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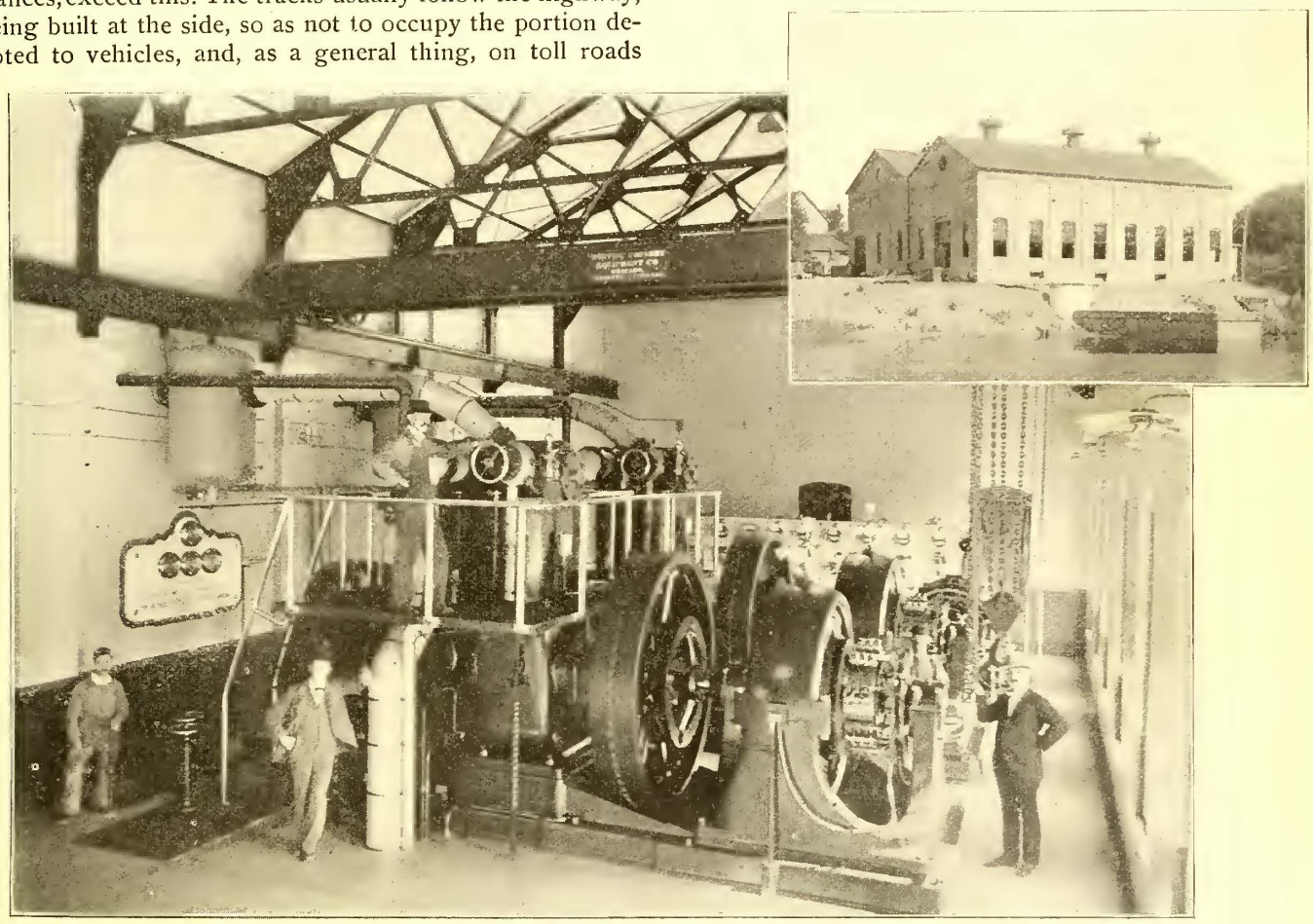
THE INTERURBAN ELECTRIC RAILWAYS AROUND DETROIT

The interurban electric railway system around Detroit is more extensive than that in the neighborhood of any other city in this country, with the possible exception of Cleveland. There are no less than six interurban lines reaching out from the city in all directions, except where limited by the Detroit River, and of lengths varying from 20 to 40 miles. The cars are nearly all of the long double truck type; when outside of the city limits they run at schedule speeds of from 30 to 40 miles an hour and, in some instances, exceed this. The tracks usually follow the highway, being built at the side, so as not to occupy the portion devoted to vehicles, and, as a general thing, on toll roads during the last year, and, while the owners of all the lines prefer not to make public any financial statements of the operation of the roads, it is apparent that most of them are doing a good business, and practically all the companies are planning important extensions in the early future.

The headway on most of the lines is thirty minutes, and the cars run on regular published timetables, giving a service more closely resembling that of steam railroads than that of ordinary city electric railways. All the companies



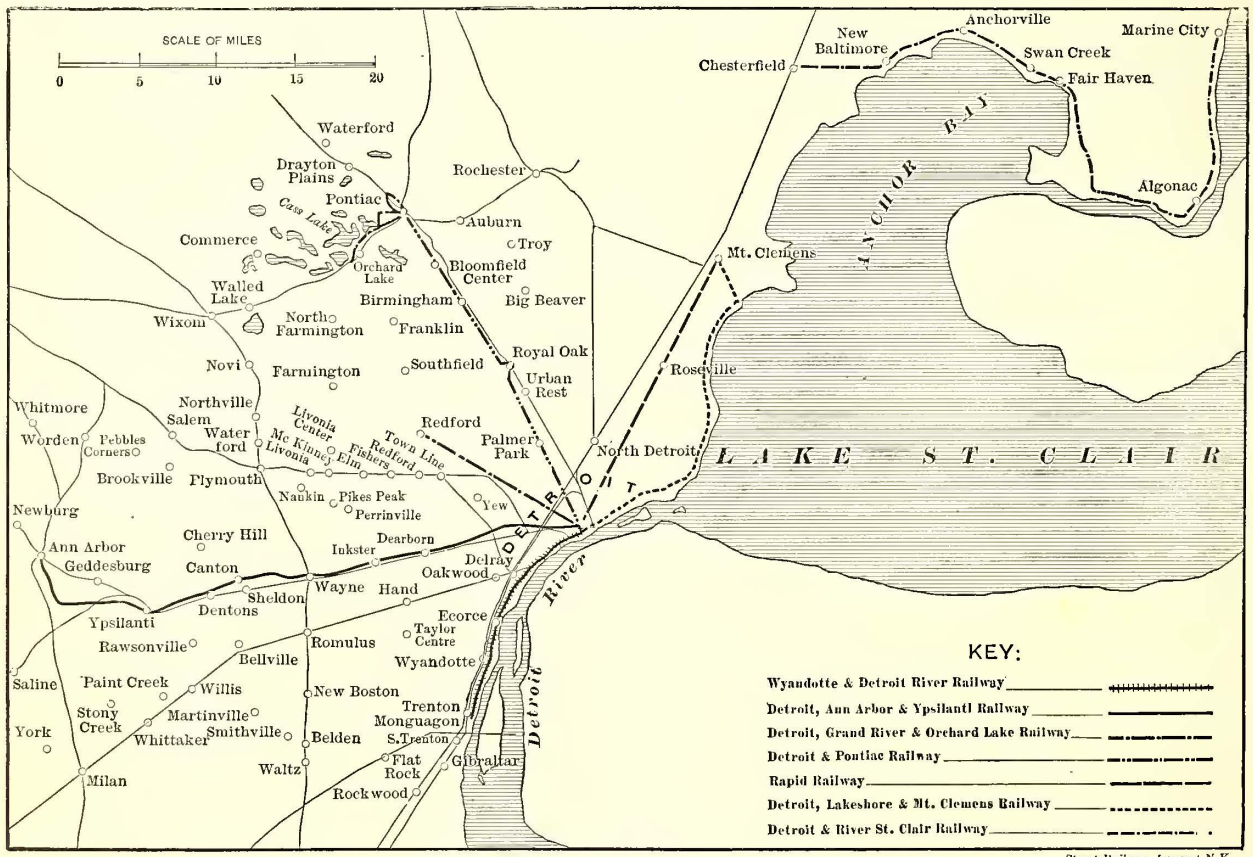
POWER STATION—DETROIT, YPSILANTI & ANN ARBOR RAILWAY

whose owners are identical with or closely allied to those of the electric railway. Within the city the cars operate by a traffic arrangement over the lines of the Detroit Citizens' Railway Company, which controls all of the lines in that city, and all start from or near the central square in Detroit, around which they make a loop; while on the lines of this company the cars are operated by employees of the Detroit Citizens' Street Railway Company, which takes the local fares and pays the interurban railways a certain mileage for the use of the cars. Upon arriving at the city limits, or at the terminus of the Detroit Citizens' Railway lines, the crews are changed and employees of the interurban lines assume the operation of the cars.

Two of the five most important lines have been built have offices in the city at which tickets can be purchased, and on one of the lines, mileage books are sold, though the coupons are detached in multiples of five. On one or two of the others duplicate fare receipts are issued by the conductor when fare is paid on the cars. All the roads are divided into 5-cent zones, and the average fare charged is about a cent a mile. Many, if not all, of the lines parallel steam railroads, and, although the running time between termini does not equal in point of speed that of the steam railroads, the frequency of the service, the ability to discharge passengers along the line and the low fares, have attracted considerable traffic from the steam rivals. The electric roads undoubtedly have also created a great deal of traffic.

Nearly all of the lines carry baggage and operate a light express system, and some operate regular freight trains, which they are entitled to do under the laws of the State of Michigan. These freight cars are of the regular box type, but neatly painted, and are run either as motor cars or as single trail cars, usually at night. Stations for the receipt of express and freight matter are located in the cities through which they pass. A considerable item of freight from the country into the city is milk, which is collected at points along the line in the early morning and delivered to depots in the city, where it is distributed in the usual way.

In spite of the long distances involved, it is interesting to note that no attempt has been yet made to transmit and distribute power by the alternating current system. The standard voltage on the trolley wire varies from 500 to 650, but the drop on the long lines is cared for by boosters, with which the stations of nearly all the companies are equipped.



MAP OF INTERURBAN ELECTRIC RAILWAYS NEAR DETROIT

One outlying line, the Detroit & River St. Clair Railway, which extends from Chesterfield to Marine City, is now operated by steam power, the trains coming in from Chesterville on the tracks of the Michigan Central Railroad. The electrical equipment of this line and its extension to Mt. Clemens at an early date, is probable, however.

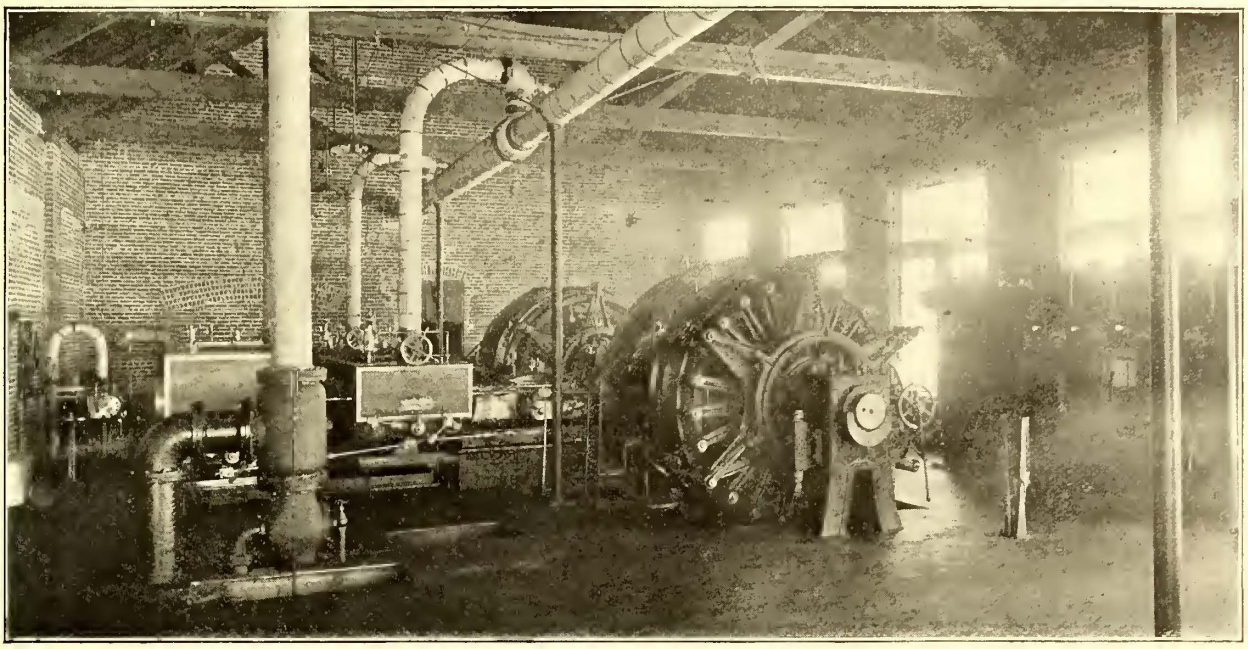
POWER STATIONS

The Detroit, Ann Arbor & Ypsilanti Railway, the longest line of the group, was put in operation last summer and takes its power from two stations, one at Dearborn, the other at Ypsilanti. The stations are identical, with the exception of the number of units in each, so that a description of the Dearborn station will suffice for that at Ypsilanti. The station is of brick, 73 ft. 6 ins. x 68 ft. 5 ins., divided into an engine room 71 ft. x 31 ft., and a boiler room 71 ft. x 35 ft. The former contains three 500-h.p. Westinghouse Kodak compound condensing units, with two boosters rated at 150 kw. each, but frequently carrying a very much higher load than this. The circuit breakers are set at 1150 amps., although the generators are rated at 392 amps. The switchboard is of the Westinghouse panel type, and a large Whiting crane runs the full length of the engine room. The gage board is of 2-in. marble, measures 4 ft. x 6 ft., and is particularly handsome. The floors are of concrete, laid with steel I-beams, with brick arches, making the station entirely fireproof. The boiler room is equipped with three batteries of 250 h.p., Babcock & Wilcox boilers, fitted with Roney mechanical stokers, which are giving excellent satisfaction. Mechanical draft is used, supplied by a duplicate set of 110-in. Detroit blowers belted to small Westinghouse Junior engines. An extra wheel is put on the stoker engine and is belted up to a shaft, by which the economizer scrapers are operated. The rest of the equipment of the boiler room includes Worthington compound duplex jet condensers, Baragwanath heaters, the Wefugo filters, and an American economizer. The feed water is first taken from the hot well, thence passes into the filter, thence to the heater, and thence to the economizers, from which point it is introduced into the boilers. The piping is extra heavy, on account of the high steam pressure used, viz., 175 lbs. to the inch. From the boilers the live steam passes by 6-in. w.i. header to a 10-in. w.i. main, from which it is fed by 8-in. pipes to the engines. The usual Westinghouse steam loop and separators are employed, and no elbows are used in the live steam piping, which is covered by Johns magnesia covering.

In the basement is a Worthington fire pump, 12 ins. x 7 ins. x 10 ins., with a capacity of 320 gals. per minute. This is also used for washing cars in the car barn, sprinkling the lawns, etc. Steam is always kept up in this pump, even when not in use, and it can be made to operate by the turning of a valve. The contractors for this station, as well as for all the electrical apparatus, were Westinghouse, Church, Kerr & Co.

The power station of the Lakeshore Railway Company

is at Lakeside, and has an entirely different equipment. It is of brick, 100 ft. x 40 ft., with metal roof, and contains two Russell compound 4-valve engines, guaranteed to develop 450 h.p. on 125 lbs. of steam, with an efficiency of 90 per cent when working at the most economical point of cut off; each engine directly connected to a 300 kw. Siemens & Halske generator. There is also a 200 h.p. Russell 4-valve engine directly connected to a 100 kw. Siemens & Halske booster. The switchboard is of the usual type. The boiler room contains two Stirling water tube boilers, each equipped with a Jones mechanical stoker. The room also contains a Laidlaw-Dunn-Gordon single-jet condenser for each engine, Wainwright closed feed water heater and the usual apliances.



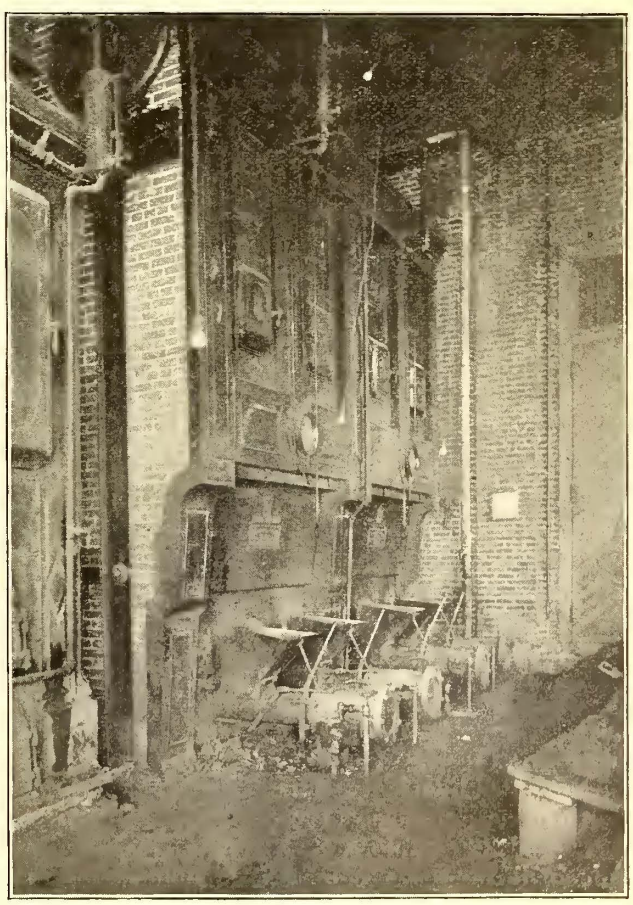
ENGINE ROOM—DETROIT, LAKESHORE & MT. CLEMENS RAILWAY

On account of the great depth and mass of the coal in the stoker, forced draft was considered desirable. The pressure of air ranges from 1½ oz. to 5 oz. per sq. in., according to the steaming capacity of the boiler, and the quality of coal used. The quantity of air delivered at these pressures ranges from 6500 cu. ft. to 12,000 cu. ft. per minute, which is sufficient for a consumption of from 1600 lbs. to 3600 lbs. of coal per hour.

The blower used was made by the American Blower Company. The wheel is 34 ins. in diameter, and the discharge outlet 20 ins. in diameter. When running 830 r.p.m. this blower will produce 1½ oz. pressure, and at 1525 r.p.m. will produce a 5-oz. pressure, with an expenditure of about 2 per cent of the total output of steam from the boilers, for power to drive the blower when running at maximum speed. The blast piping runs along the front of the boilers over the fire doors with branches extending down between them and discharges into what is ordinarily the ash pit, but with these stokers it is an air chamber beneath the stokers. This piping is made of heavy galvanized iron, soldered and riveted to make it air tight. In each branch pipe from the main pipe is fitted a blast gate to control the volume of air delivered to each boiler, according to how the fire burns under each. The air finds egress through long narrow slits or openings in a row of tuyere blocks, running the entire length of the stokers. This brings the blast beneath the ignited coal and causes the fire to burn with equal force at the front, middle and back of fire-bed.

The well from which the feed water is taken holds 39,000 gals., and is fed by an 18-in. intake pipe from the lake and an overflow pipe of the same size from the engines. The station, with the car house adjoining it, was built by the Arbuckle-Ryan Company, of Toledo, under the supervision of the engineers of the company, Van De Mark & Hill. The road was financed by the International Construction Company, of Detroit.

The power station of the Detroit & Pontiac Railway is at Birmingham. It contains two Westinghouse compound condensing engines with Worthington pump and condenser, a Westinghouse generator belted to one engine and two Detroit generators belted to the other engine.



BOILER ROOM—LAKESHORE & MT. CLEMENS RAILWAY

The boilers are of the horizontal return tubular type with vertical open heaters and New York filter. The total power capacity of the station is 600 h.p.

The power station of the Wyandotte & Detroit River Railway is at Ecorce, and contains two 150 Dick & Church compound condensing engines, built by the Phœnix Iron Works, each belted to a Westinghouse 4-pole 100 kw. generator. The boilers are of the Manning vertical tubular type, with Conover condensers and closed heaters.

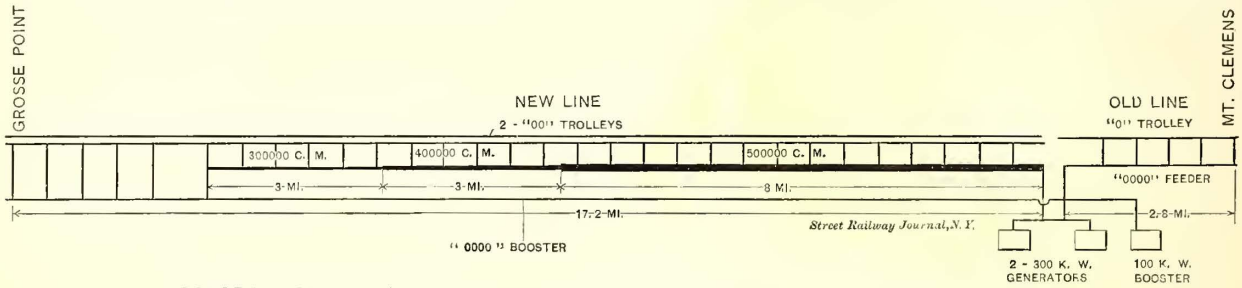


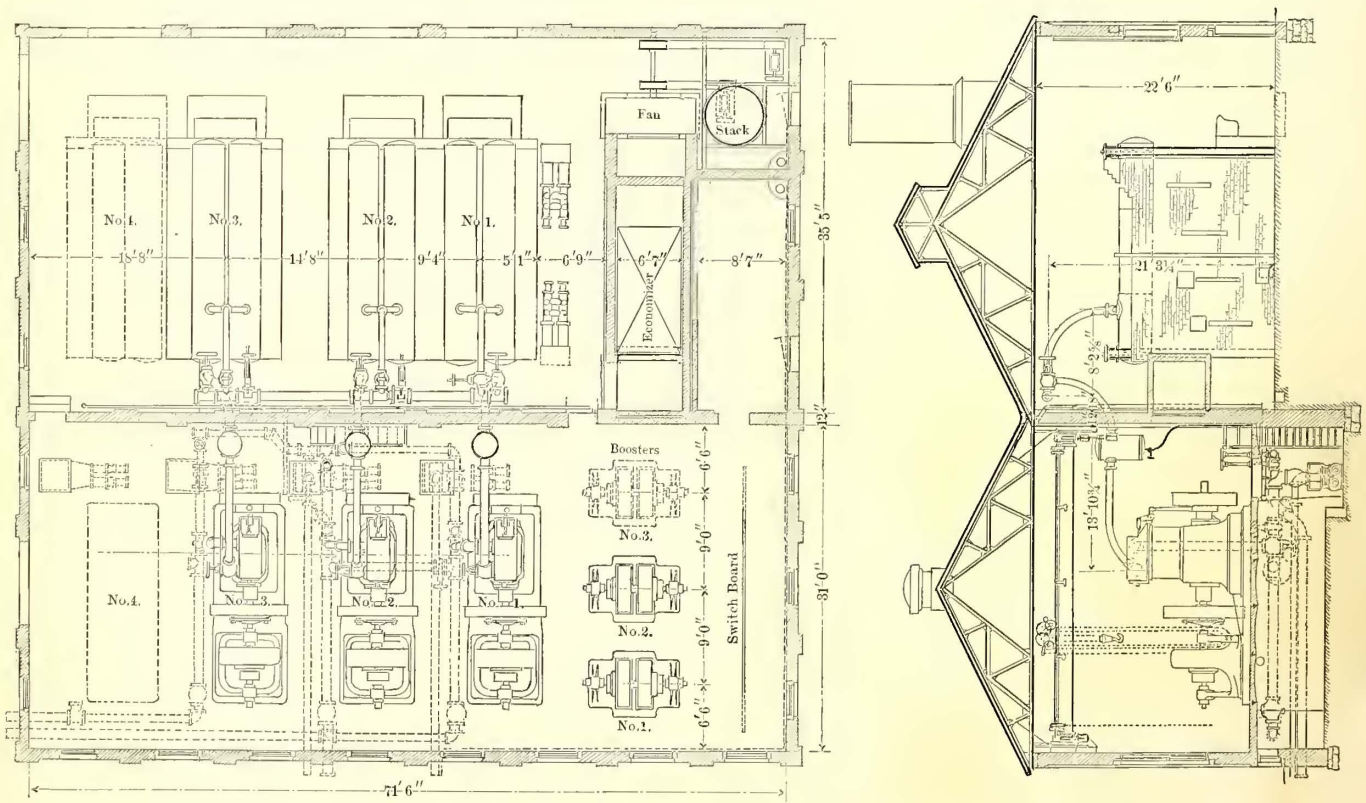
DIAGRAM OF FEEDER SYSTEM—DETROIT, LAKESHORE & MT. CLEMENS RAILWAY

The power station of the Rapid Railway contains two 250 kw. and one 400 kw. Walker generators, driven by Dick & Church engines. The boilers are of the horizontal tubular type.

The Grand River & Orchard Lake Railway power station is at Pontiac, and contains an American engine belted to a Walker generator.

OVERHEAD CONSTRUCTION

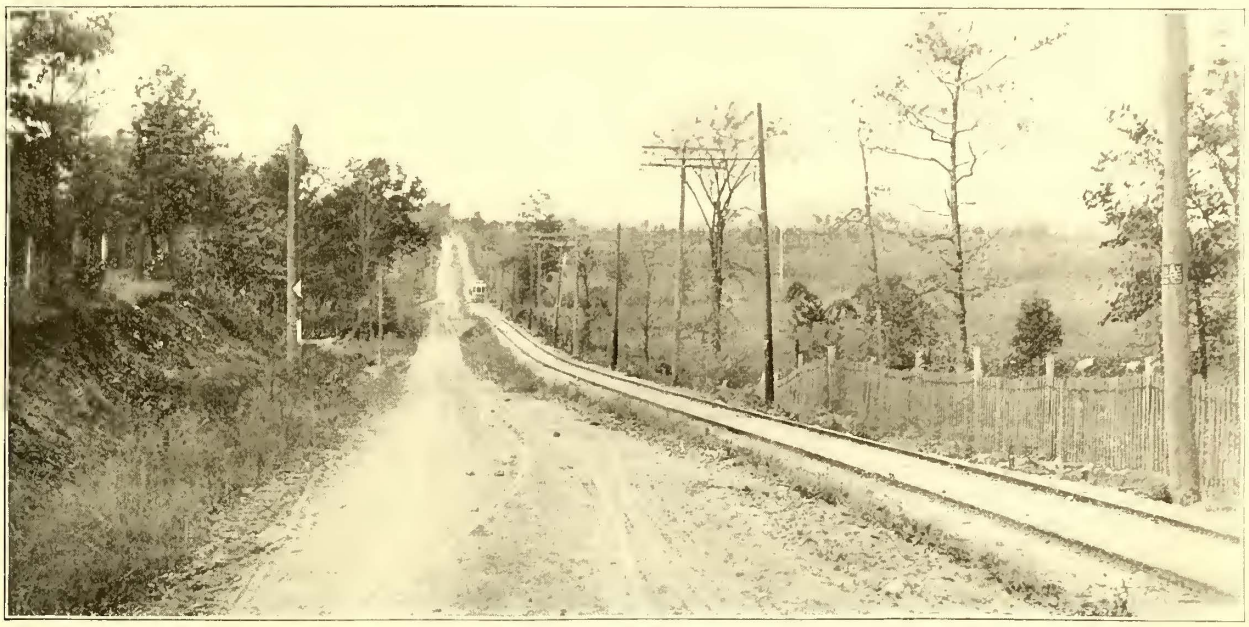
The overhead construction employed on all the roads is generally of the bracket type with flexible suspension. It is universal to use two trolley wires on all the single-track roads to avoid frogs, which have been found undesirable when running at high speeds. These trolley wires are connected together electrically at intervals of every five or ten poles, so that they reinforce each other and reduce by the amount of their cross sections the amount of feeder required. The two latest roads built employ No. 00 Fig. 8 trolley wire, equipped with Ohio Brass Company appliances. The poles are universally wooden and the specifications for those on the Lakeshore Railway, which are good samples of those employed, require that they shall be from 30 ft. to 35 ft. in length, depending upon whether they are side poles or curve poles, 7 ins. in diameter at the top, of cedar, and set one-sixth of their length in the ground. The poles have all rock setting, are spaced 115 ft. apart, and are 6 ft. 9 ins. from the center of the track. On the Pontiac and the Wyandotte lines every pole is numbered by miles; thus, those in the first mile are numbered from 0 to 42 or 43, in the next mile from 100 to 142, etc. The Wyandotte line was originally equipped with rigid brackets, but they were found undesirable for this service, as the wire would break at the hanger. On these two lines, which were for a long time under the same management and which are among the oldest of the interurban lines, pine, hemlock and cedar poles have all been used, and but little difference has been found in their life, each kind having to be replaced at the end of six years. The Lakeshore Railway is employing bare feeder wires and its feeder system is shown diagrammatically above. This distribution is based on a service of six cars, each of which takes on an average about 150 amps. when running at 30 miles per hour on a level.



PLAN AND SECTION OF POWER STATION—DETROIT, YPSILANTI & ANN ARBOR RAILWAY

Quite a little difference exists in the use of trolley wheels. The Lakeshore cars are fitted with two trolleys, one immediately in the rear of the other, but the two are used only in the case of heavy loads. The wheel has a diameter

of 6 ins., with a groove 2 ins. in width and flange 1¼ ins. in height. Wilson-Thompson trolley pole catchers are employed on this line. Practically all the lines employ the Kalamazoo trolley wheel, the hub of which is hollow and contains oil, providing excellent lubriction. This wheel



VIEW ON PONTIAC RAILWAY SHOWING TRACKS AT SIDE OF HIGHWAY

seems to answer well the requirements of high-speed service.

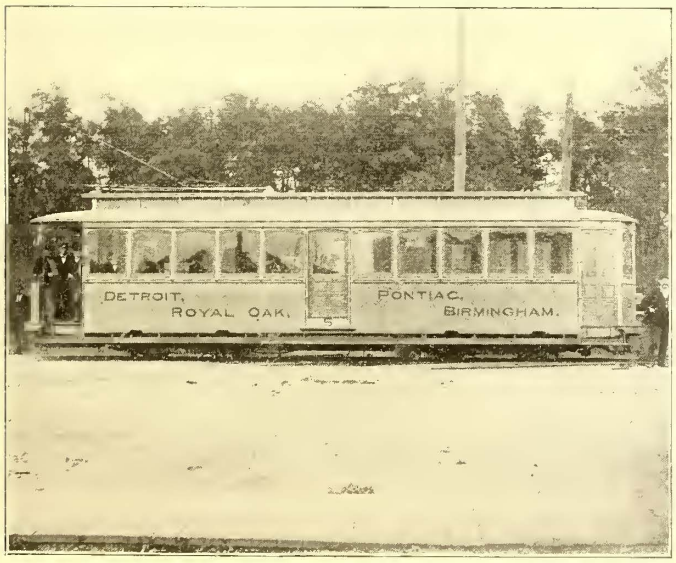
Practically all of the lines maintain a telephone service throughout the entire line. Every car carries a telephone and connection can be made with the telephone wires at turnouts by means of junction boxes. If the conductor should desire to send a message between turnouts, he makes connection with the telephone wires by means of a flexible connection, and jointed poles furnished with hooks are hooked over the telephone wires.

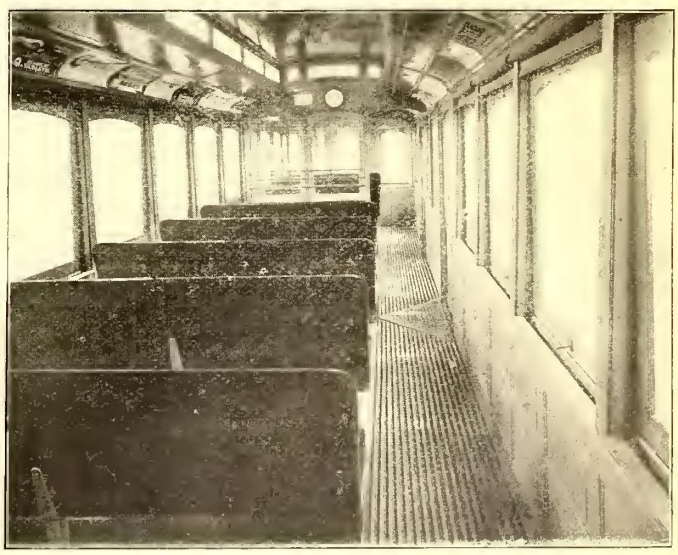
TRACK CONSTRUCTION

The T-rail is used throughout and the section of the American Society of Civil Engineers is popular. The rails weigh from 70 lbs. to 75 lbs. per yard on the lines lately equipped. On the earlier lines they are from 56 lbs. to 60 lbs. The ties are usually steam railroad standard, 6 ins. x 8 ins. x 8 ft., and spaced 2 ft. centers. The ties are usually set in gravel, and where the rail is carried through the towns, the side is packed with gravel. The Ypsilanti & Ann Arbor road and the Lakeshore road employ Forest City protected bonds; Washburn & Moen bonds are used on the Pontiac line. On the Lakeshore line American rail joints are used throughout; on the road, the special work was supplied by the Cleveland Frog & Crossing Company.

ROLLING STOCK

The tendency in rolling stock on the interurban roads around Detroit is unquestionably toward long, heavy cars. On the Lakeshore Railway they reach a maximum in being 50 ft. 6 ins. over all. This line has six motor cars and four trail cars, and will place an order for ten more cars for spring business. The Detroit, Ypsilanti & Ann Arbor Railway has fourteen long cars in use on its interurban line and twenty short cars belonging to the old Ann Arbor &



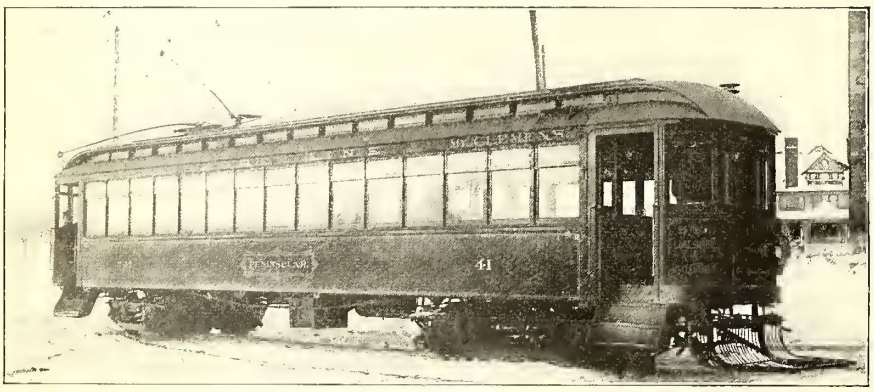


EXTERIOR AND INTERIOR OF DETROIT & PONTIAC CAR

Ypsilanti Railway and in use on the city lines in that city. The interurban cars on this railway and on the Lakeshore Railway were built by the Barney & Smith Company. The Rapid Railway has seventeen 42-ft. cars, supplied by

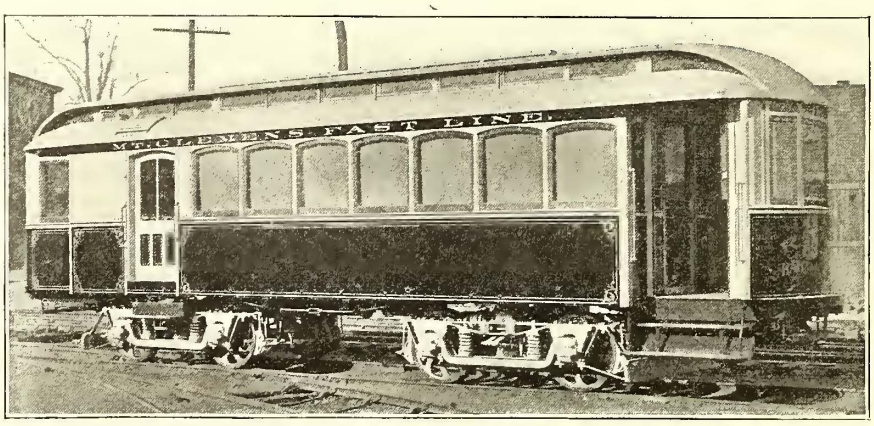
the Barney & Smith Company; one 47-ft. and eight 32-ft. cars, built by the Jackson & Sharp Company. In addition, it has sixteen freight cars, all trail cars. The Detroit & Pontiac Railway has twelve Kuhlman cars, 42 ft. over all, for passenger service. The Wyandotte & Detroit River Railway is equipped with Jackson & Sharp single-truck cars measuring 30 ft. over all. The Grand River Railroad has on its Grand River section five motor cars and four trail cars, built by the Brill Company and the Wells-French Company. The Detroit & River St. Clair Railway, being equipped at present with standard steam equipment, will not be considered in this connection.

The number of miles run per day by each car on the different electric roads averages about 300. All the recently



LAKESHORE CAR

built cars are similar in appearance to steam railroad cars, and have straight sides. Views of a number of these cars are given herewith. Those on the Lakeshore will attract attention as being the most novel in floor-plan and general arrangement. Each car contains a baggage and smoking compartment, which is fitted with foldable seats; a state-room, containing four seats, which are rented for the trip for ten cents additional fare; complete toilet, water cooler, etc., besides regular passenger compartment seating about fifty passengers. These cars are lighted with twenty-five 16-c.p. lamps each, and carry a Wagenhall's electric headlight. The weight of these cars without electrical equipment is: body, 25,320 lbs.; truck, 13,140 lbs.; total, 38,460 lbs. The state-room idea is a novel one in electric railroading, and has proved extremely popular with the patrons of the line; it is often rented to a party of four commuters, who wish to play cards on the trip, or who desire special seclusion. The weight of the convertible on the same line is: body, 18,600 lbs.; trucks, 12,600 lbs.; total, 31,200 lbs. The floor plans of these cars give full information as to dimensions.

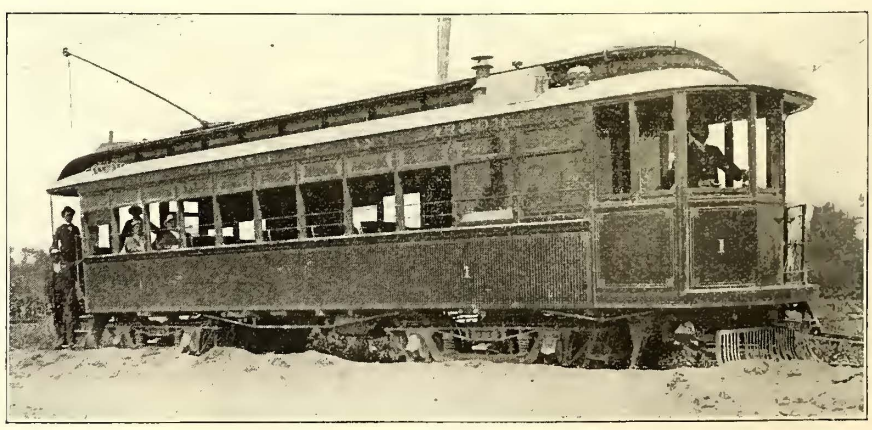


RAPID RAILWAY CAR

The Detroit, Ypsilanti & Ann Arbor cars were also built by the Barney & Smith Company, and are very complete. They are of two types, one of which is illustrated. Both are equipped with combination baggage and smoking compartments, toilet, etc. The long car weighs: body, 25,500 lbs.; trucks, 13,600 lbs.; total, 38,100 lbs. The shorter car weighs: body, 22,900 lbs.; trucks, 13,600 lbs.; total, 36,500 lbs. The trail cars on this line weigh: body, 20,500 lbs.; trucks, 13,600 lbs.; total, 34,100 lbs.; all without electrical and air-brake equipment. An interesting feature of these cars is the novel arrangement of the vestibule. Owing to the length of these cars the passengers are allowed to enter and leave the car at either end, and to prevent their passing through the motorman's compartment, the front of platform is only half vestibuled. On some of the cars which the company is proposing to install, the center of the front platform only will be vestibuled, leaving exits on each side for passengers without entering the motorman's compartment.

The Detroit & Pontiac cars, which are also illustrated, were built by the G. C. Kuhlman Company, with a side aisle on what is commonly known as the Kuhlman pattern, and a number of them are fitted with baggage and smoking compartments. They measure inside 33 ft., and over all 42 ft. One characteristic of these cars, besides their extremely handsome appearance, is that they are very low, in spite of the fact that 33-in. wheels are used. This result is accomplished by making the wheels swing inside the side sills of the car.

The Rapid Railway cars, built by the Jackson & Sharp Company, also deserve special mention. The motor cars are of two lengths, one with 24-ft. body and 32 ft. over all, finished in cherry, with cross seats upholstered and rattaned, and a passenger and baggage car with 37-ft. body and 47 ft. over platforms, finished in quartered oak. The Jackson & Sharp Company also supplied this company

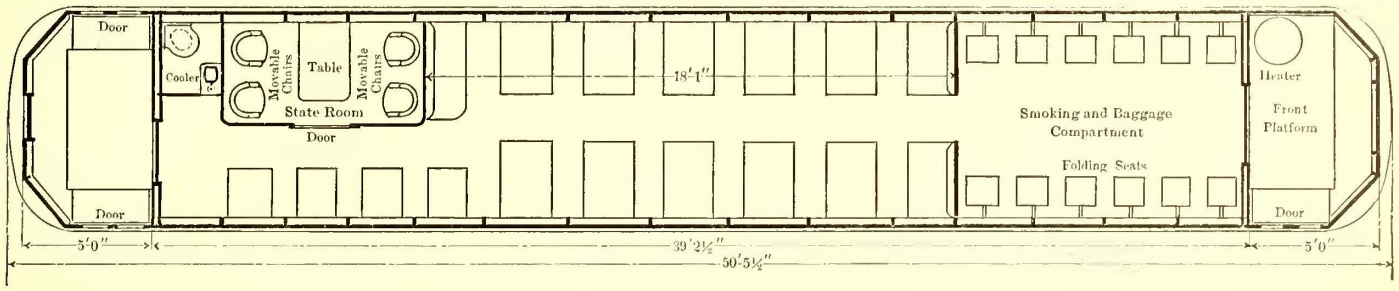


YPSILANTI & ANN ARBOR CAR

with eight ten-bench open trail cars, with six reversible and four permanent seats, finished inside with white ash, with cherry moulding and white birch veneer ceilings.

The motorman's vestibule in all these cars contains quite a variety of apparatus. A list of these as carried on the Lakeshore cars, which are a good sample of all, includes

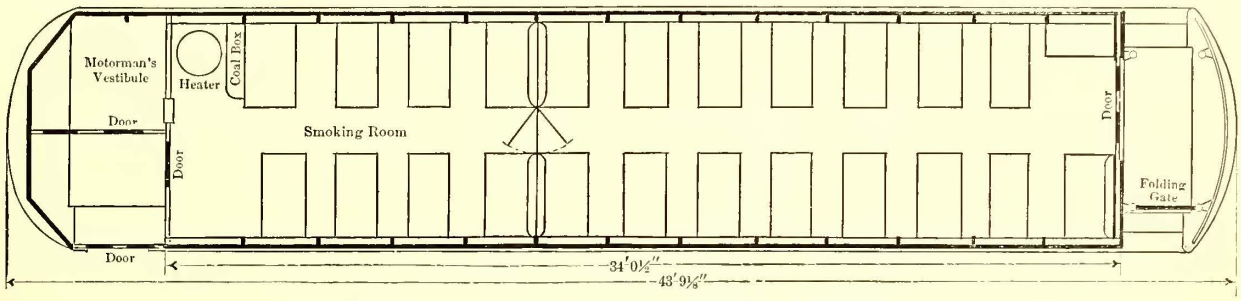
a long-distance telephone, with flexible connections, for communicating with the central office from any point of the line; a G. E. circuit breaker, the Christensen airbrake controller with gage, fuse-box and automatic controller for the motor compressor; sand-box, bell, handbrake, and



PLAN OF DETROIT, LAKESHORE & MT. CLEMENS CAR

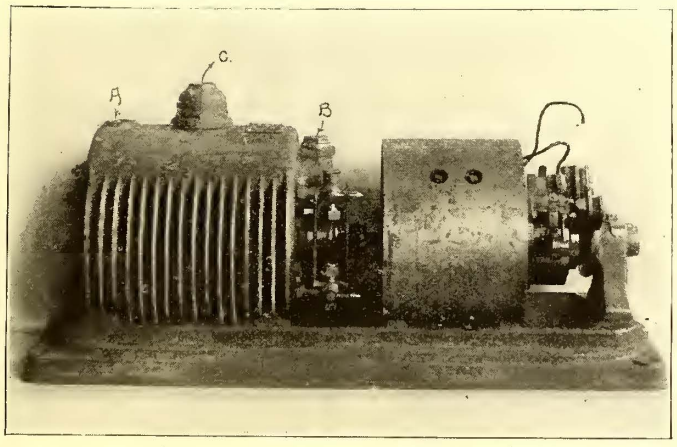
hot-water heater, besides the regular motor controller and appliances.

The heaters employed are generally of the hot-water type, Baker heaters being the most generally used. These heaters are of the "Mighty Midget" type, in which the heater is carried on the front platform, and the interior of



PLAN OF DETROIT, YPSILANTI & ANN ARBOR CAR

the car is warmed by hot-water pipes fed from it. The heater occupies but little room on the platform, and is cared for entirely by the motorman. Full particulars of this heater are given elsewhere in this issue, and it seems to be giving excellent satisfaction. On the Lakeshore and



MOTOR COMPRESSOR

on the Pontiac cars the heater is carried on the front platform; in the Ann Arbor cars, in a closet in the regular passenger compartment.

AIR BRAKES

There is a wide divergence in the practice in the use of air brakes, four different kinds being in use. The Detroit, Ypsilanti & Ann Arbor Railway employs the Westinghouse airbrake with automatically controlled electric motor and compressor, this being the first application of this system to any electric road. The general diagram of the arrangement of the system, together with a view of the motor and compressor directly connected and mounted on a single base, is given on this page. The compressor is of the rotary type, and the cast iron housing in which it is placed forms an oil reservoir, the upper portion of which is a suction chamber. The ribbed construction of the housing is for providing greater cooling surface for the compressor. The course of the air is from inlet *A* to the suction chamber, thence through a valve suitably arranged at *B* for allowing the air to pass into the pump and out at either of the reservoirs. The compression is effected in two separate cylinders, one for high pressure, and the other for low pressure.

The Pontiac Railway employs the Magann air brake, in which no compressor of any kind is in use on the car, but the air is stored to a pressure of about 225 lbs. in reservoirs carried on the car. These reservoirs are connected through a reducing valve with a working reservoir of about 40 lbs. pressure, from which the jam cylinder is operated. The compressor for storing the reservoirs on the cars is located at the power station, in Birmingham. Connection is made by a flexible coupling, the cars are stored and disconnected from the coupling in less than half a minute.

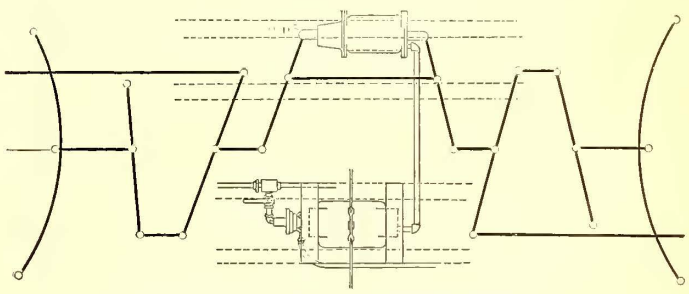


DIAGRAM OF AIR BRAKE EQUIPMENT

Full particulars of this air brake are given elsewhere in this issue.

The Lakeshore cars are equipped with the Christensen air brake, with motor compressor, which is carried under the car between the trucks. This system is working very satisfactorily.

On the Rapid Railway twelve of the cars are equipped with Hunt air brakes, with motor compressors, and two with Sellers, Beamer & Nauger air brakes, with compressors of the axle driven type with automatic cut-outs. Both are reported to be giving satisfaction.

MISCELLANEOUS CAR EQUIPMENT

The car wheels are usually of the plate type and vary from 500 lbs. to 350 lbs. each, depending upon the weight of the car. On the Pontiac Railway a spoke wheel weighing 480 lbs. is employed, the management of this line thinking that these wheels are more noiseless than the plate wheels.

Brill 27 trucks are used on the Pontiac line, Barney & Smith trucks on the Ypsilanti and Lakeshore lines, Du Pont trucks on the Wyandotte lines, and Barney & Smith and Jackson & Sharp trucks on the Rapid Railway.

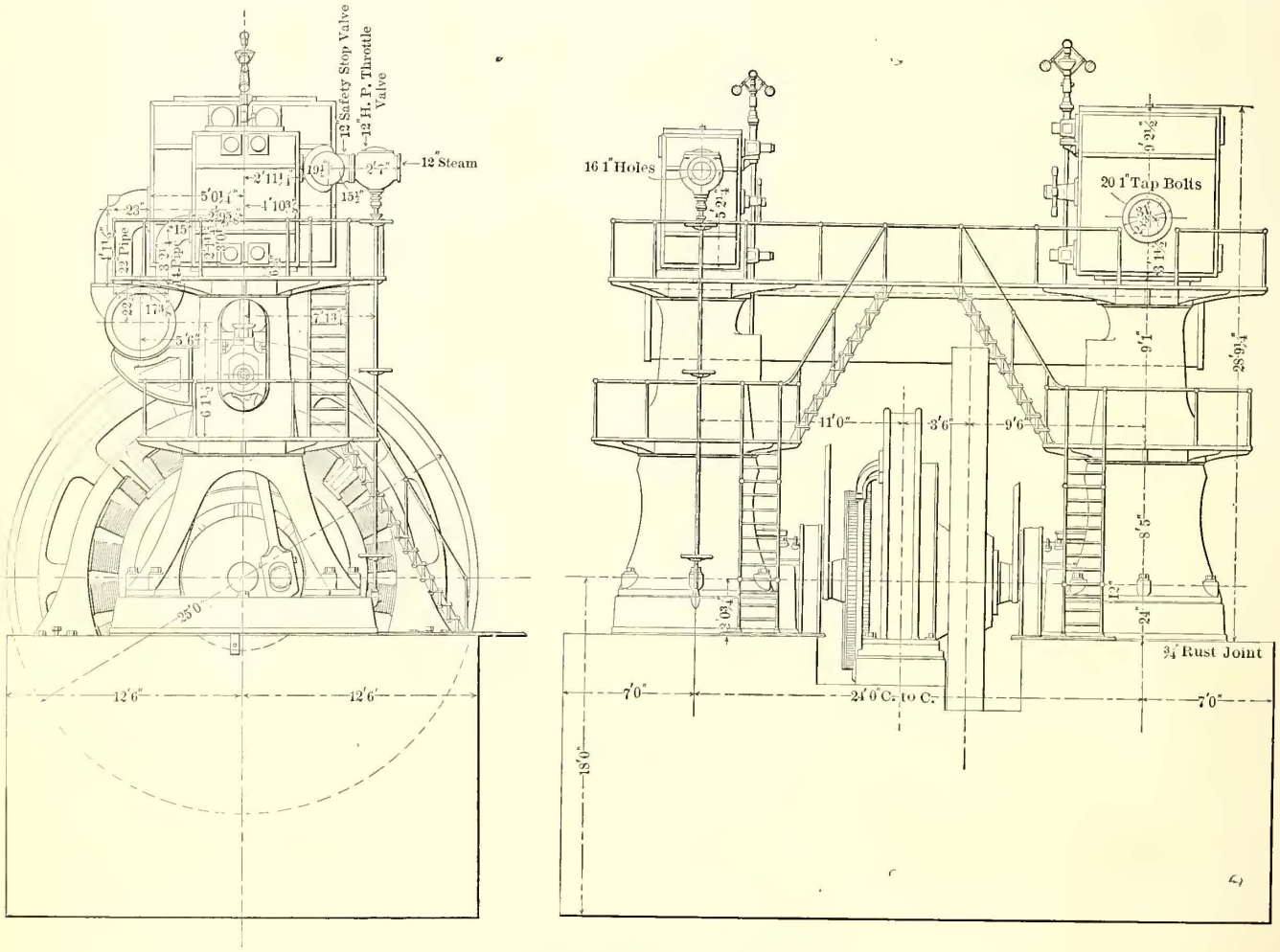
The Ann Arbor & Ypsilanti and Lakeshore lines use four motors for each car, the type employed being 50-h.p. Westinghouse, with Westinghouse 4-motor controller. The Pontiac line (double-truck cars 42 ft. over all) and the Wyandotte line (single-truck cars 32 ft. over all) use two motors on each car. On the Pontiac line the two motors are carried on the rear truck, the bolster of which is set 1 ft. nearer the center of the car than is the bolster on the front truck. The motors on the first line are mostly Steel motors, that on the latter Westinghouse No. 3, with old type resistance controllers. The Rapid Railway employs both practices on its long 42-ft. cars. The motors are mostly of the Walker type, and the general manager states that he finds two 75-h.p. motors more desirable than four 50-h.p. motors, and as easy to obtain traction with them. On this road, where two motors are employed, a motor is carried on the rear axle of each truck.

Our experience has been that if the conductors and the passengers will use the transfers as we intended they should use them, we can afford to give them.—From address at the Montreal Convention, 1895.

Large Engine for Louisville

The accompanying illustration shows side and end elevations of one of the largest engines, if not the largest, yet built for electric railway service. It is a vertical compound, with cylinders 40 ins. and 78 ins. x 48 ins. stroke, and was constructed for the Louisville Railway Company of Louisville, Ky., by the E. P. Allis Company. It is direct connected to a 1600 kw. General Electric generator, and the large size of cylinders was necessary on account of the low steam pressure used, about 100 lbs.

The main shaft of the engine is solid, and is 27 ins. in diameter. The fly wheel is 25 ft. in diameter, and weighs 160,000 lbs. The journals are 24 ins. x 48 ins. The crank pin is 12 ins. x 12 ins. The normal speed is 75 r.p.m. The valve gear is of the regular Allis-Corliss type. The engine is fitted with two governors, one for ordinary running and one for operating the safety stop valve, which becomes operative when the speed exceeds the normal by five revolutions. The total weight of the engine is 325 tons.



LARGE ENGINE FOR LOUISVILLE

The engine illustrates the current favor with which vertical engines for large units are regarded. The chief advantages claimed for this type are the reduction in wear, less chance of cylinder cutting, and less lubrication. The limiting size, according to present practice for horizontal engines, seems to be in the neighborhood of 50 ins., cylinder diameter. The saving in floor space is also an important item. For the same capacity as the engine illustrated a horizontal engine would have to be of the same width, but 40 ft. length instead of 25 ft.

The engines being built by the Allis Company for the Metropolitan Street Railway Company, of New York, are also of the vertical type.

The New Power Station of The Capital Traction Co., Washington, D. C.

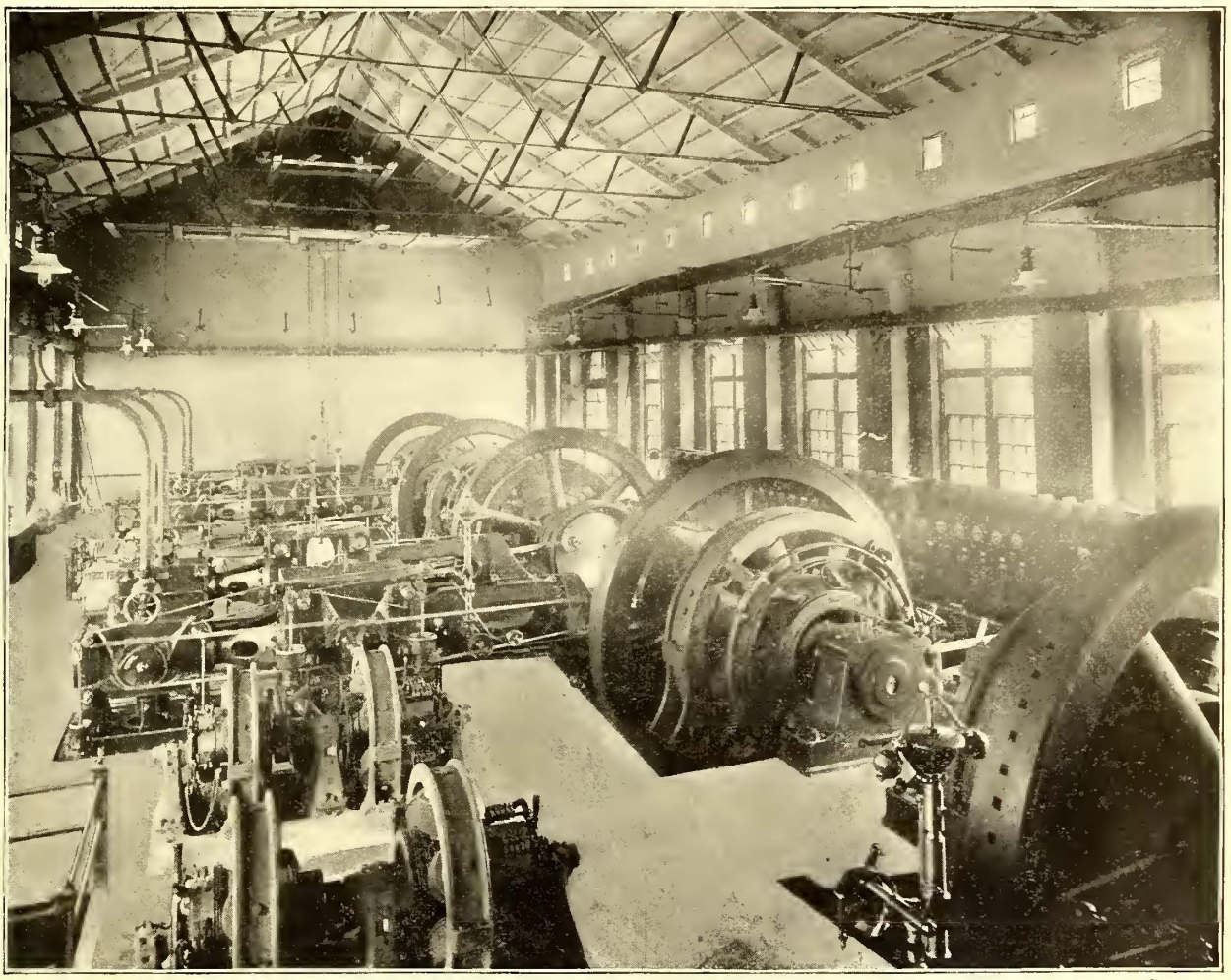
On Sept. 29, 1897, the power house of the Capital Traction Company, on Pennsylvania Avenue, Washington, D. C., was destroyed by fire, and the system which, up to that time, had been driven entirely by cable, was brought to a complete standstill. Traffic was resumed temporarily by means of horse cars, and the contrast between the modern system in use on other roads and the antiquated method which the Capital Traction Company was compelled to employ on Washington's streets at that time, emphasized distinctly the tremendous progress made in city transportation during the last decade.

In re-equipping the road the use of the trolley was prohibited by the municipal laws, so that choice lay between the electrical underground conduit system and cable. The former was adopted, and full particulars of the method of converting the existing cable conduit to one suitable for electric use was fully described in the STREET RAILWAY JOURNAL for January, 1898. Since that time the power station of the company has been completed, and is distributing power not only to the main lines of the company on Pennsylvania Avenue and Seventh Street, but also to the suburban lines using the trolley system.

The company was fortunate in possessing a location for its power house most conveniently situated for the purpose. On the banks of the Chesapeake and Ohio Canal it owned an old warehouse, one side facing on the canal, the other on Grace Street, between Thirty-second and Potomac Streets. This it practically rebuilt.

The present power house is 300 ft. long x 60 ft. wide and 65 ft. high, and is divided into two parts by a heavy brick partition wall, the eastern end being occupied by the engines and dynamos, and the western end by the boilers. West of the main building is the coal handling building. Facing the power house on the other side of the canal is a large car barn and repair and machine shop.

The boiler room, 162 ft. 9½ ins. long, contains eight Cahall, Babcock & Wilcox boilers of 350-h.p. capacity each, arranged in four batteries. The flues pass into a steel brick-lined stack of 9 ft. internal diameter and 150 ft. high, standing on a 25-ft. brick base, giving it a total height of 175 ft. The stack was built by the Campbell & Zell Company, and is provided with Locke regulators and dampers. The boilers are equipped with Roney mechanical stokers, built by Westinghouse, Church, Kerr & Company, and driven by three small Westinghouse engines, two driving the stokers for the three main batteries, and one those of the battery made up of the boilers on the west side of the stack.



INTERIOR OF POWER STATION CAPITAL TRACTION CO., WASHINGTON

The coal is taken directly from the canal barges on the Chesapeake and Ohio Canal by coal handling machinery furnished by the Steel Cable Engineering Company, of Boston, and operated by electric motors. It is housed in a small steel structure forming the western annex to the main building. A 30-h.p. motor operates a tub elevator, which raises the coal from the canal boats and dumps it into a receiving hopper, whence it passes to a weighing hopper with a capacity of 2000 lbs. on a Fairbanks scales. After weighing it drops through a chute into a crusher driven by the same motor. After crushing, the coal drops into the conveyor, which is driven by a 15-h.p. motor. The conveyor carries it up and dumps it into the coal bins over

the boilers. The returning buckets pass down the eastern side of the boiler room and through a tunnel below the boilers, where they catch the ashes from the ash hoppers and bring them out on the return journey, dumping them into an ash tank, from which they are transferred to other canal boats or to carts to be carried away. The capacity of the conveyor is 30 tons per hour. The coal used is "run of mine" Cumberland. The coal bins are duplicate bins, built of steel, and occupy the entire space above the boilers, or 162 ft. 9½ ins. x 60 ft. The bins are lined with concrete on corrugated iron arch plates. They were built by the Structural Iron Company, and have a capacity of 2000 tons. The coal is delivered into the furnaces of the boilers through measuring hoppers, each having a capacity of 1000 lbs. The coal from the rear or auxiliary bins can be chuted down through three supplementary chutes set between the boilers to the conveyer in the ash tunnel, and can then be carried up again and dumped into the forward or main bin.

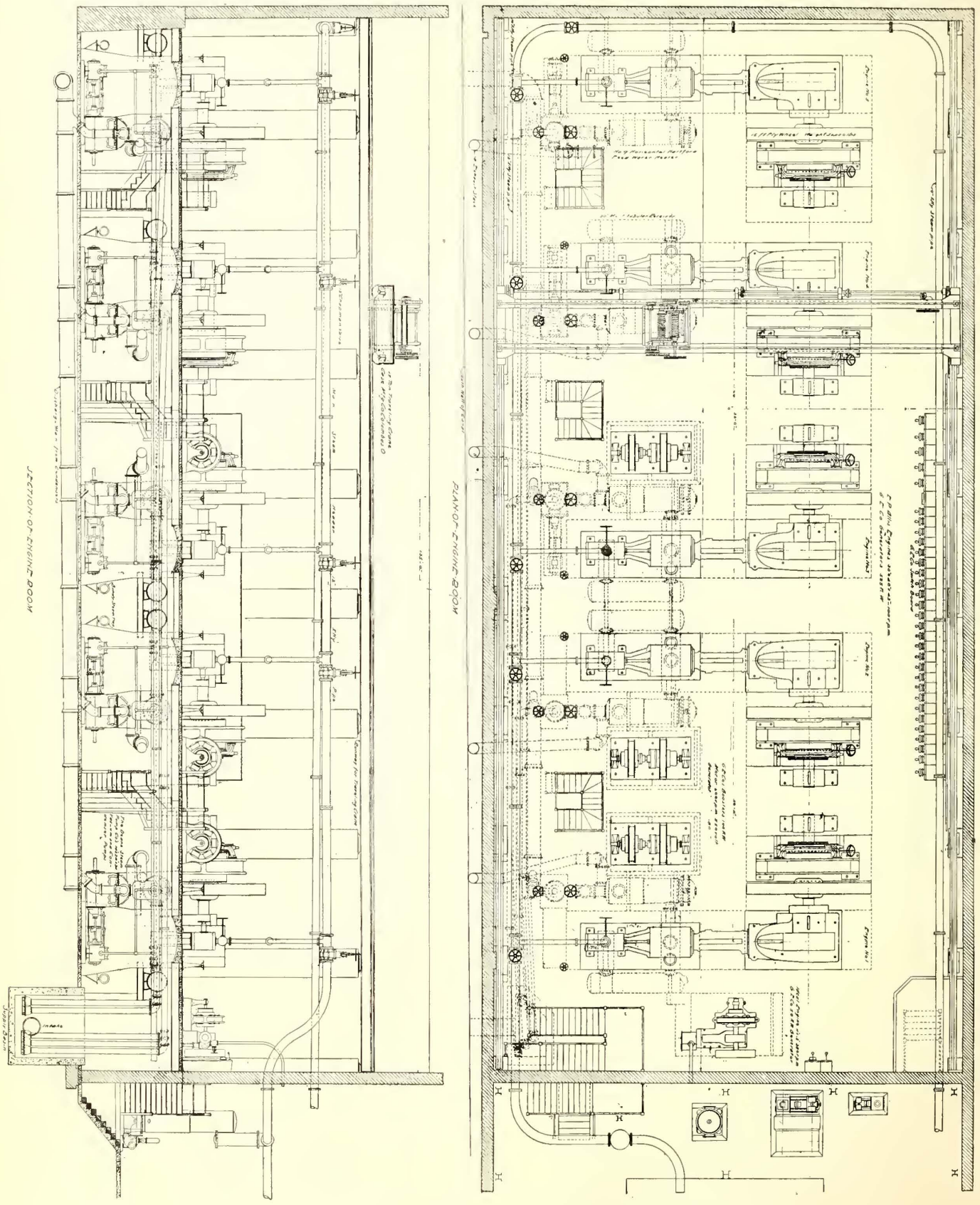


FIG. 1.—PLAN AND SECTION OF ENGINE ROOM—CAPITAL TRACTION CO.

Water for the boilers is pumped from a well in the base-

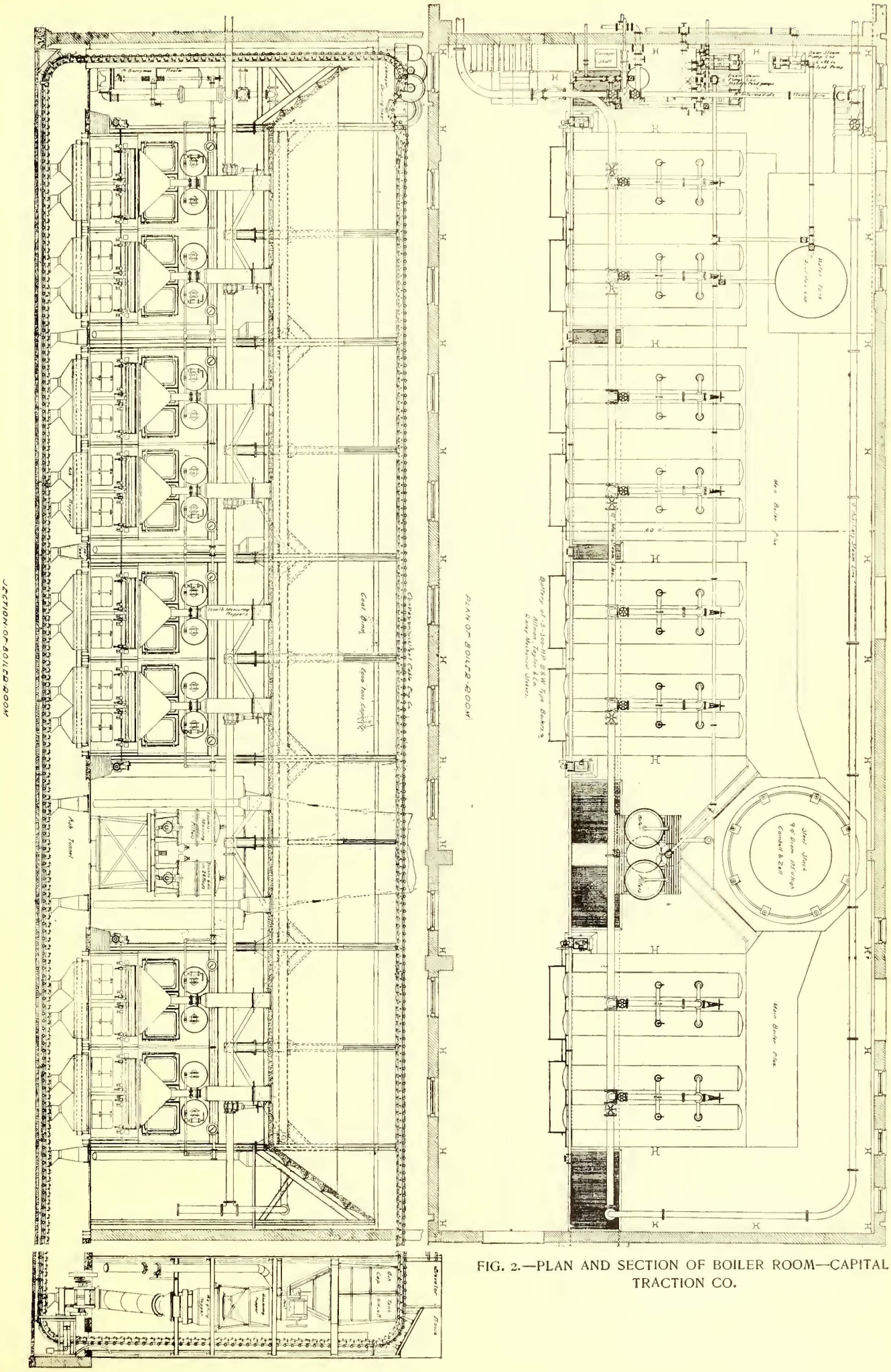


FIG. 2.—PLAN AND SECTION OF BOILER ROOM—CAPITAL TRACTION CO.

ment of the engine room, supplied from the canal, into a 4000-gal. tank, from which it passes into two Loomis-Manning filters having a capacity of 300,000 gals. in twenty-four hours, thence through Deane feed pumps to the primary heaters, then into a supplementary Berryman heater, and thence to the boilers. Water can also be taken from the city mains. After entering the main tank its course is similar to that of the canal water. Should the main feed lines or pumps break down from any cause, two Metropolitan injectors can be brought immediately into action on the auxiliary feed lines.

The arrangement of the piping above the boilers allows any battery to be cut out at any time, and, in fact, the entire arrangement of the piping and valves is such that any engine or boiler or any length of pipe can be cut out should occasion require without interfering with the running of the plant. The piping is in duplicate and extra heavy in both pipe and fittings. The valves are all of the Chapman Valve Company's make. All are constructed for a pressure of 200 lbs., although the initial steam pressure is at present only 140 lbs. The duplicate or auxiliary piping is arranged as a loop running from the main header in front of the boilers along the western, southern and eastern walls and joining the main steam line again on the north wall. At the eastern end of the boiler room connection from side to side of the loop is made by an intermediate pipe. The main steam line is of 12-in. pipe, the auxiliary of 10-in. pipe, and the intermediate steam line of 8-in. pipe. At the two points where the intermediate pipe joins the main and auxiliary piping a steam separator is provided. All piping is protected by Keasbey & Mattison magnobestos covering 2 ins. thick.

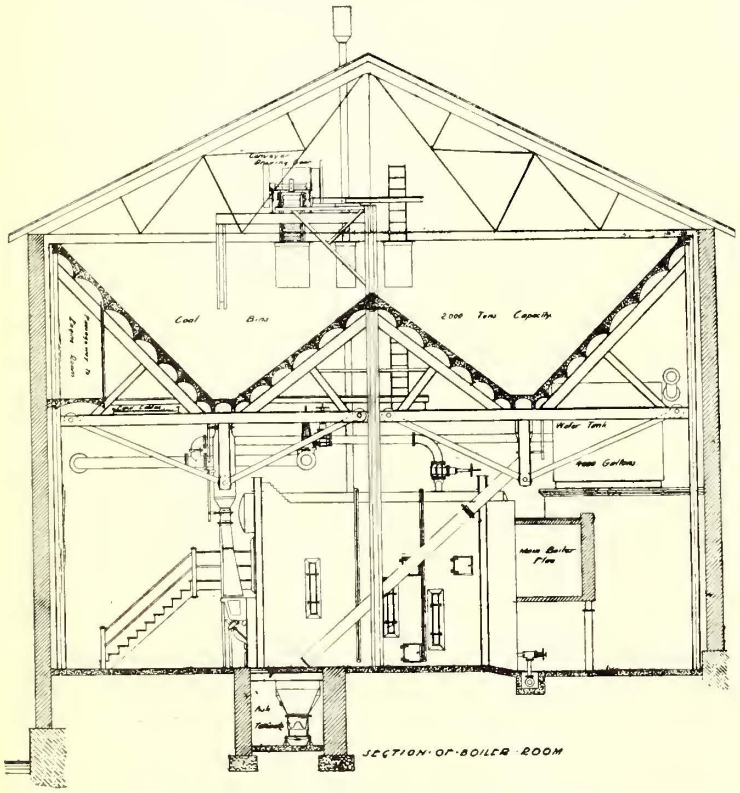


FIG. 3.—CROSS SECTION OF BOILER ROOM

Behind the boilers space has been left for the installation of economizers should their use be decided upon. Behind the boilers also have been fitted up a bath-room for the engineer and lavatories for the men.

The engines, of which there are five, are Allis horizontal tandem compounds with 1890 frame, each 20 ins. and 40 ins. x 42 ins., rated at 800 nominal h.p. at 100 r.p.m. They are provided with double-ported valves and double eccentrics, and the ball governors have a safety attachment which automatically shuts the steam off from the cylinder in case the governor belt should break. Each fly-wheel is 16 ft. in diameter and weighs 50,000 lbs. The engines can be run condensing or free exhaust. Each engine is an entirely separate unit with primary feed water heater, receiver, condenser and separate free exhaust. The receivers are each 30 ins. inside diameter and 12 ft. 6 ins. long. The condensers are the jet type, built by the Deane Steam Pump Company, and the condenser valves are controlled by valve standards on the engine-room floor. In the event of accident to the condensing apparatus an automatic action opens the valve from the engine into the free exhaust pipe, through which the steam passes to the open air. Bundy steam traps are provided—one to each receiver, and one to the main steam lines. All the gages and instruments are of Crosby make.

Lubrication of the engine cylinders is effected from two pressure oil tanks in the basement, the oil being forced up by steam pressure through brass pipes to the cylinders. A third tank supplies the oil for the boiler-room pumps and engines. Ashton sight feed lubricators enable the engineer to gage the supply of oil as desired. Lubrication of the bearings is effected by a gravity system, the oil descending from a 50-barrel tank on the east wall, whither it is pumped up again after use, after first passing through filters.

The generators are directly connected to the engine shafts, and four are set in pairs, each pair facing each other; that is, with the two commutators on the inside. The commutator of the fifth faces engine No. 4. The generators are set in a line down the south side of the engine room, and are faced by the switchboard on the south wall. They are of the standard General Electric eight-pole, 525-kw. type, running at 100 r.p.m. and delivering current at 550 volts no load, and 600 volts full load.

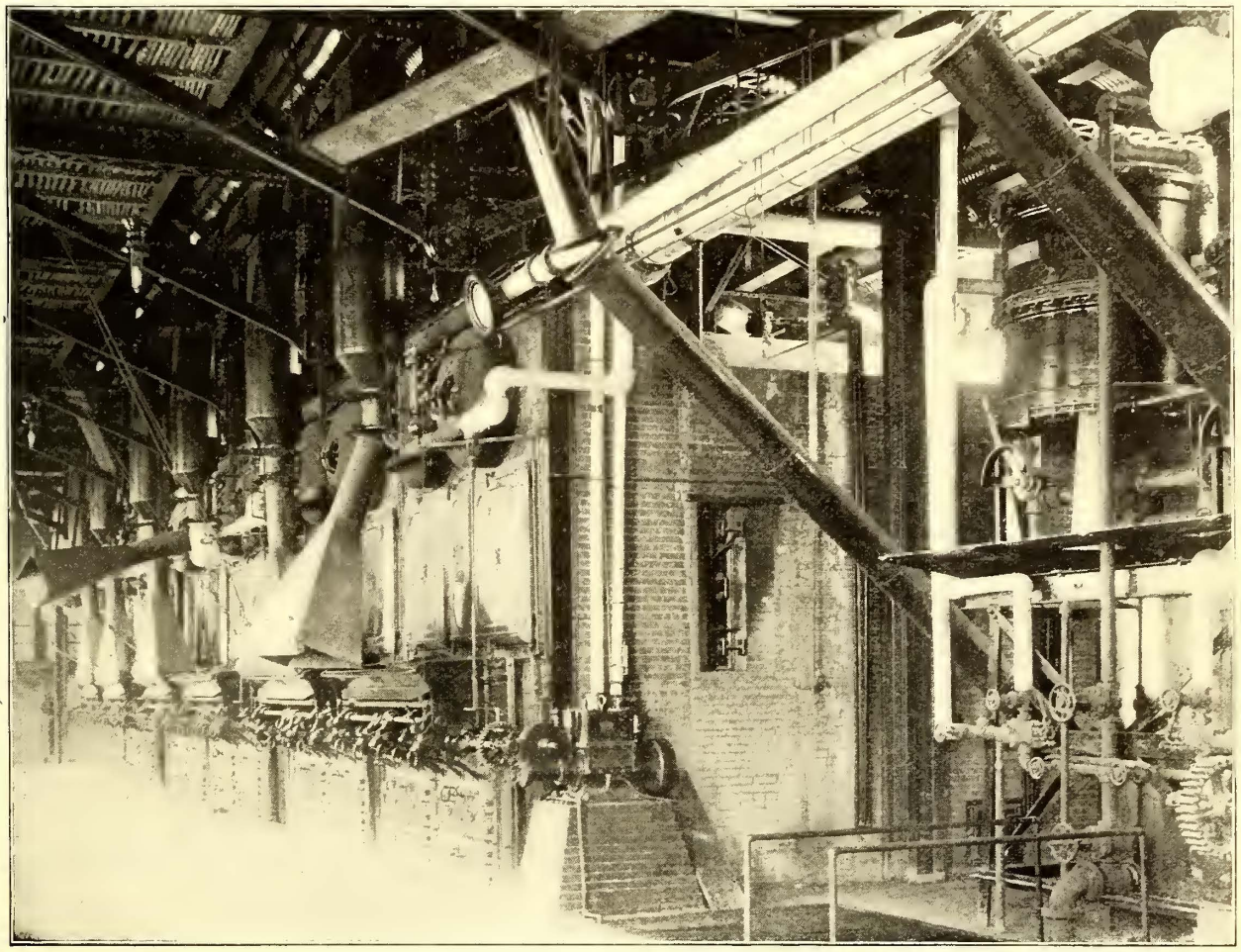
In order to compensate for drop on the Mt. Pleasant and Navy Yard lines—4 miles long in the first case and 5 in the latter—three boosters have been provided, two between engines one and two and one between engines three and four. These boosters are generators series wound for a maximum load of 550 amps. at 180 volts, and so proportioned as to give practically a straight line from zero potential to 100 volts. They are six-pole machines, each of 100-kw. capacity, running at 600 revolutions, and were supplied by the General Electric Company. Each booster is driven by a six-pole, 110-h.p., 600-revolution motor wound for 550 volts and driven from the main railway circuit.

The switchboard, about 50 ft. long, stands 5 ft. away from the south wall. It faces engines two and three, and is built up of standard General Electric panels. It comprises five generator panels, one station panel, three booster motor panels, eight pairs of feeder panels, two booster generator panels, two pairs of panels for the four booster feeders, one rheostat panel and a special panel for controlling the power house and shop motor circuits and the 500-volt lighting circuits. Each generator panel is equipped with a standard M. K. automatic circuit breaker, 5000-amp. current indicator, rheostat, two main switches, voltmeter switch and lighting switch. The station panel carries a G. Q. 5000-amp. Thomson recording station output wattmeter and an illuminated dial Weston ammeter reading to 8000 amps. Each feeder panel carries an M. K. circuit breaker, round dial ammeter reading to 1000 amps., and one double-throw, quick-break switch. The rheostat panel is equipped with an M. K. circuit breaker, 1500-amp. ammeter and three 1200-amp, single-throw, single-pole switches. The booster motor panel carries a circuit

breaker, two main switches, an ammeter and one field rheostat, as well as one starting rheostat, which serves to start any one of the booster motors. The booster generator panels carry an arrangement of switches which allows the engineer to throw the booster current on to either of the two pairs of feeders as desired. They are also equipped with circuit breakers, and in addition with an ingenious relay, devised by the engineers at Schenectady, which comes into action in case the motor circuit breaker trips, opening the booster generator circuit breaker and thereby preventing the generator from running as a motor. At the west end of the board is swung an illuminated dial Weston station voltmeter. The equalizing switches are erected on pedestals in front of each machine.

The lighting of the power house, shops and car barns and the Union Station building is effected from a 50-kw. 125-volt General Electric machine directly connected to a 75-h.p. Harrisburg Ideal engine, the set occupying a position at the west end of the room next to the partition wall. The lighting switchboard is made up of two panels equipped with a 500-amp. Weston ammeter, 150-volt voltmeter, P. C. rheostat, one three-blade main switch and six double-blade, quick-break switches for the separate circuits. The lighting is effected by General Electric inclosed arc single-globe and reflector lamps and incandescent lamps. The inclosed arc lamps in the engine room are swung on brackets made up of a 12-ft. length of gas pipe so hinged that they may be swung against the wall to allow of the passage of the 15-ton Case travelling crane, which travels the length of the room. Ten arc lamps illuminate this room, two over each engine, and each lamp is provided with its own knife switch. Six arc lamps are used in the boiler room. The incandescent lamps are set in three-light clusters scattered throughout the room. These clusters are made up of two railway lamps, one on each side of a 120-volt incandescent lamp. A similar system is followed in the lighting of the basement and the boiler room. All the arc, incandescent and railway branch lighting circuits in the engine room run in tubing. In the basement all the branch circuits to the brackets run in tubing, while the other wiring is run on insulators. In the boiler room the incandescent and arc branches, as well as the railway series circuits, are run in tubing, the other wiring on insulators.

The railway feeder cables drop from the switchboard to the basement, to the ceiling of which they are attached by insulators, rise up the partition wall and run along it to the canal side of the power house. They are then carried on a rack along and over the north side of the boiler room to a bridge crossing the canal. Passing across this bridge they drop down into a manhole, and proceed underground to their several destinations. The feeders are lead-covered 1,000,000-c.m. cables from the Roebling works, Trenton, and are laid in National Conduit Cable Company's conduits, and in Camp and Potomac terra cotta ducts set between the tracks. The first named are iron cement-lined pipes 8 ft. long and $3\frac{1}{2}$ ins. inside diameter. The latter are terra cotta 18 ins. long and of the same diameter. At intervals of about 400 ft. on the straight track and at shorter distances on the curve sections suitable manholes have been constructed between the tracks. Each manhole has concrete walls 12 ins. thick, and on the two sides next to the tracks wooden blocks are let into the cement to support the brackets for the feeder and tap wires. Each manhole is 4 ft. x 4 ft. and 6 ft. deep, but where the conduits drain into them the depth is increased to 7 ft. 6 ins. Slot



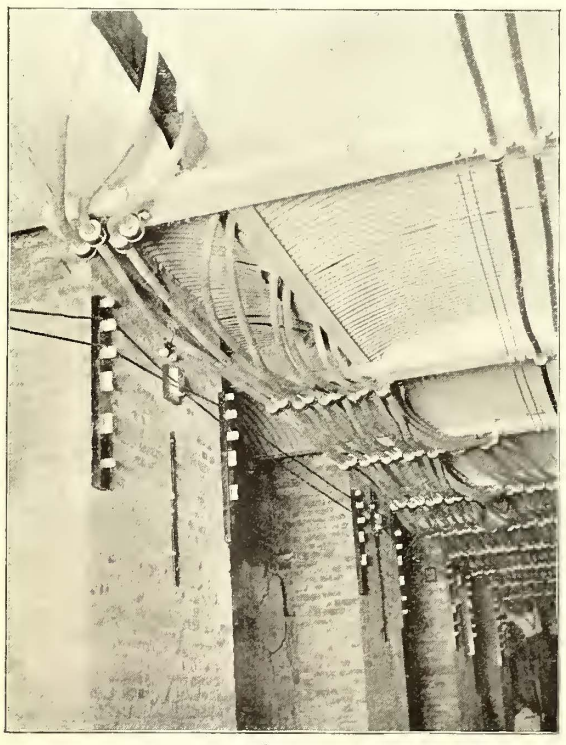
VIEW OF BOILER ROOM SHOWING MECHANICAL STOKERS

hatches are provided at intervals of 800 ft. along the slot, to allow the conductors to be drawn into the conduits and run to their proper positions.

The conductor rails are set 13 ins. to the center below the wheel rails, the distance between the face of each being 6 ins. The conductor rail weighs 23½ lbs. to the yard, with an area of 2.3 sq. ins., and is made up of 31-ft. 6-in. sections. The face is 4 ins. deep and ⅜ in. thick, and the rail is provided with a 1½ x ⅜-in. rib. The conductors are held in position by insulators suspended from a cast iron two-armed cup 5½ ins. deep, with a corrugated inner surface holding a heavy porcelain cup insulator, with exterior corrugations to correspond to the interior of the cup. Between the porcelain and the iron cup cement is poured, which holds the porcelain firmly in place. The bracket support for the conductor is bolted to a stud screwed and cemented into the porcelain cup. The distance between the center of the stud and the face of the conductor is 5⅝ ins. The arms of the cup holding the porcelain insulator are bolted into the slot rail. Over 16,000 insulators in all are used.

Each bracket is also provided with an arm, which is fastened to the conductor rail by two keys. Each length of conductor is bounded to the next by means of two flexible Washburn & Moen copper bonds, having a total cross section of 423,200 c.m.—one bond 11½ ins. long, the other 14 ins. long. These insulator brackets are placed at intervals of 15 ft. 9 ins. on the tangents, and at 9-ft. intervals, or every other yoke, on the curves, and access to each is had by a hand-hole.

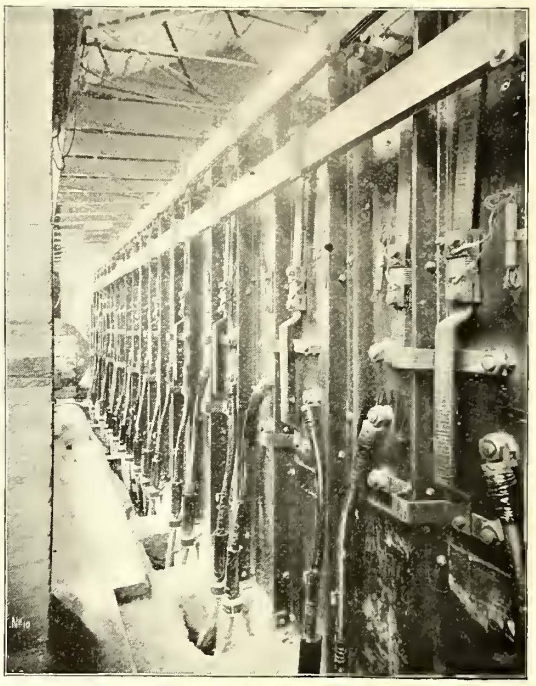
The entire length of the main line operated on this



FEEDER CABLES IN BASEMENT OF STATION

underground conduit system is about 22 miles of single track. An angle was riveted to the old slot rail, as explained in the January, 1898, issue, and illustrated in the section of the conduit herewith, and a part of the old track on Pennsylvania Avenue, from Seventeenth Street to the Capitol, a distance of about 1 1-3 miles, was replaced by 6-in. grooved girder Johnson rails weighing 86 lbs to the yard. All rail joints are cast welded. Seventh Street, Georgetown, Fourteenth Street and the Navy Yard sections are laid in 82-lb. 6-in. grooved girder rails.

The rolling stock consists of 188 motor cars and 174 trailers. All the new motor cars are from the shops of the American Car Company, and measure 26 ft. over all. They are mounted upon Lord Baltimore trucks constructed by the Baltimore Car Wheel Company. Each motor car is equipped with two G. E. 1000 A-3 motors, the characteristic curve of which is shown in Fig. 8. The motors are provided with sixty-nine-tooth gear and fifteen-tooth pinion, giving a reduction of 4.6. The series parallel controllers are of the K-9 magnetic-blowout type. Each car



REAR OF SWITCH BOARD

is lighted by three three-light clusters, the extra light burning on either platform as the case may be. All cars are provided with the "Parmenter" front fender and wheel guard, made by George Parmenter, Cambridgeport, Mass., and with registers made by the International Register Company, Chicago.

In addition to the rolling stock mentioned above, four Brill snow sweepers are used.

The contact plows used are the forms eight and nine, General Electric plows. Type nine is shown opposite. The plow handle is provided with a slot at each end, and the plow is supported by these slots on two iron bars each 9 ins. long, which run transversely on the truck. The plow can move along them transversely to the truck 4½ ins. on each side of the center, but if it runs more than 4½ ins. it runs off these supports or guides and drops into the slot sufficiently far to allow the bottom of the motors to pass over it without touching it. The conductor connections from the plow run to other connectors attached to hinged couplings on the car. When the plow falls these are pulled apart by the strain, and connection between the plow and the motors is instantly broken. Thus, should the plow follow along the wrong switch, it moves transversely to the truck until it falls from the guides, drops down into the slot and breaks the circuit at the connectors. As it cannot move either vertically or longitudinally the advantages of this construction can be readily understood. This method is intended to prevent delays, which would necessarily occur should the plow jam in the slots at any of the switches, turnouts or crossovers.

The conversion of the Seventh Street line of the same company has also been effected. The remarkable feature of this conversion is that it was made while the cable was

running, without interruption whatsoever to the service. It is the first case of this kind on record, and the skill with which it has been carried out is a tribute to the ability of the company's engineers, D. S. Carll and W. B. Upton, and to the contractor, E. Saxton. The length of the Seventh Street system is about 3 miles of double track. The cable was hauled out on May 25 last, the last cable car hauled into the car barn on the tail of the cable and without interrupting the service the underground contact cars entered upon their duties.

Along U Street, from the junction of the Seventh Street line as far as Eighteenth Street, 1 mile of double track is laid down with the Love system. This terminates at Eighteenth Street, the cars then running under the overhead trolley as far as Chevy Chase, a distance of 6 miles. The Love system will be made uniform with the rest of the system, and may be extended as far as Rock Creek.

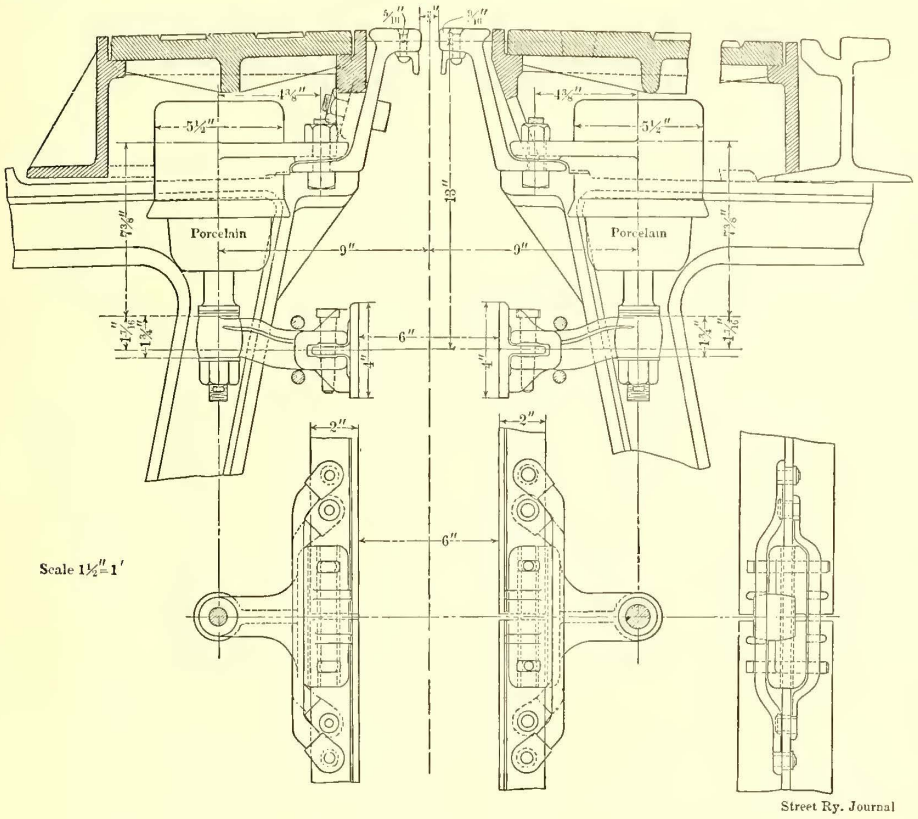


FIG. 4.—PLAN AND SIDE ELEVATIONS OF INSULATORS IN CONDUIT

PLOW

On the opposite side of the canal from the power house, the Capital Traction Company owned another large building, used in the horse-car days as car barn and stable. This has been entirely remodelled, and is now divided into car barn, paint shop, repair shop and machine shop. The car shed has nine tracks, divided transversely by tracks, on which run two transfer tables. Each track is provided with a pit, and floors and pit are of cement. To move the cars a trolley device is employed. This is a small four-wheeled trolley resting on two conductors, strung longitudinally between and over each pair of tracks. From this depend two conductors, which are connected by their own terminals to the plow terminals on the cars. Switches on a slate switchboard on the wall control the car-shed circuits. On track No. 9 is set a Murphy car-wheel grinder, driven by a G. E. 800 motor. Reduction in the speed of the car wheels during grinding is effected by means of water rheostats.

The paint shop is a spacious, well-lighted room, provided with every facility for rapidly handling the cars. The machinery in the repair shop, on the south side of the building, is driven by a 20-h.p. motor, and consists of a planer, joiner, mortising machine, band saw, circular saw, borer and grindstone. On the east side of the car shed are the machine and blacksmith shop, in which the machinery is driven by steam.

In addition to this building, the Capital Traction Company has five car barns in the following localities: Union Station, Georgetown; Navy Yard, Seventh Street, Mount Pleasant and Chevy Chase.

The Capital Traction Company has a capital of $12,000,000. Its officers are G. T. Dunlop, president; C. C. Glover, vice-president; C. M. Koones, secretary and treasurer, and D. S. Carll, chief engineer and superintendent. W. B. Upton is principal assistant engineer; J. H. Hanna, assistant superintendent; H. P. Clark, master mechanic, and Carroll Hashall engineer of power house.

The entire work of installing the electrical system was carried out under the direction of a building committee consisting of the president, Henry Hurt, director, and S. L. Philips, a stockholder. Dr. Louis Duncan was consulting electrical engineer.

An Ingenious Method of Removing Snow from Tracks

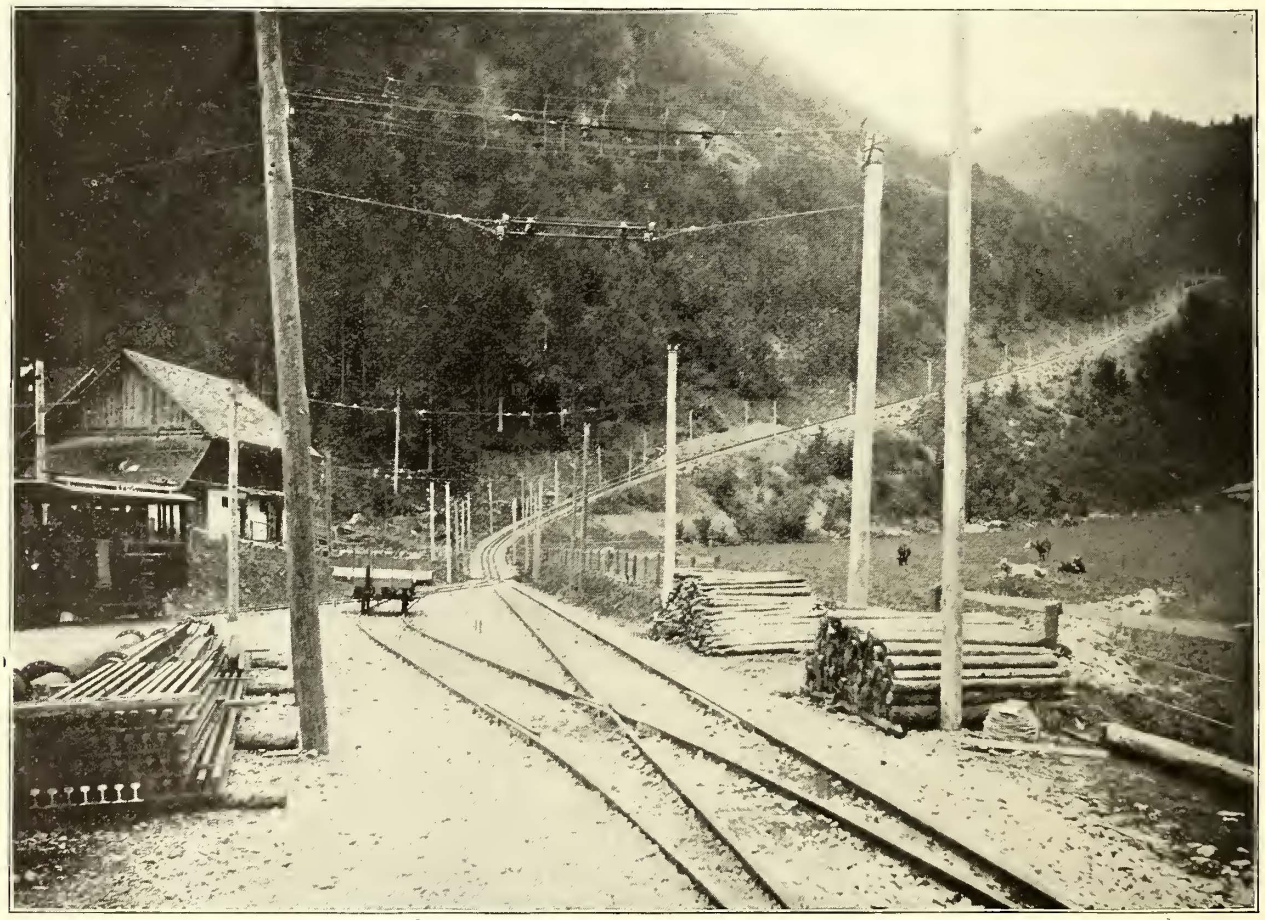
The street railways of Detroit are employing snow boards or scrapers attached to the trucks for cleaning snow from the tracks, instead of regular snow plows. The board employed is 2 ft. wide x 10 ft. long and is set on a diagonal under the rear platform. It is shod with iron, and is attached to the side bars of the trucks, which are of the Du Pont type. All the cars run on loops, so that the board always remains under the rear platform. In the case of a light snow storm every fourth or fifth car sent out from the car house carries one of these scrapers. If the severity of the storm should demand it, every car is so equipped. The method has the advantage, of course, that no extra men are needed and that snow is kept off of all parts of the system at the same time. The company also has a leveler, which is run out to throw the snow from the side of the track, where it is piled by the scraper into the gutter, but it is not necessary to run this leveler during a snow storm over any track more than once or twice during the day.

The Three-Phase Electric Railway from Stansstadt to Engelberg

BY CHARLES ROCHAT

The year 1898 will mark an interesting date in the history of electric traction by the application, on a large scale, of the alternating current, utilized directly for the propulsion of electric cars and trains. The first attempt made in this direction was in 1896, when a small city tramway with a length of 4.5 km. was installed at Lugano, but the roads put in operation during the past year leave this modest installation far in the rear.

Several weeks ago the mountain railway up the Gornergrat, near Zermatt, and the first section of the Jungfrau railway from Scheidegg to Eigergletscher were put in operation, and then, most recently, the electric railway from Stansstadt to Engelberg. It is this latter road that I now wish to describe to the readers of the STREET RAILWAY JOURNAL.



VIEW FROM FOOT OF 25-PER-CENT GRADE—THREE PHASE RAILWAY

By a half hour's trip by boat from Lucerne, the starting point for tourists in Switzerland, and in the center of a region of that incomparable beauty which characterizes central Switzerland, is found the small town of Stansstadt, which is located in the canton of Unterwald. It is here that our railway commences. It then traverses the little coquettish town of Stans at the foot of the Stanserhorn, and the capital of the demi-canton of Nidwald. It then rises through the entire length of the beautiful valley of Engelberg to come out at the locality of that name, after traversing a distance of 22.5 km. The profile of the railway is represented on the map herewith (Fig. 1), which gives the names of the stations.

From Stansstadt as far as Obermatt, where the power station is located, or about 18 km. (11.2 miles), the track is of the ordinary type, depending upon adhesion for traction. From Obermatt to a place called Gherst the roadbed is furnished with a rackrail of the Riggenbach type, the same as that used on the Rigi; then from Gherst to Engelberg the track is again of the ordinary adhesion type. The rackrail has a length of 1.54 km. (0.95 mile), and the grade surmounted by its help has an average of 25 per cent. The maximum grade on the sections depending for traction on adhesion are 5 per cent, and the minimum radius of curves is 50 meters (164 ft.). The track is built of Vignole rails weighing 20 kg. to the meter (41 lbs. per yard), placed on metal ties of 22 kg. (48 lbs.) The rails have a length of of 10.5 m. (34.6 ft.), and the ties are spaced eleven to each rail length.

The problem of equipment has been complicated, as can be easily seen, by the presence of a section of rack road, laid in between the two sections of ordinary track. After a study of the conditions the engineers decided to employ large cars with a seating capacity of forty-eight, operated as motor cars on the ordinary sections, and drawn on the rackrail section by an electric locomotive.

The entire line passes through a very interesting country, and beautiful vistas are presented on the trip. It is built upon its own right of way and not upon highways. The stations are tasteful in design, and the depots are furnished with facilities for handling baggage. This makes the system resemble a railway more than an ordinary tramway.

ELECTRICAL EQUIPMENT

The character of the current adopted is the three-phase alternating, supplied directly to the motors of the cars and the locomotives by means of two trolley lines carried overhead at a height of 4.5 meters (14.9 ft.) above the track and supported 0.9 meter (2.96 ft.) apart. The rails form the third conductor for the system. The diameter of the trol-

ley wire is 7.5 mm. (.295 in.). They are supported by steel span wires of 5.5 mm. (.216 in.) diameter, held between two wooden poles placed on each side of the track and about 35 meters (115.5 ft.) apart. The poles are of spruce, creosoted, and have a diameter at the base of 230 mm. (9 ins.) and at the top 170 mm. (6.7 ins.) All the mechanical details of the construction of this line have been calculated with a factor of safety of four against breakage. The trolley line has a double insulation against the soil. The insulators employed were supplied by the Billings & Spencer Company, of Hartford.

The three-phase current is produced at the power station at a potential of 750 volts, and for the section immediately adjoining the station is conducted directly to the trolley wire. The power station is located close to the track at Obermatt. In addition, feeders are run from the power station to Grafenort for one section and to Grünenwald for another section, in order to reduce the loss of voltage on those parts of the line having the steepest grades. To feed the section situated near Stans, a part of the current of the generators is led into a transformer of 90 kw., and is raised from 750 volts to 5000 volts. This high tension current is carried by an overhead conducting system of three wires of 3.5 mm. (.141 in.) in diameter each as far as Dallenwyl, situated at 11.1 km. (6.9 miles) from the power station. Here it is led to another transformer, which lowers the tension from 5000 volts to 750 volts. This second transformer is also of 90 kw. capacity.

The generators have a capacity of 200 h.p. each, operate at a speed of 650 r.p.m. and are each driven by a separate impulse wheel, working under a very high head; the number of periods in the current is 3900 per minute. Two generators are at present installed. They are excited by two small continuous current generators of from 10 to 12 h.p. each, operating at a voltage of 110 and running at 1800 r.p.m. Each of these is driven by a small turbine.

The power station, shown on page 20, is built with a capacity of three generating units, and can be enlarged if the needs of the traffic require it. The switchboard carries the usual apparatus, such as voltmeters, amperemeters, circuit breakers, etc. In the rear of the board are the fuses and the different connections of the transformer, to which reference has already been made. The overhead wires are protected at the point where they leave the station by lightning arresters of the Siemens horn type, placed on the first pole of the line. At the side of the station is a siding for the electric locomotives.

An interesting feature is the method of braking; when a train descends the grade of 25 per cent the motors of the locomotive are connected in parallel with the generators at the central station, and so produce a certain amount of power. This power is utilized directly in part by the other cars on the section, but as the amount of power produced in descending this steep grade is generally greater than the consumption of the other trains, the surplus has to be absorbed in some other way. Consequently at the central station there has been installed a water rheostat, consisting of three rails laid in the discharge canal from the turbines. The distance between these rails and their length has been so adjusted as to permit their absorption of from 140 to 240 h.p. When a train starts to descend the steep grade the central station is advised of the fact by telephone, and the engineer at the central station throws in the water rheostat by means of two special switches. The system, although somewhat primitive, has given excellent results so far.

Another interesting feature is the device intended to prevent accidents from the breakage of the wires of the 5000-volt circuit. The State railway department has imposed on the Stansstadt-Engelberg Railway Company the following condition: to install a device which will immediately interrupt the current in case of a break of the high tension wires. Complying with this, the company has installed the device illustrated in Fig. 5. The primary coils, *A*, *B* and *C*, of the three small transformers, are connected

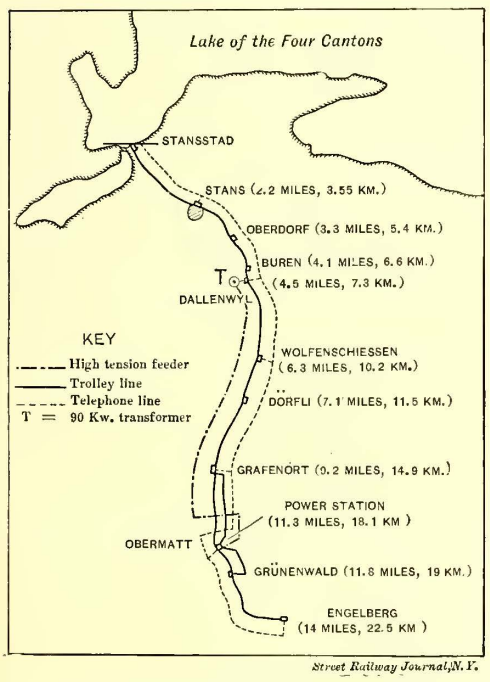
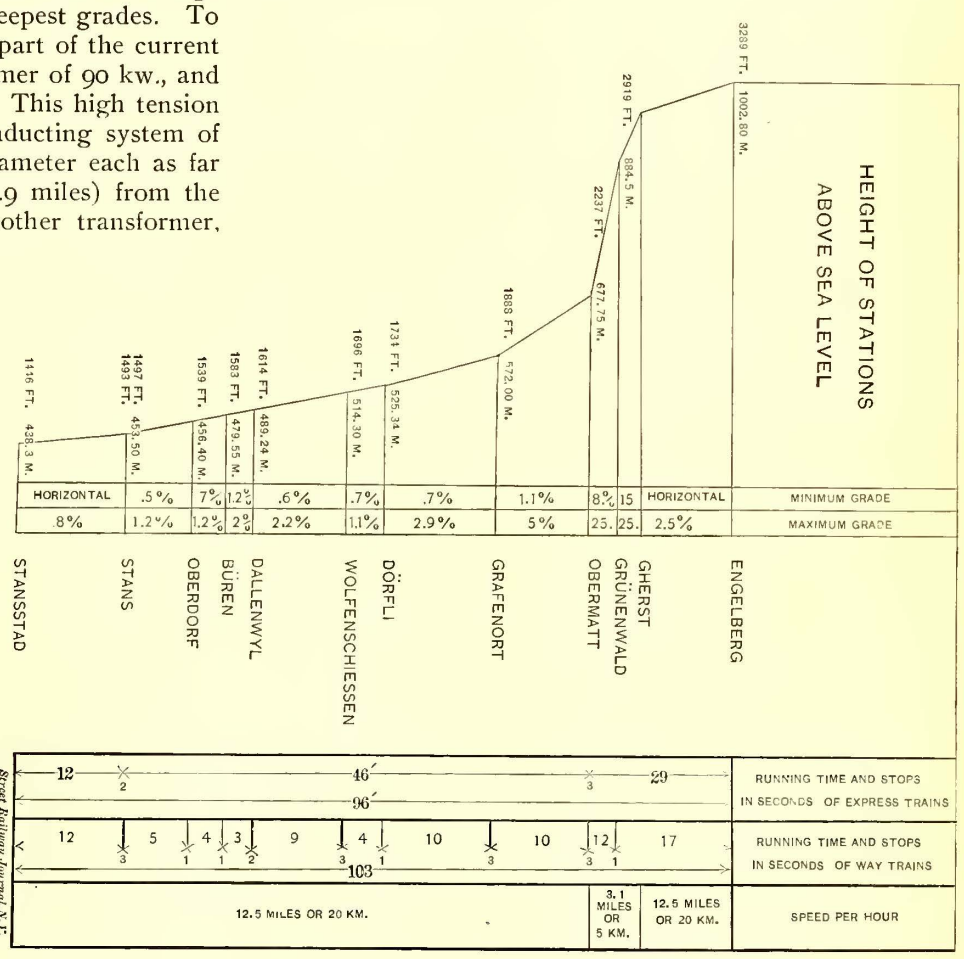


FIG. 1.—MAP OF LINE SHOWING FEEDERS



FIGS. 2 & 3.—PROFILE AND RUNNING TIMES

to three wires of the high-tension circuit at the points where they leave the station, and possess a common point *o*, which is led to earth. The secondary currents of these three transformers are connected in series to single circuit, in which is connected the apparatus which will produce the interruption of the primary circuit at the moment designed. The secondary e.m.f. of these transformers is 50 volts. The automatic circuit breaker in the circuit at *I* is an arc lamp. The following result is then secured: When there is nothing abnormal in the circuit, that is to say, when there is no broken wire, there is an equilibrium of the entire system, and the secondary coils of the three small transformers are not transversed by any current. When, on the other hand, any one of the three wires is broken, the equilibrium is interrupted. The unequal

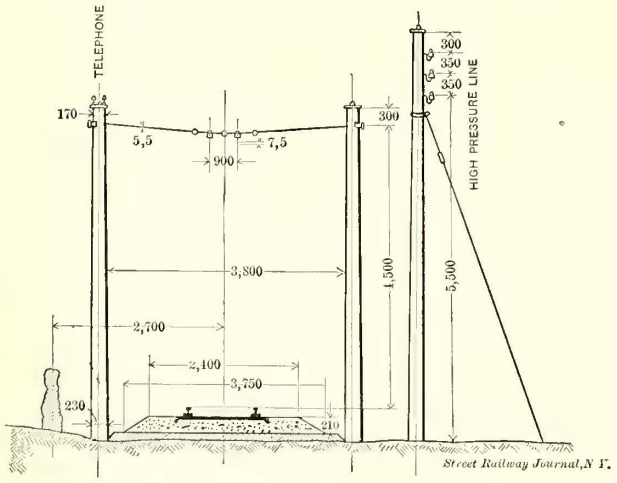


FIG. 4.—SECTION OF LINE

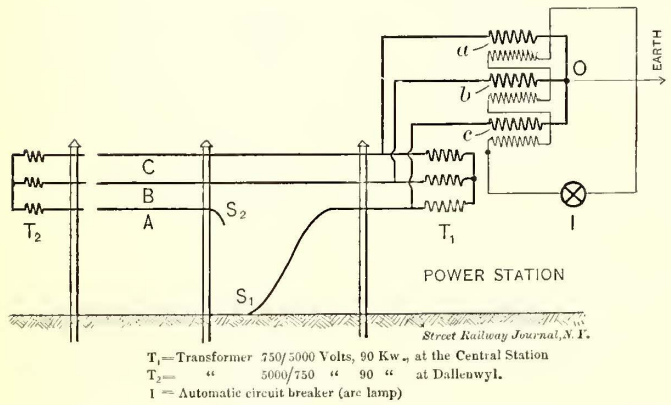


FIG. 5.—DIAGRAM OF CONNECTION OF AUTOMATIC CUT-OFF

phases excite the secondary coils and the current circulates in the lamp circuit arranged, so that the moment the carbons light they interrupt the exciting circuit of the generators. The tests made with this apparatus have consisted in letting a wire of the transmission circuit fall to the ground, and have shown that the interruption of the exciting circuit of the generators is produced in a length of time varying from four to seven seconds. The effect is then not absolutely instantaneous, but it would not be difficult to increase sensibly the rapidity of its operation, for example, by substituting for the arc lamp a circuit breaker which would open the circuit almost instantaneously. To avoid the disastrous effect of a sudden interruption of the current it would be possible to substitute for the circuit breaker an automatic switch, which would shunt the exciting current through a rheostat in series with the main switch on the exciting dynamos. The exciting circuit being 110 volts, there is not much danger, however, in breaking the circuit quickly. There is another inconvenience, however, in that the apparatus might be too sensitive, and that it might be operated by lightning. This arrangement, although somewhat crude, is still interesting to mention, for it is possible of having wide application, the high-tension lines being extremely numerous and the dangers resulting from them increasing with the number of installations.

ROLLING STOCK

The rolling stock is composed of two electric locomotives, five motor cars and four freight cars. The locomotives, which have a weight of 16.5 tonnes (36,300 lbs.), are intended, as stated, to draw the cars on the rackrail section, as well as to handle the freight trains. These locomotives are mounted on two axles, and are equipped with two electric motors of 75 h.p. each, and drive the rack gear wheel by a double reduction gearing. The motors operate at a speed of 650 r.p.m., and the speed on the rackrail is 5 km. per hour. In addition, the locomotives are so built that the rack gear can be disconnected, and they can operate on the ordinary sections at a speed of 11.5 km. per hour.

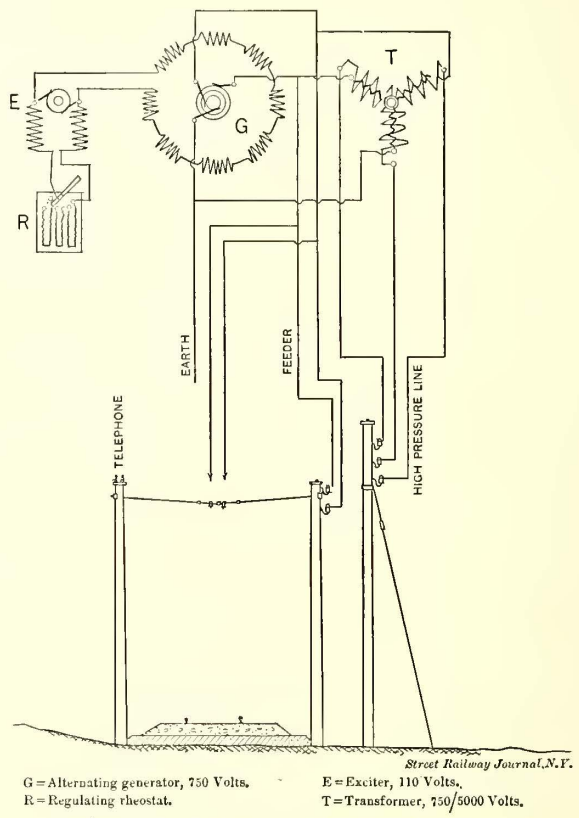


FIG. 6.—DIAGRAM OF STATION CONNECTIONS

The equipment of the locomotives includes a switch, a diverter, a volt and ampere meter, lightning arresters and fuse plugs. The duties of the engineer are very simple. He closes first the main switch and slowly cuts out the resistance which is in the circuit of the motors. The motors operate then in synchronism with the generators of the power station and at a constant speed, independent of the load drawn. When ascending a grade of 25 per cent and pushing a motor car completely loaded the locomotives absorb an average of from 95 to 100 amps. at 750 volts. In descending and with the same conditions of load, the motors furnish a current from 60 to 65 amps. going up to a maximum of 75 amps. The current is taken from the overhead wires by means of two sliding bow contacts, which are composed of two long cylinders of aluminum separated from each other by a piece of wood soaked in paraffine. The bow system of contact has been adopted in order to avoid the difficulties of construction with overhead

frogs, which were not considered desirable with two trolleys. The bows have given up to the present excellent satisfaction.

The locomotives are fitted with the following braking apparatus: first, ordinary brake shoes that operate on the four wheels; second, the motors working as generators when the current is reversed, the speed of the motors being constant whether they work as motors or generators; third, the emergency brake, operating simultaneously on the two grooved pulleys or drums, of which one is mounted on the shaft of the motor and the other on the countershaft placed between the motors and the axles. These two brakes are connected mechanically together in such a way that the pressure divides itself uniformly on the two axles. When the eight brakeshoes are applied a pressure is brought to bear against the grooved pulleys at the same time. The rack brake is operated in two different ways, by hand and automatically. To secure this a speed governor is used, which puts the brake in operation when the speed exceeds the normal. Moreover, when the main switch is opened the brakes are automatically set.

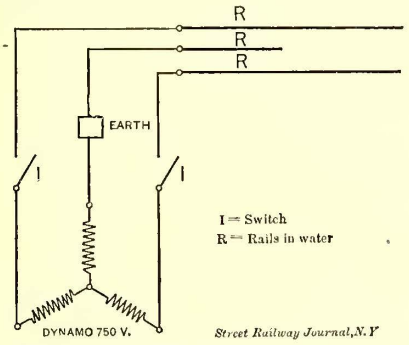
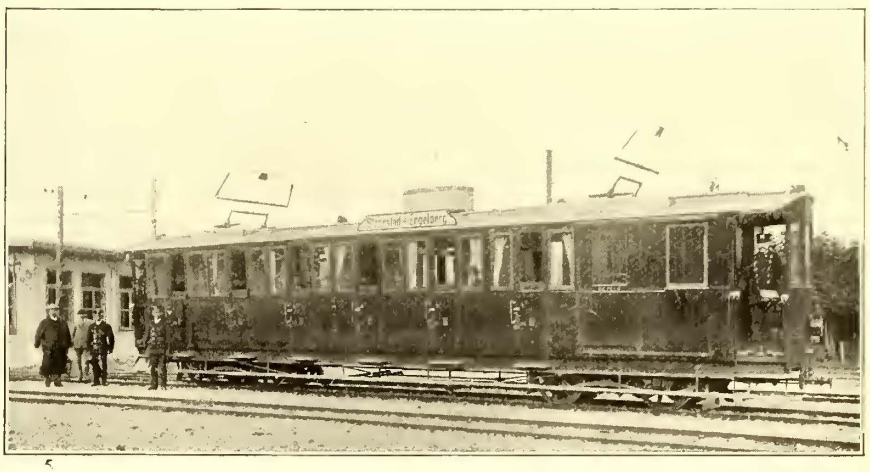


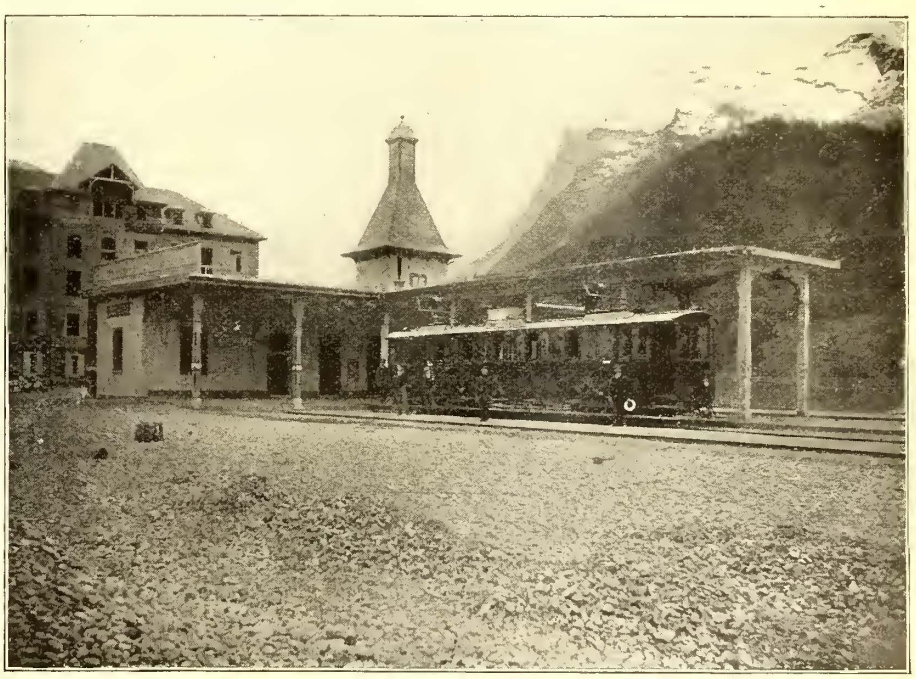
FIG. 7.—CONNECTIONS OF STATION WATER RHEOSTAT



STANDARD MOTOR CAR

The locomotives for driving gear are fitted with two shafts, of which one is supplied with a gear toothed for fitting into the rack. The motors drive an intermediate shaft placed between the two main car axles, and on which is mounted a toothed pinion, which is loose on the shaft. This pinion is operated by the electric motors through the intermediary of two trains of gears, reducing the speed in the proportion of about 15 to 1, for operating on the rack. Each motor transmits its work by a pinion of 156 mm. (6.1 ins.) diameter, mounted on the extension of its shaft. This pinion engages with a gear of 1092 mm. (43 ins.) diameter mounted on an intermediate shaft. On this shaft are found two other gears of 256 mm. (10 ins.) diameter, which engage in their turn with two gears of 608 mm. (24 ins.) diameter placed on each side of the toothed wheel engaging in the rack. The intermediate axle on which are mounted the two gears of 256 mm. (10 ins.) carry at their ends a friction coupling in order to throw the regular wheels into gear. The driving gear in the rack is then always connected mechanically with the motors, while the driving wheels are uncoupled during the ascent on the rack. For operating on the ordinary line, the friction coupling is thrown in and power is transmitted through the car axles through the intermediary of two gears of 432 mm. (17 ins.) diameter connected by means of cranks with two others of the same diameter mounted on the car axles. Below the motors is a diverter, operated by a handle, which connects the carbon contacts with the different sections of the resistance. All of the controlling mechanism of the locomotive is located in the cab, which is furnished on all sides with windows and has two doors.

The motor cars at present are five in number, and have a length of 14 meters (46.2 ft.). They are mounted on two trucks having a wheel base of 1.80 meters (5.94 ft.) and spaced 8.30 meters (27.9 ft.) apart. The car is built according, in compartments, to the French system. The number of these compartments is six, not counting the compartment for baggage placed at the end of the car. The number of seats varies from 44 to 48. The two platforms are inclosed by a vestibule, the windows of which can be lowered at pleasure. The forward platform is reserved for the motorman, who has at hand the following apparatus for controlling the speed: a switch, a lever for throwing in the resistance of the diverter, and hand brake.



STATION AT ENGELBERG

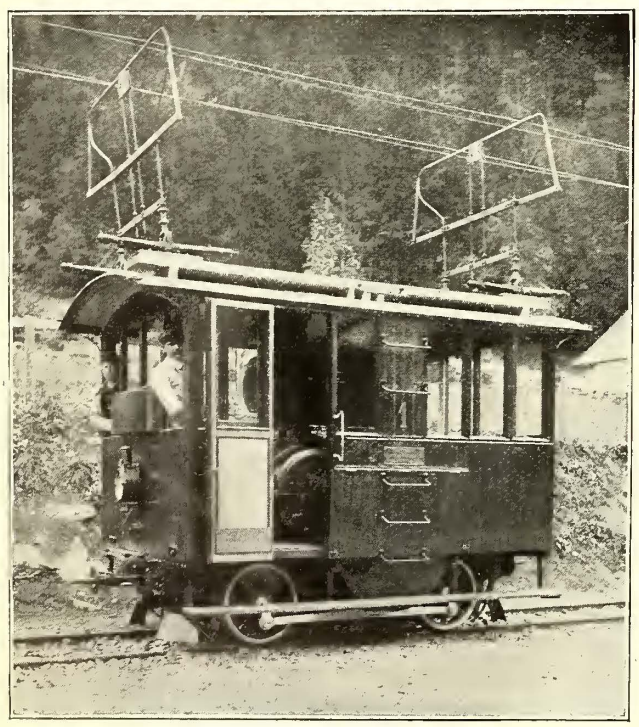
The approach of the car is signaled by means of a horn,

and the car carries a small, primary battery, so that the conductor, who is on the rear platform, can signal to the motorman on the front platform. The two motors are carried on the two axles of the same truck; they are of 35 h.p. each with six poles, revolve at 480 r.p.m. and drive the axle by gearing. The free swivel truck is furnished on one axle with a toothed gear engaging in the rack and arranged to be braked by means of an emergency brake carried on the rear platform of the car. The efficiency of the motors at full load is 80 per cent, including the gears.

The regulating resistance, which is thrown in the induced circuit of the motors, is carried on the roof of the car and enclosed in a water tight case. The electric equipment of the cars is completed by fusible plugs and lightning arresters, as well as lamps for the general lighting of the interior of the car, and two signal lamps carried regularly on the hood.

OPERATION

As stated, the distance from Stansstadt to Obermatt, where the power station is located, is about 18 km. (11 miles) of ordinary track, on which the grades do not exceed 5 per cent. This section is operated by single motor cars, which are designed to be capable of drawing one trail car. They weigh 5 tonnes (11,000 lbs.) empty, and 26 tonnes (57,200 lbs.) loaded. At Obermatt the motor car first runs on the rack for about 20 meters (66 ft.). Then the electric locomotive is run up behind it, and, without coupling, the train proceeds up the grade under the power of the locomotive only. The rack has a length of 1540 meters (5050 ft.) and terminates at Gherst. On arriving at that point the motorman on the car turns current into the motors and the car proceeds under its own power without



ELECTRIC LOCOMOTIVE

being obliged to uncouple from the locomotive, as explained above. The locomotive remains at Gherst to wait for the return car. A siding at this place permits two trains to follow each other, if desired, the locomotives being shunted onto the siding. To descend, the motor car runs on the rack section just far enough so that the gear wheel of the emergency brake is able to engage in the rack. Then the locomotive is coupled onto the car and the descent commences. When they arrive at Obermatt the locomotive is uncoupled and is then shunted onto the siding, and the motor car proceeds independently after about two minutes required for uncoupling. The speed of the cars is absolutely constant, a result which naturally follows the use of the alternating current, and on the ordinary track is about 20 km. per hour, although on the rack section it is only 5 km. per hour, owing to the change in gearing. The speed is the same in descending and ascending.

From the standpoint of the operation of locomotives and motor cars this constant speed is without doubt of ad-

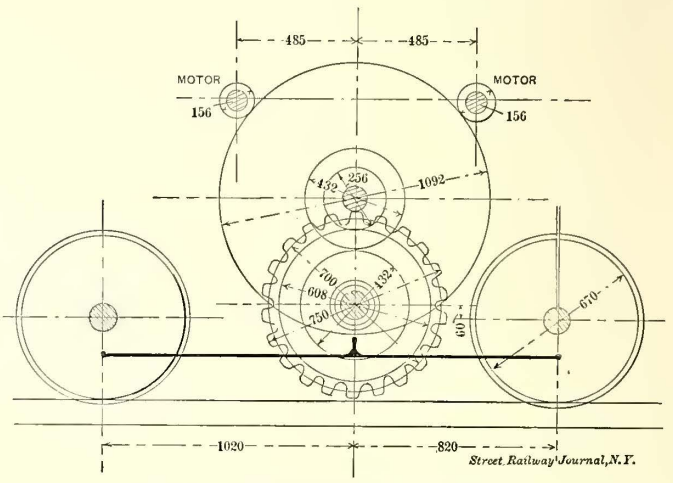


FIG. 8.—GEARING FOR LOCOMOTIVE

vantage, for the motorman is not able to waste current by lack of judgment; in a word, to take liberties with the timetable. He has absolutely only to close the switch and to cut out the starting resistance. This comprises all his work. On the other hand, from a practical standpoint, it is often desirable to be able to vary the speed within certain limits, either to gain lost time or else to vary the speed according to grades of the track, curves, where the car is passing through towns, etc. From this standpoint a three-phase current as applied in this instance has a disadvantage as compared with the continuous current, for the latter is undoubtedly much more flexible in its employment.

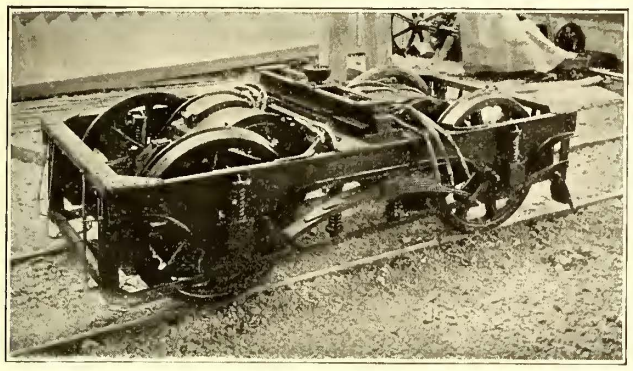
The different stations are connected between each other by telephones, using a complete metallic circuit to overcome the effect of induction and leakage from the alternating currents used. The two telephone wires are crossed every five poles, corresponding to a distance of about 175 meters (574 ft.). The wires of the public telephone system, which parallel the railway for a considerable distance, have been crossed every pole to eliminate induction. Since this was done the telephone circuit works very satisfactorily.

CONCLUSIONS

One great advantage of the direct application of the three-phase alternating current for traction lie in the facility of transporting the electric energy over considerable distances at high tension and of reducing it to a working voltage without recourse to rotary transformers, which are more or less complicated and expensive. The transformers for the alternating current are simple, take little space and require practically no attention. There are other advantages, however. The motors are of simple and strong construction as compared with continuous current motors, and have no commutator. On the other hand there are some undoubted drawbacks. Reference is not made to these to cast any discredit on the builders, who deserve great credit for their pioneer work, but to call to their attention those points which are yet capable of improvement.

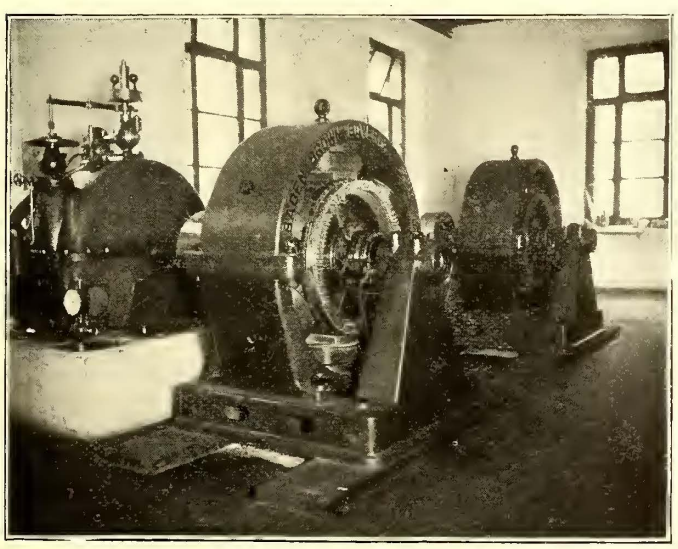
From a construction standpoint the overhead line is undoubtedly more difficult to build, more costly and more

heavy than that required for a continuous current. The installations at switches are particularly complicated and heavy. The difficulties attending the taking of current from the trolley wires are considerable, especially with the system of bow contact, where there is no guide to the



MOTOR TRUCK

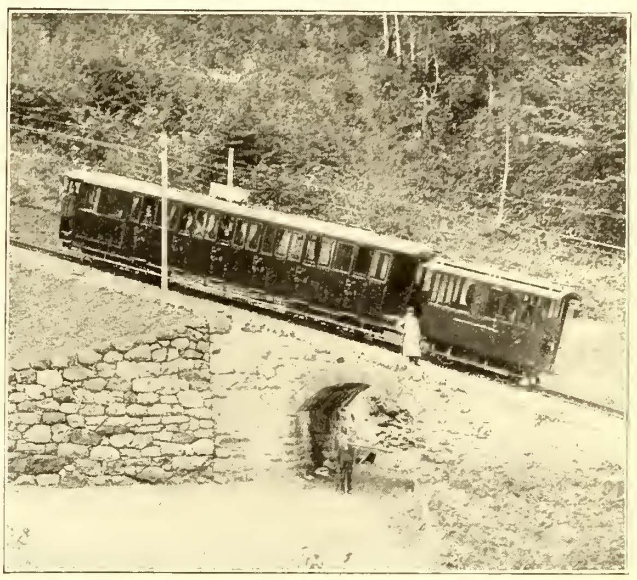
current collector. From an operating standpoint the great disadvantage is the necessity of maintaining a constant speed whether on grades or on level; that is to say, without regard to the work required of the motors. It is absolutely illogical, for example, that a car should have a speed of from 18 km. to 20 km. per hour on levels and on grades. On the former the speed ought to be much greater than 20 km., and descending a grade it ought to be somewhat less. There is another disadvantage of the system in that there is absolute dependence on the trolley line for operating the electric brakes. An example will demonstrate this. Let us consider our car descending a



GENERATOR AND TURBINES

grade of 5 per cent at a speed of from 18 to 20 km. per hour, and that we have good contact with the overhead wires. The motors are in phase with the generators and the speed cannot exceed or be less than that determined by the periodicity of the latter. Let us suppose that the current suddenly stops or that the generators are cut out for some cause or another. Our car immediately acquires a high speed, which may become dangerous if the car be not immediately checked by the ordinary mechanical brakes. With a continuous current where in descending grades the motors can be made work as generators it is possible to maintain the speed within desired limits, and this can be done with complete independence of the overhead line.

The foregoing are briefly certain critical considerations which suggest themselves to me in comparing the continuous alternating current as applied to electric traction. The criticisms, as stated, are not directed against the builders, whose work at this installation ought to be considered as a valuable contribution to the science of electric railroading. The objections may no doubt be overcome, and the alternating current, in the future, may be a considerable if not a formidable rival of the continuous current, at all events, under certain conditions. In conclusion I wish to express my thanks to the builders of the line, who have kindly supplied me with information for this article, viz.: Messrs. Brown, Boveri & Company, of Baden,



CAR AND LOCOMOTIVE DESCENDING 25-PER-CENT GRADE

Switzerland, who carried out all the electric work; La Société Industriele Suisse, at Neuhausen, who supplied the cars, and La Société Suisse pour la Construction de Locomotives, at Winterthun, who build the two electric locomotives.

Electrical and Repair Shop Practices in Philadelphia

It is the practice of the superintendent of the overhead lines and cables of the Union Traction Company, of Philadelphia, to furnish the emergency repair men blue prints showing the trolley sections fed by each cable. These blue prints are numbered, and sections belonging to power station No. 1 run from 1 to 199; those from station No. 2, from 200 to 299, and so on to the other stations, of which there are seven, and one battery station, the latter being of the chloride accumulator type. These blue prints show all the trolley sections in detail, giving the location of points where connection is made from the underground cable to the trolley wire and the location of section insulators. The number of the adjacent sections are also given, as shown by the accompanying sample print, Fig. 1.

Since the consolidation of the different companies there has been a rearrangement of feeder lines, so that the different stations are coupled in the most economical manner, resulting in a large saving of current and copper by the transfer of cables to new districts. It should be remembered that in this system nearly all feeders are carried underground in the company's own conduits. There are over 1000 miles of underground cable, composed of 620 miles of lead-covered feeder cable, 170 miles of telephone cable, and 210 miles of return cable. Since the burning of

the Thirteenth and Mt. Vernon Street station, and the consequent disarrangement of the cables in the power-house vaults, a systematic arrangement of the cables in these vaults has been effected, and the contrast is shown in the accompanying illustrations.

Fig. 2 shows the condition of a portion of one of the vaults before the change, and Fig. 3, the same manhole,

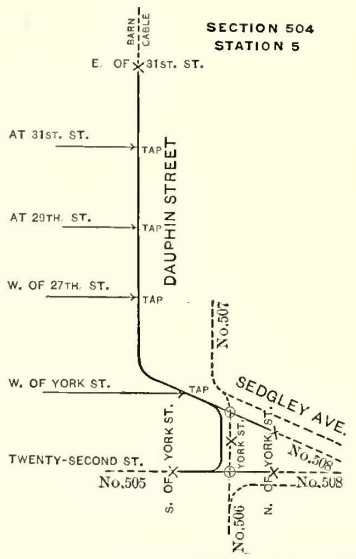


FIG. 1.—SAMPLE LINE MAN'S SHEET

with the cable systematically arranged. Figs. 4 and 5 also show how order was brought out of confusion in another vault. Fig. 6 illustrates the method of supporting lines of lead cable round a corner and also from the ceiling. In this connection, however, it may be noted that a peculiarly formed metal bracket has recently been devised by this

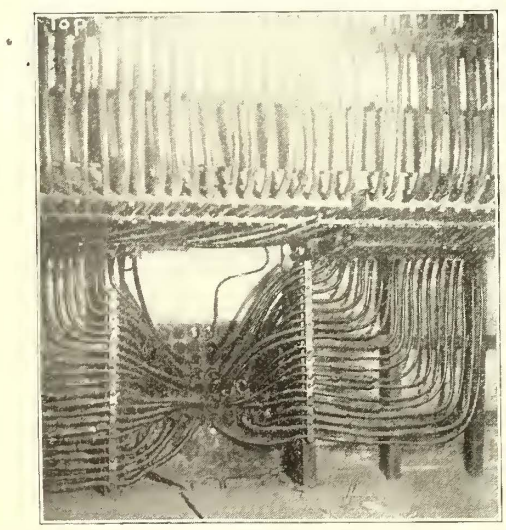


FIG. 3.—SYSTEMATIC ARRANGEMENT OF CABLES SHOWN IN FIG. 2

department. It is intended to replace the wooden strips used in the manholes, as the supports made from wood are found to rot out after about three years of service.

Five plumbers with the necessary number of helpers are employed in keeping the lead-covered cables in proper repair.

TELEPHONE SERVICE

The company maintains an independent telephone system of about 100 instruments, which connects the department offices, and also the emergency stations, power houses and car houses. The system is known as that of the Standard Telephone Company, and an independent switchboard is provided. The current for operating the call circuit of the telephone system is generated by a pair

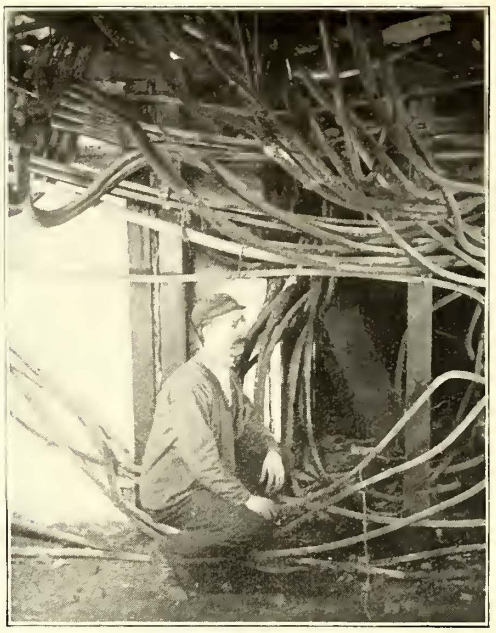


FIG. 2.—CABLES IN VAULT BEFORE CHANGE

of motor dynamos, which are located in the same room as the switchboard. There are two of these machines, but only one is operated at a time. These machines are of the Crocker-Wheeler type, and transform a 500-volt direct current down to 75 volts alternating. The switch connected with these machines is provided with an automatic cut-out and rheostat, so that if the current breaker in a power station opens, the current is automatically cut off from the motor transformer.

An operator is always on duty, who also acts as emergency dispatcher and keeps a record of all calls answered by the emergency wagons. Trouble of all kinds is re-

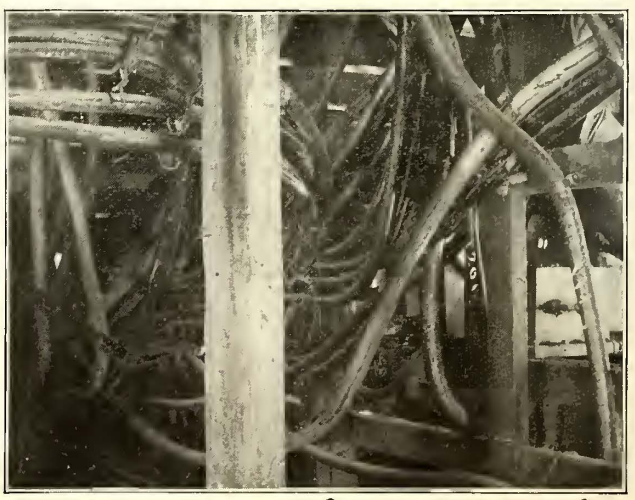


FIG. 4.—ANOTHER VIEW OF CABLES BEFORE ARRANGEMENT

ported to the central office, and this department is also connected with the city fire alarm signals, the emergency wagon running on each fire alarm, the same as the fire engines. At fires, the tower wagons are frequently used as hose bridges, so that the cars are allowed to pass through. Each wagon crew is composed of a lineman, helper and driver, and the lineman reports by telephone

the nature of all the calls to which he may respond and the time consumed.

The company employs eight emergency tower wagons, six of which are on duty throughout the twenty-four hours, and two that are on duty for twelve hours. These tower wagons are of the McCardall & West type, manufactured at Trenton, N. J.

Some idea of the work required of this department can

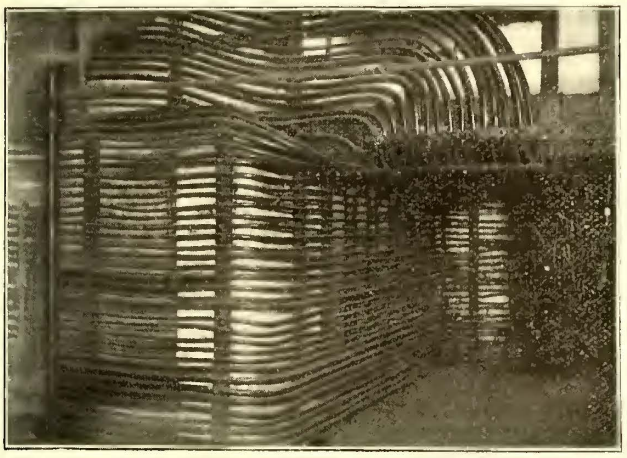


FIG. 5.—SYSTEMATIC ARRANGEMENT OF CABLES SHOWN IN FIG. 4

be formed from the statement that the system embodies about 500 miles of trolley wire and 300 miles of overhead feeder cable. No. 00 trolley wire is used in re-equipment throughout the entire system. The overhead construction is supported by tubular iron poles 30 ft. in height and in three sections; the telescoped sections are 7 ins., 6 ins. and 5 ins. A special device is employed at the overhead crossings, which prevents the wearing out or crystallizing of the trolley wire at these points. This consists of a sheet of steel about 3 ft. in length and 4 ins. in width placed above the wire with the ends turned up, and so arranged that when the trolley wheel approaches the crossing the flanges of the wheel come in contact with the curved plate, freeing the groove from the wire and relieving the latter from the blow that is otherwise dealt at the rigid point.

REPAIR SHOPS

In the main repair shop, which is at the corner of Eighth and Dauphin Streets, there is a home-made electric transfer table, Fig. 7, which eliminates almost all the hand labor required for shifting cars. This table is of sufficient length to accommodate the longest and heaviest cars, and plies between the repair shop on one side of the track, and the wood working department on the other, and crosses the tracks of the repair pits and the station storage tracks.

The table operates on four tracks, which are slightly depressed, so that the tracks on the platform are on a level with the shop tracks. The current for operating the motor

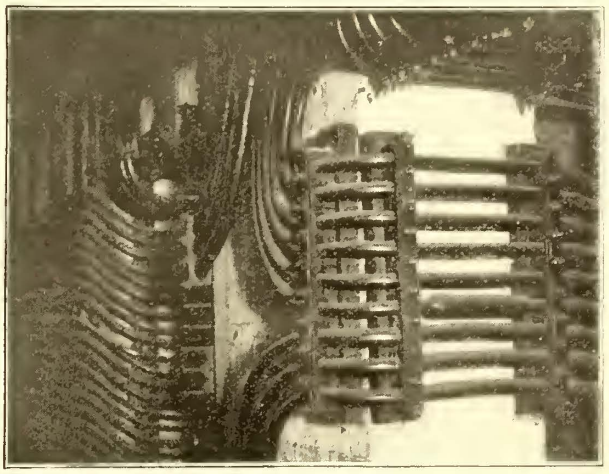


FIG. 6.—METHOD OF CARRYING CABLES AROUND CORNER

is collected by an under-running trolley, which is in contact with a T rail, used as a conductor. This rail is embedded in asphalt between the track rails, and its surface is about 2 ins. below the asphalt paving. An ordinary car motor of the G. E.-800 type, with type K-2 controller, is employed, and this is geared to the main axle, as in car practice. The resistance coils are in three sections, and boxed in directly under the main axle. The fuse box and switch are placed near the operator. Each axle has four wheels, those on the motor side of the table being 30 ins. in diameter, of special pattern undished, while the wheels on the opposite side of the table are 15 ins. in diameter. The outside wheels of each set are plain, without flanges and their axles are coupled to the driving axle by a peculiar clutch coupling, which allows them to turn independent of the driving axle. Roller bearings are provided for each journal, and these are what are known as the Standard roller bearing.

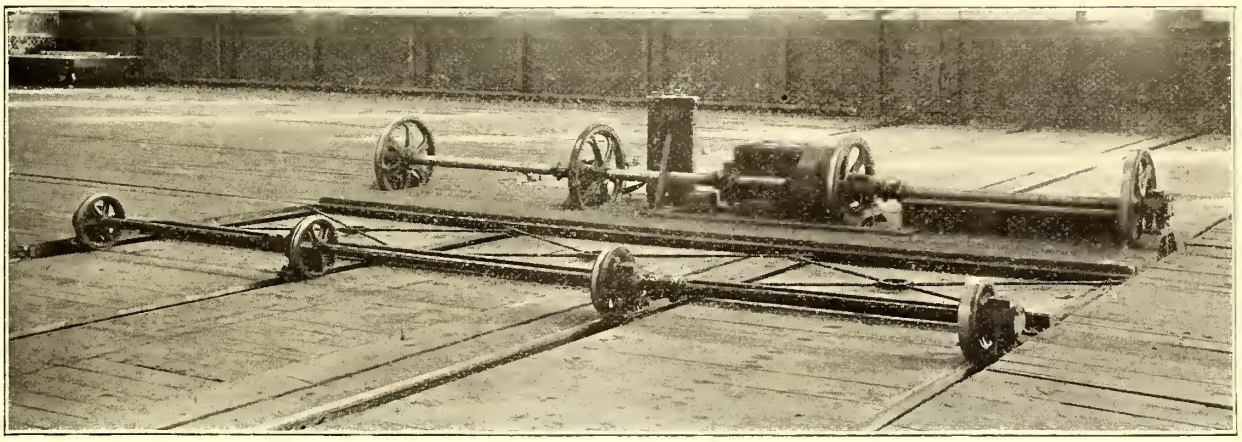


FIG. 7.—ELECTRIC TRANSFER TABLE—EIGHTH AND DAUPHIN STREETS

The middle driving wheel next the controller is provided with a band brake, which is operated by a foot lever within easy reach of the operator. The table runs very rapidly, and is readily controlled by the brake. The company has two of its shops equipped with this type of transfer table, and both are giving excellent satisfaction.

LETTERS AND HINTS FROM PRACTICAL MEN

Reversible Street Railway Rails

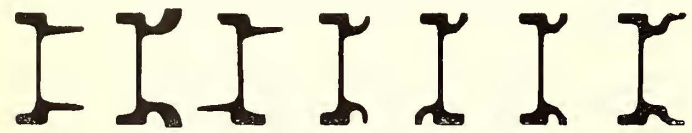
PHILADELPHIA, PA., Dec. 2, 1898.

EDITORS STREET RAILWAY JOURNAL:

The reversible girder rail is by no means a new idea. Such a rail was patented in England and Germany many years ago, and, as is well known, is used to-day largely in Great Britain and on the Continent of Europe; however, the rail forms which I illustrate in this letter are, in matter of design, proposed method of manufacture and application, original with the writer.

It is well known that in cities, under heavy traffic, the average life of the straight-line rail is from seven to ten years only; on curves this life is reduced to from two to six years. In Europe, the experiment of reversing double-headed rails on steam roads has proved a failure, due to the fact that the double or "bull"-headed rail is set on chairs, and the wear is thus concentrated on that part of the rail in contact with the chair. The consequence is that the rail is worn on the under side, and presents a series of indentations, sometimes amounting to as much as an eighth of an inch in depth.

This indentation of the rail does not occur when the rail is in contact with wood or has a uniform bearing of large surface on metal or concrete. As a maintenance of way engineer and one engaged in the manufacture of rail work, it has been a study with the writer for years how to increase the life of rails, and, while an earnest advocate of



PROPOSED SECTIONS OF REVERSIBLE RAILS

high carbon and special steels, yet even the recourse to such has not solved the problem of economical maintenance, in the writer's opinion. In the illustration are shown several designs of reversible rails; some of these are no doubt of little utility; others are superior.

Figuring at the present price of steel rails, their average life and renewal costs, allowing current prices for scrap, with interest on increased investment in the case of the reversible rail, also taking into account additional present cost of rolling the reversible rail, it appears that this form of rail presents an economy of at least one-third over the present form of rail. The pros and cons may be stated as follows:

AGAINST

1st. Increased cost of rolling.

2d. Increase of capital in investment, due to increased weight of rail.

3d. Difficulties of fastening.

4th. Fatigue of metal.

FOR

1st. Increase of life, double that of single head.

2d. Ease of change, when renewal comes.

Answering objections, I would state that with the method of rolling which I propose, the cost will not be increased, and a better rail will be obtained than in the case of a thin base, making a rail subject to internal stresses. It is true that the capital investment is slightly increased, but this is more than offset by gain in efficiency.

With the New York type of rail, shown at the extreme right, there is no increase of difficulty in fastening the rail to the tie over the ordinary base rail, and with the other forms it is generally proposed to use a concrete roadbed, which overcomes any difficulty of this kind. The concrete roadbed for street work is used so successfully abroad and at home that its introduction in such an event may be considered on the line of improved practice.

The fatigue of metal in a rail long in use would be an argument against in steam road practice, but conditions are radically different on the street railways, where the breakage of rails in use is rare. With the tremendous traffic developed by electric service in cities has come the demand for something more permanent than what is known abroad as "permanent way," but which unfortunately hardly deserves this title. Figuring the length of street railways in the United States at 12,000 miles, and assuming the average weight of rail 70 lbs. to the yard, which is low, the annual saving per mile of track per annum would be $136.19, or a total for the United States of $1,634,280, representing at 4 per cent a capitalization of $40,857,000. On such a system as the Union Traction Company, of Philadelphia, the annual saving would be nearly $70,000.

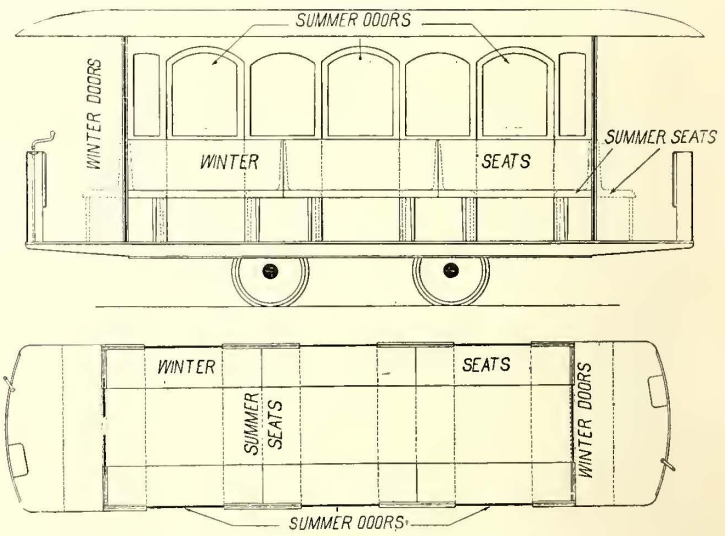
G. W. CHANCE.

Proposed Convertible Car

JOHNSTOWN, PA., Dec. 5, 1898.

EDITORS STREET RAILWAY JOURNAL:

Upon reading your editorial upon convertible cars in the current issue of the STREET RAILWAY JOURNAL, the construction shown in the sketch herewith suggested itself. Upon examination and research it will probably be found "as old as the hills," yet I cannot remember seeing it before. The length of the car must be a multiple of the width, which permits the same seats to be arranged lengthwise or cross wise for winter or summer, as desired. The sketch



SIDE ELEVATION AND PLAN OF CONVERTIBLE CAR

illustrates a car 18 ft. body, having three doors in the side and one at each end. The side doors can slide, as noted in the sketch, so that in winter they can be securely tightened in place, like cab doors. Two extra seats may be provided on the platforms for summer travel, which is almost always greater per car than in winter. I have paid no attention to detail, as I am not building such a car, merely offering it as a suggestion. For summer use the end doors are securely closed and the running boards are used for steps. The side doors are then fastened back or taken off. The only work involved in the alteration is the shifting of the seats. The two extra seats for the summer car would be the only parts requiring winter storage, and they can be so made that they will retain their shape in or out of use.

S. E. CLARKSON.

Street Railway Park at Columbus, Ohio

THE COLUMBUS CENTRAL RAILWAY COMPANY,
COLUMBUS, OHIO, Dec. 11, 1898.

EDITORS STREET RAILWAY JOURNAL:

The view herewith is a flash-light photo taken of the audience at our theater, Minerva Park Casino, on the evening of Oct. 2, 1898. We consider this picture a strong argument in favor of street railway parks and summer vaudeville, which many of your contributors seem inclined to regard as at least partial failures. Without being posted on the local conditions obtaining, the price paid for artists by these gentlemen would, it seems to us, account for the failures, as performances costing $200 to $250 will not draw, while performances costing twice that amount will command in business many times the difference paid for performers.

At Minerva Park Casino we maintain an excellent orchestra of fifteen pieces, which doubles to brass for a short concert before the performance. We pay from $500 to $600 for artists, and book all acts separately, thus avoiding anything objectionable or undesirable.

We have in the capacity of amusement manager a competent theatrical man of extended experience, and book without charge attractions for a circuit of street railway parks extending from Pennsylvania to Illinois. The object of this circuit is to enable us to contract with performers for ten or twelve weeks' steady work with short railway jumps and consequent small traveling expense, at a reduction in salary of 25 to 50 per cent to the advantage of those in the circuit.

Regarding fares, we issue an excursion ticket during the summer season for 15 cents, including a coupon for admission to Minerva Park. Five cents is credited to the park for every coupon taken at their turnstiles. No admission is charged to the Casino, but we reserve 1200 seats at 10 cents and 100 box-seats at 25 cents. The balance of the house is free. The total seating capacity is about 3000. Reserved seats are on sale at the principal hotels ten days in advance.

AUDIENCE IN CASINO, COLUMBUS

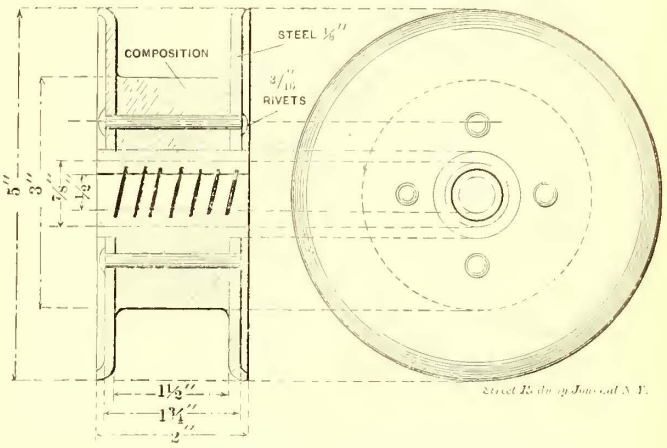
Minerva Park covers 156 acres, and contains all the usual amusements. The stimulus given to business by the addition of the vaudeville greatly increases the value of the numerous concessions on the grounds.

As a further argument that summer vaudeville can be successfully run in street railway parks, we can point to Minerva Park as a railway park that is self-sustaining, and which brings in considerable traffic to this road.

F. N. BENDELARI, Agent for Receiver.

Trolley Wheel for High Speed Roads

In the early experiments in high-speed heavy electric railroading with overhead construction carried on by the New York, New Haven & Hartford Railroad Company on its Nantasket Beach and New Canaan branches, considerable difficulty was experienced in getting a satisfactory form of trolley wheel. As explained by Col. Heft in the issue of STREET RAILWAY JOURNAL for November, 1897, it was found that as soon as the speed of the cars was increased beyond a certain point the ordinary trolley wheels would jump the wire very frequently, particularly at curves. Many trolley poles were broken in this way in addition to the damage done to the overhead construction. It was also found that the wheels were very often destroyed by the almost continual arcing when taking from the wire the heavy currents required in starting and during acceleration as well as the smaller currents taken at the maximum speeds.



TROLLEY WHEEL FOR HIGH SPEED ROADS

In order to overcome these difficulties the form of trolley wheel shown in the accompanying illustration has been devised and is now the standard type on all the overhead electrical divisions of the New York, New Haven & Hartford Railroad. The wheel is made up of a cylinder of composition metal 3 ins. in diameter, and with curved edges, which fit against 5-in. steel flanges which are ⅛ in. thick and riveted through the body of the wheel. The tread for the wire is 1½ ins. wide, this large gage being employed in order to give to the wheel more play upon the trolley wire and thus prevent it from jumping at high speeds. The tread can be easily replaced when worn out without renewing any of the other parts of the wheel.

The New York Auto-Truck Company is the title of a corporation recently organized in New York to build automobile drays, operated by compressed air motors. Joseph H. Hoadley and Henry E. Knight are largely interested.

STREET RAILWAY JOURNAL

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

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

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

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

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Street railway earnings are improving—not by leaps and bounds, but steadily and satisfactorily. The improvement appears to be general over the entire country. The great rise in the prices of "traction stocks" in the New York, Boston and Philadelphia stock markets since election day has excited widespread comment and has made bankers and brokers eager to put new enterprises upon the market—enterprises which in some cases have been shelved for several years waiting for favorable money conditions. Wall Street is full of money, full of confidence and full of daring to-day. In the vernacular of the Street, "stocks are booming" and "anything goes." It is superfluous to say that there is danger to the permanent investor at such times as this, and much discrimination should be used in sorting out the sheep from the goats. Nevertheless, the fact remains that the street railway industry of the country is in good condition, so far as earnings are concerned, and needs only a few years of continued prosperity to become favored of capitalists as a field for investment.

Americans cannot longer ignore broad world problems and responsibilities. Whether we will or not, "imperialist," or "expansionist," ideas must prevail in the long run, and no "strict construction" group of legislators or individuals can prevent it. We say this calmly and dispassionately, more as recording a prediction than as supporting a debatable policy. If the history of our own and other countries proves anything, it proves that nations are constantly broadening out in their interests and ambitions—not turning all their efforts back into the narrower grooves of self-improvement. The reflex action of a widening national policy upon the individual citizen is not the least valuable of the results which will follow. So long as Americans deal with purely national or local matters they are individually provincial. So soon as they reach around the world and grapple with international ones they become cosmopolitan. The London bus driver gravely discusses with his nearest top passenger the morning's report of Russian encroachments in Manchuria. The flower of British young manhood is winning fortune and fame in India, South Africa or Alaska. French and German capitalists examine all countries for opportunities for investment. Shall Americans, then, in proud but short-sighted self-sufficiency, say, "Our country is large enough for us?"

It would be hard for American manufacturers, and particularly for the makers of street railway apparatus, to be other than "expansionists." When the crash in prices came five years ago and home business had to be taken by our manufacturers without profit, or at a loss, the foreign markets began to be explored, at first diffidently, if not despondently. Greatly to their surprise, they found better chances for success than had been deemed possible. The high prices paid for American labor were counterbalanced by a much less rate of production per workman in foreign countries, where trades unions hold full sway, while the magnitude of our markets was, and is, such that division of labor and use of labor-saving machinery can be carried to the highest perfection, and so large a quantity of manufactured product can be turned out that much of it can overrun into other countries and be sold at a price less than the foreign cost of production with their smaller and greatly subdivided markets. As a consequence, we see enormous annual increases in the foreign shipments of American manufactured goods, which have excited the wonder of our own and of foreign statisticians, and have raised us at least to the second position among the creditor nations of the world. Moreover, it is not true, at least in the street railway manufacturing industry, that American makers have been forced to content themselves with lower prices for goods sent abroad than for those sold at home. Instead of this, materially higher prices have ruled for foreign consignment and reports of heavy price cutting and losses, circulated at home as well as abroad, are false. America has as fine a corps of selling and distributing agents in Europe as is possessed by the manufacturers of any country. We have not, however, properly and fully sought the trade of the Orient and of South America. The Philippines should be invaluable to us as a vantage point for the immense and just opening development of the Chinese Empire, for which Russia, Great Britain, Germany and France are striving. With the Nicaragua Canal constructed, with the Hawaiian Islands as stepping stones to Eastern Asia,

and with a Pacific cable binding our new possessions more closely to us, the American Empire will be firmly established in the front rank of the great world powers, and will be able, with dignity, fairness and moderation, to preserve or improve its standing, and to obtain for its citizens a rapid increase of individual and collective wealth and prosperity.

The Paris Exposition of 1900 promises to draw to that city a very large number of Americans, among whom will undoubtedly be numbered many of our readers, who will take the opportunity which the visit to Paris affords to inspect the tramway systems of France, and perhaps those of some of the other countries of Europe. The next convention of the International Tramways Union is scheduled for Paris in 1900, and Americans, who are interested in street railway enterprises here, and who expect to attend the Paris Exposition, would do well to time their visit, if possible, so as to be present at the meeting of that association. The date of that meeting has not yet been announced by the executive committee of the Union, but will be duly published in the JOURNAL when it is made public. In this connection, Mons. Lavalard, one of the managers of the General Omnibus Company, of Paris, the largest tramway company in that city, has sent us a letter in which he suggests that a congress of all the tramway companies in the world be held in Paris at the time of the Exposition, and states that he believes that a great deal of mutual benefit would be derived from such a meeting. The plan of a World's congress seems an excellent one. In spite of the differences in steam railroad practices between this country and Europe, the International Railroad Congress, held abroad, is always well attended by American railroad officials. The differences existing in electric tramway practice here and abroad are much less than in steam railroading, and, in the essential features of the mechanical and electrical sides of the subject, are practically *nil*. It is not too much, therefore, to expect good results to follow such a meeting, and what city and time are more appropriate for the first meeting than Paris and 1900?

A very large amount of the wear to which special work is subjected is caused, not by the normal, but by the abnormal, wear of the wheels. A properly proportioned wheel will not be anywhere near as destructive to special work as an improperly proportioned wheel, or one which through wear has lost its original shape. For this reason, wheel wear must not be considered as being limited to the wheels themselves, but as covering a very much wider field, and, as wheels are very much cheaper than special work, it is almost a truism to say that there is no economy in trying to get wear out of wheels after they lose their shape to any considerable extent. In other words, after they have reached a certain point, they are so destructive to track and special work, particularly when the latter is not of the hardened center type, that there is no economy in trying to save the metal in the wheel. This is one argument against the use of steel-tired wheels, which are more popular abroad than in this country. As we have repeatedly pointed out in these columns, the use of steel-tired wheels on tramways or street railways, where there is apt to be grit and dirt on the track, is an entirely different proposition than on steam railroads where the track is laid with exposed ties. With the head of the rail on a level with the pavement steel-tired wheels soon lose their shape, and while they can be run within much closer limits, so far as flange breaking and chipping is concerned, than chilled iron wheels, it is needless to say that when worn out of shape they are exceedingly destructive to the track construction. On the perfect condition of the latter hinges directly the life of the cars and motors, together with the comfort of the passengers, so that a badly worn wheel, if persistently used, is apt to produce effects of a far-reaching nature to all branches of a road's permanent way and rolling stock.

We commend to the special attention of street railway secretaries, treasurers, auditors and accountants the paper in another column on "An Ideal System of Street Railway Accounts." This is an entirely dispassionate discussion, from the standpoint of a professional accountant, of the relationship which the different classes of accounts in the profit and loss statement and the balance sheet bear to each other, and to the general accounting scheme. The key-note of the discussion lies in the statement that "the one aim of the skilled bookkeeper is to be able to produce when necessary a clear and correct final balance sheet. * * * * The ideal in bookkeeping, therefore, is a perpetual balance sheet, a balance sheet that is an integral part of the accounting system, and not something that is made up outside of the books at intervals." (In this last use of the term "balance sheet" there is included the profit and loss statement.) In other words, there is brought out in this discussion for the first time, so far as we are aware, a description of the "Balance Sheet System" of bookkeeping as applied to street railway accounting, and we heartily indorse the suggestion on its broad lines as a good one. The "Chart of Analysis and Classification" presented by Mr. Kittredge will be of great value to accountants, as it expresses the locations and relationships of the different accounts in the clearest possible manner.

The remarkable presentation in our November issue of the "Comparative Costs and Profits of Electric Cable and Horse Railway Operation in New York City" has naturally been widely noticed, and in many cases reproduced, by the engineering and daily press at home and abroad, while it has been reprinted in pamphlet form for the use of members of the London County Council and of the Glasgow Council. Many analyses and attempted applications of these figures have been made in editorial and correspondence columns, and by the advocates of different motive powers in municipal councils. The New York figures have surprised and puzzled many people, for one reason and another, and the mistake has frequently been made of trying to fit them to other conditions. Whenever startling differences in receipts and operating expenses of any two roads give rise to speculation as to causes, it is a quite safe plan to turn first to the car mileage records and ascertain the differences of practice between the roads in the matters of schedule speeds per hour, miles per car-day, use of trailers, etc. Among others, we notice in a recent number of the "Railroad Gazette," an interesting comparative schedule of the costs per car-mile of the conduit electric

system of New York, and the trolley system of Chicago, and of the cable systems in the two cities. The differences are remarkable, and, unfortunately, little attempt at explaining them is made by the author. The putting together of figures of this kind without an accurate statement of the differences in practice is a mistake from the standpoint of the true statistician, since wholly incorrect deductions may be drawn by the ill-informed, and action may sometimes be taken involving the gravest financial consequences from mere impressions given by such figures. How can New York and Chicago results be compared? In New York no trailers are used on either grip or electric cars, while in Chicago a grip car carries from one to four trailers, according to the time of day, thereby saving greatly in power consumption and in transportation expenses per car-mile; the schedule speeds per hour in the two cities are quite different, which affects both transportation expenses and power: the time interval between cars on the Broadway system is so short that the load and wear upon its cables are terriffic, thereby causing an expense for renewals of cable alone amounting to 20 per cent more than the entire maintenance of way expenses of the Chicago City Railway Company; transportation wages per hour are different in the two cities; electric cars are mostly long in New York and short in Chicago, and, finally, many of the expenses are functions not of car mileage, but of miles of road or gross receipts. The car-mile unit for comparison is extremely fallacious and misleading—the ton-mile unit, when possible to obtain it, far better.

The increasing unwillingness of municipalities in Europe and America to grant any but short-time franchises or renewals of franchises to their street railway companies is deplorable, from almost every point of view. Granting that the public should derive the greatest possible benefit, in one form or another, from the use of its streets for transportation purposes, it is yet always possible to arrange compensation over a long term of years on some sliding scale, such that this desirable end can be obtained without, on the other hand, forcing the street railway companies to borrow money at high rates or to have their securities regarded as unstable. It is always to the advantage of the municipalities, as well as of the companies, to have the former's securities regarded as low rate—4 per cent, for example—investment, but a short tenure of franchise or any other element which makes the immediate future uncertain tends to raise the rate of interest demanded by capital, and therefore reduces the concessions which can be made to the public in the way of improved service, extensions, etc. The English plan of twenty-one-year franchises has worked so wretchedly by emasculating enterprise and retarding the growth and expansion of cities, that the object lesson ought to be taken to heart by well-informed Americans. On the other hand, the magnificent enterprise shown by private companies in those places, in America, particularly, where franchises have been granted for long periods, is an object lesson of the other kind. Does any one suppose the New York City street railway companies would have spent $30,000,000 to $40,000,000 in the adoption of the cable and electricity, or would have instituted their almost universal transfer system and improved their cars and car service so tremendously had their franchises been granted but for twenty-five, or even fifty, years, instead of in perpetuity? Or would the City of New York itself, had it owned its own railways, have grappled with the city's transportation needs and problems in so bold and far-seeing a manner? No. The "debt limit" scare, or the fear of showing a temporary deficit would impel politicians at the moment in charge of the city's development to look to the present, rather than the future, and the "conservative" element would prevail. We have little need to cast our eyes over the water to British cities, which own their tramway systems, to see how true this is, and how impossible it must be for large bodies of elective trustees of the public interests, such as the London County Council, to act promptly or in a broad-gage manner on the most urgent problem with which they have to deal, that of providing a centrifugal force, in the form of transportation facilities, for throwing their populations farther and farther away from their congested districts.

* * * * * * *

In Chicago, we are just now seeing the beginnings of a retrogressive action, which may be one of the most disastrous calamities which that city can suffer. A young man, with an ambition for high political preferment, is Mayor of the city. It is openly alleged, and so far without contradiction, that he has entered into an agreement with all but one of the prominent daily newspapers of Chicago, by which he is to assist them in their efforts to "hold up" the great traction companies of Chicago for large sums of "hush money," in consideration of their support of himself as candidate for another term as Mayor, and eventually for higher office. In pursuance of this alleged agreement, the Mayor and these newspapers of Chicago are working together in every conceivable way to excite the people against the companies, and to prevent the passage of an extension ordinance in the council. These newspapers are refusing the companies a hearing in their columns. They have actually, in times past, refused to publish the text of the legislative bills which they have been fighting, even when the street railway companies offered to pay them for such publication at regular advertising rates. The companies have been forced to reach the public through the one newspaper independent of the "combination," and by circulars in their own cars. Mass meetings have been called, and threats of violence against the Aldermen, in case they vote for the measure, have been freely made, and the Mayor—an officer, sworn to uphold the law and to preserve public order—has intimated in public that he would not be disposed to call out the city's protective forces to prevent such violence. To the credit of the public of Chicago, it should be said that their love of fair play appears to have caused them to resist to some extent these inciting influences. Mass meetings appear to be not "overflows," by any means, and one instance is recorded of a mass meeting attended by four people only, who passed "without a dissenting voice" (as the combination papers said the following day), a vote declaring for municipal ownership!

Some Facts and Probabilities About Interurban Electric Railroading

The interurban electric railway system around Detroit, an extended description of which is published in this issue,

is a good example of a branch of electric railroad work in which comparatively little has as yet been done. Outside of the interurban electric railways around Cleveland and Boston, there is no system in this country which can compare in extent to that around Detroit, and, of course, there is none in any other country. It is difficult to say to what length these interurban electric railway projects can be carried to advantage. Those in the neighborhood of Detroit already reach out, in some instances, a distance of about 40 miles from the city, and nearly all of them are from 20 to 25 miles in length, while a railway from Detroit to Toledo is already under way, and appearances are that it will be completed. The roads around Boston, to which reference has been made, differ materially from those around Cleveland and Detroit, in that while as long trips in a direct line can be made on electric cars, the system is made up for a large part by the lines of separate companies, which bear a closer resemblance to the ordinary city or village railway than in the case of Cleveland and Detroit. In these last cities each radiating line is operated as a unit, the cars are long, resembling in appearance steam railroad cars, and more of an effort is made for through business than in the case cited in New England. It would seem as if these roads are prototypes of extended electric systems which will spring up around large cities, or between smaller towns, where there is a sufficient number of inhabitants along the route to develop traffic, and the effect of these lines on steam railroad traffic, while comparatively small in individual cases, must in the aggregate amount to considerable. It has been shown that with the saving which these lines can effect by building along the line of the highway and in the cheap subdivision of power possible with electricity, passengers can be profitably carried at an average rate of about a cent a mile, a figure which seems impossible under present conditions with steam railroads. The latter already recognize a dangerous competitor in electric railroads for this short distance traffic and are doing their utmost to suppress it; but it is a condition, not a theory, which confronts them, and if electric roads can be built and operated at these low fares, village and town authorities will find some way of granting them the necessary franchises.

In some, in fact, in a great many respects, the interurban railway proposition is an attractive one, especially to those railway owners and managers who have had experience with city properties. In the first place, the question of franchises is usually much simpler than with city railways, in spite of the fact that concessions have to be secured from a greater number of municipal or other governing bodies. The reason of this lies in the fact that (a) the abutting property owner is benefited to a greater extent, or "injured" to a less extent, by having the railway in front of his property than in the case of city roads, as esthetic objections to the overhead wires do not trouble him, there is less noise from the railway traffic, and it gives him direct means of transportation at his door; and (b) the community, as a whole, welcomes a transportation agency which is always more convenient and cheaper than that which existed before. In the second place, the franchises are usually for definite and longer periods and are less apt to be reviewed by common councils with a change of administration. In the third place, the ability to run at high speeds offers a continuous opportunity to reduce transportation charges, while the traffic on such a road has nearly always as great possibilities of development as the city railway without as much danger of competition. In the fourth place, many of the mechanical problems which make the life of the city manager a burden and keep him awake at night disappear in the interurban railway. One of the most important of these is that of track, which can be built according to steam railroad standards with exposed rails and ties, on which joints can be watched and bolts kept constantly tight, without continuous pavement excavation. Many problems connected with interurban electric railroading yet remain to be solved, but, taken as a whole, they do not seem to be any greater than those connected with city railway service, even in its present development, and there seems little chance that any radical changes will be effected.

In one respect, interurban electric railroading as practiced in this country seems to have taken a direction which has somewhat surprised owners of similar projects abroad, and that is the universal employment of the continuous current for transmitting power and for use on the line. In another article in this issue we print an extended description of an interurban railway in Switzerland, which is considerably smaller in extent than very many in this country, but on which the alternating current motors are employed. The author of the article, M. Charles Rochat, who has charge of the engineering branch of the Railway Department of the Swiss Government, in reviewing the application of 3-phase currents on this road, takes occasion to point out certain defects in alternating current motor work. One of these, that of constant speed under all conditions, does not seem to be unsurmountable. The use of two trolley wires is certainly a drawback, for while most of the single-track interurban railways in this country employ two trolley wires, they do so for the sake of avoiding switches at turnouts, and with the 3-phase system, if overhead switches are to be eliminated, four overhead wires would have to be used. Evidently the possibilities for trouble in the use of polyphase currents for traction work and the comparative newness of this branch of the work has so far discouraged railway managers in this country from taking it up. The continuous current motor has reached a high state of development. Its defects, though numerous, are all known and tend to decrease with the size of the motor and with time. The only immediate saving in the introduction of the alternating system would be in reducing the size of the feeders, and, as we all would

> " Rather bear those ills we have,
> Than fly to others that we know not of";

the continuous current is likely still to remain a favorite, especially as, with the use of boosters and from 600 to 650 volts on the trolley wire, the feeder cost can be kept down considerably below that required by current city practice.

Electrical improvement has cost individuals and communities large sums of money, but it has in every case produced more than the cost; and it has been cheaper to have these improvements than to do without them. This fact cannot be questioned, and the isolated cases of failure in practical experiments or poorly calculated investments are but the sacrifices by which the general good has been gained. I think I may venture the statement that the electrical industry has produced more changes in the mechanical service and convenience of civilized life than has ever been caused by the application of any other force subject to the service of man.—From paper read at the Montreal Convention, 1895.

An Ideal System of Street Railway Accounts *

BY A. O. KITTREDGE, F. I. A., C. P. A.

One of the most eminent authors of modern treatises on accounting says: "The object of all good bookkeeping is the exhibition of the growth or decline and present value of capital, and of each of the parts of which capital is made up. A perfect balance sheet shows all this in the clearest and most concise manner. A perfect balance sheet should not only give the present value of each of the component parts of capital, but should also indicate its growth and decline since the last statement. The one aim of the skilled bookkeeper is therefore to be able to produce, when necessary, a clear and correct final balance sheet."

From this we derive inferentially that the more frequently a balance sheet is made up, the more thorough is the showing with reference to the condition of the capital, its growth or decline and its distribution in different places. The ideal in bookkeeping, therefore, is a perpetual balance sheet, a balance sheet that is an integral part of the accounting system, and not something that is made up outside of the books at intervals. In this last use of the term "balance sheet" there is included a profit and loss statement. A balance sheet, so arranged as to be an equivalent, for example, of the cash account, and which, through the medium of its divisions, shows the growth and development of the business in all its branches, just as the cash account shows fluctuations in the cash on hand, is a desideratum worth striving for. On the other hand, a perpetual profit and loss statement, which shall show the relation of expenses to earnings in all proper detail, is also something well worth the effort required to secure it.

The analysis of accounts, which it is the purpose of this article to describe, and which is herewith presented in chart form, is that which is required where the balance sheet is made an integral part of the bookkeeping system and where the profit and loss statement is made perpetual and also a going part of the bookkeeping system. What is shown is no new or untried scheme. It is something that is now in successful use in some hundreds of enterprises throughout the country and something that has been found entirely satisfactory in various lines of business, from that of transportation companies to banking, from manufacturing enterprises to mercantile houses, and from the largest jobbing concerns down to small retail establishments. The universal success which the application of this plan of analysis has met, wherever tested, warrants its presentation to the street railway accountants of the country. That its application requires some books of peculiar construction and certain mechanical facilities which it is not the purpose of this article to describe, should not in the least detract from its interest. Suffice it to say in this connection that whatever is special in this regard is far less in amount and expense than the necessary equipment of various other improved methods used every day in offices of street railway companies, as well as in other directions.

At the outset it is only right that attention should be called to certain divisions or elements recognized in the chart, which to some accountants, who have not had a broad experience, will appear strange and unusual, and yet the function of each of these, it is believed, will be made clear as the explanation proceeds. Again, it should be remarked that in describing an ideal system it is necessary to include more in items and detail than perhaps ever would be employed in any individual case. The system, to be adequate, must be exhaustive in its presentation, leaving to the individual user the privilege of selection and adaptation.

All the accounts of a street railway company, as well as of any other business, are comprised in two general classes —namely, the accounts of the balance sheet and the accounts of the profit and loss statement. It is impossible to conceive of any account that will not properly fall under one or the other of these heads.

Referring now to the chart, it will be seen that the accounts of the typical overhead electric railway company are presented in these two grand divisions—first the balance sheet, and second the profit and loss statement. The balance sheet divides under the two heads commonly recognized in a document of its kind—namely, into assets and liabilities. The assets of the company, by their nature, may be divided into three classes—namely, active, fixed and passive. These terms, by the way, are optional, and others, perhaps still better in definition, might be substituted. The point is not the special names that are employed to designate classes, but the classes of the accounts in themselves.

The active assets comprise cash, the term being inclusive and embracing the amounts in the office safe and in each of the several banks in which deposits are made; notes receivable, accounts receivable, sub-divided as required, and materials and supplies, represented by such accounts in name and character as are appropriate for the purpose.

The fixed assets, as presented by the chart, are largely those designated by street railway accountants as construction and equipment accounts. This term, however, seems to be insufficient for the purpose, and therefore I have preferred the term "fixed assets," dividing under that head into two classes, the first called necessary investments and the second other investments.

The necessary investments, going back to the organization of the company, include the cost and expense of its charter and its franchise and the expenses of preliminary engineering, etc. Following this are the items properly falling under the head of way and structures, and also under the head of equipment. Way and structures subdivides into right of way, track and roadway, electric line, real estate used in the operation of the road, buildings and fixtures, being the items *B* to *G* inclusive, of the construction and equipment accounts, as reported by the committee on standardization at Boston.

Right here I desire to remark that throughout this classification of accounts I have held, so far as possible, to the terminology suggested by the committee on standardization, and have used their list almost complete. I have found it necessary, however, to make radical changes in location, so far as one or two accounts are concerned, the particulars of which will appear hereafter. In this connection the reader's attention also should be directed to the fact that in the chart the accounts suggested by the committee on standardization have been printed in different type from the balance of the chart (cap italics) and are further indicated by the letters and prefix numbers as reported by the committee.

Equipment divides into power plant equipment, shop tools and machinery, cars, electric equipment of cars, and miscellaneous equipment, being items *I* to *M* inclusive, of the construction and equipment accounts, already referred to.

Two single accounts of this class have been omitted—namely, *N* and *O*. These are "interest and discount" and "miscellaneous." The explanation of the former, as offered by the committee, is that "all interest paid or received in connection with funds for construction, and all discounts or premiums resulting from a negotiation of securities for

construction, should be charged or credited to this account." With respect to the second, miscellaneous, the following explanation appears: "Charge to this account all expenditures for printing and stationery, office supplies, damage claims, wages of clerks, and all other expenses incident to construction not otherwise provided for." Evidently what is in mind with respect to these two accounts is that they shall include the expenses in connection with the construction and equipment of the road that are specified in the explanatory notes. The items named are parts of the cost of the assets represented in the chart by the accounts *A* to *M* inclusive, although I cannot see that they are assets in themselves. The accounts *A* to *M* represent tangible assets, whereas *N* and *O*, as above described, do not represent assets, but are parts of the cost of assets otherwise designated. Therefore, it would seem to me that the items included in *N* and *O*, instead of existing in the balance sheet as separate accounts, should at the outset be pro-rated among the accounts *A* to *M* inclusive. An expense item in the capacity of an asset is an absurdity in bookkeeping, although there are several illustrious precedents of such classification.

Other investments include, in addition to item *H*, investment real estate, of the list just alluded to, stocks of other companies, and bonds of other companies. Whether or not a given company at present owns securities of other companies, it is necessary in a scheme of analysis such as we are considering, to show where such accounts would fall, in case they were required to be opened.

By the passive assets of a company I attempt to indicate those which are not permanent in character and which are to be written off sooner or later. Under this head fall some of those items which before now have been the distress of many an accountant—for example, the accounts which must be opened to offset excessive capitalization. Good will, a convenient and elastic name of an account to which is usually charged whatever cannot be properly laid upon the tangible assets of the concern, is an excellent illustration. By items in suspense are meant accounts carrying amounts of an expense character paid in advance of their consumption in the operations of the company. In a recent article in these columns I have discussed suspense items so thoroughly that further description is not necessary at this time.

The second grand divisions in the balance sheet—namely, liabilities—divides into four classes. First come the funded debts of the company, such as first mortgage bonds, second mortgage bonds, debentures, etc. Next comes the floating indebtedness of the company, including such items as notes payable, accounts payable, subdivided as required, and dividends which have been declared, but which for the time remain unpaid. Accounts of this kind are occasionally required to be opened, but for the most part they are closed almost as soon as opened. This item in the chart is only to show the location of such accounts.

Next in order come the reserve accounts, a class of liabilities occupying middle ground between what the company owes the public under the heads of funded and floating indebtedness and what it holds in trust for its stockholders, so to speak, for certain specified purposes. The reserves enumerated in the chart are quite as many as are likely to be required in any company, and yet possibly omissions will occur to the reader, and not a few will suggest substitutions. Many are likely, perhaps, to declare some of the accounts named entirely unnecessary.

First, there is the reserve for taxes; following which is the reserve for interest on funded debt, and on the floating debt as well. Next there are the reserves for the several sinking funds necessary to retire the funded debt; following which are the reserve accounts for maintenance and depreciation, each divided into two classes—way and structures, and equipment—and, finally, the reserve to establish an emergency fund out of which to pay damages, accidents and losses from the destruction of the property.

In a recent article in this journal I have described the theory of reserve accounts, introducing illustrated examples, so that extended remarks on this subject are unnecessary at this place. Suffice it to say that the theory upon which this chart proceeds is that monthly costs shall include an allowance for each of these items. The books that this chart exemplifies are the books of the stockholders exclusively, not of the bondholders, nor yet of the public. Interest, taxes, maintenance, depreciation and emergency costs must all be met before the stockholders are entitled to a dividend. Costs on each of these items, properly pro-rated, are charged up month by month, as the profit and loss statements show, and the proper reserve accounts credited. When the time for payment of any of these costs arrive—for example, when taxes are due, or when interest is due—the reserve account is charged with the amount instead of the expense account, for the expense account has already borne the charge upon the monthly pro-rata basis.

Some of my readers may take exception to the provision that is indicated of reserves for sinking funds, and they may more particularly object to the charges forming the reserve being regarded as a part of the expenses of the road. It is to be remembered, as just mentioned above, that the point of view from which we are discussing an accounting system is that of the stockholder. The showing to be made by the balance sheet and profit and loss statement is that in which the stockholder alone is interested. The resultant profit that is shown is that which is available for dividends, all charges of whatsoever name and kind having been previously provided for.

There are several points of view from which a sinking fund may be considered. Where an enterprise is "property rich" and "cash poor," a sinking fund to provide for the retirement of bonds may be created out of assets through the process of reserving from time to time a certain percentage of the cash that is received as its property is sold. That, however, is not the position in which street railway companies are ordinarily placed.

An individual, a business firm, or a corporation borrows money to use in business, primarily because the business requires more capital than the owner can supply. Theoretically, at least, the loan is negotiated with the expectation of paying it off at maturity. It can be paid when it falls due in only one of two ways, leaving out of the account for the moment the special conditions occasionally prevailing in certain classes of enterprises just referred to above. One of these ways is to take up the original loan by negotiating another loan—that is, retiring one set of bonds by the proceeds of another issue of bonds. The second plan is to reserve enough out of the profits of the enterprise to meet the bonds when due.

I venture to suppose that there are some who read this who will say that to pay off a loan, that is to retire mortgage bonds, for example, out of profits, is an absurd idea of financing at the present day, particularly when money can be borrowed at the low rates of interest which prevail whenever good security is offered. Even so, yet the accountant, not acting in the capacity of a financier, must show, in any scheme of accounting that is intended to meet all possible requirements, how to proceed whenever the stockholders determine that the bonds shall be retired out of earnings, in order that their shares may correspondingly appreciate in value.

Some who give consideration to this subject may be disposed to argue that the increasing value of the company's property by reason of the growth of population and general development of the community through which the road runs, is in itself a sinking fund adequate for all purposes. To this the accountant, in turn, is disposed to give a strictly professional answer, namely: Do not let one thing offset another, in the belief that thereby a balance is effected, but put a proper valuation on each item, both debit and credit. Let every tub stand on its own bottom, at all times.

Whether or not a sinking fund shall be created and maintained is to be decided by the management—not by the accountant. The chart shows how to proceed where a sinking fund is decided upon, and is to be built up out of earnings at a fixed rate.

Finally, we come to the capital division of the liability portion of the balance sheet. It is divided into three heads —profit and loss, impairment and surplus, and capital stock. Profit and loss, as here shown, may be defined as capital in process of accumulation. It is subdivided into weekly, fortnightly, monthly, quarterly, semi-annual and annual accounts. Profit and loss account, as here placed, is the resultant and not the active account. Referring for the moment to the profit and loss statement, it will be seen that expenses and revenues are there contrasted. The difference between expenses and revenues weekly, if the accounting is arranged on a weekly schedule, would make the weekly profit and loss account in the balance sheet statement. If the profit and loss statement be run upon a monthly basis, then its showing would make the monthly amount in the balance sheet, and so on.

Assuming that weekly closings are being made in the balance sheet ledger (one of the special devices referred to at the early part of this article), then the weekly profit and loss account, as the weeks roll on, would be closed into the monthly profit and loss account, and the monthly, in turn, according to the preference of the management, would be summarized into the quarterly, or the semi-annual, or the annual. Each basket would be emptied as soon as filled, to be ready for the next use.

If dividends are being earned and declared, profit and loss, quarterly, semi-annually, or annually, as the case may be, would be charged with the amount of dividend declared. Any amount remaining in the semi-annual or annual profit and loss account would then be carried one step further to the credit of impairment and surplus account.

If the business is running at a loss, then the closing of the semi-annual or annual profit and loss account, as the rule may be, would be to the debit of the next account in order—namely, impairment and surplus—in a way to show an impairment of capital. Capital stock account remains a fixed quantity, either in a single amount or subdivided into common shares and preference shares, as the organization may be.

In what has preceded I have anticipated much that might be said with respect to the second grand division of the accounts—namely, the profit and loss statement. The profit or loss of any business is determined by contrasting the revenues with the expenses. Since expenses must always be borne before revenues are secured, this division is given first place in the exhibit. The expenses of a street railway company are fairly classified under three heads—namely, transportation, general and maintenance. Transportation divides into operation of power plant and car service. The subdivisions opposite each of these heads are those which have been established by the committee on standardization. General expenses have been classified under four heads—administrative, emergencies, taxes and fixed charges. The accounts opposite administrative are the same as those established by the committee on standardization. The accounts opposite emergencies are likewise the same as established by the committee, with the exception of one added at the bottom—namely, accidents and destruction of property. Fixed charges are divided into interest and sinking funds. If interest is paid, it would properly fall in this class. We have already discussed the question of sinking funds, which would belong here under certain conditions. Maintenance divides into two heads—repairs and depreciation. Each of these subdivide into way and structures, and equipment.

The theory upon which this accounting system is based is that expenses shall be charged to proper accounts as they occur, so far as possible; hence the presence in the expense schedule of accounts Nos. 10 to 39, inclusive, as formulated by the committee on standardization. Where an expense is incurred which it is impossible to pay at the time, it is still charged in and the amount credited to the proper reserve account; hence the presence under the head of reserves in the balance sheet statement, of accounts 1 to 9, inclusive, of the committee's schedule. An allowance for both repairs and depreciation of way and structure and equipment should be charged into expenses week by week, or month by month, as time goes on. Since this expense cannot be paid always when it is charged in, the reserve accounts are brought into play for holding the amount until such time as the repairs can be made, or the depreciation offset by renewals. All this, however, as before mentioned, has been discussed in a previous article, and therefore does not require extended remarks at this time.

The revenues of a street railway company proceed primarily from operation, and secondarily from various other sources. These are enumerated under appropriate heads in the lower part of the profit and loss statement. How revenues and expenses are contrasted by closing all the accounts shown in the profit and loss statement back into weekly or monthly profit and loss in the balance sheet, according to the time schedule upon which the accounting system proceeds, has already been mentioned. In the arrangement of the accounts in the balance sheet ledger provision is made for this periodical closing, thus establishing the record of the results of the business at frequent intervals.

The accounting scheme here outlined dispenses with inventories, save only as inventories are taken to verify accounts. Material and supplies are charged out as used, taken at cost prices. The balance in the account of each kind of material and supplies, therefore, should show the amount remaining on hand. An inventory, therefore, would prove the accuracy of the account.

There is no line of business which I have investigated, wherein the conditions are so entirely favorable to a perpetual balance sheet and a going profit and loss statement, as a street railway operation.

Street Railway Blanks and Forms

Late in November a circular letter was issued by W. B. Brockway, secretary of the Street Railway Accountants' Association of America, referring to the new work—namely, collecting blanks and forms—which is to be undertaken by the organization named. This is described as a new departure, and one which is believed will add to the usefulness of the organization, and make it a source of practical value to every member. It will be recalled that resolutions were passed at the Boston convention requesting every member to furnish the secretary with two copies of each and every blank and form in use upon his road, and

AN IDEAL SYSTEM OF STREET RAILWAY ACCOUNTS

CHART OF ANALYSIS AND CLASSIFICATION

ELECTRIC RAILWAY COMPANY

BALANCE SHEET

- **ASSETS**
  - **Active**
    - CASH — In Office; In Ninety-Ninth National Bank; In Exchange Bank, etc.
    - NOTES RECEIVABLE
    - ACCOUNTS RECEIVABLE — Subdivided as required
    - MATERIAL AND SUPPLIES — Subdivided as required
  - **Fixed**
    - Necessary Investments
      - CHARTER, FRANCHISE and
      - Way and Structures
        - *A. ORGANIZATION EXPENSES*
        - *B. PRELIMINARY ENGINEERING AND SUPERINTENDENCE*
        - *C. RIGHT OF WAY*
        - *D. TRACK AND ROADWAY*
        - *E. ELECTRIC LINE*
        - *F. REAL ESTATE USED IN OPERATION OF THE ROAD*
        - *G. BUILDINGS AND FIXTURES*
      - Equipment
        - *I. POWER PLANT EQUIPMENT*
        - *J. SHOP TOOLS AND MACHINERY*
        - *K. CARS*
        - *L. ELECTRIC EQUIPMENT OF CARS*
        - *M. MISCELLANEOUS EQUIPMENT*
    - Other Investments
      - *H.—INVESTMENT REAL ESTATE* — An Account with each piece
      - STOCKS OF OTHER COMPANIES — An Account with each lot
      - BONDS OF OTHER COMPANIES — An Account with each lot
  - **Passive**
    - ITEMS IN SUSPENSE — Subdivided as required
    - GOOD WILL
- **LIABILITIES**
  - **Funded**
    - FIRST MORTGAGE BONDS
    - SECOND MORTGAGE BONDS
    - DEBENTURES
  - **Floating**
    - NOTES PAYABLE
    - ACCOUNTS PAYABLE — Subdivided as required
    - DIVIDENDS.—(Declared and Unpaid)
  - **Reserves**
    - TAXES
    - Interest
      - FIRST MORTGAGE BONDS
      - SECOND MORTGAGE BONDS
      - DEBENTURES
      - FLOATING INDEBTEDNESS
    - Sinking Funds
      - FIRST MORTGAGE BONDS
      - SECOND MORTGAGE BONDS
      - DEBENTURES
    - Maintenance
      - Repairs
        - Way and Structures
          - *1. TRACK AND ROAOWAY*
          - *2. ELECTRIC LINE*
          - *3. BUILDINGS AND FIXTURES*
        - Equipment
          - *4. STEAM PLANT*
          - *5. ELECTRIC PLANT*
          - *6. CARS*
          - *7. ELECTRIC EQUIPMENT OF CARS*
          - *8. MISCELLANEOUS EQUIPMENT*
          - *9. SHOP EXPENSES* (Machinery and Tools)
      - Depreciation
        - Way and Structures
          - TRACK AND ROADWAY
          - ELECTRIC LINE
          - BUILDINGS AND FIXTURES
        - Equipment
          - STEAM PLANT
          - ELECTRIC PLANT
          - CARS
          - ELECTRIC EQUIPMENT OF CARS
          - MISCELLANEOUS EQUIPMENT
          - MACHINERY AND TOOLS
    - Emergencies
      - DAMAGES
      - ACCIDENTS
      - DESTROYED PROPERTY
  - **Capital**
    - Profit and Loss
      - WEEKLY
      - MONTHLY
      - QUARTERLY
      - SEMI-ANNUAL
      - ANNUAL
    - IMPAIRMENT AND SURPLUS
    - Capital Stock
      - COMMON
      - FIRST PREFERRED
      - SECOND PREFERRED

PROFIT AND LOSS STATEMENT

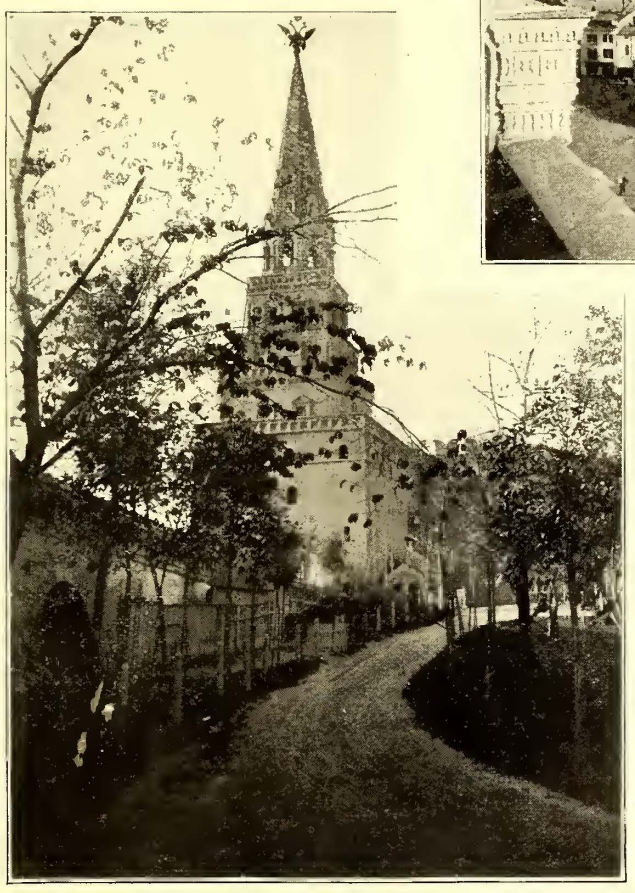
- **EXPENSES**
  - **Transportation.**
    - Operation of Power Plant
      - *10. POWER PLANT WAGES*
      - *11. FUEL FOR POWER*
      - *12. WATER FOR POWER*
      - *13. LUBRICANTS AND WASTE FOR POWER PLANT*
      - *14. MISCELLANEOUS SUPPLIES AND EXPENSES OF POWER PLANT*
      - *15. HIRED POWER*
    - Car Service
      - *16. SUPERINTENDENCE OF TRANSPORTATION*
      - *17. WAGES OF CONDUCTORS*
      - *18. WAGES OF MOTORMEN*
      - *19. WAGES OF OTHER CAR SERVICE EMPLOYEES*
      - *20. WAGES OF CAR HOUSE EMPLOYEES*
      - *21. CAR SERVICE SUPPLIES*
      - *22. MISCELLANEOUS CAR SERVICE EXPENSES*
      - *23. CLEANING AND SANDING TRACK*
      - *24. REMOVAL OF SNOW AND ICE*
  - **General**
    - Administrative
      - *25. SALARIES OF GENERAL OFFICERS*
      - *26. SALARIES OF CLERKS*
      - *27. PRINTING AND STATIONERY*
      - *28. MISCELLANEOUS OFFICE EXPENSES*
      - *29. STORE ROOM EXPENSES*
      - *30. STABLE EXPENSES*
      - *31. ADVERTISING AND ATTRACTIONS*
      - *32. MISCELLANEOUS GENERAL EXPENSES*
      - *33. GENERAL LEGAL EXPENSES*
      - *36. RENT OF LAND AND BUILDINGS*
      - *37. RENT OF TRACKS AND TERMINALS*
      - *38. INSURANCE*
    - Emergencies
      - *33. DAMAGES*
      - *34. LEGAL EXPENSES IN CONNECTION WITH DAMAGES*
      - ACCIDENTS AND DESTRUCTION OF PROPERTY
    - *39. TAXES.*
    - Fixed Charges
      - Interest
        - FIRST MORTGAGE BONDS
        - SECOND MORTGAGE BONDS
        - DEBENTURES
        - FLOATING INDEBTEDNESS
      - Sinking Fund
        - FIRST MORTGAGE BONDS
        - SECOND MORTGAGE BONDS
        - DEBENTURES
  - **Maintenance**
    - Repairs
      - Way and Structures
        - TRACK AND ROADWAY
        - ELECTRIC LINE
        - BUILDINGS AND FIXTURES
      - Equipment
        - STEAM PLANT
        - ELECTRIC PLANT
        - CARS
        - ELECTRIC EQUIPMENT OF CARS
        - MISCELLANEOUS EQUIPMENT
        - MACHINERY AND TOOLS
    - Depreciation
      - Way and Structures
        - TRACK AND ROADWAY
        - ELECTRIC LINE
        - BUILDINGS AND FIXTURES
      - Equipment
        - STEAM PLANT
        - ELECTRIC PLANT
        - CARS
        - ELECTRIC EQUIPMENT OF CARS
        - MISCELLANEOUS EQUIPMENT
        - MACHINERY AND TOOLS
- **REVENUE**
  - **From Operation.**
    - PASSENGER RECEIPTS
    - CHARTERED CARS
    - FREIGHT
    - MAIL
  - **From Other Sources.**
    - EXPRESS
    - ADVERTISING
    - TRACK RENTALS
    - RENT OF LAND AND BUILDINGS
    - INTEREST AND DIVIDENDS ON SECURITIES
    - INTEREST ON DEPOSITS
    - SALE OF POWER
    - MISCELLANEOUS

Designed by A. O. KITTREDGE, F.I.A., C.P.A.

as rapidly as any new forms are issued, two copies of the same. Notice is given that the secretary is now ready to take charge of these forms, classify them and put them in shape for exhibition purposes and general use by the members of the organization.

It is intended that these blanks and the annual exhibition of them shall be held strictly to the members of the organization. Each one contributing, therefore, is assured that whatever blanks are supplied will be used solely for the benefit of the members of the association. It is pointed out in the circular that any member desiring to get up a form for any particular purpose, will be greatly assisted by having at his disposal hundreds of blanks pertaining to the subject which he has under consideration.

The following directions are embodied in the circular: Do not fold the blanks more than absolutely necessary; rolling is preferred. Write in ink the name of the company upon all blanks, where the name does not appear. In case the blanks do not indicate clearly their use, they are to be accompanied by a synopsis of what they are intended to accomplish. The term "blanks and forms," it is explained, is intended to cover everything used by a company, including specially ruled books and tickets. The packages are to be addressed to W. B. Brockway, secretary, 106 Summit Street, Toledo, Ohio.



A CORNER OF THE KREMLIN

CHURCH OF VASSALI BLAJENNY, NEAR THE KREMLIN

Proposed Electric Tramway System in Moscow, Russia

The City Council of Moscow is proposing to grant franchises for an extended system of electric tramways in that city. The City Council has appointed a committee, of which Chief Engineer A. A. Semenoff is chairman, to consider the reconstruction of the existing horse car lines and their equipment with electric power and upon plans prepared by Technical Engineer A. A. Lineff. It is thought that the matter will be settled Jan. 1, 1899, and that soon after that preliminary work can be undertaken.

The general conditions which the council will make for the construction of the electric tramways are briefly as follows: On all existing lines electricity is to be introduced as motive power, and the system, which now has a length of 100 km., will be increased to 135 km. A very substantial construction will be insisted upon, and the gage will be 1 m., instead of the present 1.52 m. Double tracks will be made obligatory, and the speed of the cars will be limited in the center of the city to from 10 to 12 versts (10.7 km. to 12.8 km.) an hour, beyond Sadovaia Street to 15 versts (16 km.) per hour, and beyond that 18 versts (19.3 km.) per hour. The cars in the center of the city will run on the headway of three minutes. In most parts of Moscow the trolley system will be adopted, but where this is not permitted the cars will run either by storage batteries or on the surface contact system. The cars must be lighted and heated by electricity.

The fares are limited to the present 5 copeks, for which passengers are entitled to transfers to the crosstown lines, and commutation tickets will be sold. The running of freight cars will be permitted at night, and in winter cars for the removal of snow and in summer for that of dirt and refuse will be operated.

The time limit placed upon the reconstruction of the lines is four years. During the first year 28 versts must be reconstructed, and during the remaining three years 35 versts each. The lines in the central part of the city will be the first to be equipped. The change must be made without interfering with the present system of transportation. The entire cost is placed at from 15,000,000 to 18,000,000 roubles.

Current will be taken from a central power station, which will also distribute electricity for lighting. The city selected for this station is on the bank of the Moscow River, on the so-called Salt and Vinnoy yards. The builders must deposit satisfactory bonds to guarantee the completion of the work.

The STREET RAILWAY JOURNAL is indebted for the foregoing particulars to the kindness of Mr. Lineff.

A New Feeder Map

BY FRANK H. DEXTER, M. E.

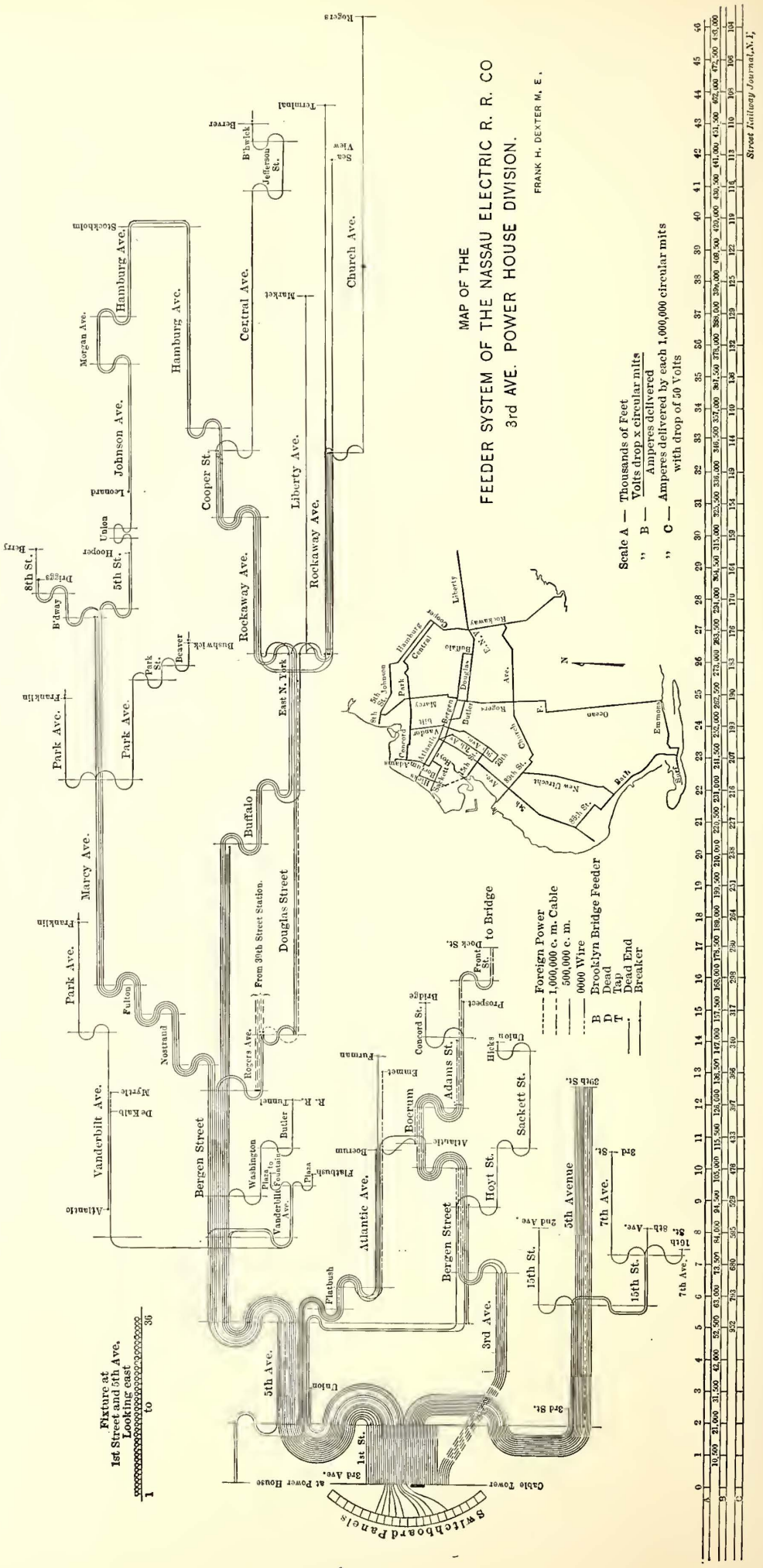
In some recent work in mapping the feeder system of the Nassau Electric Railroad in Brooklyn, the common method of laying down the wires on a map of the city was found so entirely unsatisfactory, owing to size and complexity of the system, that it was found necessary to adopt some new plan. To meet this requirement the writer devised a method which trial has proven to possess a number of advantageous features.

A map of the Third Avenue Power House Division of the Nassau system, made by this method, is shown on this page. The portion represented contains 1,000,000 lbs. of copper, which deliver, at full load, 7000 amps. to one hundred odd miles of trolley wire.

Each feeder in the system is represented on the map by a straight line parallel to a common base, and each portion of a pole line, contained by a single street, by a group of such lines. On the base line is laid off the scale of lengths adopted for the feeders. Turns are indicated by offsetting consecutive groups by a convenient distance, and to the right or left, according to the direction of the turn represented. Corresponding points of each wire are connected by suitable curves in such a way that each feeder becomes continuous from the station to its end. Since the offsets are made in a direction perpendicular to the scale, the length of the curved connection is immaterial.

In our system each wire has a distinguishing number taken from the pin it occupies on the First Street pole line where it leaves the station. With few exceptions it was found convenient to lay down the wires in the order in which they appear on the pole line; where this was not the case the pin numbers are shown on the map. Jumpers, breakers, feeding points, etc., may be shown with facility. Various sizes of cables are given distinguishing colors in the original map and by lines of different character, as dotted, dashed and solid in the engraving.

Considering the complexity of the Nassau system, it seems unlikely that the special features of any other would present any seri-



ous difficulty in carrying out the general plan described above.

By thus mapping as parallel all streets traversed by the feeders, and omitting all others, much is gained in the way of compactness, for it will be seen that, whereas the area of a common map is proportional to the square of the linear scale, that of the new form varies as the first power. Then too the convenience of being able to read at a glance the distance between points on the system is not to be regarded lightly. Information of this nature is constantly in demand for various purposes. The time saved, to say nothing of the accuracy gained, by reference to the linear scale compared with that required for reference to the tabulated data (which never contains the points concerned) or of stepping off with dividers (or a string) on the city map, is considerable.

Not less useful are the scales *B* and *C*. At every point on the line there exists a definite relation between the current flowing, the drop from the station to that point, and the size of the conductors. If *P* = the resistance of a mil foot of copper we have, as the total resistance of the conductor,

$$R = \frac{P \times \text{dist. in ft.}}{\text{cm. in conductor}} = \frac{\text{volts drop}}{\text{amps. flowing}}$$

$$P \times \text{distance} = \frac{\text{drop} \times \text{c.m.}}{\text{amps.}} = \text{drop} \times \text{cir. mils per amp.}$$

Values thus obtained are platted in scale *B*. If at any point two of the terms involved are known the third may be determined by substitution.

If it be desired to find the current delivered with a specified drop a special scale is more convenient than the general one, *B*. Scale *C* gives the number of amperes delivered with a drop of 50 volts by each 1,000,000 c.m. As before,

$$R = \frac{P \times \text{distance}}{\text{c.m.}}.$$

or

$$\text{Amps.} = \frac{\text{drop}}{R} = \frac{50 \times 1{,}000{,}000}{P \times \text{distance}}.$$

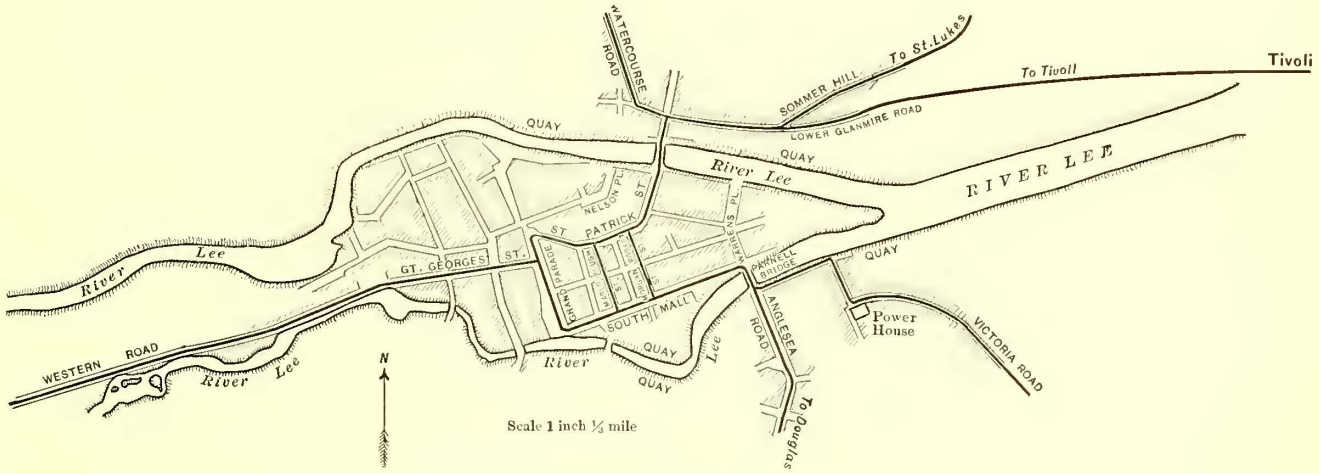
To find the current delivered by M c.m., the values of scale *C* are multiplied by

$$\frac{\text{M}}{1{,}000{,}000}.$$

Electric Tramway System of Cork, Ireland

The tramways in Cork have been recently equipped with electric power, and a general map of the system is given on this page. As will be seen, the street railway connects the center of the city, which is on an island formed by two branches of the River Lee, through the principal streets, with suburbs. The longest branch is to Douglas, a village about 2 miles south of Cork. The tramway crosses the river twice, once over Parnell Bridge, a steel swing bridge, second over Patrick's Bridge, built of stone.

The rails in the city are laid on a bed of concrete, and the roadway is paved between the rails and for a distance of 18 ins. on each side. Outside of the city boundaries the concrete is replaced by creosoted ties, 6 ft. x 4½ ins. x 9 ins. The rails are of girder type, weighing 83 lbs. per yard, with fish-plates 26 ins. long, weighing 56 lbs. per pair. The tie-bars are of wrought iron, 2 ins. x ⅜ in., weighing 10½ lbs., and double screwed at ends. The rails are fixed to the ties by thirty dog spikes and fourteen fang bolts and chips to each rail length. The switches and frogs are cast steel, made by Millar & Co., and Dick, Kerr & Co., Ltd.



MAP OF CORK TRAMWAYS

The rails form the return circuit, and are electrically connected at each joint by two No. 000 B. & S. Chicago bonds, 35 ins. long. At every switch or crossing there are two 13-ft. bonds spanning the steel casting, and there are also for each point of this kind four 35-in. bonds, connecting the rail with the casting. At each crossing there are four No. 000 B. & S. 35-in. bonds. The rails are cross bonded every 240 ft., and where there is double track, the two tracks are also cross bonded every 240 ft. These track cross bonds are placed half way between the rail cross bonds.

Where the double track is equipped with center poles the cross bonds between the two tracks are 7 ft. long, and where it is equipped with side poles they are 5 ft long. All the cross bonds on single track are 42 ins. in length. In all the loops on the single line there is a cross bond between the two tracks.

The return circuit is continued over the river at Parnell Bridge by four 0.5 in. cables, connected by bonds to the rails on either side of the water, this arrangement being necessary to avoid any interruption in the circuit when the bridge is swung open.

Center poles with double-bracket arms are used in principal streets, and side poles with single-bracket arms are employed on rest of line. Span wire construction has been installed in only a few places. The poles are 31 ft. long and

are composed of three sections. The joints are overlapping, and the sections are shrunk on while hot.

In the principal streets an arc lamp is fixed on every alternate pole. These lamps are of the inclosed arc type, connected up five in series; but consecutive lamps are not put on the same circuits; thus every other of ten consecutive lamps are on one circuit, while the remaining five are on another. The switches and resistances for the lamps are contained in the bases of the poles, so that, if necessary, a resistance can be placed in the circuit instead of a lamp. Each circuit can also be controlled from any lamp in its circuit.

The trolley wire is of hard-drawn copper and is double throughout. The portion of the trolley wire over the swing part of Parnell Bridge is supported on special poles and brackets fastened to the movable part of the bridge. The connections on the trolley wire are heavy spring clips, which allow the bridge to be moved in either direction.

The power house is situated in Albert Street, 220 ft. from the river. The building is of brick, with pile foundation.

The boiler room contains three Babcock & Wilcox boilears, each having 2531 sq. ft. heating surface and capable of evaporating 8000 lbs. of water per hour. The normal working pressure is 150 lbs. The stack is of steel, self-supporting, and 130 ft. high. It has a 7-ft. internal diameter, and it is lined with 4½-in. fire brick. The stack is erected on piled concrete foundations. The thickness of the steel plates at the base is 7-16 in. Each plate is 4 ft. x 6 ft. and there are three plates to the ring.

The feed water heater employed was supplied by the Wheeler Condenser & Engineering Company. The feed water is heated by the exhaust from the feed pumps, and the condenser pumps. The feed pumps are of the Blake & Knowles type, 6 ins. x 4 ins. x 8 ins. The steam cylinders of these pumps are fitted with an improved outside valve gear, so that they can be adjusted to the full length of the stroke under all conditions of speed. The steam connections of these pumps are so arranged that in case any repairs are required, either pump can be worked independently of the other.

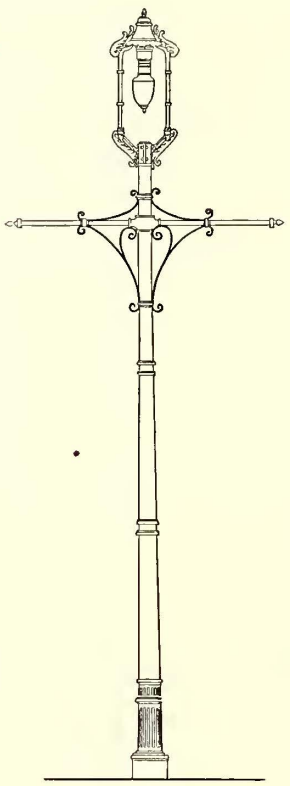
The hot well is situated in boiler house and is fitted with baffle plates, the divisions in which can be filled with coke and straw, if desired, for the purpose of intercepting any oil that may be discharged into it. It is also fitted with suitable outlets, so arranged that, by opening a valve and filling the tank, the oil, which will be found floating on the surface, can be run off. The feed water, before entering the boiler, can be passed through two Edmiston filters, capable of filtering 16,000 lbs. of water per hour. These filters are arranged on a twin system, fitted with the necessary valves to enable the filters to be used on either range of feed pipes.

The steam piping is of steel, with heavy screwed steel flanges, and is so arranged that any engine can be fed direct from the boiler immediately behind it, or, by means of the main, from any boiler. Valves are inserted to enable any faulty section in the piping to be cut out. This piping is also fitted with an automatic atmospheric valve, which, in the event of any back pressure, due to the failure of the condensing plant, will immediately allow the engines to exhaust direct into the atmosphere. The piping on the atmospheric side of this valve is of thin steel, riveted together in spirals.

The engine room contains three McIntosh & Seymour tandem compound condensing engines, running at 135 r.p.m., fitted with expansion governors and separate exhaust valves on both high and low pressure cylinders. The high-pressure cylinder is steam jacketed, and exhausts into a receiver, in the interior of which are fixed three copper coils, which can be heated with live steam. These engines are direct coupled to 6-pole 200-k.w. compound-wound generators, giving 500 volts at 135 r.p.m.

There are two condensers of the Wheeler Admiralty type with engines in the center, air-pump at one end and circulating water-pump at the other end. Each condenser is capable of dealing with 12,000 lbs. of steam per hour. The condensing water is taken direct from the river through from the water works, which can be employed to start the 12-in. cast iron pipes. There is also an auxiliary supply pump in the event of the suction pipe being emptied through the retaining valve not being perfectly watertight.

Adjoining the engine room is the accumulator room. This contains 236 Tudor cells mounted in three tiers. Each cell containing six positive and seven negative plates. The capacity of the battery is 770 amp. hours, the normal rate of discharge 110 amps. and the maximum rate 210 amps. The battery stands are of pitch pine with acid proof paint, and are mounted on large oil insulators. This battery can be charged either from traction or lighting bus bars, as desired, the necessary volts for charging being supplied by a booster, which can also be driven from the traction or lighting bus bars.



POLE

The switchboard is situated at the end of the engine-room, and contains three generator panels, fitted with automatic circuit breakers, with magnetic blow-outs; also the necessary switches, so arranged that the generators can be connected direct to either the lighting or traction bus bars; also two battery panels, fitted with the necessary regulating switches and magnetic blow-outs, and so arranged that the battery can be either charged from, or discharged to, either the lighting or traction circuits, as desired; also two balancer panels, so arranged that, if desired, the balancer can be driven, in the day time, direct from the traction bars, or used as an ordinary balancer, the two motors being in series across the outers, the junction being connected to the neutral. In this case the set is run up to give its correct voltage by means of the motor placed in the center, and the electrical connections are disconnected after the balancer sets are connected to the system.

The switchboard is also fitted with a panel containing the necessary instruments required by the Board of Trade for purposes of testing.

There are eighteen top seat cars, capable of seating forty-four passengers, manufactured by the Brush Electrical Engineering Company, Ltd., mounted on single Peckham trucks, manufactured by the Peckham Truck Company. The motor equipment consists of two G. E.-60 motors with series parallel controllers. The motors had to be specially designed for this work, on account of the very narrow gage, namely, 2 ft. 11½ ins. In other respects the car equipment follows standard practice.

The repair shop is 70 ft. x 18 ft., and contains the necessary machine and smiths' tools likely to be required for the maintenance of the cars and machinery.

The Cork Electric Tramways & Lighting Company,

Ltd., which operates the system, supplies current for lighting and miscellaneous power purposes, as well as for electric tramway service. The lighting distribution is on the three-wire system, with 460 volts between the outers. The mains are all of Messrs. Callender's manufacture, and, in the majority of cases, consisting of jute-covered, lead-sheathed, tape-armored cables, laid direct in the streets. Altogether, over 20 miles of cable, including both lighting and traction systems, have been laid, the distance between the feeding points, of which there are two at present, and the station being just under half a mile.

In their course from the power station to the feeding points, the cables cross the River Lee, and as there is only a swing bridge at this location, the cables had to be laid in a trench excavated in the bed of the river. Callender's vulcanized bitumen wire-armored cable was employed here, as being adapted as most suitable for the purpose. Four additional spare feeder cables, each of .7 in.-sectional area, have been laid across the river to cope with future extensions. The vulcanized bitumen cables are brought together in a pit on each side of the water, where they are connected to the ordinary jute-covered, tape-armored cable laid in the streets.

The greater proportion of the distributing cables in the center of the city are of the three-core type; the largest distributor used has a sectional area of .15 in. In all the outlying districts three single distributing cables are used, and, in addition to their armor, they are further protected by a covering layer of bricks. At the crossing and junction points of the system Callender's disconnecting boxes are fixed, and, of these, nineteen are at present installed.

The supply of current for light, etc., was started about the beginning of September, and since then about 130 customers have been connected to the mains. The service of the company now stands as follows:

Number of customers applied for	217
Lamps applied for	11,622
Motors applied for	18
Total horse power	113
Total applied for in 8 c.p. equivalents	14,447

The public arc lighting has not yet been permanently started. There will be altogether about 100 lamps.

The tariff for lighting current is 5d. per unit for the first two hours, and 1d. afterward, on the Brighton system of charging. The present tariff for motive power is 4¼d. per unit, and 1d. afterward, also on the Brighton system.

CONTRACTORS, ETC.

The British Thomson-Houston Company, Ltd., was the contractor to the Cork Electric Tramways & Lighting Company, Ltd., for the work as a whole—construction, building, machinery, etc.—in connection with the system, and supplied complete electrical equipments of the power station and cars.

The following were the chief sub-contractors to the British Thomson-Houston Company, Ltd.:

Permanent Way, Power House Buildings, Etc.—W. M. Murphy, Dublin.

Engines.—R. W. Blackwell & Co., London.

Boilers.—Babcock & Wilcox, Ltd., London.

Auxiliary Apparatus, Pumps, Condensers, Etc.—Wheeler Condenser & Engineering Company, and Blake & Knowles Steam Pump Works, Ltd., London.

Battery.—Tudor Accumulator Company, Ltd., London.

Traveler.—Jessop & Appleby, Leicester.

Cars.—The Brush Electrical Engineering Company, Ltd., Loughborough.

Peckham Trucks.—R. W. Blackwell & Co., London.

Overhead Line Construction.—R. W. Blackwell & Co., London.

Feeders and Cables.—Callender's Cable & Construction Company, Ltd., London.

Arc Lamps and Hoods.—General Electric Company, Ltd., London.

Alderman Fitzgerald, of Cork, was sub-contractor to W. M. Murphy for the buildings in connection with the power house.

Recent Improvements in San Francisco

The favor with which the many electric lines constructed by the Market Street Railway Company during the past five years have been received by the traveling public, and their ability to cope with the requirements of grades and heavy travel having been fully demonstrated, the company decided to reconstruct other lines to the electric system, which work has been completed during the year just passed.

The Park and Ocean Line, formerly operated by steam motors, from Stanyan and Haight Streets, along H Street (the southern boundary of Golden Gate Park), to the ocean beach, has been converted to the electric system. The double track, about 4 miles in length, has been rebuilt, using 62-lb. T rail, spiked to redwood ties 6 ins. x 8 ins. x 8 ft., space 2½-ft. centers, with fish-plate joints resting upon joint plates. The tracks are cross bonded every 300 ft. Center-pole construction has been used for the electric conductors the greater portion of the way, though for a short distance, at the town end of the line, iron side poles of the Market Street Railway standard pattern have been used. The center poles, which are spaced about 109 ft. apart, are set in concrete, extending about 12 ins. above the surface of the ground. Fig. 8 trolley wire has been used, of 330,000 c.m. cross sectional area. All span, anchor and strain wires are of silicon bronze, on account of the salt atmosphere met with.

The line, which has many grades of about 2½ per cent, one of which is over a mile in length, is operated mainly with single-truck cars of the combination open and closed pattern, which run direct to a central part of the city, though on Sundays a few cars of the double-truck pattern (also combination open and closed) are run between the ocean beach and Stanyan Street only, to accommodate the passengers transferring to and from the lines having their terminals at the latter point. Since the conversion of this line to the electric system the travel on it, which is almost entirely of a pleasure character, has greatly increased.

The Eighth Street line, formerly operated as a horse line, between Market and Bryant Streets, a distance of about 3100 ft, has been rebuilt to an electric road. The double track has been relaid with 45 to 51-lb. girder rail, on chairs spiked to redwood ties 8 ins. x 8 ins. x 8 ft., spaced 2½-ft. centers, with the rail joints cast welded. Ordinary side-pole construction has been used, the poles being of the 5-in., 6-in. and 7-in. tubular iron, Market Street Railway standard pattern. To avoid an extra number of poles upon the street, at various places the iron side poles were omitted, and the suspension wires secured to 40-ft. and 50-ft. wooden poles, already in place, for carrying the wires of other companies.

San Bruno and Precita Avenue and Army Street: The unused horse-car tracks on Army Street, between San Bruno Avenue and Folsom Street, have been rebuilt to the electric system, as also a single electric track constructed on Precita Avenue, between the same streets, with the intention of extending the Folsom Street line out to the former street and San Bruno Avenue, a distance of about 2½ miles, returning to Folsom Street via Army Street. The single tracks constructed on Army Street and Precita Avenue are each about 2500 ft. in length, and built of 51-lb. girder rail, spiked direct to ties spaced 2½-ft. centers, with rail joints cast welded. Ordinary wooden side-pole construction was used on this portion of the route.

The reconstruction of the San Bruno Avenue horse-car track is now under way, the T rails of the present track being relaid on new ties spaced 2½-ft. centers, with rail joints cast welded and rails cross bonded every 150 ft. with No. 0, B. & S. Chicago bonds. Wooden side bracket poles are to be used in the overhead construction. The reconstruction of the line has been treated as of a somewhat temporary character on account of the unfinished condition of the street and the prospect of many future changes in its grade, etc.

Taylor Street: The horse car, double tracks, on Taylor Street, between Market and Ellis Streets, a distance of about 1250 ft. have been reconstructed for electric service, using 70-lb. girder rail, laid on chairs spiked to 6-in. x 8-in. x 8-ft. ties, spaced 2½-ft. centers, with fish-plate joints. The overhead work is of the standard Market Street Railway pattern, with iron tubular side poles. This track, which was constructed for the immediate use of the Park & Ocean through line, may possibly be used in connection with other lines in the near future.

During the year the company has put in several hundred cast-welded joints on its Ocean Avenue, Kearny and Sacramento Street lines, with excellent results. While a few of the joints put in last year on the Solano, Folsom and Twenty-second Street lines had to be renewed on account of breakage, no such trouble has been experienced with those of this year's construction.

Sixteen cable cars, no longer required on account of the conversion of certain cable to electric lines, have been reconstructed to single-truck electric cars of the standard combination open and closed pattern, with very satisfactory results. These cars have been equipped with motors taken from larger cars, as noted below.

The electrical equipment of twenty-five double-truck cars has been improved by substituting two G. E.-1000 motors for the two W. P.-50 motors formerly used, and which were found to be hardly adequate to the requirements of grades, heavy loads and frequent stops. A portion of the W. P.-50 motors so removed have been used in equipping the smaller cars of the single-truck pattern, previously referred to.

The Kentucky Street car house has been enlarged during the year, and its capacity increased from forty to eighty cars, the company now having storage capacity at its three electric car houses for 300 cars.

The pipe line, running from the bay to the main electric power station at Bryant and Division Streets, for supplying salt water for condensing purposes, has been extended to the cable power station at Market and Valencia Streets, and the non-condensing power plant at that house remodeled to one of a condensing type by the addition of a new low-pressure cylinder, condensers, pumps, etc. The electric light system of the company has been extended until, from its own power station, all of its sixteen car houses and power plants are now lighted.

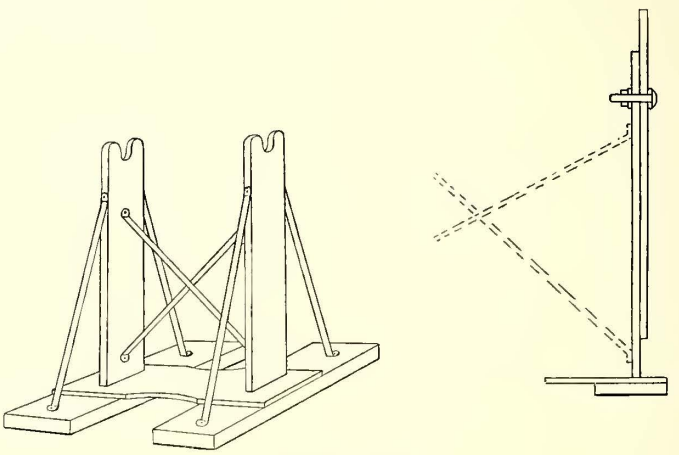
The introduction of electric motors to operate drill presses and grind-stones at the car houses has been attended with economical results. It has been found that a small motor, absorbing 10 cents' worth of current per day, will run a drill press faster and stronger than an able-bodied man can do it. Twice the work is now done with one man and a motor as was formerly done by two men.

Home Made Armature Rest.

The accompanying engravings illustrate a stand for holding armatures while repairs are being made, used at the Fifty-second Street shop of the Brooklyn Heights Railroad Company. The stand, with the exception of a few iron braces, is made entirely of wood, and so should be quite inexpensive to build. The idea seems to be a good one, as the device will apparently withstand extremely hard use for a long time before having to be consigned to the scrap pile.

The method of making the stand is as follows: Two upright pieces on which the armature shaft rests are made from a board, either ash or oak, and 1¼ ins. thick. Each side should be cut about 7 ins. wide and 36 ins. long. One end of each piece is securely fastened to a connecting base board, cut from the same plank but 12 ins. wide and 38 ins. or 40 ins. long. The edge of this latter piece is cut out crescent shape to give a more finished appearance to the completed stand. When this has been done it should be fastened to two pieces of plank, each 3 ins. x 9 ins. x 36 ins., which will support the frame from the floor.

The two upright pieces are braced with ½ in. round bar iron as explained by referring to the illustrations. It will be noticed that two braces hold these pieces from spreading out, and two fastened at the edge of each one near the



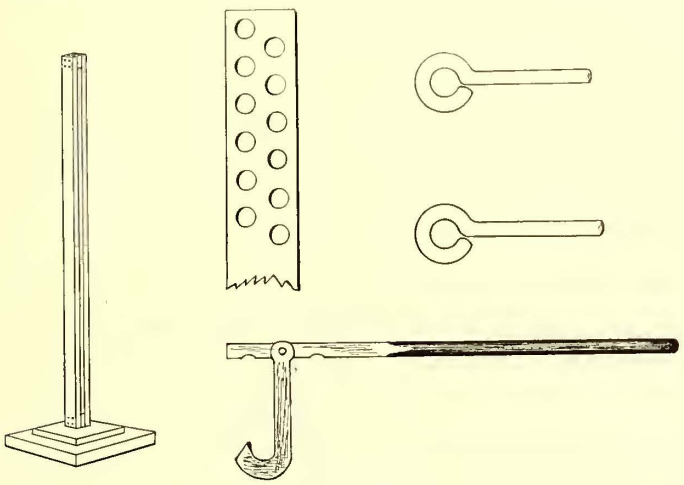
ARMATURE REST

top and at the ends of the pieces resting on the floor hold it from falling over. After these have been added the top edge of each upright piece must be hollowed out to fit the shaft, and the stand is complete ready for service. To increase the height or width two additional pieces may be fastened with two bolts to the uprights on each side as explained in the engraving on the right.

At the same shop two traveling cranes, operated by hand power, are employed to raise car bodies from their trucks, but these will be found in most all large shops having modern improvements for doing repair work. But the jack used for handling small car bodies appears to be very useful and a device which would be found very convenient in smaller shops. The following illustrations will explain how to make it. First cut two strips of hard wood 1½ ins. x 8 ins. x 8 ft. long, and have two rows of holes 1½ ins. in diameter bored in each piece. The distance between the holes is about 6 ins. The centers of the holes in one row should come opposite the center of the space between the holes of the other row, and the holes in each strip should correspond with those in the other. The two strips are then bolted together at each end, leaving a space between of about 3 ins., or sufficient to allow the lever, also illustrated, to pass easily in or out. When this has been completed the uprights should be fastened securely to a base, which can be made from a block of wood 4 ins. or 5 ins. thick and 18 ins. square, or made from two pieces nailed together, one about 4 ins. thick and 16 ins. or 18 ins. square, the other 2 ins. thick and 14 ins. square, as shown in the cut.

The lever is made from one piece of bar iron 2 ins. diameter and 6 ft. or 7 ft. long, one end being flattened for a distance of about 2 ft. to a thickness of 1¼ ins. This lever

rests on two iron pins passed through the holes made in the jack, and to keep it from slipping off these pins it is slotted sufficiently deep at these points to hold it in place. Two slots are made on the part of the lever which was made flat, as mentioned above; the first slot is about 1½ ins. or 2 ins. from the end and the other about 6¼ ins. from the first. At the center between these two slots is pivoted the hook for engaging with the car body; this is forged to the form shown. The two pins are made from round bar iron 1¼ ins. in diameter, one end of each being bent in a circular form to facilitate handling, as well as to keep it in place in the jack. It should here be mentioned that the strips of wood of jack having the holes in them can be considerably strengthened by placing bands of iron on the edges; this tends to keep the wood from splitting at these points.



CAR JACK

To raise or lower a car with this jack is simply a matter of changing the position of the pins. Thus to raise the car two jacks are placed at one end with the hooks engaging underneath the platform, one on each corner. The lever is then pressed down on each jack and the pin on each thus released is placed in the next hole above. The lever is again raised and that pin placed in the next hole above. Continuing this operation raises the car body from the truck on one end until a sufficient height is reached where the car body can be held in that position in some convenient way, perhaps by resting it across a timber placed on two barrels outside the track to allow the removal of the truck. The jacks are then taken to the opposite end of the car, which is raised and held in the same manner. Reversing these operations lowers the bar body. It only requires the services of two men to operate this jack.

Special Report to The Glasgow Corporation on Latest Developments in Electric Traction

The following is an abstract of a memorandum by General Manager John Young, on electric traction, in view of practical experience gained in Glasgow and elsewhere during the last two years, and with special reference to the present proposal to equip electrically the lines from Glasgow Cross to Govanhill and Coplawhill Car Works. It was prepared at the request of the convener of the tramways committee:

"Two years ago—in 1896—deputations from the tramways committee reported strongly in favor of electric traction, and to-day it is further ahead of its rivals than ever. At that time the system of distributing the current by means of a slotted conduit in the center of the track was only being experimented with. Mechanically it seemed successful, but considerable doubt existed as to the commercial success of a system so costly to construct. On the other hand, the overhead, or trolley system, had for several years been abundantly proved a commercial success, and to have completely revolutionized tramway traveling wherever it had been adopted. Your deputations, therefore, felt that the only choice left them was to recommend the corporation either to give a demonstration of the overhead system on one of the tramway routes, or simply to wait further developments. The former was the recommendation which was subsequently given effect to, and the overhead construction on the Springburn route, especially in West Nile Street, where rosettes are used, instead of side poles, shows the system practically at its best, and I do not think any slight improvement it may admit of would alter any one's opinion of the system generally.

"It is only within the last fortnight that the horse cars have been entirely displaced by electric cars on the Springburn route, and the power station plant has not yet been completed so as to be taken off the hands of the contractors. Our figures for operating can, therefore, scarcely be said to have settled down to normal. The results, both as regards efficiency and economy, are, however, very satisfactory. For the week ending Saturday last, Nov. 12, the total operating expenses for the electric route were, as near as may be, 6½d. (13 cents) per car mile, while the receipts amounted to 1s. 4½d. (34 cents) per car mile. I do not wish to attach too much importance to the increased traffic, although there can be no doubt electric traction does very appreciably increase the revenue. Apart from this consideration, important as it is, financial success is assured by the fact that, during the first full week of operating our small electric installation working only at half its power, we can show a saving on working expenses, as compared with horse traction, of 2d. (4 cents) per car mile.

"The position we find ourselves in at present is this: We have with difficulty kept pace hitherto with the unprecedented increase in our tramway traffic, and still we find ourselves pressed to give traveling facilities to meet this increasing demand upon us. It would be unfortunate at this time of day to propose to build more stables or horse cars. The only little present relief we can otherwise have, until a general scheme for electric traction has been adopted, is to electrically equip the route in continuation of High Street from Glasgow Cross to Govanhill, and across Coplaw Street to Coplawhill Car Works. An electrical connection between the car works and the power station at Springburn is absolutely necessary, at any rate. It is calculated that the engines and dynamos now in the power station can operate this extension, and, of course, better results will be shown when full advantage is taken of the power plant. Some extra boiler power will be required.

"The desirability of this extension is very apparent, but the question which, in view of the latest developments, has just arisen is: should this extension be on the overhead or underground system, or, rather, should we have a demonstration of the conduit system before finally discussing a complete scheme of electric traction for the city?

"Perhaps one of the most important communications upon electric traction which has yet been made public came into our hands a few days ago. It is the "Comparative costs and profits of cable, electric conduit, and horse tramway operation in New York city." This communication is published in this month's issue of the STREET RAILWAY JOURNAL, New York, and for the information of members I would ask you, with the sanction of the editor, to have it reprinted in the minutes. The figures contained in this article as supplied to the editor by H. H. Vreeland, president of the Metropolitan Street Railway Company, of New York city, seem to confirm the commercial success of the conduit system in that city of great traffic, and its great superiority to cable and horse traction.

"The report states that, for the year ending June 30, 1898, the operating expenses of the cable lines were 8.21d. per car mile; of the horse lines, 8.93d., and of the electric conduit lines, 5.11d.; while for the three months ending Sept. 30, 1898, which is more favorable to the electric conduit system, on account of its operation being more settled, the cable lines cost 8.77d.; the horse lines, 8.94d., and the electric lines, 5.03d. For comparison, I may interject here that last year it cost us in Glasgow 8.3d. to operate with horses. Upon examination of the detailed figures, it is evident that some little addition will soon fall to be made to the cost of operating the conduit on account of increased maintenance of permanent way and equipment when these have been longer subjected to tear and wear.

"Another very remarkable statement in the report is that 'during the twelve-months' period the cable lines operated at 47.7 per cent of their passenger receipts, the electric lines at 37.9 per cent, the horse lines at 65.3 per cent, and the entire system at 53.3 per cent. During the three-months' period the cable operated at 52.7 per cent of their passenger receipts, the electric lines at 38.6 per cent, the horse lines at 62.1 per cent, and the entire system at 50.9 per cent.' This very low percentage of 37.9 of the receipts has never before been reached, so far as I know. It, of course, points to very large traffic, as well as to economical working.

On our system last year the percentage of cost of operation to receipts was 74.49.

"I confess my surprise that the cable in New York, with its immense traffic, should have been so very far surpassed. With these figures before him, and also the significant fact that the cable system in Broadway, after a short history of five years, is now being superseded by the electric conduit, the writer of the article seems fully justified in saying—'There is no place for the cable in modern street railroading.'

"But it is the overhead and the conduit systems of electric traction that you are more immediately interested in.

"Your deputation, in their report of July, 1896, said: 'All other things being equal, a system which provides the power without any overhead construction is preferable.' No one will dispute this. I do not think it is possible, however, with the very much greater initial cost of the conduit, that the result can be economically equal to the overhead, but it may very properly be asked, in view of the latest experience: How near does it approach economic equality? This I have tried to estimate.

"The total length of the tramways owned by the Glasgow Corporation, including those recently constructed, although not yet opened for traffic, measures, in round figures, 37 miles of double track. This, of course, excludes the Govan Tramways, which are leased. Prior to 1894 the section of rail used weighed 79 lbs. per yard, and from 1894 to 1896, 89 lbs. per yard. Since 1896 a new section has been adopted, weighing 100 lbs. per yard. In both of the older sections (designed for horse traction) the groove is so shallow that, when new, the rail admits of a wear of only one-quarter of an inch until the flanges of our electric car wheels touch the bottom of the groove. The new 100-lb. section gives a wear of three-quarters of an inch before the same thing occurs. Our experience in relaying and operating the Springburn route has practically dispelled any hopes that may have been entertained of the economy of bonding and wearing out any considerable portion of the old shallow-grooved rails.

"Of the 37 miles of double line in question, 22 miles are laid with 79-lb. rails, and 6 miles with 89-lb. rails, making altogether 28 miles; and 9 miles with 100-lb. rails. From what I have said, we may take it that, in the event of conversion to electric traction, the former 28 miles will practically require new rails throughout, while the present rails on the latter 9 miles will be suitable for the new form of traction.

"On this basis, I have made up the following relative estimates of the cost of conversion. These estimates do not include anything for feeders, rolling stock, equipments, buildings, power and transforming stations, etc., which are common to both the overhead and conduit systems, and which, for our present purpose, may be estimated at equal cost:

I. OVERHEAD

Renewing 28 miles of double track, and electrically equipping same, including overhead construction, bonding, and ducts for feeders, at £11,000 per mile	£308,000
Converting 9 miles of double track now laid with 100-lb. rails, at £4,500 per mile	40,500
	£348,500

"These figures for the overhead system are based upon the costs of converting the Springburn route.

II. CONDUIT

Renewing 28 miles double track, and electrically equipping same at £20,000 per mile	£560,000
Converting 9 miles of double track, using the present rails, at £18,000 per mile	162,000
	£722,000

"These figures for the conduit bear the same relative proportion to the overhead as do the figures in the very able report recently presented to the Liverpool Corporation by F. S. Pearson, engineer to the Metropolitan Street Railway Company, who designed and constructed the conduit system in New York now reported upon. Mr. Pearson's figures for conversion in Liverpool are, however, somewhat higher than those given here, both for overhead and conduit.

"There is, of necessity, considerable uncertainty in any estimate for constructing a conduit in the streets of the city, arising from the unknown number and character of water, gas, and other pipes and sewers, which may require to be removed, and special work at bridges, etc. In fact, the real cost will be determined by the amount of this extra work.

"According to the present estimates it would cost £373,500 (in round figures, £10,000 per mile of double track) more to convert the 37 miles of double track under consideration to the conduit than to the overhead system, or rather more than double. The greatest sacrifice for the conduit is, it will be observed, in lifting to the foundation the lines more recently laid with 100-lb. rails.

"To construct the conduit on a road on which there are no tramways at present would probably cost about £6,000 per mile of double track more than the overhead. This would apply to extensions.

"Taking an average running of 9,000,000 car miles per annum, or 122,000 per mile of single track, the interest and sinking fund on the extra cost indicated for conversion is practically equal to ½d. per car mile. There will probably be slight excesses on other points, such as maintenance, leakage, cleaning, etc., but, from all the evidence available, I think we may assume that the excess on all points would not, in any event, exceed 1d. per car mile. It should be observed, however, that, on the mileage in question, 1d. per car mile amounts to £37,500 per annum.

"Where the traffic is not great, this excess would be serious, or even prohibitive, and it would tend to check extensions quite feasible with the trolley.

"The interference with the streets would undoubtedly be very great during the reconstruction for conduit, but this would just require to be borne at its possible minimum. Where the street would require to be taken up for the overhead system, it would only be a question of degree. There is also the question of climate. Glasgow has more damp and slush than New York, but I have assumed that the maximum excess of 1d. per car mile over the trolley would cover all such points.

"If we, for the moment, suppose the more expensive conduit system to be quite practicable from an engineering point of view, then its commercial success would depend upon the prospective traffic and receipts. We are naturally most anxious to give the community the cheapest possible means of comfortable tramway traveling, and there is no doubt that, for cheapness and efficiency combined, the overhead electric system holds the field. It is, however, a question worthy of fair and full consideration, whether, if the conduit should prove equally efficient and reliable, and be considered safer, as well as less obtrusive (even if the preference be, to a large extent, sentimental), and if it could be operated at no greater extra cost over the trolley than 1d. per car mile, it should not have a trial at this stage. In other words: is the gain, which is almost entirely æsthetic, worth the difference? Were this the only question involved, I believe the available traffic on the thoroughfares of Glasgow would justify this extra cost over the trolley if by it one were sure of securing for the city the best all-round system. But we have not this assurance.

"The extra cost can be better afforded now that the electric power can be produced at what a few years ago would have been looked upon as merely a nominal addition to the cost per car mile run. It is fully anticipated that the new 70,000-h.p. station in Ninety-sixth Street, New York, for the tramway service of the entire city, through high-tension primary lines and low-tension secondary circuits, will reduce the cost of power to somewhere between 60 cents (30d.) and 75 cents (37d.), or practically one-third of a penny per car mile run. I believe this is possible of realization. Experience in Brooklyn, Chicago and Montreal, as well as in New York, justifies the expectation. I am also convinced that, with the wages and prices in this country, if the Glasgow Tramways committee lay down their own power station on similar lines, they will be in a better position to attain this result than the Metropolitan Street Railway Company, in New York. I may mention here that, from tests made so far, our cars on the Springburn route, which is hilly, and requires considerable sanding, seem to use about 1¼-kw. hours, or board of trade units, per car mile run, or about 1½ units, including currents used for lighting and heating the cars.

"Coming now to the question of the proposed extension from Glasgow Cross to Govanhill and Coplawhill, there is nothing, if it be not insufficient depth on the bridges, to prevent a portion of this extension being altered to the conduit system, and the working of the same cars over both systems, if the committee wish it. The cars would be fitted with the trolley for the overhead portion, and the plow for the conduit portion. The one would be thrown off, and the other on, at the junction—which would be a stopping place—without much detention. The changing may not be altogether desirable, but it is quite workable. One system, however, for the entire city would certainly be preferable. Otherwise there would be difficulty in determining where one system should end and another begin.

"If the available depth makes it practicable, and a demonstration of the conduit system is wanted, what I should suggest is this: proceed at once to equip the Govanhill route, as proposed, on the overhead system throughout, and arrange, at any time you think fit, to demonstrate the conduit system on the Dennistoun route from St. Vincent Place to the terminus. The current for this demonstration could easily be supplied from the present power station, via High Street, and the working costs kept quite separate. The Kelvinside cars could simply turn at St. Vincent Place, as in former times, and this would completely isolate the Dennistoun route for this purpose.

"The article referred to is reprinted from the Street Railway Journal, and is appended hereto. John Young."

LEGAL NOTES AND COMMENTS*

EDITED BY J. ASPINWALL HODGE, JR., AND ROBERT ERNEST, OF THE NEW YORK BAR.

CHARTERS, ORDINANCES, FRANCHISES, ETC.

NEW YORK.—1. Construction of Connections—Necessity of Consent.

The construction of a connecting curve between two street railway tracks, being a necessary incident to the construction of the tracks themselves, is not within Const. art 3, sec. 18 (amendment of 1875), providing that the construction or operation of a street railroad shall not be authorized except upon the condition that the consents of one-half in value of the property bounded on, and the consent also of the local authorities having control of, that portion of a street or highway upon which it is proposed to construct or operate such railroad, be first obtained.

2. Same—Traffic Contracts.

Const. art. 3, sec. 18 (amendment of 1875), providing that the construction or operation of a street railroad shall not be authorized except upon the condition that the consents of one-half in value of the property bounded on, and the consent also of the local authorities having control of, that portion of a street or highway upon which it is proposed to construct or operate such railroad, be first obtained, does not extend to traffic contracts under railroad law, sec. 78, permitting railroad companies to contract with other companies to operate cars over the former's tracks.—(Kunz vs. Brooklyn Heights R. Co., 54 N. Y. Suppl., 187.)

MASSACHUSETTS.—Construction—Assessment of Damages.

Pub. St. c. 109, sec. 4, as amended by St. 1884, c. 306, allowing an assessment by selectmen for damages to abutting property caused by the construction of lines of "companies for the transmission of intelligence by electricity," and "electric light and electric power lines," does not authorize the selectmen to assess damages for the construction of an electric street railroad.—(McDermott vs. Warren B. & S. St. Ry. Co., 51 N. E. Rep., 972.)

VERMONT.—Municipal Corporations—Control of Streets—Construction of Statutes—Effect of Repeal—Proceedings Before Commissioners.

1. V. S. 1894, c. 170, provides (sec. 3936) that, before a street railway corporation shall begin the construction of such railway in a street in any city, such corporation must first obtain the permission of the aldermen of the city, and (sec. 3937) that, if such corporation fails to agree with the aldermen as to the location, manner of construction, or use of such railway, either party may apply to the railroad commissioners, who, after due notice to the parties, shall examine the premises, hear the parties, and decide the questions presented to them, and whose decision shall be final. By acts 1896, No. 148, sec. 53, subd. 44, it is provided that the city council of Burlington shall have power to impose and enforce the terms on which any street railway or traction company may use or occupy any street in such city, and to prohibit such use thereof until such terms have been complied with; and that, if the company and such city cannot agree on such terms, the company may petition the County Court, which shall thereupon hear the parties, fix such terms as shall be reasonable, and make all necessary orders for carrying its decision into effect. Held, that such later enactment by implication repeals the chapter referred to as to the city of Burlington, in so far as such chapter relates to the subject matter of the powers thus conferred on the city council.

2. An application to the railroad commissioners by a street railway corporation for permission to construct and operate such railway in a certain city was not "pending" at the time of the repeal of the statute under which such proceeding was brought, within the meaning of V. S. secs. 28, 29, saving from the effect of such repeal suits and proceedings in civil causes then pending, where such statute was repealed before notice of such application had been served.

3. The words "suit" and "civil cause," as used in V. S. secs. 28 and 29, relating to the effect of the repeal of a statute on actions then pending, do not include proceedings before a board of railroad commissioners, whose functions are merely administrative or ministerial, and whose decision is final.—(City of Burlington vs. Burlington Traction Co., 41 Atl. Rep., 514.)

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

LIABILITY FOR NEGLIGENCE.

INDIANA.—Street Railroads—Negligence Pleading.

1. A street railway company is not liable for failure to stop a car running at a proper speed, on approaching a frightened horse, where it does not appear that thereby the horse could have been controlled, or that the motorman had reason to apprehend the occurrence of an accident.

2. Averments that a street car was run carelessly and negligently, and run at a high rate of speed, making great noise, do not state facts showing negligence.—(Terre Haute Electric Ry. Co. vs. Yant, 51 N. E. Rep., 732.)

NEW YORK.—1. Carriers—Collisions—Questions for Jury.

In an action against a street railway company and the owner of a wagon for negligence, there was evidence that plaintiff sat on the east side of a south-bound car, near the rear. A short distance south of a street intersection, the car met the wagon, coming north on the east track in front of a north-bound car. To get out of the way of the car behind it, the wagon crossed to the west, and collided with the rear of the south-bound car, striking and injuring plaintiff. The gripman of the south-bound car ran it across the intersecting street at full speed, and the wagon driver first started to cross the west track when the car was about 75 ft. away. The wagon was a heavy one, and could not be stopped at once. Held, the issue of negligence was for the jury.

2. Same—Rule of Care Required.

The rule requiring a carrier of passengers to exercise all the care that human skill and foresight may suggest to secure their safety applies to street cars propelled by a cable.—(Keegan vs. Third Ave. R. Co. *et al.*, 54 N. Y. Suppl., 391.)

NEW YORK.—1. Damages—Fright.

Injuries from fright accompanying a physical injury furnish basis for recovery of damages.

2. Credibility of Witness—Interest.

The testimony of employees whose duty it was to inspect electric wires, one of which broke, that they were properly inspected, is that of interested persons; so that their credibility is for the jury.

3. Negligence—Electric Wires.

Plaintiff having been shocked by electricity coming from the ground after it escaped thereto from one of defendant's electric wires after it fell, the jury were justified in holding that the automatic device used by defendant was not properly adjusted, or was not in proper working order; there being evidence that, if it was, it would throw the current off the wire the moment it came in contact with the ground.

4. Opinion Evidence.

The inquiry being, not whether plaintiff's existing conditions might have been produced by the injury, but would her present condition be permanent, a witness, after detailing all the conditions he found present, may give his opinion, without giving a history of the case.—(O'Flaherty vs. Nassau Elec. R. Co., 54 N. Y. Suppl., 96.)

NEW YORK.—Excessive Damages—Personal Injuries.

Three thousand, five hundred dollars' damages for the fracture of the acromion process and of the humerus of a seven-year-old child, where the child suffered, and was likely to continue to suffer, from his injuries, are not excessive.—(Hutchinson vs. Atlantic Ave. R. Co., 53 N. Y. Suppl., 1076.)

NEW YORK.—1. Negligence of Passengers—Standing on Running Board.

A passenger who boards an open street car, where the seats are filled, but where there is standing room in the space between the seats, though uncomfortable and inconvenient, is not guilty of negligence per se in standing on the running board.

2. Same—Sudden Jerks—Negligence of Company.

The seats in an open car were filled, and passengers were standing in the space between the seats. Plaintiff boarded the car, and remained on the running board, where other passengers were standing. The conductor collected his fare without any remarks. It was customary for passengers to stand on such board when the cars were crowded. While going at from 6 to 8 miles an hour, the car gave a sudden violent jerk, occasioned by the sudden application of excessive motor power, which caused plaintiff to break his hold with one hand, swinging his body outward so as to strike a trolley pole. Held, to show negligence making the company liable.—(Hassen vs. Nassau Elec. R. Co., 53 N. Y. Suppl., 1069.)

NEW YORK.—Negligence—Personal Injuries—Damages—Excessive Recovery.

In an action for damages for personal injuries received through negligence on the part of defendant, a verdict for $10,000 was excessive, where plaintiff was not entitled to recover for loss of earnings or for medical attendance, but only damages for the pain and suffering she had endured, and for that which it was reasonably certain she would endure in the future, and where such in-

juries were not permanent, and there was no satisfactory evidence as to how long plaintiff would continue to suffer therefrom.—(Becker vs. Albany Ry. Co., 54 N. Y. Suppl., 395.)

NEW YORK.—Injury to Passenger's Clothes.

A passenger tore her dress in the door latch of a street car, and sued the company. She and her sister testified the catch was a sort of hook, and sharp as a knife, and was worn smooth and bright at the edge. The company's employees testified that it was a new car; that the catch was the same as used on their other cars; and that there was nothing wrong with it, but it was in good order, and they knew of no better appliance for its purpose; also, that each car of the company carried 500 to 600 passengers per day, and no such accident had ever happened before. Held, that she could not recover.—(Atwood vs. Metropolitan St. Ry. Co., 54 N. Y. Suppl., 138.)

NEW YORK.—1. Courts—Constitutional Law—Municipal Court of New York.

Const. art. 6, sec. 18, provides that the Legislature shall not confer on an inferior local court of its creation any greater jurisdiction than is conferred on county courts by the article; section 14 provides that county courts shall have the power possessed at the adoption of the constitution, and original jurisdiction for recovery of money, etc., where defendant resides in the county; Code Civ. Proc., sec. 341, provides that a domestic corporation actually located within a county is deemed a resident of the county; Greater New York Charter, secs. 1358, 1364, divide the boroughs composing the city into districts, and specify the district in which municipal courts shall be held; section 1370, subd. 2, provides that, if defendant be a corporation, action must be brought in a district in which plaintiff resides, or in which defendant transacts business, or has an office or agency; and subdivision 4 provides that, if action is not brought in the proper district, it may be tried where brought, unless transferred on motion of defendant. Held, the jurisdiction of a municipal court over a defendant corporation being expressly limited to a corporation resident in a borough, which, under the charter (section 2), consists of the whole or part of the county, that the provisions of the charter are not in excess of legislative authority, as extending the dominion of the municipal court over more than one county.—(Irwin vs. Metropolitan St. Ry. Co., 54 N. Y. Suppl., 195.)

NEW YORK.—Defects in Tracks—Injury to Traveler.

An injury to plaintiff was caused by a loose street railway rail. The track had been inspected that morning, and ten minutes before the accident a car had passed safely over the rail, and the imperfection was not observable; and, shortly after it, it was discovered and repaired. Traffic on the street was heavy at that hour. There was no showing that the road was improperly laid, or built of poor material, nor that the defect was caused by the company's acts, nor that its method of track inspection was not proper, nor of any previous defect causing the company to apprehend danger from loose rails or spikes. Held, that the company was not shown to be negligent.—(Kelly vs. Metropolitan St. Ry. Co., 54 N. Y. Suppl., 173.)

INDIANA.—Special Verdict—Evidence.

The jury may not return the primary facts on evenly balanced evidence, where the burden of establishing the ultimate fact rests on the party in whose favor the primary facts are returned.—(Citizens' St. R. Co. vs. Reed, 51 N. E. Rep., 477.)

ILLINOIS.—Collision—Damages—Trial—Directing Verdict—Questions for Jury—Appeal and Error—Waiver of Error.

1. Where, at the close of plaintiff's evidence, defendant moves to take the case from the jury and direct a verdict for defendant, and the motion is renewed at the close of all the evidence, a written instruction directing the verdict must be presented with the motion.

2. A failure of defendant to present an instruction directing a verdict with his motion to direct is not supplied by his presenting such instruction with his series of general instructions.

3. Where defendant did not present a written instruction directing a verdict with his motion to direct, the error in refusing to direct was waived by his presenting such instruction with his series of general instructions.

4. It was not error to instruct that if plaintiff's intestate was injured by collision with a street car while exercising due care, and defendant omitted to do certain things, plaintiff could recover, as plaintiff was entitled to have the jury instructed on his theory of the case.

5. In determining the damages resulting from personal injuries to plaintiff's intestate, the jury should consider the nature of the injuries, his physical and mental suffering, and his loss of time.

6. Plaintiff's intestate, two years after receiving personal injuries, died of abscesses which formed on the liver, the cause of which was unknown. In an action for the injuries, held, that the question of the cause of his death was properly withheld from the jury.—(West Chicago St. R. Co. vs. Foster, 51 N. E. Rep., 690.)

MINNESOTA.—Injury to Pedestrian—Contributory Negligence.

Held, that the evidence conclusively shows that plaintiff, in attempting to cross two parallel street railway tracks (at a point not a street crossing), immediately behind a moving car on the track next to him, was guilty of negligence in not exercising reasonable care to ascertain whether a car was approaching from the opposite direction on the other track.—(Greengard vs. St. Paul City Ry. Co., 75 N.W. Rep., 221.)

MINNESOTA.—Contributory Negligence—Personal Injuries—Actions—Evidence—Questions of Fact—Excessive Damages.

1. A boy eight years and four months old got upon the rear platform of a street car, intending to ride thereon to his home, several blocks distant. While sitting upon this platform with his feet upon the car step, where there was no gate, the car started, and while it was running fast the boy became dizzy, fell off, and was injured. The motorman (who was also conductor) knew that the boy was on the car. Held, that merely getting upon the car and sitting down on the platform with his feet on the step was not prima facie evidence that the boy was a trespasser, and whether he was a passenger or trespasser it was not error for the trial court to submit to the jury the question whether it was negligence on the part of the acting conductor to permit him to ride, sitting in that position, while the car was running fast.

2. It was within the province of the acting conductor to compel this boy to go inside the car, or stop it, and put him off; and, if he did not do so, the jury had a right to say that the conductor was guilty of negligence, which was imputable to the company.

3. Held, also, that the rear platform of a street car running fast was a place of danger for this boy, riding thereon, and just what degree of intelligence and prudence could be expected of him was properly left to the jury to determine, as well as whether, upon all of the facts, he was thereby guilty of contributory negligence.

4. Held, further, that the damages awarded were not excessive.—(Jackson vs. St. Paul City Ry. Co., 76 N.W. Rep., 956.)

MINNESOTA.—Master's Liability to Employee.

The plaintiff was engaged in replacing defective wooden poles with iron poles, and placed a ladder, which he climbed, against one of the wooden poles, when the pole, by reason of its rotten condition, broke off at the ground, and he was injured. Held, that the rule that a servant cannot recover damages for an injury caused by the defect which he was employed to repair applied, and plaintiff could not recover.—(Broderick vs. St. Paul City Ry. Co., 77 N.W. Rep., 28.)

MASSACHUSETTS.—Crossings — Collision — Sufficiency of Evidence.

Evidence that defendant's car was going slowly; that plaintiff was nearly across defendant's track at the time of the collision; that plaintiff's view of the track in the direction of the approaching car was obstructed until he was within 15 ft. of the track; that plaintiff looked, but saw nothing, and heard no gong; that he had been going "a little faster than a walk," but "slowed up" before reaching the track, and that upon reaching the track he hurried his horse, is sufficient to warrant submitting to the jury the question of plaintiff's due care.—(Lahti vs. Fitchburg & L. St. Ry. Co., 51 N. E. Rep., 524.)

NEW YORK.—Injury to Child—Contributory Negligence.

A child between eight and nine years of age, who attempts to cross a city street in the middle of a block, either without looking for an approaching street car, or in blind and heedless disregard of its rapid approach, is guilty of contributory negligence.—(Weiss vs. Metropolitan St. Ry. Co., 53 N. Y. Suppl., 449.)

NEW YORK.—Injury to Passenger—Negligence—Question for Jury.

In an action to recover damages for personal injuries suffered by plaintiff in consequence of the defendant's alleged negligence, it appeared that while the plaintiff was riding as a passenger in an open trolley car of the defendant, in the evening a flashing or flaming shot out of the motor box or controller, from 2 to 6 ft. high, enveloping the motorman, and continuing while the car proceeded for some 100 ft. The plaintiff was so much alarmed that she leaped from the car, and received the injuries complained of. There was evidence on behalf of the defendant that the apparatus was a standard appliance, but the flaming on this occasion was of a very unusual character; and it appeared that dirt in the controller was likely to cause such results, that the car in question had not been inspected that day, and that after the accident the controller was found to be dirty. Held, that the facts required the submission to the jury of the question of defendant's negligence.—

2. Same—Contributory Negligence.

Held, further, that the fact that other passengers remained in the car could not operate to conclusively establish contributory negligence on plaintiff's part in jumping.—(Poulsen vs. Nassau Electric R. Co., 51 N. Y. Suppl., 933.)

The Paris Exposition of 1900

BY FRANCIS E DRAKE,
Director of Machinery and Electricity, United States Commission.

Though occupying only about one-half the area of the World's Columbian Exposition at Chicago, the Paris Exposition of 1900 will have great opportunity for the satisfactory presentation of the arts of peace. The location of the grounds is practically in the heart of Paris on both sides of the river Seine, and affords an unrivaled opportunity for providing comfortably for great crowds.

The great main gate of the exposition will be at the historic Place de la Concorde, and will be capable of admitting 65,000 people an hour. Scores of other entrances will be provided, so that each section of the city may be amply accommodated.

On the south side of the river Seine the majority of the principal palaces and attractions will be installed. The Esplanade des Invalides, a rectangular tract lying immediately north of the Hotel des Invalides, will contain palaces devoted to the exhibition of general manufactures. This tract will be connected with the grounds on the north side of the river and the Champs Elysees by the magnificent new bridge of Alexander III., now under construction. From the Esplanades des Invalides to the Champs de Mars, along the left bank of the river, will be a row of official pavilions of the great nations, among which will be the building of the United States. Between the bridge of the Invalides and the Champs de Mars will be grouped the buildings devoted to the exhibits of the army and navy, and between the Champs de Mars and the river will be a building devoted to marine navigation and another containing the exhibits pertaining to forestry and fisheries.

On the famed Champ de Mars will be found the several great palaces of the Exposition, in which will be housed practically three-fourths of the exhibits. They will be built around three sides of the rectangle and will be named as follows: Palace of Agriculture, Palace of Electricity, Palace of Machinery, Palace of Transportation and Civil Engineering, Palace of Textiles and Textile Fabrics, Palace of Mines and Metallurgy, Palace of Chemical Industries and Palace of Education and Liberal Arts.

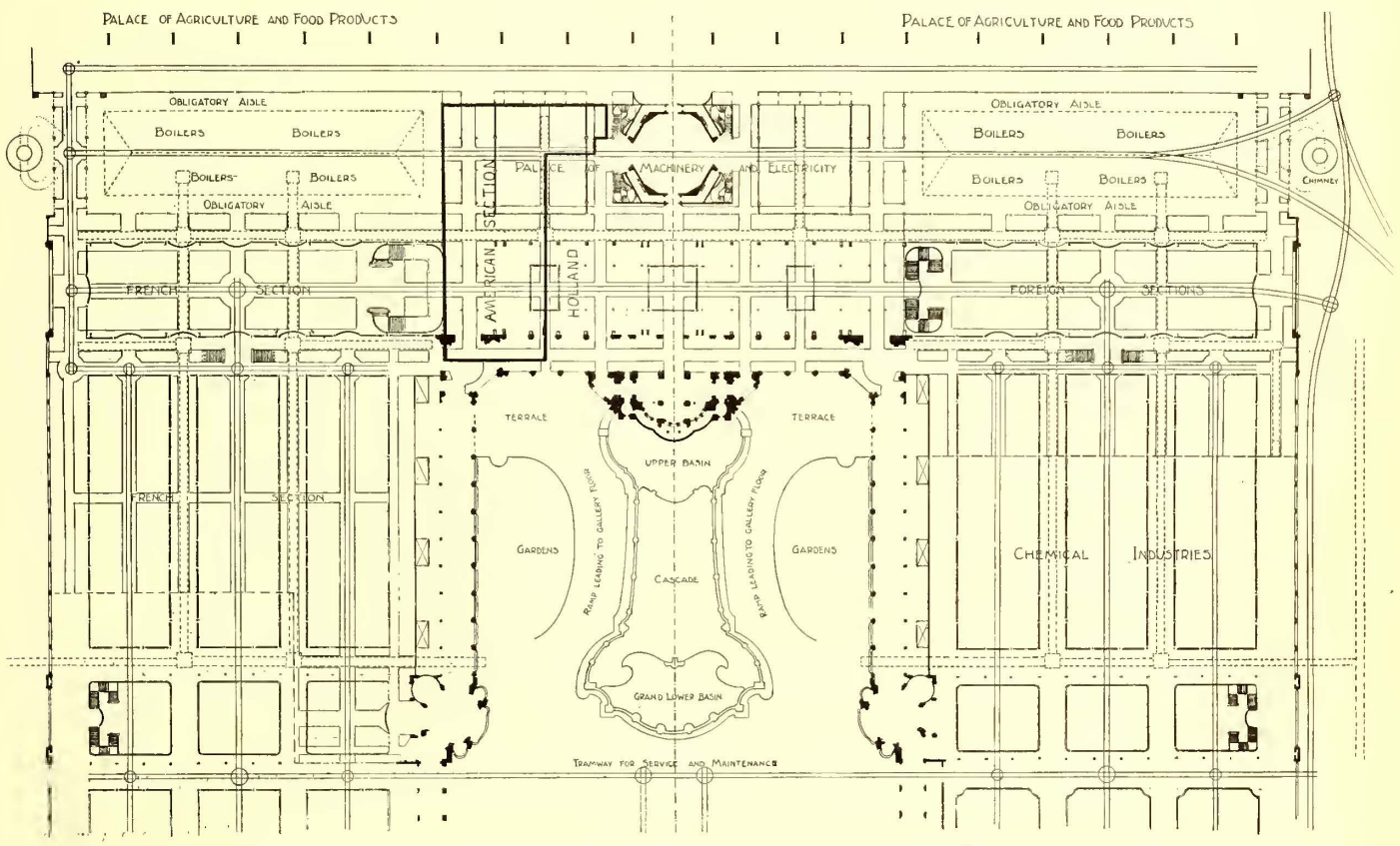
The great Eiffel tower, which was such a conspicuous attraction at the Paris Exposition of 1889, will remain at the north end of the Champs de Mars, and no doubt will excite the same general interest among the visitors to this great fair.

On the north or right side of the river will be found, beginning at the Place de la Concorde, in the order named, the two permanent art palaces, a section of Old Paris, Palace of Horticulture and Arboriculture, the Hall of Social Economy and International Congresses, and the Palace of the Trocadero and Trocadero gardens, where the exhibits of the colonies will be located.

At the park of Vincennes, 8 miles distant, will be located an annex to the exposition proper, where the railway exhibits will be placed, also the automobile, bicycle and similar displays. At this annex provision will be made for international athletic sports, and, owing to the attractive character of the park, thousands of people are expected to visit this annex daily. Ample means of transportation from the exposition grounds will be provided both by rail and boat.

MACHINERY AND ELECTRICITY

The part which machinery and electricity will play in the coming exposition is a more important one than ever assumed by these two great industries in former expositions. In a general way it may be said that but few important changes or improvements will be shown in the service of the Paris Exposition over the Columbian Exposition of 1893. The French classification, however, is a distinct advance over that of any previous exposition, inasmuch as it provides for the installation of the finished product together with the machinery and processes used in connection therewith. Under this classification collective exhibits will be most successful in presenting to the visitors a clear understanding of the state of the art in that particular industry.



PLAN OF ELECTRICAL BUILDING—PARIS EXPOSITION

GENERAL SERVICE PLANT

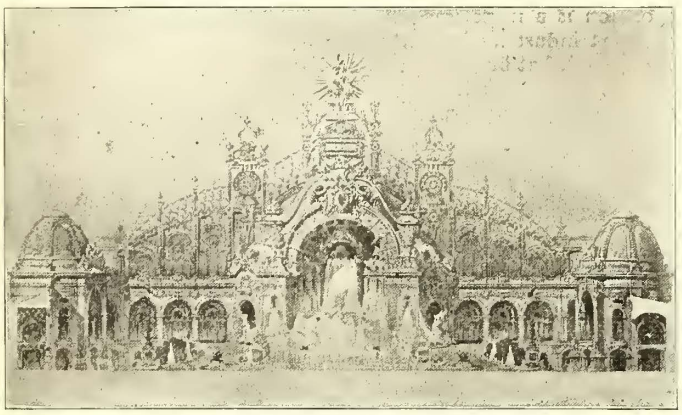
The great service power plant of the exposition will occupy a favorable position in the main group of buildings. It will be installed immediately adjoining the space allotted for the exhibits of electrical and other machinery, and any benefit which might naturally accrue to the builder of machinery installed in the service plant will be accentuated by reason of its being located in close proximity to the exhibits not offered for regular service. The capacity of the boiler plants for the service of the exposition will be approximately 20,000 h.p. The two plants will feed into one general system of mains and distributors, and either, or both, may be utilized at the same time, as occasion requires.

The engines and generators for this power plant will be placed in close proximity to the underground subways carrying the steam and other mains. Each power unit must be of the direct-connected type, the generator armature being mounted directly upon the extended shaft of the engine. The designation of these units, according to the exposition nomenclature, will be "electrogene groups." It is proposed by the administration to divide the total power comprised in the several electrogene groups required

equally among the French and foreign builders. From present indications, manufacturers will offer electrogene groups largely in excess of the requirements of the exposition. No actual contracts have as yet been made for them for either the French or foreign sections, except a nominal arrangement entered into some time ago with three German manufacturers, who desire to furnish equipment approximating 5000 h.p.

TRANSPORTATION DIVISION

The exhibit of automobiles or horseless carriages, trolley cars, railway trains, etc., will be made in the special pavilions provided at the annex in the park at Vincennes. A special track will be provided there for trials and tests, and for the daily speeding of auto-



FACADE OF ELECTRICAL BUILDING

mobiles, bicycles, tricycles, etc. The electric vehicle is at present very popular in Paris, and will no doubt come in for its full share of interest.

HISTORICAL EXHIBITS

In addition to the contemporary exposition, the official classification provides for the installation of a retrospective exhibit, which shall present an historical view of the progress in all branches of industry during this century. The department of electricity has been specially favored in this regard by the construction of a special salon d'honneur within the Palace of Electricity, where the retrospective exhibit covering the great field of electricity may be properly undertaken, and where the personal exhibits of the great inventors of the century and the collective exhibits of associations or individuals may, in their several ways, illustrate the evolution and advance of science.

ORGANIZATION AND CLASSIFICATION

For the information of those interested in the organization of the technical service under the director-general of exploitation it is desirable to state that the mechanical installations will be under the immediate direction of Monsieur Ch. Bourdon, professor of the Central School of Arts and Manufactures. The work of this department falls under two distinct categories. The first relates to the execution of the necessary installations for motive power, and may be subdivided as follows:

be subdivided as follows:

(a) Production of steam.
First—Installation of boilers.
Second—Construction of flues and chimneys.
(b) Distribution of water and steam.
First—Construction of Subways.
Second—Installation of steam mains, etc.
(c) Production of power.
Installation of electrogene groups.

The distribution of motive power is practically assigned to the service of electric installations.

The work under the second category is of an administrative order, and especially concerns the general conditions of exploitation of the boilers and electrogene groups and such other apparatus as is required for furnishing the steam for power service.

The total mechanical power furnished will be in the neighborhood of 20,000 h.p., of which 15,000 h.p. will be for electric lighting and 5000 h.p. for motor service. These figures, while not absolutely correct, are those used by the administration as the basis of the installation.

In the two power plants the boilers will be placed in two lines of batteries, with the boilers back to back. Ample space for general circulation of the public has been provided.

The location of the electrogene groups operating as generating units for the power plant will be within the regular exhibit space devoted to the department of machinery and electricity. Electricity will furnish the motive power for the operation of an intramural elevated railway, which will encircle the Champs de Mars, pass in front of the main palace on the Esplanade des Invalides, and along the Quay d'Orsay from the bridge of Alexander III. to the Eiffel tower.

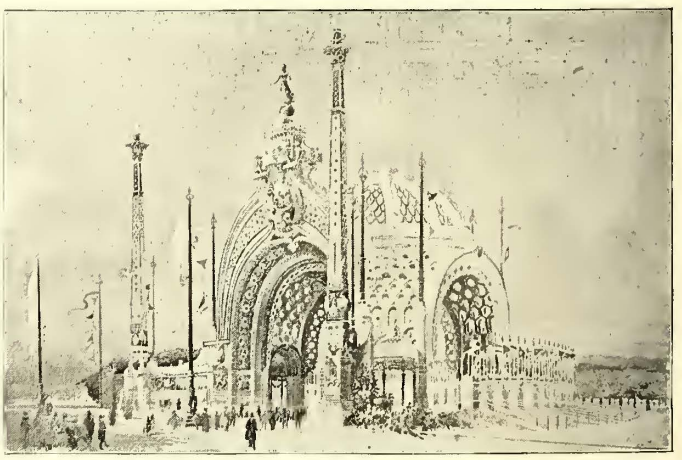
There will be no regular compressed-air service established by the exposition administration, but arrangements will be made with the City Public Service Company whereby compressed air mains will be brought into the exposition buildings and air service offered to the exhibitors at the regular city rates, less 10 per cent.

SERVICE POWER PLANT

The controlling minds of this great undertaking have not lost sight of the artistic side of questions surrounding the service power plant, and in the construction of the chimneys for the two boiler plants ample provision has been made for the æsthetic treatment of the exterior of the towering stacks which will conduct the gases from the furnaces.

Two monumental chimneys have been designed, each to be handsomely ornamented. The height of each will be 230 ft. above the level of the Champs de Mars, the inside diameter at the base 28 ft., and at the summit 23 ft. These chimneys are to be illuminated at night, and will thus trace a striking outline upon the dark background of the sky.

In appropriating funds for the power plant the administration has, upon the advice of the technical committee, provided a minimum sum, which may be said to be only about one-third of the allowance made for the use of power units at the Columbian Exposition of 1893. The great commercial rivalry between the principal nations of Europe has been a factor in determining the course of the administration. Many large concerns would have granted the use of engines and dynamos during the period of the exposition without charge, providing advantageous arrangement of space, etc., could have been assured them. It was after mature de-



PRINCIPAL GATE TO PARIS EXPOSITION

liberation, however, that the authorities settled upon a very normal compensation, which should apply alike to French and foreign manufacturers.

The details and conditions surrounding the tenders of electrogene groups are recited in the official specifications appended:

GENERAL CONDITIONS OF INSTALLATION AND EXPLOITATION OF ENGINE DYNAMO GROUPS

Art. I. General Requirements.—The electrical energy required for the Paris Exposition of 1900 will be produced by engine-dynamo groups, the steam engine of which will operate condensing; the generator armature to be mounted direct on the engine shaft, thus excluding all cables and belts.

The administration will contract either with one builder only for the combined group, or simply with the builder of the steam engine and with the builder of the generator.

Art. II. Technical Requirements.—The steam in the main pipes will have a mean effective pressure of 142 lbs. per square inch; this pressure may vary 10 per cent either above or below normal.

The electric current generated will be delivered to a switchboard furnished by the contractor. The following voltages will be permitted:

Continuous current.....125, 250 or 500 volts.
Alternating current.....2,200 volts with a frequency of 50.
Three-phase current.....2,200 volts with a frequency of 50.

Art. III. Special Requirements.—As the apparatus installed under these articles will also be considered as exhibits, the conditions of the general regulations of the exposition will apply to these groups.

The apparatus will be submitted to the examination of the international jury and admitted to compete for awards. In consequence of this particular stipulation the furnishing of these apparatus will be made under the same conditions as govern other exhibited apparatus, that is, nothing will be granted to the exhibitor as allowance for expenses except for the installation and exploitation of the apparatus, which remuneration is specified in Art. IX., below.

Art. IV. Conditions of Installation.—The installation of the apparatus will be made according to plans established by the builder and accepted by the director general of exploitation on a favorable report of the technical committee and annexed to each copy of the contract. The builders will conform to the regulations enjoined by the administration concerning public safety.

Foundations.—The administration will furnish the necessary floor space to the exhibitors, who will provide all foundations and accessory works at their own expense.

The materials employed for the construction of the foundations will remain, after the exposition is over, the property of the builders, who may remove or abandon them as they may elect.

Piping.—The steam engine builder will establish at his expense special piping to his engine from the main steam pipe provided by the administration. A throttle valve will be supplied by the engine builder at the junction of his piping with the exposition mains. The engine builder will also furnish and erect the feed-water pipes and evacuation pipes for the hot water of condensation, as well as all necessary valves, traps, etc., to be placed at the junction with the main piping. The pipes conveying live steam and cold water as well as for the outlet of the hot water from condensation will be placed in underground conduits connecting the engines to the underground galleries in which are installed the main distributing pipes. These main galleries and pipes will be established by the administration, and the private piping will be installed by the exhibitors at their expense. Special regulations will fix the details to be observed concerning valves and joints.

Switchboards.—Each generator will be provided with a switchboard having the necessary means of interruption and protection such as are usually employed, also current-measuring apparatus to be approved by the administration. The administration also reserves the right to require the use of current-registering apparatus.

For the alternating-current generators the contractors will be obliged to furnish and install the necessary transformers for the distributing stations, so that the current of these alternators may be rendered available.

ART. V. DURATION OF SERVICE.—The duration of service is that of the exposition itself, that is, from April 15 to Nov. 15, 1900, 205 days. The administration reserves the right to vary this period not exceeding thirty days, in which case no modification concerning the remuneration allowed will be made.

ART. VI. DAILY SERVICE.—The duration of each day's service and the duration of working hours will be determined by the director-general of the exposition according to service requirements. The builders agree to furnish at any time the maximum amount of power they have undertaken to supply.

The director-general of the exposition will establish between the several builders an equalization of work so as to permit proper working and resting periods for facilitating the visiting, cleaning and repairing of apparatus without causing any inconvenience to, or disruption of, the regular service.

ART. VII. MEASUREMENT OF ENERGY.—The administration, with the assistance of the contractor's employees and at his expense, will make such experiments and tests as are necessary to ascertain if the engines and generators are capable of furnishing the power stipulated in the private contracts. An official report will be made concerning these tests. At any time during the exposition period these tests may be renewed to verify the previous reports.

ART. VIII. FINANCIAL CONDITIONS.—The live steam required by the engines and water for condensing will be furnished by the administration free of charge. The builders will receive: (1) A fixed sum to remunerate them for a portion of the prime installation expense; (2) a sum proportionate to the number of hours of work at the normal rating of the group as accepted by the administration. These sums will be fixed according to the power of the units as determined in the private contracts and in accordance with the following tables (the amount to be contributed by the administration toward the first cost of installation is presented in Tables No. 1 and No. 2):

TABLE NO. 1.

Total allowance:	Engine.	Dynamo.	Together.
Total maximum contribution	$46,330	$19,300	$65,630
Amount allotted to the French section (Plant La Bourdonnais)	23,165	9,650	32,815
Amount Allotted to foreign section (Plant Suffern)	23,165	9,650	32,815

TABLE NO. 2.

Allowance per indicated horse power:	Amount allowed per horse power. Engine.	Dynamo.	Together.
For the first 1000 h.p.	$1.92	$ .78	$2.70
For 1000 to 1500 h.p.	1.37	.24	1.61
For all above 1500 h.p.	1.00	.18	1.18

In the event of the maximum horse power accepted by the administration from foreign builders being such as to make the total remuneration based on Table No. 2 greater than the total sum for this service as established in Table No. 1, a proportionate reduction will be made on the horse power allowance for each builder which shall be commensurate with the increase in total horse power over the limit established by the appropriation.

The capacity of the groups admitted for service will be so proportioned that this reduction will not exceed 50 per cent.

TABLE NO. 3.

((Sums representing the administration's contribution toward the expense of exploiting and operating the electric groups).

Allowance per i.h.p. per hour.	Per Horse Power. Engine.	Dynamo.	Together.
For the first 1000 h.p.	Cents 0.162	0.138	0.300
From 1000 to 1500 h.p.	Cents 0.067	0.057	0.124
Above 1500 h.p.	Cents 0.056	0.046	0.102

The administration guarantees to the builders a minimum duration of work fixed at 500 hours.

ART. IX. TERMS OF PAYMENT.—The remuneration above stipulated will be paid to contractors as follows: On July 10, 1900, payment of the number of working hours furnished from the beginning of the exposition up to and including June 15; on Sept. 10 for the number of working hours furnished from June 15 to Aug. 15; one month after the close of the exposition the balance covering the number of working hours furnished after Aug. 15. That portion of the remuneration allowed toward first cost of installation will be paid in thirds on the same dates.

ART. X. DATE OF DELIVERY.—The contractors agree to begin the foundations for the engines and dynamos not later than October 15, 1899. If at that time they have not taken possession of the space granted to them and are unable to show satisfactory progress in the construction of the apparatus and in arrangements for prompt delivery, thus assuring the administration of the fulfilment of their obligations, the right to cancel without indemnity the contract between the administration and the contractor is reserved to the exposition officials.

The contractors must complete the installation of their groups on or before March 15, 1900; on this date will begin the trials mentioned in Art. VII.

ART. XI. PENALTIES EXACTED FOR DELAYS.—In event of delay beyond the time fixed in Art. X. for the installation of the units, the administration will exact the following penalties and will deduct them from any sums which may ultimately be due to contractors from the exposition. (1) A penalty equal to the allowance corresponding, for the apparatus referred to, to the normal service of the group during a working day of seven hours; (2) a penalty on the allowance made for installation expenses, which will be calculated by multiplying the amount of this remuneration by a coefficient of reduction equal to the ratio of the number of days delayed to the total duration of the exposition.

ART. XII. CANCELLATION OF CONTRACT FOR EXCESSIVE DELAYS.—If the apparatus is not in condition to furnish a regular service beginning with May 15, 1900, the administration reserves to itself the right to cancel the contract made by the builder without indemnity being due to either party, and without remuneration for installation expenses to be paid by the administration.

ART. XIII. PENALTY IN EVENT OF INTERRUPTION OF SERVICE.—In case of interruption to the regular service, aside from the resting hours fixed by the director-general of exploitation, the contractor will have imposed by the administration for each day of said interruption a penalty equal to the allowance corresponding, for the apparatus referred to, to the normal service of a day of seven working hours.

If this interruption exceeds a period of ten days, a second penalty will be exacted and deducted from the remuneration provided by the administration toward the installation expenses, which penalty will be calculated by multiplying the amount of such remuneration by a coefficient equal to the ratio of number of days of delay to the total duration of exposition.

ART. XIV. EMPLOYEES.—The director-general of the exposition will retain the right to require the discharge of any agents or employees in the service of contractors for insubordination, incapacity, intemperance or want of probity.

ART. XV. MEDICAL SERVICE.—The builders, being considered as exhibitors, as stipulated in Art. III., will not be classed as contractors for the masonry work required; therefore, the amount of their contracts will not be submitted to the customary deduction of 1 per cent for medical service required in Art. XVI. of general conditions.

On the other hand the employees of the builders, in case of injury or accident, will receive only the "first help to the injured," the regulations of Art. III. and IV. of the "Arrêé Ministériel" not applying to them.

ART. XVI. GENERAL REGULATIONS.—The contractors agree to conform to all the regulations promulgated by the director-general of the exposition. They will be held responsible for accidents caused by their apparatus or employees.

Disagreements between the administration and contractors must be, previous to any definite action, examined by three competent members of the technical committee. One of these members will be chosen by the commissioner-general of the exposition, the second by the contractor, and the third will be chosen by the two first-named members.

The contractors agree to withhold any procedure or action at law until after having submitted the disagreement to the council of arbitration as above provided for.

In the main the general conditions of installation and exploitation of steam boilers are similar to those governing the engine-dynamo plant, but there are some special features which are presented in the following abstract:

SPECIAL CONDITIONS OF BOILER INSTALLATION

ART. I. GENERAL REQUIREMENTS.—The steam required for the production of motive power for the Universal Exposition of 1900 will be produced by two distinct plants; one, called "Usine La Bourdonnais," being reserved for French builders, will be placed in the court of 117 by 40 meters situated between the Palace of Electricity, Palace of Agriculture, Palace of Machinery and the passage along the Avenue de la Bourdonnais; the second, reserved for foreign builders, will be placed in a court situated next to the Avenue Suffren and called "Usine Suffren."

These boiler plants will be formed by groups of boilers, each group being able to produce under normal conditions a minimum of 22,000 pounds and a maximum of 44,000 pounds of steam per hour.

The administration of the exposition will not contract for more than one group with the same builder.

ART. II. SPECIAL REQUIREMENTS.—Same as Art. III., engine-dynamo groups.)

ART. III. CONDITIONS OF INSTALLATIONS.—(Same as Art. IV., engine-dynamo groups, with the following additions:)

Chimney Flues.—The main flues for smoke from both boiler plants will be established at the expense of the administration. Junction pieces will be prepared to receive the ends of the flues from the different groups of boilers. The private flues connecting the boilers to the main flues will be made by the contractors at their expense after the approval of the plans by the director-general of exploitation.

Smoke Stacks.—A large smoke stack will be established by the administration for each boiler house.

Steam Pipes.—The administration will furnish the main piping connecting the boiler houses with the engine rooms and the different parts of the exposition where steam is required, but each builder must furnish at his expense the connection from his boilers to said main pipes.

Feed Water.—The administration will furnish main feed-water pipes through which will be conducted the water required for the boilers, but contractors must connect their feed tanks or pumps to these mains.

Sewerage. General Sewer pipes will be established by the administration. The contractors will be required to make at their expense the connections to the sewers from the boilers, blow-offs, drains, etc.

Condensers.—To avoid the escape into the atmosphere of the steam used in the different auxiliary apparatus, the administration will erect independent condensers into which this steam will be evacuated.

Main overflow pipes for these condensers will also be established by the administration, but the contractors must connect their apparatus thereto at their own expense. They must also establish a security escape into the open air.

ART. IV.—TECHNICAL CONDITIONS.—The steam apparatus must comply with the conditions of French laws and the regulations concerning public security unless exceptions have been granted by the Minister of Public Works, that is, apparatus built according to legal requirements and subjected to official security tests established by law in the originating country may be accepted upon the proper recognition of such requirements and tests being in consonance with French law. The administration, on the advice of the technical committee, reserves the right to require such other safeguards or safety appliances as it may deem necessary for apparatus working near the public aisles and passageways.

The boilers and their accessories must be established and the conditions of regulation carefully observed for a normal working pressure of 156 lbs. per square inch.

Plans of Installation.—General and detailed drawings must also be submitted to the technical committee, this committee prescribing the conditions to which the builders must conform in the installation they undertake.

The committee may particularly require satisfactory arrangement concerning the installation of the boilers from the chimney flues, water pipes, steam pipes, etc. All feed pipes, etc., must be installed and maintained in perfect condition.

The furnaces shall be constructed so as to avoid the production of opaque smoke, the fuel adopted by the builder being carefully selected with this end in view.

ART. V. MEASURING AND CONTROLLING APPARATUS.—The builders agree to mount on their boilers such indicators, gages or verification apparatus as the director-general of exploitation may deem necessary, and to have such experiments made as the technical committee or jury of awards may demand.

The builders will furnish, mount and keep in repair at their own expense during all the time of the exposition a suitable water meter of one of the patterns accepted by the administration, to be installed on the pipe supplying the feed water to their boilers, readings of the meter to be taken every day by the inspector of mechanical service, who shall keep the key to such water gage; two seals will be placed by said inspector on the feed and outlet pipes of the meter.

The builders agree not to blow off the boilers except in the presence of said inspector, and will make sure that the evacuation and overflow cocks are closed in due time, so as not to show erroneous results concerning the evaporization.

A special steam outlet will be located between the boiler and the main throttle valve, according to the conditions to be prescribed by the director-general of exploitation, which shall permit the measurements of the water carried away by steam.

Arrangements will also be made for the reading of the temperature of the gases escaping from the furnaces and for analyzing them.

ART. VI. DURATION OF SERVICE.—(Same as Art. V., engine-dynamo groups.)

ART. VII. DATE OF DELIVERY.—(Same as Art. X., engine-dynamo groups.)

ART. VIII. DAILY SERVICE.—(Same as Art. VI., engine-dynamo groups.)

ART. IX. FINANCIAL CONDITIONS.—The feed water will be furnished free of charge, according to the conditions of Art. III. As explained in that article, the chimney flues as well as the general steam feed, sewerage and overflow

pipes will be furnished by the contractors at their expense, as well as dampers, cocks, gutters, and in a general way, all other accessories required.

The administration will furnish the boiler house. The fuel, necessary employees and all other expenses concerning the installation as well as for the exploitation and trials will be at the expense of the builders. The exploitation will therefore entirely be at the expense of the builders, particularly that which concerns fuel, employees, etc., and these expenses will be settled directly by them without any interference by or responsibility resting on the administration, which will in no case assume any expenses incurred inside of the grounds of the exposition by the builders engaged to furnish the steam.

Within the grounds no fuel, ashes, etc., shall be allowed to be stored, except in sacks.

The remuneration allowed to builders includes: (1) A fixed sum representing the administration's contribution toward the expense of installation of boilers and their accessories. This sum is fixed at $289.50 per 2200 pounds of productive capacity of steam per hour, as contracted for by the administration and appearing on the private contract of each builder. This productive capacity will be determined by the technical committee and will, in any case, not exceed 122 pounds per square ft. of grate surface.

(2) A sum representing the administration's contribution to the expense of exploitation, which sum is fixed at 85 cents per 2200 pounds of steam effectively produced from the opening to the close of the exposition and during the working hours fixed by the director-general of exploitation.

Art. X. Terms of Payment.—(Same as Art. IX., engine-dynamo groups.)

Art. XI. Penalties Exacted for Delays.—(Same as Art. XI., engine-dynamo groups.)

Art. XII. Cancellation of Contracts for Excessive Delays.—(Same as Art. XII., engine-dynamo groups.)

Art. XIII. Penalty in Event of Interruption to Service.—(Same as Art. XIII., engine-dynamo groups.)

Art. XIV. Accounts.—The administration reserves the right to take for the regulation of the accounts any steps necessary, or to make tests and trials so as to be informed as exactly as possible concerning the power produced by the boilers and accessories.

Art. XV. Regulations.—(Covered in Art. XVI., engine-dynamo groups.)

Art. XVI. Employees.—(Same as Art. XIV., engine-dynamo groups.)

Art. XVII. Responsibility.—(Covered in Art. XVI., engine-dynamo groups.)

Art. XVIII. Medical Service.—Same as Art. XV., engine-dynamo groups.)

Art. XIX. Disagreement.—(Covered in Art. XVI., engine-dynamo groups.)

INCLINED ELECTRIC ELEVATORS

A new feature of the exposition service is the "escalader," an inclined elevating way, constructed in the form of an endless carpet or belt, propelled by a drum at one end. No former exposition has made such generous provisions for means of carrying the public to the galleries, and as the typical "escalader" has been so recently brought into public use, nearly everyone in the commercial world will be anxious to see the results obtained with it. The extent to which the elevating stairway may be successfully used can scarcely be estimated at this time. They are said to be safe, easily installed, simple to operate, and their capacity is far in excess of vertical elevators so far as transportation from floor to floor of large crowds is concerned. Such devices have long been sought for large stores, elevated railway stations, etc. Privilege has been granted the commissioner-general for the United States to install a working exhibit of one or more of these "inclines" in or near some United States section.

The terms under which the inclined electric elevators are to be installed are essentially the same as those of other exhibits that find a place in the service plant of the exposition. There are special conditions, of course, and details of construction that may prove interesting to those considering this class of apparatus. The competition will be divided into two lots, one comprising thirteen elevators in the palaces fronting on Avenue Suffern, and the other fourteen in the palaces fronting on the Avenue de la Bourdonnais and Constantine.

The following abstracts from the official specifications cover the principal points of interest:

The inclined elevators, their electric motors, means of transmission and other accessories, will be established in conformity with the general regulations to the general design accompanying these articles.

The beams supporting the inclined elevators will be supported on the upper floor by one or two pillars resting on a solid mass of masonry level with the ground floor. They may also be supported at some point of their lines by one or two additional pillars, in line with the pillars of the palace proper.

The bay to be cut through the upper floor will be established by the administration at its expense. The contractors shall provide for a platform of a particular type accceptable to the aministration. The bay will be 6 ft. 6¾ in. in width and 32 ft. 9¾ in. long.

The apparatus will be constructed for one file of passengers, and the proportions will be as follows:

Width of carpet or elevating surface.....23⅝ in.
Distance between railings.....35 7-16 in.
Grade of incline per foot (approximately)..... 4 in.
Capacity of the elevators in passengers.....20 passengers
(Normally one person per yard.)
Capacity of elevator in passengers.....40 passengers
(At maximum of two persons per yard.)
Distance between the surface of ground floor and the surface of the gallery floor.....23 ft.

The apparatus will be installed for a minimum speed per second of 19 11-16 in. and a maximum speed per second of 23⅝ in.

The conveyor, properly speaking, will consist of an endless belt or platform constructed of pliable and yet resisting material, which will roll continuously and uniformly, and must possess both softness and necessary rigidity for the service to be performed.

When in operation the rolling surface must so move over the supports or rollers as to cause no perceptible or disagreeable effect beneath the feet of the passengers.

The devices for stretching this moving surface, or scheme for "taking up the slack," must allow for all the elongation which may be produced during the entire period of the exposition, so that it will not be necessary to dismantle any portion of the elevator during such time.

The entire inclined elevator must work absolutely without noise. All mechanical apparatus connected with the elevator which may need oiling or greasing must be so arranged as to avoid all possibility of contact with passengers or their garments.

The electric motor and the apparatus for driving the elevator must be placed as near as possible to the elevators.

All parts must be accessible, either from the ground floor or the platform on the gallery floor, for the maintenance in operation.

Proper arrangements must be made so that, in event of damage or accidents to the motor or mechanism, the rolling surface loaded with passengers cannot receive a descending movement.

The side rails will be also formed by endless cables, so constructed that they will present under the hands of the passengers a soft and clean support.

The upper part of this endless cable or moving side rail at the height of the hand will only be seen; the lower part will be inclosed by framework which will have a perfectly plain and smooth surface offering no possibility of accident to the garments of the passengers. These moving side rails must have precisely the same speed as the elevating surface proper.

The tests of capacity of the elevators will be made under a load of 7780 lbs., representing the weight of fifty passengers, uniformly spread over the lines of the elevator. This load will be retained as long as deemed necessary by the administration.

As it is impracticable to make the tests of capacity under a load equal to fifty passengers, which should be renewed in a continuous fashion, the device for stretching the endless belt or moving elevator will be arranged in such a manner as to give to it a tension corresponding to that which it would receive under the weight of fifty passengers or the equivalent of 7780 pounds.

Under this tension the maximum speed must be maintained continuously as may be required by the administration.

The electric current necessary for the electric motors will be supplied by the exposition without expense to the contractor.

The remuneration of the contractor will consist of a fee to be exacted of each passenger using the elevators; this fee shall be ten centimes per passenger.

A percentage of each fee for the right of the concession will be allowed the exposition, and the amount of such percentage is to be indicated in the proposition of the bidders; the liberality of this percentage will largely influence the choice of the successful contractors selected by the exposition.

The contractor will be authorized to collect from the public direct the fee of ten centimes for each passenger.

ELECTRICAL FEATURES

Among the special features of interest to electrical men will be the illumination of the grand entrance, and the big wheel. The latter is larger than the Ferris wheel at Chicago, and differs in many important details of construction.

Not all of the main palaces will be lighted at night. The Palace of Manufactures, Palace of Electricity, Palace of Transportation and Civil Engineering, Palace of Textiles, and perhaps one or two other palaces, will be well illuminated every evening. The great Hall of Fetes, which occupies a central position in the Palace of Agriculture, will be illuminated brilliantly whenever in use for evening gatherings. The Palace of Education and Liberal Arts, Palace of Mines and Metallurgy, Palace of Chemical Industries, and Palace of Agriculture will not be equipped for evening illumination.

It is the Palace of Electricity, to which all eyes will naturally turn at night, and, as its main facade reaches across the entire width of the open plaza in the center of the Champs de Mars, splendid opportunity will be afforded for the attractive treatment of the architectural features of the exterior of this palace. Immediately in front of the Palace of Electricity is the grand Château d'Eau, which, as planned, will assume the character of an immense fountain with a series of cascades, to be effectively illuminated by vari-colored lights, thus making a most brilliant and striking attraction for the evening. A very ingenious scheme has been undertaken in connection with this Château d'Eau. All of the water used in the power plant for condensing purposes is to be discharged through the Château d'Eau and the cascades surrounding it, thus making use of this water in artistic effects, and obviating the necessity of pumping from the river another great volume of water simply for fountain use.

The administration has considered well the necessity for making the gallery space in the various palaces as accessible to the public as possible, and provision has been made not only for numerous vertical elevators of steam, electric and hydraulic type, but for a large number of inclined elevating ways, or "rolling carpets," to carry the passengers easily and speedily from the crowded ground floor to the galleries, where many interesting and instructive exhibits will be installed. The limited ground area at this exposition makes necessary the husbanding of all available gallery space. On the Champs de Mars there will be installed fourteen of these elevators, or "escaladers," which will have a capacity each of not less than 3000 passengers per hour. A fee not exceeding two cents for each passenger will be charged for the use of these "escaladers."

Decision in the Series Parallel Controller Case

The United States Circuit Court of Appeals (Judge Shipman writing the opinion) on Dec. 17, 1898, decided in favor of the plaintiffs in the case of the Electric Car Company, of America, and the Thomson-Houston Electric Company vs. the Nassau Electric Railroad Company, for alleged infringement of the patent issued to George Herbert Condict. The exclusive right under this patent for trolley roads is owned by the Thomson-Houston Electric Company. The patent covers broadly the modern form of series parallel controllers, in which both series-parallel changes and resistance changes are combined, so that by the movement of the same controller handle, both modes of regulation are utilized, and the resistance changes supplement and assist the series-parallel changes.

The Court, in its opinion, said in part: "It cannot be denied that

Condict's combination of two existing systems for regulating the supply of the current to an electric car motor was previously unknown and that the invention was one of much importance. * * * It is also obvious that the mixed controller system is in use whether the insertion is preparatory to or accompanies the shifting of the motor switch, and that in all the forms used either by the defendant in this case or by the defendant in the Hartford case auxiliary resistance was brought in at the time of making the change to parallel. * * * There is and there must be a substantial use and an enjoyment, more or less partial, of the benefits of the Condict idea and system, although the insertion of the dead resistance takes place during the transitional positions which result in a change from series to multiple." Since the original decision, a petition for a rehearing was presented and denied by the Court.

Railway Men in the Late War

Caryl D. Haskins, late commander of the volunteer electrical corps of the Boston Battalion during the late war, has written the STREET RAILWAY JOURNAL in regard to a statement in the last issue in connection with the part taken by the Boston office of the General Electric Company in the coast defense. Mr. Haskins states that while quite a large portion of the staff of that office did take part in the harbor defense work, they did so not as General Electric men, but as individuals and members or officers of the Volunteer Electrical Corps, Boston Battalion. Fully two-thirds of the squad officers and a large proportion of the privates of the battalion were associated with electric lighting companies, construction companies, or other companies foreign to the General Electric Company, so that it is not the desire of the latter that the mistake of giving it all the credit should be made.

There was another unintentional injustice in the same article, to which Mr. Haskins calls attention. This was in the omission of the name of E. H. Hoyt. Mr. Hoyt, who is well known in street railway circles throughout the state, and is chairman of the street railway committee of the State of Massachusetts, served as a special staff officer in connection with the Boston Battalion of the Volunteer Electrical Corps through almost its entire period of service. He dropped all of his important interests, abandoning his duties as representative of the Massachusetts House, and devoted himself exclusively to harbor defense work in connection with the corps, entirely without recompense and to his own personal loss.

Insulating Paint Abroad

The insulating compounds of the Standard Paint Company, popularly known under the name of P. & B., are so extensively employed in this country that American readers will be interested to know that the company is enjoying a very large export trade. Indeed, so large has this trade become during the last few years that after a number of visits abroad Mr. Shainwald, president of the company, decided some time ago to build a branch factory at Hamburg, Germany. The erection of this factory was begun in July, 1897, and completed in 1898, since which time all the compounds and apparatus manufactured by the Standard Paint Company in this country have been supplied by the branch factory at Hamburg. These include not only the P. & B. paint, tape, varnish and other goods which pertain directly to the electrical trade, but also P. & B. rubberoid roofing, P. & B. building sheathing and insulating papers and P. & B. preservative roof and structural paints.

It is a good indication of the standing of this company's products that material which has proved so popular in this country is regarded as equally indispensable in the countries of Europe.

An Advertising Bureau

With the closing of this year, the Manufacturers' Advertising Bureau, of New York city, complets the second decade of its existence—a fact which demonstrates beyond question the value of a concern of its unique character to the progressive manufacturer. Established in 1879 by the present proprietor, Benj. R. Western, the bureau has grown steadily in public favor and commercial importance. Its clientage is a large one, and comprehends representative concerns in nearly every industry in the country.

The Manufacturers' Advertising Bureau makes a specialty of the trade journals, and Mr. Western is, perhaps, one of the best-informed gentlemen in the advertising business regarding this class of publications and their conditions and possibilities as business bringers. A booklet, having the attractive title, "Advertising for Profit," is issued by the Manufacturers' Advertising Bureau, and will be sent on application.

Prospects for 1899

The results of an investigation recently conducted by the STREET RAILWAY JOURNAL shows that a large number of street railway companies are planning to make extensions and improvements during the coming year. Details of some of the new work proposed are given below:

ARKANSAS

The Hot Springs Street Railway Company will probably extend its line about 2 miles.

ALABAMA

The Birmingham Traction Company will probably add to its power station equipment two 300-kw. direct connected generators.

The Mobile Light & Railroad Company expects to add a direct connected generator and engine to its power station and build new car shed and repair shops.

The People's Street Railway and Improvement Company, of Decatur, is planning to reorganize the company and build 4 miles of new track.

CALIFORNIA

The Oakland Railroad Company will reconstruct about 7 miles of cable and horse lines, equipping them with electricity, and will replace twelve grip cars with motor cars. The care are in process of construction.

The Market Street Railway Company, of San Francisco, has not yet fully decided upon further construction and reconstruction for next year, but is planning to do considerable new work. The company has a franchise for an electric line about 1 mile in length, which may possibly be built. There is also a possibility that all the remaining horse lines and steam lines will be equipped with electricity.

The Sacramento Electric, Gas & Railway Company will not build any new mileage during the year, but may make an extension of existing electric transmission lines for power and lighting.

The following roads report that no new work is in contemplation: Gerry Street, Park & Ocean Railroad Company, San Francisco; San Jose & Santa Clara Railroad Company, Santa Rosa; Central Street Railway Company, Santa Rosa; Santa Rosa Street Railroad Company, Santa Rosa; Union Street Railway Company, Santa Rosa.

CONNECTICUT

The Hartford Street Railway Company will build a ¾-mile extension.

The Norwich Street Railway Company will build a ½-mile extension.

The Norwalk Tramway Company will probably build a line from Norwalk to New Canaan.

The Putnam & Thompson Street Railway Company, in connection with the People's Tramway Company, of Danielson, Conn., will construct, early in 1899, 16 miles of single track, together with power station and building equipment.

The following roads report that no new work is in contemplation: Norwalk Street Railway Company, Norwalk; Middletown Street Railway Company, Middletown; Bristol & Plainville Tramway Company, Bristol.

DISTRICT OF COLUMBIA

The Columbia Railway Company will build 10 miles of new suburban line, equipped with the overhead electric system. It will also change the existing cable road to underground electric, will add two 750-h.p. Allis engines and two 525-kw. G. E. generators to its power station, and will increase its rolling stock by sixty motor cars, twenty of which will have double trucks.

The Capital Traction Company will reconstruct about 1¾ miles of double track to conform with the electric conduit system now used on the city lines.

The Washington, Arlington & Falls Church Railway Company will extend its present line for a distance of 3 miles.

FLORIDA

The Pensacola Electric Terminal Railway Company will probably equip 4 miles of steam dummy line with electricity, and will extend present lines about 2¼ miles.

The Palatka Heights Street Railway Company has no new work in contemplation.

GEORGIA

The Augusta Railway & Electric Company has recently completed a new 1½-mile extension, and has installed a 4-kw. 2-phase generator for electric lighting purposes. During 1899 a 400-kw. railway generator will also be added.

The Atlanta Railway Company expects to build 11 miles of new track and add about twelve more motor cars.

The following roads report that no new work is in contempla-

tion: Columbus Street Railway Company, Columbus; City Electric Railway Company, Rome.

ILLINOIS

The Alton Railway & Illuminating Company will build 5 miles of new line and will add five new 28-ft. motor cars. It will also build a new car house, and will install a hot water heating plant for the heating of its buildings. This company is now engaged in relaying 2½ miles of old track and making a ½-mile extension.

The Chicago City Railway Company is planning to make many additions and extensions early in 1899.

The Galesburg Electric Motor & Power Company will add two double-truck motor cars, new motors and new boilers to its present equipment.

The Streator Railway was sold, Oct. 8, and bought by C. C. Barr, who expects to place the property in first-class condition early in the spring.

The Springfield Consolidated Railway Company has not fully determined on improvements for the next year.

The Belleville Electric Railway Company will rebuild about 3 miles of track.

The Rockford Railway, Light & Power Company will build several extensions to present lines.

The City Electric Railway Company, of LaSalle, will make extensions in the spring and add one more generator to the power station. The present rolling stock will be repainted and thoroughly repaired.

The City Electric Railway Company, of Decatur, will probably extend to Fair Haven Park, a distance of ½ mile, next spring.

The following roads report that no new work is in contemplation: Aurora & Geneva Railway Company, Aurora; Calumet Electric Street Railway Company, Chicago; North Kankakee Electric Light & Railway Company, Kankakee; Kankakee Electric Railway Company, Kankakee.

INDIANA

The Union Traction Company, of Anderson, has recently completed its line from Alexandria west to Arestes, 3 miles, and is extending the same to Elwood, a distance of 7 miles further. The company will erect at Alexandria a power station completely new, with 600-kw. generators, with necessary engines and boilers.

The John S. Crumps Street Railway Company, of Columbus, has not decided on new extensions for the coming season.

The Kokomo Street Railway Company will add 1 mile of new track and four new motor cars.

The South Bend Street Railway Company will build a new line to Notre Dame College, a distance of 1½ miles, and will also make other extensions amounting to about 2 miles. A new power station will be erected.

The following roads report that no new work is in contemplation: North Vernon & Vernon Street Railroad Company, Vernon; Logansport Street Railway Company, Logansport; Terre Haute Electric Railway Company, Terre Haute.

IOWA

The Waterloo & Cedar Falls Rapid Transit Company will build 1½ miles in Cedar Falls, and will add to the power station equipment one 300-h.p. engine and one 250-kw. generator.

The Boone Electric Street Railway & Light Company will build 3½ miles of new track.

The Marshalltown Light, Power & Railway Company intends to equip some of its open trail cars with motors.

The Omaha & Council Bluffs Railway & Bridge Company has recently built a new power station, and has no further work in contemplation.

The Sioux City Elevated Railway Company is lowering its elevated structure and extending it on the surface a distance of eight blocks into the city, giving this company a surface line all through the business district.

KANSAS

The Atchison Railway, Light & Power Company has not fully decided what new work will be undertaken, but will probably make some extensions of track.

The Leavenworth Electric Railroad Company expects to build a new car barn, to be modern in every respect and to accommodate forty cars. New shops will also be added.

The following roads report that no new work is in contemplation: Citizens' Railway Company, Fort Scott; Topeka Railway Company, Topeka.

KENTUCKY

The Ashland & Catlettsburg Street Railway Company will increase the capacity of its power station.

The following roads report that no new work is in contemplation: Paducah Street Railway Company, Paducah; Frankfort & Suburban Railway Company, Frankfort.

LOUISIANA

The New Orleans City & Lake Railroad Company will equip with electricity two miles of horse lines and will add six new double-truck motor cars, and will rebuild twenty others.

MAINE

The Sanford & Cape Porpoise Railway Company will build a new line from Sanford to Cape Porpoise, a distance of 22 miles.

The Bangor, Hampden & Winterport Railway Company will extend its line about 8 or 10 miles.

The following roads report that no new work is in contemplation: Bangor Street Railway Company; Biddeford & Saco Railroad Company, Biddeford; Fryeburg Horse Railroad Company; Mousam River Railroad, Sanford.

MARYLAND

The Baltimore, Middle River & Sparrow's Point Electric Railroad Company intends to double its present steam power plant, add ten more cars, and extend its tracks possibly 6 miles.

The following roads report that no new work is in contemplation: Baltimore & Northern Electric Railway Company, Baltimore; Cumberland Electric Railway Company.

MASSACHUSETTS

The Palmer & Monson Street Railway Company will make several extensions to its lines.

The Braintree & Weymouth Street Railway Company expects to build from 4 to 8 miles of new line.

The Shelburne Falls & Colrain Street Railway Company will extend its line for a short distance.

The Boston Elevated Railway Company will build its new elevated structure during 1899.

The following roads report that no new work is in contemplation: Greenfield & Turner's Falls Street Railway Company, Greenfield; Athol & Orange Street Railway Company, Athol; Fitchburg & Leominster Street Railway Company, Fitchburg, Lowell & Suburban Street Railway Company, Lowell; Newton & Boston Street Railway Company, Newton; Newtonville & Watertown Street Railway Company, Newtonville; Wellesley & Boston Street Railway Company, Newtonville; Northampton Street Railway Company; Springfield Street Railway Company; Worcester & Marlborough, Worcester; Taunton Street Railway Company.

MICHIGAN

The Long Lake, Durand & Corunna Electric Railroad Company has recently been formed to build a line from Fenton and Durand to Corunna.

The Adrian Electric Street Railway Company will build ¾-mile extension.

The Escanaba Electric Street Railway Company will build 3½ miles of new track laid with 60 lb. steel T rails; 200-h.p. engines and generators will be added to the power station, and new car-house and shops will be built. Two large interurban cars will be added to the rolling stock.

The Michigan Traction Company proposes to connect Kalamazoo and Battle Creek with an electric railway 23 miles long, with a spur 3½ miles from Augusta to Gall Lake. The road has been surveyed and part of the material is on the ground. It is thought operation will be commenced in June, 1899.

The Manistee, Filer City & Eastlake Railway Company will build about 3 miles of new track. This company has recently enlarged its power house and increased its power house equipment. The company is also opening a large park on the shore of Lake Michigan.

The following companies report that no new work is in contemplation: City Electric Railway Company, Port Huron; Muskegon Railway Company; Menominee Electric Light, Railway & Power Company; Detroit, Fort Wayne & Belle Isle Railway, Detroit; Detroit & Pontiac Railway Company, Detroit.

MINNESOTA

The St. Cloud City Street Car Company will extend its line 1½ miles to the Great Northern Passenger Depot.

The following companies report that no new work is in contemplation: Twin City Rapid Transit Company, Minneapolis; Lakeside Railway Company, Duluth.

MISSISSIPPI

The Meridan Street Railway & Power Company is adding new boilers to its station equipment.

The Greenville Street Railway Company has abandoned its old property and the track has been taken up. but it is the purpose of

the company to establish a new road some time in the near future.

The following road reports that no new work is in contemplation: Bluff City Railway Company, Natchez.

MISSOURI

The Hannibal Railway Company proposes to build at least 2 miles of new road to Oakwood, and possibly 10 miles more to Palmyra. The present line will also be extended about 3 miles. A new power house will be built and equipped, and new rolling stock and equipment will be added.

The Brooklyn Avenue Railway, of Kansas City, now operated by cable, will be converted to the overhead electric system and 15 miles of extensions (also electric) will be built during the spring. Work will be commenced as soon as the weather permits. A new bridge will be built over the Belt Railway tracks, a new power house erected, and new rolling stock and equipment will be purchased.

The Northwest Electric Railway Company, of Kansas City, is preparing to rebuild its entire line.

The Clinton Street Railway Company is endeavoring to secure capital to equip the road with electricity.

The following roads report that no new work is in contemplation: Electric Railway, Light & Power Company, Sedalia; St. Louis & East St. Louis Electric Railway Company, St. Louis; People's Railroad Company, St. Louis; Citizens' Street Railway Company, Cape Girardeau.

MONTANA

The following road reports that no new work is in contemplation: Bozeman Street Railway Company, Bozeman.

NEBRASKA

The Nebraska City Street Railway Company expects to change from horse traction to electric traction in the latter part of 1899.

The following roads report that no new work is in contemplation: Benson Railway Company, Benson; Lincoln Traction Company, Lincoln.

NEW JERSEY

The Atlantic City Electric Railway Company expects to make some additions to power station equipment.

The Bridgeton & Millville Traction Company is planning an extension to Cedarville, a distance of 4 miles.

The Union Traction Company, of Rutherford, has the construction of 7 miles of new line under consideration, but it is not decided definitely when the same will be built.

The Bergen County Traction Company, of Undercliff, expects to complete its extension to Hackensack, a distance of about 4 miles.

The Trenton Passenger Railway Company will build 2 miles of new line.

The Ocean City Electric Railroad Company recently completed 5 miles of new line and installed new equipment in its power station. No new work is contempleted for 1899.

The following roads report that no new work is in contemplation: Brigantine Transportation Company; Camden, Gloucester & Woodbury Railway Company, Camden; North Hudson County Railway Company, Hoboken.

NEW HAMPSHIRE

The Laconia Street Railway Company will extend its line about 5 miles along the lake shore.

The Exeter Street Railway Company will build from Exeter to Epping, a distance of 6 miles, and from Hampton to North Hampton, a distance of 3 miles, in the spring, and will add about 400-h.p. engines and generators to the power station.

The following road reports that no new work is in contemplation: Nashua Street Railway.

NEW YORK

The Brooklyn Heights Railroad Company has contracted for 150 thirteen-bench open cars and 5000 tons of 9-in. steel girder rails. This rail, when laid, will complete the change of the entire Brooklyn Heights system from horse traction with various kinds of rails to electric traction with standard 9-in. construction.

The Elmira & Horseheads Railway Company will complete a short extension to a new park which it will open to the public in June, 1899, and will also rebuild 3 miles of the present line with 60-lb. T-rails.

The New Paltz & Wallkill Valley Railroad Company will probably add some small motor cars.

The Metropolitan Street Railway Company, of New York City, is now equipping existing horse lines with the underground electric system, and this work will probably be completed during 1899.

The Kingston City Railroad Company may possibly add six or eight new cars to its equipment.

The Hornellsville Electric Railway Company is planning to erect a new power station, and equip some with gas engines.

The Dunkirk & Fredonia Railway Company is endeavoring to secure franchises for building 1 1-3 miles of new track.

The Auburn Street Railway Company will make an extension of its lines about 9 miles in length.

The Syracuse, Skaneateles & Moravia Railroad Company is a new company recently incorporated, and expects to build several miles of track in the spring.

The Green County Traction Company, of Coxsackie, has recently been incorporated, and intends to build a new line in the spring.

The Buffalo, Hamburg & Aurora Railway Company intends to build a new line 21 miles in length in the early spring.

The Saratoga Traction Company will extend its present line to Ballston Spa.

The following roads report that no new work is in contemplation: Bennington & Hoosick Valley Railway Company, Hoosick Falls; Rochester Railway Company, Rochester; Ossining Electric Railway Company, Sing Sing; Oneida Railway Company, Oneida; Niagara Falls, Whirlpool & Northern Railway, Niagara Falls; The Niagara Falls & Suspension Bridge Railway Company, Niagara Falls; Herkimer, Mohawk, Ilion & Frankfort Electric Railway Company, Mohawk; Middletown-Goshen Traction Company, Middletown; Fonda, Johnstown & Gloversville Railroad Company, Gloversville; Citizens' Street Railway Company, Fishkill-on-Hudson; Cortland & Homer Traction Company, Cortland; Buffalo & Niagara Falls Electric Railway Company, North Tonawanda.

NORTH CAROLINA

The Intermontaine Railroad Company, of Asheville, will put in a new plant to be operated by water power.

The following roads report that no new work is in contemplation: Wilmington Street Railway Company, Wilmington; Winston-Salem Railway & Electric Company, Winston; Charlotte Electric Light & Power Company, Charlotte.

OHIO

The Ashtabula Rapid Transit Company has recently completed a number of improvements, including a number of new turnouts, a signal block system and additional shops and car barns. The car barn is heated by steam.

The Oakland Street Railway Company, of Dayton, will make a number of improvements in its property.

The Lima Railway Company will build a ½-mile extension.

The Citizens' Electric Railway, Light & Power Company, Mansfield, is remodeling its power station equipment.

The Tuscarawas Electric Company, of New Philadelphia, is considering the advisability of building a line from Uhrichsville to Cadiz.

The Springfield Railway Company will rebuild 1 or 2 miles of present track and will extend its line about 1½ miles. It also intends to build a new car barn with capacity for thirty-five cars and to add six new cars to the present rolling stock.

The Tiffin, Fostoria & Eastern Electric Railway Company is engaged in finishing its line. All power station equipment has been ordered, but the company may wish to purchase a few more cars.

The Toledo Traction Company will probably lay some additional double track and add one or two railway generators. It may possibly also purchase a few more open cars.

The Cleveland & Eastern Railroad Company is constructing a new line, but new cars, motors or electrical equipment have not yet been ordered.

The Akron, Bedford & Cleveland Railroad Company will double track a considerable portion of its line.

The Worthington, Clintonville & Columbus Street Railway Company is considering the advisability of operating trail cars on its lines.

The Pennsylvania & Ohio Railway Company, of Ashtabula, is a new company which intends to build 45 miles of electric railway. It is also intended later on to continue the line to Erie, Pa., a distance of 26 miles. Part of this road has already been constructed, and as soon as the spring opens the work will be pushed through as rapidly as possible.

The Cleveland, Medina Southern Electric Railway Company will build a new line from Cleveland to Wooster.

The following roads report that no new work is in contemplation: Sandusky, Milan & Norwalk Electric Railway Company, Sandusky; Salem Electric Railway Company, Salem; Tuscarawas Railroad Company, New Philadelphia; Lorain Street Railway Company, Lorain; the Price Hill Inclined Plane Railroad Company, Cincinnati; Cincinnati, Newport & Covington Railway Company, Cincinnati; Chillicothe Electric Railroad Company, Chillicothe.

OREGON

The City & West Portland Park & Motor Company, of Portland, intends to extend the present line 12 miles and equip its existing steam line with electricity.

PENNSYLVANIA

The Beaver & Vanpool Electric Street Railway Company will make a short extension of its line.

The Schuylkill Valley Traction Company, of Norristown, will probably make a number of improvements and extensions.

RHODE ISLAND

The Newport Street Railway Company is asking permission from the city to build a small extension.

SOUTH CAROLINA

The following road reports that no new work is in contemplation: Charleston Street Railway Company, Charleston.

TENNESSEE

The Electric Street Railway Company, of Clarksville, has completed surveys for a new line to New Providence, 2½ miles in length.

The Memphis Street Railway Company expects to build about 2 miles of new track and to construct a car barn and office building, with paint, carpenter and machine shops, etc. The buildings will be 320 ft. x 300 ft. and 105 ft. x 150 ft.

The Nashville Street Railway Company will probably buy some new motor cars and rails for 4 or 5 miles of track.

TEXAS

The Dallas Rapid Transit & Terminal Railway Company is now in process of reorganization. The road will be completed in January, 1899, and several changes and considerable improvement are contemplated.

The Dallas & Oakcliff Electric Railway Company contemplates making some changes, but has not fully decided upon them as yet.

The Austin Rapid Transit Railway Company contemplates a short extension of its line. This company is replacing the old pine ties with mountain cedar ties.

The Uniontown Electric Railway Company expects to make an extension of two miles in the spring.

The Titusville Electric Traction Company will add one new 325-kw. G. E. generator and one new Atlas Corliss engine and boiler.

The Connellsville, New Haven & Leisenring Street Railway Company will build 3 miles additional track from Leisenring to Vanderbilt, and also renew 4 miles of old roadbed with new track. track.

The Pennsylvania Traction Company, of Lancaster, is planning to build about 17 miles of extensions.

The Quakertown Traction Company is planning to build a line from Quakertown to Perkasie and Doylestown, a distance of about twenty miles.

The following roads report that no new work is in contemplation: Paris Railway Company, Paris; Citizens Railway Company, Waco; San Antonio & Magoffin Street Railway Company, San Antonio; El Paso & Juarez Avenue Street Railway Company, El Paso.

UTAH

The following roads report that no new work is in contemplation: Ogden Electric Railway Company, Ogden; Salt Lake Rapid Transit Company, Salt Lake City; Salt Lake City Railroad Company, Salt Lake City.

VERMONT

The following road reports that no new work is in contemplation: Rutland Street Railway Company, Rutland.

VIRGINIA

The Portsmouth Street Railway Company has under consideration an extension of its line.

The Lynchburg & Richmond Street Railway Company will construct an extension 1½ miles long; 90-lb. girder rail in paved streets, and 55-lb. T rail in unpaved streets will be used. This company intends to greatly improve and beautify its park covering about thirty acres, and will put in attractions of various kinds.

The Staunton Street Car Company may extend its line about one mile in the spring. This company is now remodeling its open cars, making combination cars of them, with removable vestibules.

The following road reports that no new work is in contemplation: Richmond Traction Company, Richmond.

WASHINGTON

The West Street & North End Electric Railway Company, of Seattle, expects to extend its line to Army Post, a distance of two miles.

The Seattle & Rainier Beach Railway Company is remodeling its rolling stock and roadbed.

WEST VIRGINIA

The Charleston Street Railway Company expects to build a 1½-mile extension to Ruffner, purchase a rock crusher and rock-ballast all its track outside of paved streets; also to relay about 1½ miles of old 50-lb. T rail, and lay new 62-lb. T rail on new ties.

The following road reports that no new work is in contemplation: Consolidated Light & Power Company, Huntington.

WISCONSIN

The Fox River Electric Railway Company, of Green Bay, expects to extend its De Pere line about two miles into the city of De Pere, and cross the river to the West Side. This company has ordered one new double-truck car, and will probably order two more during the year.

The following roads report that no new work is in contemplation: Sheboygan Light, Power & Railway Company, Sheboygan; La Crosse Street Railway Company, La Crosse; Ashland Light, Power & Street Railway Company, Ashland.

CANADA

The Montreal Island Belt Railway Company will make extensive extensions during 1899.

The St. Thomas Street Railroad Company will make a ½-mile extension and purchase new cars.

The Halifax Electric Tramway Company will build three miles of new track, and add a 300-kw. rotary transformer to the power-station equipment.

The Belleville Traction Company has six miles of extension under consideration.

The Quebec, Montmorency & Charlevoir Railway proposes to build a double track-line from Quebec to Montmorency Falls, a distance of 6.27 miles, and change a 30-mile steam road to electric traction.

The British Columbia Electric Railway Company, of Vancouver, will make several extensions during the coming year.

The following roads report that no new work is in contemplation: Niagara Falls Park River Railway Company, Niagara Falls; Oshawa Railway Company, Ontario; London Street Railway Company, London.

New Law Requiring the Licensing of Private Detectives

A law of considerable interest to street railway companies hiring private detectives or "spotters" has recently been passed by the New York Legislature, through the efforts of A. L. Drummond, general manager of Drummond's Detective Agency, of New York city. This statute requires all private detectives and private detective agencies to take out a license before they can do detective work of any kind. A penalty of a fine of $500, or imprisonment for a year, or both fine and imprisonment, will be imposed upon all offenders of this regulation. The principal reason for the law was the number of unexperienced and irresponsible people who were going into the detective business. Under the new statute, the license fee is $20 a year, and every applicant must have five reputable freeholders of his county to sign his application, and in addition to this he must give a bond of $2,000.

The strong points urged for the new regulation are as follows: At a small cost a man becomes a licensed detective, and he must be a very poor sort of a man and detective who cannot get five reliable indorsers as to his qualifications. It is thought that the requirement of a bond will also be a very valuable feature, as it gives clients something to fall back upon should a detective commit any fraud. This bond, of course, can be sued upon.

The law covers all special policemen, special peace-officers, special watchmen, and other private detectives of any character.

NEWS OF THE MONTH

The Boston Elevated Railway Company has decided to adopt the service stripe system for all uniformed employees. One stripe will be worn for each five years of service; motormen will wear silver braid; conductors, inspectors, starters, etc., gold; emergency linemen, scarlet, and switchmen and subway watchmen, green. A number of the large street railway systems throughout the country are introducing service stripes for employees.

The Traction Company Centennial Band, which is a social organization of employees of the Toledo (Ohio) Traction Company, gave a very successful and enjoyable entertainment recently. The band, which consists of twenty-five good musicians, rendered a musical programme, after which a dance was given. Thomas H. McLean, general manager of the Toledo Traction Company, was present, and with Mrs. McLean led the grand march. Refreshments were provided at the expense of Mr. McLean.

The new electric line from Elkhart to Goshen, Ind., which is owned by the Indiana Electric Railroad Company, was opened on Dec. 19. There now remains only a ten-mile stretch between Elkhart and Mishawaka to give a continuous line of 40 miles from Goshen to South Bend, Ind.

The Cicero & Proviso Street Railway, of Chicago, Ill., was granted a fifty-year franchise by the Cicero Town Council on Dec. 20. The companies to be benefited by this ordinance are the Cicero & Harlem Street Railway Company, Cicero & Proviso Street Railway Company, Ogden Street Railway Company, Suburban Railway Company, and the Chicago Telephone Company.

The Third Avenue Railroad Company, of New York, for the quarter ending Sept. 30, 1898, reports gross earnings of $594,807, as against $699,052 for the corresponding quarter of 1897, and $726,980 in 1896. This is a diminution in gross earnings of $104,245 during the past year, and of $132,173 during the last two years. The net earnings, after paying operating expenses, were $243,221 in 1898, as against $338,790 in 1897, and $377,040 in 1896, and the surplus for stock, after paying charges, is $150,827 in 1898, as against $246,970 in 1897, and $290,261 in 1896.

The annual report of the Railroad Commissioners for the State of Maine for the year ending June 30, 1898, shows an increase in gross earnings in 1898 over 1897 of $49,342. The Portland Railroad Company earned the largest sum per mile of road, $9,762, and the Augusta, Hallowell & Gardiner Railroad Company operated its line at the lowest percentage of operating expenses to earnings, 54 per cent. Only one person was killed and but thirteen injured by the street railways of the State during the year, seven of the latter being in a single collision, and the other six from their own carelessness, nearly all in getting on or off cars while in motion.

The just issued report of the Railroad Commissioners of Connecticut for the year ending June 30, 1898, shows that the capital stock and funded and floating indebtedness of the street railways of the State amount to $51,610 per mile of road. The largest capitalization per mile is that of the Meriden Electric Railroad Company, $92,507. The average gross earnings per mile of road operated were $5,254, and per mile run were $.1945. The largest earnings per mile of road were made by the Fair Haven & Westville Railroad, $12,460, and the largest earnings per car mile were made by the Waterbury Traction Company, $.2698. The largest operating expenses per car mile were $.171, those of the Norwich Street Railway Company, and the smallest were $.0856, those of the Bridgeport Traction Company, the average for the State being $.1271. But ten people were killed by the railways of the State during the year, and 128 injured. The capital stock was increased by $680,600, and the bonds by $930,000 over the totals of the previous year. The gross earnings were reduced by $607,242, and the net earnings by $242,328. The dividends were reduced by $85,350, and the interest paid, by $143,852.

A syndicate has acquired, for $1,472,000, the entire street railway system and street railway concessions in Havana, Cuba. It is officially stated that the owners of the Metropolitan Street Railway Company, of New York City, are largely interested in this deal, and that the work of giving Havana one of the finest street railway systems in the world will certainly be commenced in the spring, or as soon as certain minor legal details are settled.

The Union Elevated Railroad, of Chicago, which operates the loop terminal, held its annual stockholders' meeting on Dec. 5, and re-elected directors. No financial statement was given out, but the result of operation for the year ending Nov. 30 is locally estimated as follows:

Revenue from 23,556,000 passengers on the Metropolitan road at one-half cent	$117,780
Revenue from 18,702,000 passengers on the South Side road, at one-half cent	93,510
Minimum charge, Lake Street line	62,500
Minimum charge, Northwestern line	62,500
Total earnings	$336,290
Interest on bonds	$210,000
Surplus on stock	$126,290

This surplus is equivalent to about 2.5 per cent upon the stock.

The ordinance extending the franchises of the Chicago City Railway Company for fifty years has been defeated in the Council.

S. Dana Greene, who is head of the sales department of the General Electric Company, and who served on board the "Yankee" in the Spanish-American War as lieutenant (junior grade), has been detailed for duty as aide to Governor-elect Roosevelt, at the latter's request. Lieut. Greene now occupies the position of lieutenant commander in the naval militia and chief of staff to its captain. He comes from an ancestry, direct and collateral, distinguished in the army and navy of the United States. He is the son of Captain S. Dana Greene, who was first lieutenant of the "Monitor" when she fought the "Merrimac," and who was in charge of her during almost the entire engagement, owing to the accident to Commander Worden. His grandfather, General George S. Greene, is the oldest living graduate of West Point, and his uncle, Major-General Francis Vinton Greene, U. S. V., is in command of the Seventy-first Regiment New York Volunteers.

The officers of the First Regiment of United States Volunteer Engineers gave a dinner on Dec. 8, at Sherry's, New York, in honor of their colonel, Eugene Griffin. Most of the officers of the volunteer regiment were present. Lieut.-Col. Hodges acted as toastmaster, and with a few well-chosen words presented Col. Griffin with a handsome silver loving cup from the officers of the regiment. In acknowledging the souvenir, Col. Griffin reviewed the work of organizing and equipping the regiment, and mentioned the efficient services performed by the engineers in Porto Rico. The latter work included a detailed topographical survey of the main highway of the sea through Ponce to Aibonito; a survey of the Aibonito Pass, showing the locations of the Spanish batteries and entrenchments; a detailed hydrographical survey of the harbors of Ponce and Guanica; a rebuilding of several fine masonry bridges, and the building of a dock and commissary storehouses. An ice and refrigerating plant, a reservoir and a fort were also erected by the regiment. Following Col. Griffin's speech, a number of other addresses were made, and steps were taken looking to a permanent organization of the officers of the engineer regiment.

Important Changes in the General Electric Company

W. J. Clark, of the General Electric Company, has accepted the position of general manager of the company's foreign department, with headquarters in New York.

In the reorganization of the foreign department, D. Mazanet, who, for five years, has held the general managership, and who has piloted it from its small beginning to its present position as one of the foremost departments of the company, becomes managing director of the Mexican General Electric Company, with headquarters in the City of Mexico.

In view of the importance which our recent foreign acquisitions and our improved relations with foreign countries, will give to our commerce, especially in the field of electrical development, the scope of the foreign department will necessarily be greatly widened, and this department will undoubtedly become the foremost in the company. It will have charge of commercial relations between the General Electric Company and all countries outside the United States.

Mr. Clark's wide experience in foreign commercial matters peculiarly fits him for his new position. He has traveled through

Europe, as well as in the countries south of us, and his familiarity with foreign methods and manners will stand him in good stead. His book, "Commercial Cuba," recently published, is already generally acknowledged to be the standard authority on Cuban commercial affairs. He will be greatly missed from the railway department, in the management of which he made a unique record, and his hosts of friends in the American street railway field will regret to hear that he is no longer to be in active charge of the home business.

Americanizing a Railway in Porto Rico

The incorporation in Albany on Dec. 27 of the San Juan & Rio Piedras Railroad Company, with a capital of $300,000, brings to a focus an interesting enterprise which has been carried out by a syndicate organized by the well-known engineering firm of J. G. White & Company, to obtain a foothold in the transportation industry of Porto Rico. Some months ago Mr. Young, an engineer connected with this firm, was sent to Porto Rico on a tour of investigation, and found a valuable railroad property, seven miles in length, connecting San Juan with a rich residential district, practically the only one in the city. An option was secured by Mr. Young, and the property was shortly after purchased by the White syndicate.

This road was formerly owned by Mr. Pablo Ubarri, a Spaniard, resident in San Juan, and was originally built as a steam road in 1880. The line extends from a point near the center of San Juan, to a distance of seven miles through the suburban territory of Puerte de Tierra and the residential suburbs of San Tource, Martin Peña, and Rio Piedras. The entire Rio Piedras district has about 12,000 inhabitants, but the town proper has about 3000, and contains the Governor's summer palace. The railroad, as constructed, runs along the side of the main military road, extending from San Juan to Ponce, but is separated from it by well-defined embankments, and is upon its own right-of way, so that practically any desired speed can be made without difficulty. The present gage is about 30 ins., and many of the ties that have been down for eighteen years are still in good preservation, being of the native hard woods of the country.

The new company proposes to widen the gage of the road, to electrify the same in the best possible manner, and also to extend the road by a loop around the principal plaza in San Juan, and when the new work is completed and modern cars are operated at frequent intervals it is expected that the line will be largely patronized. The company also has in view still further extensions and improvements, which make this railroad a most important one for San Juan and the island of Porto Rico. It likewise contemplates furnishing electric lights along the line of the road.

This steam road was purchased and taken over on Nov. 26, 1898, and has been operated by Messrs. J. G. White & Company, who are, as before stated, managers of the syndicate which secured and are promoting the enterprise. The incorporators of the new company are George H. Walbridge, Fernando G. Echeverria, H. H. Harrison, Edward Schmidt, Lathrop R. Bacon, F. Kingsbury Curtis, Philip H. McMillan, Augustus N. Hand and William B. Parsons, of New York City.

Consolidation Negotiations in Several Cities

Early in December a syndicate, headed by Alexander Brown & Sons, prominent bankers of Baltimore, and said to include the powerful New York and Philadelphia capital interested in the street railways of those two cities, made an offer to purchase the $3,500,000 capital stock of the Baltimore City Passenger Railway Company at a price of $90 per share, the shares being $25 par value. Acceptance of this offer was recommended to the stockholders by the president and directors of the Baltimore City Passenger Railway Company, and there is no doubt of the stockholders' decision. As a result of this purchase there are now two large competitive street railway systems in Baltimore—the Baltimore & Northern and the Baltimore Consolidated. The former owns about 135 miles of track and the latter 207 miles. There are now outstanding $9,172,000 of the capital stock of the Baltimore Consolidated Railway and $10,550,000 of its bonds, while of the Baltimore & Northern system there are $4,700,000 in outstanding bonds and $1,400,000 in outstanding stock, exclusive of the $3,500,000 of Baltimore City Passenger stock now purchased for the sum of $12,600,000.

About ten days after the above purchase was made it was officially announced that an agreement had been reached between the Baltimore Consolidated and the Baltimore & Northern companies for a general consolidation of the entire street railway system of Baltimore, but shortly after this a disagreement taking place before the final merger of interests, the consolidation was not effected.

The Brown Syndicate is known to include Harry Parr and G. R. Webb, of Baltimore, and Sidney Wright, of Philadelphia, while the Elkins-Widener-Dolan interests are believed to be also associated with Mr. Brown.

Another important street railway purchase, amounting probably to eventual consolidation, has taken place in St. Louis during the past month. It will be remembered that last summer a new company, the Central Traction Company, obtained a franchise to build about eighty miles of track in St. Louis. This franchise was passed by the Municipal Assembly, was vetoed by the Mayor, and was passed over his veto. It was extremely valuable, as it gave the new company the right to lease the tracks of any other street railway, and, in effect, to bring about a consolidation. It soon developed that the parties behind this new company were the Elkins-Widener syndicate, of Philadelphia, and Sellers McKee, of Pittsburgh.

On Dec. 7, the National Railway Company, of Chicago, which owns seven street railway properties in St. Louis, sold and transferred those properties to local capitalists, Messrs. Spencer & Orthwein, who had previously, about two years before, purchased the Southern Electric Railway property. Up to the present time it is not known whether these two gentlemen bought the stock for themselves or bought it on account of Eastern capitalists, but it is significant that at almost the same time, Messrs. Brown Brothers, of New York, who are closely associated with the Elkins-Widener syndicate, purchased or secured an option on the stock of the Lindell Railway Company, the general understanding in St. Louis being that the road has been sold. It is believed that the Eastern syndicate now controls every street railway in St. Louis except the Union Depot line, and that there is simply a question of price in negotiations for the latter.

In connection with these attempts at street railway consolidation there appear to be movements on foot in New York City, Brooklyn, Philadelphia, Baltimore, Pittsburgh, St. Louis and Chicago, to effect general consolidations of electric lighting, gas and street railway properties with a view to introducing economies in management, to utilize the waste products to better advantage, and to operate power stations with more economical load factors. It is now known, for example, that the New York Light, Heat & Power Company, recently organized, with a capitalization of $25,000,000, has been, and will be, closely associated in interest with the Metropolitan Street Railway Co. It has purchased the Empire Conduit Company, which has the monopoly of high-tension underground conduit system in the northern part of Manhattan Island, and the Mt. Morris Electric Light Company, and the surplus power of the new 70,000-h.p. station which the Metropolitan Company is building will be used for lighting purposes, together with many of the ducts now being laid in such quantities on the company's north and south railway lines.

Electric Equipment in Silesia, Germany

The Electricitats Gesellschaft Felix Singer & Co., Aktiengesellschaft, of Berlin, has recently received a contract from the Ober Schlesischedampf Strassenbahn-Gesellschaft for twenty electric motor cars with eighty motors for a gage of 785 mm. These will be used on some future extensions of this railway. This order makes a total of 208 motors which the Ober Schlesischedampf Strassenbahn-Gesellschaft has purchased from Felix Singer & Co.

Calendars for 1899

The coming of the new year has brought the usual number of calendars, but of a greater variety and more attractive than ever before. The number issued is extremely numerous, but some which have been already received deserve special notice. The most elaborate calendar this year is, without doubt, that issued by the Falk Manufacturing Company. This is a collection of six beautiful reproductions of well-known paintings, each accompanied by a calendar for two months. With this is a short story of each of the pictures by Prof. H. Ward Rhodes, Museum of Fine Arts, Washington University. The pictures are printed with a tint on heavy cardboard, and are extremely tasteful. The Okonite Company has also recently published an attractive calendar bearing handsome colored pictures. A beautiful calendar has also been issued by the American Electrical Works, of Providence, R. I., and others are being received with each mail.

Trolley Wheel for High Speed Roads

A trolley wheel especially designed for high speed roads, but also adapted for any kind of trolley road, has been put on the market by the Star Brass Works, of Kalamazoo, Mich., and is known as the Kalamazoo wheel. The peculiar feature of the wheel is that it will lubricate itself and is soft enough not to injure the overhead work. The hub is cast hollow and is filled with oil, which lubricates the bushings. All the long distance lines running out of Detroit are using this wheel. This service is a severe one, as a car is run from 30 to 40 miles an hour for long distances. The metal in the wheel is treated for electrical purposes by a method owned and controlled by the Star Brass Works, and gives, it is claimed, excellent results and entire proof against sleet. The wheel is supplied in a harp of special design, so made that the harp will not catch on anything in case the trolley leaves the wire.

Contracts Awarded by the Third Ave. Railroad Co.

A description was published in the last issue of the STREET RAILWAY JOURNAL as to the plans of the Third Avenue Railroad Company, of New York, for electrical equipment, and mention was made of a number of contracts. During December a number of other contracts were awarded by the company, including that for the steam plant and electrical apparatus. Bids were submitted by the different electric companies on specifications drawn up by Dr. Louis Duncan, consulting engineer of the company, and the contract was given to the Westinghouse Electric & Manufacturing Company, who will furnish all the electrical apparatus from its own shops; the Westinghouse Machine Company will furnish the engines, while the Westinghouse, Church, Kerr & Co. will execute contract for the construction of the entire steam plant. The total contract amounts to about $5,000,000, more than half of which is for the steam plant, and this does not include the building or the substructure on which it stands. Westinghouse, Church, Kerr & Co. are the engineers and architects for the building and furnished complete plans and specifications by which the contract will be let.

The power station for supplying current to all the lines of the Third Avenue Company, which comprise over 100 miles of track, will be on the Harlem River, between 216th Street, Ninth Avenue and 218th Street, and the distribution will be made at high tension to substations located in different parts of the city. The power house will be approximately 320 ft. long and 250 ft. wide, and will contain sixteen 3000 kw. alternating current generators, which will be driven by engines having a mechanical rating of about 4000 h.p., but a maximum capacity of at least 50 per cent over this. Thus the station will have a nominal rating of 64,000 h.p. and a maximum capacity of about 100,000 h.p., and is undoubtedly the largest station ever projected. The engines will stand in double rows in the engine room, 320 ft. long.

The boiler house will stand parallel to the engine house and will contain a double row of Babcock & Wilcox boilers in two decks. These boilers, if set in continuous battery, would be about 1000 ft. long. Coal will be received from an enormous coalbin overhead, from which the fuel will chute to the Roney stokers, with which the boilers will be equipped, and the ashes will be drawn from the hoppers under the boilers. The boiler plant will be generously supplied with economizers and the draft will be handled by a combination of natural and mechanical draft on a system more complete than has ever yet been installed, and involving the use of four tall stacks. The condensing apparatus will be so arranged that the engines will be served in sections, with special provisions for handling this part of the service with greater economy and reliability. The method of piping is most complete, and with numerous provisions for all contingencies.

Aside from the sixteen large generators, there will be much other electrical apparatus in the power station, including an enormous switchboard about 200 ft. long, exciting apparatus with separate switchboards, rotary transformers, not including the various substations throughout the city, all the apparatus for which will be furnished by the Westinghouse Electric & Manufacturing Company. In addition to the power station and substation apparatus, all the car equipment will also be supplied by the Westinghouse Company.

Spring Liner for Track Rails

The wisdom of employing a spring liner for track rails to relieve the anvil effect noted in rigid roadbed construction is already apparent in the new track construction of the Third Avenue (New York) Railway Company. The new construction, which was illustrated and described in the December issue of the STREET RAILWAY JOURNAL, has been completed from 124th Street as far south as Seventy-fourth Stret, and the striking contrast in the effect upon the car and rail is instantly noticed by the most unobserving passenger as the car passes from the old to the new section. The rumbling and bumping sound is eliminated and the cars ride with a most agreeable motion, as if one were floating in a boat on the surface of placid water. The result in the life of the rail will be watched with a great deal of interest, as the old rail, which was a 7-in. grooved girder, has been so hammered out as to be unfit for legitimate service, and this after a life of less than five years.

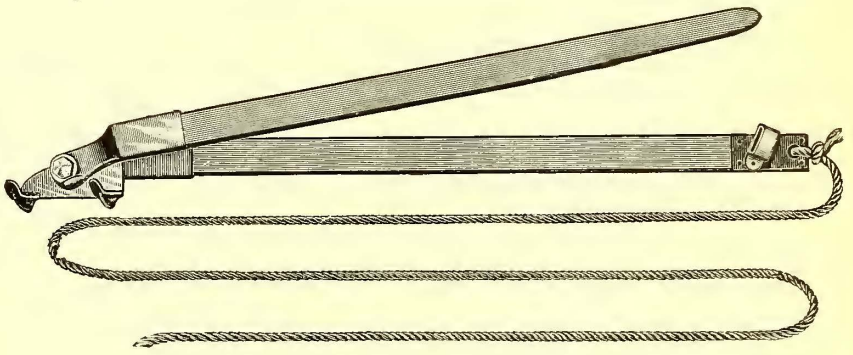
Railway Building Near Detroit

Of the many roads which go to make up the chain of interurban systems around Detroit a considerable number were constructed by the International Construction Company of that city, who certainly can feel a just pride in their record in Detroit. During the year 1898 this company contracted for the complete construction and equipment of the Detroit, Lake Shore & Mt. Clemens Railway, Detroit & River St. Clair Railway, Detroit, Plymouth & Northville Railway and the Mt. Clemens & Lake Side Traction Company. All these lines are in actual operation, or soon will be, and their aggregate length is over 80 miles. The companies were also largely financed by the International Construction Company.

The International Construction Company was also contractor for the Mill Creek Valley Street Railroad from Cincinnati to Hamilton, Ohio, and for the year 1899 has a large amount of work on hand, not only in the city of Detroit, but over the entire country. The company's offices occupy five large rooms in the Chamber of Commerce, and its drafting and engineering departments occupy three more rooms.

Trolley Wire Emergency Clamp

The accompanying engraving shows an emergency clamp or pickup manufactured by the Western Electrical Supply Company, of St. Louis, and used to handle broken trolley or other live wires. The handles are made of hard wood, which gives perfect insulation. Attached to the handle of this device is a piece of rope about 20 ft. long, which enables the conductor of the car to replace broken wire where it will be harmless until the linemen can place it in its proper position. For this purpose one of these clamps should be carried on each car.



TROLLEY WIRE EMERGENCY CLAMP

Line Material

L. A. Chase & Co., of Boston, will hereafter control the sale of "Pawtucket" line material. This material has a high reputation and is the standard on many roads. Notwithstanding the high grade of this material, Chase & Co. claim to be able to market it at prices generally obtained for the cheapest grades. This is due to the unsurpassed facilities for manufacturing this material.

The Electrical Exhibition Company has, at a meeting held Dec. 7, decided to conduct another electrical exhibition at Madison Square Garden during the month of May, under the auspices of and in connection with the twenty-second annual convention of the National Electric Light Association.

Switchboard Instruments for Street Railway Generator Panels

The selection of indicating instruments for the generator panels of a street railway switchboard is a matter of as great, if not greater, importance than the selection of the instruments for the feeder panels. The latter subject was discussed in the November issue, and much that was said in connection with feeder ammeters applies equally well to generator or summation ammeters. The principle employed in both cases is the same, the major difference being that of range, since one generator frequently supplies many feeders.

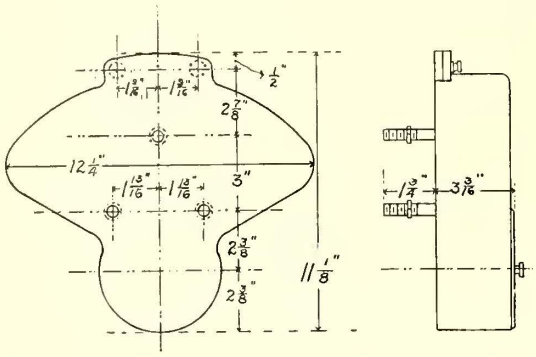


DIAGRAM OF VOLTMETER

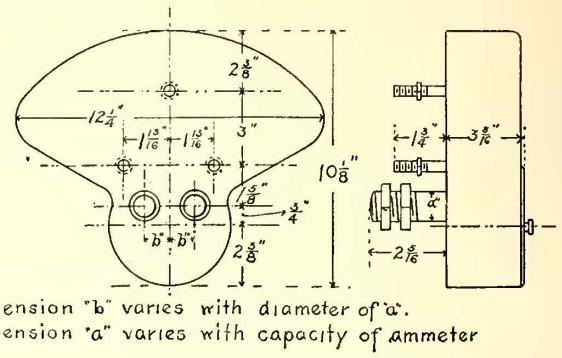
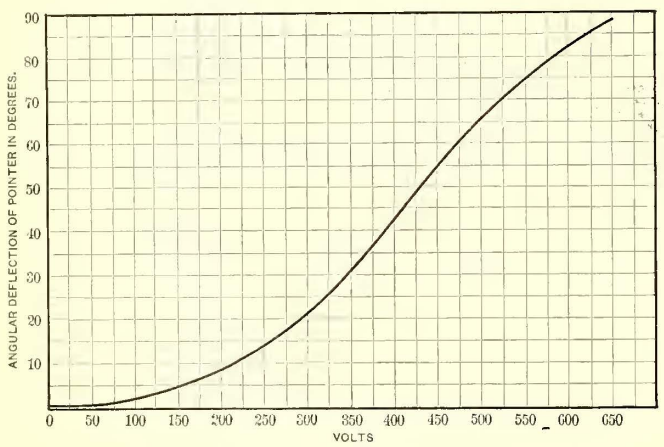


DIAGRAM OF AMMETER

On the generator panel, however, it is the voltmeter, rather than the ammeter, which occupies the position of prime importance. The voltmeter indicates the potential of the generator, and, by proper deductions for line drop, the potential at the terminals of the car motors. Since street railway systems are invariably operated on the constant potential system and any abnormal variation of potential is followed by more or less serious trouble, it is important that the generator voltmeter should be accurate, durable and dead-beat, and if it lack any of these attributes it is not adapted for railway use.

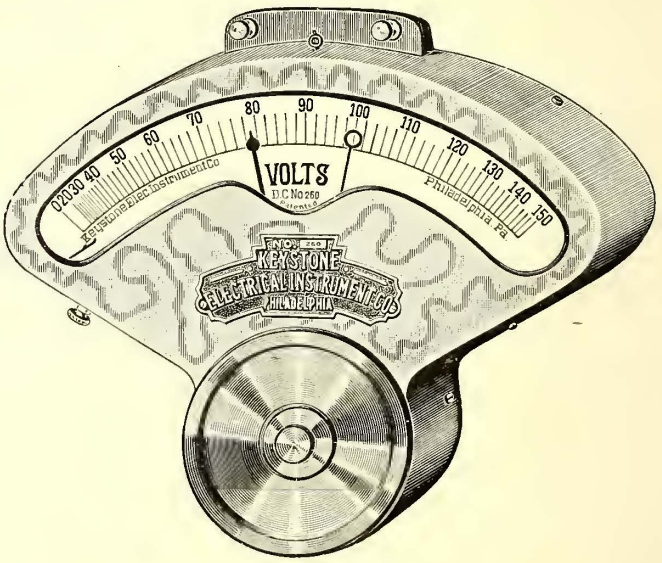
To meet these requirements the Keystone Electrical Instrument Company, of Philadelphia, placed on the market, some years ago, a line of instruments designated by them as its Type "K." The engravings presented herewith show the external appearance of this type of instrument and, diagrammatically, its dimensions. As may be noted, the case is of graceful design and the scale long, with clearly marked and open divisions around the normal working point. The scale shown is that of an instrument reading to 150 volts, but if each scale division is multiplied by 4 it will represent its appearance when calibrated for a maximum potential of 600 volts. The finish of the case is brass, grained and lacquered by hand.



CALIBRATION CURVE OF VOLTMETER

The system employed in the voltmeter is electro-magnetic, a system concerning which much has been written pro and con, but which has survived all attacks made upon it, and to-day is recognized as the one which, if scientifically designed and properly constructed, meets the exacting requirements of modern engineering practice. The general principle of the voltmeter and the methods employed in its construction and calibration, follow the lines laid down previously for feeder ammeters. Careful provision is made to protect the instrument from the influence of external fields, and the design is such that variations of temperature produce no variations in indications. This latter point is accomplished by employing a special alloy wire in the instrument, the temperature coefficient of which is negligible, and, in addition, providing a generous area of cross section, so that there can be no perceptible heating in the windings of the instrument due to the flow of the very small actuating current.

Calibration is effected by comparison with a standard voltmeter which never leaves the laboratory, and this standard is kept in absolute check by the galvanometer, bridge and standard cell method, now so well known in laboratory practice. In alternating current work comparison is made with a standard voltmeter employing the dynamometer system, and the windings of the switchboard instrument under calibration is so carefully proportioned between inductive and non-inductive resistance that errors due to self-induction and capacity, under normal variations of frequency, are quite negligible. Absolute compensation for any variation of frequency may be obtained by the employment of an inductive shunt across the terminals of the actuating solenoid. This method is described in a patent recently issued to the Keystone Electrical Instrument Company, and provides for compensation between direct current and alternating current of any frequency.



VOLTMETER

One of the most important features in any indicating instrument is the curve of calibration, and attention is called to the curve shown herewith which was taken from a voltmeter now in use, calibrated for a total potential of 650 volts. From this curve, it will be noted that the lower portion of the scale is suppressed, and the calibrated portion, or working range, is from 100 to 650 volts. Values below 100 volts are never used in practice, and the suppression of this portion of the scale permits wider divisions around the normal working point. The curve is fair and follows accurately known laws with a total absence of irregularities. This last point is of prime importance, for an irregular calibration curve indicates arbitrary calibration and a system improperly designed or proportioned. Such a system is sure to give inaccurate results and to possess inherently objectionable features.

The calibration curve of any instrument can be found by removing the scale plate and finding the center, from which the arc of the circle forming the base of the division lines is described. Then by plotting the angular distance between the division lines, ex-

tended to the center, as ordinates with their coresponding values in volts as abscissae, the curve may be laid down.

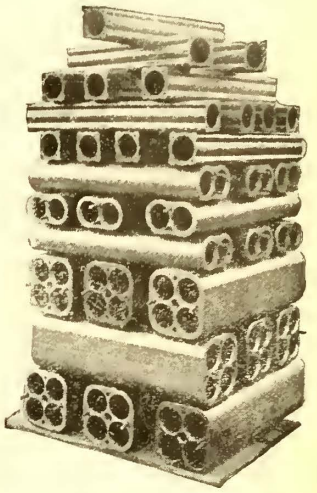
Generator ammeters and summation, or total output, ammeters may be constructed on either the series or shunt principle, depending on the current to be measured and the local conditions governing the construction of the switchboard. For alternating current of large volumes the series transformer presents many advantages. This series transformer consists of a primary of one turn, cut in on the bus-bar and clamped or bolted to it, and a secondary of a number of turns of finer wire. The ammeter is connected across the terminals of the secondary and receives a current of from 10 to 25 amps. with a drop of a small fraction of a volt. The total current in the secondary circuit of the transformer is so proportioned to the current in the primary circuit that the effects of self-induction and capacity balance one another, there being sufficient current in all cases to provide ample force to properly actuate the ammeter system. The ratio of the current in the primary to that of the secondary in this series transformer must, however, be carefully determined under variations of load and variations of frequency, and these adjustments are always made by the instrument maker, then the ammeter can be calibrated in terms of the primary, or bus-bar, current.

Voltmeters for high tension alternating current should be placed in the secondary of a regular step-down trasformer, which accurately transforms the bus-bar potential to a working potential of from 100 to 120 volts. All voltmeter transformers should be carefully tested by the instrument maker to determine their exact ratio and their variation, if any, under varying frequency and varying primary potential.

It is now considered good practice in high potential alternating circuits, using two or three phase transmissions, to place an independent voltmeter in each leg in order to obviate the dangers and annoyances incident to switching such high potentials on one instrument by means of a voltmeter switch when reading the voltage of each leg.

Modern practice in electrical engineering demands of each piece of apparatus employed in an installation accuracy, efficiency and durability, and if these are of importance in the generating, transmitting and translating devices, they are of far greater importance in the measuring instruments employed to determine them. Great care should be exercised in the design and construction of measuring instruments, and an equal amount of care and thought should be given by the designer of the plant to the proper selection of this important part of his installation.

TERRA COTTA CONDUITS READY FOR SHIPMENT



ONE, TWO AND FOUR-DUCT CONDUITS

The Manufacture of Terra Cotta Conduits for Electric Wires

Terra cotta, or baked clay, is one of the most enduring substances known, as the clay tiles and tablets from the ruins of ancient temples testify, being found by recent explorations in a perfect state of preservation. It is interesting to note in this connection how the potter's art, the most ancient of all arts, is now contributing to the safe and successful use of electricity, the most recently developed of nature's forces.

It is not the province of this article to tell how all conduits of this character are produced, but only as found in the works of the Potomac Terra Cotta Company, which are located at Terra Cotta, four miles out from Washington, D. C., on the line of the Baltimore & Ohio Railway. The plant includes clay beds, whence the material is mined, an extensive building for housing the machinery, and drying floors and kilns for the burning and vitrifying. The surface of the region is abruptly rolling, and the clay deposits, which are seemingly inexhaustible, are found in irregular veins located from a few to several feet below the surface, appearing to have been thrown up from a lower level by some internal upheaval. The deposit is in streaks of red and white, the red predominating, and in process of mining nuggets of iron ore are frequently found, ranging from a few ounces in weight to several hundred pounds. The method of mining is simple, as it is only necessary to remove the layer of gravel and sand, which covers the clay, which is very hard and dry, so that it is readily broken from the face of the vein by means of heavy iron wedges. The material, which is in lumps of various sizes, is transported a short distance to the mill in tram-cars or carts, and is dumped directly into a hopper at the side of the building, which is located against a bank, so that the road is slightly above the basement floor. From the hopper the material falls directly into a grinding mill, which consists of an open trough, about 10 ft. long, in which revolves a horizontal shaft. The latter is provided with heavy radial knives placed spirally, which cut or pulverize the lumps into smaller grains, and discharge the material at one end after the manner of a spiral conveyor. From this the material falls upon a belt conveyor, by which it is elevated to the grinding mill, and as it passes along the conveyor an attendant picks out from the mass all lumps of iron or stone.

The grinding mill consists of a rapidly revolving cylinder with grooves cut lengthways in the surface, and reduces the material still finer. From this mill the material drops directly into a pair of chilled crushing rolls, which are spaced less than 1/16 in. apart, and serve to crush the material into a fine powder. From this machine a belt conveyor distributes the clay along the floor of the basement of the building, when it is moistened by means of a hose, and piled up against the side walls, where it is left from five to seven days, or until thoroughly soaked or "tempered," which is the term employed. The amount of moisture depends upon the character and size of the product to be moulded. For instance, the material for large sewer pipe sections is necessarily more plastic than for smaller pieces. When sufficiently tempered the clay is delivered to the pug mill, which consists of a steel cylinder 8 ft. in length and about 18 ins. in diameter, in which is a revolving shaft carrying, over most of its length, spiral knives, and near the end a beater, which is similar to the flukes of a propeller. This serves to force the clay through the cylinder, and as the material emerges, the mass is sliced up by means of revolving knives, which run parallel to the end of the cylinder; from this the clay is immediately taken up by a bucket conveyor, and lifted to the top or third floor of the building, where, by means of short belt conveyors, it is conveyed to the cylinders of the forcing presses.

There are two vertical presses in which the steam cylinder is placed directly above the cylinder which receives the plastic mass. Three piston rods convey the power from the steam cylinder to the head of the press; the steam cylinders in each press are about 3 ft. in diameter, and have a stroke of about 4 ft., and operate under a pressure of 120 lbs. The diameter of the forcing press is from 20 ins. to 30 ins., and the material is fed in at the side after the follower is lifted. Suitable dies are attached to the base of the forcing cylinder, depending upon the character of the product. For making the four-way ducts the four dies are attached to a suitable interior frame-work, and are each about 12 ins. in length, cone shaped to within 3 ins. of the lower end, for which distance they are uniform in diameter, either 3 ins. or 3¼ ins., depending upon the size of the duct required. There are also rods placed in the dies, which serve to form the cavities designed for the dowel pins, and also for the small central duct. The conduits are made in one, two and four-duct sections, and are usually about 30 ins. in length. The four-duct sections when burned weigh about 80 lbs.

Sewer pipe, of sizes, up to 30 ins., is forced in the same manner, the dies being rounded off on the inner surface, so that the material spreads out and emerges in a perfect ring, which is cut into any desired length. In the process of forcing the sewer sections or conduits, a balanced platform, carrying a square board, known as a "shod," is placed directly under the die, which descends by the weight of the section as fast as it emerges from the die. When of sufficient length it is cut off by means of a wire, when the section still standing on end is transported to the drying floor. The sewer sections are readily shifted about the floors by means of long-handled trucks with small wheels. These trucks have, at their outer extremity, in line with the handles, iron bars bent in such shape as to be readily slid under the base or shod on which the section rests. Cleats on the under side of the shod raise it sufficiently above the floor to allow the bars of the truck to be inserted, when, the handles being slightly pressed down, the section is lifted, and can be safely shifted about. Flat two-wheel trucks with handles are employed for handling the conduit sections. The two upper floors of the building, which is T shape, one wing being 200 ft. in length, and the other 100 ft., are employed for drying the sections. This process requires from four to six days, steam pipes being attached to the ceiling of both floors to provide a suitable drying temperature.

For turning the sewer sections in the process of drying a semi-circular frame of slats is provided with curved runners on one side, and iron bar extensions on the other. This is called a cradle, and by inserting the bars under the shods on which the section rests the whole is gently lifted and turned on the rockers, end for end. Just before it is placed in position an attendant removes the shod, and puts it at the other end when the section is slid against it, and is brought to an upright position. The operation is performed very rapidly.

As soon as the sections are ready for the kilns they are lowered to the ground floor by means of balanced elevators, with which each floor is served, and the weight of the material as it descends serves to raise the alternate platform, so no power is required for the operation. Three boilers, two of 50 h.p. and one of 125 h.p., provide the steam for the drying processes, also for driving a 100-h.p. Atlas engine, by means of which the grinding machines are operated.

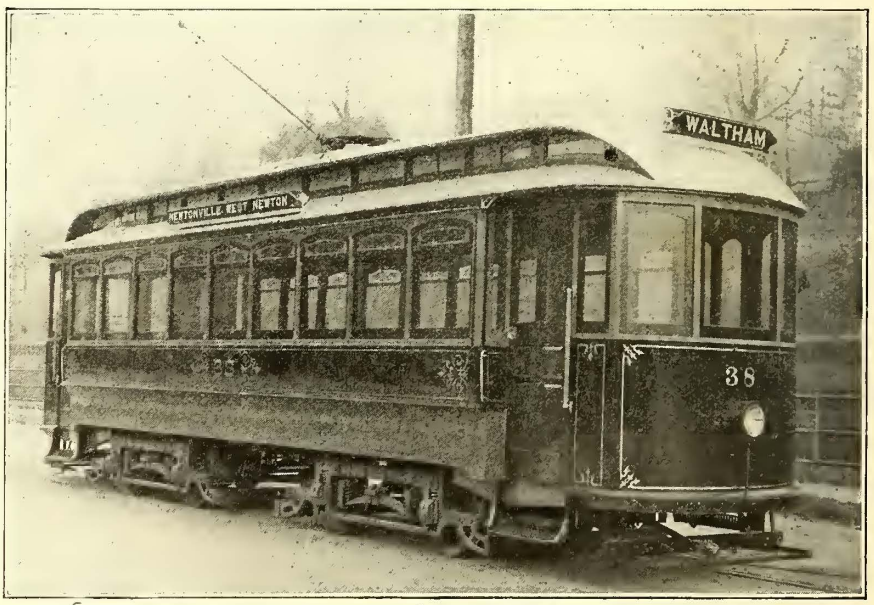
We are now ready to follow the sections of material to the kilns, of which there are twelve, and which are circular, some being 22 ft. in diameter, and others 26 ft., with two 30 ft. All are dome shaped, and bound about by hoops of steel plate 5 ins. in width. One of the newest, a 30-ft. kiln, has the dome finished in steps, and four hoops at the crown. It is built extra strong to support the expansive pressure of the dome, and, it is believed, will last for many years. In the process of setting the kilns the sections are transported from the dry house by means of trucks, or on the shoulders of the laborers, and are placed on end, with one section above another, until the whole interior is filled. The furnaces are placed at intervals in the outer rim of the kilns, and soft coal is burned in them. A double interior flame wall is provided about 6 ft. in height, between which and the outer wall the heat from the furnaces is delivered and passes to the dome, thence downward through the floor into the flues beneath, through which the smoke is conveyed to large chimneys, one of which answers for two kilns. The fire is started gradually and increased until the contents of the kilns are brought to a white heat, and continues from five to seven days, when the fires are removed. The furnace is then sealed up and the material is left for about the same length of time for gradual cooling. Just before the firing process is completed a cheap grade of salt is sprinkled into the furnaces, about a wheel-barrow load being required for a kiln. The fumes of the salt, uniting with the heated clay, serves to glaze the surface of the material inside and out, with the hard, impervious coating which is characteristic of this class of product.

The business of the Potomac Terra Cotta Company was established about twenty-five years ago, and until ten years ago the company was engaged in the manufacture of sewer pipe exclusively. This concern claims the distinction of having been the first terra cotta factory in this country to begin the manufacture of material for electric conduits, and filled its first conduit contract in 1887, the order being from the United States Electric Lighting Company, of Washington. One claim of superiority made by the manufacturers for their conduit which is known as the "Mason" is that of perfect vitrifaction, due to the use of a clay that vitrifies at a high temperature, rendering it non-absorbent, while it is indestructible by the elements when properly made. Another feature, and for which the company owns letters patent, is the provision of minor openings, designed for the reception of iron dowels in the ends, which secure perfect registration of the ducts in the process of laying. The dowels are about ½ in. diameter, and are provided on one side with a barb, which prevents a settling too far into the chambers designed for them. As the conduits are glazed inside, as well as out, little or no friction resistance is offered to the drawing in of the cables, and there is no chafing of the sheath. The conduits are thoroughly burned, have a dark chocolate color, and are unusually strong for this class of material. Being manufactured in standard lengths of 30 ins., they are easily handled, and not liable to breakage in handling or shipping. The affairs of the company are under the direction of George Mason, after whom the conduits are named.

A Handsome Vestibuled Car

The car shown in the accompanying illustration is, perhaps, one of the handsomest electric cars for regular service now in use on any road in New England. It is one of three which have just been built for the Newton Street Railway Company, of Newton, Mass., by the Laconia Car Company Works, of Boston.

The car is 25 ft. over end sills, and 35 ft. over bumpers. It is fitted with vestibules at each end, has reversible seats, and the windows are heavy plate glass, with double sash, similar to those on the finest steam cars. The interior of the car, including the vestibules, is finished in the choicest of mahogany panel work, with mahogany doors. There are eighteen reversible plush seats 32 ins. wide. The car is wired for twelve incandescent lights, and at each window post is a push-button for signaling the conductor. The car is mounted on Brill No. 27 trucks.



CAR FOR NEWTON, MASS.

A New Type of Surface Contact System

The Campbell Electric Traction Company, of Towanda, Pa., has recently put on the market a new type of surface contact system. In this system the conduit, which is about 6 ins. x 9 ins. in cross section, and air and water tight, rests on the top of the ties, and its upper surface is flush with that of the paving. The bottom and sides of the conduit may be of either wood or iron, as preferred. The top consists of 8 ft. metal sections, thoroughly insulated from the rest of the conduit and from each other. The interior of the conduit is hollow, and at the bottom on the inside lies a continuous rail, carrying the 550-volt current. Contact between this rail and the insulated sections on the surface of the street can only be made by a specially designed trolley or traveler that runs in the conduit, and is controlled in its movement by a pair of strong electro-magnets on the car. As the car moves along, the trolley on the inside of the conduit travels at the same rate, being always in position under the magnets at the center of the car. Consequently there can be no live section, except that over which the car is situated.

New Horizontal Engine, with Direct-Connected Generator

One of the latest designs of direct-connected units has been brought out by the B. F. Sturtevant Company, of Boston, Mass. This unit is unusually compact and neat, and has been built with special attention to the requirements of all conditions of service. The frame of the engine with the attached oil guard and removable side plates practically inclose the running parts, prevent the throwing of oil and decrease the annoyance from dust. The valve is of the balanced piston type, with snap rings, and operates in a removable bushing. The regulator, which is of the most delicate construction, secures the closest possible regulation through a range from zero to three-quarters cut-off. Continuous sight feeding arrangements are provided for all bearings. The engine is of the automatic horizontal center-crank type.

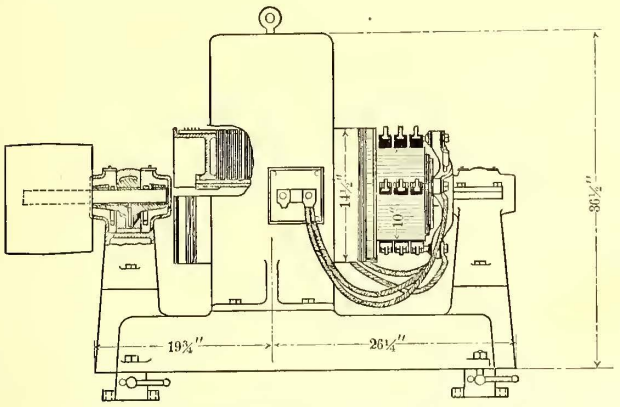


FIG. 3.—SIDE ELEVATION OF GENERATOR

The magnet frame of the generator is of cast steel, and the shaping of the pole pieces and proportioning of magnetic field and armature is such as to insure absolutely sparkless operation under all changes of load, from no load to 25 per cent overload. The temperature rise after a full load run of ten hours is guaranteed not to exceed 90 deg. Fahr. The bearings, which are ring oiling, are built upon the ball and socket principle.

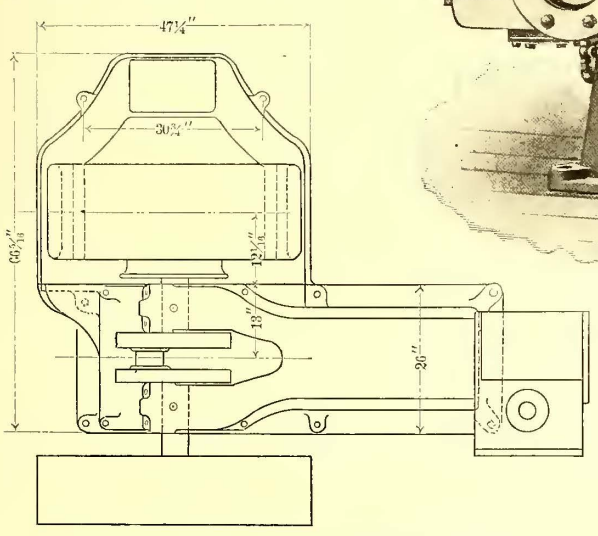


FIG. 2.—PLAN OF DIRECT CONNECTED UNIT

In Fig. 1 is shown the Sturtevant horizontal center-crank engine direct-connected to a four-pole generator. This unit is built with the engine cylinder of various sizes, ranging from 6 ins. x 8 ins. to 13 ins. x 12 ins. These are standard combinations, but any special combinations can be made to meet any requirements. Fig. 2 shows a plan view of a 11-in. x 10-in. horizontal engine connected to a 30-kw. generator. Fig. 3 shows the side elevation of the Sturtevant M P-4 generator. This unit is provided with a substantial bed, which serves to render the entire foundation extremely rigid.

The Thompson-Walker Surface Contact System

This system has been worked out by Prof. S. P. Thompson, the well-known writer on electrical subjects, in connection with Mr. Miles Walker, and upon invitation, an experimental line at Willesden was recently inspected by F. H. Fernie, representative of the STREET RAILWAY JOURNAL for Great Britain. The line is about 200 yards in length, and contains a sharp grade and curve. The electro-magnetic system is employed, as shown diagrammatically in Fig. 1, the magnets being excited by a piece of iron carried on the car. To understand the principle employed, some preliminary explanation is necessary.

If an iron plungeboard with extended ends like No. 2, in Fig. 2, is surrounded by a solenoid of wire carrying the current, it is possible to choose the size of the heads so that the tendency of the plunger to assume a central position is balanced by the attraction of the solenoid on the iron heads. With properly chosen heads the solenoid exerts no force whatever on the plunger. Gravity being the only force upon it, it will, of course, take up the position shown. If now a piece of iron is placed over it, as shown in No. 3, the plunger may be raised by the attraction between the two. In case a very heavy plunger is used it is possible to support part of its weight by merely increasing the size of the lower head by a small amount. It is thus possible to construct a simple piece of mechanism whose movement is entirely dependent upon the presence of a mass of iron in its neighborhood, and which cannot be moved by the solenoid itself, even though the magnetizing current carries the iron up to the saturation limit. This has been converted into the operating part of the switch.

Though the force of attraction is sufficient to lift a fairly heavy plunger and operate a switch, it is desirable to have something more than this, i. e., a switch which will, notwithstanding its massive moving parts, close in an exceedingly short space of time, as well as a very great acceleration upon the moving parts during the first part of their motion. This is obtained by the inventors by merely separating the upper head from the plunger by a short air-gap, and arranging matters so that the mass of iron comes over the switch before current is put through the magnetizing coil. As soon as current passes, the attraction upon the head is so great that the plunger gets up a high velocity before the two come together, with the result that the switch operates as though it had been hit with a hammer. A very simple device, a mere film of oil acting as a cushion, can be employed to prevent the switch from being injured by the concussion.

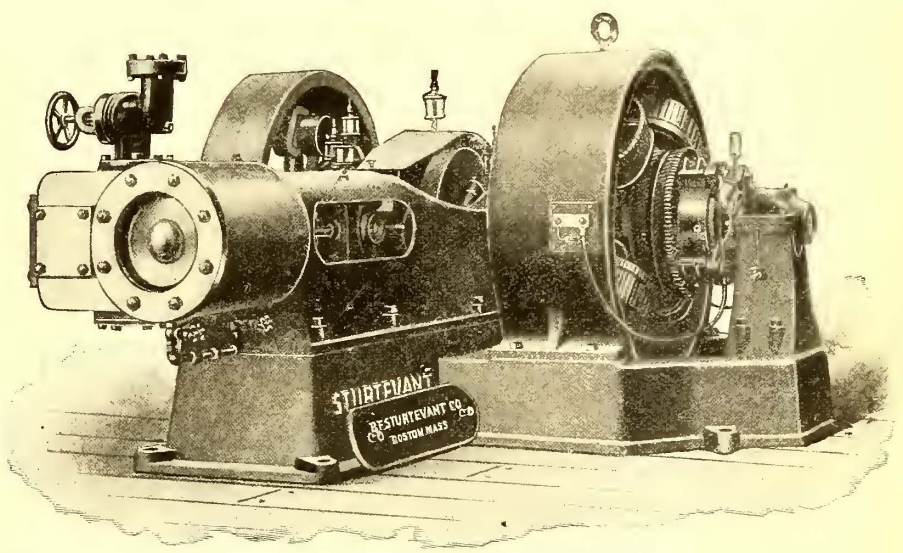


FIG. 1.—DIRECT CONNECTED UNIT

The connection of this operating part to the contact points of the switch has been the subject of some very varied experiments. If the safety of the street passengers could be made dependent upon nothing else than the falling of the plunger when the mass of iron is removed, it was thought by the inventors that as great perfection would be attained as could be hoped for from any moving mechanism. The attachment of any gear at once introduces the risk of friction and the simplicity of the issue is destroyed. For that reason, as well as for cheapness and convenience, the method shown in Fig. 3 was decided upon, though there are some simpler modifications of it still under experiment. The diagram, which is intended to illustrate the principle only, shows, in the first place, the cast-iron box which is laid in the street. This is surrounded by a gunmetal stud *S*, faced with a phosphor--bronze wearing cap.

This stud is insulated from the iron box by a sheet of micanite. A non-porous road material is placed around the stud to make up the level.

The box is filled with oil, which besides performing the function presently to be considered, maintains very high insulation throughout. The switch is attached to the stud and comes away with it in one piece. Being only about 4 ins. in diameter no difficulty is found in making a perfectly watertight joint.

The next point to consider is the method of making electrical contact. The requirements of switchpoints for disconnecting sur-

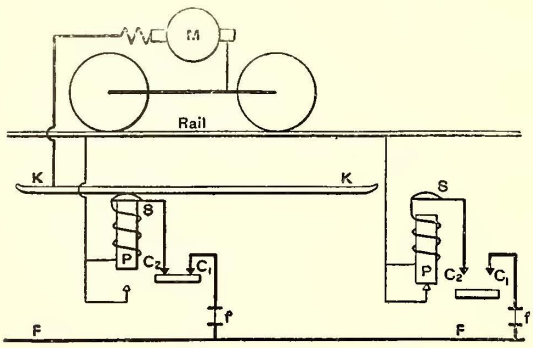


FIG. 1.—DIAGRAM OF CIRCUITS

face-studs are given by the inventors as follows: When closed the contacts should be of low resistance and capable of carrying 100 amperes easily. They should be incapable of fusing or sticking in any way, and should require only a small force to operate them. They should retain their shape and efficiency unimpaired for a long time without requiring attention. It will be observed that the current through the stud ceases as soon as the skate parts company with the stud as the car moves forward. Hence in the operation of the car as the switch-plunger falls it does not have to break the main current, that having already ceased. Yet although the switches are not required in the ordinary course to break a large current, it is desirable that they should be able in case of accident to do so without injury. After experimenting with different forms of contact it was found that nothing fulfils these requirements so completely as a properly designed mercury contact. Mercury contacts are, therefore, used throughout these switches.

The yoke of copper which dips into the mercury is supported by a brass tube which floats in the oil and fits loosely into a fixed brass tube which acts as a guide. When the plunger rises it takes the oil from under the float, which accordingly falls and connection is made. When the plunger falls the float rises. As the plunger moves quickly the oil has not time to leak past the sides, notwithstanding the very loose fit of the parts and the force upon the yoke piece is very great. At the same time a long movement is obtained.

To operate the switch contacts requires a fraction of an ounce. The forces which operate on the moving plunger (which slides freely in a brass tube in oil) are over 80 lbs. at the commencement of the stroke, and are several pounds at the end. The sliding plunger itself weighs 3 pounds. There is, therefore, a margin of safety of many hundred per cent. As the car passes on, there is a breaking of the magnetic and also of the electric circuit, adding to the security. There is yet a third line of defense to the public in that the switch is actually earthed, if when the car passes on the switch fails to open; for then the plunger earths the switch. In that event the fuse would be blown, effectually protecting the public from the possibility of a stud being left alive in the roadway.

It will be seen from Fig. 3 that three cups are employed; the two outer being connected to the main and the stud respectively. The main cup is inclosed in a metal sheath (not shown) permanently connected to earth, so that it is impossible for current to reach the stud except when the yoke is down. It will be seen from Fig. 3 that when the plunger is down it earths the center cup, so that if from any accident whatever the yoke piece fails to open the switch after a car has gone past, the plunger puts the stud to earth and blows the fuse between it and the main. Either shunt or series coils may be used to connect up the switch boxes. In practice a shunt coil is preferred because the slightly increased expense is more than compensated for by the smallness of the bulk. Only one skate is employed, and this is in the center of the car. This gives much greater facility in going round curves than where two skates and two rows of studs are necessary.

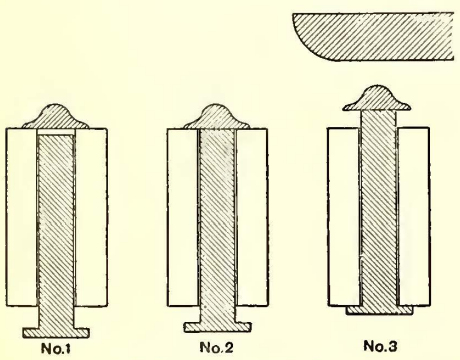


FIG. 2.—PLUNGERS

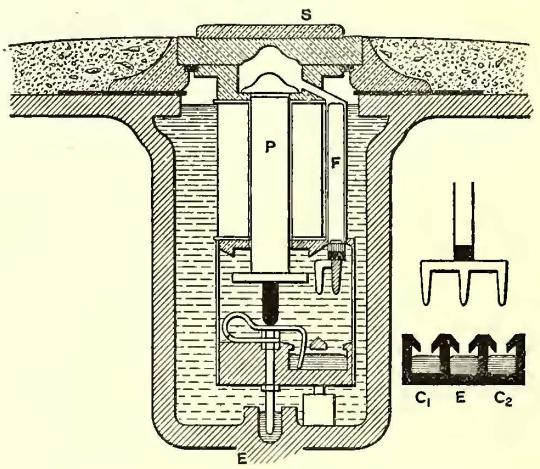


FIG. 3.—SECTION OF CONTACT BOX

New Electric Railway in Virginia

Contracts for the construction of the Norfolk & Atlantic Terminal Railroad, which is to run from Norfolk to Sewell's Point, Va., have recently been let to the Tennis Construction Company, Stephen Gerard Building, Philadelphia. The road will be operated by the overhead electric system and contracts for the material required have been awarded as follows: Hamilton Corliss Engine Company, Hamilton, Ohio, engines; E. Keeler, Williamsport, Pa., boilers; Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., generators, motors, etc.: H. W. Johns Manufacturing Company, New York City, overhead equipment; Maryland Steel Company, Sparrows' Point, Md., steel rails.

Telephones for Street Railway Service

The advantages of a private telephone exchange for connecting the different departments or offices of large corporations are so obvious that the demand for these exchanges has greatly increased within the past few months. To meet this call the Viaduct Manufacturing Company, of Baltimore, Md., is manufacturing a full line of telephones and accessories for private exchanges, and special care has been given to the designing of telephone instruments for the use of street railway companies. These instruments operate independently of a central exchange. They are made in two patterns; one, which is shown in Fig. 1, is a desk telephone with a switch located in the base, and the other, Fig. 2, is a wall telephone, with a switch in the face of the case. By means of the switches calls are made to any of the other instruments on the system. The calls may be received with the switch on any point, but in order to talk with the new call it is necessary to place the switch upon the home stud. The use of these instruments avoids the necessity of a switchboard and attendant.

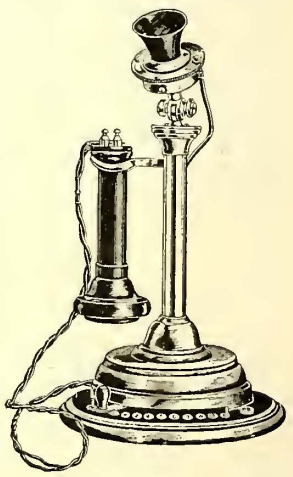


FIG. 1.—DESK TELEPHONE

This company also makes a portable telephone outfit designed for the use of the street railway conductors, who are required to report to the starter at the station from any point on the road. For using these instruments when no special provision has been made, contact is made by throwing the wire over the telephone line wire and making a ground connection, but where a metallic circuit is employed, contact is made with both limbs of the service. Where there is much telephoning to be done it is better to provide cut-outs at intervals on the trolley poles along the line, so that the plugs of the telephone instrument can be attached directly to the circuit. The portable outfit consists of a generator ringer, a re-

ceiver of hard rubber, the transmitter and two-cell dry battery. This is all inclosed in a neat case and provided with a strap for carrying. The outfit weighs only about 9 lbs.

Another specialty manufactured by the Viaduct Manufacturing Company for the use of electric railways is an alarm or signal for use in outlying districts. This instrument is fitted with a large vibrating gong, and is intended to be attached to a trolley pole. In this way the starter can signal the conductor of a passing car should he wish to communicate with him while on his trip. This signal can be used in connection with either a stationary telephone at the same pole to which the gong is attached, or else the conductors can be supplied with a portable outfit.

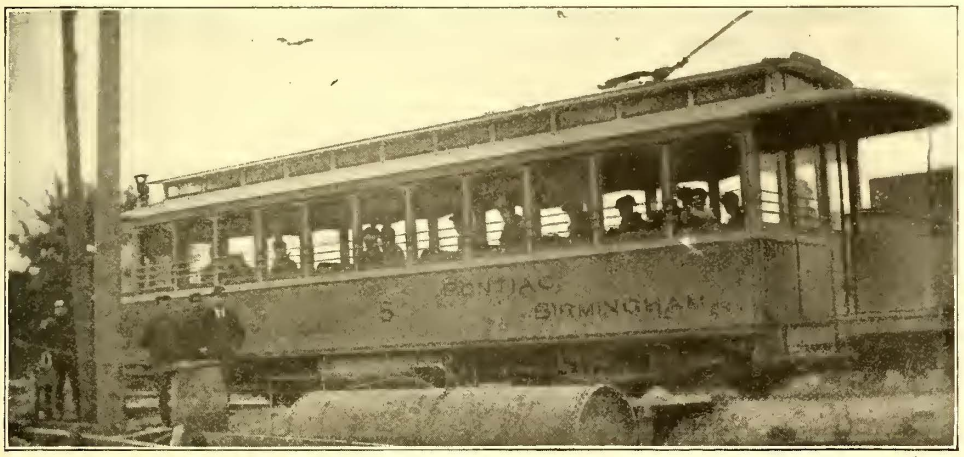
Storage Air Brake System

A new type of air brake has been in use for some time on the Detroit & Pontiac Railway, as mentioned elsewhere in this issue, and is giving excellent satisfaction there. It is placed on the market by the G. P. Magann Air Brake Company, of Detroit, Mich., and is illustrated in detail in the accompanying engravings. The system contains a number of novel features, one of which is that no compressing devices, either axle or motor driven, are carried on the car, but the air is compressed to the requisite pressure by means of a stationary steam driven compressor in the power station, and is then stored in reservoirs on the car for use. This, of course, reduces enormously the amount of apparatus required, and removes entirely the most complicated part of the air brake system to the station, where it can be directly under the supervision of the power house engineer. The chief claims made for this radical step are that it eliminates: first, any noise from the air-pump when the car is at rest; second, attention required to the pump and its motor, either on the road or in the car house; third, possibility of breakdown; fourth, greater amount of apparatus, and, fifth, the loss of valuable space in the car.

As in use on the Pontiac line, the air is first compressed at the power station to 225 lbs. per square inch by means of a Laidlaw-Dunn-Gordon reciprocating air pump located near the boilers and driven directly by steam pressure, and is stored in a large reservoir, from which it is piped to an adjustable coupling near the track. Each car carries two storage cylinders made of riveted sheet steel and tested under hydraulic pressure to double their working pressure. These cylinders have a capacity aggregating about 36 cu. ft. and are stored to 225 lbs. The time required for making connections, charging and breaking connections, is less than half a minute, and is done while the conductor is obliged to enter the office of the company at that point and make his usual report. The storage tanks on the car are piped through a reducing valve to a small reservoir which carries 40-lb. pressure, which is the working pressure. The usual connections are then made from this small reservoir to the jam cylinder through a 3-way controlling valve on the platform. The jam cylinder is of the differential type, air being admitted on both sides of the piston, which moves in two cylinders of different sizes. To stop the car the large-sized cylinder is exhausted, allowing the air pressure in the smaller cylinder to force the brake on. To release the brakes air is admitted to the large side forcing the brake off, making a positive release. This also allows the motorman to put on only the requisite braking pressure, any undue pressure being immediately relieved by air cushioning in the large cylinder. With 36 cu. ft. stored to an original pressure, 200 lbs., a large double truck interurban car on the Pontiac line ran six hours and twenty minutes, or a total of 96 miles, in a hilly region, and made 228 stops. When the car was run into the car house there was still enough air pressure to handle the brakes with ease, the gage showing 40 lbs.

The average reduction in pressure in the large cylinder for each stop is 0.8 lbs.

The equipment has been in constant use on the line mentioned for over nine months without requiring any repairs.



CHARGING AIR BRAKE RESERVOIRS—DETROIT

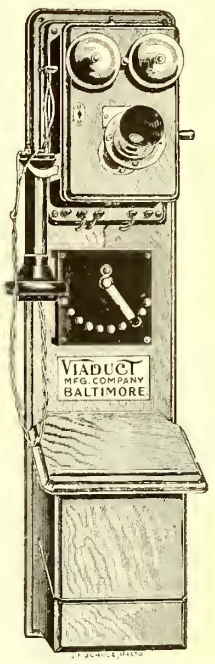


FIG. 2.—WALL TELEPHONE

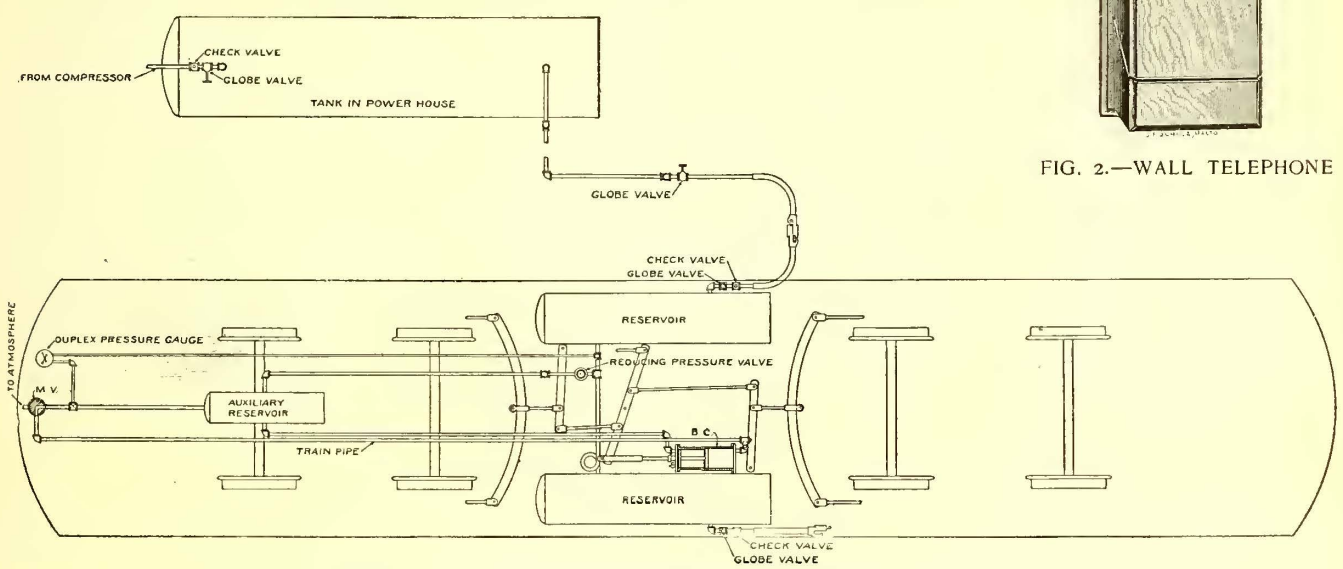


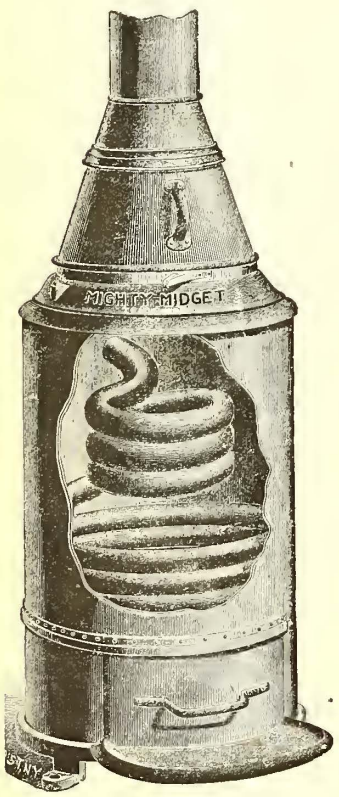
DIAGRAM OF AIR BRAKE EQUIPMENT FOR DOUBLE-TRUCK CARS

Hot Water Heaters for Electric Railways

The increasing use of long double-truck cars has brought the method of car heating by hot water for electric railway cars into considerable prominence. As mentioned elsewhere in this issue, the principal interurban railways in the vicinity of Detroit are employing for car heating an improved type of the Baker hot water heater, which has been so extensively employed in steam railroads for the last thirty years. The heater is made in a variety of sizes, that employed on the Detroit suburban cars being known as the "Mighty Midget." This type embodies all the features which have given these heaters their high reputation.

The generator coil forms a complete water cage for the fire, as the latter is entirely within it. This coil is seamless and is tested by high hydraulic pressure before installing. The pipe is 1¼ ins. in diameter and has a spiral length equivalent to 22 ft. 4 ins.

The water employed is saturated with salt to prevent freezing, and its course is first through the generating coil, thence upward into the water reservoir and expansion drum above the heater. It is thence downward through the radiating pipes which are run along the sides or under the seats of the car, then back to the generating coil. Salt is employed to keep the water from freezing, but it is found this does not exercise any deleterious effect on the inside of the pipes.



HEATER

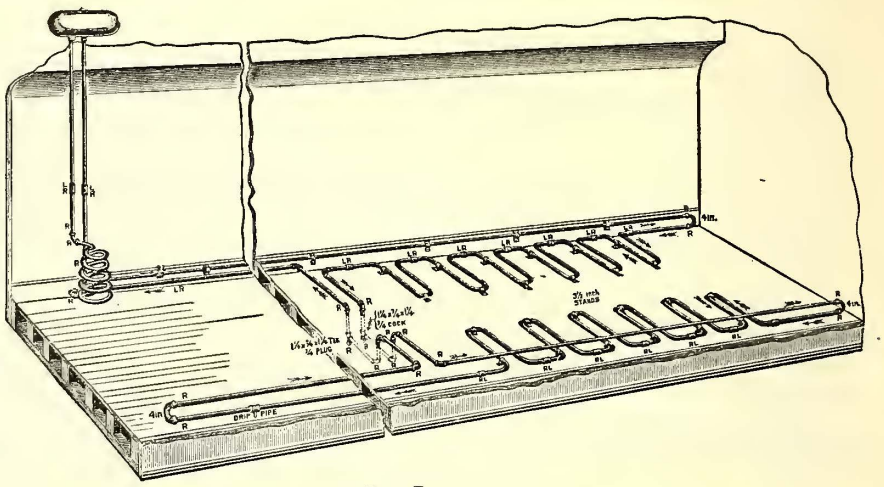
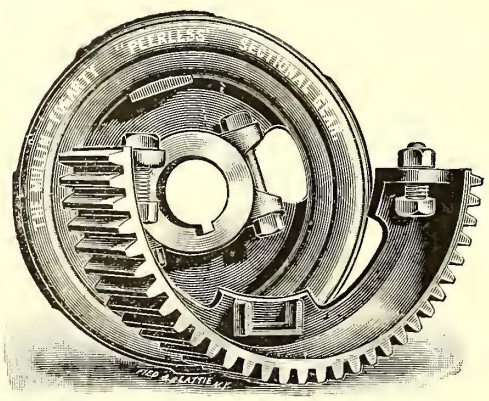
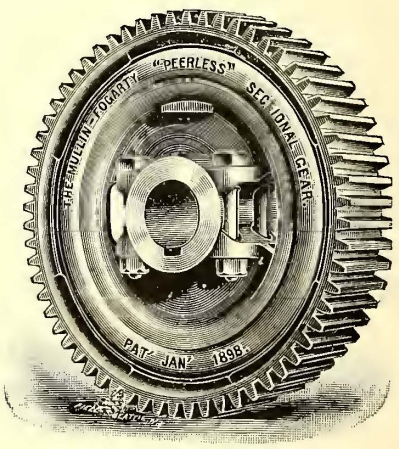


DIAGRAM OF PIPING



SECTIONAL GEAR WITH HUB AND RIM SEPARATED



SECTIONAL GEAR

Usually these heaters are placed in the front vestibule, and what little care is required by them is given by the motorman. The position of the heater on the car at this point does not take up any valuable space and serves to keep the vestibule warm. The diameter of this sized heater is 18½ ins., its height is 3½ ft., and its weight, boxed ready for shipping, is 520 lbs.

These heaters are giving splendid satisfaction in Detroit, Minneapolis, St. Paul, Milwaukee and other large cities where large cars are used, and seem adapted for electric car heating purposes, especially for long cars on interurban and suburban roads, such as exist in these cities and are becoming common in all sections of the country. These heaters are manufactured by William C. Baker, successor to the Baker Heating Company, New York.

The Electrical Installation Company, of Chicago, has been doing a large amount of construction work recently, notably in Kansas City, where it is changing the Broadway Cable line to electricity.

Sectional Gears

A new sectional gear, embodying a number of novel features, is shown in the accompanying illustrations. The invention consists of a cast-iron hub, or center-piece, to which are attached removable sections of any metal specified. These sections are interchangeable. When the hub, or center-piece, has been once keyed in place on the shaft it does not require any further attention, and when the teeth of the rim sections have become worn, these sections can be taken off and replaced by new ones in a few moments, thus making practically a new gear.

The hub piece and rim sections are beveled where they come in contact with each other in such a way as to make a perfect fit and prevent all lateral motion. To do away with the possibility of the rim revolving on the center-piece, a steel safety key is slipped in place between the rim and the hub, absolutely locking them. The advantages of an interchangeable construction of this kind will be evident to any one using gears, as it removes the necessity of taking off the entire gear as soon as a few of the teeth are worn out or broken. This construction also makes an extremely light wheel without, it is claimed, reducing the strength. One cut shows a complete gear with a solid hub, and the other, the hub and one section of the rim before being placed in position on the hub. These gears can be made of any shape and pitch with coiled discs for small sizes and with arms for larger sizes, if desired. They are manufactured by the Peerless Section Gear Company, of New York City.

The Worthington Water Tube Boiler

The Worthington boiler, which is illustrated herewith, has been used to considerable extent in electric light and other work, and has established a high reputation for compactness, accessibility and economy of fuel. The furnace extends under the entire boiler and is of proper height to permit the use of any kind of fuel. The tubes are lap-welded and each is straight. The circulation of the water, as will be seen, is upward in every tube with the exception of the two downtakes at each end of the boiler, which are not exposed to the gases. The course of the water is then, from the steam and water drum located above the tubes into which it is fed, through

the downtakes placed outside of the furnace to the mud drums at the base, thence by the tube connections into the lower series of headers, thence through the tubes over the fire through the upper series of headers, thence by the tube connections into the water and steam drum from whence it started.

As the tubes are short, their linear expansion and contraction are not perceptible and they can easily be cleaned. The headers are of steel or iron, according to the service required, and are arranged in the boiler close together, forming complete side walls. The furnace is lined with fire brick. The only other brick required, excepting in boilers of large units, consists of two foundation walls of proper depth, rising above the floor level about 12 ins.

From the fire the gases rise, percolating through the tubes, which are thus exposed directly to the action of the fire, and finally make their exit at the top on either side, as is most convenient.

The vertical space between the tubes is only about ⅜ in. No baffle plates are used, and, as the gases rise perpendicularly and without any sharp turn, the draft is good. It is estimated by the manufacturers that the boiler will run to its full capacity with about ⅛-in. draft, or about one-half that required by other boilers.

Another important feature of the boiler is the quality of the steam. As will be noticed from the design of the boiler, the circulation is excellent, and when the steam from the pipes is discharged into the steam drum the distribution is along the whole length of the drum and at the surface, and not underneath the water. The delivery is therefore quiet and the steam does not take up any of the water from the drum. As it impinges against a small baffle plate in the drum on entering the latter, the water held mechanically in the steam is separated from it.

The water enters the mud drum from the ends and leaves it from near the center. At the latter point, therefore, is a dead place where the mud accumulates and where the blow-off is located.

Owing to the fact that the heat is so directly utilized, the boiler requires a less grate surface than most other makes. Economy of floor space is an important feature of this boiler. This will be seen from the statement that the 25-h.p. boiler is 9 ft. 4 ins. in length, 8 ft. 9 ins. in width and has a total height of 10 ft. The amount of saving in floor space is figured at about 50 per cent. The boiler can be fired either at the ends or on the sides. The normal condition is the end method of firing and is the one shown in the engraving. Where desired, however, the end can be closed up and the boilers fired at the side. This is usually done on large boilers, because the boiler is made of sections, and beyond a certain depth it would be impossible to reach the end of the grate surface easily.

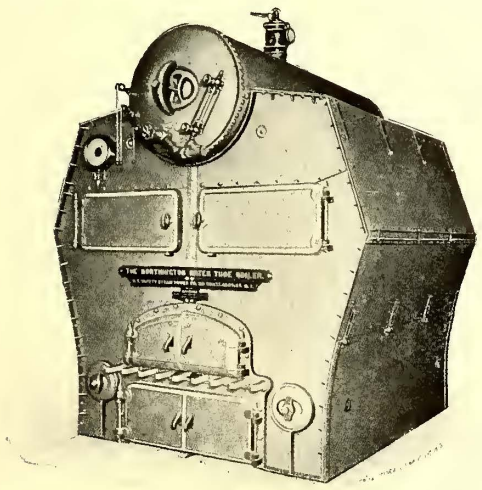
Where the boiler is fired on the side two or three of the headers are removed and the end is closed up.

The following are some figures secured from a test of boilers made in June, 1897, by Prof. D. S. Jacobus, of Stevens Institute of Technology, on boilers in the plant of the American Surety Building, New York:

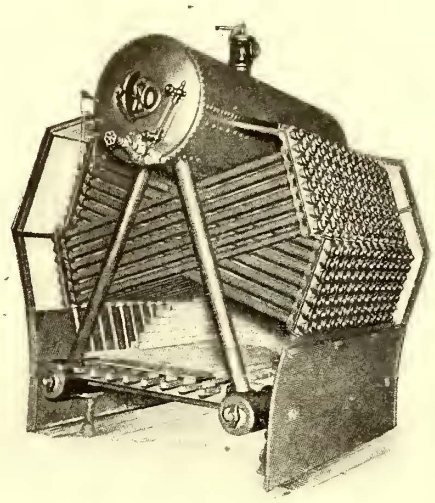
Builder's rating of h.p.			142
Heating surface, in square feet			1275
Grate surface, in square feet			36.35
Ratio of heating to grate surface			35.1
Number of test	1	2	3
Date of test	June 1.	June 4.	June 7.
Length of test in hours and minutes	10-17	12-12	11-11
Total Quantities—			
Coal consumed, not deducting moisture in same, in lbs.	10,664	6,556	10,881
Wood used in starting fire, in lbs.	159	159.5	150
Coal equivalent in wood at 0.4 x weight of coal, in lbs.	10,728	6,620	10,941
Ashes, in lbs.	1,651	1,149	1,857
Net combustible, in lbs.	9,077	5,471	9,084
Water evaporated during test, in lbs.	69,785	50,484	73,438
Water evaporated during test, in lbs, per hour	6,786.4	4,138.1	6,566.9
Average Quantities—			
Pressure of steam, in lbs per sq. in above atmosphere	94.55	92.72	95.56
Temperature of feed water, in degrees F.	65.14	64.45	64.34
Temperature of boiler room in deg. F., dry bulb.	79.17	87.18	80.02
Temperature of boiler room in deg. F., wet bulb.	68.91	78.50	66.59
Draught, in inches of water, in flue leading to chimney	1.057	0.814	1.124
Draught, in inches of water, in connection at top of boiler leading to flue	0.548	0.212	0.461
Percentage of ash in coal	15.39	17.36	16.97
Percentage of moisture in coal	2.06	1.80	2.00
Temperature of flue gases, in degrees F.	504.4	440.4	524.9
Calculated Quantities—			
Factor of evaporation	1.191	1.191	1.192
Pounds of water evaporated per lb. of coal, not deducting moisture in coal (actual)	6.50	7.63	6.71
Pounds of water evaporated per lb. of coal, not deducting moisture in coal (from and at 212 F).	7.75	9.08	8.00
Evaporation in lbs. per lb. of combustible, not deducting moisture in coal (actual)	7.69	9.23	8.08
Evaporation in lbs. per lb. of combustible, not deducting moisture in coal (from and at 212 F).	9.16	10.99	9.63
Evaporation in lbs. per lb. of combustible from and at 212 F., deducting the moisture contained in the coal	9.38	11.23	9.87
Coal burned per sq. foot of grate surface per hour, in lbs.	28.7	14.9	26.9
Water evaporated per sq. ft heating surface per hour, in lbs.	5.32	3.25	5.15
Horse-power of boiler.—One h.p. 34½ lbs. of water evaporated from and at 212 F., per hour	234.3	142.9	226.9

Lubricating Compounds and Cups

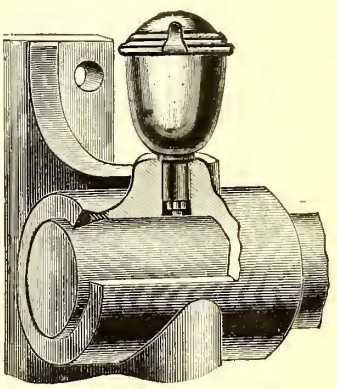
A lubricating compound, which is claimed to give absolute satisfaction under all conditions of temperature, wear, etc., is made by the Albany Lubricating Compound & Cup Company, of which Adam Cook's Sons, of New York, are the proprietors. This compound is known as Albany grease, and when it is used the manufacturers guarantee that it will absolutely prevent the burning out of armatures and overheating of bearings.



EXTERIOR OF BOILER



BOILER WITH SIDE REMOVED



LUBRICATING CUP

The Albany compound is usually made in four different degrees of hardness, figures being used to denote the different grades; No. 0 is very soft, being for use in extreme cold weather and on exposed journals; No. 1 is harder than No. 0, and is to be used on ordinary journals in cold weather, or on very cool or slow running journals; No. 2 is still harder and is a grade ordinarily used in moderate and warm weather; No. 3 is adapted to the use of all stationary, marine and tugboat engines, also shafting in warm weather. An extra grade, known as No. X, is also made. This is very hard, and it is stated will lubricate journals when no oil or other lubricant will work.

A special lubricating cup has been designed by Adam Cook's Sons, and they advise its use with their Albany grease, to secure the best results. The cup is shown herewith. As will be seen, the manner of attaching it is very simple, and it can be done by any mechanic. The Albany cups require the minimum of attention and very seldom get out of order. When filled with the lubricating composition they will run from one to four months, according to the power and velocity of the shafting, without refilling. They thus effect a great saving of labor, as well as in the cost of lubrication. With the use of Albany grease and these cups, no drip pans are required.

Combined Baggage and Passenger Car

The two great fertile valleys of Frederick and Middletown, in Maryland, have recently been connected by a street railway running through a gap in the mountains. The termini are respectively the cities of Frederick and Middletown. It is a matter of some interest to know that this electric railway takes nearly the same

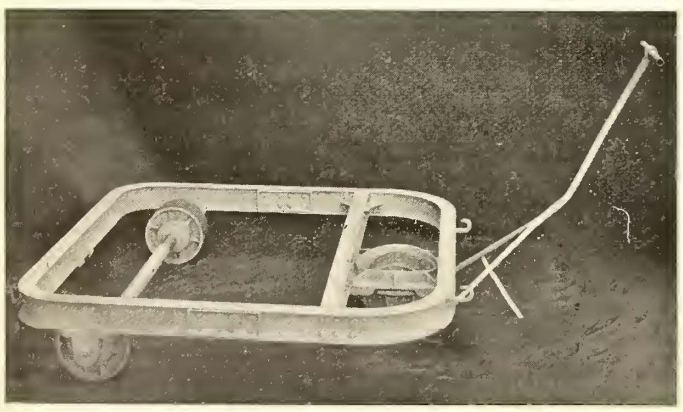
COMBINATION BAGGAGE AND PASSENGER CAR

line as the Great National Road of the early part of the century. Communication until the advent of the railway had been difficult between the two valleys, owing to high tolls and the steepness of the grades. The successful operation of the road is developing a baggage and express business in addition to the passenger traffic. The car illustrated shows the method which the road has adopted to carry on this business in an economical manner. The cars of the road are mounted on No. 21 E trucks, and the same truck is employed for the combination express and baggage car, which also has a passenger compartment. There is considerable advantage in combining the service, because it does not interrupt the regularity of the trips, as is the case where the car is exclusively devoted to freight and carries no passengers.

The car is 18 ft. long over end panels and 7 ft. 6 ins. wide at belt rails. There are two G. E. 51 motors for propulsion. The platforms are 4 ft. long and have vestibules with folding doors, and are plated with sheet steel. They are also provided with angle iron bumpers. The trim of the car throughout is of solid bronze. The passengers' compartment is 8 ft. 8 ins. long, and the remaining portion of the body is finished in hardwood with folding seats, making a baggage, express and smoking compartment. There is a sliding door in the partition between them. The oak side sills are of unusual depth and are plated to provide the necessary strength. Brill sand boxes and gongs are provided. Taken altogether, the car is a very neat and complete example of its type as adapted for use on interurban roads.

Hand Trucks for Buenos Ayres

In the STREET RAILWAY JOURNAL for November, 1898, was described the method by which meat is handled in the city of Buenos Ayres between the slaughter houses and the markets. Reference was made in the article to the trucks upon which the meat boxes



HAND TRUCK

were handled on arrival at destination. The accompanying illustration shows one of these trucks. They are mounted practically upon three wheels, although the forward wheel is doubled, to facilitate turning. This forward wheel is set in a turn-table carried in ball-bearings, and the whole truck can be turned in its own length. While it is intended that these trucks should be moved by hand, a large portion of the work done with them is performed by means of mules, and the trucks themselves are arranged so they can be hauled in trains.

The handle of one truck is made of sufficient length to drop into the hooks at the rear end of the truck in front of it. The handles of the forward truck can be turned up against the meat box, or can be unshipped and the team attached to the two hooks seen in front of the trucks. The construction is exceedingly simple, and at the same time of the greatest strength. Hyatt's roller-bearings for each journal reduces the friction to a minimum. This is a small truck that might be used to advantage in repair shops, depots and other places where heavy weights are to be moved and when the roads do not have overhead trolleys for the purpose. The trucks illustrated were made for 6000 lbs. capacity, but they can be built for any desired load from 1000 lbs. up.

Remedy for Flat Wheels

The annoyance to passengers from "flat" wheels and the expense to the street railway company of renewing these wheels has made this problem of preventing "skidded" wheels one of the most serious that the manager has to meet. Various methods have been suggested as to the best way of dealing with the problem, one of the latest being the use of a brake shoe containing emery inserts. This shoe is designed to be substituted for the ordinary brake shoe on a wheel that has become flattened, and in this way to gradually true up the wheel without removing it or the car from service.

This shoe has been introduced by the Wheel Truing Brake Shoe Company, of Detroit, Mich., and is in every way similar to the regular brake shoe with the exception that in its face it contains pockets or compartments, every alternate one of which is filled with an emery mixture baked hard like the section of an emery wheel. When the wheel becomes flattened the regular brake shoe is removed and the wheel truing brake shoe is put on in its place. The car is then run as usual, and every time the motorman applies the brake, for the purpose of checking the speed of the car, the wheel is ground down a little and brought back to the proper shape. The shoe, of course, grinds only when the brake is applied, so that usually it requires a number of trips to true up the wheel and then the old shoes are replaced. It will be seen that in this way the new brake shoe acts upon the same principle as an emery wheel, with the exception that the emery is held stationary and the wheel revolves against it. The face of the shoe is a part of a true circle, and therefore the shape imparted to the wheel will be perfectly true. The time required to take off the old shoes and put on the wheel truing brake shoe is very short compared with the loss of time incident to running the car into the barn and jacking up for the purpose of grinding the wheels.

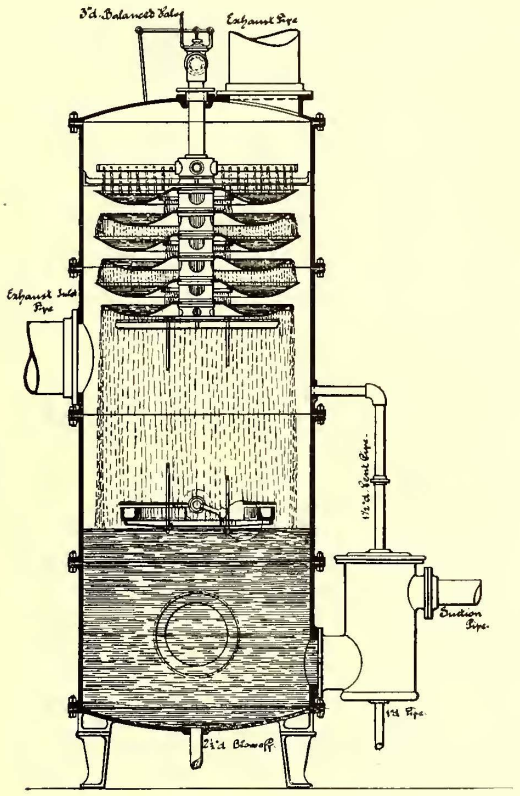
SHOE FOR TRUING FLAT WHEELS

These shoes have passed the experimental stage and are now in use on a number of roads. The Rapid Railway, running between Detroit and Mt. Clemens, Mich., was the first road to equip its cars with them, and it is stated that this company has not been obliged to remove any wheels, for the purpose of truing them up, since the time the new shoes have been in operation. The invention is patented in America and in all European countries, the later patents being the exclusive property of J. M. Griffin, the president of the company which is handling the shoe in the United States.

Open and Closed Feed Water Heaters and Purifiers

Steam users designate the two leading types of feed water heaters as open and closed. In the former the water is divided by means of open pans, so that the exhaust steam comes in direct contact with the agitated water. In the closed type the cold water is directed through a nest of pipes, and is heated by the surrounding steam. An open type of heater is shown in the accompanying

illustrations, Figs. 1 and 2. In this particular type the shells, as well as the interior parts, are made from cast iron, it being found that this metal is less liable to corrosion than steel or rolled iron. As will be noted, the interior construction consists of a series of round settling pans, mounted one above another on a central hollow shaft, but loosely, so that they can be readily turned and every part be brought before a side door in the shell, when they are easily cleaned or inspected. The water is admitted at the top through perforated branching pipes of brass, by which means the water is evenly sprayed over the whole surface of the upper pan, which is perforated, and from which the water flows in small streams to the pan below, then over the edges of the succeeding pans until it is accumulated at the bottom of the heater. Exhaust steam is admitted through the sides of the heater, below the pans, and ascends along the outer edge of the pans and through the perforated hollow shaft, so that it passes over the surface of each pan, imparting its heat to the finely subdivided water, causing rapid



SECTION OF HEATER

condensation, with little or no back pressure. In its passage all impurities are deposited in the pans or at the bottom of the heater.

A horse-shoe trough within the shell at the normal water level serves to skim off and discharge the oil or other floating impurities, while a sensitive float, consisting of a copper ball, operates a valve in the supply pipe, at the top, and thus regulates the supply of water. A small auxiliary cylinder, known as an oil separator, is attached to the side of the shell, and is connected by a pipe to the water in the base of the shell, but a little above the bottom. The suction pipe from the feed pump enters this auxiliary cylinder a little below the surface of the water, while a second pipe, or by-pass, connects the top of the cylinder with the steam space in the heater, and so designed that should the water, from any cause, fall to a level with the suction pipe, it would draw steam instead of water, or the oil that might possibly have gained entrance to the cylinder. Blowoff pipes for removing the sediment are provided at the bottom at both the main shell and the auxiliary cylinder. A water gage and thermometer complete the essential parts of the heater. The heaters as above described are known as the Pittsburgh feed-water heaters and purifiers, and for which James Bonar & Co. are general sales agents.

The same concern handles a closed type of heaters that are manufactured in various shapes, both with curved and straight pipes, which united different chambers, and providing large heating surface.

The open heaters are manufactured in sizes from 50 h.p. to 6000 h.p. Some of the shells, as shown by Fig. 1, are from 18 ft. to 20 ft. in height and 5 ft. to 6 ft. in diameter. The heaters of different types are manufactured in Pittsburgh under the direction of J. E. Schlieper, by whom they were designed and patented.

The "Sterling" Specialties

The beautiful white enameled dial of the Sterling Supply & Manufacturing Company is coming to be seen more and more often on the cars of American street railways, small as well as large, though hitherto a favorite among the larger companies chiefly. Its exclusive use by the Metropolitan Street Railway Company, of New York, is, of course, almost in itself a guarantee of its excellence and satisfactory qualities, since it is well known that every possible "leak" is avoided on the Metropolitan system, and no leak is so important as that of earnings. The Sterling trip and totalizing alarm registers are made with either the plain white numeral disc referred to, or the dial indicator, as may be preferred, and are arranged for either cord or rod connection, as desired. All of the auxiliary equipment devices are of the finest quality and most carefully made.

Nearly every one who rides on the Broadway cars in New York City wonders at the power and delicate adjustment of the brakes in use thereon, by means of which a car may be run in a crowded street at considerable speed, almost to the point of touching a wagon or another car in front, and yet may be instantly brought to a complete stop by a slight movement of the gripman's hand. The brake which accomplishes this result is the invention of Thomas Millen, master mechanic of the Metropolitan Street Railway Company, and is made by the Sterling Company. It is a simple hand brake with one essential peculiarity, namely, that the usual movement of the brake rod is multiplied in power through a gear and pinion working in the ratio of 5 to 2. On the gear axle is a double

GROUP OF HEATERS

sprocket wheel, which operates the brake levers by means of a chain. Another feature of the entire brake apparatus is that the brake shoes are run very close to the wheel, so that a slight motion only is necessary to bring them to full bearing, and the wear on the brake shoe is taken up in the chains connecting with the brake rod. There is a material saving also in the wear of chains as compared with the old-fashioned brakes. With the sprocket wheel used a chain usually wears several years.

Another well-known device made by the company is a street car fender also in use in New York and other cities. This is a track fender, not a dashboard fender.

The Sterling Company has recently enlarged that portion of its plant devoted to the manufacture of insulating material and commutator bars, and large quantities are being turned out to meet a greatly increased demand. The insulation is a special compound molded while in a plastic state under hydraulic pressure. It is hard, tough and impervious to weather, and has high insulating qualities.

In addition to these more important specialties, the Sterling Company also manufactures a large line of street railway supplies of various kinds, including the Sterling sand box, conductors' badges, the Sterling counter for counting reciprocating or rotary movements, including revolutions of wheel axles, machinery, etc., a wire measuring machine and a winding machine for recording revolutions of spindles and armature bobbins. With so large a number and variety of specialtics, it goes without saying that the Sterling Company is of great use to street railway purchasers.

The Bloomfield (Mich.) & Orchard Lake Electric Railroad Company has been incorporated with a capital stock of $50,000. George L. Hendrie is the principal stockholder.

The Lord Baltimore Maximum Traction Truck

The design of this truck conforms to that of the well-known Lord Baltimore single and center bearing trucks. The pedestals are of steel and form part of the side frames; they are provided with housings to receive graduated coil springs, which rest on the axle boxes and carry entire weight, thoroughly cushioning all. The car body and load ride upon four half elliptic springs, two to each truck and suspended from the below the side frames by links and connected by posts to the truck bolster, the posts being held in place between and guided by the bars forming part of side frames and connecting the pedestals. They are of bolster construction, to which pivotal centers are fastened, the pivotal centers being located at or near the centers of driving axles; the weight of the entire structure is so proportioned that 66 per cent rests upon the driving wheels, and is applied to the wheels through bolsters and distributed upon centers of bolsters and self-oiling roller side-bearings revolving upon steel thimbles. These roller side-bearings, upon which car body chafe plates bear, are placed directly above centers of half elliptic body springs. The axle boxes are of most approved dust and oil tight pattern and provided with either felt or waste feed, as may be desired.

The driver and cross frames are bolted directly to the main pedestals and of such form that they will never be outside of track line in curving; the only function they perform is to carry bars supporting the motors upon outer ends, the motors being placed outside of drivers.

These end cross frames form stiff end ties for side frames, which are also securely braced diagonally between the wheels. The frames, taken as a whole, are as securely built as the best locomotive trucks and have all the advantages of stiffness and stability claimed for center-bearing trucks of the most approved design.

The brakes are applied between wheels and so constructed with proportioned levers that 70 per cent of the braking power is applied to the drivers; they are operated by levers acting from the pivotal points of trucks, avoiding the use of objectionable quadrants in applying brakes upon curves; all the working parts of the brake mechanism have large bearings provided with oil holes, work upon steel thimbles, are placed at center lines of trucks and not liable to receive mud or dust thrown up by the wheels. They are extremely powerful, and the braking power is equalized between the trucks by interposing springs in such manner that it will be divided equally between the trucks, and each wheel will receive its proper proportion of the braking power.

These trucks are thoroughly and carefully built in every particular, and special attention has been given to preventing shearing strains upon the bolts, and all parts are of steel and malleable iron, no cast iron being used except for wheels and brake shoes.

The trucks are manufactured by the Baltimore Car Wheel Company, of Baltimore, Md.

Transformer Design and Operation

Under the title, "Transformer Design and Operation," the General Electric Company issues a pamphlet from two important papers on the subject of electrical transformers. One is written from the standpoint of the central station manager by W. F. White, general manager of the Omaha (Neb.) Electric Light, Heat & Power Company; the other, by Prof. Winder Elwell Goldsborough, M. D., deals intimately with the question of transformer economy. The first paper, which was read before the American Institute of Electrical Engineers, is the record of long personal experience with the operation of transformers under actual commercial conditions, showing the relation of the many losses incident to the use of many small transformers to the earing capacity of the plant, and the very tangible economies realized as the result of the substitution of a few high efficiency transformers of large capacity. Mr. White gives examples of these economics reduced to dollars and cents. In his station a saving of $6,000 per annum in the cost of coal alone was realized as the result of the practical application of lessons drawn from his extended observation and experience.

Prof. Goldsborough's paper was read before the National Electric Light Association, and treats of the inherent economy of transformers of various design and construction. It contains many able arguments in favor of the use of high-grade transformers, and emphasizes the necessity of frequent tests as the only means of detecting leaks, losses and the general depreciation of transformers. Prof. Goldsborough gives examples of manufacturers' claims belied by careful test, but instances other cases in which guarantees have been exceeded, and urges upon station managers the wisdom of keeping as vigilant a watch on the efficiency of their transforming apparatus as upon the items of operating expense and maintenance if economical results are to be obtained.

To these papers the General Electric Company has added several maps showing graphically the significance of the substitution of a few large transformers for numerous small ones. The pamphlet is, as usual, well printed and illustrated, and should find a prominent place in the literature of every alternating current station and every educational institution. It will be sent free by the General Electric Company.

Personals

MR. JOHN B. HICKS has resigned his position as manager of the railway department for Pratt & Lambert.

MR. W. W. RUTHERFORD has been elected chairman of the Liverpool Tramways Committee and Alderman F. Smith has been appointed deputy chairman.

MR. GEORGE J. JACKSON, of New York, is spending the winter in London, looking after the interests of the recently incorporated National Conduit & Cable Company, Ltd.

MR. CHARLES H. KIRKLAND has made arrangements for handling in New York the supplies of the Bibber-White Company and the Crefield Electrical Works, both of Boston. Mr. Kirkland has been for some time in the sales department of the C. & C. Electric Company.

MESSRS. E. E. SOLDANA, N. T. HARRINGTON AND H. H. WATSON, of the E. P. Allis Company, have returned to America from Europe. Messrs. Soldana and Harrington have just completed the erection of two 500-h.p. engines at Madrid and three at Barcelona, Spain.

HON. GARDNER C. SIMS, who served during the war with Spain as one of the chief engineering officers on the "Vulcan," has returned home, to Providence. The "Vulcan," as is well known, was the repair ship for the fleet off Santiago, and as such rendered

MR. HENRY G. ISSERTEL, formerly manager of the Boston office of the Walker Company, has accepted the position of manager of the New York office of the Anchor Electric Company, which makes a specialty of high-grade switches. Mr. Issertel's headquarters will be at 26 Cortlandt Street.

MR. O. VON GOBEN, MR. FREDERICK TISCHENDORFER, MR. B. WINTER-GUNTHER and MR. PETERSEN, all connected with the Elektricitäts Aktien Gesellschaft vorm. Schuckert & Co., were in New York last month inspecting a number of electric railway plants, including the third-rail system in use on the Marine Railway at Coney Island. Mr. Tischendörfer will remain in this country about a month longer. The other three gentlemen returned to Nuremburg Dec. 10.

MR. A. BAKER, manager of the Nottingham Corporation Tramways, has been appointed to the post of "Chief Officer of Tramways" of London by the London County Council, and his appointment was ratified Dec. 13. Mr. Baker has shown conspicuous ability in the discharge of his duties at Nottingham, and much satisfaction is expressed at his acceptance of the post in London. It has been decided to call the London tramways "The London County Council Tramways," although only the initials, "L. C. C.," will be painted on the cars.

PROF. SIDNEY H. SHORT, of Cleveland, sailed for Liverpool on the Majestic, Dec. 13, for an extended tour in England and the Continent. In the course of his travels he will visit London, Paris, Frankfort and Berlin, besides many other places of interest. This is almost the first real vacation which Prof. Short has had for many years, and his intention is to devote his time chiefly to recreation, although he has already been invited to address a number of scientific societies in England, France and Germany on the subjects, particularly, of application of electricity to heavy railroading, and of high speed traction, on which subjects he is recognized as an authority of high standing. Prof. Short is accompanied by Mrs. Short, and they expect to return to America about the middle of April.

MR. JOHN YOUNG, manager of the Glasgow Corporation Tramways, has recently declined the office of Chief of the Tramways Department in London. Mr. Young's recent work in Glas-

gow is known throughout the tramway field, and his remarkable success in bringing the Glasgow Municipal Tramway service to its present state of efficiency has placed his name among the foremost tramway managers of the world. Mr. Young was born in 1845 at Fulwood, Renfrewshire. He received his early education at the Paisley Grammar School, and expected to take up the duties of a professional life. His love of the country led him to devote himself to the practical study of agriculture, and for a time he was in charge of his father's farms. It was from this position that in 1895 he was appointed Superintendent for Cleansing in Glasgow. Shortly after that time he became manager of the tramway systems of Glasgow, and under his guidance all the various departments of the tramways were thoroughly organized and equipped.

MR. FRANKLIN E. HUNTRESS has been re-elected for the third time from the Seventh Middlesex District to the Massachusetts House of Representatives. This is the first instance in the history of the city that a candidate has ever received three terms from his ward. Mr. Huntress was successful against the combined efforts of the local machines, and, though there was a large number of candidates, he carried his own ward and precincts over all others. He has served for two years on the committee on manufactures, which has supervision over the gas and electric lighting interests of the State. Mr. Huntress is a Republican, and though a candidate a number of times, he has never been defeated. He is a member of the local Republican organization, the Massachusetts Republican Club, the Middlesex Club, the University Club of Boston, and several fraternal organizations. He was graduated from Harvard University in the class of '89. In business he has been equally successful, and successfully introduced the Neal electric headlight, which has been adopted by the West End Street Railway, of Boston; the Brooklyn Heights Railroad, of Brooklyn, N. Y.; Metropolitan Street Railway, of New York City, and is in use on hundreds of roads all over the United States.

Obituary

MR. WM. E. HALE, treasurer of the Toledo Traction Company, of Toledo, Ohio, and also a prominent capitalist, died on Nov. 16, after a short illness. Mr. Hale made his home in Chicago, where he was connected with a number of large enterprises, and he was also a heavy stockholder in the Toledo Traction Company.

MR. FREDERICK CULVER WHITMORE, of the railway engineering department of the General Electric Company, died, at the early age of twenty-six years, of typhoid fever, at his home, in Hartford, Conn., on Dec. 7. Mr. Whitmore began his career with the Thomson-Houston Company, on the "students course," at the Lynn factory, from which he was advanced to the power and mining department, where he was engaged chiefly in design. In 1894 he was transferred to the Scranton, Pa., office of the General Electric Company, where he was general consulting engineer in power and mining work till 1898, at which time he returned to the home office, in Schenectady. His work at Schenectady was wholly with the railway engineering department, in which at the time of his death he was filling with conspicuous success an important post in connection with the design of special railway apparatus. Mr. Whitmore was a man of uncommon gifts, who possessed unlimited energy and enthusiasm in his work. He had, besides, a manly and straightforward character and numerous qualities of personal charm, which won him friends and gained him universal esteem.

AMONG THE MANUFACTURERS

W. C. NAGEL & CO. has been organized, with headquarters at Toledo, Ohio, for the purpose of conducting a general business in electrical machinery, supplies and construction.

THE BRITISH THOMSON-HOUSTON COMPANY has received the contract for the supply of six motor cars for the Liverpool Tramways at £554 9s. 6d. each, and sixteen trail cars with extra brakes at £587 4s. 6d. each.

THE NATIONAL INDIA RUBBER COMPANY, of Bristol, R. I., has recently published a catalogue and price list of its rubber-covered wires and cables, giving full details of all the sizes and characters of wire manufactured by them.

MESSRS. R. W. BLACKWELL & COMPANY, of Liverpool, have been granted the contract for the overhead construction for the Liverpool Tramways along the Aigharth Road, a distance of 2 miles. The contract price was £1,780 12s. 1d.

THE WEBER RAILWAY JOINT MANUFACTURING COMPANY, of New York City, has moved from the Cotton Exchange Building to the Empire Building, 71 Broadway, rooms 1813-1816, where it will be glad to receive inquiries and give information regarding the Weber joint.

THE MURRAY IRON WORKS COMPANY, of Burlington, Iowa, reports that the Sioux Corliss engine at the Omaha Exposition was awarded the gold medal over its competitors. This engine was in continuous operation, twenty-four hours per day, during the greater part of the exposition, furnishing all of the power used on the grounds.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, Mo., has published a handsome and complete catalogue of its electric railway supplies, entitled Catalogue No. 16. This pamphlet seems to be a regular cyclopædia of all overhead parts, track tools and other apparatus required in operating electric railways, and is well illlustrated.

THE STANDARD RAILROAD SIGNAL COMPANY has moved its works from Arlington, N. J., to Troy, N. Y., where it has erected a new and much more extensive plant. Henry Burden, 2d, of New York, has been elected vice-president, and Eugene Seitz, of Troy, N. Y., treasurer, of this company, to fill vacancies caused by the resignation of Henry Johnson.

THE CONTINENTAL CONSTRUCTION COMPANY, Wentworth Building, Boston, reports some good contracts in hand for new electric roads. This company embraces in its management and directory some of the most solid and influential men in New England, and its capital is reported as sufficient to enable it to carry out any contracts the company may make. The company's principal business is the construction and equipping of electric railways complete.

THE PENNSYLVANIA ELECTRIC COMPANY, of Marietta, Pa., was granted the highest award at the Omaha Trans-Mississippi and International Exposition for telephone apparatus. The company did not make any special effort to secure the award, merely sending a line of samples to the exposition, in charge of its local agent. The Pennsylvania Electric Company is now at work on an order for 2000 telephones for the Independent Telephone Company, of Lancaster County.

THE WESTINGHOUSE COMPANIES were awarded the contract for the electrical equipment of the Third Avenue Railroad Company last month upon the lines laid down in the STREET RAILWAY JOURNAL for December. This is probably the largest contract for electric railway equipments which has ever been given to any one company or set of interests, and means, it is understood, that Westinghouse apparatus will be used throughout in the power station, rolling stock and elsewhere on the line.

THE WHITNEY CAR WHEEL WORKS, of Philadelphia, announce that they have resumed the manufacture of chilled wheels at 901 Montgomery Avenue. Having their old patterns and chills, as well as the drawings and records of all former orders for the last fifty-two years, they will be prepared to duplicate shipments made heretofore, as well as to meet new requirements. The firm is composed of James S. Whitney, manager; Asa W. Whitney, superintendent, and H. F. Hannis, treasurer.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., is furnishing the steel work for the new electric power station of the Boston & Maine Railroad Company, at Portsmouth, N. H. The building is 118 ft. wide and 64 ft. long, divided into two rooms, one for the boilers and the other for the engines and electric generators. The side walls are of brick and the roof construction is fireproof. The trusses are of steel, and they support steel beams for the purlins, on which is to be placed a concrete roof.

THE PHOSPHOR-BRONZE SMELTING COMPANY, Limited, of Philadelphia, is sending out a postal card to all its customers reading as follows: "Owing to the high prices of copper, tin, etc., we hereby withdraw all quotations on phosphor-bronze, delta metal and other alloys in manufactured goods, ingots and castings. We shall be pleased to quote prices on detailed specification for prompt orders, or to receive any orders, which will be filled at such prices as are warranted by existing conditions."

THE LOMBARD WATER WHEEL GOVERNOR COMPANY, of Boston, Mass., reports that the demand for its gov-

ernors is constantly on the increase. During the last month the company received orders for upward of twenty governors to regulate forty-one water wheels, which will develop 15,750 h.p. More than half of this machinery will be used in electric stations—principally in power transmission plants—and electric railway stations, the balance being in textile and other manufacturing plants driven by water power.

THE ELECTRIC RAILWAY & MANUFACTURERS' SUPPLY COMPANY is the title of a new firm organized in the last few months at San Francisco by Allen St. J. Bowie and S. H. Taylor. The company is agent for the Ohio Brass Company, Eureka Tempered Copper Company, Solar Carbon & Manufacturing Company, Vulcanized Fibre Company, Positive Lock Washer Company, A. O. Schoonmaker, and several other prominent Eastern manufacturers, and it is its purpose to extend its lines in the electric railway field.

THE WESTINGHOUSE MACHINE COMPANY, of Pittsburgh, Pa., is sending out quite an elaborate catalogue describing the Westinghouse compound engine. The catalogue contains handsome half-tone engravings and a large amount of information of value to steam users. The manufacturers of the Westinghouse compound engine claim that, running non-condensing, it will deliver a horse power at the shaft for a smaller expenditure of steam than any other non-condensing engine of any type whatever running under similar conditions.

THE DETROIT AUTOMATIC SWITCH COMPANY, Limited, is just introducing a new device by which a motorman can turn a switch which he is approaching without leaving the platform. The device consists in inserting in the trolley wire a short insulated section, and the motorman can operate the switch by passing this with the current on. If he does not care to move the switch, he shuts his current off and drifts past the insulated section. This device has been in use for some time at the corner of Fourteenth and Warren Avenues, Detroit, Mich.

THE Q & C COMPANY, of Chicago and New York, is sending to the trade a very handsome catalogue descriptive of the Q & C valveless pneumatic tools for riveting, chipping, caulking, cutting stray bolts, chipping iron and steel castings, stone cutting, carving, lettering, etc. The Q & C Company has recently purchased the entire business of the Ridgely & Johnson Tool Company, of Springfield, Ill., and has added a pneumatic tool department to its already well-known list of special machinery and railway appliances. Pneumatic tools are now coming into quite extensive use, and the full line carried by the Q & C Company will undoubtedly create a large demand for this class of implements.

THE WATSON-STILLMAN COMPANY, of New York City, has made arrangements for issuing from time to time special or group catalogues containing a list and descriptions of hydraulic tools best adapted for some one particular use. It has recently issued its catalogue No. 50, which illustrates tools designed for steam railroad work, and it intends to publish within a short time catalogue No. 52, which will contain tools used by street railways. Catalogue No. 51 is just being sent out, and it is shown as the "Illustrated Index of Hydraulic Tools." This index is intended to show in a medium-sized book, the large variety of tools which this concern manufactures. Each cut shown represents from one to about twenty sizes of tools, and the illustrations are intended more as suggestions than anything else. Full and complete descriptions of any one of these tools or of any class of tools will be sent upon application.

THE B. F. STURTEVANT COMPANY, of Boston, Mass., has just issued a second edition of its very suggestive pamphlet, Bulletin E, entitled "Draft Without a Chimney." The pamphlet will be sent on application. This company has also just issued its Bulletin G, which contains a description of the Sturtevant generating sets with automatic horizontal and upright engines. The generating set with horizontal center crank engine and four-pole generator manufactured by the Sturtevant Company is described elsewhere in this issue, but these sets are also made with horizontal center crank engines with six-pole generators, double upright engines with four-pole generators, single upright engines with four-pole generators, single upright engines with eight-pole generators and horizontal center crank engines with four-pole (marine type) generators. All of these sets have been very carefully designed, in order to secure the maximum amount of efficiency with the minimum amount of weight and size.

THE SAFETY THIRD-RAIL ELECTRIC COMPANY, of New York, has published from time to time very interesting and attractive printed matter describing the safety third-rail electric system, better known as the Murphy system. The latest pamphlet to be issued by this company is unusually artistic typographically, and, in addition, contains a great deal of information which will be eagerly read by all engineers, or others, interested in the development of an electric railway system to take the place of the overhead trolley in large cities on suburban and interurban railways and on steam railroads. The pamphlet just issued first describes and illustrates the principal third-rail, conduit and surface contact systems on the market, and points out some of their disadvantages. The safety third-rail system is then described, and the principal claims made for it are given in such a way as to show how the Murphy system overcomes the objectionable features in other systems.

THE HARRISON SAFETY BOILER WORKS, of Philadelphia, Pa., reports a very large number of recent sales of Cochrane separators. Among these may be mentioned: Standard Oil Company, Whiting, Ind., 6-in. oil-ammonia; De La Vergne Refrigerating Machine Company, New York, two 5-in. oil-ammonia; Buckeye Engine Company, Salem, Ohio, 5-in. vert.; Bailey Estate, Boston, one 3-in. and one 4-in. horz.; Montgomery, Ward & Co., Chicago, one each, 12-in., 7-in. and 4-in. horz.; Parke & Lacy Company, San Francisco, Cal., one each, 3½-in. and 5-in. horz., and one 5-in. vert.; Theo. A. Koch Company, Chicago, two 2-in. and one 6-in. horz.; Brown Bldg., St. Louis, Mo., three 4½-in. and one 3-in. horz.; Washington Coal & Coke Company, Star Junction, Pa., two 6-in. horz.; Fred. W. Wolf Company, Chicago, 4½-in. horz.; Jung Brewing Company, Cincinnati, Ohio, one each, 5-in. and 6-in. oil-ammonia; Buffalo (N. Y.), Bellevue & Lancaster R. R., 8-in. horz.; Cleveland, Cincinnati, Chicago & St. Louis R. R. Company, Urbana, Ill., one 5-in. and two 3-in. vert.; So. Covington & Cincinnati Street Railway Company, Newport, Ky., 4-in. horz.; Edison Electric Illuminating Company, Brockton, Mass., two 6-in. horz. A few of the recent sales of Cochrane feed-water heaters and purifiers are as follows: Raritan Copper Works, Perth Amboy, N. J., 1000 h.p.; Montgomery, Ward & Company, Chicago, 1000 h.p.; Chicago & Great Western Railroad Company, Oelwein, Iowa, 500 h.p.; Boston Packing & Provision Company, Cambridge, Mass., 200 h.p.; St. Clair (Pa.) Coal Company, 1500 h.p.; U. S. Glue Company, Carrollville, Wis., 1500 h.p.; Armour Elevator "D," Chicago, 1200 h.p.; Rush Run Coal & Coke Company, Rush Run, W. Va., 500 h.p.; Isaac Braithwaite & Son, Kendal, England, 100 h.p.; Phœnix Iron Company, Phœnixville, Pa., 2000 h.p.; Diamond Ice Company, Wilmington, Del., 200 h.p.; C. W. Boynton, Chicago, 100 h.p.; O. S. Kemmerer, Nazareth , Pa., 50 h.p. (special).

New Publications

Tourists' Guide to New Orleans. Published by the New Orleans City & Lake Railroad Company. 14 pages.

This is a neat little folder containing a map of all the street car routes in New Orleans and directions for reaching all the principal points of interest.

Graphite. Vol. 1, No. 1. December, 1898. Published by the Joseph Dixon Crucible Company, of Jersey City, N. J. 4 pages.

This is a periodical which will be issued from time to time by the Joseph Dixon Crucible Company, and will be sent to all users of graphite or others interested. Graphite now enters very extensively into most of the arts, sciences and trades, and is, in fact, employed in some form by every civilized nation in the world.

President's Address Before the American Society of Mechanical Engineers. 15 pages. Published by the American Society of Mechanical Engineers.

This is a copy of the address delivered by President Charles Wallace Hunt before the above-mentioned society. In his address Mr. Hunt carefully reviewed the latest engineering practice in America and abroad, and spoke of the duties, pleasures and usefulness of the engineer of to-day.

Report of the Sixteenth Annual Meeting of the Street Railway Association of the State of New York. Published by the New York State Street Railway Association. 144 pages.

This is the printed proceedings of the sixteenth annual meeting of this association, which was held at the Manhattan Hotel, Brooklyn, N. Y., Sept. 13-14, 1898. The report is very complete, giving all the papers read, all the discussions and all the speeches both at the meetings and at the banquet. The pamphlet also contains the annual report of the secretary and treasurer, and a copy of the constitution and by-laws of the association, together with a complete list of all the members.

Trade Catalogues

Pneumatic Tools. Published by the Q & C Company, of Chicago and New York. 46 pages. Illustrated.

Hydraulic Tools. Published by the Watson-Stillman Company, of New York City. 44 pages. Illustrated.

The Safety Third-Rail System. Published by the Safety Third-Rail Company, of New York City. 16 pages. Illustrated.

The Westinghouse Compound Engine. Published by the Westinghouse Machine Company, of Pittsburgh, Pa. 94 pages. Illustrated.

List of Street Railway Patents

U. S. PATENTS ISSUED NOV. 22 TO DEC. 20, 1898, INCLUSIVE

Prepared for the STREET RAILWAY JOURNAL by
THOMAS DREW STETSON

WEEK ENDING NOV. 22, 1898

Rolling Stock.—Henri J. Caillet, Paris, France. No. 614,697. Three claims.

Car Fender.—John D. Hodges, Chicago, Ill., assignor of five-sixths to James Bellew, Frank H. Repetto and Patrick J. King, same place. No. 614,654. Four claims.

Claim.—2. The combination of the rule-jointed fender frame, pivots upon which it swings and which constitute the hinge between its joints, the buffer, its bearing rods terminating in about a line with said hinge, a thrust rod in contact with the headed rear end of one of said bearing rods, and mounted in the rear section of the fender frame, a lever actuated by said thrust rod, a latch bolt with which said lever engages, a spring acting upon said latch bolt in opposition to the lever, and a latch hanger into which said bolt takes.

Indicator for Railway Cars.—Edouard Cros, Paris, France. No. 614,700. One claim.

Means for Driving Railway, Tramway or Automobile Cars.—Gustave Dupont and Maxime Johannet, Paris, France. No. 614,709. Four claims.

Claim.—3. In a motor vehicle, the combination of a front and rear axle of two counter shafts, a field magnet and armature mounted on each, a main shaft geared to both counter shafts, a reversible clutch on the main shaft and a single circuit including the armature of both dynamos, substantially as described.

Lubricating Car Wheels.—John V. Hawkey, Greensburg, Pa. No. 614,808. One claim.

WEEK ENDING NOV. 29, 1898

Nut Lock.—William H. Carruthers, Chicago, Ill., assignor to Marguretta E. Carruthers, same place. No. 614,835. Two claims.

Trolley for Electric Cars.—Hosea W. Libbey, Boston, Mass. No. 614,875. One claim.

Claim.—A trolley head having two arms between which the main trolley wheel is mounted and a bracket on each side between which and one of the arms is mounted a small contact wheel or roller substantially as and for the purpose set forth.

Rail Joint.—George F. Owen, Canal Winchester, Ohio. No. 614,885. Two claims.

Railway Rail.—John W. Peterman, Banta, Cal. No. 614,976. One claim.

Underground Conduit for Electrical Conductors.—Charles H. Sewall, Chicago, Ill. No. 614,995. Seven claims.

Claim.—1. The combination with a body of material having a conduit or conduits inclosed therein, of an inclosing layer or sheath of insulating material completely surrounding said body of material on the top, bottom and sides and effectively insulating the same from the earth to prevent the access of extraneous currents to the inclosed body of material, substantially as described.

Railway Switch.—George A. Penrose and Thomas F. Penrose, Meredith, Ark. No. 615,101. Three claims.

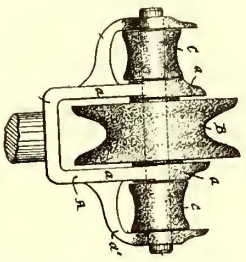
Nut Lock.—Silas Chambers, Sterling City, Tex. No. 615,139. Seven claims.

Electric Railway.—Hermann T. Hillischer, Vienna, Austria-Hungary. No. 615,176. Four claims.

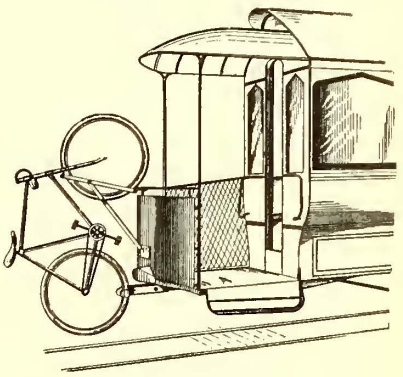
Claim.—4. In an electric railway, the combination of the running rails, an inverted U-rail arranged parallel thereto, an electrical conductor carried in the hollow of said U-rail, but insulated therefrom, a channel or conduit between the said rails, a slot between the said rails leading to said channel or conduit, plates pivoted to the track rail along the conduit, springs acting upon said plates and tending to hold the same across said slot, a trolley running upon said rails, a curved contact arm carried thereby and running in said conduit, and rollers mounted in said trolley frame for depressing said pivoted plates *seriatim* to allow the said contact arm to pass along said slot, substantially as described.

WEEK ENDING DEC. 6, 1898

Bicycle Carrier.—Thomas C. duPont, Johnstown, Pa. No. 615,264. Two claims.



NO. 614,875



NO. 615,264

Claim.—1. The combination of a wheel holding frame, a brace pivotally secured thereto and supporting the same, and a brace block having a vertical slot for the passage, the brace and a cam slot for the end of said brace, said cam slot extending downward from the top of the brace block and curving outwardly at its lower extremity.

Street Car Motor.—Thomas D. Hoskins, New York, N. Y., assignor, by mesne assignments, to Sarah E. Warner. No. 615,274. Twelve claims.

Driving Gear for Motor Vehicles.—Joseph Millot and Benoit Millot, Gray, France. No. 615,360. Six claims.

Headlight Reflector.—Andrew Metternich, Newark, N. J. No. 615,490. One claim.

Claim.—In combination with a car having an interiorly located lamp, of an elongated tubular reflector extending through the wall of the car with its opposite ends flaring outwardly from a point between its ends; the inner flaring end of the reflector being independent of connection with said lamp and supported in a position opposite the latter with a space between the same, and its opposite outer end extending to a desired position to utilize the light from said interior lamp as an exterior headlight.

Truck Lifter.—William J. Donaldson, La Grange, Tex. No. 615,534. One claim.

Electric Locomotive.—Martin E. Thomas, Cassaday, Ky., assignor of three-fourths to W. F. Toops and H. L. Hendrick, Bowling Green, Ky. No. 615,592. Three claims.

Claim.—1. In an electric locomotive, a truck, a body mounted thereon through the medium of interposed springs, wheels mounted upon an axle journaled in the truck, a motor carried by the truck in gear with the axle, a dynamo carried by the body in electrical connection with the motor, an engine, a gear upon the axle, a gear journaled in the floor of the body and normally held in mesh with the gear upon the axle by a spring interposed between the floor of the body and the gear, a gear meshing with the said gear mounted upon a horizontal shaft, pulleys upon the said shaft and a belt connecting the pulleys with the armature of the dynamo, substantially as described.

Electric Locomotive and Truck.—Samuel M. Vauclain, Philadelphia, Pa. No. 615,594. Four claims.

Claim.—4. The combination in an electric motor or truck, of the frame, bearing blocks thereon, a motor, a motor shaft carrying the armature of the motor, said shaft being reduced at each end, a crank adapted to each end of the said shaft and keyed thereto, the ends of the shaft being threaded, nuts thereon confining the cranks to the shaft, the sleeves of said cranks extending through the boxes, wheels mounted on the sleeves, substantially as described.

Brake Handle.—Patrick Flood, Albany, N. Y. No. 615,614. Two claims.

WEEK ENDING DEC. 13, 1898

Wheel and Track Brake for Railway Cars.—Richard Shultz, Davis, W. Va. No. 615,917. Four claims.

Electric Arc Headlight.—William G. Wagenhals, Dayton, Ohio, assignor to the United States Headlight Company, Utica, N. Y. No. 615,927. Twenty-five claims.

Claim.—3. The combination with a vehicle propelled by electricity, of a case and an electric arc lamp contained therein, means

for detachably securing the case to the vehicle, a carbon-feed-operating device attached to the case, but disconnected from the lamp fixture, an upper carbon carrying rod adapted to slide in suitable guides attached to the lamp fixture, spring retracting feeding mechanism adapted to coact with said rod and said carbon feed operating device, means whereby the latter can be manipulated, and suitable connections with the lamp and the case and the vehicle whereby electric current is conveyed from the propelling power of the vehicle to and from the lamp.

Trolley Replacer for Electric Railways.—Lucian A. Cowles, Randolph, Mass. No. 615,966. Five claims.

Claim.—2. A trolley wheel restoring device composed of a forked lever, properly connected with the trolley pole and wheel, and having the ends 5, swinging guides, slotted and adapted to be moved by the ends of the forked lever, a spring hinge in said guides, proper mechanism for connecting and operating said lever and guides in connection with a trolley pole, and a spring normally holding said device out of action, substantially as and for the purposes described.

Hand Strap for Cars.—Edward P. Hendrickson, New York, N. Y. No. 615,986. Two claims.

Claim.—1. A hand strap for cars comprising a main portion and integral straps extending in opposite directions therefrom, a bar and means for uniting the straps together at their ends and to the bar so that loops are formed in the straps to receive the rail of the car and at the main portion for the hand, the straps being held in a diverging condition by the means aforesaid and the hand opening being parallel to the supporting bar, substantially as set forth.

Ball Bearing for Trolley Wheels.—George E. Mittinger, Jr., Cleveland, Ohio, assignor of three-fourths to Frederick J. Schweitzer, same place. No. 616,060. Six claims.

Claim.—1. A wheel having at each side a ball cavity situated at the center of rotation thereof, supporting bearing blocks having registering ball cavities, and a single ball in each pair of cavities, the balls projecting from the wheel cavities into the supporting block cavities and a connection for the supporting blocks passing around the wheel and adapted to permit it to freely revolve, substantially as described.

Trolley Wheel Replacer.—George E. Mittinger, Jr., Cleveland, Ohio., assignor of three-fourths to Frederick J. Schweitzer, same place. No. 616,061. Seven claims.

Claim.—6. A replacing section consisting of sheet metal tapered toward its outer ends and provided with a spiral groove formed by depressing the sheet metal, substantially as described.

Ball Bearing for Electric Motors.—John M. Murphy, Torrington, Conn., assignor of two-thirds to David F. Halsted, New York, N. Y., and William M. Keepers, Newark, N. J. No. 616,063. Four claims.

WEEK ENDING DEC. 20, 1898

Controller for Motor Cars.—Arthur P. Dodge, New York, N. Y. No. 616,089. Six claims.

Claim.—1. In a motor operated by steam or like pressure, a boiler, a controller, comprising a valve, a central shaft, a hand wheel connected therewith, a piston and a cylinder on one side thereof connected with brake mechanism by a hydraulic column, a piston and cylinder on the opposite side similarly connected with a reversing mechanism, the sleeve surrounding the shaft and connected so as to operate the reversing piston and the hand lever with geared connections with the piston of the first named brake cylinder, substantially as described.

Car Fender.—Peter Heesem, Pittsburgh, Pa. No. 616,102. Three claims.

Claim.—1. A car fender comprising the frame provided at its forward portion with rollers mounted on a shaft 19, said shaft 19 being provided with a pinion at one end, in combination with a shaft provided at each end with a pinion, said shaft and pinions being adapted to be brought into engagement with the pinion on the shaft 19 and a gear wheel on the front axle of the car, substantially as set forth.

Nut Lock.—Raymond Hines, Cresson, Pa. No. 616,103. One claim.

Railway Switch.—Edwin S. Leaycraft, Jersey City, N. J. No. 616,120. Eight claims.

Claim.—1. A railway switch, consisting of a switch tongue, an armature operated by a magnetic device carried on a vehicle moving along the railroad track, an arm carrying said armature and oscillating transversely of the railroad track, and a mechanical connection between said switch tongue and armature whereby movements of the latter will be transmitted to the former, substantially as specified.

Combined Rail Joint and Device for Preventing Spreading of Rails.—Henry M. Williams, Fort Wayne, Ind., assignor of one-fourth to Franz Burger, same place. No. 616,171. Five claims.

Claim.—2. The combination with the parallel rails of a railway track, of a rail joint connecting abutting rails at one side of the track, and a tie rod formed at one end with a fork, the branches of which extend through openings of the rail joint and receive nuts at their ends, said rod extending across the track and being provided at its opposite end with a bearing for engaging the rail at the other side of the track, substantially as described.

Car Coupling.—Charles S. Park and George B. Park, Greenfield, Mass. Filed Feb. 8, 1898. No. 616,203. Two claims.

Extension Car Step.—William J. Griffiths, Jr., Mount Vernon, N. Y. No. 616,230.

Rail Bond.—Walter E. Harrington, Camden, N. J. No. 616,232. Six claims.

Claim.—2. In combination with abutting ends of railway rails, a bonding member with smooth contacting surface adapted to contact therewith, a temporarily plastic alloy intermediate said bonding member and the rails and set screws adapted to act upon said bonding member to maintain pressure between it and the rails, substantially as described.

Car Advertising Device.—Arthur H. Hieatzman, Baltimore, Md., assignor of one-half to Napoleon B. Lobe and Ernest M. Manger, same place. No. 616,235. Six claims.

Car Truck Equipment.—Sidney H. Short, Cleveland, Ohio. No. 616,264. Five claims.

Claim.—3. The combination with a truck and its supporting axles, a reservoir carried by said truck, a frame loosely journaled at one end on one of said axles, means for yieldingly suspending the other end of said frame from the truck, an air compressor mounted on said frame, and a pipe delivering from said compressor to said reservoir, as and for the purpose set forth.

Air Brake.—Murray Corrington, New York, N. Y. No. 616,288. Three claims.

Pneumatic Motor for Electric Appliances for Cars.—Clarence A. Evans, Upland, Pa. No. 616,301. One claim.

Valve for Pneumatic Motors.—Frederick W. Hedgeland, Chicago, Ill., assignor to The W. W. Kimball Company, same place. No. 616,323. Five claims.

Sprinkling Vehicle.—Arthur H. Howland, Worcester, Mass., assignor to Frederick C. Austin, Chicago, Ill. No. 616,334. Four claims.

Rail Joint.—William E. Smith, Telluride, Colo., assignor to himself and John Hebbard Adams, same place. No. 616,365. Six claims.

Claim.—6. In a rail joint, the combination of a chair, a pressure plate extending alongside the rail, and a toggle working between the chair and the pressure plate, the toggle having means for holding it in extended position.

Station Indicator.—Jefferson D. Barry, Marlin, Tex., assignor of one-half to A. L. Branson, same place. No. 616,393. Two claims.

Car Coupling and Operating Device Therefor.—Seth Bedford, Charleston, Mo. No. 616,395. Twenty-two claims.

Combined Bearing and Power Transmitting Device.—Carl O. C. Billberg, Lewisburg, and Paul A. N. Winard, Philadelphia, Pa. No. 616,396. Four claims.

System of Electric Traction.—Michelangelo Cattori, Rome, Italy. No. 616,403. Three claims.

Rail Joint.—Orlando Smay, Johnstown, Pa., assignor by mesne assignments, to the Lorain Steel Company, of Ohio. No. 616,440. Two claims.

Claim.—2. In a railway joint, the combination of rails having a portion of their entire web removed, two splice bars, one of which is formed with a projection and perforation, said projection serving in place of the said removed web and sustaining the head of the rails at all points necessitated by the removal of the web, a lug on the other of said splice bars, said lug extending through said perforation, and a key to engage said lug.

Nut Lock or Fastener Bar.—Irvin Y. Baringer, Perkasie, Pa., assignor of one-half to Thomas L. Kneile, Philadelphia, Pa. Term of patent, 14 years. Design 29,834. One claim.

Railway Rail.—George J. Capewell, Hartford, Conn. Filed Nov. 26, 1898. Serial No. 697,565. Term of patent, 14 years. Design 29,833.

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 BUIDDING, NEW YORK.

Financial Notes.

AKRON, OHIO.—The property of the Akron Street Railway & Illuminating Company has been appraised at $932,000, and will be sold to a reorganized company, of which Samuel Thomas is at the head. The new company will be capitalized at $2,000,000. The present outstanding indebtedness of the company is $1,200,000, one-half of which will be done away with. The present bondholders will be given preferred 5 per cent stock to the amount of $600,000, in place of the amount of bonds now held. In addition to this, bonds to the amount of $300,000 will be issued to provide for the entire rebuilding of the lines and the purchase of new rolling stock.

BALTIMORE, MD.—The Baltimore & Northern Electric Railway Company, backed by a syndicate of capitalists headed by Alexander Brown & Sons, of Baltimore, have purchased the Baltimore City Passenger Railway Company. The terms of the sale are $90 per share, cash, involving a total of $12,600,000. The directors of the Baltimore City Passenger Railway Company have ratified the sale, subject to the decision of the stockholders. It is understood that the lines will be rearranged, and that the motive power of the Red & White lines will be changed from cable to electricity.

BALTIMORE, MD.—The capital stock of the Baltimore Consolidated Railway Company is to be increased from $9,172,000 to $9,672,000, to meet the expense incurred by the construction of the extension to Ellicott City. Present stockholders will be allowed to subscribe for the new issue at par in amounts proportionate to their holdings.

BALTIMORE, MD.—The Consolidated Railway Company has decided to issue $500,000 additional stock, which will be offered to the present stockholders in proportion to their holdings at par. The company has outstanding $9,172,000, and its authorized capital is $10,000,000.

BOSTON, MASS.—The West End Street Railway Company has declared a semi-annual dividend of 4 per cent., payable Jan. 2 by the Boston Elevated Railway Company.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

November.	1897.	1898.
Gross receipts	$417,818	$446,501
Five months ending Nov. 30.		
Gross receipts	2,271,539	2,614,732

BUFFALO, N. Y.—The Buffalo Railway Company has declared a quarterly dividend of 1 per cent, payable Dec. 15.

CHATTANOOGA, TENN.—The Chattanooga Electric Railway Company has filed a consolidated mortgage to secure $625,000 of 5 per cent bonds, with the Maryland Trust Company, of Baltimore, as trustee. The new mortgage takes the place of the $625,000 old bonds now existing, the object being to reduce the interest from 6 to 5 per cent.

CHICAGO, ILL.—Stockholders of the Chicago & St. Louis Electric Railway Company, which was organized several years ago to build an electric railway from Chicago to St. Louis, are, it is said, considering an investigation of the affairs of the company.

CHICAGO, ILL.—The Chicago City Railway Company proposes to increase its stock at the annual meeting to be held in January, from $12,000,000 to $14,000,000, the stockholders to be given the right to subscribe. The company has declared a dividend of 3 per cent, payable Dec. 31.

CHICAGO, ILL.—The West Chicago Street Railroad Company recently declared a quarterly dividend of 1½ per cent.

CLEVELAND, OHIO.—It is reported that an English syndicate is negotiating for the purchase of the property of the Cleveland City Railway Company, the Cleveland Electric Railway Company and suburban roads.

DENVER, COL.—The Denver City Railroad has been sold at auction, by order of the United States Court, under foreclosure of a mortgage for $4,000,000. Frederick P. Olcott, of New York, chairman of the reorganization committee, secured the property for $500,000, the minimum bid allowed. The West End Street Railway was also sold under foreclosure, being purchased by the same party for $40,000.

GREEN BAY, WIS.—Upon the application of M. Joannes and Thos. W. Spence, receivers of the Fox River Electric Railway Company, Judge Hastings has signed an order for the sale of the property on Jan. 14. The sale will be held at the office of the Sheriff of Brown County, at 9 A. M.

LANCASTER, PA.—The report of William B. Given, receiver of the Pennsylvania Traction Company, for the past year shows an increase in passengers carried of 274,779 over the previous year, and an increase of $15,005.31 over last year in receipts. A decree has been entered, by the United States District Court, for a final adjustment of all accounts. A committee of reorganization has been appointed and a charter applied for.

MERIDEN, CONN.—The Meriden, Southington & Compounce Tramway Company has prepared a petition to the General Assembly for permission to increase its capital stock to $500,000, with rights to build and extend its tracks from Milldale to Mt. Carmel, Waterbury, Meriden and Berlin, by an independent route, to Plainville from Southington, from Dunham's to Compounce Lake, and to build a cable road to West Peak.

NEW YORK, N. Y.—The car barn of the Union Railway Company, situated at Woodruff avenue and Boston Road, was totally destroyed by fire recently, together with a number of cars and supplies. The loss is estimated at $150,000.

OSWEGO, N. Y.—Justice Wright, of the Supreme Court, has granted the motion of the Knickerbocker Trust Company, of New York, to foreclose bonds against the Lake Ontario & Riverside Railway Company for $125,000. The property has been ordered to be sold within two months.

PORT CHESTER, N. Y.—The Highway Commissioners of Harrison have granted the Port Chester Electric Railway Company a franchise through that part of the town lying between Rye and Mamaroneck.

PROVIDENCE, R. I.—The Providence and Taunton Street Railway Company has declared a dividend of 2½ per cent, payable Jan. 2.

QUEBEC, QUE., CAN.—Notice is given that the Quebec, Montmorency & Charlevoix Railway Company will make application, at the next session of the Parliament of Canada, for an act amending the act incorporating the said railway company, viz.: To change the name of the company to the Quebec Railway, Light & Power Company; to ratify and confirm the purchase of the property and franchise of the Quebec District Railway Company; to authorize the company to build a line, or lines, of railway or tramways in Levis, Bellechasse, Dorchester, Beauce and Lotbiniere Counties; to ratify and confirm the purchase of the property, works and capital stock of the Montmorency Electric Power Company; to authorize and empower the company to carry on the business of the Montmorency Electric Power Company; to acquire water powers, and to maintain the construction necessary to improve or utilize the same; to expropriate for the purpose of placing poles and carrying wires; to authorize the purchase of gas and lighting companies.

ST. LOUIS, MO.—Negotiations, which have been in progress for more than three months, have resulted in the sale to a New York syndicate, represented by Brown Brothers, of the Lindell Railway and the Missouri Railroad systems for $8,500,000. The papers completing the sale have been signed and the actual transfer will be made in a few days. The purchase price paid is on the basis of $174 a share for Lindell stock and $192 for Missouri. Nearly every part of the west and southwest portions of St. Louis are reached by the two systems.

ST. CLOUD, MINN.—The car barn of the Benton Power & Traction Company was destroyed by fire recently. Four passenger cars, a snow plow and the building were completed destroyed, entailing a loss of $15,000; partly insured.

SPRINGFIELD, OHIO.—The stockholders of the Dayton, Springfield & Urbana Electric Railway Company have authorized an increase of the capital stock of the company from $10,000 to $750,000.

WASHINGTON, IND.—Ziba F. Graham, formerly general manager of the Washington Street Railway Company, has purchased, at sheriff's sale, the property of said company for $12,500.

ZANESVILLE, OHIO.—A number of Philadelphia capitalists have inspected the lines of the Zanesville Street Railroad, relative to purchasing the same at the receiver's sale, to be held January 3.