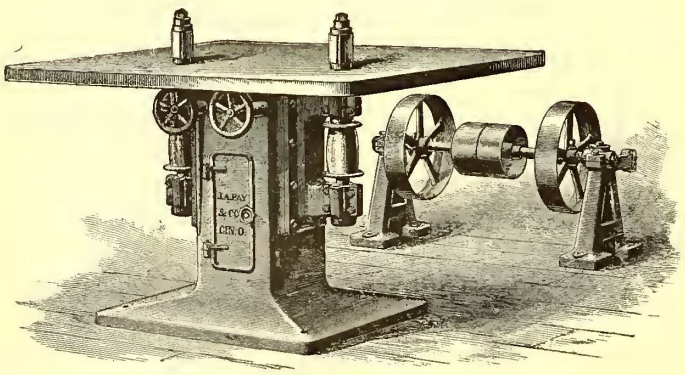
In Figs. 2 and 5 we have an illustration of the lever action of the two trucks under the influences of the brakes. The weights A and B are supposed to represent the respective forces exerted by the brake on the two ends of the truck, B being shown acting over a pulley to represent the upward thrust, while A is downward, the truck, of course, running in the direction from B to A. It will be understood that both trucks are drawn to the same scale, having the usual wheel base of a steam road, namely 7 ft. Under these conditions, in the "perfect," or No. 27 truck, the downward pull of the brake where it catches most powerfully under the wheels gives a

leverage of 24 ins. against 42 ins. This is nearly two to one against any tilting action. At the other end the upward lift is 108 ins. against 42 ins., somewhat more favorable to the tilting of the truck than at the other end, but a very great improvement over the ordinary passenger truck, as illustrated in Fig. 5. Here the downward pull has a leverage in its favor of 45 ins. against 21 ins., the pressure on the spring being almost double that which the downward action of the brake exercises on the forward end of the truck. At the rear of the truck it is quite as bad. The upward pull acts on a lever 87 ins. long with the load 21 ins. from the fulcrum. The longitudinal steadiness of the two trucks is very well represented by the circles drawn through the links, shown in Figs. 3 and 6. In one case the links supporting the load are spread 60 ins. to the center lines, being but 12 ins. inside the center lines of the journal lines themselves. In the other case, the spread of the links is but 24 ins. These dimensions explain the great difference in the behavior of the two trucks both when running and under the brakes. In the Perfect, or No. 27 truck, the load is always directly upon the springs and so upon the wheels, without giving the wheels an opportunity through the medium of leverage to throw an undue weight upon the springs and at the same time to prevent them lifting.

One of the remarkable features which is of special advantage and interest to the air brake manufacturers is the steadiness of the truck when the brakes are strongly applied. Owing to the fact that there is no tilting of the truck frame, there is no displacement of the center of gravity of the truck; consequently, the only difference in the weight brought upon the two wheels by the act of stopping is that due to the horizontal component of momentum. This, of course, is the same in all trucks. The steadiness of the truck and the fact that the brake shoes retain their normal position during the stop, makes it very much less necessary for accurate adjustment of the shoes, since they are always applied to the wheels in practically the same plane, and there is no opportunity for the leading shoe to be drawn under the wheel or the trailing shoe to be lifted unduly above its normal position.

Double Spindle Edge Moulding and Shaping Machine.

The machine illustrated herewith has recently been brought out by J. A Fay & Company for light work and, it is thought, will prove especially convenient in repair shops. The column is of cored section cast in one piece, with bearings for the arbor gateways. The arbors are one inch in diameter above the table and run in gateways having connected bearings by which the arbors are always retained in line, and are gibbed to the sides of the column, making a very substantial and compact machine. The lower step bearing is arranged to compensate for any wear.



MOULDING AND SHAPING MACHINE.

The arbors have a vertical movement by means of the hand wheels in front, and either may be readily dropped below the line of the table. The bearings are self-oiling, and nothing has been omitted to make it the best machine of its size in use. It will work all kinds of irregular forms and warped surfaces, straight or circular mouldings, etc.

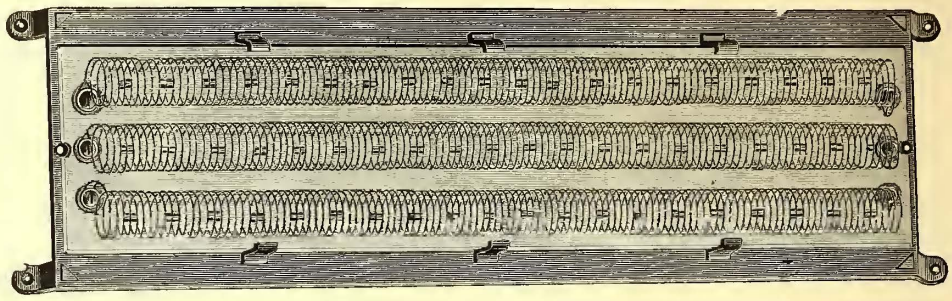
The heads are independent of the arbors, and quickly changed for different widths of cutters which are held by end pressure. The arbors are twenty-four inches apart, and carry heads three inches in diameter. A floor countershaft goes with each machine. The table is 48 ins. × 44 ins., and is made either of wood or iron as may be preferred.

The tight and loose pulleys are 8 ins. × 4 ins., and should make 900 revolutions.

THE Shelton Street Railway Company, of Shelton, Conn., may extend its lines to Bridgeport.

New Electric Heater.

Some changes have been made since last season by the Ohio Brass Company in the Warner electric heater and the engraving on this page shows the heater in its present form. In its construction two malleable iron castings are employed, one being the frame which supports the wires and which is provided with lugs for securing the heater in position, the other being the cover which protects the wires and insures a perfect draught for the heated air. The frame is skeleton in form, and has several offsets projecting from the face of it which hold in place the sheets of asbestos to which are attached the heater filaments. These are supported and held securely in position by small metal clips, which are fastened into the asbestos board at frequent intervals in such a manner that should it become desirable to replace the original coils with new ones, it



NEW ELECTRIC HEATER.

can be done without removing the clips. The filaments are of a special grade of wire, which will not oxidize readily, nor change in resistance, even when a high temperature is maintained. They are coiled in spiral shape to allow for the usual expansion and contraction due to the alternate heating and cooling of the wire. Suitable binding posts, thoroughly insulated from the frame of the heater, are placed at each end of it, into which are fastened the terminals of the heater filaments, and which provide also means for attaching the service wires. The frame of the heater as regularly made is so constructed that it can be fastened directly to the front of the seat panel by means of ordinary wood screws, but should it be desirable to attach it to the floor, or when used with cross seats, to support it beneath the seat itself, special attachments suitable for such cases will be supplied. The dimensions of the heater over all, are as follows: length, twenty-seven inches; height, seven inches; thickness, three inches.

The heating effect of the current is utilized to the fullest extent by the uninterrupted circulation of air through the heated coils, as they are mounted in such a way that no obstruction is offered to the passage of it. The entire surface of the wire being exposed also allows the air to come in contact with every part of it so that a maximum number of heat units is generated from a given amount of current. In a six heater equipment the three intensities of heat take 3, 6 and 9 amperes, at 500 volts, respectively, but the last amount is only used during the extreme cold weather for the larger sizes of cars. For a set of four heaters, 3 and 6 amperes are required respectively for the two intensities.

In a set of four heaters the filament in each heater is divided into two sections, each taking the same number or amperes, the alternate sections in all the four heaters being connected in series. The two circuits are each controlled independently of the other by an indicating switch, which shows plainly when the current is "On" and "Off." This plan allows for two different intensities of heat, and distributes it over the entire car. When six heaters are used to the set, the regulation of heat is obtained by dividing the filament in each heater into two sections, one of which allows for the passage of twice as much current as the other. A special form of controlling switch is used which brings each of the sections into circuit independently of the other, or both together in multiple.

Type C-3 Steel Motor.

The type C-3 Steel motor, illustrated, is rated at thirty horse power, and is designed to exert a horizontal effort or drawbar pull of 1000 lbs. continously, without heating or sparking at the brushes. The frame is of low carbon, cast steel, insuring maximum power for minimum weight, and the bearings for both axle and armature are contained in the same casting, insuring perfect alignment. The frame is parted through the center and suspended so as to remove the armature from below. The top and bottom of the motor frame are also separable and contain the upper and lower pole pieces, to which are securely attached the field coils, making it possible to remove either without disturbing any other part of the motor.

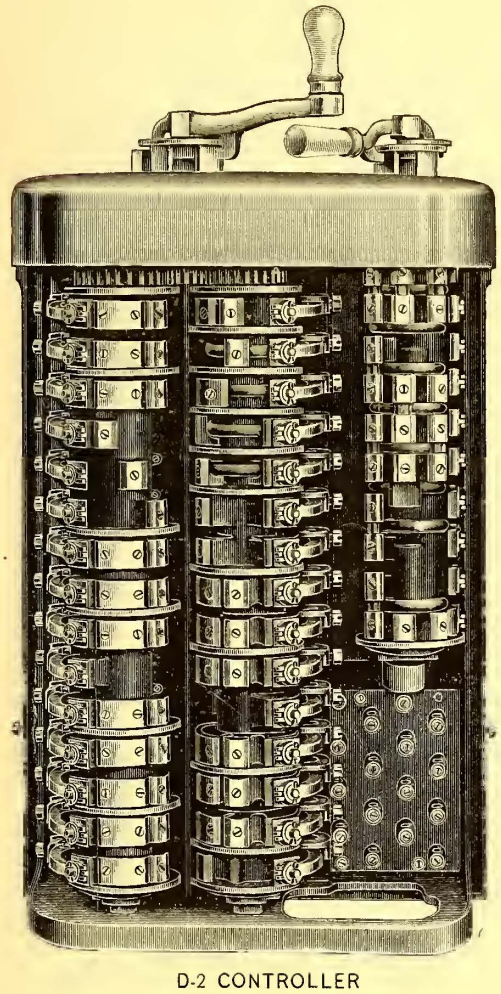
The armature core is of the drum type, is built up of thin disks of Sweede's iron, with soft steel heads, and is pierced with holes parallel with the shaft for ventilation. The shaft is of hammered steel, 3⅞ ins. in diameter, and provided with tapered seat for both commutator and pinion. The bearings are of large diameter and

great length, insuring cool running. Flanges or collars are keyed to the shaft and run in the open spaces between the motor frame and bearings. These prevent end motion of the armature and are also an extra safeguard to prevent oil or moisture from entering the motor frame. They are easily removed and replaced.

The armature winding consists of machine wound coils, thoroughly insulated by a special compound and a double layer of insulating material. The slots of core are also lined with troughs of special insulating material which ensures their easy removal no matter how long in service. The coils are laid in the slots of core, well below the surface. The balance of the slot is filled with a hard wood strip, and the whole securely bound with German silver wire.

The heads of armature are covered with canvas, thoroughly varnished to exclude moisture and dust, and a brass ventilated shield is placed on the head opposite the commutator, which effectually prevents the coils raising from centrifugal force when running at excessive speeds. The coils are placed so the heads do not interfere with the ventilation of the core.

The commutator is a malleable iron shell filled with dropped forged copper segments and insulated throughout with the best quality of India mica. The segments are locked in place by double tapered collars. The design allows the greatest wear, and eliminates all possibility of the segments becoming loosened when partially worn. The leads from the armature coils to the commutator are doubly insulated by specially prepared tubing, and are soldered into slots milled in the commutator segments. The commutator, fitting a tapered seat on the shaft, is easily removed.



D-2 CONTROLLER

The bearings of phosphor bronze are of generous dimensions. The armature bearings are provided with a boss, which fits a recess in the bearing cap, preventing all rotary movement of the bearing. This boss is tapped to receive a cap screw passing through cap, which suspends the bearings and armature in the upper half of motor.

The field coils, two in number, are wound on insulated brass spools. These spools are placed upon and fastened to the upper and lower pole pieces (the poles in the horizontal planes being induced). Damage from chafing of insulation is entirely eliminated.

The top and bottom of the motor, to which the field spools are fastened being detachable from the motor frame, either field coil can be removed independent of all other parts of the motor.

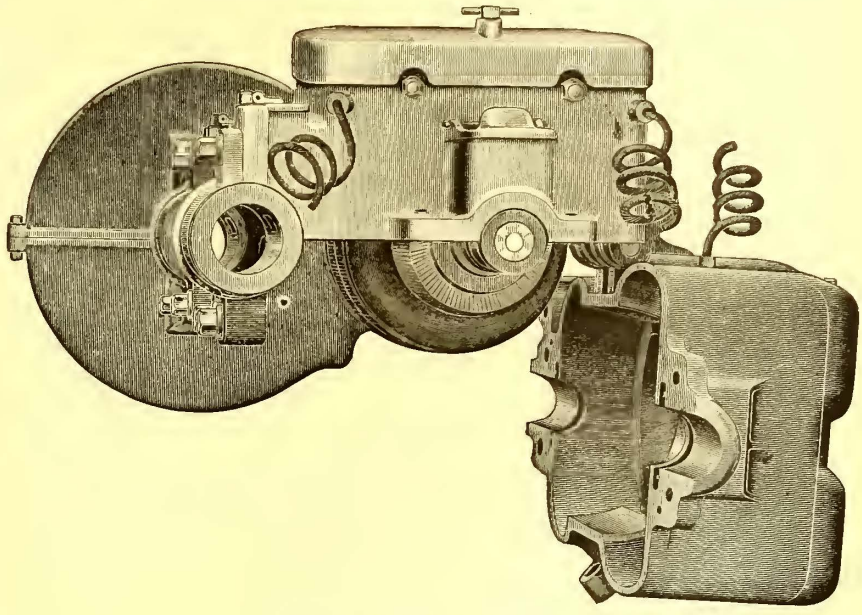
The brush holders are adjustable together or independently. The carbon brushes are 3½ ins. long and have a bearing of 2½ ins. on the commutator. The tension of the pressure spring is uniform throughout the length of feed, and the arrangement of the levers permits the hammer block to be thrown back when removing or replacing brushes.

The gear casing is of malleable iron, accurately fitted. A special feature is a small removable section, just below the pinion, which is all it is necessary to remove when taking out the armature.

The company manufactures two controllers, the type "C" and type "D-2." The former can be operated in series-multiple or multiple only. It occupies a space of 15 ins. wide, 9 ins. deep, and is 38 ins. high to the top of the drum shaft. The cylinder or drum contains fifteen contacts. Guards of vulcabeston prevent an arc forming between the contacts. The reverse switch is operated by a handle at the top of the controller, which cannot be removed except when the current is cut off. In addition to reversing the motors, a movement of the same handle to a point shown on the index, locks the controller drum, preventing its movement beyond the fourth notch or point of contact, and so changing the combination of connections that the motors are operated in either direction in multiple only.

The type "D-2" controller is of the series-multiple type, occupies a space 17 ins. wide, 11 ins. deep and is 39 ins. high to the top of the drum shaft. The cylinder or drum contains fifteen contacts, insulated from the shaft by an air gap of 1½ ins. and from each other by the overhanging flanges of the vulcabeston sections to which they are attached. The reverse switch is simple and compact and is operated by the handle on top of the controller. The cut-out switches enable either motor to be cut out of circuit. Both cannot be cut out simultaneously. The operation of either switch locks the controller cylinder, preventing it from revolving beyond the fourth contact.

Indexes are provided in both types of controller which indicate the different points of contact; both also contain a locking device which prevents the motors being reversed except by first sending the current through the proper resistance.



TYPE C-3 STEEL MOTOR.

The other sizes of motors built by the company are the type C-4 of forty horse power and type C-6 of sixty horse power.

Some Fast Running.

The Royal Blue Line trains on the Baltimore & Ohio Railroad between Washington and Philadelphia have attracted considerable attention by reason of the rapid time they make and the beauty of the equipment. No effort has been made to break any speed records, yet within the past two or three weeks some very creditable performances have been made by the new Baldwin engines, ten of which were recently purchased for service upon these trains.

The schedule time between Washington and Philadelphia is fifty-three miles per hour and the maximum obtained is seventy-five per hour, the latter speed being only maintained for short distances, and in most cases when engineers are attempting to make up lost time.

On Nov. 4, train 510, with engine 1310, hauling 4 cars, covered 96.7 miles in 124 minutes and made four stops. This train covered 61 miles in 65 minutes, including 5 minutes crossing the Susquehanna River Bridge.

On Nov. 6, train 511, with engine 849 (which, by the way, is not one of the new engines), with 4 cars, covered 25.6 miles from Aberdeen to Bay View in 24 minutes.

Probably the best performance of the month was on Nov. 15. Train 507 (the Chicago limited), with engine 1308, hauling 11 cars, the entire train, with the exception of 3 cars, being vestibuled, left Camden Station, Baltimore, at 7:04 P.M. and arrived in Washington at 7:52 P.M., being a run of 40 miles in 48 minutes. This train covered the distance between Muirkirk and Alexandria Junction, on the Washington Branch, 8.1, miles in 7 minutes. This was an exceptionally good run, when it is taken into consideration that the speed had to be slow through the cities of Baltimore and Washington, and there was one slow order on account of sewer construction.

Horizontal Water Tube Boilers.

The three illustrations given show a horizontal water tube type of boiler recently put on the market by the Aultman & Taylor Machinery Co., which is also the manufacturer of the "Cahall" vertical water tube boiler. About a year ago, finding that there were many locations where it was impossible on account of lack of space to install a vertical boiler, the managers of this company decided to build a horizontal water tube boiler in addition to the vertical.

The steam drums are of the best open hearth flanged steel, the heads for the drums being of the same material, hydraulically flanged. All the sheets are beveled on the edge and bent into shape, the rivet holes are then drilled. The performance of this work after bending insures absolutely round holes without crystallization and allows caulking of all seams both inside and out. In boilers, the working pressure of which is not to exceed 140 lbs. to the square inch the longitudinal seams in the drums are double riveted. In the higher pressure boilers, that is from 140 lbs. up to 250 lbs. pressure, all horizontal seams are butt and double strapped joints with six rows of rivets. This makes a very fine and durable joint, and when made with care produces a really fine piece of art in boiler manufacture.

Each drum has at both ends the Cahall patent swinging manhead. This manhead although a very simple device, has an important function. Engineers who for years have been annoyed with the laborious and tedious practice of taking manheads out of boilers and lifting their heavy weight to a place of safety, and then going through the great annoyance of putting them back in their places again after the work in the boiler is finished, will appreciate fully this device. By simply loosening the nuts on this manhead, a slight push swings the head in as though it were a door. It then swings back against the drum without occupying any appreciable amount of room. When the time arrives to again close it, it is pulled back to its place. Being hinged as it is, the seats come together in exactly the same place every time, and the joint being made tight once, is tight for all time, less than one minute being required to open the manhead and close it perfectly tight.

The flanges on the steam drums for the steam and safety valve openings are all dropped forged from flanged steel plates. It will also be noticed from the rear view of the boiler (Fig. 2) that the sections of tubes are connected by nipples to cross boxes or saddles on the steam drums. The material usually supplied in these cross boxes is either flanged steel plates or cast iron. Both of these, the Aultman & Taylor Machinery Company claims, have disadvantages. If made of cast iron it is difficult, it says, to have the curvature of the box conform exactly to the curvature of the drum and when they are riveted in place, the sheets in the drums are distorted, the cast

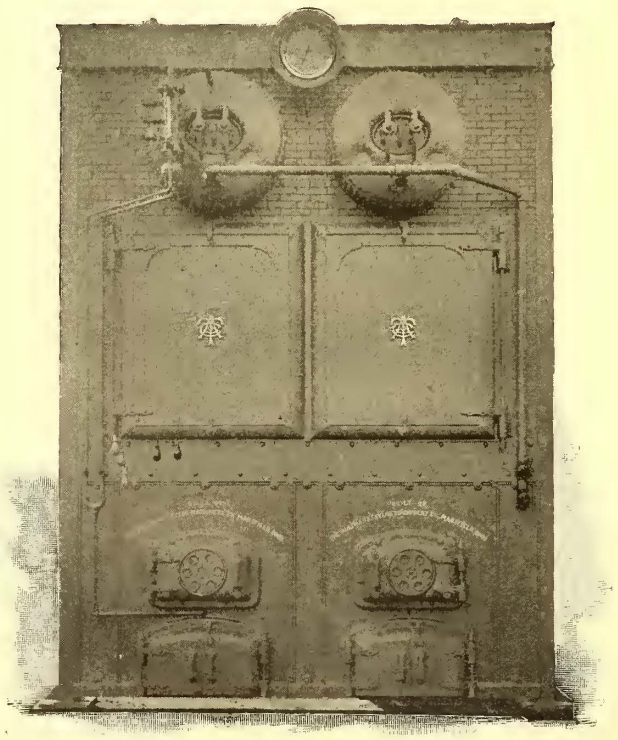


FIG. 1.—FRONT VIEW OF BOILER.

iron is cracked from the pressure, or a leaky joint is made. The trouble alleged against flanged cross boxes is that the successive heatings and applications of hydraulic pressure, by which the flat sheets are bent around sharp corners, result in a great pull or a strain upon the corners, and this reduces the thickness of the metal in places to the danger point. Moreover, at the points of the cross boxes where the nipples go in at the end, the recess inside the cross box is sometimes so shallow that it is impossible to remove a nipple after the boilers are once erected, without tearing down a portion of the brickwork. In the boiler illustrated, these cross boxes are made from open hearth steel which is melted and run into moulds, being what is technically termed "flowed steel". This steel, after cooling and annealing, is said to present all the chemical and physical properties of regular boiler plate steel, physical tests on a large number of coupons from these forms showing

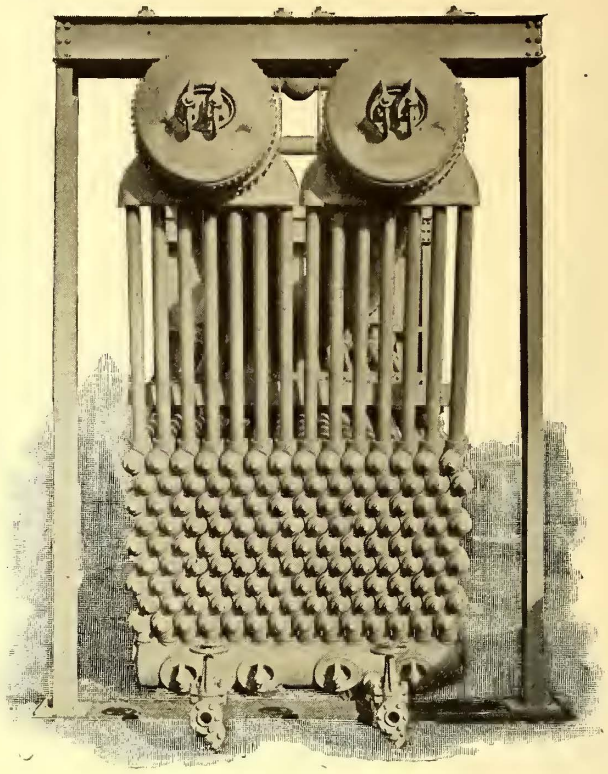


FIG. 2.—REAR END OF BOILER.

an elongation of over twenty-five per cent, a reduction in area of over fifty per cent with a tensile strength of over 60,000 lbs. to the square inch. Manufacturing the cross boxes under this process allows any thickness of metal desired at all points in the cross box where it is most desirable, and moreover, permits making sufficient depth in the cross box to make renewals or repairs, when connecting nipples without interfering with any other portion of the boiler.

The steam drums are of the best material, and great attention is paid to the workmanship, everything being done to templates and all parts fitted before the drums are even tested.

As will be seen from the illustrations, the headers or manifolds into which the tubes are expanded are of the standard sinuous type. These headers are made of a special mixture of cast iron. As the Aultman & Taylor Machinery Company has been building steam engines and other machinery requiring very intricate and delicate castings for nearly thirty years, its engineers have a thorough knowledge of the best mixtures of iron to accomplish given results. To secure best effects with these headers the mixture must be a tough, close grained iron, and that used for this purpose shows, it is said, a tensile strength nearly twenty-five per cent higher than that used heretofore in the manufacture of headers of this type, by actual hydraulic stress applied to numerous instances. These headers are also made about twenty-five pounds heavier than usual, and this additional weight is distributed almost entirely in the form of fillets. In fact no sharp corners are permitted in the headers, every corner being filled out to a perfect curve by the use of fillets. The result is that these headers have been repeatedly subjected to a pressure of 2000 lbs. to the square inch without any sign of rupture.

Great attention has been paid to making a perfect seat in these headers for the tubes. To secure this the company has designed a special tool for reaming all these holes to an accurate seat, preventing the possibility of leakages from this cause. The seats on the opposite side of the manifold, covered by the hand hole caps for access to the tubes after the boiler is erected, are cut down and milled to a perfect face and the caps which fit over these are also milled and smooth finished, so that when they are put in position they make a steam and water tight joint without the intervention of packing of any kind. The hand hole guards, which go inside these hand holes, to which the bolt for fastening the hand hole plates in position is fastened, are malleable iron castings and are elliptical in form, so that they cover almost entirely the inside of the hand hole. This is done as a safeguard so that in case a bolt fastening the hand hole plate in position should break, from any reason, there can be no sudden rush of steam or water through the hand hole. The bolts used for fastening these hand hole caps in place are one inch in thickness.

It will be noticed from the side view of the boiler that the entire structure stands on wrought iron supports and cross beams, independent of the brickwork, so that the entire structure is free to contract and expand without any strains occurring either on the setting or on the boiler itself. In the Aultman & Taylor method of

suspending the boiler, the entire suspension framework is outside of the brickwork. In this way all possibility of its burning away or weakening through overheating is avoided.

The fronts for the boiler are what is known as the wrought iron style, that is, the entire general framework of the front is made up of wrought iron or steel beams, channels and girders, and only the panels containing the door frames are cast. This permits of a very light, but rigid, structure which it is impossible to crack from the application of internal heat. All the tubes used in this boiler are of the best knobbled charcoal iron, which, though more expensive, is, probably, in the end the most economical. The general fittings and trimmings of the boiler are of the highest grade, the safety valves and steam gauges being generally either of the Ashcroft or Ashton type, unless otherwise specified. The water column used is either the Reliance or Pittsburgh high and low water alarm. The blow-off valves are specially made under patents owned by the Aultman & Taylor Machinery Company, and are so designed that the disks are renewable at any time, and both the disk and valve seat can be cleaned without taking the valve apart. It will be noticed in the illustration, giving the rear view of the boiler, that these valves have two wheels, one directly above the other, the upper one being smaller than the lower. The larger wheel forces the disk down on its seat, the smaller wheel revolves the spindle carrying the disk. By revolving the larger wheel until the disk rests lightly on its seat and then revolving the smaller wheel, the disk is rotated on its seat, effectually clearing it from any obstructions that may have accumulated thereon.

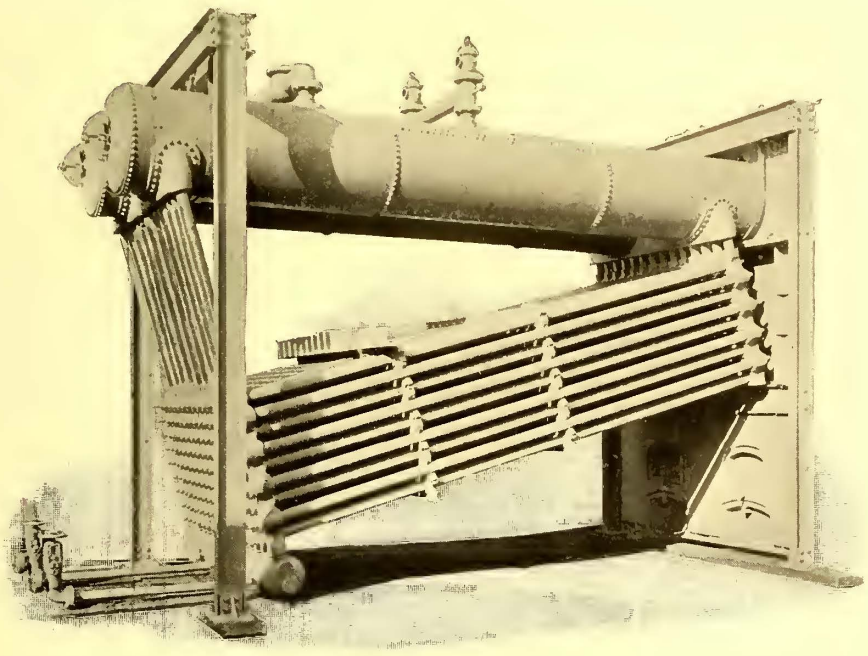


FIG. 3.—SIDE VIEW OF BOILER.

The side cleaning doors for the boiler are of a new design which permits the use of only one door instead of two, and when the door is opened it is thrown back entirely from the slot into which it fits, leaving a full and free opening for the introduction of the steam hose and when the door is closed, wedged shape. The fire brick tile, which line the door, are placed in a straight line in the opening, making a perfectly smooth wall on the inside and an absolutely tight joint against the leakage of air into the setting.

Where very high pressures are to be used, say, in excess of 225 lbs. to the square inch, the headers or manifolds for the reception of the tubes are made of the same material used in the cross boxes on the drums.

These boilers are built in sizes of from 125 h. p. up to 500 h. p. in single units. The company also builds what is known as the "double-decker" type of this same boiler. The boilers are built for working pressures of from 150 lbs. to the square inch up to 300 lbs. to the square inch.

The factories of the Aultman & Taylor Machinery Company are ample in size, new and equipped with the latest tools and machinery. With the exception of the hydraulic and pneumatic plant all the tools in the factory are direct electrically driven. The factory has an annual capacity of 200,000 h. p. vertical and 100,000 h. p. horizontal water tube boilers with the present facilities.

THE Montgomery Construction Company, Washington, D. C., has nearly completed arrangements for the building of the lines of the Washington & Tacoma Electric Railway Company.

THE People's Electric Railway, Nanticoke, Pa., which was built by an English syndicate nearly a year ago, and operated between Nanticoke and Glen Lyon, has been purchased by an American Company, and extensions will be made. The new superintendent is Mr. Higgins, formerly of Wilkesbarre.

Gas Motor Cars in Europe.

Reports have been received from different points in Europe at occasional intervals during the last two years in regard to the installation of gas motor cars on various street railway systems abroad, but the information has all been of a fragmentary character. For this reason the paper by M. A. Lavezzari published in the last number of the *Mémoires et Compte Rendu des Travaux* of the Société des Ingénieurs Civils de France is of especial interest. The Gas Traction Company, the owner of the Lührig system made its first experiments in 1891, but it was not until July, 1894, that any cars were put in commercial operation.

The general appearance of the cars is similar to that of compressed air cars and all the mechanism is concealed and hidden from view. The motor is of the Otto type with two horizontal cylinders facing each other. The motor is placed under one of the side seats of the car. The gas is electrically ignited by current derived from a small storage battery carried on the car or from a dynamo driven from the car axle. The power is transmitted to the axles by an ingenious system of gearing by which the motor can be thrown out of engagement with the axles or it can run the car at either one of two rates of speed. The motor is kept in continuous operation, but when a stop is made by the car, the motor speed is reduced from 220 r. p. m. to 80 r. p. m. by cutting out one cylinder.

The gas is stored in three reservoirs, two carried under the floor and one under the bench opposite to that which covers the motor. These reservoirs have a capacity of about thirty-five cubic feet, at an initial pressure of from 145 lbs. to 175 lbs. per square inch. The water necessary for cooling off the cylinders is carried in another reservoir, or more often in a series of tubes mounted on the top of the car. The water is kept in circulation by the heat imparted to it as it passes around the cylinders upon the same principle as that of a thermo-syphon.

In Dresden four motor cars are in operation and they run on the same line with the horse cars. The grades are not steep, there being only one as high as four per cent. The consumption of gas amounts to thirty-seven cubic feet per car mile, including the gas required by the gas engines used in the compressing station.

The total length of the Dessau line is about four miles and the steepest grade is five per cent. There are thirteen motor cars. Each weighs six tons empty and eight tons loaded and holds twenty-eight passengers, of which sixteen can be seated. The amount of gas carried in the reservoirs is twenty-eight cubic feet, at a pressure of 145 lbs. This permits a trip of from ten to twelve miles without recharging. There are two compressing stations equipped with motors of eight horse power each. Each motor for compression runs only three hours a day, and the capacity of the station reservoirs is sufficient to supply two motor cars without recharging. The speed is limited by municipal regulations and does not exceed 6.2 miles per hour, including stops, which corresponds to a maximum speed of about 7.5 miles an hour. The consumption of gas is found to be about twenty-nine cubic feet per car mile, including the amount required by the compressing engines, which is about ten per cent of the whole.

The line at Blackpool, England, was put into operation only last May, and has a length of only eight miles. There are sixteen double deck motor cars carrying forty passengers each, and weighing seven tons empty and ten tons loaded. During the first few months of operation the consumption of gas was claimed not to exceed thirty cubic feet per car mile.

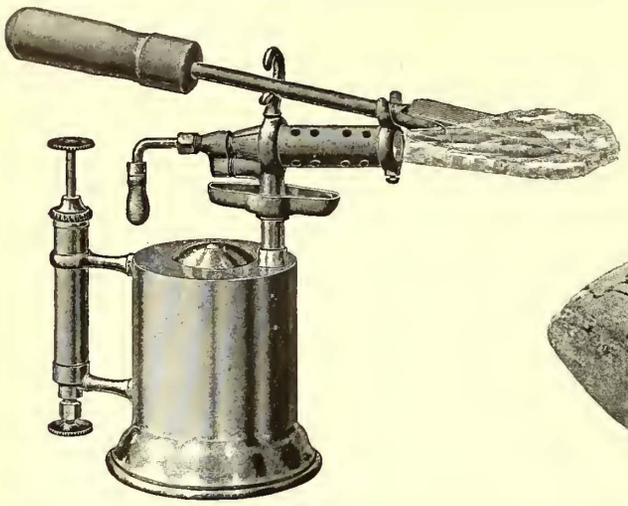
Encouraged by these results the Gas Traction Company, of Paris, has put one car in operation in that city. It is double decked, equipped with a motor of from ten horse power to fifteen horse power, and is designed to operate at a speed of ten miles per hour. It has not been in operation long enough yet to determine the economy.

In his conclusions upon the subject of mechanical traction with gas motors, Mr. Lavezzari sums up the advantages and disadvantages as follows: the experience of operation shows that traction by gas merits a consideration among other systems. It is a method which is easy to establish, economical and certain. The cost of installing and operating the central stations is comparatively small. Since nearly every community possesses gas works, the fuel is easy to obtain and can be secured at a very low cost.

There are however opportunities for considerable improvement in gas motors. The motors, which up to the present have been used, are practically the same as those employed for stationary work and are about as well adapted to the service as stationary steam engines would be upon a locomotive. The principal defect of the motors is that they cannot ascend steep grades, for if built powerful enough for this service they would work uneconomically under ordinary conditions. Another desirable feature would be to devise a motor which could be stopped when the cars stop, in order to avoid all disagreeable noise and vibration. Finally, the method of gear transmission could be improved. The gears at present make a disagreeable noise while in service. This might perhaps be remedied very simply by the employment of gears with wooden teeth.

Brazier and Blow Torch.

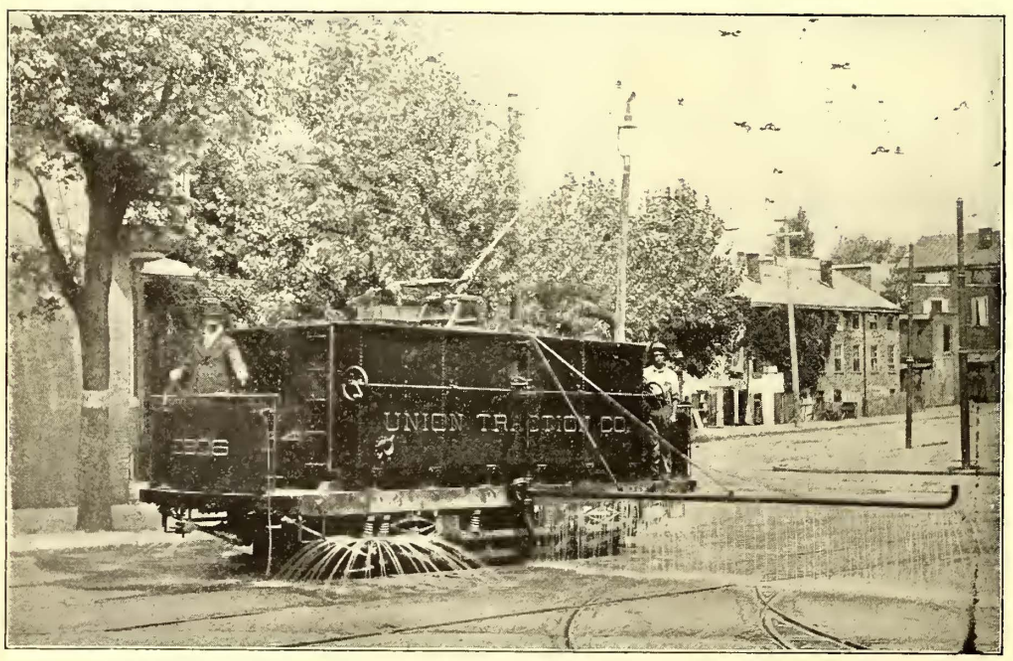
The accompanying cut shows a new kerosene brazier for electric welding and brazing, suitable for all linemen and tracklayers' work. It can also be used for soldering irons. It will work in the wind, and in fact anywhere wanted. The fact of its burning coal oil will recommend it everywhere, as it makes the operation of it absolutely safe in any building. Furthermore, one quart of oil will do the work of 2½ qts. of gasoline and is so easily obtained that there seems to be no good reason why this appliance should not come into general use. It is made by the White Manufacturing Company, which also makes the same tool for use with gasoline, and a large number of similar devices using both kerosene and gasoline.



BRAZIER AND BLOW TORCH.

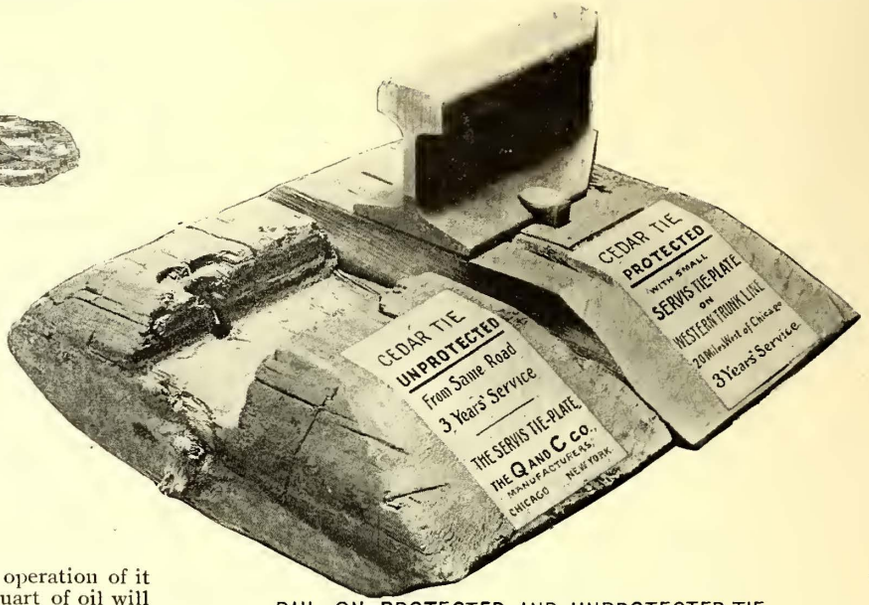
Tie Plates as Tie Preservers.

Street railway managers are gradually becoming impressed with the merits of the Servis tie plate. That it has become standard in steam road construction, where the sales of this plate already exceed 30,000,000, clearly demonstrates that it is an unusually good thing, otherwise all of the push and enterprise of the Q. & C. Company, the manufacturers, could not begin to accomplish such results.



STREET SPRINKLER.

Beginning with the old strap plate the story of the evolution of the tie plate is instructive and interesting. It is claimed for the Servis tie plate that it represents the high point in this development. These plates are manufactured of soft, tough steel and are reinforced with flanges which enter the tie in the direction of the grain, confining and compressing the fibre of the wood and becoming practically a part of the tie, to which it firmly adheres. This arrangement practically prevents all buckling or curling up of plates and likewise loosening and rattling as is generally the case where light plates are used. Neither can there be any rocking or pounding of the plates. They provide a uniform support to the rail on every tie without reference to the age of the tie, and absolutely prevent the cutting in of ties by the action of the rail. The illustration on this page is made from a photograph of two cedar ties removed from the tracks of the Atchison, Topeka & Santa Fe Railway. Both were in equal service for three years, the one protected by the Servis tie plate and in good condition, the other without the plate and showing the action of the rail in gradually breaking the wood fibre and cutting into the tie. The plates are made with two and three flanges, and, as before stated, these flanges are longitudinal with the grain of the tie, thus never cutting the fibres, but wedged tightly between them so that a perfect union is secured which becomes more permanent by the frequent pressure of the cars in passing over it.



RAIL ON PROTECTED AND UNPROTECTED TIE.

The Kensington Sprinkling Car.

The sprinkling car shown in the accompanying engraving, is built by the Kensington Engine Works, Limited, and combines in its design and construction, a number of new and attractive features. It has a tank sixteen feet long with a capacity of 3000 gals., enough, it has been demonstrated, to effectually sprinkle about three miles of road. The tank is of plate steel and has six baffle plates extending from side to side, making seven compartments; these communicate with each other by triangular openings in the corners of the plates, preventing swash of the water in case of violent stopping of the car.

Manholes and openings for filling the tank conveniently and quickly are to be found at the top and there are two hose connections arranged at the ends on opposite sides for filling from plugs when that is desired. Ladders from front and rear platform give easy access to the top of the tank and float tell-tales at each end indicate the height of water carried at all times. To sprinkle over the track and within a short distance upon each side, there are perforated pipes at both ends of the car. These curve outward and return to the side of truck.

To sprinkle the street a considerable distance on both sides of the track, the car carries two swinging arms with perforated pipes carried on cranes that swing in a half circle, with a radius of about eighteen feet, making a total width of road sprinkled of over forty-five feet. These arms are worked from either platform, by hand wheels actuating a worm engaging wheel on post of crane. In case of necessity, these arms can be swung against the car in ten seconds, and are entirely out of the way.

The water valves are of quick opening design and are placed beneath the car. The Union Traction Company of Philadelphia, has equipped its lines with these cars, using eleven for the work.

National Conference on Standard Electrical Insurance Rules.

At the joint conference of electrical, insurance and allied interests looking toward the adoption, promulgation and enforcement of a national code of rules for electrical construction and operation, which was held Mar. 18 and 19 of this year at the headquarters of the Americair Society of Mechanical Engineers, in New York, a large amount of work was done. After a permanent organization, to be known as the National Conference on Standard Electrical Rules, had been effected, with headquarters at 12 West Thirty-first Street, New York, it was decided to place the work of drafting the final code in the hands of a committee of eight, including the president (ex-officio), who were to report back to the next meeting of the National Conference. This committee consisted of the following gentlemen: Prof. Francis B. Crocker, chairman, delegate of the American Institute of Electrical Engineers; Frank R. Ford, Secretary, delegate of the American Street Railroad Association; William Brophy, delegate of the National Electric Light Association; William H. Merrill, Jr., delegate of the National Board of Fire Underwriters; E. A. Fitzgerald, delegate of the Underwriters' National Electric Association; Alfred Stone, delegate of the American Institute of Architects; E. V. French, delegate of the American Factory Mutual Insurance Companies; W. J. Hammer (ex-officio).

This committee has recently met in New York, spent two days upon the preparation of the code, and then adjourned to meet again Dec. 11 and 12. This date was decided upon in order to enable the Underwriters' National Electric Association, which meets in New York on Dec. 8 and 9, to consider the suggestions already made by the code committee and to secure its criticisms and co-operation in the matter. It is expected that shortly after the next meeting of the code committee, the National Electrical Conference will be called to take action upon the code prepared by the committee.

It is very gratifying to observe that the various engineering societies, and the strong representation of the insurance organizations represented in the National Electrical Conference, are working so harmoniously and with so much energy to bring about the long wished for and much to be desired single national code of rules.

Annual Convention of Connecticut Street Railway Association.

The annual convention of the Connecticut Street Railway Association was held at New Haven on Nov. 18. Representatives were present from all the New Haven, Hartford, Bridgeport, Waterbury, New Britain, Derby, Bristol and Norwalk lines, and from the Westport & Saugatuck road.

The election of officers resulted as follows: president, H. Holton Wood, Derby; vice-president, Henry S. Parmelee, New Haven; secretary, E. S. Breed, New Britain; treasurer, E. S. Goodrich, New Britain. Executive Committee: A. L. Young, Waterbury; Israel A. Kelsey and G. A. W. Dodge, of New Haven.

After a general discussion the representatives present inspected the street railway lines in New Haven and at 2:30 o'clock in the afternoon sat down at a banquet at the New Haven House.

Patent Suits.

The General Electric Company has just brought five suits against the Fiberite Company, manufacturers of the Medbery insulation and overhead trolley equipment, for an alleged infringement of patents owned by it on "suspension devices and ears" for trolley roads.

These suits will be watched with much interest by all electric roads not using General Electric equipment, and by all manufacturer's of overhead devices as they will probably be made test cases, and if the General Electric Company can establish the validity of these patents, similar suits may be brought against others.

The Fiberite Company proposes to defend these suits vigorously and has employed some of the most eminent patent lawyers in the country.

Colorado Notes.

The Colorado Springs Rapid Transit Railway Company has equipped eighteen of its old motor cars with the new type D controllers and equipments of the Steel Motor Company. The other nine motor cars will be entirely overhauled and it is thought G. E. 800 equipments put in place of the old ones. McGuire A 1 suspension trucks will be used. The whole system is undergoing a complete change. Double track is substituted for single, a new car house is about to be built and the company also contemplates ordering eighteen new cars. These will probably be of the combination open and closed type.

All cars have large signs on them telling the route. The Colorado City & Manitou line is the only one that runs trailers. All the others run single twenty foot motor cars with the exception of the Manitou Avenue & Iron Springs line and West Colorado Springs. The former runs twenty-six foot open motor cars and the latter twelve foot closed motor cars. Seven of the cars have Crawford fenders and all have now stationary registers.

The Manitou line is cutting into the profits of the steam railroad which it parallels. The latter has reduced its fare to ten cents the same as the street railway fare. Before the electric line was built the steam railroad fare from Manitou to the Springs was twenty-five cents one way, round trip forty-five cents. Now only five trains are run daily on the steam line instead of every hour. The electric cars run every fifteen minutes and beat the time of the steam railway by four minutes.

Colorado Springs is growing fast and the street railway company has done an enormous amount of construction and repairing this summer. It handled the crowd well during the late Flower Carnival.

Since the road in Pueblo changed hands it is doing better, financially, and is being improved greatly. All cars there are being painted one standard color, viz., a rich plum. Formerly a variety of colors were used. A new car house is being built; the tracks are being relaid with heavier rails, and new hard wood ties are being put in everywhere. The company will soon order some new equipments for both power house as well as cars. Four extra regular cars have been put on since the road changed hands. The company contemplates considerable reconstruction and new equipment yet.

H. K. Hendricks, A. C. Bileser and others are interested in an electric line in Boulder, which will take in four or five main streets of the town. The offices and power house are to be on Pearl Street. If the city line pays an interurban line will be built to Marshall and then on to Denver. The headquarters of the interurban line will be in Denver. The company has the franchise and rights of the former horse car company, with additional rights.

The Cripple Creek Traction Company is the name of a new corporation that intends to build a line in Victor, Altman and Cripple Creek. The company has the right to use electric, steam or other power. Thirty old Denver horse cars have been sent there with the object of splicing or otherwise utilizing them. Grand Junction is also to have an electric line. The track in all will be fourteen miles in length, and twelve new cars will be ordered. The line, it is thought, will be running by July next.

The Durango railway system was taxed to its utmost on "Fruit Day." All four electric cars were pressed into service, and three old cars were utilized as trailers.

The Denver Tramway Company is now doing an enormous amount of construction and repairing, especially in its paint and cabinet shops. Some of the company's old cable cars are being fitted up as trailers and some as motor cars. Forty-two have been changed over in this way. Downtown at the loop, pit-holes have been constructed under the switches and side tracks, so that if a car is disabled it is run over a pit and given a thorough inspection to find the location of the difficulty. Fifteen or twenty extra trolleys are also kept on hand at the loop on a high stand even with the top of the car. If a trolley is disabled, a change can be made promptly. Four cars are also always kept on hand here in case of emergency, together with signs, headlights, brakes, etc.

On the Denver, Lakewood & Golden Railway traffic has increased so much that all trains running through to Golden, have to carry an extra trailer. It is of the combination type, half baggage and half passenger. Three of the Denver, Lakewood & Golden Railway Company's freight cars are being equipped with motors

and trolleys to carry freight between Denver and Golden. Electric freight trains on this line are run to Golden four times every day (except Sunday). If the business increases more cars will be added to the freight service. The company has also bought four fourteen seat open cars from the Circle Railroad (steam) Company, lessee Atchinson, Topeka & Santa Fe. They were formerly used by the Circle, as summer cars. It is the intention of the Denver, Lakewood & Golden to equip them with electricity and in the future to get a few more of them to be used as trailers.

The Denver City Cable Railway Company has been reorganized and is now the Denver City Railroad Company. Under this new name the company proposes to soon commence to build electric lines and also to repair the cable lines. The management is said to now have no intention of changing the cable lines to electric, as the cables are beginning to pay exceedingly well.

Foreign Notes.

London, England.—The Light Railways Act, which has recently passed Parliament, promises to permit the establishment of many electric railways in the near future.

Chalons, France.—Three propositions for establishing a street railway in this town are before the Municipal Council: one by M. Popp, of Paris, for any kind of mechanical traction (cables or electricity excluded); the second by M. Gossot who proposes to use the Scott petroleum motor busses; the third, a syndicate of Lyons capitalists, which proposes the installation of an overhead trolley system with extensive suburban branches.

Brussels, Belgium.—For the World's Exposition, which will be held here during the next year, a number of electric railway projects are under way.

The official report of the Société Nationale de Chemins de Fer Vinceaux for the year 1895 has been submitted and contains a great deal of interesting information. The corporation is really a department of the royal government, and is presided over by the Minister of Railways and Telegraphs.

On Dec. 31, 1895, seventy-six lines, with a total length of 1573.1 k. m., were reported. The rolling stock consisted of 266 locomotives, 710 passenger cars and 1981 freight cars. The total receipts were 5,903,465 francs, and expenses 4,901,111 francs. Of the seventy-six lines, sixty-five were in operation, ten in construction, and upon one no work had yet been commenced. Of the sixty-five in operation, sixty-three with a total length of 1307.3 k.m. were operated by steam, one with length of 5.1 k. m. by horse, and one with length of 12.6 k. m. by electricity. The latter, which is in Brussels, shows increased receipts over 1894, when the road was operated by steam power.

Vienna, Austria.—The following is a comparative statement of Austrian horse railway companies for 1893 and 1894 as given in the November issue of the *Zeitschrift für Kleinbahnen.*

	Investment	Horses	Passenger Cars	Length	Receipts	Expenses
1893.	15,937,000 fl.	4273	1049	165.2k.m.	6,483,000 fl.	5,013,000 fl.
1894.	14,999,000 fl.	4309	1136	166.7k.m.	6,782,000 fl.	5,030,000 fl.

Milan, Italy.—According to *La Nature*, the falls of Paderno, distant thirty-three kilometers from the city of Milan, will be utilized to furnish electric power for the operation of electric lines in that city. Ten thousand kilowatts is available, and the voltage transmission to be used will be 11,600 volts. Two generators of 500 k. w. each have already been installed for this service.

Johannesburg, South Africa.—The Government of the Transvaal has awarded a franchise, it is said, for the equipment of the new lines in that city by electric power.

Liege, Belgium.—Electric traction has been substituted on two former horse car lines in this city.

Berlin, Germany.—The Grosser Berliner Pferdebahn has put in operation a number of combination accumulator and trolley cars. The accumulators supply the current for operating the cars within the business section of the city, and when the suburbs are reached a change is made to the overhead system. The cars have an entrance at the side and room for twenty-six passengers, sixteen seated and ten standing.

Cologne, Germany.—The managers of the Cologne Tramway Company have voted unanimously to substitute electric for animal power on the system operated by them, as well as to build a number of new lines.

Nantes, France.—By a decree dated Sept. 22, two new tramway lines were authorized in Nantes. They will be operated by the Nantes Tramway Company, and will use compressed air as a motive power.

Paris, France.—The Tramway Company of Paris, of the Department of the Seine, expected by Nov. 1 to replace the steam power on several of its lines by electric accumulator power.

Vienna, Austria.—According to the *Austrian Railroad Journal*, the Russian Railway Minister has decided to purchase four Heilmann electric locomotives for use in Russia. Two of these locomotives will be built to draw a train of 380 tons at a speed of 106 k. m. per hour. The other two are to operate at a speed of 42 k. m. a train of 1000 tons. The cost of operation for the first two, it is thought, will be .45 fr. per verst, and of the others, .52.

Barcelona, Spain.—D. Jose Carbonell has been accorded a franchise for an electric road in this city.

Sidney, Australia.—A bill authorizing an electric tramway in George Street has passed both houses.

The Tramways of Glasgow.

It will be remembered that the city of Glasgow, Scotland, entered, some two years ago upon the experiment of operating its own tramway lines, the franchises of the former Glasgow company having expired, and Parliamentary authority having been obtained by the Town Corporation to enter upon the direct management of the properties. It will also be remembered that considerable controversy arose at the time of making this change over the question of motive power and of fares, and the decision of the corporation to purchase a new horse equipment throughout was criticized at the time as being ill advised in view of the great advances being made in electric traction, while it was predicted that the reduction in fares, which was also determined upon at the same time, would make the enterprise an unprofitable one.

The second annual report covering the operations for the year ending May 31, 1896, has recently been received, and shows that the management has been at least wise and economical. The traffic and other receipts amounted in round numbers to $1,671,885, and the working expenses to $1,255,550 (equivalent to about 75 per cent of the gross receipts) leaving a balance of $416,335. This balance has been distributed as follows; $63,285 has been applied to interest on capital; $45,000 has been paid to the city fund called the "Common Good" in lieu of the mileage rate, etc., formerly received from the lessees of the tramways; $52,710 has been passed to the sinking fund; $89,045 has been charged to depreciation and written off capital account; $85,000 has been charged to the renewal fund for permanent way; $81,295 has been carried to a "General Reserve Fund".

The total capital account stands at $2,914,965. During the year the tramways operated 6,831,379 car miles and 101,271 omnibus miles, and carried 86,462,594 passengers. The average receipts per car mile were $.2302 and per omnibus mile $.0510. The minimum rate of fare was one-half penny ($.01) and ranged from this to three pence ($.06).

The money raised on capital account for the operation of this tramway system was taken from the "Common Good" fund of the city, which was on June 1, 1895, the creditor of the tramways department to the amount of $2,635,490. If we may consider that the above item entitled "Sinking Fund" will in time take care of the principal of the debt incurred by the tramway department to the fund of the "Common Good", and that the items entitled "Interest on Capital" and "General Reserve Fund" form a true return upon the investment, it would appear that the profits of the tramway property during this its first year of operation are equivalent to a return of about 5.5 per cent upon the capital investment. This figure is not, however, exact and the true figure cannot be ascertained without a more intimate knowledge of the items in the depreciation and renewal funds than can be obtained from the report. Moreover, if the Glasgow corporation should decide to adopt an improved motive power, there would necessarily be a considerable loss in disposing of the present equipment, and this loss must either be added to capital account or absorb the entire profits of many years to come.

News Notes.

Allentown, Pa.—The Town Council of Hellertown, has appointed a committee to confer with the South Bethlehem City Council relative to the early extension of the line of the Allentown & Lehigh Valley Traction Company from South Bethlehem to Hellertown. There will be no difficulty over right of way.

Baltimore, Md.—In the First Branch of the City Council the following measures have been introduced: authorizing the City Passenger Railway Company to lay tracks on Aliceanna Street from Ann Street to Patterson Park Avenue; on Monument Street from Patterson Park Avenue to the city limits and on many other streets in the city; authorizing the Baltimore Traction Company to lay tracks on the old Liberty road from Slingluff Avenue to the Baltimore and Liberty Turnpike road, and to make other extensions; authorizing the Walbrook, Gwynn Oak & Powhattan Railway Company to lay tracks from the terminus of its present line, on the Liberty road, from Garrison Avenue to the city limits; authorizing the Lake Roland Extension Railway Company to erect a double track iron bridge over the Windsor Mill road from the terminus of the Lake Roland Elevated Railway line at Walbrook to private property on the north side of the road.

THE Central Passenger Railway Company, of Baltimore, will order about seventy additional motor cars for its lines when the extensions now being built are completed.

Bangor, Me.—At a stockholders' meeting of the Bangor, Hampden & Winterport Railway Company, on Nov. 12, the following directors were chosen: Henry L. Mitchell and E. C. Nichols, of Bangor; H. W. Mayo, of Hampden; Israel A. Kelsey and Tracy Walker, of New Haven, Conn.; Thomas M. Waller and S. H. Wagner, of New York. At a directors' meeting the following officers were elected: H. L. Mitchell, president; Israel A. Kelsey, treasurer; H. W. Mayo, secretary.

the charter, and at Walloomsac will connect with the Hoosick Falls road. A. E. Powers, of Lansingburgh, N. Y., is interested in the proposed road, and he thinks that it will do business enough to pay the running expenses, fixed charges and a fair dividend in addition. The survey for the road was completed several weeks ago.

Binghamton, N. Y.—The Binghamton Railroad Company has been granted permission to double track its Court Street line.

Braddock, Pa.—Surveys for the Braddock & Homestead Electric Railway have about been completed. It is likely the bridge to connect Homestead and Braddock will be built this winter, and the railway built in the spring.

Bradford, Pa.—The Western New York & Pennsylvania Railway Company has sold its road between Olean and Bradford to a company of Boston capitalists, who will equip it with electricity and operate it in connection with the street railways of Olean and Bradford.

Butte, Mont.—The Butte Consolidated Railway Company will purchase 150 h. p. additional generators.

Canton, O.—The City Council has granted a franchise to the Canton & Massillon Electric Railway Company to extend its lines on South Market and Bridge Streets.

Charleston, S. C.—The City Council has granted a franchise to the Charleston Street Railway Company to build and operate electric railways in Charleston. Among the incorporators are Charles A. Deans and Edward S. Jarrett, of New York; Jas. B. Chastain and J. S. Lawrence, of Baltimore, and P. H. Gadsden, of Charleston.

Columbus, O.—The County Commissioners have granted an extension of time to the Columbus & Buckeye Lake Street Railway Company. The road is to be built and in operation by Oct. 1, 1897.

Dallas, Tex.—The Dallas City Street Railway Company will equip the remaining eighteen miles of its system with electricity as soon as it can raise funds for that purpose.

Dayton, O.—It is reported that the Dayton Traction Company will extend its lines from Dayton to Eaton. Rights of way have been secured from property owners along the line and work will be begun very soon.

Dighton, Mass.—The Dighton, Somerset & Swansea Street Railway Company desires to increase its capital stock from $60,000 to $110,000.

Duluth, Minn.—G. A. Leland, president of the Minnesota Point Street Railway, write us that "the motive power of the road will be changed from horse to electricity, compressed air or steam." The directors are as yet undecided as to the one that will finally be adopted.

Fayetteville, Ark.—The Fayetteville Electric Railway Company has been incorporated by F. T. Cronmett, O. M. Wallace, J. W. Lipsey and J. A. Griffith to build and operate an electric railway in Fayetteville. Capital stock, $50,000.

Fitchburg, Mass.—The Gardner, Westminster & Fitchburg Street Railway Company has been granted a franchise by the Board of Aldermen of Fitchburg. Among those interested are F. S. Coolidge, of Fitchburg; J. A. Stiles, of Gardner, and Herbert Carter, of Springfield.

Flint, Mich.—Judge Nolan, of Saginaw, who holds franchises for the construction of an electric railway to Long Lake and Fenton, from Flint, has been to Fenton and had the franchise extended to Nov. 18, 1897. He says that the prospects are good for the construction of the road, and that the larger part of the bonds will be taken by Eastern capitalists.

Fresno, Cal.—J. S. Eastwood, of the San Joaquin Electric Company, is interested in an electric road to be built by the company in and around Fresno.

Georgetown, Mass.—The Haverhill, Georgetown & Danvers Street Railway Company has been petitioned to extend its lines from Georgetown to Rowley.

Guadalajara, Mex.—The Guadalajara Street Railway Company is considering the equipment of its lines with electricity or compressed air. Mr. Blake, engineer of the company, is about to make a report on the subject to the directors, and shortly after work will be begun in installing the system adopted.

Hamilton, Ont.—Edward Henerson, of Ancaster, Ont., Harry Maxey, Frederick Garner Beckett and Frederick Snider, of Hamilton, and Henry G. Beckett, of the township of Barton are the incorporators of the Hamilton, Chedoke & Ancaster Electric Railway Company.

Hingham, Mass.—Pepper & Register, of 1414 South Penn Square, Philadelphia, write us that the Hingham Street Railway Company will probably buy five open motor cars.

Joliet, Ill.—The Joliet Railway Company is considering the extension of its lines from Lockport to Lemont.

Kansas City, Mo.—The North East Electric Railway Company has been incorporated by S. M. Jarvis and R. R. Conklin, of New York, and Baylis Steele, of Kansas City, as a reorganization of the North East Street Railway Company. Capital stock, $250,000.

Kingston, Jamaica.—Kingston, the capital of Jamaica, and the principal city of the British West Indies, with a population of about 60,000, is going to put in an electric railway system. About twelve miles of road will be equipped. The Jamaica Street Car Company which is making the change is an old and prosperous company, having operated the road for many years past with mule power.

Kingston, Ont.—The Kingston, Portsmouth & Cataraqui Electric Railway Company will probably extend its lines 3½ miles.

Knoxville, Tenn.—The City Council has passed on first reading an ordinance granting to the Knoxville Street Railway Company permission to extend its lines in many streets of the city.

Lewiston, Me.—The citizens of Minot Corner at a recent meeting appointed W. W. Dennen and J. H. Cuskley, a committee to request the Lewiston & Auburn Horse Railroad Company to extend its lines through Minot Corner to Mechanic Falls and farther if they see fit.

Lockport, N. Y.—The Lock City Electric Railroad Company may extend its lines to Rogers Grove and Cold Spring.

Los Angeles, Cal.—Edgar E. Lefebor, secretary of the Main Street & Agricultural Park Railroad Company, writes us that the company will rebuild the whole road and equip it with electricity. Sixty pound rails will be used, and fifteen new cars will be bought.

Madison, Wis.—The Madison City Railway Company may purchase three motor cars.

Manchester, Va.—The resolution of the City Council authorizing John C. Robertson to construct and operate an electric railway has been passed by the Ordinance Committee.

Manistee, Mich.—The Manistee, Filer City & East Lake Railway Company expects to make several extensions to its lines in the spring.

Marysville, Cal.—The Marysville & Yuba City Street Railroad Company is expecting to add four miles of new track to its system during the coming year.

Montgomery, Ala.—The Montgomery Street Railway Company will purchase four open motor cars.

Montpelier, Vt.—The Montpelier & Mad River Electric Traction Company has been incorporated by Mr. Ward, of Washington, Vt.

Montreal, Can.—The Montreal Park & Island Railway Company contemplates adding 300 h. p. generators to its power plant, ten motor cars, four trail cars and 50 h. p. electric motors to its rolling stock and the construction of five miles of new road.

Muskegon, Mich.—Notice of sale on Jan. 5, under second mortgage foreclosure of the Muskegon Railway Company's property and franchises, has been made public.

Newark, N. J.—It is reported that the North Jersey Street Railway Company is considering the extension of its lines from Caldwell to Pine Brook, Parsippany and Morristown, a distance of about fifteen miles. J. K. Corbiere, of Montclair, N. J., is president of the company.

New Bedford, Mass.—The Union Street Railway Company has declared a dividend of two per cent.

Newburgh, N. Y.—The Newburgh Electric Railway Company is thinking of extending its lines a distance of 1¾ miles.

New Haven, Conn.—The residents of Cosy Beach are requesting the New Haven Street Railway Company to extend its lines from the lighthouse to Cosy Beach on the east shore. The company now has a charter to run as far as Mansfield's Grove, and owing to the increase of houses at Cosy Beach, it is believed that the company will apply to the legislature for a charter to extend its line as petitioned. Probably the line will ultimately be extended to Short Beach and Branford Point.

New Orleans La.—The Canal & Claiborne Railroad Company expects to construct and equip about twenty miles of new track next year.

New Rochelle, N. Y.—The Village Trustees have granted a franchise to the Larchmont Electric Company, and the work of constructing the new electric railway in New Rochelle will be begun at once.

Newton, Mass.—The Newton & Boston Street Railway Company has decided to extend its road to Great Plain Avenue, Needham, at once, providing a franchise can be secured.

New York, N. Y.—Comptroller Fitch has awarded the franchise for building and operating twenty-eight miles of street railway in the Twenty-third and Twenty-fourth Wards to the People's Traction Company. The People's Traction Company gets the privilege at its bid of eighty-seven per cent of the gross receipts for the first five years and ninety-five per cent thereafter, in addition to the statutory minimum charges of three and five per cent, respectively. This makes the total gross receipts payable to the city.

Oshkosh, Wis.—The franchises and property of the Central Wisconsin Electric Railway Company have been sold by the sheriff for $3076. W. H. Clark, of Chicago, purchased the franchises, W. F. Gruenwald, of Oshkosh secured the ties and poles, and Chas.

Barber, president of the Oshkosh Street Car Company, paid $1900 for the rails.

Philadelphia, Pa.—The citizens of Bridesburg and Frankford have prepared an ordinance to be introduced in the City Council requiring the Union Traction Company to extend its lines from Frankford to Bridesburg.

Pottsville, Pa.—The Schuylkill Electric Railway Company has been granted permission to extend its lines.

Reading, Pa.—C. R. Eberle, of 647 North Fortieth Street, Philadelphia, has been awarded a contract for the construction and equipment of fifteen miles of electric railway between Boyertown and Reading.

Richford, Vt.—Citizens of Richford have formed a company to build an electric railway from Richford to Montgomery Center. A good route has been surveyed, and the incorporation of the company has been applied for under the title of the Richford & Montgomery Elcctric Railway Company.

Riverside, Cal.—It is probable that the Riverside & Arlington Railway will be equipped with electricity during the coming year.

Saginaw, Mich.—The Inter-Urban Electric Railway Company, will apply to the City Council for permission to build a loop line in the city and to bridge the river at Tuscola Street. This will give the company an entrance into the city. Isaac Bearinger is president of the company.

St. Joseph, Mo.—It is reported that the St. Joseph Railway, Light, Heat & Power Company will extend its lines to Lake Contrary and build a park and race track there. The company has decided to equip its cars with electric heaters the contract for which has been let.

St. Louis, Mo.—The St. Louis, Fenton & Southwestern Railway Company has been granted a franchise to build an electric railway from Carondelet, in St. Louis County, to Big River, in Jefferson County.

Schenectady, N. Y.—The Mexican General Electric Company has been incorporated by S. D. Greene, Henry W. Darling, D. Mazenet, J. R. Lovejoy and M. F. Westover, of Schenectady, to deal in electrical apparatus and to install electric plants in the Republic of Mexico. Capital stock, $50,000.

Seneca Falls, N. Y.—The Seneca County Railway Company will extend its lines from Geneva to South Waterloo as soon as the rights of way are obtained. John E. Nolan is president.

Sioux City, Ia.—The Sioux City Traction Company has awarded the contract for the extension of its lines to Dakota City and Homer, to Nangle, Holcomb & Company, of Chicago.

Tacony, Pa.—The Holmesburg, Tacony & Frankford Electric Railway Company will issue $350,000 first mortgage five per cent thirty year gold bonds to the West Philadelphia Title & Trust Company, as trustees. The total mortgage is $400,000, but the remaining $50,000 bonds are reserved in the treasury of the company, and can only be issued for the purpose of extension or the acquisition of additional property.

Wabigoon, Ont.—An electric railway is projected from Wabigoon, on the Canadian Pacific Railway, to the gold fields of the Rainy River district, a distance of seventy-five miles. Toronto capitalists are backing the enterprise. Water power will be used for generating the electricity, and if a charter is obtained soon, the road will, probably, be completed next fall.

Washington, D. C.—Surveys have been made, rights of way secured and estimates are about completed for the Washington, Annapolis & Chesapeake Electric Railway. The projected length of the road is twenty-seven miles. L. H. Hyer, 1216 F Street, N. W., is chief engineer.

Waterloo, Ia.—The Waterloo & Cedar Falls Rapid Transit Company is thinking of building a twelve mile extension to its lines and adding to its equipment the following: 200 h. p. generators, five motor cars, five trail cars and seven electric motors. L. S. Cass is president of the company.

Waynesboro, Va.—J. A. Patterson, of Staunton, Va., has purchased a controlling interest in the Waynesboro & Basic City Street Railway, and will introduce new methods in its management.

Webster, Mass.—A company is being formed by E. L. Spaulding, E. N. Bigelow, N. T. Hurlburt, L. R. Eddy, John Flint and J. W. Dobbie, of Webster, to build an electric railway in Webster and a line from Webster to Worcester. Franchises will be applied for during the session of the Legislature this winter.

West Superior, Wis.—It is stated that the Superior Rapid Transit Railway Company will extend its lines in Superior and from Old Superior to Duluth.

White Plains, N. Y.—A petition is being signed by Mount Vernon business men to be presented to the New York, Elmsford & White Plains Electric Railway Company, to show that the public desires electric railways from Mount Vernon to Bronxville, Tuckahoe, New Rochelle and City Island.

Wilkesbarre, Pa.—The Wilkesbarre & Wyoming Valley Traction Company, of Wilkesbarre, and the Lehigh Traction Company, of Hazleton, are interested in the proposed electric railway from Wilkesbarre to Hazleton and it is reported that they will begin work on the road next spring. The line will run through Milnesville and St. Johns.

Worcester, Mass.—The date for beginning the construction of the lines of the Worcester & Marlboro Street Railway Company has been extended to Apr. 1, 1897. A. D. McClellan, of Worcester, is interested in the company.

Youngstown, O.—The Mahoning Valley Electric Railway Company has filed with the Secretary of State an application for permission to increase its capital stock from $150,000 to $1,500,000 and to change its headquarters to Youngstown. This application is in consummation of the consolidation of the Mahoning Valley and Youngstown Street Railway Companies.

Annual Report of the Montreal Street Railway Company.

The annual report of the Montreal Street Railway Company for the year ending Sept. 30, 1896, shows gross receipts $1,265,898, an increase over the previous year of $163,111, or 14.79 per cent. The operating expenses were $710,865, an increase over the previous year of $58,053, or 8.89 per cent. The operating expenses required 56.48 per cent of the gross receipts, as against 59.2 per cent in 1895, 71.16 per cent in 1894, 79 per cent in 1893, and 82.68 in 1892.

The net earnings in 1896 were $555,034, an increase of 23.35 per cent over 1895, and these earnings were equivalent to 11.55 per cent on the total capitalization, as against 10.21 per cent in 1895, 9.69 per cent in 1894, 8.17 per cent in 1893.

The company carried 29,896,470 passengers in 1896, as against 25,877,758 in 1895 (an increase of 15.53 per cent), and 11,631,386 in 1892. 8,541,530 transfers were issued, amounting to 28.57 per cent of the passengers carried, a slight increase in percentage over the previous year, but a reduction from the figures of 1894 and 1893.

Two regular dividends of four per cent each were declared for payment in May and November, and an additional "bonus" of one per cent was declared for payment in November, while $102,107 were carried to surplus account.

The Annual Report of the Bridgeport Traction Company.

The annual report of the Bridgeport Traction Company is somewhat novel in form inasmuch as it is prepared at the instance of Messrs. Redmond, Kerr & Company, who are largely interested in the property, by an outside engineer, Horatio A. Foster, and is in the shape of an unbiased report by him on the physical and financial features of the property.

For the six months ending June 30, 1896, the car miles run were 945,423, and the total receipts were $149,502, equivalent to .158 per car mile. This is an increase of $18,863 over the corresponding months of 1895. The operating expenses were $117,829, equivalent to .125 per car mile. The net earnings were $31,673, equivalent to .0335 per car mile.

Of the operating expenses $58,930 were general expenses, including interest on bonds and taxes, $9567 were chargeable to motive power, $5253 to maintenance, and $44,079 to transportation.

The balance sheet of Sept. 30 is as follows:

RESOURCES:	
Plant and equipment	$3,800,205
Accounts receivable	1,691
Cash on hand	34,429
Total	$3,836,325
LIABILITIES:	
Capital stock	$2,000,000
Bonds outstanding	1,683,000
Accounts payable	30,100
Surplus	74,802
Profit, July 1, to date	48,424
Total	$3,836,325

The total receipts amount to .213 per car mile, the operating expenses to .161 per car mile, and the net earnings to .052 per ear mile.

Personals.

Mr. A. H. Woodward, treasurer and general manager of the International Register Company, of Chicago, is making a trip East. He reports business as improving.

Mr. C. Densmore Wyman, general manager of the Milwaukee Electric Railway & Light Company, has been elected general manager of the New Orleans Traction Company.

Mr. W. Phillips has been appointed acting manager of the Niagara Falls, Park & River Railway Company, of Niagara Falls, Ont., in place of Mr. R. McKenzie, who has resigned.

Mr. F. E. Huntress was elected a member of the Massachusetts House of Representatives at the recent election. Mr. Huntress

will represent the Seventh Middlesex District, comprising two wards of Somerville, of which city he is a resident.

Mr. A. Langstaff Johnston, engineer of construction of the Richmond(Va.) Traction Company, having completed his work in that city, severed his connection recently with that company. Upon the occasion of his retirement, the officials tended to him a banquet. Mr. Johnston, it is reported, has several important electric railway installations in contemplation.

Mr. A. H. Englund, of Mayer & Englund, Philadelphia, was in New York last month. He stated that the business outlook for the coming year was excellent and anticipated that a large number of electric railway projects in Pennsylvania, which had been held in abeyance during the past few years on account of adverse business conditions, would be put through during the coming season.

Mr. Charles L. Harry resigned recently as superintendent of the Bay Cities Consolidated Street Railway Company. His retirement was made the occasion of the presentation to him by the employes of the company of a handsome gold watch, chain and charm which bore the inscription "With Compliments of the Employes of the Bay Cities Consolidated Street Railway Company."

Mr. J. R. Beetem resigned on Nov. 10, as general manager of the Union Traction Company, of Philadelphia. Mr. Beetem went to Philadelphia about two years ago from Scranton, Pa., where he had held the office of general manager of the Scranton Traction Company. Previous to his connection with the latter company he had been superintendent of the Atlantic Avenue Railway Company, of Brooklyn.

Mr. Newton Jackson has severed his connection with the Electric Mutual Casualty Association, to devote his attention entirely to the work of the Electric Mutual Fire Association, which company has recently been organized for the purpose of insuring railway plants against losses from fire, on the mutual plan. Mr. Wm. W. Wharton has been elected his successor with the Electric Mutual Casualty Association.

Gen. A. B. Upshaw, who held an important position in Washington during President Cleveland's first administration, has arranged to go extensively into street railway securities and the reorganization of street railway properties. A strong financial company is being organized for this purpose by him and others. One of New York's most prominent lawyers will be counsel of the corporation and to him all legal matters relating to the Investment Company will be submitted. While the organizers of the company contemplate that most of their negotiations will be for properties on this side of the Atlantic, the establishment of European connections of the most desirable character is under way. General Upshaw has for months been a neighbor of the STREET RAILWAY JOURNAL, occupying a suite of offices in the Havemeyer Building. He established when in the service of the Government a reputation for the possession of administrative and executive abilities of a high order and has now a wide acquaintance throughout the country among the men who are making its history to-day. These qualities promise to make the much needed enterprise that is about to be launched by him and his associates a pronounced success.

Obituary.

WILLIAM G. ELLIS, of the Ellis Car Company, Amesbury, Mass., died Nov. 3, at the age of sixty-four years. Mr. Ellis was a native of Scotland, and when a young man emigrated to Australia where he engaged in gold mining. He came to this country in 1863 and entered the carriage manufacturing business. In 1875 he commenced business on his own account and his street railway cars were shipped all over the country. In 1893 a fire destroyed the plant. Business was recommenced in another factory, but the car building department was given up. Mr. Ellis was a prominent citizen of Amesbury and director in a number of financial and railroad companies.

AMONG THE MANUFACTURERS.

St. Louis Car Wheel Company, of St. Louis, reports a very decided change for the better in its business since the election, and feels confident of steady and continued improvement.

The Clonbrock Steam Boiler Company, of Brooklyn, reports that its works are extremely busy and the company has much work ahead. Business prospects, it states, are very bright for the future.

The American Engine Company, of Bound Brook, N. J., is about to ship one of its new American-Ball engines to the Chinese Government, to be used in driving machinery for the coinage of silver.

The Western Electric Company, of Chicago, reports a very large demand for the Sunbeam lamps, especially for the two, four, and six candle power lamps. Large orders have been filled for use in sign and decorative work.

The Ball & Wood Company, of New York, reports that its works are running on full time and in the past few years it has not only considerably widened its market, but very much improved its methods as well as products.

The Creaghead Engineering Company, of Cincinnati, O., is engaged on the construction of the overhead line for the Ironton & Petersburg Electric Railway of Ironton, O. The Creaghead Company also reports a number of other orders on hand.

J. P. Sjoberg & Company, of New York, reports that the amount of business done by them during the past year has been very satisfactory and they have every reason to believe that their orders will more than double up during the coming year.

The Wheeler Reflector Company, of Boston, writes in regard to the prospects for the coming year that it expects a much larger business than has been possible in the last year or two, although the company has no occasion for fault finding with results, even during that period.

John T. McRoy, of Chicago, has just issued a very handsome and tasty booklet entitled "Conduits and Cables," descriptive of the McRoy vitrified terra cotta conduit. Any one interested in putting wires under ground should look into the merits of the McRoy conduit.

The Barney & Smith Car Company, of Dayton, O., has completed and delivered to the Baltimore & Ohio, ten combination baggage and passenger cars. These cars are of the latest design, being equipped with gas, heated by steam and painted blue, and are sixty feet in length.

Elmer P. Morris has been appointed Eastern agent of the McGuire Manufacturing Company, and will hereafter have his office at 36 Dey Street. H. P. Hirsch, who has made an excellent record as Eastern agent of the company, will return to Chicago to take an important position in the home office.

The Walker Company, of Cleveland, writes that its business in railway generators and motors and in lighting apparatus has been very good the past season in spite of the adverse conditions which have prevailed, and the company confidently expects to share in the general increase of prosperity the coming year.

The Mason Electric Equipment Company, of Chicago, reports an encouraging revival of business since the election. A number of contracts which had been put off until the result was known were closed during the ten days succeeding election and the number of smaller orders received were decidedly encouraging.

The Fitzgerald-Van Dorn Company, of Chicago, has done a business throughout the past year which has been very satisfactory. The prospect for the coming year in its line, to judge from inquiries and business already promised, is certainly very bright and the company is preparing for a greatly enlarged business.

The Novelty Electric Company, of Philadelphia, has been appointed Eastern and Southern selling agent for the Changeable Electric Headlight. This headlight is giving excellent results in street railway service. It has a powerful, parabolic, aluminum reflector.

The Correspondence School of Technology, Cleveland O., has recently added still another instructor to its force in the person of I. H. Sherwood, B. S. Mr. Sherwood is a graduate of the Case School of Applied Science, has been employed by the firm of E. P. Roberts & Company, and will also assist as instructor in the Correspondence School.

J. M. Atkinson & Company, of Chicago, report that they are doing a large business with the horse shoe rail bond, having recently taken some large orders from a number of roads in various parts of the country. Many of their first customers are repeating their orders for much larger quantities, which is encouraging and speaks well for the bond.

Blood & Hale is the title of a new firm recently organized in Boston to act as consulting engineers. The firm will take up especially the different points of construction and reconstruction of power stations, where losses are too frequently found at present. The members of the firm are well known in electric railway work, and have acted as engineers in a number of important installations.

The Kinzer & Jones Manufacturing Company, of Pittsburgh, Pa., writes us that business is picking up well since election, and orders are coming in from all parts of the country for the Kinzer patent shoes and connections. The company claims that the use of this shoe will materially reduce expenses in the brake shoe and wheel items, an important feature of the expenditure on some roads.

The Standard Air Brake Company, of New York, has recently received another extensive order for its air brakes to go abroad. This time, fifty-two motor car equipments of the company's axle driven type have been ordered. The company is also arranging for a large shipment of its motor-compressor type, with automatic controlling device, to be shipped to an important narrow gauge railway.

The Goubert Manufacturing Company, of New York, is doing an excellent business in the sale of its well known feedwater heaters and purifiers. The Chicago office has been particularly busy in sending in orders and among recent shipments numbers one to Japan, a large separator to the Terre Haute Street Railway Company, and another to Portland, O., besides a number of smaller orders.

The New Haven Car Register Company, of New Haven, Conn., writes that its registers have been adopted by several roads

in foreign countries, and other important roads abroad are testing them with a view to their adoption. In this country New Haven registers are adding to their old time popularity and the company has just succeeded in closing a fine order with the Syracuse Railway for its double machines, and has other large contracts under way.

The Simonds Manufacturing Company, of Pittsburgh, Pa., has closed arrangements with Elmer P. Morris to act as a representative and handle its gears and pinions in the East, with an office at 56 Dey street, New York City. Mr. Morris will be glad to see all railway men when they are in New York. This company has also arranged with J. C. Carry to represent its interests in Chicago. Mr. Carry is also an old railway man and well known among the railway fraternity.

The Berlin Iron Bridge Company, of East Berlin, Conn., has received from the Glens Falls Paper Mills Company, of Glens Falls, N. Y., an order for a new pulp mill, at Cadyville, N. Y., including water tower and boiler house. The same company has also placed an order with the Berlin Iron Bridge Company for additional buildings for its Kent's Falls plant, consisting of a pulp mill, boiler house, barker room and wood room. The contract is a large one. Orders for machinery for equipping the various buildings will be placed at once.

The Q & C. Company, of Chicago, reports that in view of the improved business prospects it is preparing for a large demand for its goods and that it has been obliged to put up new and large works at Chicago Heights, a suburb of this city. The company has provided facilities for making prompt shipment of the portable rail saws, power saws and the Perfection oil purifier, and has also just taken up the manufacture of the Q & C pressed steel brake shoe key, which is M. C. B. standard and already used on a large number of roads.

The Ohio Brass Company, of Mansfield, O., writes in regard to indications for next year's business that it has every reason to believe that the business will exceed that of the past two years by a very considerable increase. The company's sales this year, which were probably much less than they would have been under a normal condition of affairs, have shown considerable increase over those of last year, and this gives the company every reason to believe that with the present outlook its next year's business will be the largest of any which it has ever done.

The Q. & C. Company, of Chicago, is meeting with excellent results in the sale of its portable rail saw, which has been illustrated in this column. A recent letter from O. A. Anderson, general manager of the Youngstown Street Railway Company, of Youngstown, O., states that the saw "has given perfect satisfaction, and is of great advantage in cutting short lengths of rails which it is impossible to do with a chisel, and in cutting off the ends of rails to reduce kinks in the track during the past summer. It has also been of great advantage in making cuts without removing rails."

The R. D. Nuttall Company, of Allegheny, Pa., writes us that the gears manufactured by it from a special composition of iron, and termed by it "malleable iron gears," have been giving very excellent results in service. This composition, which has been controlled by the company for more than a year, was that used in the manufacture of a gear referred to in a recent issue of the STREET RAILWAY JOURNAL as having a life of two years and five months, during which time the car equipped with it ran over 100,000 miles. Other gears of this metal have shown equally good results.

The Ohio Brass Company, of Mansfield, O. writes that the increasing demand and growing popularity of the Walker trolley ear have resulted in several companies placing on the market a mechanical ear patented after it which they claim will give equally good results in practice. The Ohio Brass Company states, however, that the salient features of the Walker ear, are fully covered by letters patent No. 526,422, and that no trolley ear can be made similar to it which will give "equally satisfactory results" unless it infringes upon it. The Ohio Brass Company has the sole right to manufacture this article.

The Link-Belt Engineering Company, of Nicetown, Pa., has published one of the most tasteful catalogues of its elevating and conveying machinery and transmission of power apparatus which has ever reached this office. The coal handling machinery of this company has had a very extensive use in street railway power stations, and for this reason the catalogue possesses a peculiar interest to street railway managers. A number of the most important installations made by the company are illustrated by handsome photo-engravings, while the details of the apparatus of the company are also illustrated and described.

Wm. S. Turner, M. S., formerly of Woodbridge & Turner, consulting engineers and contractors, has opened an office at 253 Broadway, New York, as a consulting and constructing engineering business in electric railways, lighting, power transmission and steam engineering, similar to that heretofore conducted by Woodbridge & Turner Engineering Company, which concern has recently discontinued business. An active and continuous experience of ten years in designing, constructing, supervising and consulting in the department of engineering work mentioned, well fits Mr. Turner to carry out the plans of an electric railway company in new construction or betterments.

Pratt & Lambert, of New York, the well known varnish makers, have increased their facilities by purchasing the entire varnish plant of Poillon & Company; so that they now have four factories in all, namely: two in Long Island City, N. Y, one in Chicago, Ill. and one in Montreal, Can., with branch offices in New York, Chicago, Philadelphia and Montreal. Their leading specialty is in the paleness of their railway varnishes, they claiming to manufacture the palest line of varnishes on the market to-day. This is a great advantage in application over all shades of colors, and particularly so on the light or cream color shades. They will cheerfully furnish samples, upon application.

Morris, Tasker & Company, of Philadelphia, Pa., have recently published a very complete and tasteful catalogue of their wrought iron and steel tubular poles for street railway, telegraph, telephone, electric light and power circuits. This company has unexcelled facilities for the manufacture of tubular poles, and its enterprise and superior workmanship have been the means of the extensive use of its poles for electrical service. The list of railway companies employing Morris, Tasker & Company's poles is a long one, and includes not only many of the largest railways in this country, but also abroad. The catalogue contains on each page a tasteful engraving of a different type of pole, making the whole a complete illustrated encyclopaedia of the present state of the art.

Wendell & McDuffie, of New York, who represent a number of prominent manufacturers of street railway apparatus, such as the Taunton Locomotive & Machine Works, the Rochester Car Wheel Company, etc., have changed their headquarters from the eighth to the fifth floor in the Havemeyer Building. At their new office which is No. 504 they have much more room than formerly, a change made necessary by their growing business. The firm has recently added one more to its excellent line of agencies, that of agent for New York and New Jersey of the Haskell steam generator, a device to be attached to boilers by which, it is claimed, the economy of the boiler is greatly increased. The company has also secured a warerocm at No. 51 Dey Street. J. Ellis Hoffman has recently associated himself with Wendell & McDuffie and will act as treasurer of the Haskell Steam Generator Company, of New York.

K. McLennan & Company, of Chicago, Ill., sole manufacturers of the celebrated Gale's commutator compound, extend an invitation to all users of generators and motors, who are troubled with sparking and cutting, to send to them for a free sample stick of their compound. To a representative of the STREET RAILWAY JOURNAL, Mr. Isaacs, manager of the company, stated that several thousand free samples have lately been distributed. He stated that the results, attendant upon trials by users, which have been reported to them, are indeed satisfactory, and in each instance, it has been conceded that Gale's commutator compound will absolutely prevent sparking and cutting, and will not gum the brushes. Among the many street railway companies that have recently adopted the use of this compound, are the Union Depot Railroad Company, St. Louis, Mo.; the Houston Electric Street Railway Company, Houston, Tex.; the Galveston Street Railway Company, Galveston, Tex., and the Tuscarawas Company, New Philadelphia, O.

The Western Electric Company, of Chicago, has been given the agency for the products of the Interior Conduit & Insulation Company, of New York. All brass armored and iron armored conduits, elbows, couplings, fittings, etc., will be carried in stock in Chicago, and unusual facilities will be given to all jobbers and contractors for obtaining this material at the lowest prices. The Interior Conduit Company has just brought out a special conduit which is much superior to anything which has ever before been placed upon the market, and it has not only increased the excellence of this material, but has very materially decreased the price. The Western Electric Company is prepared to furnish new prices upon application. Coupled with this agency the Western Electric Company has also secured the agency for a fine line of standard, iron amored, slate lined, panel, distributing, fuse, main, and feeder terminals, also branch junction boxes. These boxes are specially designed and each box can be used on either two or three wire system.

The Berlin Iron Bridge Company, of East Berlin, Conn., is putting up a new machine and blacksmith shop for the Robert Palmer & Son Shipbuilding Company, of Noank, Conn. The same company is also furnishing a rolling mill for the Rome Brass & Copper Company, of Rome, N. Y., an iron roof for the new armory at Rutherford, N, J., and a new power house for the Plattsburgh Light, Heat & Power Company, of Plattsburgh, N. Y. Among the numerous contracts which the company has secured of late for steel roofs covered with corrugated iron, lined with the patent anti-condensation roof lining, is the roof for the new power station for the Stamford Gas & Electric Company, at Stamford, Conn. The layout of this station is very convenient, and the construction is to be the very best. The engine and dynamo room is 60 ft. wide and 100 ft. long, and the boiler room adjoining is 40 ft. wide and 75 ft. long. The walls are of brick, and the framework of the roof as well, as the supports for the traveling crane in the engine and dynamo room are of steel. The Berlin Company has the contract for furnishing and erecting all of the structural steel work.

The J. G. Brill Company, of Philadelphia, is just shipping the last of the lot of cars recently built by it for South Africa. These cars are a curiosity to Americans, being of the double decked variety. They are arranged with double stairways, one at each end. The platforms are of necessity very wide, and in order to accommodate some peculiar conditions of the road, the head room is but 6½

ins. in the center of the aisle. One division of this lot of cars was arranged with outside seats on the lower floor. The neeessity for meeting a number of peculiar and unusual conditions called for a great deal of ingenious designing to secure the desired result, and at the same time make a strong and durable car. While they were not strictly knock-down ears, yet the platforms and upper deeks had to be entirely removed and put in separate boxes. The ears themselves were boxed after having the platforms removed and stowed inside. The company is also building a number of other cars for foreign service. Of the thirty No. 27 trucks sent five months ago to the Buffalo & Niagara Falls road, it was reported not long ago that they had never been off the traek, and a day or two since Mr. Van Horn said, "The record is unbroken to date"—rather a remarkable statement, considering the speed at whieh the ears are run.

The Laclede Car Company, is delivering 115 ears to the Cincinnati Consolidated Street Railway Company. These are all closed motor ears, about twenty-seven feet over all and of the Cincinnati standard type. They were designed by the Laclede Car Company. There are four large windows of polished plate glass on each side, automatie twin doors, Hale & Kilburn seats. The ears have front vestibule and the interior finish is of poli:hed cherry. The Laclede company is also building some cars for the Binghamton Railroad Company about twenty-nine feet over all, half vestibule at front, the interior finish being polished cherry and the outside a rieh wine color. These cars also have automatic twin doors and are similar to the handsome ear built for exhibition purposes for the Chicago Exposition. The Laelede company is also building five cars for the Second Avenue Traetion Company, Pittsburgh, to be finished in polished quartered oak, front vestibules, eighteen foot bodies, twenty-seven feet over all. They are also building three private palace ears for the Cincinnati Consolidated Street Railway Company; these cars being designed throughout by the Laclede Company. They are for private and trolley parties. One of these ears will be similar to the "Julia," built for the Philadelphia Traction Company. The company reports prospects for new business exceedingly good, and is counting on a large business for the coming year.

The Falk Manufaeturing Company, of Milwaukee, has just issued an interesting pamphlet entitled "Always in Line." It gives faets and figures relative to the cast welded joint or Falk method of making a continuous rail, that should prove of value to every one interested in track construction and maintenanee, as well as the eeonomy and net earnings of street railways. The claims of the Falk Company as to the saving and economy of the cast welded joint seem to be fully substantiated. The principal claims are that a very much lighter rail may be used; a perfect electrical joint and a great saving to rolling stock, to say nothing of the satisfaction given to patrons of riding over a perfectly smooth track. Up to the present time there have been 89,410 of these joints put in. Chieago leads the list with 39,700, Minneapolis is second with 12,000, St. Louis, 10,500, Memphis, 6000, Providenee, 5510, the balance in Brooklyn, New Haven, Milwaukee, Washington and Newark. Albert Hoffman, second vice-president of the eompany, is now at Lyons, France, superintending the introduction of the proeess there, and expects to introduce it in other European cities prior to his return. An arrangement has reeently been effeeted between the Falk Manufacturing Company and the Thomson Houston International Company for the introduetion of the cast welding proeess in Europe.

The Manufaeturers' Advertising Bureau, has now been some six months at its new location, 126 Liberty Street, New York City, and finds the move from the old time headquarters at "111" to have been a good one. The present facilities of the bureau are thoroughly up-to-date and enable it to care for the large business entrusted to its eare to the utmost satisfaetion of its clients and with the greatest degree of convenience and dispatch. There is no other eoncern in the United States quite like the Manufacturers' Advertising Bureau in the business it conducts, which is original and peculiar to itself. Established in 1879 by its present head and proprietor, Benj. R. Western, who was for some years previously a publisher of trade journals, its purpose is to manage the newspaper work and advertising for firms who have not the time, inclination or experience to eonduct this department of their business themselves, and yet wish brought to it the attention it deserves. The bureau is an authority on trade journal advertising to whieh it has eonfined its operation, almost wholly, and those in need of expert help in this direction will do well to note the fact. A booklet with the title "Advertising for Profit" is published by the concern for gratuitous distribution among manufaeturers generally who are desirous of knowing just how it works.

The McGuire Manufaeturing Company, of Chicago, has reason to be thoroughly satisfied with the business in its different lines the past two months, and reports the sales for October as the largest this year, whieh is quite surprising, considering the dullness in all lines of trade at this time. The shipments of last month ineluded 281 of the company's standard A1 suspension trucks, thirty-eight L trueks, 486 Columbia heaters. The company is also completing eighteen snow sweepers, and is doing the usual business in ratchet handles and in its well known steam lines. This business can hardly be eredited to the outeome of the recent eleetion, but it is hoped and expeeted that there will be a big boom in all the company's lines in the near future. The Chicago newspapers announce the faet that the company has plans out for a seven story addition to its Morgan Street works, from whieh it would seem that the McGuire Company at least, expects an increase in business. Its stove and sweeper departments have been running night and day the past month, and as this paper goes to press the report is current that the Consolidated Traction Company, of Pittsburgh, has placed a quick delivery for seven McGuire eombination sweepers, which is the third order from this company, and that the company has reeeived an order from the Holmesburg, Tacony & Frankford Railway, of Tacony, Pa., for one sweeper to be shipped in five days. All of this adds to the McGuire people's reputation for quick delivery.

The Ameriean Engine Company, of Bound Brook, N. J., has begun the shipment of its new engines known to the trade as the American-Ball engines. The first of these engines, of 100 h. p. eapacity, has gone to the Detroit "Evening News," and the second, a 50 h. p. engine, to the Savannah "News." Since the addition of this new line of work the business of the American Engine Company has inereased so that the works are now eompelled to run double time, having installed a night force. In the electrieal department, among the recent shipments, are the following; Cliff Paper Company, Niagara Falls, N. Y., two motors, 150 h. p. eaeh; Detroit "Evening News," Detroit, Mich., two dynamos, each 25 k. w.; Albany "Morning Express," Albany N. Y., one 18 k. w. dynamo; Oakland "Tribune," Oakland, Cal., 25 h. p. motor; A. N. Kellogg Newspaper Company, Chieago, Ill., four 15 h. p. and one 25 h. p. motor; Topeka "Capital," Topeka, Kan., 5 h. p. motor; Boston "Traveler," 12 h. p. and 5 h. p. motor; Worcester "Post," "Worcester, Mass., 9 k. w. dynamo; Cincinnati "Post" Cincinnati, O., 35 h. p. motor; Philadelphia "News," 25 h. p. and one 3 h. p. motor; Elmira "Gazette," 25 h. p. motor. American Newspaper Publishing Company, 25 h. p. motor; Carrington Publishing Company, 12 h. p. motor; J. B. Cranfill, Waeo, Tex., 25 h. p. motor; Fall River Publishing Company, Fall River, Mass., one 25 h. p. ahd one 3 h. p. motor; Saginaw "Evening News," Saginaw, Mich., 12 h. p. motor: B. A. Meade Company, Augusta, Me., 3 h. p. motor: Chieago "Journal," 15 h. p. motor; Grand Rapids "Democrat," 15 h. p. and 3 h. p. motor; St. Paul "Pioneer Press," St. Paul, Minn., 5 h. p. motor; Wallaee Publishing Company, Des Moines, Ia., 12 h. p. motor; New York "Tribune," two 15 h. p. motors; Rubber Tire Wheel Company, New York, N. Y., 12 h p. motor.

The Cahall Sales Department, of Pittsburgh, Pa., writes us that Cahall horizontal water-tube boilers, manufactured by the Aultman & Taylor Machinery Company, of Mansfield, O., have reeently been sold to the following parties: Nekoosa Paper Company, Nekoosa, Wis., 500 h. p.; Abbeville Cotton Mills, Abbeville, S. C., 300 h. p.; Steere Worsted Mills, Providence, R. I., 500 h. p.; Block Plant Electrie Light Company, Boston, 175 h. p.; Willimantic Linen Company, Willimantic, Conn., 750 h. p.; Crystal Ice Company, Allegheny, Pa., 750 h. p. Cahill vertical boilers, manufactured by the Aultman & Taylor Machinery Company, have reeently been sold the following firms: Briar Hill Iron Company, Youngstown, O., 500 h. p.; United Coke & Gas Company, McKeesport, Pa., 600 h. p.; Phoenix Horse Shoe Company, Poughkeepsie, N. Y., 125 h. p.; Brown & Company, Wayne Iron Works, Pittsburgh, Pa., 450 h. p; F. C. Hood, Watertown, Mass., 400 h. p; Ameriean Net & Twine Company, Anniston, Ala., 320 h. p.; Lowell & Suburban Railway Company, Lowell, Mass., 1250 h. p.; Chicago Horse Shoe Company, Chieago, Ill., 250 h. p.; Buffalo Furnace Company, Buffalo, N. Y., 200 h. p.; Woodland Fire Brick Company, Woodland, Pa., 100 h. p.; Apollo Iron & Steel Company, Apollo, Pa. (fifth order), 250 h. p.; National Tube Works Company, McKeesport, Pa. (second order), 400 h. p.; Merrimaek Manufacturing Company, Lowell, Mass., 250 h. p.; George Westinghouse, Jr., Pittsburgh, 100 h. p.; Sicilian Asphalt Paving Company, New York City, 300 h. p.; Elmira Knitting Mills, Elmira, N. Y., 200 h. p. The Carnegie Steel Company has just finished the installation of 6000 h. p., of these boilers at its Edgar-Thomson Steel Works, Braddock, Pa. Cahall horizontal water-tube boilers, manufactured by the Aultman & Taylor Machinery Company, have also been sold to the following customers: Nekoosa Paper Company, Nekoosa, Wis., 500 h. p.; Abbeville Mills, Abbeville, S. C., 300 h. p.; Steere Worsted Mills, Providence, R. I., 500 h. p.; Block Plant Eleetric Light Company, Boston, 175 h. p., Willimantie Linen Company, Willimantic, Conn., 750 h. p.; Crystal Ice Company, Allegheny City, Pa., 750 h. p.

New Publications.

BLOCK AND INTERLOCKING SIGNALS. by W. H. Elliott, Sig. Eng. C. M. & S P. R. R. Leather; 277 pages. Price $3. Published by *Locomotive Engineering*, New York.

The elaborate development of the interlocking railway block signal and the efficiency with which it accomplishes its work is elearly shown by this volume. The modern interloeking block signal system is the result of a great deal of thought and study, and it has been of almost incalculable benefit in the rendering of travel safe. The different systems in use are carefully deseribed, and the volume is illustrated by many engravings.

ELECTRICITY AND WATER POWER. By M. A. Replogle. 161 pages. 16mo. Price $1. Electrical Review Publishing Company, New York.

The eleetrical utilization of water power was one of the results sought for by early workers in electricity, and this field has always seemed, as if it should be a most fruitful one to eleetrical engineers. For a long time, however, it remained but little developed owing to many diffieulties which still eonfront the hydraulic electrical

engineer. To explain what these difficulties are and describe the best way of overcoming them has been the aim of Mr. Replogle. The book contains many interesting suggestions and gives a short description of each of the most important electric water power installations in his country.

Trade Catalogues.

Catalogue. Forty-nine pages. Illustrated. Published by the Steel Motor Company, Johnstown, Pa.

Electric Light and Street Railway Poles. Forty-one pages. Illustrated. Published by Morris, Tasker & Company, Incorporated, Philadelphia.

Modern Methods Applied to the Elevation and Conveying of Materials and Transmission of Power. 131 pages. Illustrated. Cloth. Published by the Link Belt Engineering Company, Nicetown, Pa., and New York.

List of Street Railway Patents.

U. S. Patents Issued Oct. 27, 1896, to Nov. 17, 1896, Inclusive.

Oct. 27.

Automatic Car Holder for Hoisting Cages.—J. R. Campbell, Litchfield, Ill. No. 569,999.

Grip and Brake Operating Mechanism.—Julius Jonson, New York, N. Y. No. 570,023.

A grip operating worm, a divided shaft, one part of the shaft provided with a worm wheel to engage the worm and the other part adapted to be connected with the grip, and means for locking the parts of the shaft to and releasing them from each other.

Trolley for Electric Railways.—W. M. Whiting, E. Orange, N. J. No. 570,078.

A trolley arm and a trolley head secured thereto, and fingers on said head, a pivoted trolley carrier to constantly and yieldingly force said trolley wheel against the trolley wire irrespective of the movements of the trolley pole, and said fingers on the trolley head being adapted to be brought against said carrier to act as stops.

Electric Car Motor.—C. S. Bradley, Avon, N. Y. No. 570,119.

Consists of a car truck, an electric motor mounted upon a sleeve surrounding the axle, said sleeve being supported by the car wheels upon tangentially arranged springs.

Cable Railway Grip.—L. J. Hirt, Brookline, Mass. No. 570,173.

Electric Railway.—A. Norman, Toronto, Can. No. 570,328.

A supporting rail on which the cars run, the rail being formed of sections of inverted U-shape, in cross section, a main conductor mounted within the cavity formed within the rail, and insulating supports for the conductor also mounted in the said cavity.

Track Cleaner or Current Collector.—W. M. Roberts, Cumberland, Md. No. 570,239.

Railway System.—G. D. Baldwin, Passaic, N. J. No. 570,447.

A roadbed having a guide slot therein and the car a hanger plate held to oscillate horizontally beneath the car, and a guide arm dropped from the hanger plate to enter the slot.

Nov. 3.

Bitransit Railway System.—B. F. Carpenter, Roselle, N. J. No. 570,451.

Trolley.—J. A. Hance, St. Louis, Mo. No. 570,475.

Electric Railway.—H. C. Reagan, Jr., Philadelphia, Pa. No. 570,565.

A feed wire, an oscillatory contact mounted on the latter and provided with a magnetic arm or armature and a resilient non-magnetic arm also attached to said contact.

Magnetic Path for Underground Electric Railways.—H. C. Reagan, Philadelphia, Pa. No. 570,566.

Car Fender.—J. M. Staley, Reading, Pa. No. 570,571.

Mechanism for Cable Railroads.—L. J. Hirt, Brookline, Mass. No. 570,635.

Movable tripper bars, arranged and adapted to be thrown into operation and open the cable grip, and mechanism whereby the tripper bars are operated from the surface of the road.

Car Fender.—A. A. Lydecker, Paterson, N. J. No. 570,645.

Track Instrument.—T. B. Dixon, Henderson, Ky. No. 570,700.

Street Car Sign.—E. L. Dyer, Cambridge, Mass. No. 570,747.

Comprises a case having fixed upon its front a plurality of destination signs thereon one upon the other, a screen pivoted between said signs and adapted to cover one or the other and means to move the screen to conceal one of the signs at a time.

Car Fender.—R. C. Hoyer, Memphis, Tenn. No. 570,758.

A lower fender having pivotal movement and a second fender mounted to reciprocate to and from the lower fender, one fender being set in operation by the other.

Safety Appliance for Street Cars.—W. Wiggins, Brockton, Mass. No. 570,888.

Nov 10.

Car Fender,—T. M. Miller, Bethlehem, Pa. No. 570,943.

Railway Street Sprinkler.—J. R. Gaithright, Louisville, Ky. No. 570,990.

A car body having wheels arranged to run on a track in the ordinary manner, a tank mounted in said car body, a vertical pipe extending down from the tank near one end of the car body, and a horizontal filler-pipe pivotally mounted on said vertical pipe, whereby said filler-pipe may be swiveled or turned to co-operate with sources of water supply at either side of the track.

Railway Street Sprinkler.—J. R. Gaithright, Louisville, Ky. No. 570,991.

Trolley For Electric Railways.—P. C. Macevoy, Brooklyn, N. Y. No. 571,092.

Electric Railway Trolley.—H. D. Hinckley, Hartford, Conn. No. 571,120.

Sand Depositing Apparatus for Cars.—J. Oldfield, Medford, Mass. No. 571,136.

A sand box, a sand feeding device consisting of a screw having its end formed with two quadrantal flat surfaces and a casing inclosing said screw, the delivery end of said casing being formed with two quadrantal openings, means for operating said screw and a pipe or tube for conducting the sand to the rail.

Car Fender.—I. N. Stanley, Brooklyn, N. Y. No. 571,175.

Safety Fender for Street Cars.—J. W. Angell, Owosso, Mich. No. 571,256.

A car, a pair or more of jaws pivotally connected with the car to swing vertically to a folded position and movable, when unfolded in a horizontal plane to clasp or retain the object or person brought in contact therewith.

Car Truck.—T. Crawford, Green Island, N. Y. No. 571,263.

Consists of axle boxes, vibrating or swinging links connected thereto to opposite sides thereof at their lower ends, the spring supported on and connected to the upper ends of said levers and a truck frame supported on the spring.

Unremitting Rotary Car Fender.—J. J. Holloway, Los Alamos, Cal. No. 571,320.

Nov. 17.

Electric Brake.—E. A. Sperry, Cleveland, O. No. 571,409.

A dynamo-electric machine, a storage battery with a device adapted to connect the battery in the brake circuit in one direction for charging and in the other direction for discharging.

Electric Controller.—E. A. Sperry, Cleveland, O. No. 571,410.

Dynamo electric machines used for propelling and braking purposes, a switch for limiting the current when the machines are acting as generators and braking the car, and means for insuring the opening of the limit-switch at a predetermined time.

Electric Railway System.—G. J. Forrey, Carlisle, Pa. No. 571,435.

Automatic Trolley Switch.—L. M. Erb, Leavenworth, Kan. No. 571,517.

A shiftable tongue and a trigger lying in the path of the tread of the trolley wheel and adapted to be moved upward by the upward pressure of the trolley and thereby shift said tongue.

Station Indicator.—H. Feder, New York, N. Y. No. 571,518.

Car Fender.—W. H. Kaltenbeck, Roxbury, N. Y. No. 571,528.

Apparatus for Use in Painting Trolley Poles.—H. A. French, Providence, R. I. No. 571,560.

A platform, a movable support therefor, a ladder pivotally and adjustably mounted on said platform, two or more knee brackets pivoted to swing on the outer sides of said ladder, small platforms fast on said brackets and an adjustable brace-rod secured to said ladder and platform to support and adjust said ladder.

Compound Tramway Rail.—W Towler, Leeds, England. No. 571,709.

Car Fender.—P. J. Waters, Bristol, Pa. No. 571,714.

Illuminated and Changeable Street Car Sign.—C. R. Klettner, Cincinnati, O. No. 571,726.

A sign frame, constructed of longitudinal rods, and end frames forming a number of sign-faces, wires stretched transversely between the rods, the letters of the sign secured thereto, and the whole pivotally supported at the end frames to permit the sign-faces to be changed.

Switch Throwing Device.—W. H. Reece, Boston, Mass. No. 571,733.

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.