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Car House and Shops of People's Street Railway Co., Scranton, Pa.

By J. H. Bickford.

When electric power was first adopted upon street railways, it was generally supposed that the existing car houses and repair shops would answer all purposes. Consequently many roads packed their cars into low, narrow buildings, studded with posts, rendering it impossible to get between the cars to do the necessary repairs, and in many cases having but a single short pit for the examination of motors. Others housed their cars in open sheds, while still others stabled their electric steeds in places where it became necessary to examine the bottom of the cars from improvised boats or rafts, two cases of the latter kind having been encountered by the writer. The maxim "experience is a good teacher" may be ancient, but that it applies to the subject under consideration is self evident and needs no further comment. The short space of four years has taught us many useful lessons, and although there have been some heedless and thoughtless scholars, yet I hope the majority have graduated to a position where they realize the importance of providing proper facilities for the housing and repairing of the much, heretofore, neglected street car motor. That some have done this is a fact made plain by the many substantial and convenient buildings which have been erected during the last year, some of which have already been illustrated and described in this journal. It is true that, like the Phœnix some of these have arisen out of the ashes of former structures, but the latter are far more beautiful than the former, and decidedly more useful.

Among those which were unfortunate enough to be visited by fire, was the People's Street Railway Co. of Scranton, Pa. However, they are fortunate enough today in possessing a building for the housing and repairing of cars, that is so much superior to the former one that the company should consider their bitter experience in the form of a blessing.

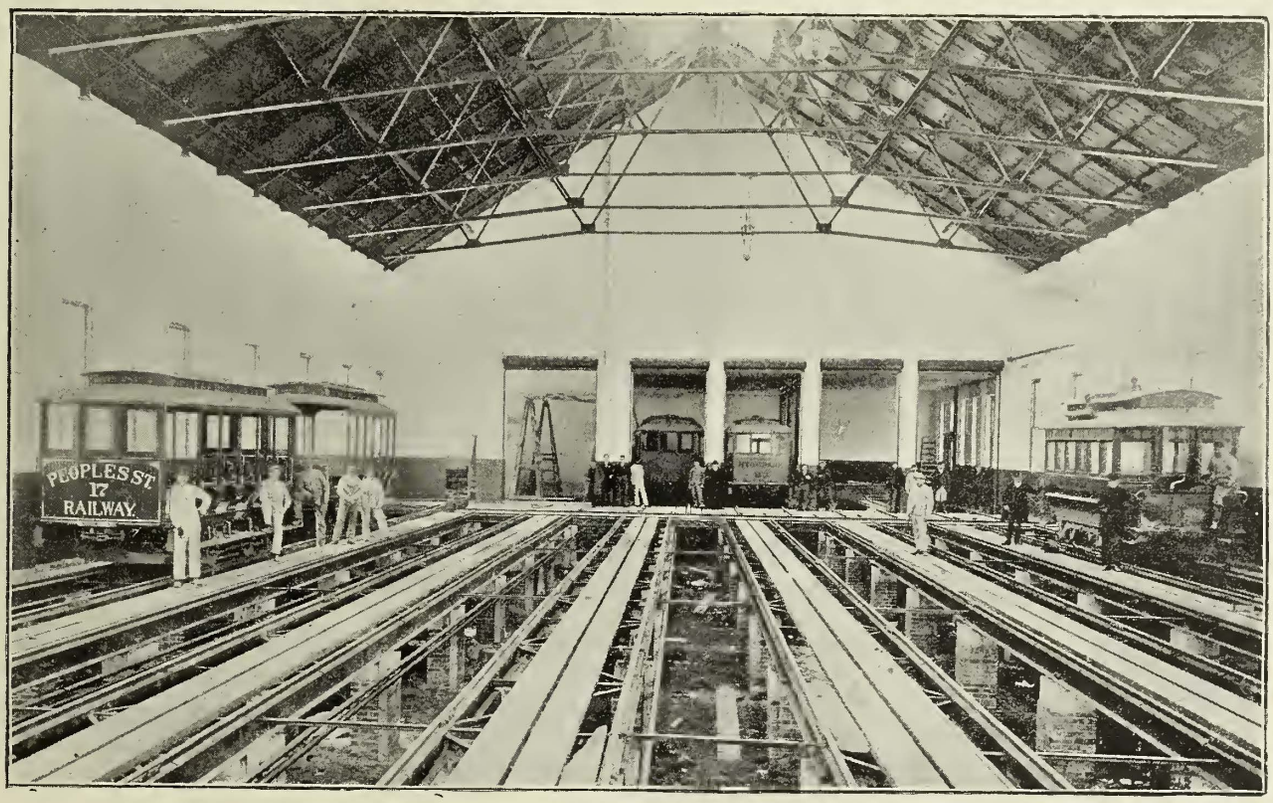


FIG. 1.—INTERIOR OF NEW CAR HOUSE—PEOPLE'S STREET RAILWAY, SCRANTON, PA.

A short description, with illustrations of this car house, may be of interest to those contemplating building a similar structure; and, I hope, will serve as a lesson to those who are still living in their old barns of four years ago. The general design and arrangement for the building was made by the writer, while the architectural work was done by Mr. L. C. Holden, of New York City.

The building stands close beside the new Government post office now being erected at Scranton, and consequently, its outward appearance, especially the front, was made to correspond with its surroundings. It is 68 ft. wide, 225 ft. long, and the height from rails to trusses is 25 ft. There are but three pillars or posts in the whole structure, the whole roof being supported by trusses. It will be noticed by an examination of Fig. 5, that the building combines a car house and complete set of repair

shops. This combination is decidedly advantageous, making it less expensive to do the repairs, and bringing all parts of the work directly under the eye of the superintendent. It is true there is some risk in housing all cars in one place, and concentrating all shops under the same roof, but in this case, the building being as nearly fireproof as is possible to make it, total destruction by fire would be almost an impossibility.

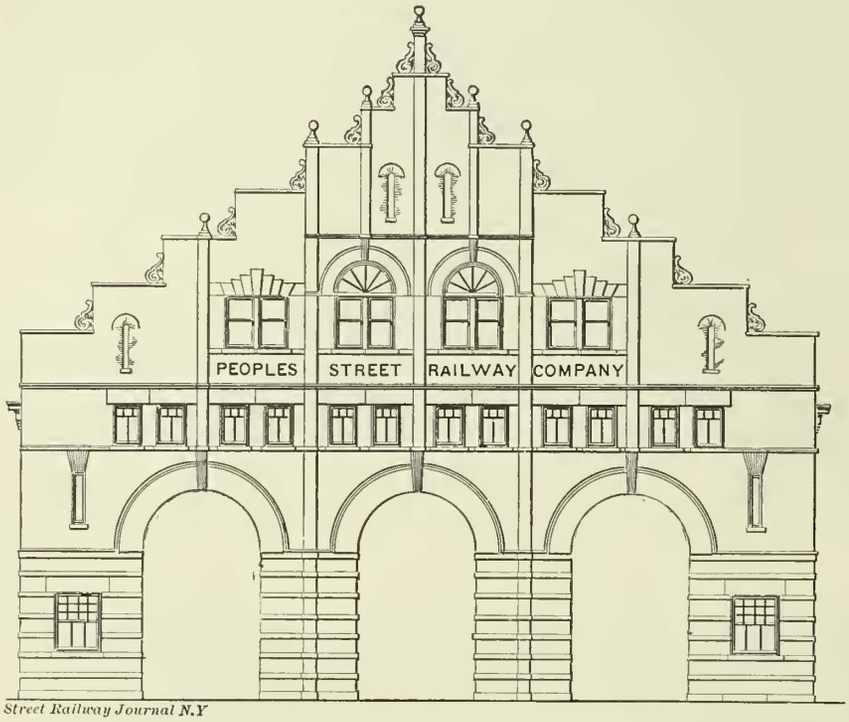


FIG. 2.—FRONT ELEVATION OF CAR HOUSE—PEOPLE'S STREET RAILWAY.

Brick and iron are the principal materials used, the only wood entering into the construction being the window frames and sashes, a few of the doors and the planks between the tracks.

Before the building was designed, the railway company decided that they would establish shops sufficiently large and convenient to accommodate the requisite amount of machinery for doing all repairs of every kind, being dependent upon no local machine or wood working establishment. This was undoubtedly a wise conclusion, and the example here set is surely worthy of the consideration of all roads not provided with means for doing their own repairs.

No description of the outside of the house is necessary, as it is well shown in Figs. 2 and 3. Looking at the inside (Figs. 1, 4 and 5), we have, first, the main storage room for cars, shown in Fig. 1, which is 150 ft. long and 68 ft. wide. Here is space for thirty-five cars on seven tracks. Three of these tracks lead directly to the street, while a transfer table is used for putting cars on the other four.

There are, strictly speaking, no pits in the house, but an iron trestle work covers the entire room, making a clear space, four feet six inches deep under every car, which permits passing from one side of the building to the other underneath. The ground under the trestle is concreted, and then cemented, and provided with drains, all centering in one main sewer. By this means all cars can be washed right where they stand. This can be done in winter as well as summer, as every track is provided with steam heat. By having ready access to the bottom of all cars, a thorough inspection can be had of all the motors and running gear at any time, without moving a car. The height from the rails to the trusses being twenty-five feet, enables work of all kinds to be done on top of the cars to the trolleys, and when cars are standing in the house the trolleys can stand erect, relieving the springs from all strain. The entrances to the front of the main building are closed by means of rolling steel shutters.

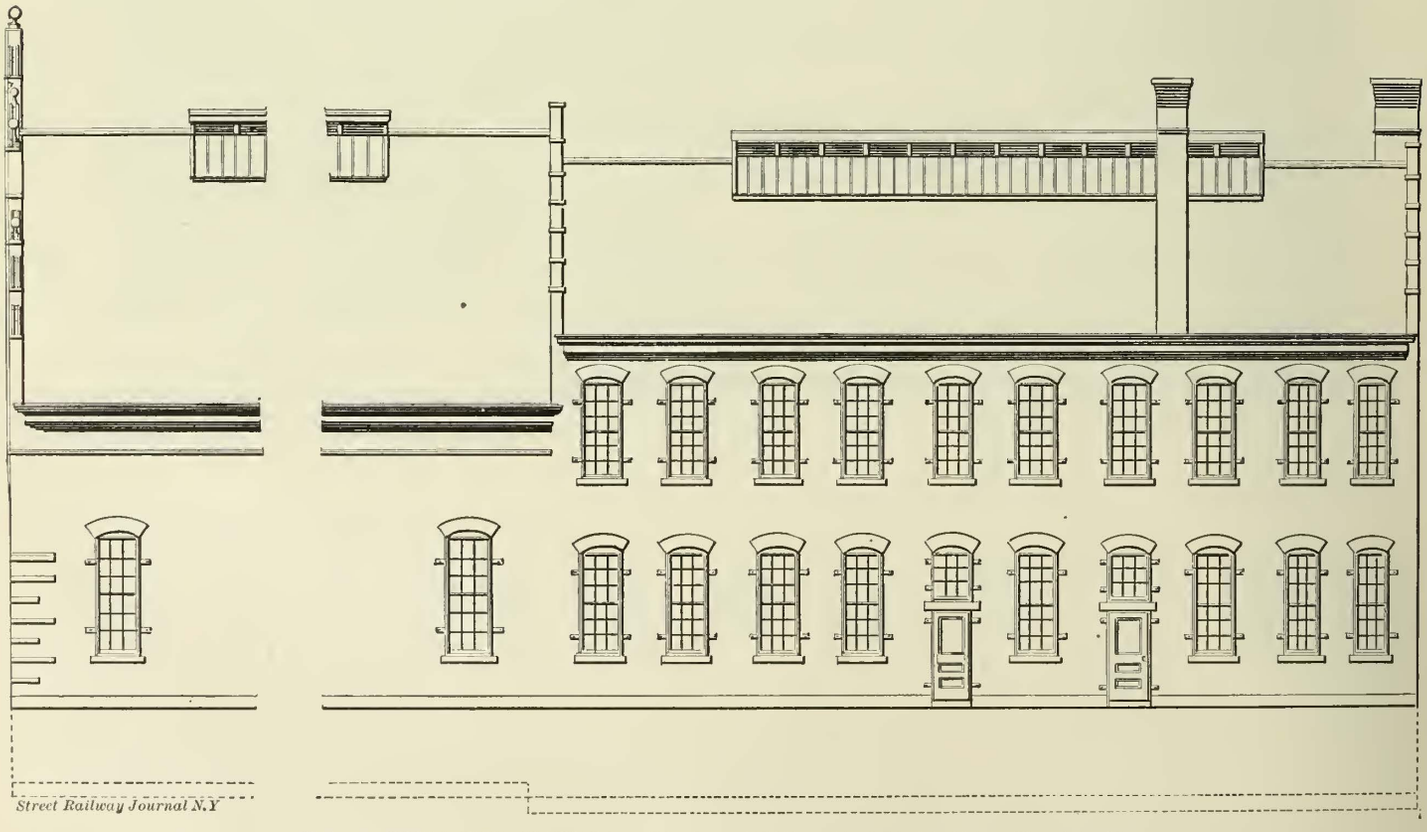


FIG. 3.—WEST SIDE ELEVATION OF CAR HOUSE—PEOPLE'S STREET RAILWAY.

Passing to the repair shops directly in the rear of the main car storage, we have the following rooms on the ground floor: Machine shop, blacksmith shop, winding and testing room, stock room, oil room, and general work-

ing space. This general working space will admit of four cars being put in at one time, and is separated from the main house by rolling steel shutters, as also is the elevator well. There is, besides, a small room for rough storage. There is also an elevator well extending from this floor to the second story, provided with an elevator capable of taking up a fully equipped car and run by an electric motor.

In the second story we have the paint shop which is a large and thoroughly lighted room, and capable of holding six cars at one time; the carpenter shop, and employes' reading room. In the basement is the boiler room, and a large storage room under the machine shop. All the shops are heated by steam, and all conveniences are provided for the employes. No pains or money have been spared to make this house a model in every respect, and the railway company deserve great credit in providing such a structure.

It is pleasing to note the improvements in this kind which have been made during the last twelve months, all bespeaking the confidence which many of our leading street railway officials have in this comparatively new form of motive power. That it has come to stay is an assured fact beyond question, notwithstanding the severe attacks and malignment of the daily press, and improvements such as described above are only a forecast of what is to come.

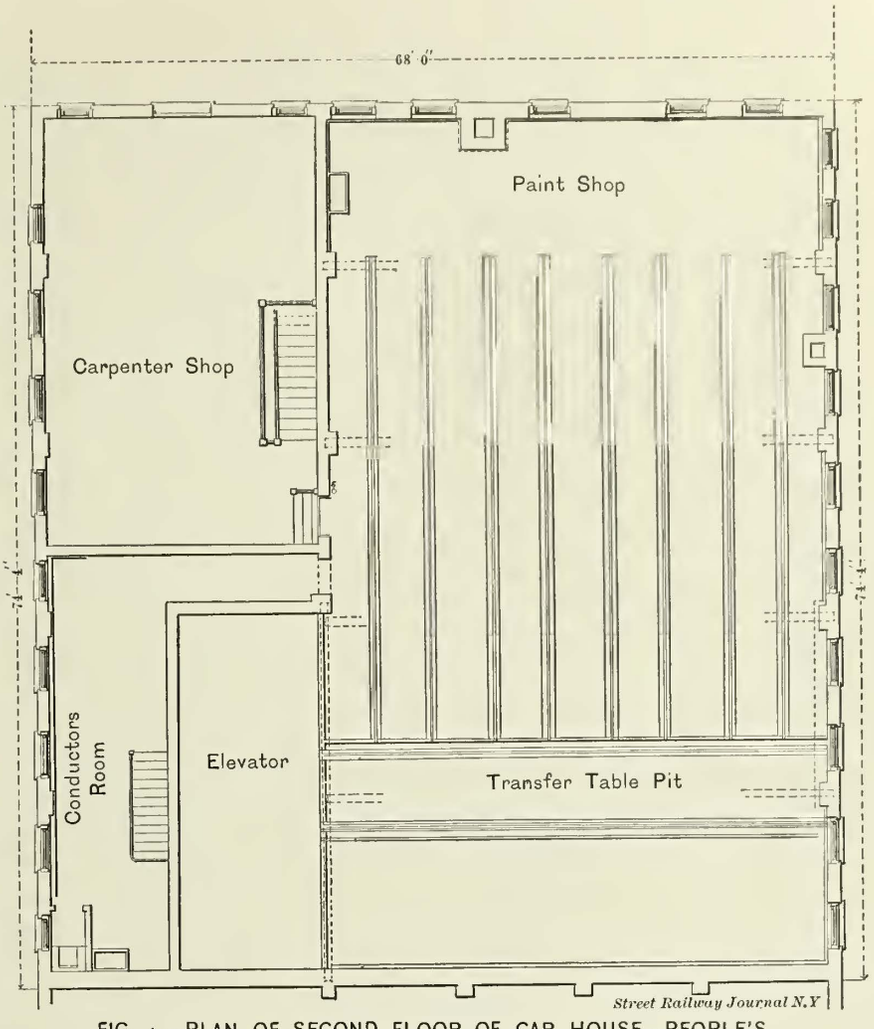


FIG. 4.—PLAN OF SECOND FLOOR OF CAR HOUSE—PEOPLE'S STREET RAILWAY.

A BILL has been introduced into the Massachusetts legislature and favorably reported by the railroad committee, authorizing all steam railroads of that state to operate their roads by electricity. The movement is said to have originated with the late James T. Furber, who was an advocate of electricity for interurban railroad traffic. The Old Colony Railroad Co. have been carrying on some experiments, with a view to investigating the relative advantages and disadvantages of electric power for railroad service, and it is said that this road, as well as the Boston & Albany, will probably make practical trial on a short section of their lines before long. In the meantime Henry Villard is reported as making a careful investigation of the same power for some of his Western roads, especially the Wisconsin Central, and as being greatly in favor of a trial on a large scale. The result of these investigations throughout the country will be watched with the greatest interest.

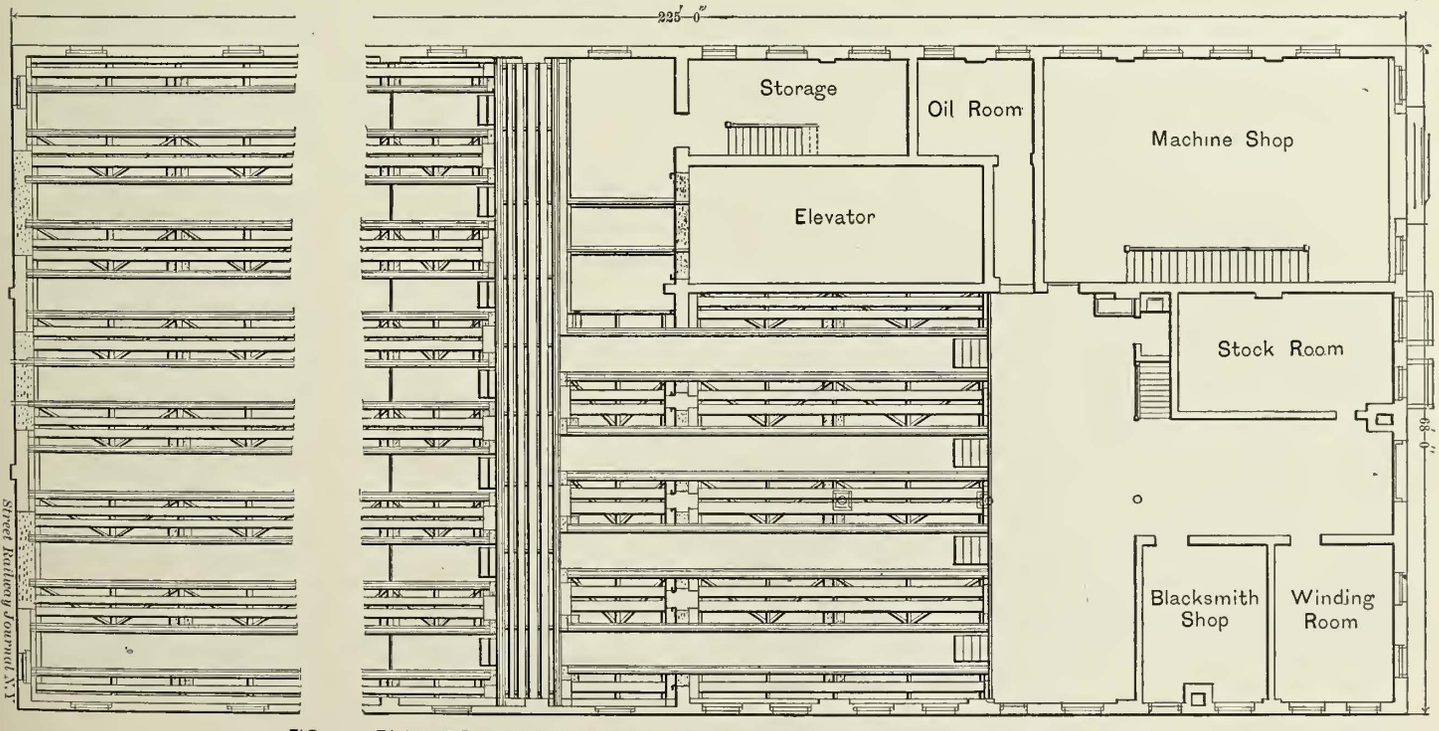


FIG. 5.—PLAN OF GROUND FLOOR OF CAR HOUSE—PEOPLE'S STREET RAILWAY.

THE net earnings of the West End Street Railway Co. of Boston, Mass., for January show an increase of about $40,000 over the net earnings of the corresponding month of a year ago.

A Paying Train.

Street railway managers who complain about the general dullness of business, should glance at the accompanying engraving which is from an actual photograph, and which shows that some roads sometimes carry paying loads. The view shows a cable railway train on the Washington & Georgetown Cable Railway going north on Seventh Street, loaded with passengers bound for a ball game, and was taken last summer. The building in the

LOADED FOR BASE BALL, SEVENTH STREET, WASHINGTON.

background is the United States Patent Office. The single car shown in the engraving as turning the corner is an Edco storage battery car, on the Eckington & Soldiers' Home Railway.

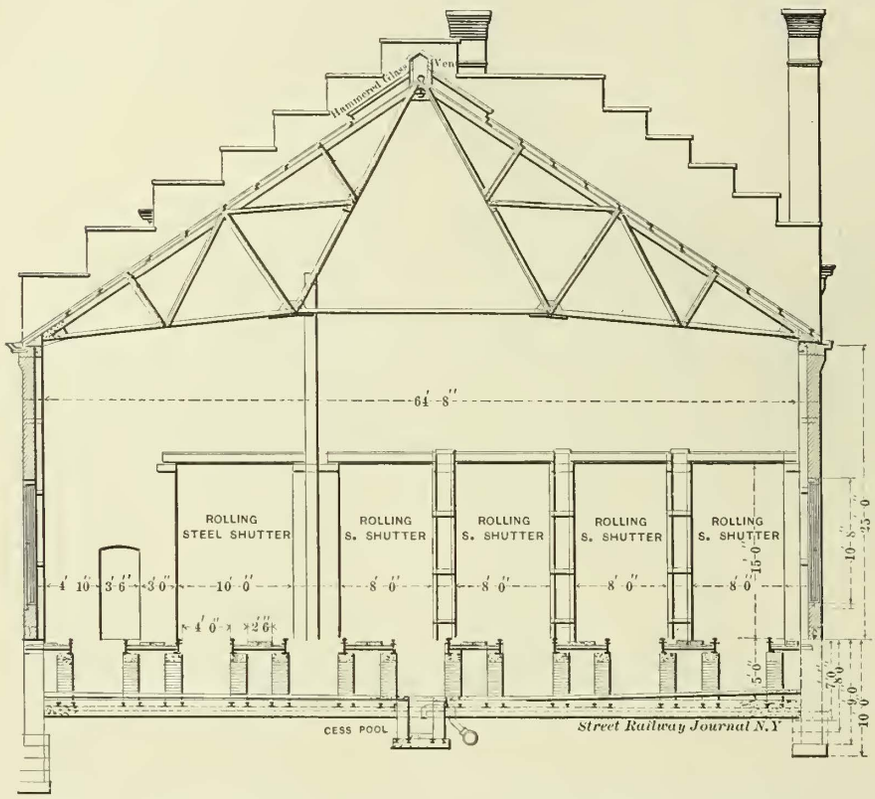


FIG. 6.—CROSS SECTION THROUGH CAR SHED, PEOPLE'S STREET RAILWAY.

The East Cleveland Street Railway.

Cleveland was one of the first cities in which electric power was adopted on a large scale as a means of street car propulsion, and the success attained on the several lines there went far in convincing street railway managers of the desirability of the electric means for propulsion. During a recent visit to the city by one of our representatives, the same officials, who showed their foresight in the adoption several years ago of the electric motor on their lines, exhibited equal enthusiasm over the results attained by electricity and confidence in it as providing the most desirable method of operating future extensions. Below will be found some facts secured during a visit to the power station of the East Cleveland Railway Co. and a trip over this company's line.

THE POWER STATION.

This is located near Cedar Avenue, is entirely of brick and presents an attractive appearance. The dimensions of the first building constructed by the railway company for the purposes of a power station were 80 × 100 ft. to which was added later an extension, 80 × 140 ft. with flat roof finished off with battlements rising to about thirty feet from the sidewalk, making the present building an L with a front of 160 ft. and sides of 100 and 140 ft. This building will probably be again extended soon, so as to occupy an area 240 × 140 ft. All future buildings will be of brick with roof of 2 × 4 ins. joists laid edgeways and supported on iron trusses. The present stack is 136 ft. high with six foot flue and the contract has been let for an additional stack which will be 175 ft. high and will have an eight foot six inch flue.

The boiler equipment (Fig. 2) consists of seven Cooper boilers, and an equal number built by the Variety Iron Works of Cleveland. Each of these is 72 ins. × 18 ft., of 130 H. P. capacity, and is designed to supply steam at 100 lbs. pressure. All are provided with the Murphy smokeless furnace and automatic stoker, manufactured in Detroit, which give satisfaction. The Ford boiler cleaner is being tried, and seems to give good results. The pumps are of the Deane duplex and Hughes' patterns, two of the former and four of the latter being employed. Five Berryman heaters, 12 ft. × 40 ins., and Reliance water columns, complete the boiler house equipment.

Water for the boilers is now taken from the city mains, but the railway company have just completed an artesian well, 377 ft. deep, and having a hole eight inches in diameter. This well will give a supply of 100,000 gals. in each twenty-four hours, with natural rise of water to within seventy-five feet of the surface. The contractors for this well were the Buffalo Well Drilling Co.

The railway company are using for recording the steam pressure at all times, a Bristol recording steam gauge, made in Waterbury, Conn. This makes a record upon a prepared disk, and these latter, which show the pressure record for each twenty-four hours, are kept on file.

The interior of the engine room is clearly shown in Fig. 1, and the power is furnished by both high and low speed engines. The former were the first installed, and they occupy the old part of the building. The original installation was one 125 H. P. Armington & Sims engine, with two generators of sixty H. P. each. This was soon increased 200 per cent., which took care of all the motors for about seven months, at which time the entire plant was again increased 200 per cent., giving a generator capacity then of 1,000 H. P. About one year later this plant was increased over 100 per cent., which gives at the pres-

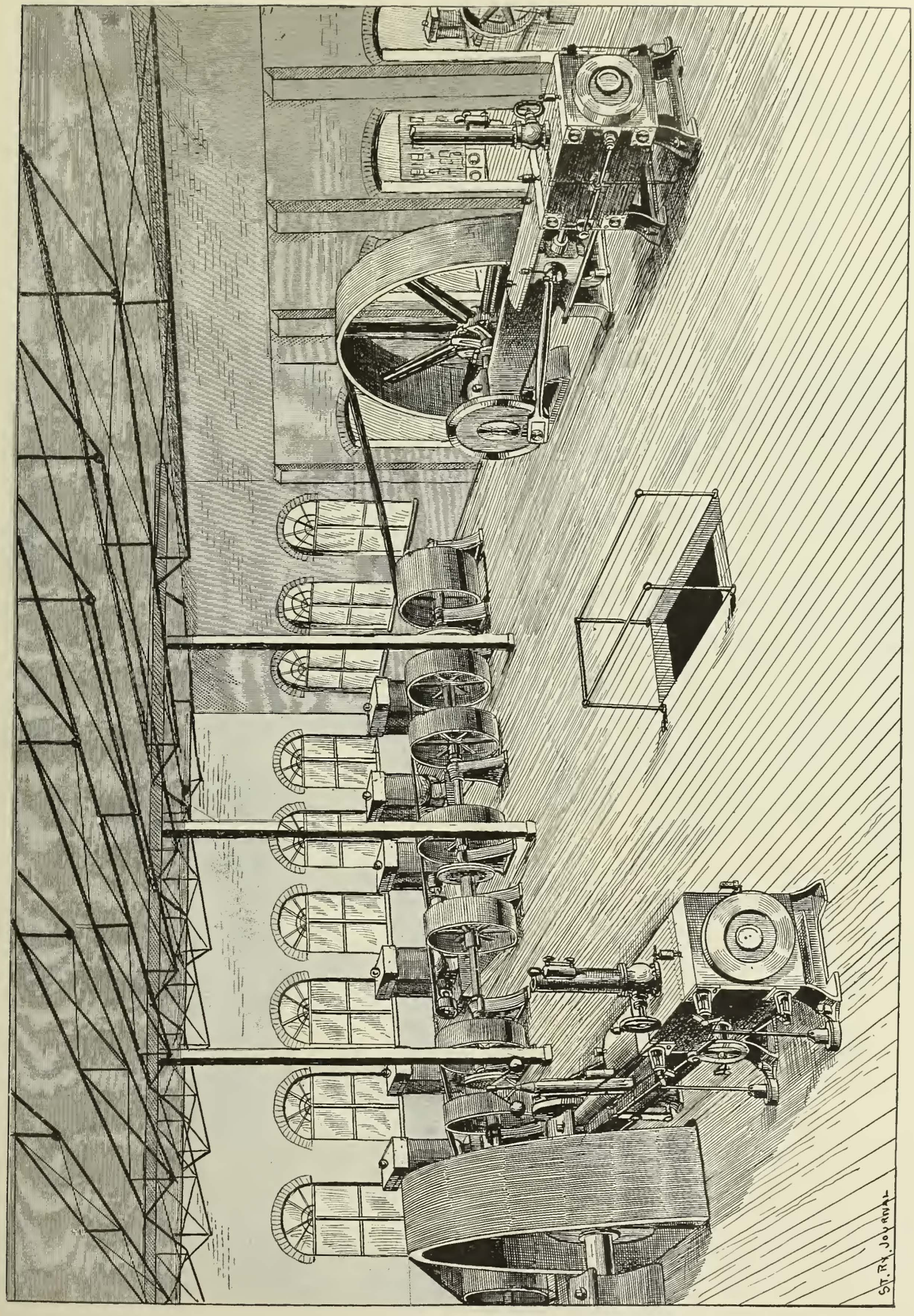


FIG. I.—INTERIOR OF ENGINE ROOM—EAST CLEVELAND STREET RAILWAY.

ent time a generator capacity of more than 2,000 H. P. The last increase was made contrary to the general opinion at that time in regard to the practicability of running low speed engines in connection with high speed engines, the result of which, however, has been very favorable, and enables the management to judge of the efficiency of the two kinds of plants. Some interesting figures in this regard are given in another column.

The present steam engine equipment consists of three 200 H. P., 18½ × 18 ins. Armington & Sims engines, running at 200 revolutions, and three 125 H. P., 14½ × 15 ins. engines of the same type running at 260 revolutions. The slow speed engines are two in number, manufactured by C. and G. Cooper & Co. of Mt. Vernon, O., of 500 H. P. each, cylinders 28 × 48 ins., and with a speed of seventy-two revolutions per minute. The fly wheels of these engines are twenty feet in diameter, have a fifty-two inch face and weigh twenty-five tons each. These engines are fitted with a bell crank on the governor with a movable weight by which the speed can be increased or decreased at will while the engine is running. The effect of the weight is to balance in part the influence of gravity on the governor balls, and the connections are so arranged that should the governor belt break, the steam supply will be cut off, avoiding any tendency on the part of the engine to race.

All oiling of the engines is done automatically through a series of pipes connecting with a reservoir and having branches with outlets over each oil cup. The waste oil is first put through two filters, then runs by gravity into a tank, whence it is pumped to the reservoir over the boilers and which has a capacity of about eight barrels. From this reservoir the oil runs through a settling T which has a valve at the bottom, through which all impurities may be drawn out, and from there to every engine in the station. Small branch pipes lead to all bearings. Each pipe is fitted with a small valve by which the flow can be regulated.

The belting is two ply, was supplied by the Bodifield Belting Co., and gives good satisfaction.

The high speed engines are, of course, belted directly to the generators. The low speed engines are belted to a line shaft furnished by the Hill Clutch Works of Cleveland, O., and consisting of four lengths, aggregating about seventy-nine feet, seven inches in diameter. On this there are six 88 × 26 ins. split friction clutch pulleys so arranged that either of the two engines, which are at the ends of the shaft, can run the entire line, and there being a friction clutch cut-off coupling in the centre either engine can run one-half separately.

The receiving pulley of the engine next to the old part of the building is on a quill or hollow sleeve. This is done so that if the plant be extended in the future and another slow speed engine added, this engine can be shut down without interfering with the running of the line shaft.

The engine nearest the observer in the view of the station interior is belted direct with a cut-off coupling between the receiving pulley and the shaft, by which means the engine can be stopped while the shaft can be run from the other engine. The receiving pulleys are 74 × 50 ins. The shaft is supported by eleven Hill self oiling bearings and stands.

As each generator is driven from a clutch pulley it can be stopped or started without interfering with the other machines, and as the engines are entirely independent of one another, the plant is strictly interchangeable, lessening the possibilities of a shut down to a minimum.

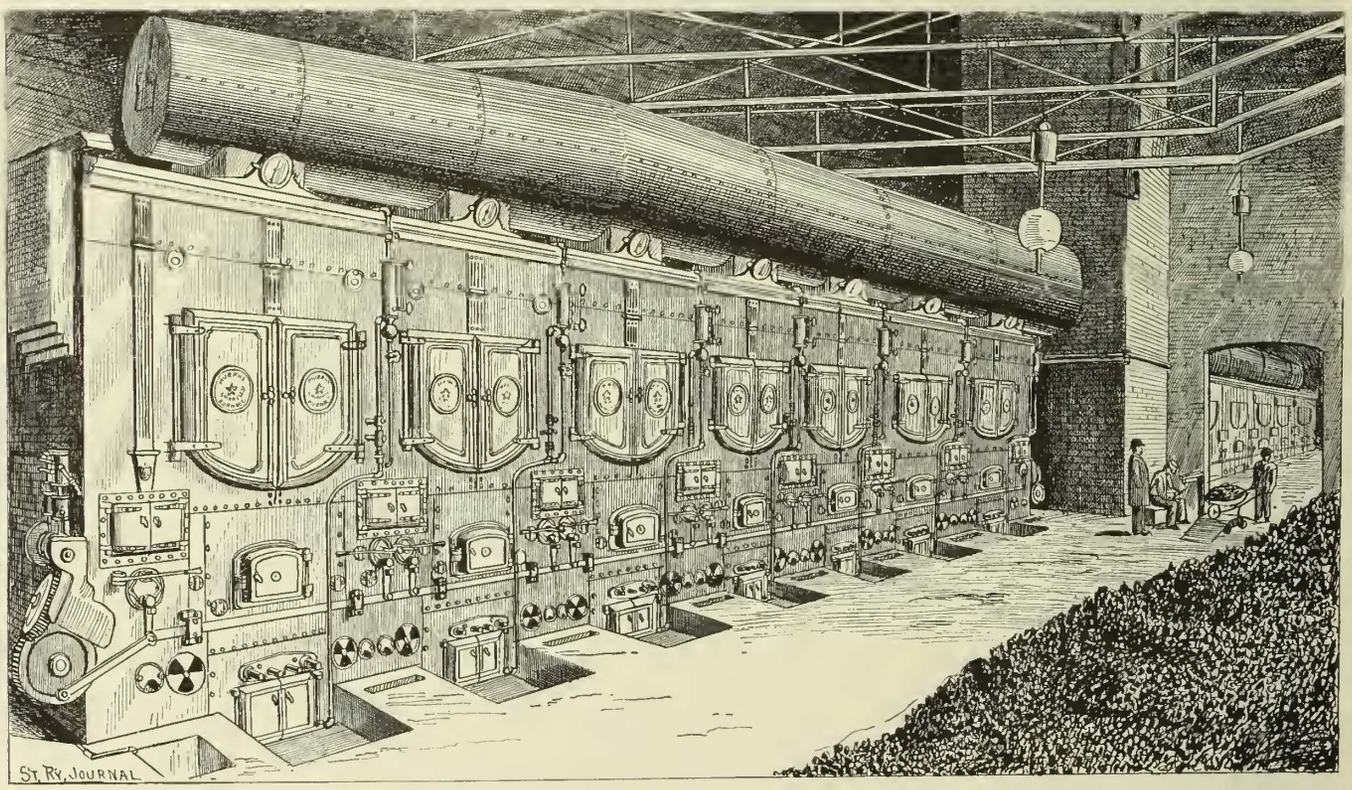


FIG. 2.—BOILER ROOM, EAST CLEVELAND STREET RAILWAY.

The generators, which are sixteen in number, are all of the Edison compound wound type, and vary in size from forty to 175 kilo-watts capacity each. The first six generators installed were of the shunt type, but it was found that the voltage varied so greatly when these were relied upon to supply the current that a change had to be made to compound winding. The present machines hold the voltage within a range in variation of ten volts and give excellent satisfaction. Two more generators of the 175 kilo-watt size will soon be added to the station equipment.

A special device has been adopted to keep the armatures cool while running. The power station is provided with a basement six feet in the clear under the engine and dynamo rooms and having grated windows. Laid into the generator foundations are tile pipes four inches in diameter, the upper opening being directly under the armature while the lower end opens into the basement. The air in the latter being always cooler than in the engine room, a stream of cold dry air is insured through the tile pipes. It has been found by tests that the air in the basement is about twenty degrees below that of the engine room.

The power house, motor shops and grounds are lighted by arc lights, operated from the street railway circuit. These lamps have proved very satisfactory to the company, especially on the ground of economy of power. The company consider themselves the pioneers in lighting in this manner from a 500 volt railway circuit, having had lamps in operation about three years.

The switchboard is in the old part of the building and is so arranged that it can be extended indefinitely as the plant grows.

Each line section, which, it might be mentioned, includes not more than three miles of double track, is provided with fusible copper plug switch on the switchboard, which admits of each section being operated separately or with the others, the feed wires of all the sections being connected together at their outer ends by fuses. The fusible switches employed are of a special construction, designed by Mr. R. M. Fuller, assistant electrician of the company,and manufactured by the East Cleveland Co. The peculiarity of this switch is the manner in which the fuse is adopted, it being held between a stationary post and an eccentric, at the outer end of which is a lever with a ball or weight. This arrangement compensates for any slack in fuse wire, at all times insures a sure contact, and makes it easy to replace any melted fuses. The company have always used a fusible plug and think it much superior to circuit breakers. They have never had a machine damaged from overload due to short circuit on the line.

The power house is provided with the Wason lightning arresters, two of which are connected to each feed wire on entering the building. These arresters are arranged to be switched on separately, permitting the placing of new fuses at any time. The company have never had a case of damage in the power house by lightning.

The voltmeter is connected to a switch, from which the voltage of any machine can be taken, and each section of line is provided with an ammeter. All the feed wires being connected together at their outer ends, the station attendants are enabled to switch out all but two wires after 1 o'clock at night, when only the night cars are on. These two feed wires are provided with a drop, which rings a large bell in case a fuse blows on any section.

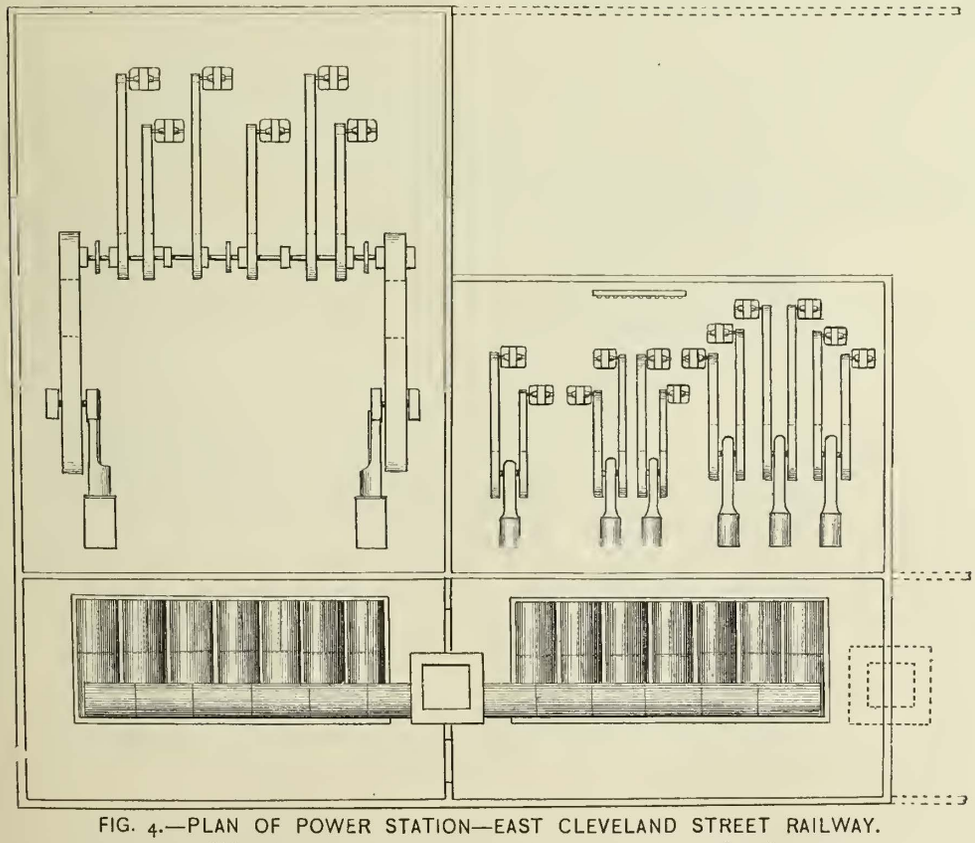


FIG. 4.—PLAN OF POWER STATION—EAST CLEVELAND STREET RAILWAY.
(Direction of proposed extension is shown by dotted lines.)

All the wiring in the power house is below the floor, which makes a much neater appearance than having it overhead, and also facilitates moving machinery. The greatest loss on the longest line, which is about six miles from the power house, is never over 10 per cent., and it is the policy of the company that, as the number of cars increases, to put up additional feed wires, always keeping their loss within 10 per cent.

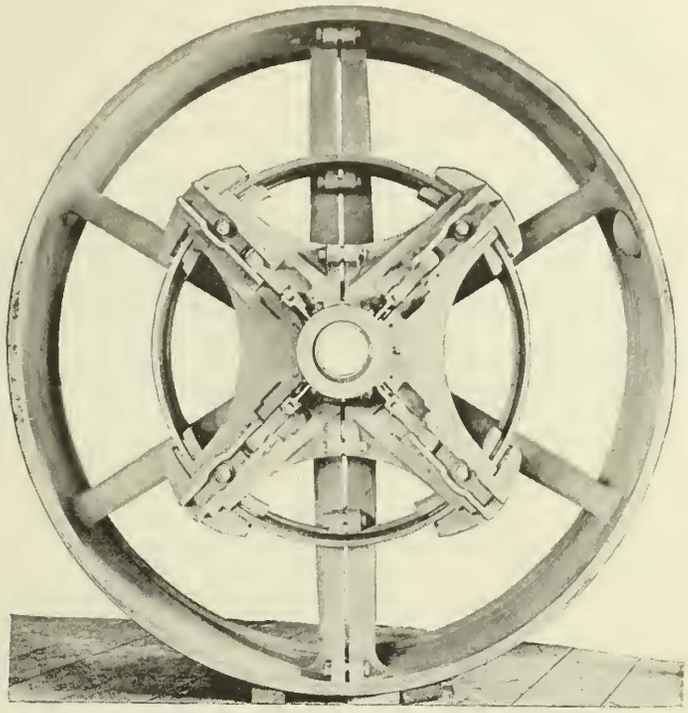


FIG 3.—HILL CLUTCH PULLEY—EAST CLEVELAND STREET RAILWAY.

OVERHEAD CONSTRUCTION.

The first overhead construction put up consisted of iron poles twenty six feet long, set five feet in the ground, and tamped in with broken rock and cement. The span wires were No. 6 iron cable, and No. 6 silicon bronze trolley. But with the increase of the number of cars, the company found these wires too light, and have substituted No. 4 soft copper for span wire, and No. 0 hard drawn copper for the trolley wire. The advantage claimed for copper as a span wire is long life, owing to its ability to withstand heavy blows without breaking, and its resistance to corrosion from acid and gases in factory smoke. The construction just described covers six miles of the total of forty-four miles of road, while the rest consists of copper span wire and No. 4 silicon bronze trolley, except on the Suburban, which has wooden poles carrying a bracket arm eight feet long, and a No. 0 hard drawn copper trolley-wire. The section of line which runs east from Lake View through the village of Collamer, is lighted by the company with thirty-two C. P. lamps, suspended in the middle of the street from every second span wire.

The overhead wiring in the centre of the city is so arranged that it can be cut out in sections in case of fires, thereby facilitating the work of the firemen. Providing for the safety of firemen in this way, the company find that the fire department does much in return to facilitate

the clearing up of a street after a blockade has been opened. The downtown wires of the East Cleveland Co. cross and recross those of other roads with which circuit breakers have been arranged, permitting the interchange of current in the downtown sections. By the different roads keeping the same polarity on the overhead wires there is never a difference of potential to exceed forty volts between the ends of the circuit breakers.

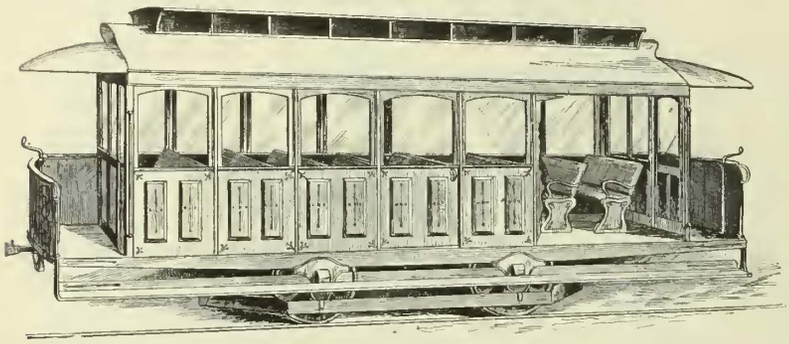


FIG. 6.—COMBINATION CAR—EAST CLEVELAND STREET RAILWAY.

All the overhead lines are provided with Wason lightning arresters well grounded and placed one at every mile of the road.

RETURN CIRCUIT.

The return curcuit is partly provided for by laying between the rails of each track two No. 4 copper wires, while the heavier lines have three No. 4 wires to each track. The company are of the opinion that an efficient return circuit cannot be provided by means of rods or plates buried in the earth, especially in a soil which, like that of Cleveland, consists of dry sand. In addition to the wires between the rails, the latter are connected together by No. 4 copper wire. The rail bonds are connected together across to each track at every second joint, and at every fourth joint the four rails are connected together, insuring a perfect return even in case one or more wires be broken. By placing the ground wire about six inches away from the rail the company find there is no galvanic action which would deteriorate the copper were it placed in contact with the iron.

TRACK.

The track is laid with Johnson sixty-two pound girder rails spiked directly to the ties, and without ballast. This construction, it is stated by the management, does not seem to stand up well under the traffic, and the joints pound considerably.

CARS.

Of the ninety-three motor cars operated by the East Cleveland Railway Co., ninety are equipped with Edison motors. Of these, eighty have the Edison No. 6 motors, and ten the Edison No. 14 motor, both of which give good satisfaction. In addition, the company have in operation one car equipped with Thomson-Houston S. R. G. motors, one equipped with Wightman motors, and one with a Detroit motor. The company have three long cars, two mounted on Robinson radial trucks, and one on Brill maximum traction trucks. All other cars are of the sixteen foot, open platform type. A number are equipped with Burton electric heaters, and all carry Wason lightning arresters. About eighty motor cars, two-thirds of which draw trail cars, are kept in constant operation, and the total daily car mileage is 13,000.

During the last year the company built about twenty-five car bodies, and they expect in the future to do all their own construction in this line. They are about to build under patents a combination car of an entirely new design.

This car, as will be seen from Fig. 6, has eight cross seats with room for four passengers in each and is intended to be used as a closed car in winter and an open car in summer. The aisle instead of being in the centre as in ordinary cars, is at one side. When used as a closed car, this aisle is reached by three doors, one at each end of the car and one at the side. A step is provided which extends the entire length after the manner of ordinary open cars. The side of the car nearest the aisle consists of two removable panels which are taken out in summer. The windows at the opposite sides and ends are so constructed that they can be let down, making it practically an open car.

The officers of the East Cleveland Railroad Co. are A. Everett, president; C. W. Wason, vice-president; H. A. Everett, secretary and treasurer; E. Duty, superintendent.

The Ford-Washburn Storage Car.

During the month of March a number of public trial trips were made in Cleveland by the "Ideal," a new storage battery car operated by the Ford-Washburn Storelectro Co. of Cleveland. This car, a view of which is shown on this page, is twenty feet nine inches long inside, twenty-eight feet over all, was built by the J. G. Brill Co., and is mounted on a Tripp truck, furnished with extension springs.

The battery is of an entirely new design and possesses a number of novel and important features. Each cell contains five sets of elements comprising four positive and five negative, made of perforated lead, formed in rectangular shape and placed alternately, one outside of the other. Recognizing the trouble which has occurred in previous storage batteries from short circuiting, the inventors of this battery have made it impossible for a positive element to touch a negative. This has been accomplished by separating the two by a porous partition, through which the acid can percolate, but which offers an effective barrier to the active material. The arrangement is exceedingly simple, and attains effectively the desired result.

THE STORELECTRO CAR.

The negative elements are all connected together by a solid lead strip welded to the bottom of each receptacle. The positive elements are similarly connected at the top. By this method of connection, it is claimed that a more evenly distributed charge is obtained, and an extra strength given to the battery, while at the same time perfect contact is assured.

The sets of elements are placed in hard rubber boxes, the dimensions of 150 ampere hour cell, such as is used on the present car, being twelve inches high and $4\frac{1}{2} \times 8$ ins., and its weight complete with acid and rubber box, forty pounds.

To prove the impossibility of injury from short circuiting these cells, this has frequently been done by the

inventors who have connected the positive and negative elements through an ampere meter and obtained a momentary current of from 300 to 500 amperes, but the cells have withstood the strain without deterioration.

The battery equipment for each car consists of 180 cells of the size already mentioned. The cells are completely sealed up, with the exception of two vent holes in each cover.

The motor is a Ford & Washburn thirty-five H. P., with patent ventilated armature, and is capable of working up to forty H. P. for a short time. This motor is geared to both axles, and can be run from either end in either direction, and at seven variations of speed, by an ingenious method of battery commutation. The weight of the motor equipment complete is about 2,000 lbs.

The batteries are, as usual, carried under the seats, but, instead of having the side panel removable, are carried in trays which are slid into position through openings at the ends of the car. This is provided for by having suitable openings in the dash board.

The car in its trial trip has made an excellent showing and has maintained, for a considerable time, a speed of from fifteen to eighteen miles an hour. Upon a recent trip over the lines of the Woodlawn & West Side and East Cleveland Street Railway companies, the car, with thirty-five passengers, covered sixteen miles with an average ampere reading of 20, and voltmeter reading of 350, and 3.3 miles were run in twelve minutes, during the rest of the trip trolley cars were in the way. On the route named there are twenty-three sharp curves and ten grades, ranging from 2 to 5 per cent. The car has drawn a loaded trailer up a 1½ per cent. grade at the rate of fifteen miles per hour. With one charging the car can run, it is said, on ordinary track, for a distance of forty miles. At a test made in Cleveland, the cost of coal for charging the battery was one-half cent per car mile, with coal at $1.40 per ton.

THE KINETIC STEAM MOTOR CAR FOR WEST CHICAGO STREET RAILWAY.

The Kinetic Motor.

This new street railway motor, after a series of exhaustive tests, is claimed by its inventors to have thoroughly solved the problem of how to secure the best possible service at the least possible cost. It represents no new principle of power, but is a direct application of the most simple, efficient and reliable form of energy yet discovered or utilized—that of steam.

The working machinery of the motor resembles that of the locomotive, but in place of the boiler there is a receiver of proper capacity, which is charged with water heated to a high temperature. This receiver is heavily jacketed to prevent radiation, while a simple form of auxiliary heat, occupying but a small space and completely hidden from view, assists in maintaining a steam producing standard of heat in the water from five to eight hours from one charging. Steam is generated as needed from this heated water, and, passing into the cylinders, performs its work as in the locomotive. The motor is charged from a stationary boiler, which alone consitutes the "plant," the process of charging occupying only two minutes or less. A run of twenty miles or more can be made without recharging. The weight of the car and apparatus shown in the engraving is nine tons.

The claims made in behalf of the motor may be thus summed up :

Each motor contains its own source of power, and is not dependent in its working upon any system of wires, trolleys, cables or conduits.

Under the most exacting conditions it has shown itself equal in strength to the ordinary electric motor car, being capable of hauling from three to five loaded passenger cars over an ordinary track with ease.

There is absolute freedom in its use from the grinding and buzzing sounds inevitable in the operation of many mechanical systems. The machinery works easily and noiselessly, and the motor can be stopped or started without the jerky motion common to other forms of power.

There is no smoke or cinders, no noise of escaping steam no possible danger from overheated boilers. Any one competent to run a horse car can operate it.

It has been demonstrated by repeated trials that the cost of maintaining power by this system will not exceed one-third of that of any other system known. President H. M. Whitney, of the West End Street Railway of Boston, says in a recent speech that for that road in the year 1891 the cost of running a horse car was nearly twenty-eight cents per car mile, and of this about twelve cents per car mile was for motive power alone.

The cost of the Kinetic motor has been found to be less than two cents per car mile for motive power.

The illustration shown is of the car which has just been completed and will very soon be in operation on the line of the West Chicago Street Railway.

The Kinetic Power Co., of which Gen. Joshua L. Chamberlain of New York is president and Gen. Francis A. Osborne of Boston may be addressed for further particulars. The offices of the company are in the Rookery, Chicago, and the Mills Building, New York.

Handsome Open and Closed Cars.

In the accompanying engravings are shown two handsome cars, built for the Jamestown (N. Y.) Street Railway Co., by the J. G. Brill Co. of Philadelphia,

OPEN CAR EMPLOYED ON ELECTRIC RAILWAY AT JAMESTOWN, N. Y.

which are illustrative of the growing tendency to longer cars for high speed and heavy traffic.

The closed car is twenty-four feet long, has vestibuled ends, which are fitted with drop sashes, sheathed up with sheet steel on the outside, and fitted with Brill's folding vestibule doors on the sides. The interior is finely fitted and decorated. As will be noticed, the car differs from most other styles of cars in having a beveled edge, polished crystal, plate glass window nearly six feet in length, in the centre. The body of the car is mounted on two Brill Eureka Maximum Traction trucks. The car is painted black, with gold decorations, letters and numbers, and the trail cars are of the same colors.

The open car is a new design of a twelve seat, open motor car, eight of the seats having reversible backs, and four seats having stationary backs. The ends of the car are enclosed with drop sashes, and the cars themselves are fitted with spring roller curtains, bird's eye maple veneer ceiling, handsomely decorated, and solid, polished bronze trimmings throughout. This car, like the closed car, is mounted on Eureka Maximum Traction pivotal trucks. This car is painted white, with gold letters and decorations, while the trail cars to be drawn by it are also white, making a white train of open cars, and a black train of closed cars.

Both cars will be equipped with two Short single reduction, thirty H. P. motors to each car, and both will have thirty-three inch driving wheels

These cars are the result of the liberal policy of A. N. Broadhead, president of the Jamestown Street Railway Co.. who has made special efforts to bring his street railway to the front as one of the best equipped electric railways in the country, and the manufacturers state it as their belief that these styles of cars will be adopted in many places where interurban and suburban street railways are being installed.

The Street Railway of Palatka, Fla.

We present herewith a view of one-half of the

CLOSED CAR EMPLOYED ON ELECTRIC RAILWAY AT JAMESTOWN, N. Y.

motive power, together with the entire rolling stock, car, barn and stable of the Palatka, Fla., Street Railway. As will be seen, the rolling stock consists of two short cars, one open and the other closed, both made by the John Stephenson Co., Ltd., of New York. The motive power consists of two mules, one of which is shown in the view. The line is laid narrow gauge. The view shown was taken on the occasion of an excursion recently tendered by the president and owner of the road, who may be recognized in the group.

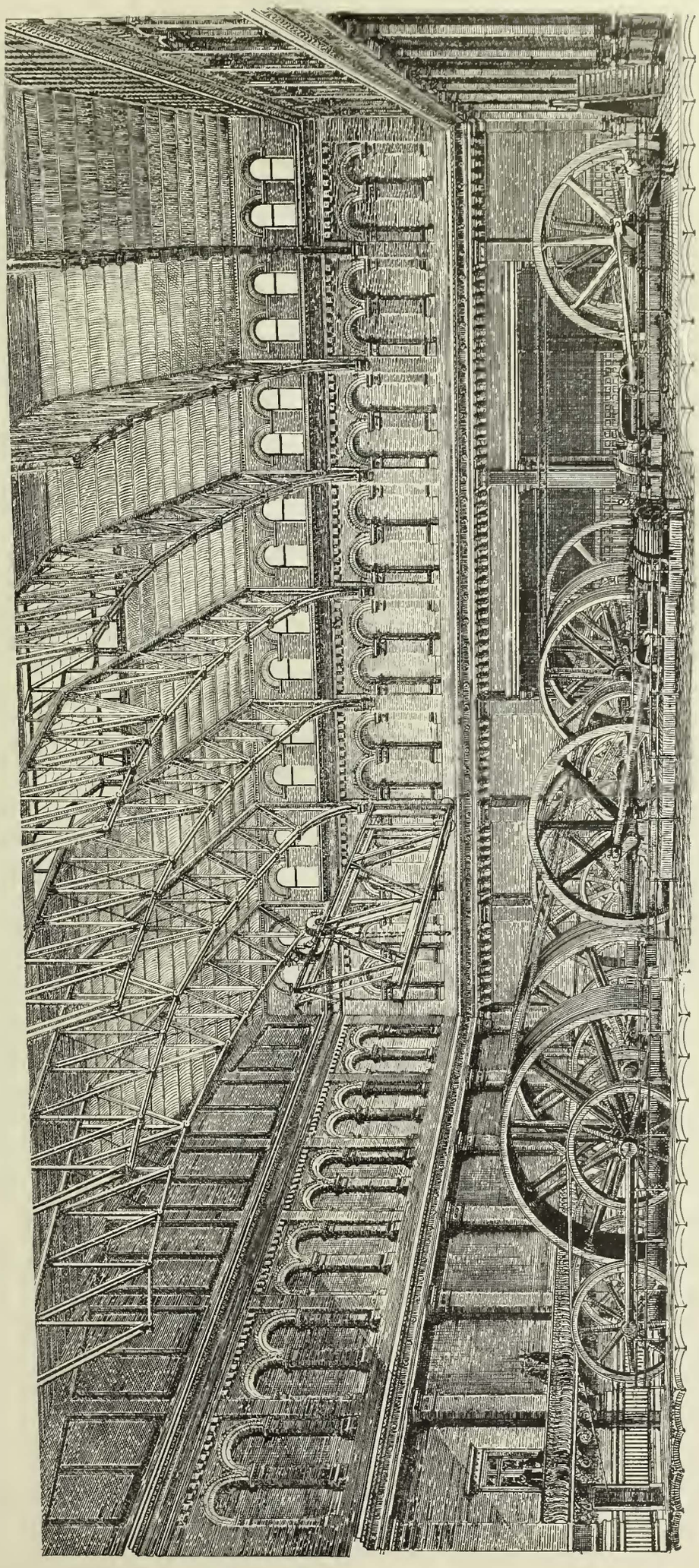
STREET RAILWAY OF PALATKA, FLA.

The frequency of fires in street car houses and power plants, emphasizes the value of fireproof structures for these purposes, and among the materials employed nothing in the market is superior to the porous terra cotta manufactured by the Pittsburgh Terra Cotta Lumber Co. The above is a name given to earthenware tile which is made of a composition of clay and sawdust, fashioned into hollow forms and rendered porous by the sawdust being consumed in the process of burning. This material is adapted for flooring and partitions in all classes of buildings. It will hold nails and screws perfectly and can be readily cut with a hand saw. Besides being adapted for building purposes this material is highly recommended for switchboard construction in electric power plants. An illustration showing its use for this purpose was given in our Souvenir edition last October, since which time it has been extensively employed. The material being in place is plastered on the face with cement, and finished to represent marble or marbleized slate.

Interior of Third Avenue (Uptown) Cable Railway Station.

In our September issue for 1891, ground plans were shown of the two cable power stations of the Third Avenue cable railway of New York, and in the February issue for this year there was shown an exterior view of the lower power station. On this page the reader has before him a view of the engine room of the Sixty-fifth Street station. The power will be provided by four Corliss engines, built by the Corliss Steam Engine Co., of Providence, so arranged that one or all of them may be operated simultaneously. The means of transmission will be by Lambeth cotton ropes. The cotton rope drums contain twenty-two grooves.

The machinery will be securely fastened to substantial cast iron bed framing, which is firmly bolted to the foundations which are built of brick, laid in the best Portland cement. The architect for this station is Albert Wagner, of 67 University Place, New York.



PERSPECTIVE VIEW OF ENGINE ROOM OF MAIN POWER CABLE STATION, THIRD AVENUE RAILROAD CO., SITUATED ON 65TH AND 66TH STS., BETWEEN 2D AND 3D AVE., NEW YORK.

Love Electric Conduit System.

The Love conduit electric railway system which was fully illustrated and described in the last issue of the Street Railway Journal is now in practical operation in Chicago. The car which is run over the Fullerton Avenue loop, is an ordinary open car equipped with a McGuire truck. Thus far little or no difficulty has been experienced in the electrical part of the system. There has been no trouble from grounds. The Love company, however, state that the mechanical details have not yet been entirely worked out. The matter of a trolley was not decided upon in advance, but several different forms were experimented with. A number of changes have been made, but the best form of trolley has not yet been determined upon. Superintendent Roach of the North Side cable road, who has been examining the system carefully, states it as his opinion that the company has every reason to be encouraged by reason of the successful operation of the car. The minor details in the system will, in his opinion, be worked out without any great trouble. The Love company are very conservative in their statements. While they say they believe they have been successful they assert that they propose within a short time to demonstrate the complete success of the system in all respects and in every kind of weather. Until they have done this, they say, they will not make any strong statements, although they are confident the problem of a conduit road is solved.

Eickemeyer Motors in Toledo.

Reference was made in the last number of the Street Railway Journal to the fact that several Eickemeyer motors were in operation on the system of the Toledo Consolidated Street Railway Co. The machines, which were made under the Eickemeyer patent by the Western Electric Co. of Chicago, were regarded as experimental when first sent to Toledo, but they have proved so successful in operation that additional orders have been sent to Chicago, and within a short time twenty-one motor cars of this type will be operated.

The general appearance of the car is shown in Fig. 1, which illustrates generally the method of connection between armature and axles.

The motor and truck are shown in Fig. 2. The former is of the Eickemeyer design in which the armature and field magnet coils are completely encased in a steel framework which forms the magnetic field. The armature coils of the motor are first formed upon arbors, and afterwards are placed upon the armature where they are secured by the usual lugs and bands. The field magnet coils also are wound upon arbors, from which they are removed before being placed in position in the motor. The coils are divided into sections, and are so connected to the controller mechanism as to give the changes necessary to produce the several speeds. Little, if any, use is made of resistance coils in operating the motor, so there is practically no lost energy due to that cause.

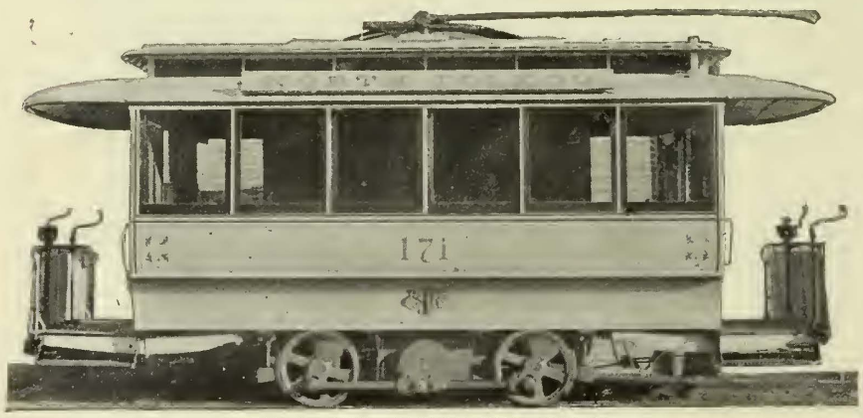


FIG. 1.—CAR—EICKEMEYER SYSTEM.

The truck consists of four cast iron pedestals bolted to the steel frame of the motor, and in the pedestals float the axle boxes which are within the drive wheel. At the outer extremities of the pedestals are bolted heavy timber cross girths, which serve as supports for the car body. The system of connection of the motor and axles is effected, as the illustration shows, by means of parallel rods which are fitted with swiveled brasses, so that the independent movement of the axles, to the necessary degree, is made possible, thus facilitating the rounding of curves, and the passing of slight irregularities in the track. The motor armature is provided with a crank disk at each end, with the pins located at angles of ninety degrees. This arrangement prevents the possibility of a dead centre in the motor, and a consequent refusal to start. The success of this method of connection, which has been adopted in locomotives for many years, has been extremely gratifying.

In equipping cars the Western Electric Co. supply a thirty H. P. motor, when the grades to be encountered do not exceed 6 per cent. When more severe conditions are to be met more powerful motors are furnished. The weight of the thirty H. P. motor and truck complete is four and a half tons. The sixteen foot car body used with the motor weighs three tons, making seven and a half tons for the complete equipment.

Novel Method of Motor Attachment.

A novel method of connecting an electric motor to the axles of a street car has recently been devised by Mr. John Christiansen, of Quincy, Mass., and has been tried on the line of the Quincy & Boston Railway. The motor is designed to run continuously and is so arranged that it can be thrown in and out of connection, at the volition of the driver, by an endless belt connected with the car axles. Connection between the motor and belt is made by mounting a rubber covered pulley on the armature shaft and pressing, or not, the belt against this by means of a corresponding rubber covered pulley which acts as a buffer. A novel type of car wheel having serrated rims is also used, one of its objects being to facilitate the operation of the car when the rails are covered with ice and snow.

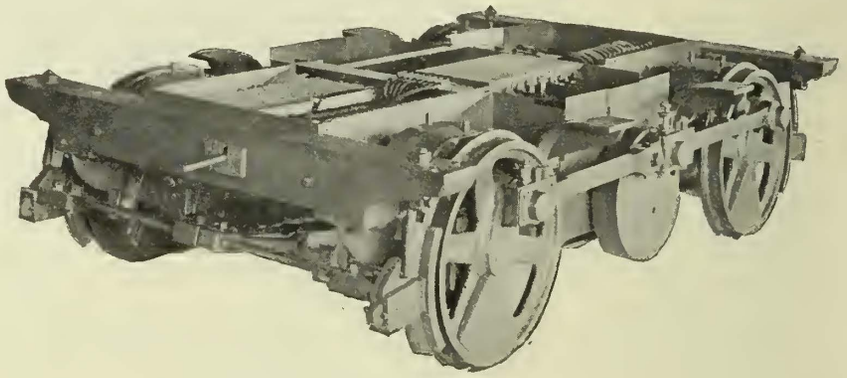
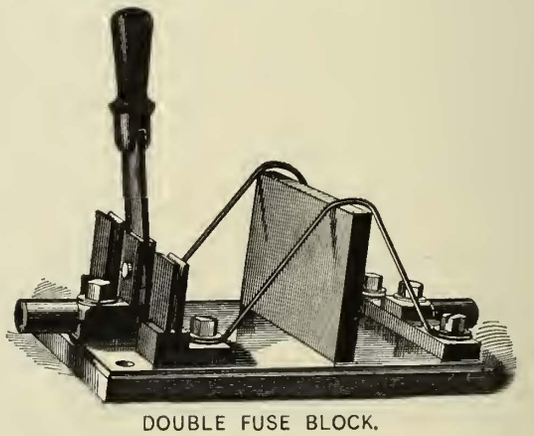


FIG. 2.—TRUCK—EICKEMEYER SYSTEM.

Double Fuse Block.

The accompanying illustration shows a double fuse block recently brought out by Wm. H. Weston & Co., of Philadelphia, manufacturers of electrical apparatus. The arrangement of the apparatus is compact, and, as will be seen from the engraving, its method of operation is simple. It is claimed that the change from one side to the other can be made very quickly by means of the switch attachment in case that one of the fuses blows, and that it can be manipulated with much greater ease, and with much better effect than the ordinary plug fuse block.



DOUBLE FUSE BLOCK.

The West End Street Railway Co. will institute the electric system in Brookline, Mass.

The Mather Generator for Electric Railways.

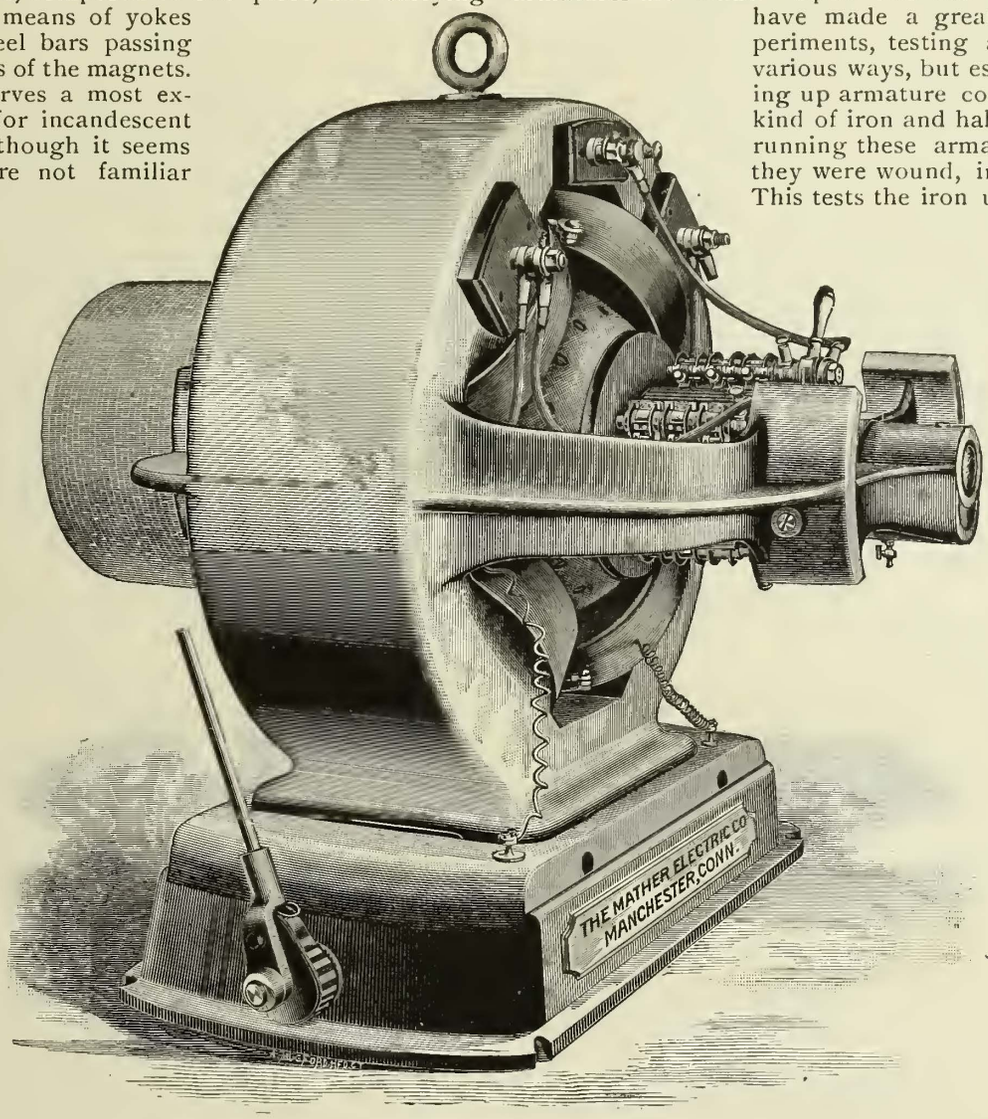
By Prof. Wm. A. Anthony.

The special feature of the dynamos manufactured by the Mather Electric Co. of Manchester, Conn., has been the construction of field magnets without joints, and having a general form as nearly as possible like the natural one of the lines of magnetic force. Following out this principle of construction, the Mather incandescent dynamos, which have been on the market for several years, have been made with cast iron field magnets of the well known ring forms, composed of one piece, and carrying the armature by means of yokes supported by steel bars passing through the poles of the magnets.

This form serves a most excellent purpose for incandescent dynamos, and although it seems to those who are not familiar with the mode of winding a difficult form to wind, it is really not so when wound for low potentials, but for high potential machines it becomes necessary, in order to avoid the strain on the field coils due to sudden changes of potential or breaking of the field circuit, to wind the wires in such a way that no two wires having any considerable difference of potential should be near each other. This necessitated the adoption of a form of field coil that could be wound in a lathe, with a single wire, in layers, and it was this necessity that led to the adoption of the form here illustrated of generators and motors. It was deemed very desirable to retain as far as possible the special features of the incandescent machines, and to this end designs were made to cast the field magnets in one piece, or, if joints are used at all, they are made by a cylindrical piece fitting into a hole bored in the casting and presenting a very large surface of contact so as to reduce as far as possible the magnetic resistance of the joints, and the machine has been so constructed that there were exactly the same joints in each of the magnetic circuits. By this construction there is a perfect symmetry of form in the several magnetic circuits of any one field magnet, and the different coils of the armature all pass through precisely equal magnetic fields. As a result of this arrangement there is absolute freedom from sparking at the commutator. In the four pole machines the armatures are so wound that there are only two paths for the current, but, at the same time, the winding is such and the commutator is so constructed, that opposite bars are joined by a cross connection, and either two or four brushes can be used at pleasure.

The speeds of the various machines have been adjusted to the sizes of the armatures. The faster a generator or a motor runs, the greater is the output to be obtained, and the limit of speed is entirely a mechanical one. In designing these machines, it has been the aim of the Mather company to use as high a speed as is consistent with good mechanical principles, and they believe that the speeds adopted will be found in every way more satisfactory than anything slower. Besides the advantage of greater output, the smaller number of windings upon the armature running at a higher speed presents very many advantages in smooth running at the commutator.

A very important factor in the construction of large machines is the quality of the sheet iron of which the armatures are made. Upon this the Mather company have made a great number of experiments, testing all their iron in various ways, but especially by building up armature cores of half of one kind of iron and half of another, and running these armature cores before they were wound, in an excited field. This tests the iron under exactly the conditions to which it is exposed in practice, and if one end of the core was found to heat more than the other, the iron which heated less was, of course, the better iron. By such experiments as this the Mather company have at last found an iron which can be used for armature cores of twenty-four and thirty inches in diameter, running in intense fields and at speeds of 400 or 500 revolutions, with very little heating. This reduces the unknown losses in the running of the dynamo to a minimum, and the C^2R losses in the winding of the armature and field, which can be known to a fraction, become the greater part of the total loss when the machine is doing work. The Mather company claim a machine in which all the magnetic and electrical parts are absolutely balanced, a machine which will run at a perfectly safe and manageable speed, and gives a large output for its weight, a machine which runs with absolute freedom from sparking at the commutator under great variations of load, and has an efficiency at least as high as, if not higher than, any other similar machine in the market. The sizes of machines constructed for railway generators are 50, 75, 120, and 180 kilowatts capacity. The last has six poles; the others are four pole machines. The same principles of construction apply to all.



THE MATHER GENERATOR FOR ELECTRIC RAILWAYS.

It is an interesting fact that the street railway lines of New York City have come under the control of Hon. William C. Whitney almost as completely as the same service in Boston has come under the management of his brother, Henry M. Whitney, and their remarkable business ability is being pretty generally recognized in both cities.

Track Brakes.

By Frank Van Vleck, M. E.

Street cars, in design, are a hybrid from two different classes of construction, the omnibus and the railway car, and partake of many of the good and bad features of each. The wheel brakes were the mechanical inheritance from the steam railway car, and structural lightness from the omnibus. This lightness of weight on wheels is one of the reasons of the inefficient action of wheel brakes on street cars. In the steam service, the cars are heavy and the brakes are powerful, quick and mechanically automatic, and a car is rarely required to stop within its own length. Grades are necessarily light and other conditions favorable. Hence, wheel brakes constitute all that is necessary or desirable. But the instant we apply the wheel brakes to the street cars we are met with a host of difficulties. The cars are light for a heavy adhesion contact between wheel and rail. Often the rail is slippery with ice, dampness, or the slimy ooze of a city pavement. No matter how powerfully the brakes are applied the wheels will slip; then from an electric car drops the sand; usually, by this time the wheels are locked by the brakes, skidding occurs, the limit of braking power is reached, and the car gracefully slides, to the ruination, incidentally, of wheels.

For celerity of action in applying these brakes look at the childishly elementary brake handle. It would be a libel to say that this descended either from the omnibus or the steam car. The only conceivable parentage indicates that it is direct from the hand organ, and is similarly successful in blasting many lives. Some of the late ratchet brake handles are a great step ahead, but what is wanted is something better than a bent brass handle set to wind up a loose chain on the end of a rod. The new arrangement demands a lever, direct, powerful, positive and quick. The lever, of course, may be operated by either hand or foot as circumstances dictate. If a hand lever, it can be equipped similar to a locomotive reverse lever, with its engaging and disengaging pawl. The hand lever offers a long leverage, and a long arc of action with a quick movement. The foot lever offers the disadvantage of a small arc of action, due to the fact that a man cannot be relied upon to raise his foot more than twelve inches to tread his brake, and that pawl or ratchet cannot be adapted to hold the foot lever down, without requiring an awkward additional movement or mechanism for disengaging.

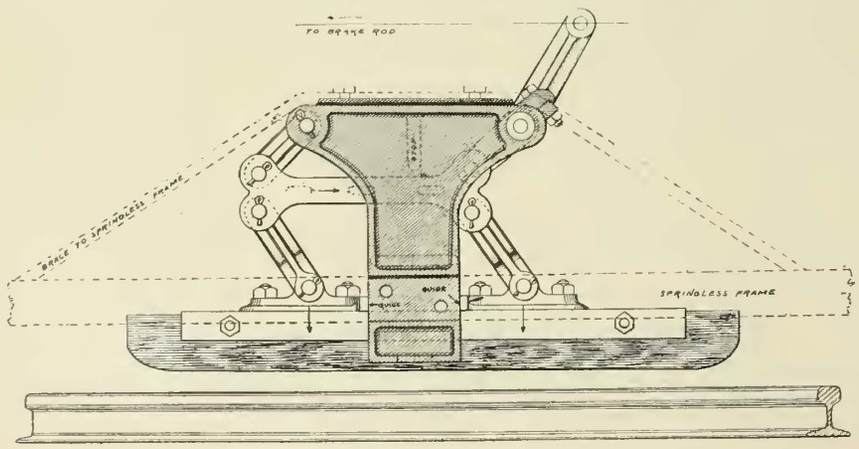


FIG. 2.—TRACK BRAKE—LOS ANGELES.

From what has been said it must not be inferred that wheel brakes are to be abandoned. They should be retained and their efficiency and efficacy greatly enhanced by better design and construction. Every wheel of the car should have its proper brake shoe, regardless of whether the car is of four, six or eight wheels. In addition, track brakes should always be provided.

To be sure, no track brake or other form of brake, save a rigid bumper on the rails, will stop a car instantaneously. If such a brake existed it would kill a car load of passengers to save, possibly, a victim from the wheels. A track brake is simply an aid, but an extremely valuable one.

Calfornia, which has "set the styles" for cable road inventions, has every one of its hundreds of cable cars equipped with track brakes. When questioned as to whether they are regarded as desirable or useful, there is not an officer but will reply "They are absolutely necessary." In San Francisco, cars are stopped and even held on grades by these brakes, which to the Eastern wheel brakeman seems scarcely less than miraculous. On the level, in preventing collisions, cars are often brought to a stop from full speed within ten feet.

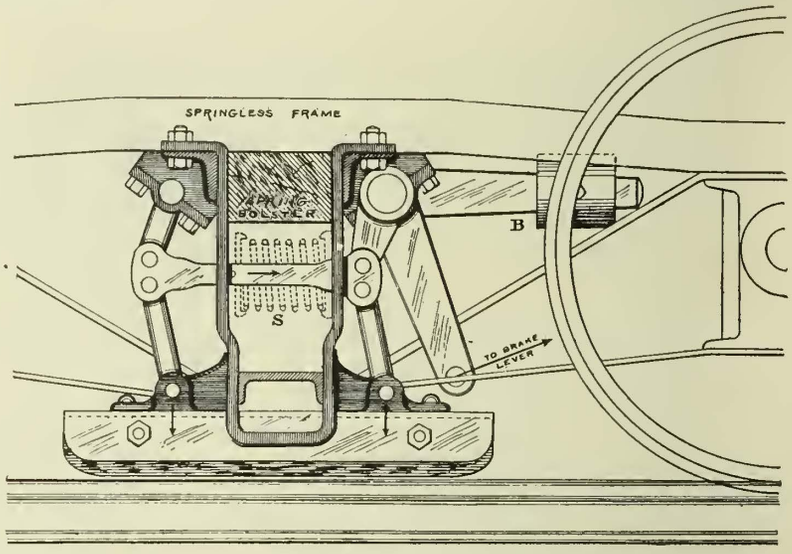


FIG. 1.—TRACK BRAKE—SAN FRANCISCO.

Track brakes, as ordinarily constructed, have the brake shoe or "slipper" formed of wood. Many roads use soft wood, while others regard the wearing of a hard close grained wood most satisfactory, the matter being solely determined by the original cost and the cost of renewal. Under ordinary usage, the slipper ought to wear from two to four weeks, and often longer. Iron brake slippers have in many instances been tried, but in each case they were found wanting in adhesion, and when the rails were wet or icy the sliding might become disastrous. The usual length of the wooden slipper is from eighteen inches to three feet; when made longer than this they will overdrag at the ends when passing curves of short radius. The length is governed by the size of the car.

Most failures in the arrangement of track brakes have been due to faulty connections with the truck or car body. The brake to be always successful must be supported directly from the axles; that is, there must be no interposition of springs; consequently they cannot be located on truck bolsters or on the car body. In short, they must be carried on the "springless frame" (for want of a better name) of the truck. The reason for this is evident. If located on parts subject to springing, or on the car body, irregularities in the loading of the car, swaying and all other movements are communicated to the track brakes, the consequence being that the track brake is in full bearing at one instant and free at the next. If this one matter is carefully looked into it will generally bring successful working of an otherwise badly designed brake. Original amplitude of leverage at the brake handle reducing to a minimum the final move-

ment at the slipper will bring into play heavy power, and in well arranged cases even sufficient to take the weight of the car from the wheels. It is a mistake to attempt to lift the slipper too far from the rail. One-half inch is ample, while to go as far as two inches, means a waste of power.

The track brakes described in this article are all chosen from examples which are now in use and have

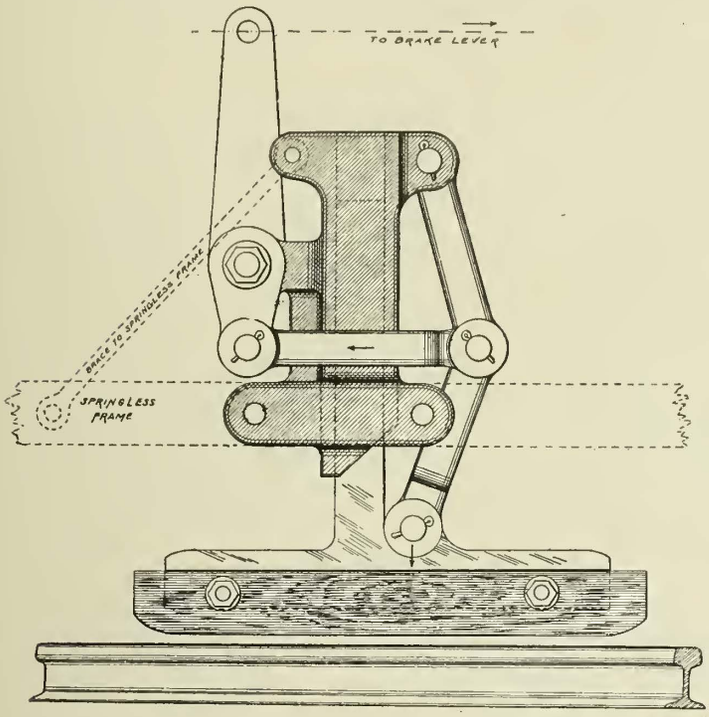


FIG. 3.—TRACK BRAKE—CINCINNATI AND PITTSBURGH.

afforded eminent satisfaction. The prevailing mechanical principle underlying them all will be seen to be an adaptation of the toggle joint.

In Fig. 1 is shown a type of track brake fitted to the rear truck of combination open and closed cars. It is placed on the truck under the closed portion of the car, as that is the heaviest portion of the car body, and therefore, more of the weight of the car can be brought upon the track brake. It will be seen that the brake is brought into action by the straightening of the double toggle joints. As these joints move, the wooden brake block or slipper is brought forcibly down upon the rail. This movement of toggles approaching the straight or dead position, as is well known, affords one of the most powerful mechanical devices for exerting pressure. The upper end of each toggle joint, it will be observed, is attached to the springless frame of the truck; hence no vibration or unequal loading of the body of the car due to the feminine passengers seeking the shady side of the car or other cause, will affect the degree of the pressure of the wooden brake shoes on the rail.

Of course the entire truck is not springless; the bolster or other arrangements are as usual carried on ample springs. The springless portion, of which most trucks possess one or more members, is sought as an absolute necessity for the track brake. It will be seen that the weight of the brake shoes and levers all tends to drop the brake upon the rail. This in practice is provided for in three general methods. The first and most usual is to attach a weighted lever to the brake shaft, as shown at B. The second plan is to place on the toggle connecting rod a spring, as shown by the dotted lines at S. Another method is independent of weights and springs, and relies solely on the holding power of double pawls, or square cut ratchets on the gripman's or motorman's brake lever. In short, it is nothing less than the locomotive driver's lever—it stays where put.

This form of track brake is in use to almost the exclusion of any other in San Francisco, has been adopted by the San Diego Cable Tramway, the cable roads of Portland and Seattle and others.

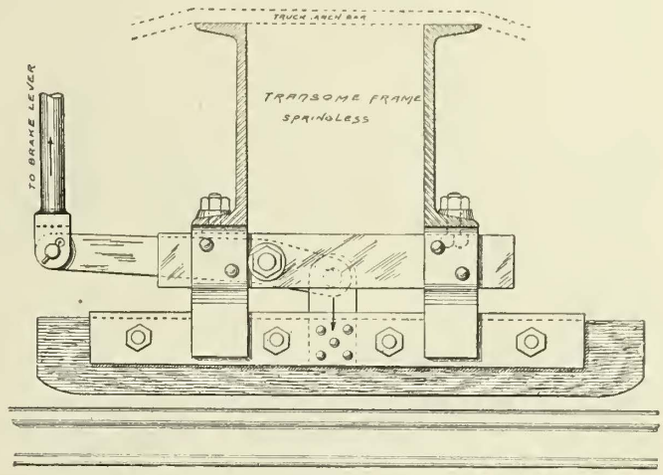


FIG. 4.—TRACK BRAKE—HOBOKEN.

Another modification of this double toggle brake is shown in Fig. 2. This has the advantage in being a self-contained attachment to the truck, and is easily removed and replaced by another, and then repaired for its own ills, without the necessity of sending the whole truck to the shops.

The cable lines of the Pacific Railway at Los Angeles, the Butte City Cable Railway as well as several others, use this form entirely. It was brought to its present success by the Brownell Car Co. of St. Louis.

In Fig 3 we have another form in which the employment of the double toggle is abandoned. The brake has many advantages, is very compact and most substantially proportioned. The Cincinnati Cable Railroad and the Pittsburgh Cable Co. have used this design extensively, and have found the brakes reliable. The J. G. Brill Co. of Philadelphia were its introducers.

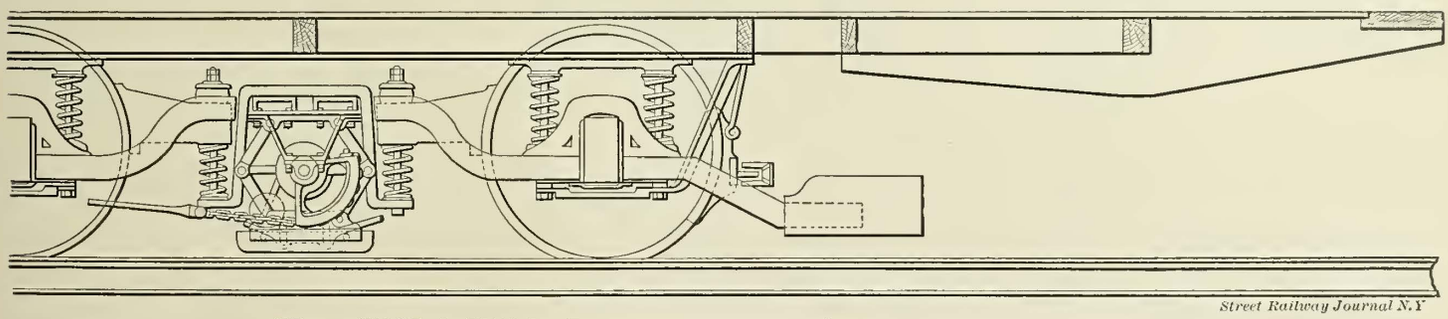


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FIG. 5.—WOOD & FOWLER TRACK BRAKE FOR ELECTRIC CARS—SIDE ELEVATION.

Fig. 4 represents the form of track brake used on the Hoboken elevated railroad. It does its work with a certain degree of success, but is by no means a model. It lacks the power of the toggle arrangement, and is not properly guided to prevent up and down rocking of the end of the brake shoe. A sufficient "see-saw" action in the brake shoe, may bring the end of the shoe in contact with some projecting end of a rail or with a high guard rail; then disaster is at once courted. In the previous example it will be seen that the shoe must come down in perfect parallelism with the rail.

One of the latest forms of track brake has been brought out by Messrs. Wood & Fowler of Los Angeles, and it possesses many valuable features. In Figs. 5, 6, 7,

8, 9 and 10 it will be seen that the brake action, as before, is by means of the reliable toggles, but these latter, instead of being connected together by a single connecting rod, have each a connection with the revolving eccentric head. Figs. 5, 6, and 7 show the application to an electric car, and 8, 9 and 10 to a cable car.

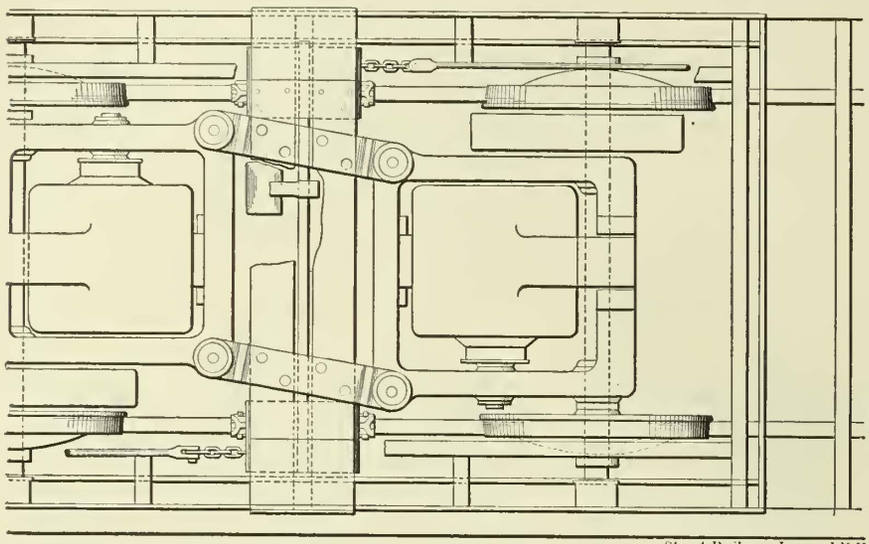

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FIG. 6.—WOOD & FOWLER TRACK BRAKE FOR ELECTRIC CARS—PLAN.

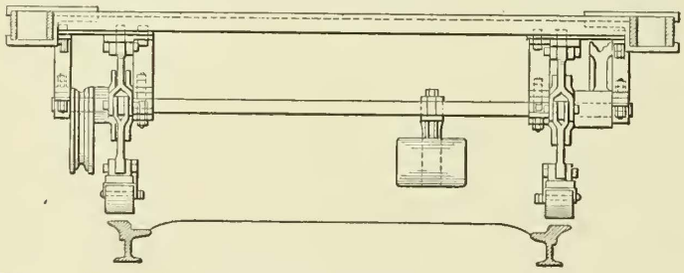


FIG. 7.—WOOD & FOWLER TRACK BRAKE FOR ELECTRIC CARS —END ELEVATION.

From the position of the toggles it will also be seen that guides to prevent the see-saw action are wanting, and are totally unnecessary. This permits of the whole device being arranged in a lighter manner. This type of brake is readily adaptable to any truck, and when attached to the springless frame can be made specially effective. A very ingenious substitute for the brake equalizer is seen in the use of the two sectors and chain on the main brake shaft. By this means it is equally easy to apply the brakes from either end of the truck or car.

The special significance attaching to this brake is that it has been doing admirable service on a road by nature afflicted with grades running from 18 to 20 per cent., the Temple Street Cable Railway of Los Angeles. The brakes are the outcome of a grim necessity for something to hold a car on these grades, and the management devised these as being the best suited for exacting conditions.

A number of other valuable possible forms of track brakes suggest themselves to the writer, but as the object of this description has been to describe brakes at actual and successful work, possible designs cannot, therefore, be considered.

Many who anticipate the introduction of track brakes specially for use on electric trucks, first of all inquire what about the "patent plague" and track brakes; to which it must be acknowledged that the field is well covered with patents. There being numerous modifications of the

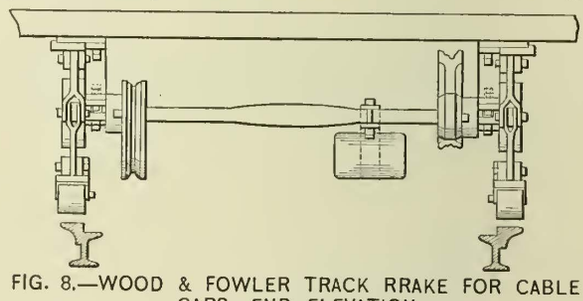
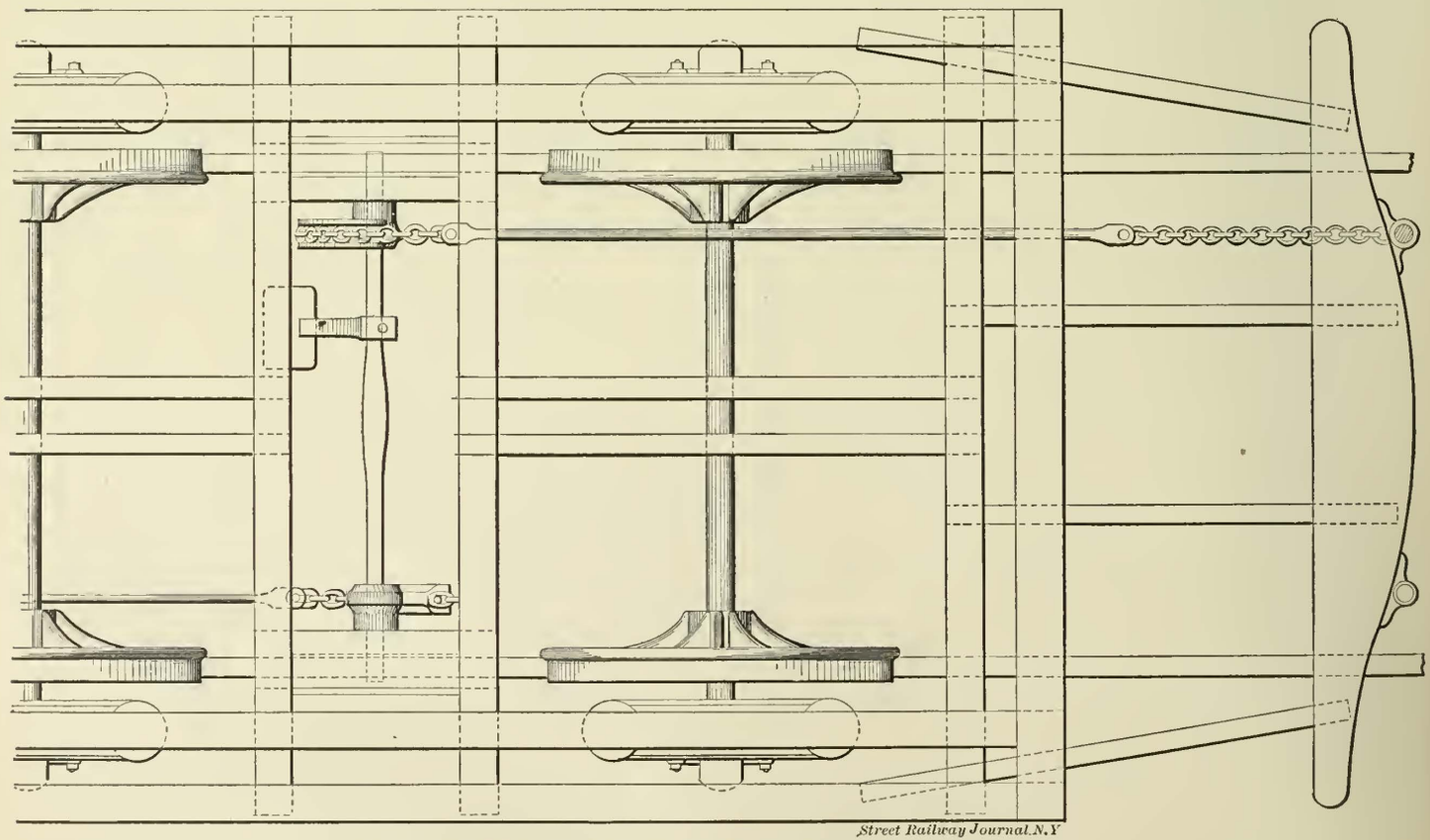


FIG. 8.—WOOD & FOWLER TRACK RRAKE FOR CABLE CARS—END ELEVATION.

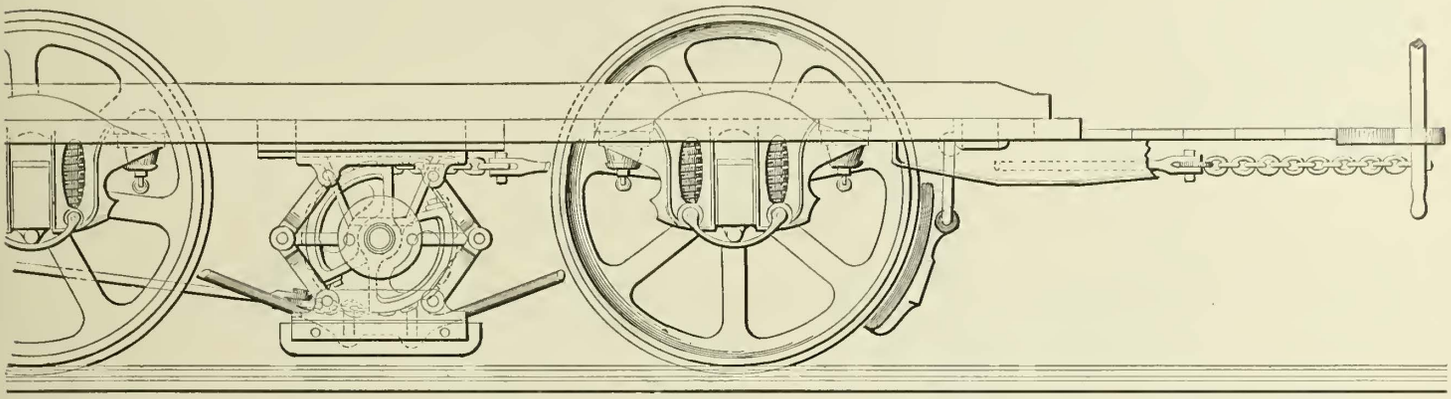


Street Railway Journal N.Y

FIG. 9.—WOOD & FOWLER TRACK BRAKE FOR CABLE CARS—PLAN.

same design, royalties or construction premiums need not be large, certainly never large enough to counterbalance the many advantages derived from their use. If the patentees of these brakes who, years since, had the temerity to apply for patents solely by reason of the fact that look into the future they should see the pressing need for them, why should they not now receive the small reward for their foresight?

It should be added, in conclusion, that the writer has neither invented, patented, nor is interested in brake patents, but as a witness simply desires to praise this new and valuable aid to street railway car safety. As track brakes become more widely known, they will inevitably be generally adopted. Even now practically all cable roads are equipped with them, some few electric roads, and a larger number either arranging for or debating the near introduction.



Street Railway Journal N.Y.

FIG. 10.—WOOD & FOWLER TRACK BRAKE FOR CABLE CARS—SIDE ELEVATION.

A Table of Statistics.

In the subjoined table are given statistics of the street railways in the United States at the end of the years 1890 and 1891, compiled from the directory of street railway companies published each month in the STREET RAILWAY JOURNAL.

A COMPANY has been organized in Pensacola, Fla., to introduce a spring motor for street cars. Each car carries a combination of six steel coil springs confined in barrels, somewhat similar to those used in clock mechanism, placed under the car, and so arranged that they may be wound singly or all together, and the force expended in like manner. The springs are wound at the station and when wound are intended to be capable of driving a car about eight miles.

Comparison of Mileage and Cars of Street Railways in the United States for the Years 1890-91.

States and Territories.	1890.										1891.									
	Horse.		Electric.		Cable.		Steam Dummy.		Total.		Horse.		Electric.		Cable.		Steam Dummy.		Total.	
	Miles	Cars.	Miles	Cars.	Miles	Cars.	Miles	Cars.	Miles.	Cars.	Miles	Cars.	Miles	Cars	Miles	Cars.	Miles	Cars.	Miles.	Cars.
Alabama	88	179	.....	.....	.....	.....	149	135	237	314	67	153	8	8	.....	.....	165	141	240	302
Arizona	3	2	.....	.....	.....	.....	.....	.....	3	2	4	6	.....	.....	.....	.....	.....	.....	4	6
Arkansas	50	127	5	8	.....	.....	.....	.....	55	135	60	188	8	39	.....	.....	7	3	75	230
California	153	517	31	45	130	655	60	132	374	1,349	272	614	97	201	146	731	57	135	572	1,681
Colorado	101	207	93	167	24	137	4	10	222	521	76	242	130	264	39	198	.....	.....	245	704
Connecticut	86	291	12	24	.....	.....	.....	.....	98	315	117	388	7	16	.....	.....	.....	.....	124	404
Delaware	7	32	5	10	.....	.....	.....	.....	12	42	5	33	7	23	.....	.....	.....	.....	12	56
Dist. Columbia	60	229	16	36	6	24	.....	.....	82	289	62	368	29	62	6	24	.....	.....	97	454
Florida	57	104	.....	.....	.....	.....	.....	.....	57	104	59	107	.....	.....	.....	.....	.....	.....	59	107
Georgia	96	259	44	49	.....	.....	35	32	175	340	86	151	99	151	.....	.....	34	41	219	343
Illinois	394	1,699	150	273	67	1,050	8	16	619	3,038	382	2,011	229	436	69	1,342	8	16	688	3,805
Indiana	117	394	66	81	.....	.....	6	8	189	483	108	393	107	164	.....	.....	7	11	222	568
Iowa	101	222	111	213	.....	.....	19	34	231	469	58	133	158	318	4	25	20	31	240	507
Kansas	90	160	55	95	.....	.....	20	19	165	280	72	129	66	116	.....	.....	20	19	158	264
Kentucky	173	478	38	80	.....	.....	.....	.....	211	558	133	344	72	238	.....	.....	.....	.....	205	582
Louisiana	146	329	5	8	.....	.....	.....	.....	151	337	117	464	5	4	.....	.....	36	36	158	504
Maine	33	90	11	13	.....	.....	.....	.....	44	103	45	89	11	37	.....	.....	.....	.....	56	126
Maryland	178	522	9	5	.....	.....	.....	.....	187	527	169	480	9	9	10	30	.....	.....	188	519
Massachusetts	403	2,865	157	493	.....	.....	6	8	566	3,366	482	3,265	257	912	.....	.....	7	8	746	4,185
Michigan	166	639	88	154	.....	.....	9	6	263	799	123	524	157	238	.....	.....	11	6	291	768
Minnesota	60	131	115	437	16	73	.....	.....	276	664	16	26	230	740	16	73	.....	.....	262	839
Mississippi	6	11	5	15	.....	.....	2	6	13	32	18	24	.....	.....	.....	.....	6	13	24	87
Missouri	83	554	192	713	125	1,166	37	78	437	2,511	92	684	252	907	118	996	44	79	506	2,666
Montana	.....	.....	13	23	3	4	12	19	28	46	5	14	43	44	6	4	11	9	65	71
Nebraska	110	299	83	121	10	22	.....	.....	203	442	67	191	133	223	10	22	.....	.....	210	436
New Hampshire	28	63	14	33	.....	.....	.....	.....	42	96	26	66	16	32	.....	.....	.....	.....	42	98
New Jersey	203	683	48	167	3	14	.....	.....	254	864	210	690	71	211	3	17	8	20	292	938
New York	861	5,510	234	465	13	80	19	17	1,114	5,992	921	5,877	326	531	13	88	8	17	1,268	6,513
North Carolina	15	32	10	20	.....	.....	.....	.....	25	52	11	25	27	42	.....	.....	.....	.....	38	67
Ohio	335	1,046	224	698	43	261	.....	.....	602	2,005	284	636	378	1,060	44	305	2	4	708	2,005
Oregon	26	76	26	55	.....	.....	34	24	86	155	34	11	34	76	6	22	31	35	105	144
Pennsylvania	517	2,505	187	390	41	234	4	8	749	3,237	576	1,945	338	776	64	339	4	8	982	3,068
Rhode Island	68	439	10	25	3	8	.....	.....	81	472	69	355	13	31	3	57	.....	.....	85	443
South Carolina	37	83	.....	.....	.....	.....	.....	.....	37	83	35	89	.....	.....	.....	.....	.....	.....	35	89
South Dakota	13	11	.....	.....	.....	.....	6	2	19	13	17	16	9	7	.....	.....	6	2	32	25
Tennessee	128	220	94	94	.....	.....	79	114	301	428	34	121	161	193	.....	.....	74	99	269	413
Texas	185	441	139	175	5	12	21	33	353	661	189	464	197	297	6	24	32	41	424	826
Utah	19	31	15	52	.....	.....	30	19	64	102	.....	.....	79	107	.....	.....	3	11	82	118
Vermont	15	21	.....	.....	.....	.....	.....	.....	15	21	15	22	.....	.....	.....	.....	.....	.....	15	22
Virginia	48	116	50	120	.....	.....	.....	.....	98	236	42	101	73	97	.....	.....	4	.....	119	198
Washington	4	6	110	134	21	55	28	12	163	207	6	12	160	154	31	75	29	18	226	259
West Virginia	18	31	19	36	.....	.....	8	12	45	79	16	26	16	39	.....	.....	8	12	40	77
Wisconsin	114	305	39	65	.....	.....	5	7	158	377	117	310	49	89	.....	.....	.....	.....	166	399
Wyoming	5	5	.....	.....	.....	.....	....	.....	5	5	5	11	.....	.....	.....	.....	.....	.....	5	11
Total	5400	21970	2523	5592	510	3795	604	751	9,109	32,051	5,302	21,798	4,061	8,892	594	4,372	642	815	10,599	35,877

Car Building.

From Advanced Sheets of "Street Railways" (Trams).—Continued.

By C. B. Fairchild.

CAR TRUCKS.

Truck building is a business by itself, and is not necessarily carried on where the coaches are made, although most car shops have a truck department, and make some special type of truck. Trucks are made in a great variety, adapted to the various forms of motors and power employed, and purchasers of street cars usually specify the style and make of truck upon which they wish their cars to be mounted.

Trucks are not only modeled to suit the different types of motors employed, but also for use under long and short cars employing the same motors, while in the material used and the method of construction, we find a wide range of practice. This is not surprising, for in horse car practice we still find many forms of running gear, with no approach to a universal standard, except it be in the matter of a journal box, which, fortunately, is admirably adapted for use with mechanically propelled cars. But the running gear of a four wheel horse or trail car cannot be regarded as a truck in the sense in which the term is applied to the combined appliances upon which the bodies of mechanically propelled cars are mounted. Hence, the self contained motor truck is of comparatively recent origin, and may be said to have had its birth with the advent of electric traction. It is true that rigid frames have been employed in the construction of trucks for steam and gas motors and for grip cars, but nothing growing out of the experience had with these trucks, nor, indeed, from steam railway practice, serves as a guide in the construction of electric trucks so that they will meet the peculiar conditions under which electric railways are constructed and operated. Hence, it is not surprising that radical defects have heretofore entered into truck construction, attended with damaging and fatal results to motor, car body and track, as the scrap heap of many a street railway can testify. The cause of failure in some cases and of success in others, is owing, no doubt, to the methods followed by the inventors. One class invented a theory, and then denied or ignored facts which demonstrated its fallacy, while the other class ascertained and studied the facts and worked along the line of scientific truths evolved from the plain teachings of experience. While gratifying success has crowned the labors of the latter class, so that the market is well supplied with a great many models and designs that are used and accepted as the best attainable under the circumstances, no one claims that a standard truck has yet been devised, one that will give satisfactory results and serve as a cure-all for the many minor evils in which the service abounds. The possibilities of making trucks better or worse are almost as wide as the range of human effort, for which reason it may not be idle to study the lessons that may be drawn from the logic of events and actual practice, with the hope of a nearer approach to a satisfactory standard.

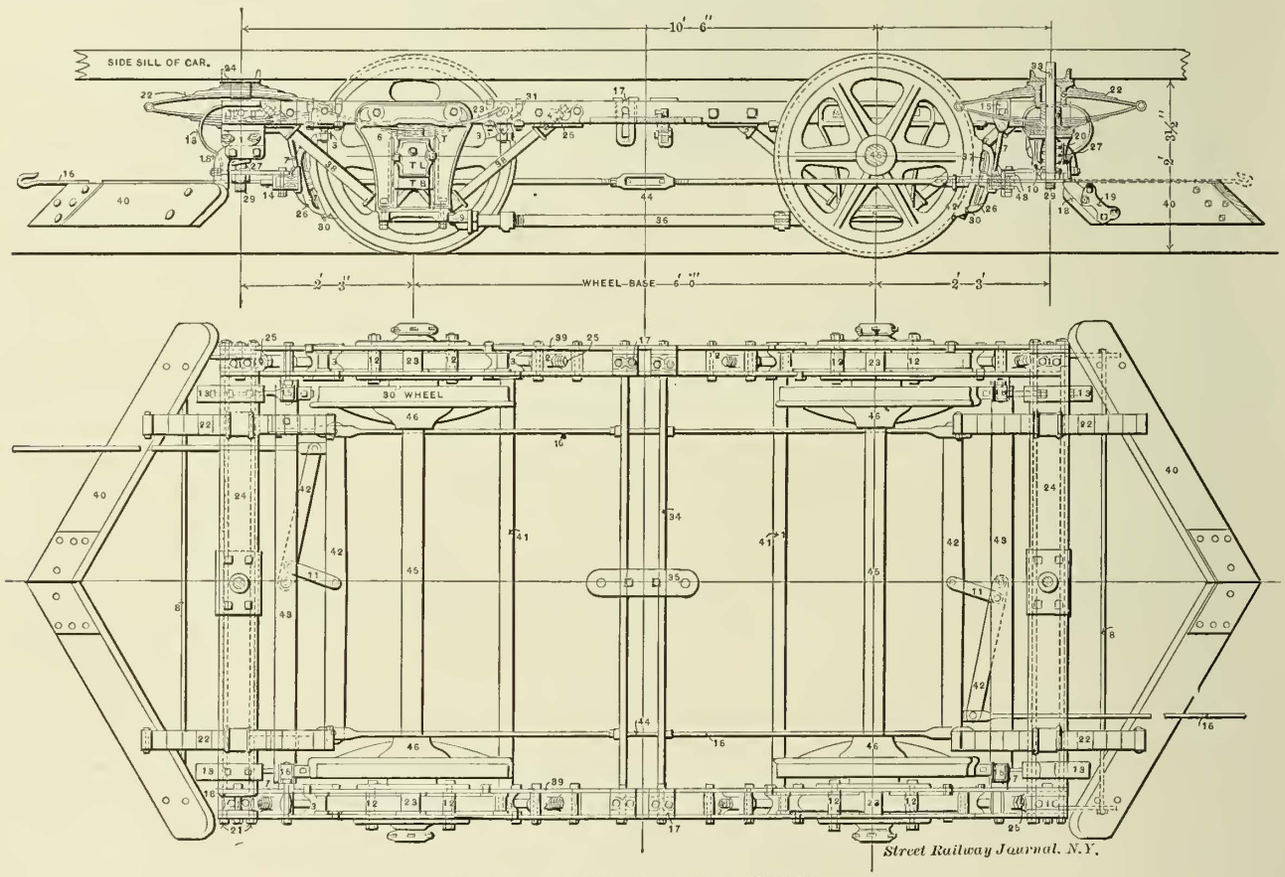


FIG. 1.—TAYLOR ELECTRIC MOTOR TRUCK.

By reference to the accompanying illustrations (Figs. 1 to 4) it will be observed that an immense amount of mechanical genius has already been devoted to improvements in truck construction, and that important changes are still being made.

Trucks are the fundamental features of an electric car, and the details include many parts, some of the most important of which are wheels, axles, journal boxes, journal bearings, motor bearings, frame, springs, guards and brake appliances. The importance of the car truck arises from the fact that it combines these parts with the motor, gears and a large number of auxiliary appliances under such conditions that the aggregate combination forms, in a mechanical sense, a car; for that which is above the trucks is only the car body. There are four wheel trucks and six wheel trucks employed in electric traction, the latter being of the radial type and chiefly employed under exceptionally long cars (Fig. 3). A large number of eight wheel cars are also employed, and with these the wheels and other necessary appliances are combined in two sets of four wheel trucks, each of which helps to support the car body (Fig. 4). The primary object of this arrangement, and of the six wheel trucks is to enable long car bodies to be conveniently moved round sharp curves. Various other purposes are to be served in the construction of an elec-

tric truck, each of which must be considered in attempting to improve the details of construction, and to promote the ends of electric traction.

The mutual relations of truck and track are an important consideration, for no amount of skill or material expended in the building of a track will produce a structure that will give prolonged service upon an uneven and badly constructed track.

The essential features of an electric motor truck are strength and durability without too great weight. It would seem to be as simple a matter to design a frame that would support the motors and maintain the gears in proper relation, as to set up any machine in which gears are employed, but service develops many difficulties that must be met. The motor must be properly insulated, and one end must be flexibly supported to relieve the gears from sudden strains at starting, and to relieve as much as possible the shocks due to its own weight. While these points cannot be ignored, the design must be such as to allow of ready access to the different parts of the motor, and to allow of the armature and wheels being readily removed. The brake mechanism must be provided for

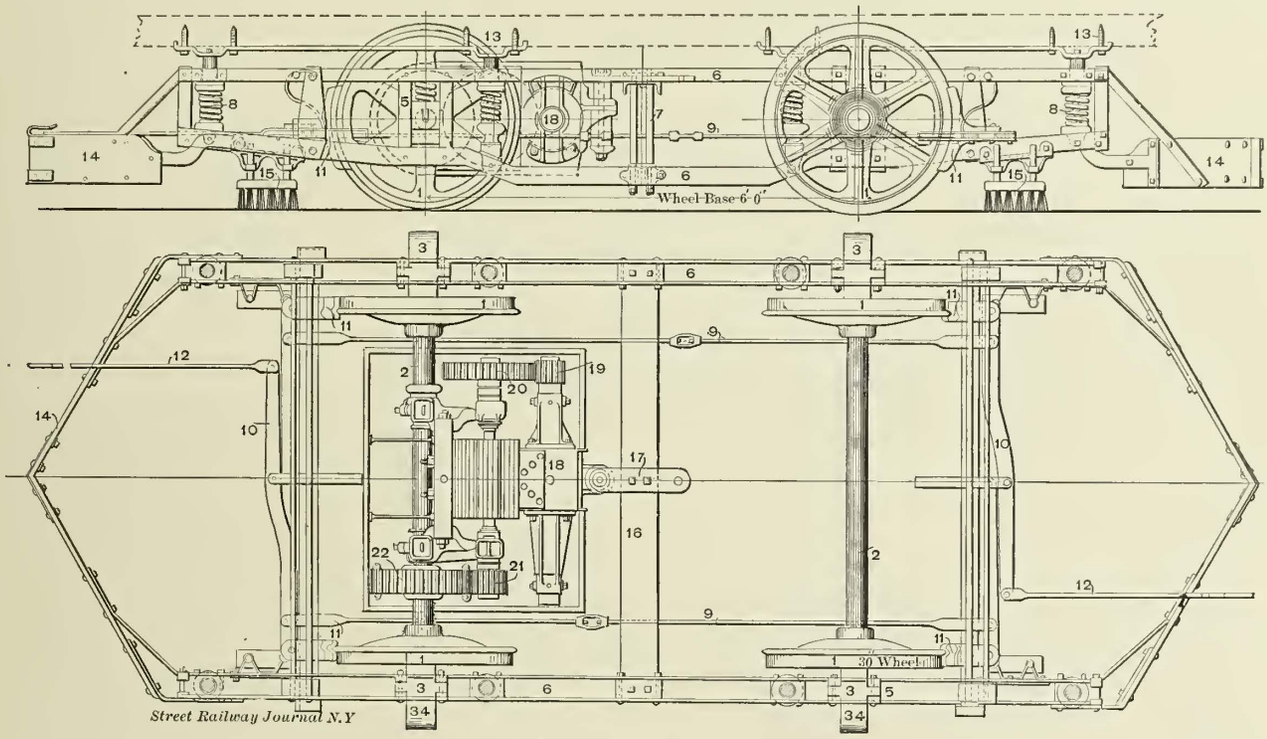


FIG. 2.—MANIER TRUCK.

both to insure reliable action and to admit of adjustment and repairs. Provision must be made for attaching the car body in such a manner that it may be readily removed; while if a long body is to be mounted upon a truck with a short wheel base, provision must be made to prevent side and end oscillation, both with light and heavy loads. The latter requirement is quite important, not only on account of the comfort of the passengers, but because of the destructive effect of the oscillation upon the wiring and the car body, and because it reduces the tractive effort of the wheels and affects the life of the wheels. The latter point has been generally overlooked, but a case is cited where trucks of different types are employed on the same line, both being equipped with wheels of the same make and operated under the same conditions, but on the one in which oscillation is prevented and the weight equally distributed the wheels have a longer life; and the car operates on a slippery track and through snow with much better results than the one lacking these provisions.

In case double trucks are employed, which carry only one motor, it is desirable to so pivot the truck that the driving wheels will carry a large portion of the weight in order to secure the maximum amount of traction. In connection with such an arrangement the idle wheels are made smaller than the drivers so that the truck will swivel without interfering with the steps or the car framing, permitting of the body being mounted several inches lower than where the wheels are all of the same diameter. In any construction, other things being equal, that type of motor truck which has the fewest number of parts and avoids the use of bolts and nuts is the most desirable.

In the manufacture and repair of car trucks, the requirements, as we have seen, are very exacting, and include a number of parts which must be specially manufactured for their construction. Among the auxiliary industries which perform important service in this direction, are those which manufacture wheels, axles and springs, and, although this work is usually conducted in independent establishments, it is important that some general knowledge of the characteristics of these parts and details of manufacture be had to serve as a guide in their selection and prevent disastrous mistakes, for the fortunes of a company may be made or marred by success or failure in the selection of these three items alone.

WHEELS.

Chilled cast iron wheels were used almost exclusively under street cars in this country until the advent of electric traction, and even now constitute the principal portion of all wheels manufactured for this service, but the manufacture of the various types of steel and steel tired wheels for motor cars is a growing industry, and the demand for them arises chiefly from the belief that they are capable of performing a greater amount of service, have a greater tractive force, and are safer under high speed electric cars. In regard to the relative economy, it is claimed for steel tired wheels that the extra amount of service which they are usually capable of performing, and consequent diminution of the number of changes of wheels, compensate for the difference in first cost. This theory is ably advocated on the one hand, and forcibly opposed on the other, by manufacturers of chilled wheels and some street railway managers.

There are records of the performances of both types of wheels made by reputable manufacturers that are very creditable, and in some cases, under favorable circumstances, a degree of excellence has been attained that has fully met or even exceeded all reasonable expectations, but unsatisfactory results have been reported in both cases where wheels were furnished at a price too low to afford compensation for the skill, care and labor necessary in the manufacture of a first class article. In making a choice between cast and steel tired wheels, one must be

governed somewhat by the reputation of the makers, and by the peculiar conditions existing on the line where the wheels are to be put in service. For instance: If the conditions are such that the flange of the wheel will be worn out before the tread needs turning down, it will not be economical to employ steel tired wheels.

The manufacture of chilled car wheels depends upon the principle that when certain kinds of cast iron are melted and poured against a metallic mould or "chill," that portion of the iron next to the mould is suddenly cooled and becomes white, crystalline and brittle, while the inner portion remains gray and more or less tough and fibrous. Hence by placing in the mould a metal ring having the form of the tread and flange, the molten metal surges against it as it is poured, causing the wearing parts of the wheel to become hard and very durable.

Formerly the "chill" consisted of an ordinary iron ring, but owing to its unequal expansion and contraction the finished wheel is apt to be irregular in shape and the chilled surface of unequal depth. To correct this, and take advantage of the laws of expansion and contraction, the "contracting chill" has been devised, which in some form is now almost universally used. The ordinary contracting chill is a ring cast in one piece, but having its inner surface divided into segments by means of thin slots, so small that the iron does not penetrate therein to any extent. As the metal is poured the entire ring expands from the heat, and as it cools the circumference contracts, keeping the inner surface in contact with the metal.

In order to increase the depth of the chilled surface and make it uniform, some manufacturers employ a "chill" in which the expansion and contraction are controlled by external means. One of the most efficient chills of this type is cast with a hollow outer rim, having its inner face or chilling surface divided radially into inch sections, by a saw cut, but further back by a wider opening to secure ventilation. The application is about as follows: The mould being prepared, live steam is passed through the outer hollow rim of the chill for a brief period, causing it to expand and carrying with it the chill segments, thus increasing slightly the diameter of the chilling surface. As soon as the pouring begins, the steam is shut off and cold water is admitted to the chamber of the chill, causing the rim to contract, thus holding the inner surface in contact with the metal as it shrinks in cooling. Another advantage claimed for this process is that the metal can be poured rapidly and while very hot, giving a more solid casting than with slow pouring.

As soon as the metal is set, the wheels, while still red hot, are removed from the mould, and immediately placed by means of iron trucks, cranes and tongs in the annealing pits, where they remain four or five days, and allowed to cool gradually, a process necessary to prevent cracking from unequal contraction. The annealing pits are usually brick lined wells about four feet in diameter, and of sufficient depth to receive twelve or fifteen wheels, placed one above the other. The pit being filled, an iron cover is placed over, and above this a bank of sand. In some establishments provision is made for heating the pits before the wheels are introduced.

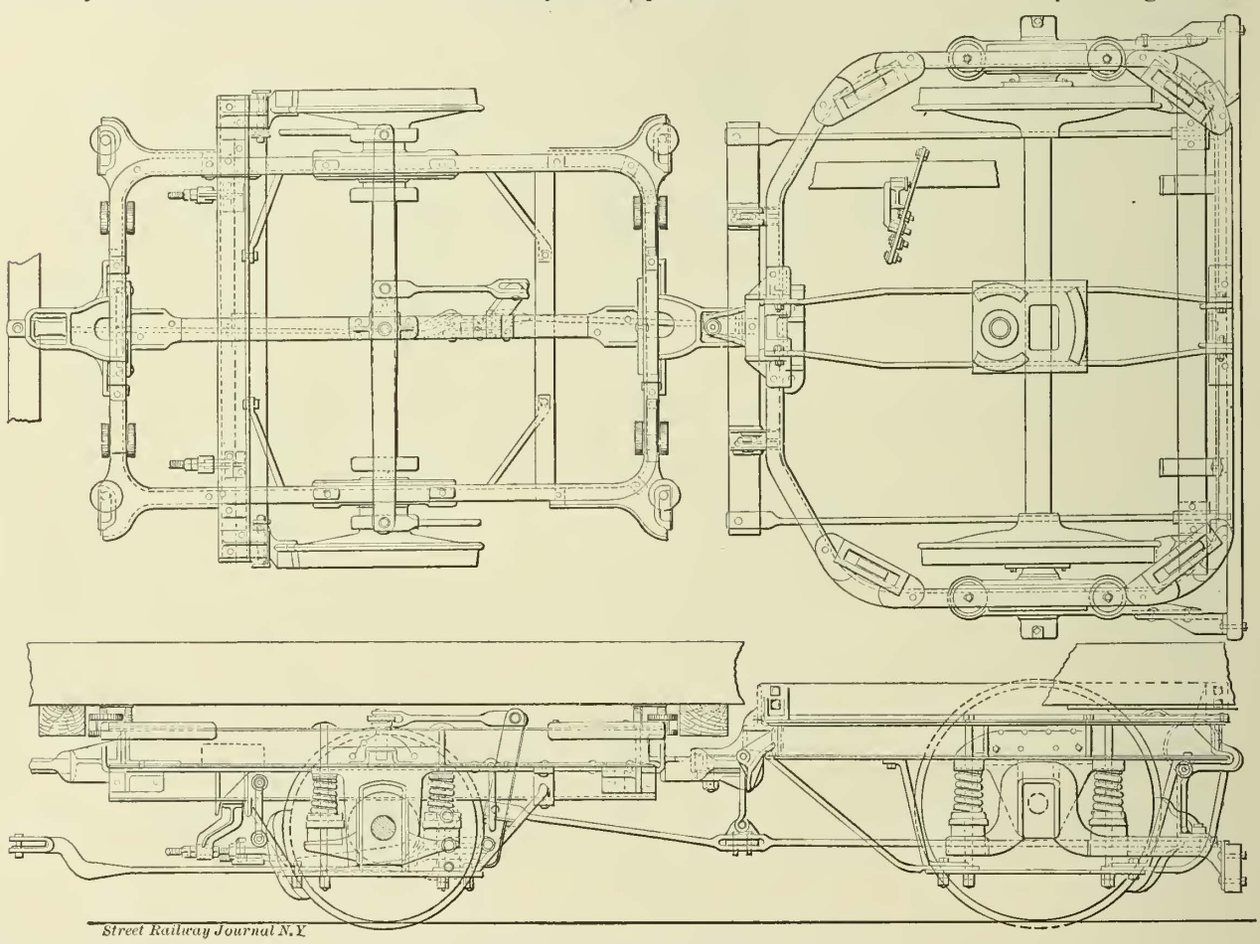


FIG. 3.—ROBINSON RADIAL SIX WHEEL TRUCK.

The wheels, when sufficiently cooled, are removed to the scratching room, or placed under a sand blast where the moulding sand which may adhere to the metal is removed, when the hub of the wheel is bored out to receive the axle, and they are carefully ground upon an emery wheel; which process removes the chill marks and renders the wheel perfectly cylindrical, a very important consideration, for if the wheel is not true the brake pressure will be greater at one point of the circumference than at another, resulting in the skidding or slipping of the wheel upon the rail, thereby producing a flat spot upon the tread which is rapidly enlarged thereafter, soon rendering the wheel unserviceable.

The process of manufacturing differs considerably in details in different establishments, special care being devoted by some to the nature of the raw material or mixture of irons used, by others to secure a perfectly cylindrical shape, while still others give special attention to the process of annealing.

It is obvious that in a process based on such principles as are enumerated above, the qualities of the product

depend largely upon the degree of care and skill exercised in the various stages of manufacture, ranking the business among the highest branches of the art of casting iron.

There is a considerable diversity in the depth of the chill of wheels made by the different manufacturers, the general range being from one-fourth of an inch through the intermediate fractions to three-fourths of an inch, the latter depth being necessary for a serviceable motor wheel. The diameter of wheels for electric motors is thirty-three and thirty-six inches, and the weight varies from 300 to 425 lbs. For horse and trail car service the weight is from 180 to 200 lbs., and for cable service the diameters are twenty-two, twenty-four and thirty inches, with the corresponding weights of 140, 160 and 240 lbs.

The patterns of wheels vary through a large range to suit the fancy of the truck makers, one firm, we are told, making more than twenty patterns of wheels for electric service. This is unfortunate, and it is hoped that a standard will be adopted in the near future.

All wheels are, presumably, subjected to a severe test, either by the manufacturers or the purchasing companies, or both, before they are put in service. The tests, however, are not as severe as in steam service, and, usually, no guarantee is required of the maker. In case it is found desirable to exact a guarantee, the specifications as to the design, essential points, inspection and manner of testing, may be modeled after those employed on certain steam lines, as follows: "First, that the wheel shall be truly cylindrical; second, that the body of the wheel shall be smooth and free from shrinkage, slag or blow holes, the tread from deep and irregular wrinkles, and free from sand or slag. Wheels broken must show clear gray iron, free from holes containing dirt or slag more than one-fourth of an inch in diameter or clusters of such holes, and the depth of white or chilled iron must not vary more than one-fourth of an inch from the standard depth round the tread of the wheel."

The life of cast wheels in horse car service, under favorable conditions, is about one year, and they are usually good for a mileage of from 25,000 to 40,000. In some cases, however, a mileage of 70,000 has been obtained. Under trail cars the average mileage is not quite so high, owing to increased speed. A good average for the driving wheels of motor cars is 30,000 miles.

Wheels are scrapped when broken, when the flange is too much worn or broken, when the chill of the tread is worn through, or when slid flat.

Steel tired wheels are manufactured in various styles, but the process in most cases is too complex to be readily described. The various types consist of a steel tire shrunk and bolted to a web or core made of paper, cast iron or corrugated steel plates having a cast hub. The merits of this type of wheel were noted above. As in the case of cast wheels, there is a notable difference in the respective merits of the steel tired wheels made by different manufacturers.

GLASS AND ITS PREPARATION.

Glass in large quantities enters into car building, and is employed for window, door and deck lights, also for Gothic windows and mirrors. Plate glass, of a quality suitable for ordinary glazing and for silvering or embossing, is made in this country, but English and Belgian plate are considered better suited for the finest mirrors.

The process of embossing glass is about as follows: The naked pane of glass is first heated to a temperature of about 120 degs., by being put in a pit over coils of steam pipes. A coating of a compound made of beeswax and rosin is then spread over the upper surface, and over this a sheet of tin foil is placed, to which it adheres quite firmly, and after cooling, the foil is covered with dark paint. A tracing of the required design is then made on the blackened surface by means of a stencil plate and chalk dust. Then by means of sharp needles, the portions of the lead foil necessary to show on the glass the figures and designs to be etched, are cut out. This work may be performed by young girls. The under side or back of the pane is then covered with paraffine, and with its covering is immersed in a bath of fluoric acid, which, in the course of an hour, eats out the exposed portion of the glass to the depth of one thirty-second of an inch, but has no effect upon the covered portions. The surface of the pane is then ground, which renders the raised portions translucent, while the etchings remain perfectly transparent. Another process is sometimes followed, in which fluoric acid and ammonia are employed, which render the exposed portions translucent.

In case the figures of men, animals or landscapes are desired, these may be painted in free hand upon the glass, the paint serving the purpose of the lead foil, in protecting the covered portions from the effect of the acid. The glass, being taken from the bath, is again heated to remove the wax and lead foil, when it is thoroughly cleaned

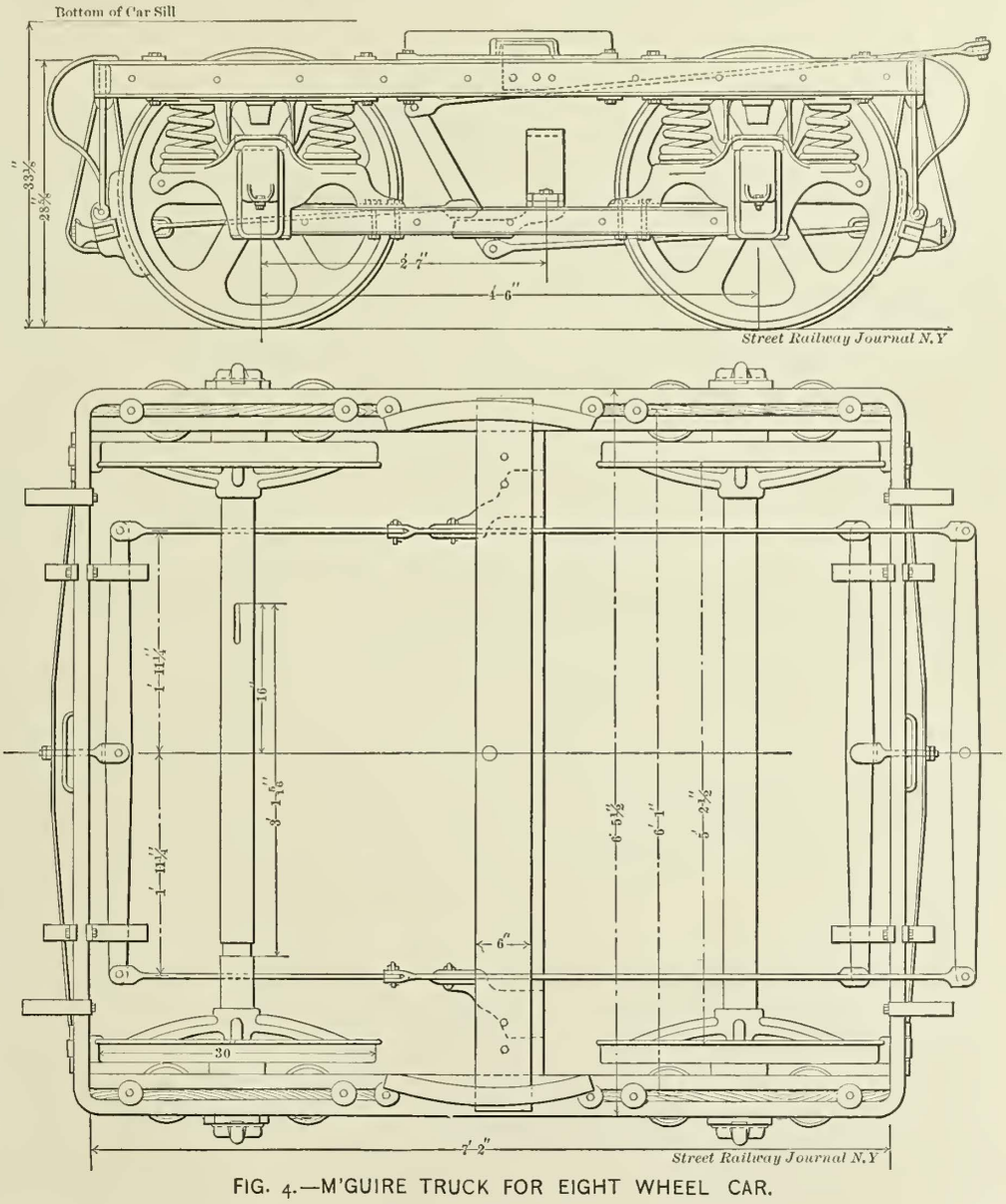


FIG. 4.—M'GUIRE TRUCK FOR EIGHT WHEEL CAR.

with soda water, dried and made ready for the glazier or for silvering, if portions require silvering. To protect the hands from injury while working the acid bath, workmen usually wear rubber gloves. Glass is also ornamented for car purposes by the sand blast process, by which means there are brought out upon the surface of the glass most exquisite representations of the tendrils, sprigs, leaves and flowers of the daintiest plants.

Beveled glass is made by grinding off the corners of the plates successively upon horizontal iron wheels sprinkled with fine sand, then upon a similar wheel covered with emery, then upon a horizontal grindstone having a peculiar grit, next upon a wooden wheel, and, finally, the edge is perfectly polished upon a wheel covered with felt and rouge.

Mirrors are made, preferably, as before stated, of English and Belgian plate glass. In the process, the plates are first cleansed with water, and then polished with rouge, (oxide of iron) which removes any surface defects. It is then heated by being placed upon a grated platform over coils of steam pipe, and the upper surface is covered with a solution of nitrate of silver and chloride of calcium, when the metallic silver is precipitated, and deposited upon the surface. The glass is then carefully washed, and after drying, the back is covered with a coat of red lead, and afterwards bronzed so that the silver is protected from oxidization.

Old mirrors may be renewed by first removing the paint by means of a lye bath, and then the metallic silver by means of nitric acid, when it is treated as above described for new glass. The silver for the mirrors is purchased in the form of nitrate crystals.

METALLIC TRIMMINGS.

These are usually of bronze and are sometimes plated or japanned. They include such articles as locks, hinges, door knobs, change wickets, dash and body grab handles and holders, window guards, lifts and catches, window blind lifts, sash springs, deck sash pivots and openers, ventilators, rail rackets, bells and gongs, bell strap guides, hooks, etc.

Trimmings ready for use are usually purchased from dealers who make a specialty of this line of work. Some shops, however, manufacture their own trimmings, which are turned out from specially prepared patterns.

The process of manufacture may be described as follows :

The material, which consists of copper (best lake), tin (English block) and spelter, is mixed in certain proportions, depending upon the desired quality of the product, and melted in small crucibles over sunken furnaces such as are commonly employed in brass foundries. The moulding is done in small iron flasks with a specially prepared moulding sand. Each flask may contain matrices for a large number of small parts so connected that the metal will fill each when poured through one or two openings. Long rods, such as dash rails and window rods, are usually moulded in coils and afterwards straightened. This can be done without fracture, provided the proper mixture of metals is employed. From the foundry the castings are placed in the "tumbler," which is commonly an iron barrel, which, being made to revolve on its axis, causes the parts to chafe against each other, till the rough surfaces are worn smooth. This process is sometimes hastened by the admission of water which can be introduced through hollow journal bearings. The parts next go to the filing and drilling department where the rough corners and ears are filed off and the screw holes are drilled and countersunk. The polishing follows, and this is done in the buffing department, which usually occupies a room by itself. First, the parts are ground smooth upon an emery belt, against which they are held by hand, and are then further treated upon a leather bound wheel covered with fine emery. The process continues through six or seven hands, and the trimmings are finally burnished upon a wheel formed of canvas discs upon which a little rouge is placed. The trimmings, except such as are to be plated or japanned, now bright and shining, are wrapped in tissue paper and taken to the store room. A silver and nickel plating department is provided with vats containing a solution of nickel salts or sulphate of copper, in which the trimmings to be plated are placed for about twenty minutes. The electric current for this work may be generated by a dynamo operated for the purpose, or may be obtained from the lighting plant or galvanic battery. After the plating the parts are thoroughly washed and dried. The japanning of trimmings is done in the ordinary manner. In some well regulated establishments slanting shelves or vertical boards are provided in the store, upon which samples of every pattern of trimmings are kept, numbered and named for ready reference.

THREE PLY VENEER.

A great variety of goods are embraced under this heading, and include seats, backs, ceilings, sides and panels. The manufacture of veneers is usually a process by itself, and car builders in most cases purchase the finished product from dealers. A few large car building establishments, however, manufacture it for their own use. The woods from which three ply veneers are usually made are maple, birch, oak and white mahogany. The veneer, with the exception of that made from oak, is shaved from the surface of a log by means of long knives against which the log is made to revolve, the shaving being from one-twentieth to one-eighth of an inch thick, and of any length and width, depending upon the diameter and length of the log. This process is done in the neighborhood of the growing timber, and the material in rolls and sheets is shipped to the veneer factory. The oak veneer is sawn from the log, which is first quartered lengthwise, and the quarters are then sawn into thin strips, beginning at the centre. The best material for oak veneer is obtained from dead trees from which the sap part has decayed.

At the veneer factory the material is cut into strips, small pieces being jointed and fastened together by narrow pieces of glued paper. The strip designed for the middle ply is so cut that the grain of the wood runs lengthwise, while those for the outside plies have the grain running crossways. This arrangement of the grain in the three parts gives strength to the finished veneer. The strip designed for the middle ply is now led through a pair of glueing rollers, in which both sides are thoroughly covered with a coat of hot glue, when it is placed between the two outside sheets, and the three are quickly transferred to thick wooden moulds or cauls which are then placed in powerful presses, where they remain until the glue is set and the ply becomes rigid, so that it will remain in the form (flat or arched) given it by the caul. The flat pieces are now dressed and polished in a sandpapering machine, and the curved or waved surfaces are scraped and dressed by hand. They are then made ready for varnishing and decorating or for the perforating bit, in case they are designed for seats or ventilated ceiling.

CAR SHOPS.

The arrangement and equipment of shops for the building and repair of cars will depend largely upon the amount of work to be done, and whether the product is for the trade or for home consumption. Repair shops are a necessary adjunct of every well regulated street railway, and whether a company builds its own cars or not (a practice which is not recommended) repairs sometimes amount to the same thing. The following particulars apply to shops in general, and may be modified to suit any particular case. The success of any manufacturing enterprise depends upon its compliance with the laws of rigid economy and industry, the adoption of the most approved processes in the preparation of the material, the use of the latest improved machinery, tools and appliances, and the employment of workmen thoroughly bred to the business who will fit all parts with exactness and nicety. To this may be added the employment of each set of workmen only upon one special branch of work (for which they are paid by the piece, by the hour or by the day) so that each shall attain perfection in his particular division, then holding the foreman of each department per-

sonally responsible for any defects that may occur in the work turned out from his department. The above presumes that the proprietors have had long experience and a reputation for honorable and fair dealing with their customers.

If a new business is to be established, great attention should be paid to the modeling and arrangement of the buildings to be occupied, and their location with reference to shipping facilities both for material and product. When it becomes necessary to occupy old buildings these should be remodeled to suit the business as far as possible. One, two or three story buildings may be employed, depending upon the value of property and the amount of space the plant is to occupy. Light, warmth, the exclusion of dust, and the adoption of such other means as will conduce to the health of the workmen, should be carefully considered, while no little attention should be given to protection against fire.

THE GENERAL OFFICE,

which may occupy a building by itself or one of the main buildings, should be equipped with all necessary office furniture and safes, and be furnished in as tasty and inviting a manner as the business can afford. Separate apartments are preferably provided for the timekeeper and bookkeepers, and a comfortable reception room should not be overlooked. The toilet arrangements, including closets, wash basins and lockers, are important, and should be ample and suited to the force employed.

THE DRAUGHTING

department usually occupies rooms in the vicinity of the office. These should have ample light and be furnished, according to the magnitude of the business, with draughting tools, tables, cases of drawers, safes or fireproof vaults for the preservation of all important drawings and specification details. A photograph or blue print room is also a necessary adjunct to the draughting department of a car shop.

THE STORE ROOMS

may be apartments near the main office and may be located on the ground or other floors, depending upon the character of the different classes of material. Each should be in charge of a keeper who should deal out materials only on the written orders of a shop foreman, which order should specify the number of the car order for which it is wanted, a receipt in all cases being required from the party to whom the material is delivered. Heavy parts, such as the malleable iron castings, journal boxes, springs, etc., are preferably stored on the ground floor, for which suitable bins and shelves, numbered and classified, should be provided. The store rooms for lighter parts may occupy some of the upper floors, and should be served by elevators for the speedy and safe transfer of the materials. The bolts and nuts, properly sorted and classified, may be stored in small bins or pockets, each of which should be numbered and lettered to correspond with the dimensions of the particular piece for which it is designed. Metallic trimmings should be stored in closed boxes classified and arranged upon convenient shelves.

Canvas, duck, curtains and upholstering material are preferably stored on spools and mounted in convenient positions, to be readily unrolled, measured and dealt out. Store rooms for this material are usually located near the the upholstering department, which is supplied with cutting tables, sewing machines aud other necessary appliances for making curtains, cushions, etc.

TRANSFER TRUCK TRACKS

and elevators are essential features of any car works. The first should be conveniently located and equipped with transfer tables of sufficient capacity to deliver the car body, while in process of construction, from one department to another. The second should communicate with every building, storehouse or yard, and be provided with flat trucks and cars to facilitate the transfer of material. Tracks should not only communicate with the buildings, but the floors of each structure should have tracks of uniform gauge with numerous turntables, by means of which cars or material can be shifted about, and, by means of the elevators, be transferred from floor to floor.

THE LUMBER YARD

will necessarily be located where space can be had, sometimes, in large cities, at some distance from the works. It is preferably located, however, within the same enclosure as the works. The lumber should be piled in sorts, and for the finer grades, both open and closed sheds should be provided, the sheds being partitioned and divided into stories of suitable height to provide for housing a great variety of material in position to be readily accessible. A few closed sheds are necessary for the storing of kiln dried lumber.

A DRYING KILN

is a necessary adjunct of the lumber yard, and is preferably constructed with apartments or ceiled chambers, with tight closing doors. The heat can be obtained from the exhaust steam of the power plant by leading it through coils of pipe in a separate chamber, and providing a power fan for driving the heated air through the flues which communicate with the various chambers. The inlet and discharge flues should be provided with gates or valves, so that the temperature of each chamber can be regulated to suit the conditions of the stock. The material should be piled in open order in the chambers, and each chamber should be provided with a thermometer. A record of the stock, including the kind, amount and date of being placed in the kiln, may be conveniently kept by having a slate attached to the outside of the door of each chamber, and housed in with a glass in front. A second kiln for seasoning the cabinet material is provided in many shops, and in some cases this is located directly above the boilers of the power plant, so that the radiated heat of the boilers is utilized for drying purposes. In other cases the blast fan is placed near the boilers, and the kiln is located in an adjoining department.

A steam chest and bending appliances are also adjuncts of the cabinet department.

THE POWER

for operating the machinery of car shops is usually derived from a steam plant. This should be conveniently located so that by shafting or belts the power can be transmitted to the different departments. Repair shops are frequently operated by power from the stable plant which also operates the mills for grinding and cutting the feed. Electric motors are employed to good advantage in some shops, while a few depend upon horse power.

THE HEATING AND LIGHTING

is also a function of the power plant, and by having the different buildings properly equipped with piping, either for direct radiation or the blast system, the exhaust steam may be utilized for warming purposes. An electric light plant is a desirable feature in the car shop equipment, for it is frequently necessary to continue the work at night. Arc lamps should be conveniently located for lighting the yards and approaches, and both stationary and portable incandescent lamps should be provided for bench and inside car work.

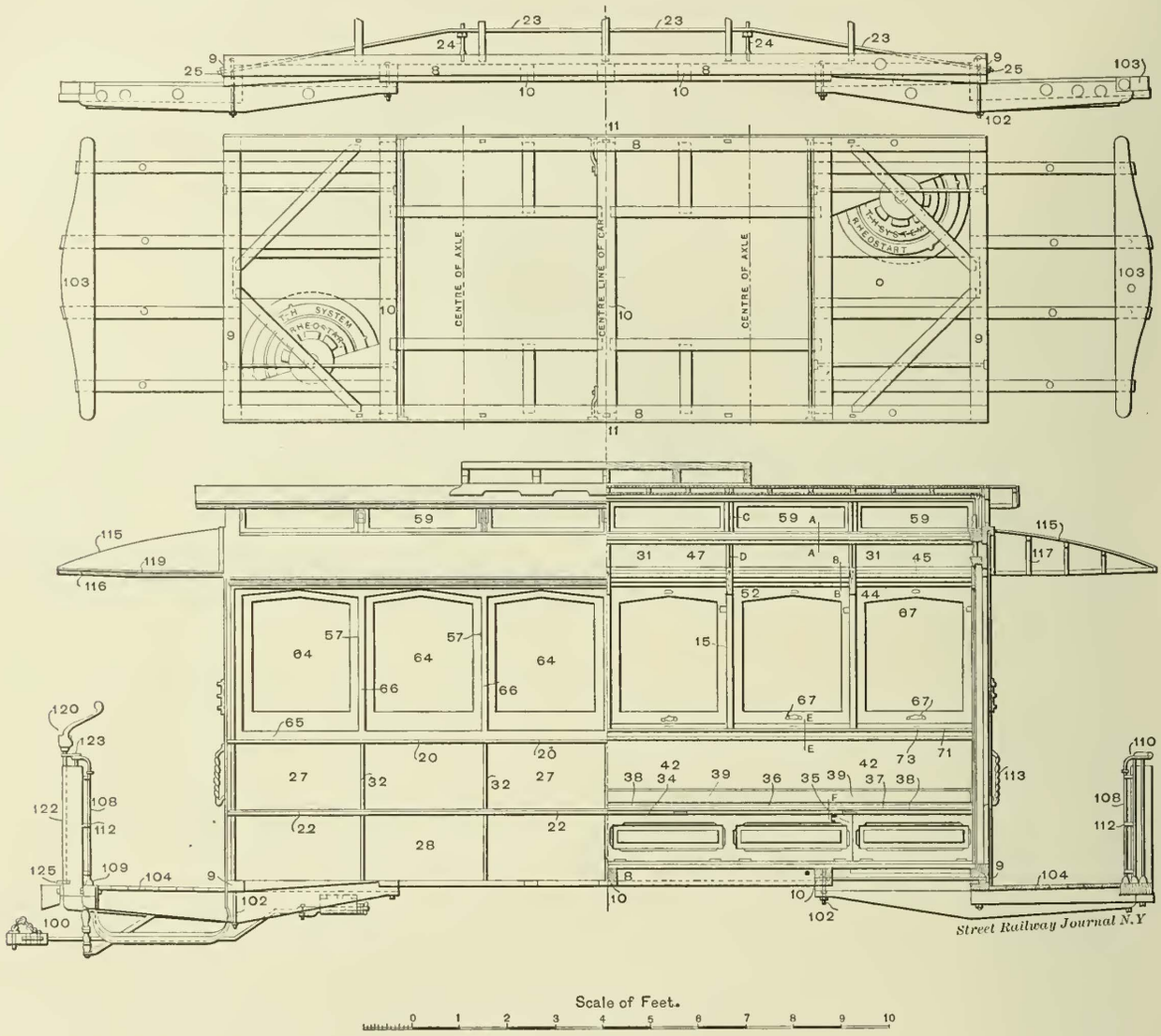
THE WOOD WORKING DEPARTMENT

is one of the most important in car building, and upon its location, equipment and management the success of a business largely depends. It may occupy a building by itself on the first or second floor of a building in which other departments are located. In any event it should be thoroughly partitioned off, that all the dust may be confined within its own limits. It is highly important in the arrangement of machinery in this department that ample room be given to each machine, so that all may be operated at the same time without interfering with each other or with the operatives; also, to provide that all the work may be done on the individual parts in their continuous passage through the mill without having to be carried back and forth several times, resulting in unnecessary steps and consequent loss of time.

In planning a repair shop provision should be made for handling longer timbers than those required for car

construction proper; for it not infrequently happens that larger timbers, such as are required in the buildings, bridges or tracks, find their way into the wood shop.

provided, with flues over each machine for removing the dust and shavings and delivering them to the boiler room for fuel. A spiral separator placed at the terminal of the

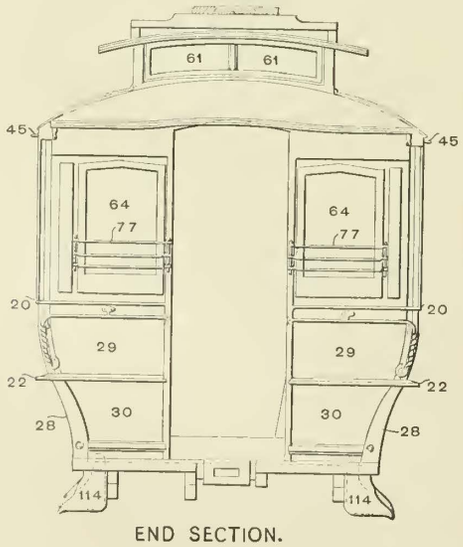


Scale of Feet.

FIG. 5.—SET OF SHOP DRAWINGS FOR SIXTEEN FOOT ELECTRIC CAR—THE LEWIS & FOWLER MANUFACTURING CO.

See page 149 *March issue.*

Due regard should be had to the safety and convenience of the operators by placing of the shafting, pulleys, belts and shifters in proper positions and housing them in. The best practice favors placing the shafting beneath



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the floor, openings being provided for leading the belts to each machine. Regard for the comfort and health of the men employed in this department, and for economy, requires that a system of exhaust pipes and conveyors be main flue will separate the dust and deliver the shavings in proper condition for the furnace. The exhaust may be produced by a fan operated at or near the engine room. For large shops small trucks and tracks should be provided for the speedy transfer of small pieces about the works.

The number and character of the machines that may be employed to advantage in this department depends upon the amount of work to be done. For repairs alone a very few will answer, but if a company builds its own cars it should have quite a number of the same patterns as are employed in commercial street car work.

The following are among the best machines in the market, and have been selected from the lists of a number of manufactories. New machines are constantly appearing, and any car builder who may require a special machine for shaping any piece, no matter how irregular, has but to apply to the makers of this class of tools and the desired device will be forthcoming.

LIST OF WOOD WORKING TOOLS.

Automatic cut-off machine.

Self feed rip saw and pendulum saw.

A four sided planing machine having a capacity for a 6 × 12 ins. stick.

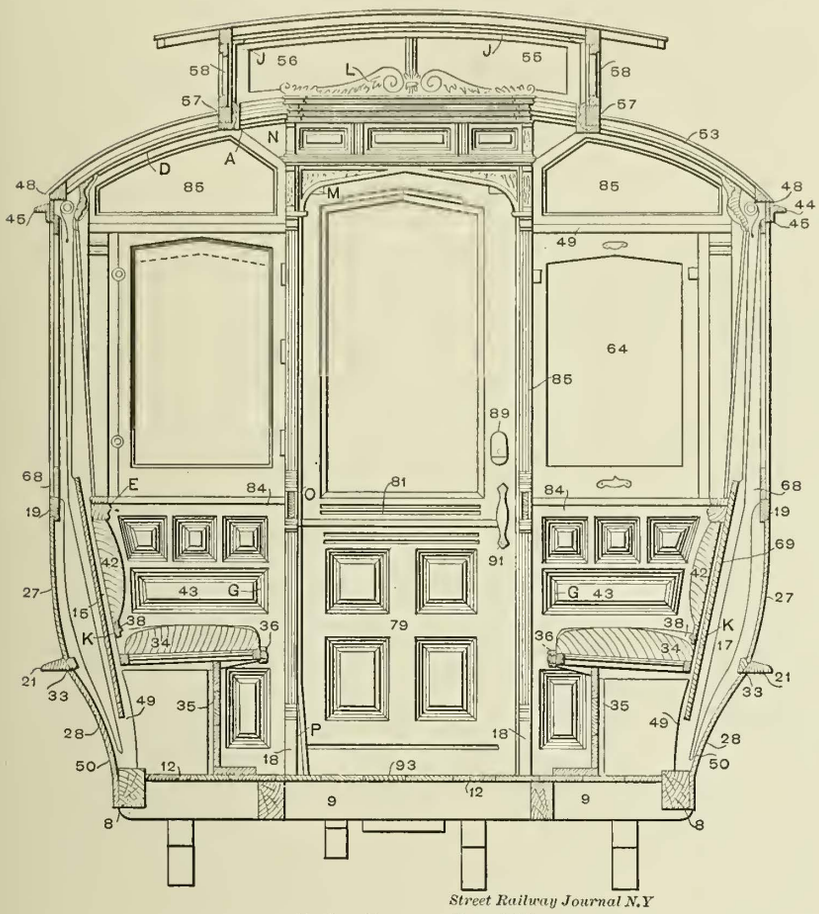
A thirty-six inch and a forty-two inch band saw, with a Mohawk Dutchman guide.

A Universal wood worker.

A six inch outside moulding machine.

A single spindle, horizontal boring machine.

End Vent, Sash, 5/8 thick



Street Railway Journal N.Y

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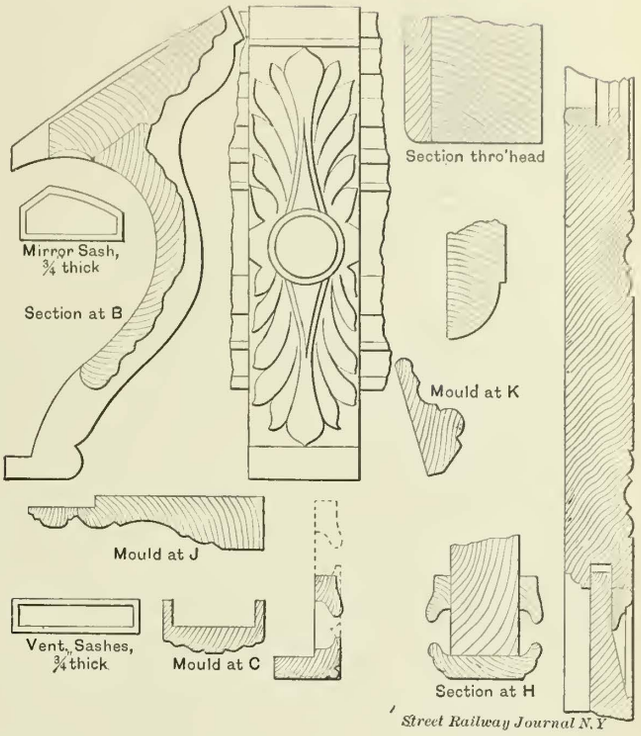

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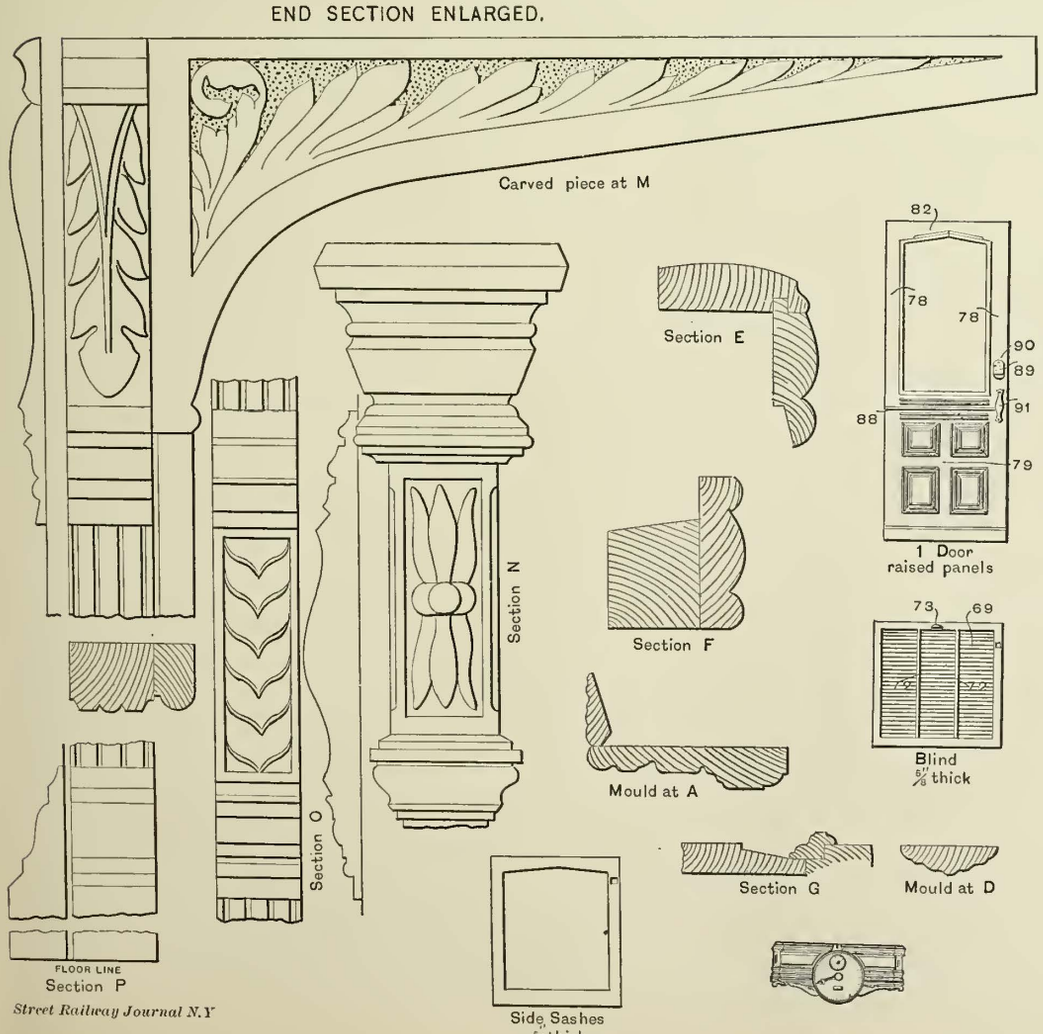

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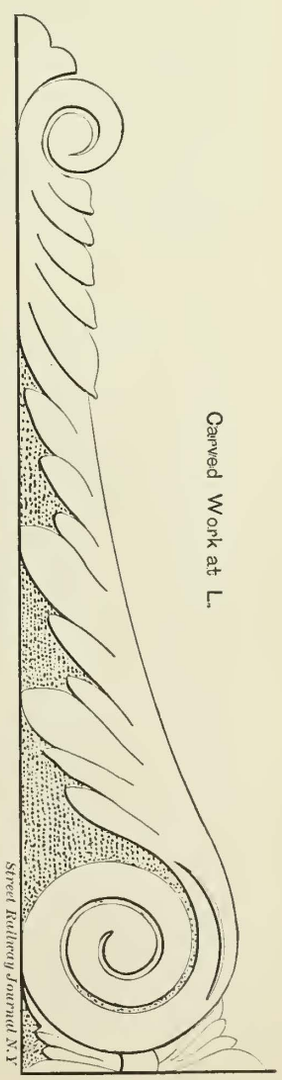


Street Railway Journal N.Y

A heavy end tenoning machine with double heads and copes.
An automatic mortsing machine.
A panel raising machine.
A wood turning lathe, medium size.
A buzz planer.
A complete sash, door and blind relishing and mortising machine.
An Invincible sanding machine.
A belt sander.
A scraping machine.
A planer for squaring up timber out of wind.
A fret saw.
A band saw filing machine.
An emery grinder for sharpening tools.

ERECTING SHOP.

In large works this department often occupies a building by itself; sometimes it is located above the wood working department. In this case, elevators of sufficient capacity for transporting material will also be found to be convenient. As before stated, this department should be carefully partitioned off to protect it from the dust of the machinery department. The temperature should be maintained at about sixty degrees to insure accurate fitting of joints, and lessen the liability of shrinking after being put in service. Carpenters' benches, chests and closets for tools should be provided, and also a system of suspended platforms to facilitate work upon the sides and roof of the car body. Numerous small trucks and horses, before referred to, are a part of the necessary equipment of the erecting shop, for they facilitate the movement of the body as the work progresses. A store room should be provided as an adjunct of this department where all finished parts can be delivered as they come from the wood mill, and stored until they are needed by the body frame builders.

CABINET SHOP.

This department may be provided for in connection with the erecting shop, or the work may be done in rooms set off from the wood mill. But few separate machines are required for this work, as the material is usually prepared in the wood mill and delivered ready for fitting. Screw clamps and tables should be provided, and there should also be provision for storing glass and glazing the sash. Wood mouldings with felt linings are now generally employed instead of putty for holding the glass in the frame; hence, this work properly belongs to this department.

PAINT SHOP.

This is one of the most important departments in car building and should receive careful attention. Besides being located in a convenient position to receive the bodies as they come from the builders, the rooms occupied by this department must necessarily be carefully partitioned to exclude dust and insects, and should be high, having at least fifteen feet between joints, with provision for abundant light on all sides. Light is not only necessary for doing good work, but it also hastens the drying and hardening of paint and varnish. Heating facilities should also be provided, so that a uniform temperature of at least seventy-five degrees can be maintained in winter. This high temperature is not required for the comfort of the workmen alone, but upon it depends the facility with which the paint and varnish can be laid, the depth to which it will penetrate the wood, and, not a little, the durability of the coat. Separate rooms should be provided for the different stages of work, especially in which to finish the cabinet work and veneers. The varnish room should be amply provided with tables, and with racks and frames for holding the spindles, sashes, headings, doors and panels in a horizontal position while the varnish is drying, so that a heavy coat can be laid on without danger of flowing. When dry, these parts may be stored in any position. When it was customary for painters to mix their own colors, the tops of painting tables consisted of heavy, flat stones; now that colors are purchased ready for use the stone is not necessary, and board tops are provided. It is convenient, however, in this connection, to have pieces of thick glass on which to place the colors.

The rubbing room is usually set off by itself, and equipped with benches, washing vats and other appliances, where, by means of pumice stone or rubbing bricks, the wood work is carefully polished and prepared for receiving its coat of varnish.

A store room for paints is a necessary adjunct of this department, from which the material should be dealt out to various workmen upon requisition from the head painter, as is required in other departments.

IRON SHOPS.

Under this head are embraced three departments, the foundry, blacksmith and machine shops, all of which should be located near each other. The former is not an absolute necessity in all car building establishments, as castings may be purchased or contracted for from commercial foundries. In case, however, such a department forms part of a plant, it should be equipped with the necessary appliances, including one or more cupolas with service elevators and blast fans, also trucks, ladles, sand pits, rumblers, cranes, flasks, core ovens and, if wheels are to be cast, with contracting chills, annealing ovens and wheel grinders

A pattern shop and store room for patterns are necessary adjuncts of the foundry. The former should be provided with wood lathes, band saws and other machines necessary for this work, and the latter with racks and shelves, properly numbered and so arranged that any pattern may be readily found when required. Good light and proper ventilation should not be overlooked in planning buildings for the foundry department.

The blacksmith shop requires for its equipment forges, anvils and, if the work is heavy, one or more steam hammers, bending machines, etc. To facilitate the removal of the smoke and foul gases from the forges, a flue with mechanical exhaust should communicate with each, and each should be served with an air blast for forcing the fires. Power cranes, trolley cranes and hand hoists, to facilitate the handling of heavy material, should in all cases be provided. The iron store room, with proper racks for storing the bar iron and steel, is usually located adjacent to the blacksmith shop, and here the power shears and punches for cutting the bars and plates to proper shape are also placed. Weighing scales, hand barrows and trucks complete the equipment of this department.

A machine shop with a more or less elaborate equipment of iron working tools, is a necessary department in any building or repair works. If for repairs only, both the blacksmith shop and machine shop may be located so as to flank the reception and pit tracks, from which they may be readily served with the parts needing repairs by means of overhead trolley tracks, with switches and crossings so located that communication can be had with every department. The overhead trolley and hand lifts may be employed instead of jacks for lifting car bodies and removing motors.

The following are among the most important iron working tools that will be required for commercial car building or for making repairs. These are manufactured in various sizes and may be duplicated according to the amount of work to be done: Axle lathe, radial drill, drill press, planer, key seating mill, wheel boring mill, wheel press and steam hammer. Some of these are illustrated in the accompanying engravings.

A portion of the machine shop is usually partitioned off for the grinding room, where are located the stones and emery grinders for polishing and finishing the close fitting or ornamental parts which enter into car or truck construction. Sometimes a separate building is employed for the truck erecting shop; for this only a few tools are required, but the overhead lifting arrangements should be ample. The tin shop, by no means the least important feature of a car building works, is usually located in the vicinity of the iron tool shop and may occupy a room on any floor. In this department are prepared the lamp flues, stove pipes, stove box lining, ventilating jacks,

thimbles and plates for roof work. Also lamp-oil cans, waste cans, water tanks, etc. The tools required embrace all the appliances found in ordinary tin or stove shops.

SHIPPING.

It is frequently necessary to ship cars that have been built for the trade over long distances, either by rail or by water, in which case they must be boxed or otherwise protected to prevent their being injured *en route*. The bodies may be shipped already mounted, or bodies and trucks may be shipped separately. When dismounted, false sills are sometimes placed under, to which the body is securely bolted. These sills provide for the use of rollers which facilitate the work of shifting the body about. All bronze rails should be carefully wrapped with burlap. In case boxing is not required, most builders provide canvas or waterproof covers which enclose the entire body, and may bear the imprint of the manufacturing firm. These covers being returned often do long service, and answer for various shipments.

Some companies own their own shipping cars which are usually of the platform type, and of sufficient length (fifty or sixty feet) to accommodate two ordinary bodies, upon which they are transported over the different steam lines to their destination. Frequently these shipping cars are provided with a housing of sufficient capacity to enclose and protect the largest street car body.

For export trade it is sometimes necessary to so construct the body that it can be knocked down after being finished and compactly packed for shipping. In this case, the sides, ends, roofs, hoods, platforms and bottom are so connected that by removing a few bolts each may be separated from the other parts, and after reaching their destination can be readily set up and securely united.

In case a car building establishment is not located near a steam line, it is customary to provide low platform wagons, on which the car can be transferred from the shop to the shipping station. These platforms, being provided with grooved or adjustable rails, provide for handling trucks of any gauge.

[END.]

Direct Connected Steam Generators.

By Walter C. Kerr.

So much interest has been awakened in the design of the steam generator (popularly known as the "Kodak"), illustrated in the issue of the Street Railway Journal for October, 1891, that it seems pertinent to examine the reasons for its existence.

The simplest glance at the application of steam power to electrical service will show that engineering practice has for the past ten years alternated from one extreme to the other; first with engines too small and too poor, then too large and too complicated, back to engines not sufficiently economical, and again to engines improperly proportioned to the electrical unit employed, and gradually settling down to a reasonable proportion in size of engine and resultant efficiency.

A compound engine running with high efficiency, whether condensing or non-condensing, of a simple construction and comparatively large size, directly connected to a moderately slow speed generator, is unquestionably the net result of all that is good out of all the experimenting. Such a device is, therefore, not a plan invented, but is rather an outgrowth of the very nature of the problem. It introduces no really new factor, but is characterized chiefly by what it omits; and notably the greatest omission is that of the transmitting devices, be they the simple direct belt or the complicated system of clutches, shafting, belts and pulleys still occasionally used.

The economy of space, and its influence on real estate, buildings, etc., is evident. The virtues surrounding the operation of an electric generator at the moderate speed of 200 to 300 revolutions per minute are equally apparent. The power wasted in transmission is an uncertain factor; small under the best conditions, enormously high under bad ones, and too great to be tolerated under any average service. Even in the simplest method, that of belting directly from the engine to the dynamo, the loss can scarcely fall below 2 per cent., and it has been measured as high as 10. Under more complicated systems of transmission this loss is found between the last shaft and the generator, and to it must be added the further loss between the engine and head line under the strain of ponderous belts. Moreover, this loss is largely at the mercy of the man who sets up the jack screw, sliding the generator on its base to tighten the belt, and hence, measurement under carefully pre-arranged conditions is no indication of the daily loss which may be and generally is incurred.

The difficulties surrounding the building of electric generators in large sizes, at speeds below 100 revolutions per minute, are of a formidable nature, while the construction of such machines to run at speeds of 200 to 300 presents practically no difficulties. Small generators, say, 100 to 200 H. P., may be driven by belt with no more inconvenience and loss than we are accustomed to tolerate, notwithstanding the power can be delivered more efficiently by direct coupling of shaft to shaft; when, however, units of 300 to 1,000 H. P. or more are driven, the mechanical difficulties and losses are unduly augmented as size increases, and direct connection appears not only a necessity, but a welcome one.

It is fortunate for the development of electrical industries that the past five years have been so fruitful in the production of simple types of compound engines more or less capable of performing such services up to any power within which it is expedient to build generators. The prime obstacle to the steam engineer in working out this problem has been the apparently fundamental impossibility of getting a non-condensing compound engine to show fair economy under comparatively light loads, but even this has surrendered unconditionally to a persistent investigation of the conditions. For this and other reasons the earlier attempts in direct connection were more or less unfortunate, the failures being due largely to the apparent necessity of high speed in the dynamos and inability of existing steam engines to meet their requirements. To be sure, the requirements themselves were not very well understood and it was not to anyone's discredit that judgment failed to perceive the limitations then surrounding the electrical service and the engineering attachments.

The past inability of moderate sized engines to produce the highest grades of efficiency has led many to the supposition that ultra-large units were essential to economy, but now within moderate sizes the highest efficiencies can be rendered in simple designs, such as the one which is the subject of this article. In the struggle for recognition, a large number of devices more or less on this order have been developed, and others are yet to follow. Some will be good, others worthless, and, as is customary, there will be all degrees of excellence between these extremes. The most common error in such matters is to fail of the mark through complexity, and it is on this basis, more than any other, that the "Kodak" generator makes claim to special recognition from the standpoint of both steam and electrical engineering. Something simpler to produce equal results may be produced, but if so, it is yet to be suggested. The compact, rigid, substantial design in which a strong bed plate holds two well proportioned and practically independent machines, coupled invariably shaft to shaft, yet with full provision of flexibility for misalignment, and elasticity against short circuits, is simply a good engineering plan in which well known and well tried articles are fitted for the varying loads and the peculiar emergencies of electric railways, and involving no uncertainties as to efficiency or continuous running qualities.

The scale of importance which electrical railway work has now assumed and the experience that has been gained in construction of electrical power plants would seem to be sufficient to provide against serious error in determining units, in selecting electrical and steam ma-

chinery, and in properly connecting them for efficient service. The progress in these lines is all towards greater simplicity, and those who permanently invest for returns cannot hope to accomplish their desires through methods that are rapidly becoming obsolete. All the connections heretofore made between electrical generators and engines form collectively an item that is doomed, because unnecessary, occupying valuable space, expensive to buy, maintain and operate, and a source of frequent accident. That such connections should have ever existed would not be altogether creditable to engineering had they not filled a somewhat necessary, but temporary, gap during the interval in which development could bring electrical generators and steam engines into such relations that each could meet all the requirements of the other.

This direct coupled type of steam generator stands to-day the best and simplest device by which the heat of steam can be turned into current on a wire with minimum opportunity for impairment, mechanically or economically, through any of the exigencies of the unusually severe service for which it is adapted.

Who Pays the Taxes When a Street Railway Franchise is Taxed?

By J. M. Batchelor.

One of the most important questions relating to street railway interests is a matter frequently put before many of our state legislatures, whether street railway companies should or should not pay into the state treasury a proportion of the receipts which the roads earn. Particularly is this issue an exciting subject for debate in Western and Southern town caucuses in consequence of the requests for street railway franchises, due to the rapid development of these neighborhoods.

If a town is young it is glad enough to get anybody to build new street railways, and it asks no concessions from the investors in them; in fact the town is willing to take some of the stock itself rather than get no road at all. But as the town grows and several street railways are in existence, reaping, say, from 4 to 6 per cent dividends, the people begin to demand compensation for these dividends, and advocate that the granting of new charters should contain a clause to that effect.

In numerous cases these expectations on the part of the public authorities prevent a town's development, for capitalists are not disposed to take risks in a business where the profits are so curtailed that even if the business comes out without positive loss the highest possible gain is too small for the chance of getting it.

There is a strikingly odd feature in this subject which the public generally should more closely observe; which feature is well illustrated in the case of Nebraska concerning its treatment of steam railways. Before the railways were built no kindness towards the roads' constructors was considered too great, as the people found many of their otherwise valuable lands almost worthless in consequence of a lack of proper transportation facilities. After the roads were built, however, and there was no further opportunity for the investors in them to withdraw, even if they would, the state legislature passed anti-railway laws, restricting the railways' income, and contrary to the letter of the state charters these roads held; and in a minor way the state practically confiscated—through a restriction in profits—the steam railways of the state. Had the state bought out these roads, that would have been another thing, but it did not buy them out, it merely took a certain control of the investor's property without compensation. The consequence was—what any business man in the state should have foreseen—capital for railway investment was driven from the state. As is well known, Nebraska has considerable territory so far undeveloped in consequence of a deficiency of railways. The inhabitants of this state have just begun to realize that the anti-railway laws they had so energetically supported because they supposed investors were getting too much for nothing, meant a cessation of further railway construction. They have now turned about, and, through their legislature, offer extra inducements for the investors to come back again; but up to date they have not been successful; consequently these inhabitants are realizing that they committed a species of business suicide in adopting their short sighted policy.

The illustration applies very well to the newer or more rapidly growing cities in many parts of the country, and these towns may well heed the lesson in relation to street railways. But the older cities—those having more or less street railways to supply immediate wants in case no more were built—look upon the granting of further franchises in another light. They frequently say their city has attained a large growth, and the giving a company the right of street railway service in any district not fully provided is giving something for which compensation should be obtained.

Admitting this claim in certain cases, although there are others where the claim is largely overrated, it would appear that the interests of the inhabitants of the district through which a proposed line is to run would be best subserved, if any allowance granted for the franchise should be put in the shape of better cars, more frequent service or even reduced fares—after they were earned—rather than by any tax on the franchise itself. A general tax on a franchise is too wide in its distribution of benefits. On the other hand, if a road reduces its fare by the sale of tickets or otherwise—say, whenever 10 per cent. net earnings are cleared—and thus divides the extra profit with the road's patrons, the best results are obtained, because such reduction in fare tends to develop a locality by the reduced cost of living there; and the inhabitants already located get the benefit of what they have done toward making that locality what it is.

All taxes imposed upon street railway charters rest upon the patrons of the line; they have to pay the taxes whatever they are. This is a point not sufficiently appreciated by the makers of the law; many of them seem to reason that a tax on a street railway franchise, comes out of the investors' pockets; but this view is an error. The road must earn its expenses, its taxes and all costs; otherwise it becomes insolvent. Earnings mean what the road's patrons pay to it. Then a tax on a franchise of this kind is merely a tax on the people who make the tax; that is, they tax themselves. If they look at the matter in this, its true light, they will appreciate the absurdity of imposing such taxes.

Meetings of the Massachusetts Street Railway Association.

The members of the Massachusetts Street Railway Association dined at Young's Hotel, Boston, February 24, and talked on "Snow Plows."

About twenty-five members were present, and in the absence of the president, Mr. Charles B. Pratt of Worcester, because of illness, Mr. Amos F. Breed of Lynn occupied the seat of honor.

The last meeting was held March 9, and fourteen companies were represented. Vice-President Amos F. Breed occupied the chair.

After the records of the previous meeting were read and approved, the question of taxing street railway corporations came up for discussion, and the prevailing opinion among those present was that the franchise tax of to-day, in its amount and method of assessment, is just and equitable and ought to continue without change, except in the distribution of money thus collected. It was thought that this money should be distributed among the towns and cities according to the number of miles of track in the cities and towns through which the tracks extend.

The next meeting of the Association will be held on April 13 next, at Young's Hotel, Boston. The subject to be discussed is "The Rights of Patentees in and to Electrical Appliances."

We have received from the secretary of the American Street Railway Association copies of three interesting law cases, being Nos. 11 and 12 of Vol. VIII., and No. 1 of Vol. IX.

Works of The American Car Co., St. Louis.

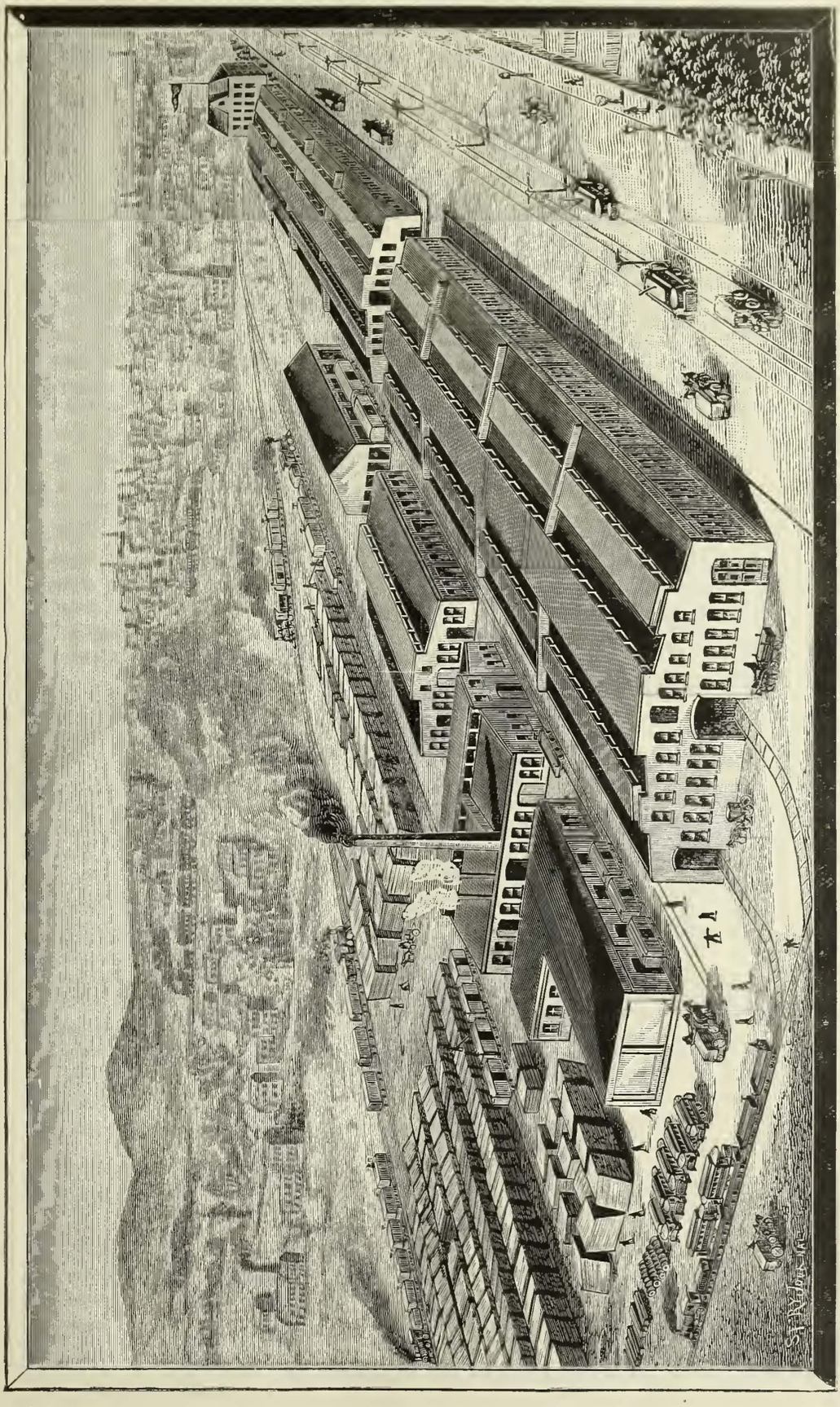
In the foremost rank of enterprises that have commenced operations in St. Louis within the past year, may be cited the works of the American Car Co, organized for the especial manufacture of street, elevated and suburban railway cars.

The name of this company is an important addition to the already long list of car builders n this city, and their advent has established the fact that more street cars are built in St. Louis than in any other city in the world. The reasons for this are most natural. St. Louis is the fine lumber market of the country, and is located to compete successfully with Eastern, Northern and Western builders, both in cost of production and in delivery to markets in any section of our country.

The works have the most advantageous location that could be selected, the site, covering about ten acres, is at Tower Grove Avenue and the crossing of the Missouri Pacific, the St. Louis & San Francisco, and the Oak Hill & Carondelet railroads, the latter being practically the city terminus of the St. Louis, Iron Mountain & Southern Railroad.

The premises have a shape tending to a lengthened triangle—the thoroughfare running along the right -- and shipping connections with the three railroads on the western and southern sides. The buildings cover the greater part of the premises, excepting about three acres used for lumber yards. Everything in connection with the works is laid out so systematically that we have no difficulty in describing the succession of buildings and departments in their regular order.

In planning the works, a perfect economy in handling the materials in progress of manufacture, has been closely studied. This has been one of the special aims of the company in the selection of the site, and in the construction of the buildings, which are at present six in number and form two rows or branches converging at the paint shop. On the left are the blacksmith shops and machine shops, the engine room and boiler room, following which come the lumber kilns. On the right are, first, the office building, next the paint shop, occupying the large building following, and the buildings of the erecting shops, varnish room and cabinet shop and mill. All the buildings are substantial brick structures, but one story in height. As may be seen by the cut, most ample consideration has been given to the all important subject of good light, the machine and blacksmith shop and engine and boiler room buildings being surmounted by one single lantern, and the other buildings with three rows of lanterns, as well as very large and high windows. Be-



WORKS OF THE AMERICAN CAR CO. ST. LOUIS.

tween the two rows of buildings runs the main railroad switch, which has a branch passing through the lumber yards.

Now that we have described the general configuration of the grounds and buildings, we shall proceed to speak of each one of the latter separately and in detail. We first visit the office building, which is situated on Tower Grove Avenue and the railroad tracks. Here are situated the general offices and draughting rooms. The present building is a frame structure, and is to be replaced by a neat edifice with ample office accommodations, and draughting and photographer's rooms designed according to the latest methods.

From the office we go to the lumber yards. Here there are at present piled up over 2,000,000 ft. of lumber, valued at $50,000. It is all of the very finest quality and thoroughly seasoned. The yards measure 275 × 450 ft., or over two and three-fourths acres.

The blacksmith and machine shops occupy a substantial building measuring 175 × 175 ft. A railroad track runs through its centre from north to south, and the railroad cars deliver at its doors the heavy material to be made into the various necessary shapes. The blacksmith shop and the machine shop each measure 75 × 150 ft. In the blacksmith shop, the roominess of which is most noticeable, are eighteen forges and four furnaces. There are two steam hammers of the Bement & Miles type, and two of the Blakesley type. One novel and very interesting machine, the invention of Mr. William Sutton, president of company, makes a complete steel car step at one blow.

We next enter the machine shop. Here we find a large punching machine at work. This, together with a shearing machine, was made by Hills & Jones. There is also a large Niles wheel press of 100 tons pressure capacity, as well as many other machines which belong to this department. A railroad track passes through this shop, enabling the shipment of trucks and delivery of wheels, axles, etc.—of which there are a very large number on hand— with the greatest facility. Between this building and the engine and boiler house are two large wells, and above them, supported by the walls of the two buildings, is a storage tank having a capacity of 40,000 gals. The city water is entirely too muddy for use ; well and artesian water have to be used in its place.

Adjoining the machine shop is the power house. It is a brick structure measuring 50 × 80 ft The boiler room measures 31 × 80 ft. The boilers are three in number and are of 120 H. P. capacity each. They were made by the Springfield Boiler & Manufacturing Co., of Springfield, Ill. The water supply for the boilers is obtained from an artesian well inside the boiler room itself. It was necessary to bore down 300 ft. to obtain the proper quality. A vertical pump sends the water direct into the boilers. We noticed two small pumps for ordinary uses, and a purifier. The engine room is 20 × 80 ft. The equipment consists of one Hamilton-Corliss engine of 250 H. P. capacity, but which can deliver 300 H. P. on the fly-wheel. This engine supplies the necessary power for the entire works, with the exception of the fans and the lumber kiln exhausts, each of which derives power from other engines to be spoken of hereafter. The cylinder of the engine measures 22 × 42 ins. A 250-light incandescent dynamo supplies the necessary light for the entire works. It is operated by the Hamilton-Corliss engine by means of a pulley attached to the main pulley shaft.

One of the most valuable and interesting features of the works is the drying kiln. It occupies the brick building without windows and lantern shown in the cut on the left. It consists of five separate and distinct chambers, each one of which measures 20 × 40 ft. In each one of these is laid the lumber to be dried, and record is kept of its kind and quality, and of the time required for each to undergo the process. The timber rests on rafters, and thus it is thoroughly exposed to the heat coming from a series of pipes, with which each chamber is supplied. The temperature at the time of our visit was eighty degrees. The heat drives out the moisture from the timber, and an exhaust fan is connected with each chamber by a large pipe, through which the vapor is taken and deposited in the form of water at the rear of the building. A room also in the rear contains the twenty H. P. Sturtevant engine which operates the exhaust fan made by the same company. It is claimed that grass green poplar, bass and cherry woods can be dried here in forty-eight hours ; three inch and four inch oak right from the saw, in two weeks, and ash in eight days, all of these showing no signs of checking whatever. At the time of our visit there were two kinds of lumber in one kiln, that which seasons the quicker being above. Green timber is never put in the kiln, but only selected lumber from the company's stock, which has had thorough outdoor seasoning. The wood mill being situated opposite the kiln, lumber is taken from the latter to the former ready to be cut into various shapes and forms.

We next enter the mill. This department occupies one large room, measuring 150×150 ft. On account of insufficient room and facilities, an addition is to be added which will measure 150×300 ft. This will give a total mill room of about two and one-quarter acres. There is an almost endless variety of wood working machines and tools, a number of which were made in St. Louis by Hall & Brown, and others came from the East.

Adjoining the mill is the cabinet shop measuring 75×150 ft. In this department the delicate framing and joinery work are performed. The monitor roofs are here erected, and call forth a great deal of skill in bending wood to the required shape. The main and foot panel boards are bent to graceful curves by being put on a series of steam pipes so placed that they form a curved surface. Where the panels are laid on the pipes they are drawn down to the required curvature. Platforms of various sizes are being built. Seat backs of fine burl oak, bent, stand up ready to be placed in the cars, as well as veneered ceilings of the same wood. In the southwest corner of this department is the heating apparatus, of the Sturtevant system, which supplies a uniform temperature as well as a change of air throughout all the buildings. It is arranged as follows :

Within a large iron box is a series of coiled steam pipes supplied with steam from the boiler room, and kept at a constant temperature of sixty degrees in the winter. These pipes fill the large iron box with heat, and connected with the latter is a fan operated by a twenty H. P. engine. In connection with this engine and the one in the lumber kiln, is used a rubber belt. The fan sends the hot air throughout all of the departments, by means of galvanized iron pipes. Not only are the buildings heated, but there is a constant and most perceptible change of air, found to be so by a continuous warm draught encountered by passing from one department to another. During the summer months cold air is sent through the buildings in the same manner as the hot air at present.

We next enter the varnish room. This department measures 50×150 ft. In one part of the large room are window sashes of cherry wood varnished so smoothly and brightly that they will reflect any image, and furnished with the heaviest plate glass. Again we see fine wood seat backs highly polished and varnished, and veneers for ceiling decoration. On the latter is bestowed some of the most artistic work executed in the shops by means of stencils. Handpainting is also done in this department which very often requires great talent, and attains to a high degree of excellence.

Passing through the erecting room, 100×150 ft. in size, we enter the last department, the paint shop. This department at present only measures 150×300 ft., and can accommodate about 150 cars. The company now has in course of erection a mammoth paint shop measuring 400×300 ft., occupying about three acres, and capable of accommodating about 260 cars at one time. Twelve tracks will run through the building from east to west, and corresponding to these will be twelve doors entering on to the main railroad switch. Thus the newly built car can be run on to the flat railroad car without any unnecessary lifting or hauling. Between the new paint shop and the erecting shop there is to be a large transfer table, fifty feet in width, running the width of both buildings. To give a good idea of the insufficiency of the present

quarters in the painting department, it was necessary to rent one-half of the large cotton compress building east of the company's premises, and at the present time 200 cars are being painted there alone. It is in the paint shop that the street car appears, as we are accustomed to seeing it, in a complete state.

The process of painting a car never strikes the ordinary run of mortals as being a difficult and tedious one. They think that two or three coats of paint are put on, then the lettering, and the whole completed in a day or two. Every car first receives, in the erecting shop, a coat of white paint, which serves as a base for every color. After entering the paint shop it receives different coats of the color chosen. The foreman of this department has a reputation for his fine and durable work. After this painting is completed, the car is ready for the interior decorations, such as the carpeted or upholstered seats, the veneered ceiling, the lamps, the brass mountings and the last finishing touches. It is then mounted on its truck, and after it has received a canvas covering, is ready to be shipped to any point in the Eastern or Western hemisphere, as the case may be.

At the time of our visit the company were building some very handsome cars equipped with cabs, for Cincinnati. The cabs of these cars were not as cumbersome and heavy as some we have seen. Each side door where passengers enter swung on hinges, and was provided with a drop sash. Some of the cars had sixteen foot bodies, and others eighteen foot. There were a number of open cars for Peoria, Ill., with seven benches, the end ones of which were double, and having an aisle down the centre. The company have adopted a style of their own in shaping the panels of these cars to a compound curve.

The monitor roof is the style of roof generally put on the company's cars, but, of course, they can build all kinds, and to suit the fancy of the most fastidious. There were also cars for Chicago, for which point the company have already built several hundred cars, Washington, D C. and Omaha, in various stages of completion. They are also at present remodeling one of the twenty-two foot cable cars formerly used on the St. Louis & Suburban Railway. As this road now employs electricity as a motive power, the large cars are to be equipped with two four wheel trucks, each of which is to be fitted with a fifteen H. P. Thomson-Houston S. R. G. motor. Seven feet four inches of one end of the car is being made open, and when the whole is completed it will have the appearance of the Market Street cable cars in San Francisco.

Three hundred men are at present employed in the works, some of them by the piece work, and still others by the hour. The wood mill men all belong to the latter class. Till very recently there was a night shift employed in addition to the day force, the many orders on the company's books rendering this necessary, but the new mill has relieved all pressure and the regular day's work of ten hours has been resumed.

The American Car Co. was incorporated under the laws of the State of Missouri, in August, 1891. The officers of the company are: William Sutton, president; Theophile Papin, Jr., 1st vice-president; Ferdinand Meyer, 2nd vice-president; Emil Alexander, secretary; Louis H. Tontrup, treasurer. These gentlemen are well known citizens and prominent in many large business enterprises in connection with the new growth of St. Louis, and their connection with the American Car Co. has brought it at once into the foremost rank of St. Louis' great industries. Messrs. Sutton & Alexander are the practical conductors of the works. They were the organizers of the Laclede Car Co. with which they have been connected until recently. Mr. Sutton has also been connected with various other car building works at different times.

That these gentlemen thoroughly appreciate the growing requirements of the street railways throughout the country in the way of modernized equipments is demonstrated by the number of orders now under way in their establishments.

Mr. Alexander, with justifiable pride, pointed out to us that some 275 cars stood in the paint shop and annex about completed, making the daily output about seven cars. When the annex to the mill is completed, the company will have a reserve capacity of twice again that number and will be ready to make delivery of five or 500 cars at any time wanted.

When we consider that the works have been in operation but six months, we do not wonder at statements that the street railway companies are declaring larger dividends and growing faster than ever.

A New Electric Line in France.

The projected new line of the Puy-de-Dôme is to connect with the electric tramway from Clermont-Ferrand to Royat. The first section, of 1,500 metres, will use a rack rail and will have grade of one in five. The second section is 11,000 metres in length, with smooth rail and grades up to one in seventeen, which will be followed by a third section of 1,000 metres of rack rail of various gradients on one in eight to one in five. Finally a fourth section of 400 metres of cable, and an incline of one in two. This last section will probably be replaced by a tunnel of one in four, with rack rail opening out on the summit of the Puy-de-Dôme. The difference of the altitude between the two termini is 1,000 metres (or 3,280 ft).

The entire line will be operated by electric power, using an overhead wire and return current through the rails. The power station, which will supply current to both the Puy-de-Dôme railway and to the Clermont-Ferrand tramways will probably be placed near the junction of the two lines.

The rack rail sections and smooth rail sections will each have a special type of vehicle, and a special device will be used to facilitate the transfer of passengers from one set of cars to the other.

The overhead wire will be of silicon bronze and will be supported on iron poles. The span wire construction will probably be used. The generating station will have a capacity of 300 H. P. The management is also studying whether it will not be possible to utilize this current from the motors on the down grade to charge accumulators at the generating station. The power will probably be furnished by turbine wheels.

We are indebted for the above facts to Mr. Chigot, engineer of bridges and causeways, Clermont-Ferrand, Departement du Puy-de-Dôme.

Notes on the Columbian Fair.

FOREIGN participation in the Exposition, up to the present, embraces seventy-two nations and provinces.

CANADA has been given 68,471 sq. ft. of space in the various buildings, exclusive of space yet to be granted in the agriculture and live stock departments.

THE Bethlehem Iron Co. of South Bethlehem, Pa., will make an extensive exhibit, including steel rails, shafting 125 ft. in length, guns, projectiles, and various naval appliances. The company will also erect a full size model of their famous 125-ton steam hammer, said to be the largest in the world. It will be to all appearances a perfect duplicate in every respect. It will span the main avenue of Machinery Hall, and will rise to a height of ninety feet. At the last Paris exhibition great attention was attracted by a similar model shown by the Creusot works, but representing only a 100-ton hammer.

SEVEN of the World's Fair buildings are now so far advanced that they are fast assuming the appearance of finished structures. The rough carpentry work on them is practically done and the ornamental and finishing work is in progress. These buildings are the Woman's, Horticulture, Transportation, Mines, Administration, Forestry and Fisheries. Five more—the Government, Fine Arts, Agriculture, Dairy and Illinois State—are erected to the roof lines. The Electricity, Manufactures and Machinery buildings are being advanced rapidly.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

Street Railway Publishing Co.,
World Building, New York.

The Street Railway Companies of Chicago have recently been granted privileges which will enable them to provide a much better service for the public. There has been of late much complaint of the inadequacy of the service, but the fact seems to have been that improvement was impossible without the grant of facilities which an unreasonable municipal council refused to concede. With increased looping privileges the cable companies can respond much more successfully to the tremendous demands made upon them in a city which depends for transportation wholly upon the surface cars.

A Comparison of Miles and Cars belonging to the street railways in the United States at the close of the years 1890 and 1891, is given on another page. The basis of the table is the directory of street railway companies published each month in this paper. While we realize that all directories of this kind are more or less inaccurate, and that, consequently, any table compiled from one has a margin of error, it is believed that the table referred to is as accurate and complete as it is possible to make it. Reports had to be sent in from all parts of the country, but all have shown a cordial desire to co-operate in keeping our street railway directory correct, and to all we herewith extend our thanks for the furnishing of statistics.

The Electric Railways of Chicago at the present time are located in the outlying districts, and it has been generally assumed that overhead systems would not be permitted on streets nearer the centre of the city. The City Council has, however, recently passed ordinances which authorize the use of aerial wires on the crosstown lines within five or six miles of the heart of the city. The overhead system is well adapted for these roads, which are comparatively short. More rapid transit is demanded than is possible when horses are used, and the traffic is not sufficiently heavy to warrant the use of a cable. Perhaps when these roads are electrically operated, and the merits of electric railways are more perfectly understood, the prejudice against the trolley wire may be less pronounced, and electric lines can be more generally utilized as adjuncts to the cable systems.

Car Building as presented in this and the preceding number, will, we think, be found to be a valuable treatise on the subject. Already several parties to whom the matter was submitted before publication, have commented favorably on its practical value, and one has added in his communication, "It would have saved me much labor and expense could I have had such help in my early railroad experience." The article, with important additions, and a larger number of illustrations, will constitute one of the fifteen chapters in our forthcoming handbook (Trams), which has been for some time in preparation, but the publication of which has been unavoidably delayed. We will, however, have it ready for delivery within the next few weeks. The work is intended to cover the entire street railway field, and will treat the subject in every detail.

The Desirability of Exhibition Roads at the World's Fair was urged in these columns in the February issue. Until within the last few days it has looked as if the authorities would refuse to entertain a proposition with this end in view. We have just received information which warrants us in announcing that in all probability three tracks, which will be parallel to the Baltimore & Ohio tracks at the southeastern corner of the Exposition grounds at Jackson Park, will be used for the purpose. It was thought at first that electric cars only would be exhibited in operation on these lines, but it is now considered not improbable that other systems of street car traction will be shown. It is certainly hoped that this plan which now seems likely of adoption will be favorably considered by the authorities. The trials of the various methods of street car propulsion, which would be illustrated would form a most attractive and instructive exhibit to a vast number of persons who will visit the grounds.

The Question of One or Two Motors for an electric car equipment was recently debated in the Chicago Electric Club, and it is interesting to note the opinions that were expressed. First of all, it was conceded that at the present time its tendency was toward the single large motor. Those advocating this form of equipment emphasized the electrical advantages to be gained by having a large machine instead of two smaller motors. On the other hand it was maintained that the mechanical difficulties connected with transferring power to the axles were easier of solution with two motors than with one. It was also urged that if the two machines were run in series electrical difficulties would be greatly decreased. There is a great deal to be said on both sides of the question, and there is a great deal in the remark made by one of the gentlemen in discussing it, that success in operation with either system depended in a great degree upon the superintendent. At the present time when so many roads are changing their equipment, this question is of especial interest, and it is well worthy the careful study of railway men.

Enterprise is One of the Chief Characteristics of the Street Railway Man, although one might not reach that conclusion after perusing the daily newspaper. The readiness with which so many companies have substituted improved forms of motive power within the last few years is striking proof of the statement. Street railway companies are always on the alert to secure improvements, which will increase the value of the service that they render to the public. An interesting illustration can be found in Chicago at the present time. The newspapers of that city never cease their attacks on the railways, but one of them, which is the most bitterly opposed, whose president is conceded to be the most thoroughly abused man in Chicago, never ceases its trials of new forms of motors. At the present time there are in operation on the lines, cable cars, an imported tramway locomotive, a gas motor, electric cars with underground conductors, and contracts have been signed for the operation of one line by compressed air. In what industry can a more enterprising search for improvement be found?

They Yield Ungracefully to The Inevitable, as the following editorial cut from a leading New York daily, will indicate:

"Brooklyn is to be cursed with a trolley system. The people seem to like it, and the Railroad Commission permits them to have their way."

In our February issue we expressed surprise that the New York papers, which ordinarily treat public themes with great dignity and fairness, should lose their heads when treating on the trolley system, and continue to parade the danger spook, after it had been shown over and over again that their utterances in this direction were based on ignorance and misconception. It is time now for the papers to recognize the fact that the people do like the trolley system, that they are bound to have it, and they regard it in the light of a great blessing rather than a curse. Such flings as the above are undignified, and while they may do for a street gamin who has been worsted in an encounter with his fellow, they indicate a mind too narrow to deal intelligently with questions so vital to the well being of the people of a great city. It is unfortunate for the reputation of the public press, that it has generally opposed the introduction of electric traction, and had it not been for the technical press there would not be a car wheel turned by electricity in any city of our Union. We would not call attention to this unpleasant fact, were it not that in certain localities the same farce is being again enacted. Papers with a national reputation are bending their energies to prevent the introduction of the trolley in a neighboring city, with inevitable defeat staring them in the face. It would save much humiliation on their part, and much trouble in street railway circles, if such publications would join the party of progress, and lend a hand in the development of these industries which promise so much for the comfort of thousands of people, and an enormous increase in the value of real estate.

"We Go Fast Enough and do not need any more improvements or discovery in locomotion," said a well known Brooklyn divine recently, "we do not need any more labor saving apparatus, we have enough now to throw millions of people out of employment; but the world agonizes for improvement and discovery in the matters of physical health." We do not deny the latter statement, but do not at all agree with the first assertion, for facts do not bear out the claim that labor saving appliances have narrowed the field for individual employment. Machinery has taken the place of muscle in certain trades, and compelled some men to learn other trades; but at the same time other machines have bred new trades demanding skilled labor for their operation so that numberless enterprises have sprung up, giving in the field at large employment for a greater number of laborers at better wages and more congenial employment than would ever have come to men had mere hand work been the prevailing method as of old. "We want the race to live longer, and be more comfortable while they do live," was a statement made in the same connection as the above. We admit this also, but claim that such a condition is possible, for city people at least, in the near future, only by improved means of transit. No one is satisfied with the present speed of street car and railway trains. Each of those who daily patronize the former would save from ten to sixty minutes a day, depending upon the distance traveled, a result by no means impossible, and which requires only a little figuring to determine how much even ten minutes a day would add to the average life of man. Popular errors like the above remaining unrefuted tend to subdue inventive efforts; hence, we urge the need and invite the best inventive talent of the age to address itself to this subject. We do not hold that higher speed on existing surface lines with the present forms of track and rolling stock, is safe or desirable, but we do believe that there are possibilities of rapid transit upon some form of an elevated structure, that will virtually annihilate space and be at the same time safe and agreeable.

The Table of Statistics, published on another page, giving a comparison of mileage and cars of street railways in the United States for the years 1890–91 shows, among other points, an increase during the year of 3,300 electric cars, or a total at the end of 1891 of 8,892 electric cars. If we could reckon all the results of the important change in street railway methods connected with the adoption of electricity as a motive power, we should find that they are far reaching and affect nearly, if not every, industry in the country. While acting as a stimulus in many lines and creating new sources of supply and new industries, the change has affected some industries adversely, and is destined to have still greater effect. Take the question of horse provender alone, for example. If we consider that six electric cars, owing to their higher speed, can perform the same service as ten horse cars, the service of 8,892 electric cars corresponds to that of 14,920 horse cars. That is, the latter number of horse cars would be required to do the same work as the less number of electric cars. It would evidently not be fair to assume from this that this number of horse cars would be in operation to day were it not for electricity, since the equipment of many lines has been made possible only because electricity was available as a motive power; but, taking these roads into consideration, it can be stated with a fair degree of accuracy, that of these 14,920 horse cars 10,000, or about two-thirds, have been taken from our streets. If we allow an average of eight horses per car for operating these cars, the total number of horses relieved from service is seen to be not far from 80,000. Taking up the question of feed, then, and allowing a ration per horse

per day of ten pounds of hay, eight pounds of corn and six pounds of oats, we would have a gap in consumption, so soon as the present number of horses can be reduced, of 136,000 tons of hay annually and 4,171,428 bushels of corn and 5,840,000 bushels of oats during the same period. While this is only a small proportion of the total amount of produce raised and horses employed in the country, it shows that the effects produced by the introduction of electric cars are far reaching and of considerable magnitude, even in some of the industries not directly connected.

A Petition has been presented to Congress by the Metropolitan Railroad Co. of Washington, asking for an extension of the time within which they are to be required to change to some form of mechanical traction. It will be remembered that Congress enacted a law on August 6, 1890, requiring, among other provisions, that certain street railroads in the District of Columbia substitute for horse power some form of mechanical traction other than the use of overhead wires, within two years of the date of the act, and in case of failure to make the required change "such company shall forfeit its charter." The company state in their petition that the time is too short in which to perfect the change, that they have spent $242,000 in an effort to comply with the laws by operating their cars with storage batteries, all the necessary buildings and machinery being in place, but that it will be utterly impossible even with an unlimited amount of money to put all the lines in operation on this system by August 6, but express their confidence of being able to do it within a short time thereafter. The committee to whom the matter was referred have recommended that the time be extended for one year, so far as it applies to the Metropolitan company. This is fair, and it is hoped that the members of both houses will be reasonable in the matter and grant the extension. In the meantime there is an opportunity for the street railways throughout the country to come to the assistance of the Washington company by using their influence with their represenatives in Congress and persuade them to grant the extension. At the same time the act was passed we commented on it quite severely, for it seemed to be an unjust measure, and particularly hard on the above company, for while other lines were in a position to adopt cable traction, the lines of this company, owing to the numerous curves, could not with advantage be equipped with this system. It seemed to us at the time premature and unfair to exclude the trolley system, and we are now of the opinion that the interests of the people of the district will be greatly promoted, not only by the extension of time to the Metropolitan company but by the repeal of that clause that prevents the use of overhead wires. The success that has attended the operation of the trolley system in a large number of the cities of our land during the last two years and the favor with which it has been received by the people, should convince Congress that it is not an undesirable method to be employed in Washington. Doubtless many of the members are already familiar with the operation of electric lines in their own towns, and should not presume to deny the people of the District of Columbia the facilities which others enjoy.

Mob Rule reigned supreme in the city of Indianapolis during a good part of last month. The claim of ex-operatives, who had voluntarily left the service of their employer, to dictate how he should still conduct his business and whom he should employ, was tacitly admitted by the citizens and municipal authorities by their failure to prevent the open enforcement of this claim It is a dangerous doctrine to champion that an employer has not the legal right to employ new helpers in his business, when the old ones are no longer willing to work on the terms offered. But this was the claim advanced in Indianapolis by the street railway strikers; the guardians of the law made no attempt to deny it, and the street railway service became suspended in consequence. Of course, during the disturbance, considerable property belonging to the railway company was destroyed by the strikers and their sympathizers. Before the curtain was rung down on this travesty on justice, which, however, so far did not differ materially from many like events in other cities, the judiciary was called upon to interfere, and rendered a decision which was so peculiar that it demands special attention. A citizen, not financially interested in the company, filed an application late at night during the strike, with Judge Taylor of the Superior Court, for a receiver; an application which was granted after an *ex parte* hearing, by the appointment of a former employe of the company to take charge of the road, though no claims of insolvency were made against the company. In other words, Judge Taylor laid down the new principle of law, that if an employer does not pay his employes the wages they desire, his property can be taken from him. Judge Taylor said in explanation of this, after the property had been returned to the company:

> By the contract between the city of Indianapolis and the Citizens' Street Railroad Co., the company was bound to furnish car service on all its lines within the city limits, each and every day, and during the hours for business and travel for each day. I am not sure that the very words are stated, but that is the substance of the agreement, and it is one of the essential provisions of that contract. The company has broken that contract, and it might fairly be held, that far, to be in a failing condition, a state of quasi-insolvency or bankruptcy—inability to perform its obligation.
>
> Sec. 1,222 of the statutes of this state provides for the appointment of a receiver, and it specifies the cases in which a receiver may be appointed by the court. I shall not set forth these specifications in detail, but refer only to the seventh which is in these words: "And in such other cases as may be provided by law, or where, in the discretion of the court or the judge thereof in vacation, it may be necessary to secure ample justice to the parties." Now the parties to this contract are the citizens of Indianapolis, and the Citizens' Street Railway Co., and the justice to be secured is the compliance with that contract by that company, wherein it had failed and was helpless through its own act or failure to fulfil.

It is a new proposition, and one which it might possibly be well to compare with the Constitution before acting upon that the law will take when through its own negligence it fails to protect. In fact, it would not require a very vigorous imagination to picture a judge who upholds this doctrine as hanging a prisoner first and trying him afterwards. But another point in the statement demands attention, and that is, that the city of Indianapolis is made synonymous with its citizens, and that any citizen can bring action on a contract in which the city is a party, if he thinks that the contract has been broken by the other side. Usually such action is brought through the city's officials or constituted head, and it would be interesting to know Judge Taylor's reasons for extending the right.

The Government Control of Railways was made an important plank in the platform adopted at the recent

convention in the city of St. Louis, of delegates representing, what they call, the people's party. While this body doubtless is in an infantile condition, it has put forth one phase of an important issue which is more and more coming to the front. And it is none the less significant to the street railway interests, because street railways were not mentioned in the plaform, for it is reasonably safe to say, should the larger railways be subjected to government control, street railways would quickly be looked upon as worth similar attention. Government control of railways wherever it has been tried has not proved a success; the reasons therefor are apparent enough when one reflects upon government methods in the conduct of industrial enterprises; usually, employes so engaged, while they may or may not do their work thoroughly, feel that their positions are secured by many considerations besides the actual merit of their work. Outsiders should not be deceived in this particular by affairs which the government at present control and which seem to give efficient service, as, for instance, the postal department. In regard to this the post offices of a country have never yet been in the hands of private parties; in fact, the latter are restrained from engaging in such business in this country, and it has frequently been said that such restraint is due to a fear by the government, that they would, in competition with the government, get all the business. However this may be, the numerous attempts of private parties, under one guise or another, to do the postal business in New York and other cities, were so successful in point of a reduced cost to the public, and other advantages in connection with quick service, that they were steadily getting all the business out of the Government's hands; and in consequence, the latter felt itself obliged in self-defense to make a special law meeting such cases, prohibiting private individuals or corporations repeating the attempt. The latest news from Australia, where the Government has control of the railways, shows that no dividends have been declared since it took them from private ownership, and that the average rates of fare are considerably higher than our own, both for passengers and freight. The Australian situation is, in many particulars, much like that which one might reasonably expect to develop in this country, should our Government take control of the railways; and because of this similarity it is interesting to note some facts in connection with it. The construction of the Australian railways has been a source of grave charges of dishonesty and corruption, and great discontent prevails, particularly among the farmers, regarding their present management. But these roads have different gauges, and there is no competition between them; not alone because the Government has control of them all, as each road has certain localities which it monopolizes. Each of the colonies took charge of the roads in its district; and, some time after, the cares of the management proved so heavy, that the colonies appointed commissioners to look after the business, giving them almost complete control. These commissioners are not exactly the Government, for they stand between the Government and the people; and at the present time they are in great distress in not knowing how to make both ends meet. One of these commissioners recently said in public that the managers were not able to cope with the situation, that they were ignorant of what would be best for the interests of all concerned, and unless money was obtained from outside sources, (which means a special appropriation by the Government to make up the deficit) the outlook was dubious. He recommended that the railway employes be consulted, as heretofore—according to English usages a respectful distance has been maintained between the roads' employes and the commissioners, consequently the commissioners have not yet learned how to run railways. This commissioner said the deficit was due to "the working of non-payable lines, the construction of which was the outcome of political jobbery; also to the free carriage of persons and property of those not connected with the department, and the running of trains to suit the convenience of the public." The experience of Germany in the Government control of railways, while not so bad as that of Australia, shows no advantage to the people over our system; in fact, freight charges and passenger fares average higher than in this country, while the service, in point of speed and public accommodation is far worse. Only a short time ago the Rhine miners were loudly complaining against their inability to get cars enough to transport their products; not that the railroads were overworked, as is now the case with some of our granger roads, but the Government was indifferent, preferring that commerce should adapt itself to the railway service, rather than the railway adapt itself to commerce. This matter became so serious that almost a riot was developed before the Government consented to make any change in its regular routine. Results of this description seem to be a part of all attempts at government railway control; it is a common observation that governments move indifferently to the requirements of the people, and if the public does not like it they are at liberty to do the other thing. This same experience took place in England some years ago, when, at the instigation of the public, the Government took control of its railways. Before that there was great dissatisfaction, particularly among the smaller towns, at discriminations in favor of one locality at the expense of another; and to remedy that and other matters which the people thought inseparable from monopolistic control, they finally urged the Government to interfere and run the railways in behalf of the public. The programme was carried out according to their wishes for several years, until the indignation of the public could stand it no longer; then they again literally obliged the Government to again put the old corporative control in power, for the people had learned, as they are now beginning to do in slower moving Germany, that railway abuses are far more numerous under government than under corporative control. And what was worse to them, such abuses were not remedied at all, or, at least, infrequently, by the Government; but with corporations, while rectification of abuses was frequently slow, they commonly were granted when the people asserted their wants in a vigorous way. It should be unnecessary for our country to go all over this vast experience; if the advocates of government control of railways will examine what has already taken place abroad, they can easily learn that private corporations are much easier moved to do justice, where local abuses exist, than could possibly be the case where the Government is obliged to frame a statute for each instance.

Herr Wermuth, the Imperial German World's Fair Commissioner, has already received nearly 2,000 applications for space from the intending exhibitors of his country.

By a recent decision of Judge Marshall J. Clarke, the control of the Atlanta (Ga.) Traction Co. has passed into the hands of Messrs. Lanier, Hoppie and Stewart. This is the result of a long law suit.

Legal Intelligence.

Ordinance—Forfeiture of Charter—Constitution. This action was brought to have it determined that the defendant has forfeited, and that it be excluded from all rights and privileges under its charter or franchise. The theory advanced was that the law does not permit any incorporated town or city in the state to grant authority to any individual or corporation to lay railroad tracks through the streets or public highways whereupon cars can be propelled by the force of electric power. The trial court entered judgment against the defendant; the latter appealed.

Held, That where the constitution (Calfa.) provides that no act shall be passed extending the charter of any corporation or remitting the future of a franchise. During the pendency of an action to forfeit the charter of a street car company operating under a city ordinance, Acts of Cal., 1891, were passed, one amending Civil Code, s. 467, so as to invest municipal corporations with power to authorize street railways to use electricity as a motive power, the other ratifying existing ordinances granting such power.

Held, That the acts did not extend the company's franchise or charter, and, as there had been no decree of forfeiture, there was none to remit, and therefore the acts were not repugnant to the constitution.

2. Where the code provides that work on the construction of a street railway must be commenced within a year from date of the ordinance granting the right of way and the filing of the articles of incorporation, and must be complete within three years thereafter, *Held*: That when the complainant in an action to forfeit a charter did not state when the company commenced the construction and thereby show that the three years had elapsed within which the work must be done, it failed to state a cause of action. Judgment reversed and remanded.

People v. *Los Angeles Electric Railway Co.*, Calfa. S. C., Oct., 1891.

Motor Car—Injury to Horse—Evidence—Verdict. In an action against a street railway company for the negligent injury of plaintiff's horses, where the evidence showed that plaintiff's driver was holding the team beside the track; that when they saw the motor coming they grew uneasy and when it was about 125 ft. away one of the horses "danced" on to the track and remained there until struck by the motor; that the motor was not going at the usual speed, but was going so fast, that it would have been unsafe to step on or off it. It did not appear whether the motor could have been stopped after it was seen by the engineer that the horses were on the track.

Held, that there was no evidence of negligence on defendant's part to support a verdict for plaintiff.

Coughtry v. *W Ilamette St. Ry. Co.*, Oregon, S. C., Nov. 9, 1891.

Injury to Child in Street—Negligence of Parents—Driver's Conduct. 1. In an action for injuries to a child four years of age, who was run over by a street car, the question whether his presence in the street alone was due to the negligence of his parents is for the jury, where it is shown that he was left alone in a room with the door shut for a few minutes before the accident, and escaped therefrom without anyone's knowledge, and that he had never been known to go on the street alone before.

2. In such action evidence of the careless and inhuman conduct of the driver of the car after the child had been injured and carried home is incompetent, and its admission is reversible error, as its tending is to inflame the jury and augment the damages allowed. Judgment reversed, and new trial awarded.

Barry v. *Second Ave. St. Ry. Co.*, N. Y. S. C., Dec. 7, 1891.

Car Shops Burnt at St. Louis.

About 8.50 o'clock on Tuesday night, March 15, the car shops and general offices of the Missouri Railroad Co. were destroyed by fire. Private watchman Van Bibber discovered flames issuing from the eastern end of the paint shop, and immediately turned on an alarm. The Fire Department responded very promptly, but as the first alarm called but five or six engines, second and third alarms were turned on. By the time the latter arrived the flames had gained such headway that the car houses adjoining (see cut) were in danger, and the firemen confined their efforts to the latter, as it was impossible to save the shops. On the first floor of the burnt building were nine cars and on the second floor twelve cars in various stages of repairs. Among the cars burnt were several which were to be operated on the new Forest Park extension of the electrical division. A portion of the west wall fell, and going through the roof of the car house on that side demolished a snow sweeper. Two new sweepers just received from the Thomson-Houston company had narrow escapes, as well as several cars. In a pile of half burnt papers we noticed a copy of the Street Railway Journal.

RUINS OF CAR SHOPS AND OFFICES OF THE MISSOURI RAILROAD CO., ST. LOUIS.

The offices occupied a portion of the second floor. The safe contained $5,000 at the time of the fire, which was gotten out in safety. The paint shop, car shop, repair shop and motor shop occupied the remainder of the building. The total loss to the company was about $54,000 $27,000 on the building, and $27,000 on the cars. The insurance carried was said to be light. The company's lines were in no way affected by the fire, and soon after the fire were running on time as usual.

The Story of a Belt.

THE CONNECTION BETWEEN ENGINE AND GENERATOR.

Within the last few years the prime transmitting agent in power stations has necessarily been a subject for careful study. When electrical machinery was introduced it was realized at once that successful operation was practicable only when the connection between engine and generator was as nearly perfect as possible. In a system which is primarily nothing more than a comprehensive scheme for distributing energy, it is obvious that any unnecessary loss of power should be peculiarly noticeable. In the early history of the electric railway especial difficulty was experienced in procuring belts suited to the exigencies of the extraordinarily severe service. In spite of widely fluctuating loads and high engine speed, absolute steadiness was essential in the delivery of power to the generator pulley—a condition which is attainable only when the belt is strong, straight, true, evenly balanced and elastic. Under the stimulus of this increasing and exacting demand, American belt makers have introduced many improvements and refinements in manufacture, with the result that the best belts produced in the world are made in this country.

The manufacture of leather belting for electric railway plants is an interesting process which involves the application of the nicest skill, and the use of specially designed machinery. The following description, with the accompanying illustrations, of one of the largest establishments devoted to this industry, that of the Jewell Belting Co., of Hartford, Conn., will, it is believed, prove the truth of the general statement. As an introduction to the subject a brief sketch of the history of the company is presented.

The business was founded by Pliny Jewell, in 1848, in very unpretentious quarters, and with capital correspondingly modest.

From time to time his sons were taken into the business; first, Marshall, afterwards Governor Jewell, then Pliny, Jr., Charles A. and Lyman B. Jewell, in the order named. The demand for the product was at first confined to Hartford almost exclusively, but Mr. Marshall Jewell, soon afterwards entering the firm, expressed his confident belief in a vigorous policy for the extension of the business into new fields. He became the first traveling salesman, and subsequently his brothers followed his example. The business has grown steadily since that time, until, to-day, the prosecution of the industry is distributed in the group of buildings shown in the illustration (Fig. 1), and the belts are used in transmitting power in every country on the globe where machinery is in operation. But not merely were the members of the partnership practical and sagacious business men; they were fully as competent in the manufacture and handling of leather

FIG. 1.—WORKS OF THE JEWELL BELTING CO.

Mr. Pliny Jewell, the president of the company to-day and Mr. Lyman B. Jewell, the present vice-president are practical tanners, curriers and belt makers, and both are able to perform the manual work in any department of the establishment.

The business of the Jewell company embraces the stages preliminary to belt making. The heaviest and best steer hides which, for the most part, are purchased on the Chicago market, are tanned at the Jewell tanneries at Jellico, Tenn., and Rome, Ga., where the best oak bark is to be obtained. It is found more economical to send the hides to the bark than to reverse the order.

The belly being removed at the tannery the leather in its rough state is delivered at the belt factory. The first step in the work is to cut the shoulder from the hide, or "butt," as it is termed. This operation is performed by the workman, shown to the left in Fig. 2, after which the cutter at the right carefully examines the butt to determine what particular width of belt can be cut from it.

From the heaviest and largest butts centres are cut,

from twelve inches to forty-eight inches in width. In belts designed for electrical service only those parts are employed which have the centre line corresponding to the line of the backbone. The material, being cut, is sorted and placed in piles where it remains until required for use.

The currying processes follow and, as a preliminary, the leather is thoroughly soaked, after which it goes to the skivers, shown at work in Fig. 3, who by means of long knives such as are used in ordinary currying shops remove all remnants of the flesh which may adhere to it. This is a tiresome operation, as the workman must bend over his beam continuously, and it requires the exercise of great skill to avoid cutting away any portion of the fibre.

The next work is performed by scouring machines which are illustrated in Fig. 4. This machine consists of a sliding frame, which carries at each end a stone which rubs the surface thoroughly while a stream of water is allowed to flow over it constantly.

It is essential that the stretch of the leather be removed, and this necessity is constantly kept in view throughout the process of manufacture. The preliminary stretch, and the most powerful, is that exerted upon the leather by the machine shown in Fig. 5. The view represents a centre which was cut for a forty eight inch main driving belt. The leather is fastened in a sliding frame, which is attached by chains to a windlass. By the multi-

Fig. 2.—Cutting the Hide.

plication of gears a tremendous tension can be applied to the piece.

In the farther end of the room, illustrated in Fig. 6, are located two stretching machines designed for narrower belt widths. The three machines in the foreground are employed for what is termed "stoning." The leather is here thoroughly rubbed by a stone attached to the arm of the machine, and the object is simply this: The strength of the hide lies in the fibres. The work expended on the hide tends to compact it and thus add to its strength, and it is for this reason and for removing the stretch that, in all the processes through which the leather passes, the work is directed along the line of the longest fibres.

Fig. 7 illustrates the process of "stuffing" and table setting. The term "stuffing" is perhaps self-explanatory; it consists in the application of grease to the leather and rubbing it in. This operation concludes the currying of the leather.

The preliminary work has now been accomplished, and what is, more properly, belt making commences. The first stage consists in cutting the leather into strips of varying width. The operator first examines it carefully to determine how wide the strips can be cut, and to detect any imperfections such as cuts or scratches which might weaken the belt. As soon as he determines by his eye the general width which is to be cut from a particular piece, he sets his cutting gauge and strips the leather, pulling it against the knife blade in the manner shown in Fig. 8. The two men at the bench to the left beyond the stripper are engaged in "fitting"; sorting, perhaps, would convey the idea more closely. The heaviest pieces are selected for what is termed in the Jewell factory the "short

Fig. 3.—The Skiving Process.

lap extra," and other strips make the "short lap standard" belt. In addition, the strips are arranged by widths. The fitters also mark the leather to indicate how it is to be scarfed in order that the belt may be even throughout its entire length.

The scarfing machines are illustrated at the left in Fig. 9. They slice off the wedge-shaped piece at the end of each strip where it is to be lapped in the belt. The men who are working at the tables at the right in the same view are engaged in what is technically styled "pointing." They finish the work of the scarfing machine by the aid of a knife and a square by bringing the lap to a perfect "feather" edge in order that the joint may be true and of the same thickness as the rest of the belt.

The process of joining the strips is then begun. For single belts the operation is performed as shown in Fig. 10. The laps are covered with cement, and pressure is applied at the points of junction by means of the presses

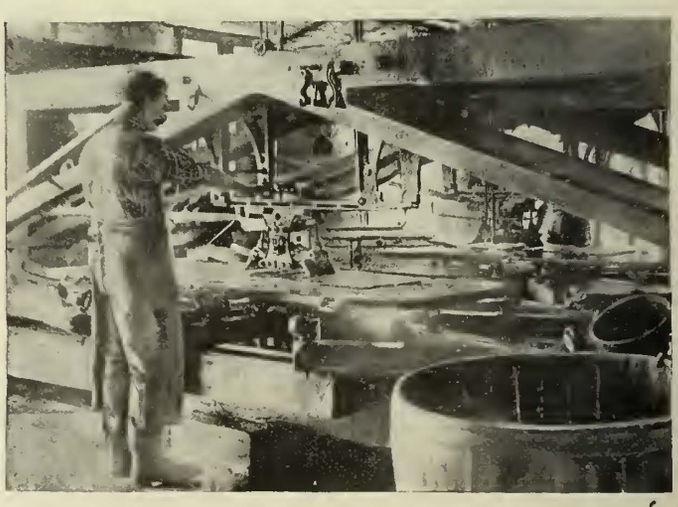
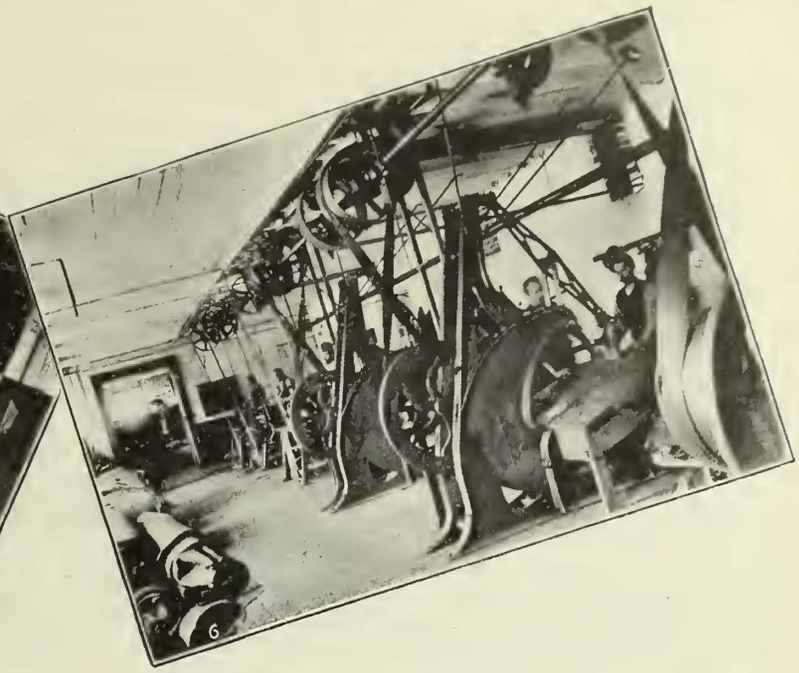
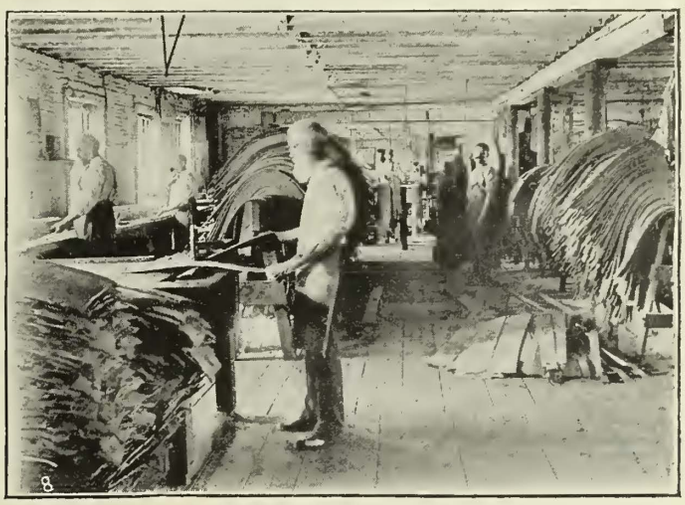
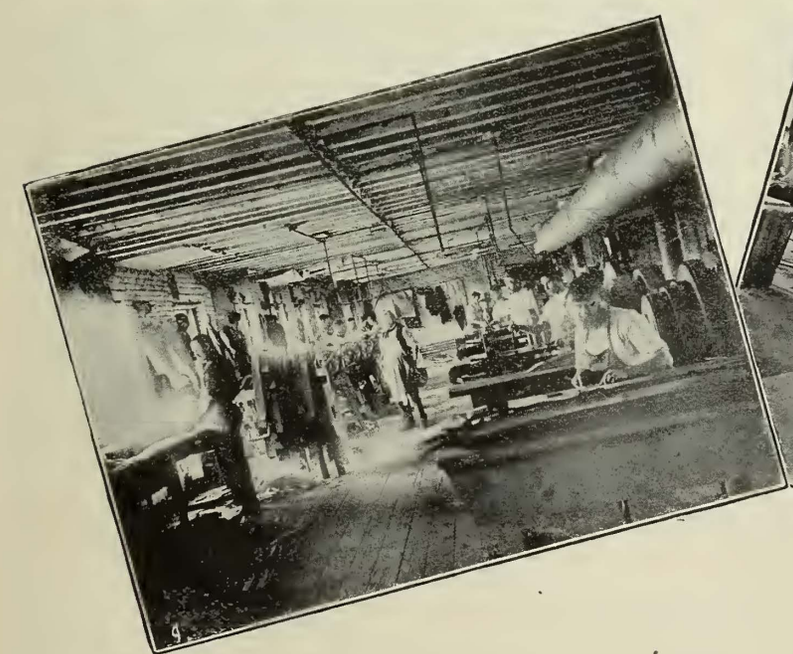


Fig. 4.—The Scouring Process.

which in operation and general design are not materially different from those employed in offices for copying letters. The smaller belts, which are used for a variety of purposes, are strengthened at the laps by rivets or staples. These fastenings are applied by automatic machines







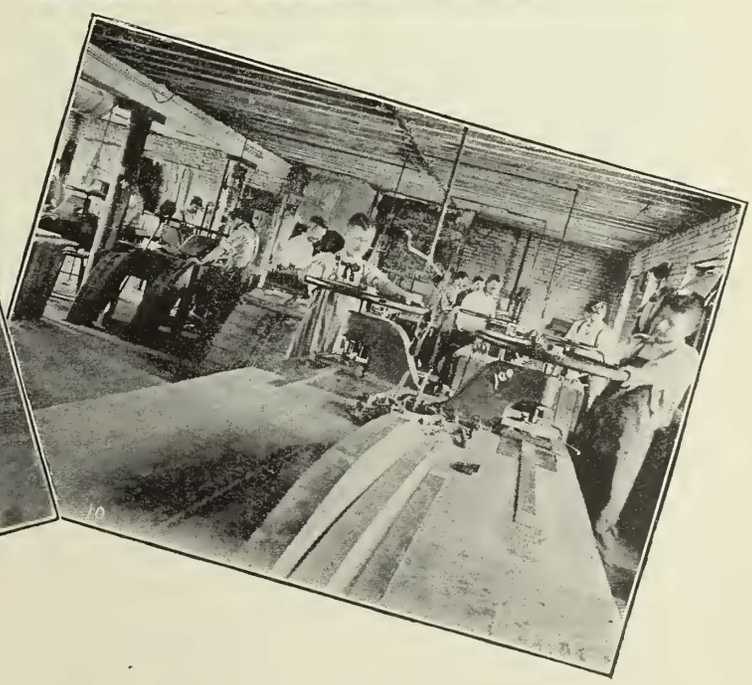


Fig. 5.—Stretching the Leather for a Forty-Eight Inch Belt.

Fig. 6.—The Stoning Room.

Fig. 7.—The Stuffing Room.

Fig. 8.—Sorting and Stripping the Leather.

Fig. 9.—Scarfing and Pointing the Leather.

Fig. 10.—The Joining and Cementing Room.

which are shown in Fig. 11. Both are extremely ingenious inventions. That at the left of the view is the riveting machine. The rivets are fed from a little hopper which is not shown in the view. Before the blow descends which completes the operation, the burr is placed in position automatically. In the stapling machine at the right, the wire used for the fastening is fed from a coil at the top. The wire is formed into the staple, driven into position and clinched automatically. It may be remarked incidentally that the patents on the stapling machine are controlled by the Jewell company.

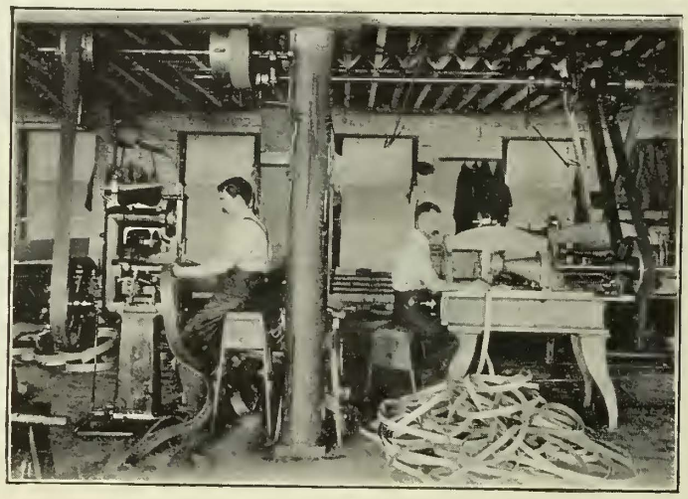


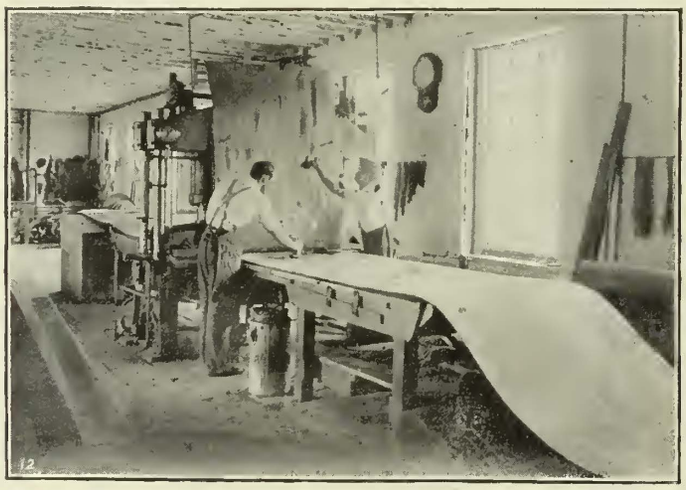
Fig. 11.—Riveting and Stapling Small Belts.

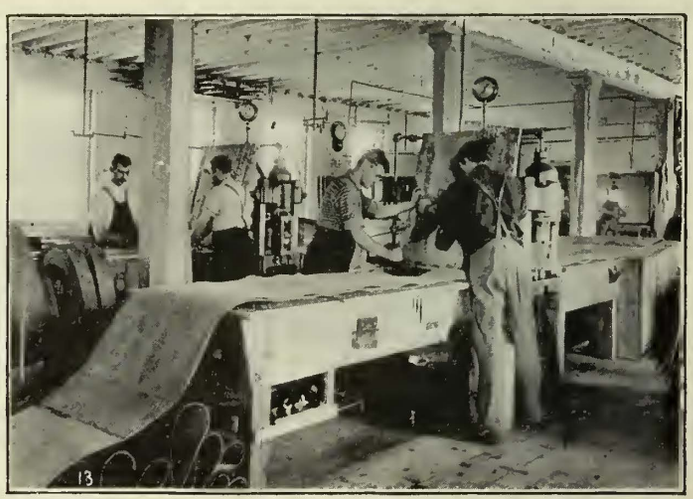
Much more formidable appliances are employed for uniting the centres that compose wide double and three-ply belts. Inasmuch as belts designed for use in electrical stations are put together without any form of metallic fastening, the utmost pains must be taken with the process of cementing. First of all the cement is selected with the utmost care. It is applied hot with the brush, and pressure is then applied at the lap by the hydraulic presses, shown in Figs. 12 and 13.

Fig. 12 shows on the press a forty-eight inch, three-ply belt designed for use in an electric station in Canada. The photograph was taken while the men were applying the cement. As soon as this work is completed the cemented section is pushed under the clamps, and a pressure of more than 175 lbs. to the square inch is applied. The machine is built to work on widths up to seventy-six inches, and it exerts a total pressure of 500,000 lbs. The belt shown in the cut is three-quarters of an inch in thickness. Some idea of the amount of leather required to make it may be gained from the fact that every eighteen inches of its entire length represents all the choicest part of a single large hide.

The belt presses, illustrated in Fig. 13, are smaller than those shown in the previous view, but are identical in design. They are adapted for belts up to thirty-two inches in width, and each machine applies a pressure of 250,000 lbs.

As has already been remarked, it is one of the great objects in the manufacture to remove the stretch of the belts, although the effort must not be carried so far that elasticity is lost. Should that quality be gone the belt no longer hugs the pulley tightly, and will no longer do its work well. The ideal condition would include minimum stretch and maximum elasticity. After the general completion of the large belts in the Jewell factory they are operated in the stretcher shown in Fig. 14. Here the stretch, which would otherwise be taken out in the operation of the belt in the first few days of actual use, is





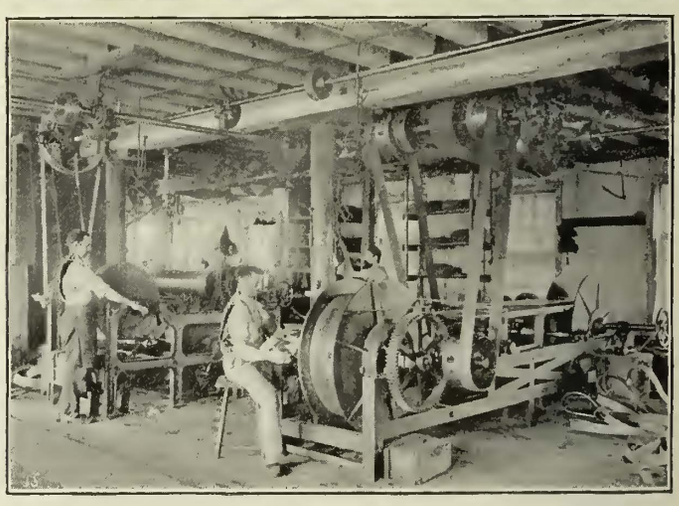


Fig. 12.—Cementing and Pressing a Forty-Eight Inch Belt.

Fig. 13.—Cementing and Pressing a Thirty-Two Inch Belt.

Fig. 14.—Removing the Stretch from a Main Driving Belt.

Fig. 15.—Stretching, Measuring and Trimming.

very effectually removed. The belt runs over two pulleys which are connected with power. The pulley in the foreground is located on a carriage, which is attached by chains to a windlass. All the slack resulting from the continued motion of the belt can be taken up, and it can be kept taut over the pulleys. The final stretch of the narrow single belts is effected by means of the machine shown at the right in Fig. 15. The belt is wound from the drum at the front of the machine in the foreground to the drum at the farther end. As the belt passes from one

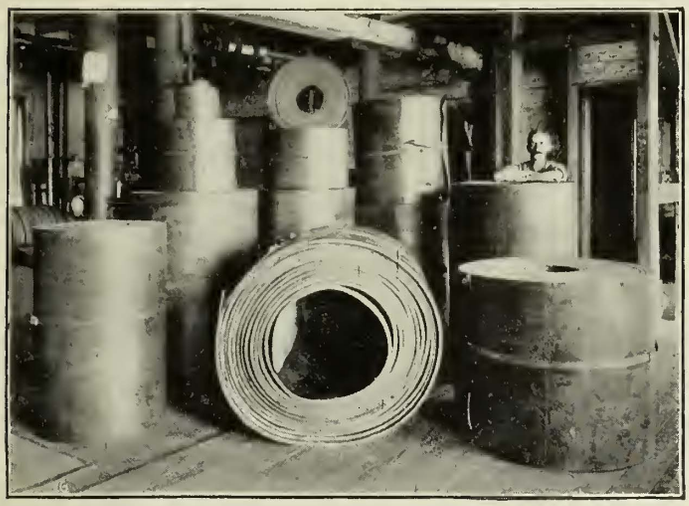


Fig. 16.—A Group of Big Belts.

drum to the other a brake is applied at the unwinding drum with such force that the leather is subjected to considerable tension. The strain is sufficient not only to remove the stretch but to indicate, by breaking the belt, a cemented joint that may be in any way defective. As every workman who makes a joint applies his mark at that point, the responsibility for the faulty piece of work can be properly placed.

In the background of the same view is represented another ingenious machine. As the belt winds from drum to drum it is trimmed and measured. The measuring

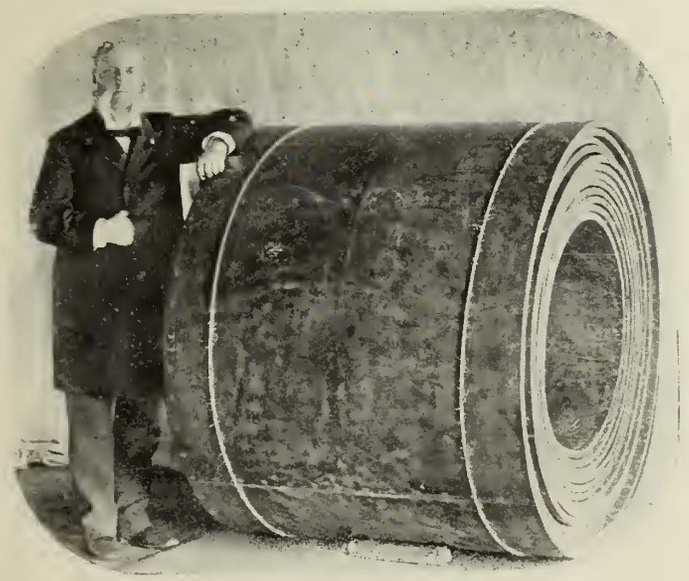


Fig. 17.—The Heaviest Belt in the World—Weighs 2,730 Lbs.

mechanism, located under the cylinder shown in the centre of the machine, marks the length every foot, and every ten feet stamps the quality and brand of the belt.

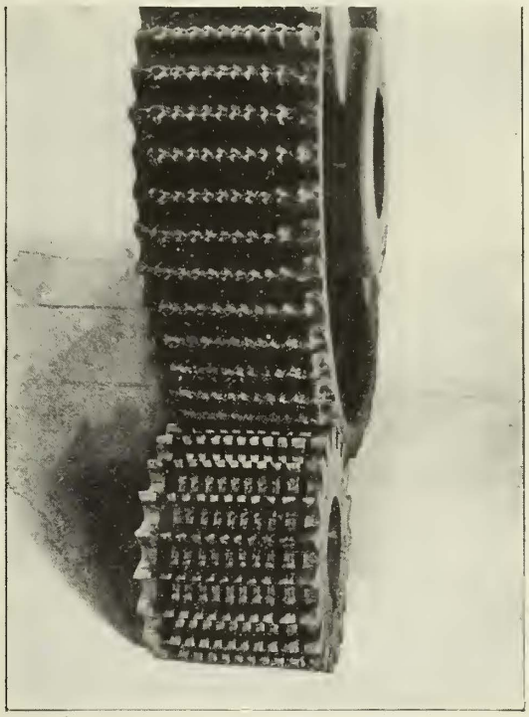
In Fig. 16 is shown a group of belts that happened to be in the factory at the time the other photographs illustrating the plant were taken. Most of the large belts were made for electrical stations. In Fig. 17, is a view of the heaviest belt ever manufactured in any factory. It is four ply, forty-six inches in width, 158 ft. long and weighs 2,730 lbs.

The visitor who inspects the several departments which have here been briefly described will find that his visit has been extremely interesting and instructive. He will be struck by the fact that so careful an economy is exercised that not a scrap of leather is wasted, but, especially, will he be impressed with the time, patience and ingenuity which have been devoted to the manufacture of what is ordinarily regarded as an exceedingly commonplace product.

Chamberlain's Wave Pinion.

In the article which appeared in our last issue, pages 171-2, accompanying the illustrations of the Chamberlain Wave pinion, so much stress was laid on the term "composite" that the impression might obtain that it was a composite pinion pure and simple. This pinion, though composite in its construction, differs radically from the old style known as composite pinions.

Every railway manager will recognize the accompanying figure as showing the wear produced by this old style composite pinion. The Chamberlain Wave pinion entirely prevents such wear, for it is so constructed by the crimping or bending of the plates that the peripheries of



OLD STYLE COMPOSITE PINION.
From a photograph, showing wear on intermeshing gear.

the plates are caused to describe wave lines, so that the steel portions of each tooth do not travel in the same plane, and cannot therefore wear grooves into the intermeshing gear, as shown in the illustration.

On the contrary, actual practice has demonstrated that a pinion constructed in this peculiar manner distributes the wear evenly over the entire surface of the intermeshing gear, so that the teeth of the gear are worn perfectly smooth and straight faced. Thus the life and efficiency of the gear wheel is increased, the whole face of its teeth being available so long as the gear is used, and the non-resonant fibre layers make the pinion less noisy than solid metal.

According to the generally veracious *Boston Traveller* an iron eating worm, which lives on railroad rails, has been discovered in Hagen, Germany. Though less than one inch long its rate of consumption is thirty pounds of steel rails per week.

The Berlier system of metallic railway tunnel for electric cars has been examined by a commission in Paris, and approved. There are now a number of administrative formalities to go through, so that active work will, probably, not be begun until the month of May.

Baggage, Mail and Express Cars for Electric Railways.

One of the many uses to which electric railways connecting towns and villages may be put is the transporting of baggage and express matter. Cars for this purpose, vary in dimensions and designs to suit the requirements of the various roads over which they are operated. We illustrate four different types of merchandise cars which have been designed and built by the J. G. Brill Co., of Philadelphia.

Fig. 1 shows a twenty-one foot car body mounted on Brill's well known No. 13 truck. This car is running on the line of the East Liverpool & Wellsville Street Railway, at East Liverpool, O. It is sheathed on the inside of the top rail with hard wood tank and grooved boards, and provided with hinged seats against the wheels of the car so that when they are dropped they fall flush with the sides and do not occupy the space necessary for express or freight matter, and when raised the car can be utilized for carrying passengers. It has a four foot door on either side to admit all kinds of freight and express articles, and is arranged as a motor car equipped with Short motors.

Fig. 2 is an eighteen foot baggage, mail and express car ; it has monitor deck roof and radiating draw bars, but is not arranged with seats inside for carrying passengers. It has the necessary large door on either side and is a trail car. This car is in operation on the Jamestown Street Railway, Jamestown, N. Y.

Fig. 3 is a sixteen foot trail car with hinged seats on the inside for passengers, the seats being precisely the same as in the first car shown. It has large doors, windows and radiating drawbars. It is operated on the West Chester Street Railway, of West Chester, Pa , and is a trail car.

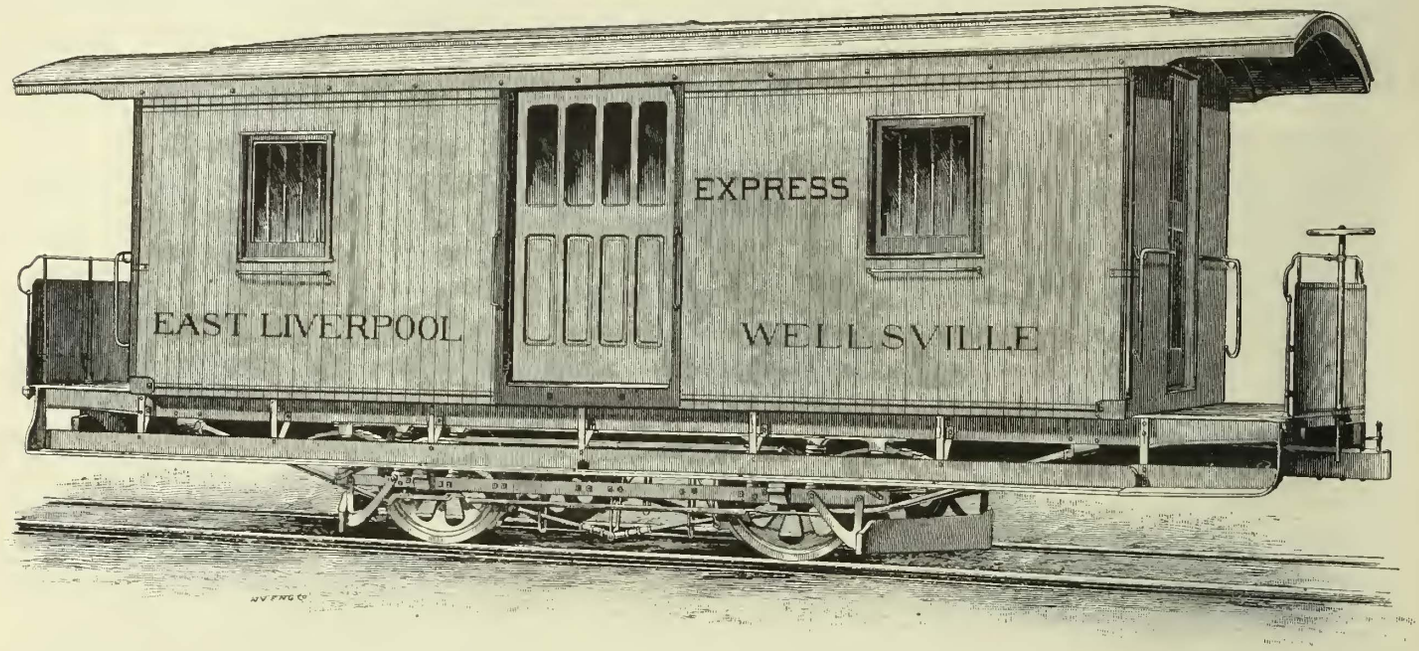


FIG. 1.—EXPRESS CAR—EAST LIVERPOOL & WELLSVILLE RAILWAY.

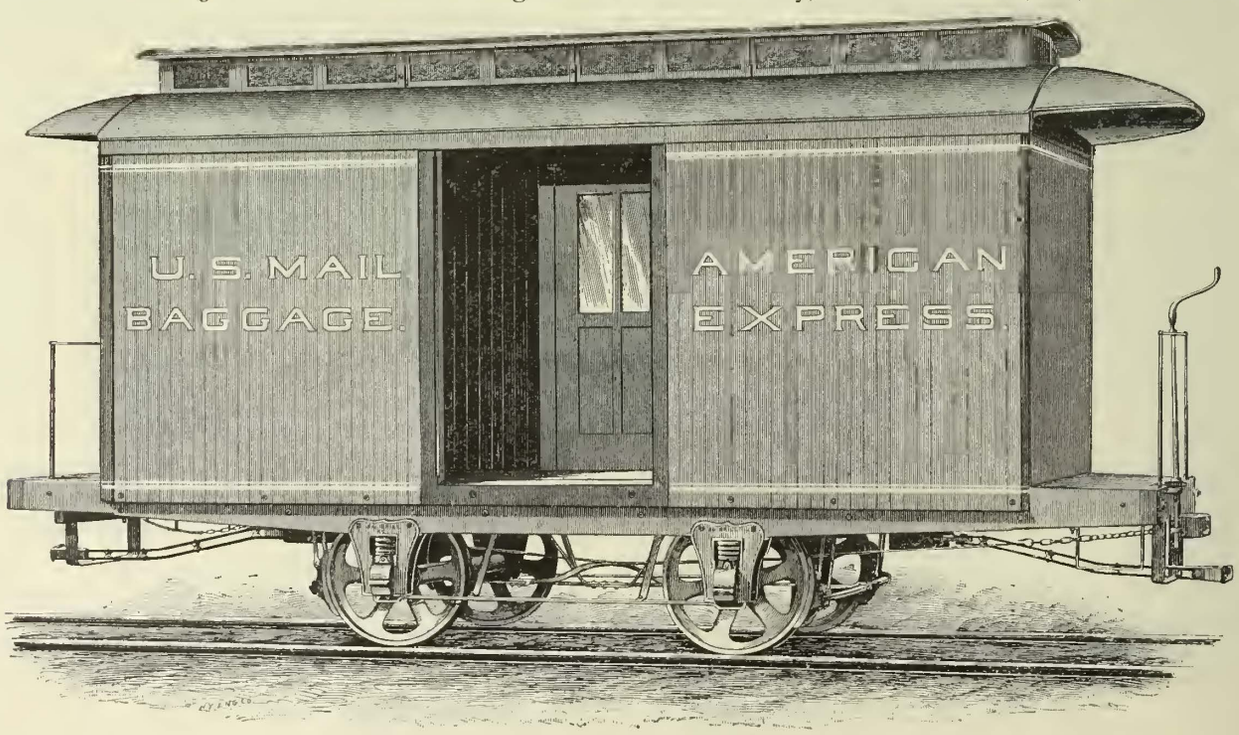


FIG. 2.—MAIL AND EXPRESS CAR—JAMESTOWN STREET RAILWAY.

Fig. 4 is a plain, flat car body with stanchions for supporting the roof and the trolley. This car was specially designed for hauling oysters in barrels. The floor is lined with zinc, crowned in the centre so that all water drains through the sides and not through the trap doors on to motor. The body is mounted on Brill's No. 13 independent rigid motor truck and equipped with Edison motors. This car is in operation on the Hampton & Old Point Railroad, of Hampton, Va.

Ottawa, Ont., Electric Railway.

In the last issue of the Street Railway Journal a description was given of the system employed by the Ottawa, Ont., Electric Railway in removing snow along their right of way.

FIG. 3.—EXPRESS CAR—WEST CHESTER STREET RAILWAY.

The road, which consists of eight miles of double and four miles of single track, was constructed in seven weeks, and cars were put into service in the latter part of June of last year. The excellence of this service in all kinds of weather has been favorably commented upon by the press and public. The climatic difficulties made the question of running in winter a subject of much interest. Though much snow has fallen, the cars have never lost a trip, and their warmth and comfort combined with their smooth running have made the service a luxury.

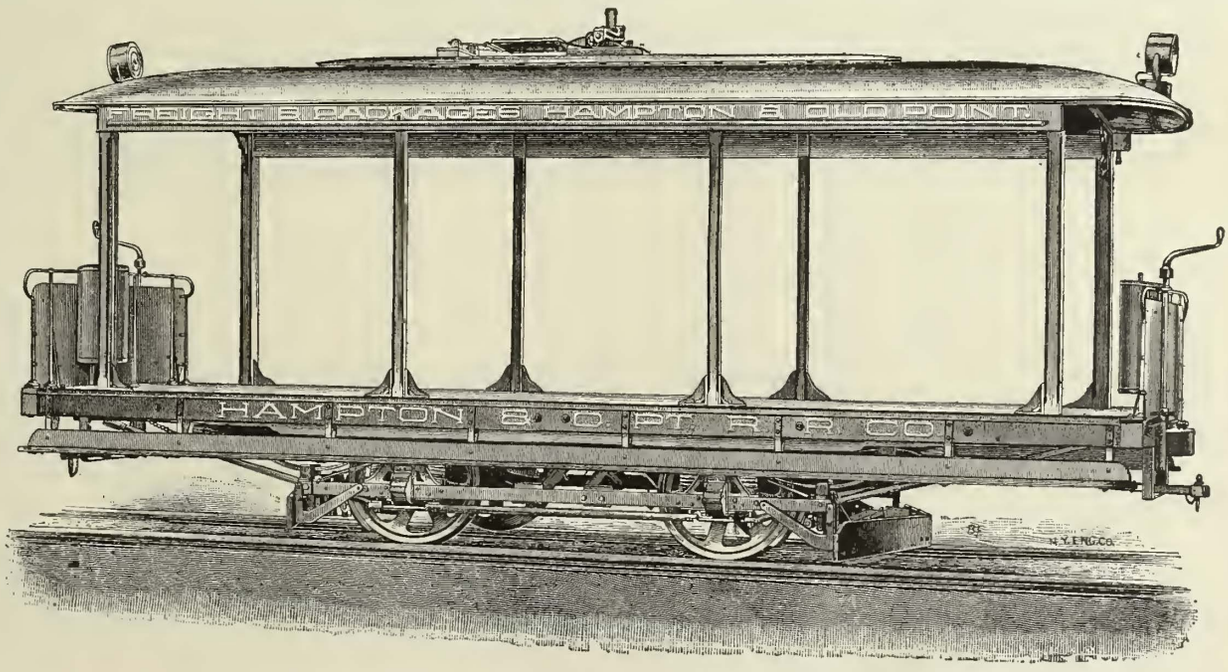


FIG. 4.—OPEN FREIGHT AND PACKAGE CAR—HAMPTON & OLD POINT RAILWAY.

The officers of the electric railway are J. W. McRae, president, G. P. Brophy, vice-president, J. D. Fraser, secretary-treasurer. The rails used are fifty-two pound Johnson girder and forty and fifty-six pound T. The gauge is standard, four feet eight and a half inches. The car bodies, which are of the ordinary and vestibuled types, were manufactured by Patterson & Corbin, of St. Catharines, Ont. Brill trucks are used. The electric system employed is that of the Westinghouse Electric & Manufacturing Co., with two single reduction motors, twenty H. P. to each car. The plant consists of sixteen cars. The dynamo room is located at the famous Chaudière Falls, where two turbine water wheels drive two 100 H. P. Westinghouse compound dynamos; a third machine is kept in reserve. The difficulty in supplying steady current by water wheels was at first a matter of serious difficulty, as, owing to the frequent stopping of all or nearly all the cars at the same instant, the water wheels were liable to race. By an ingenious mechanical device the water wheel gates are now raised and lowered instantly, and by the introduction of a novel electric device sufficient load is kept on the dynamos at all times to keep down the speed of the water wheels. This device consists of several coils of iron wire which are connected in shunt to the trolley circuit and are so arranged that any current from twelve to seventy-two amperes may be made to flow through them. The wire is kept cool by being immersed in water which is changed as it becomes warm. This useful device was designed by T. Ahearn of the firm of Ahearn & Soper, the builders of the road and its principal owners.

Several fifty H. P. motor cars have been ordered by the Mt. Adams & Eden Park electric road of Cincinnati.

The American High Speed Engine.

A new high speed engine, peculiarly adapted to direct coupling with electric railway generators, has been recently put upon the market by the American Engine Co. of Bound Brook, N. J. The purpose of the inventor, Elmer S. Smith, was to construct an engine that should gain a much higher speed than had ever been attained by high speed engines, with, at the same time, a greater economy in the use of steam, as well as less mechanical friction. To do this he avoided the ordinary paths, and set to work, as he says, to devise a machine as one would who had never seen the steam engine as heretofore constructed. The engine illustrated herewith as the result of his labors and study, is not a rotary engine, and yet the motion of its parts is such that there are no dead centres. It takes steam and exhausts four times at each revolution, and may be run up to 1,000 revolutions per minute, yet maintaining a constant speed even under varying loads.

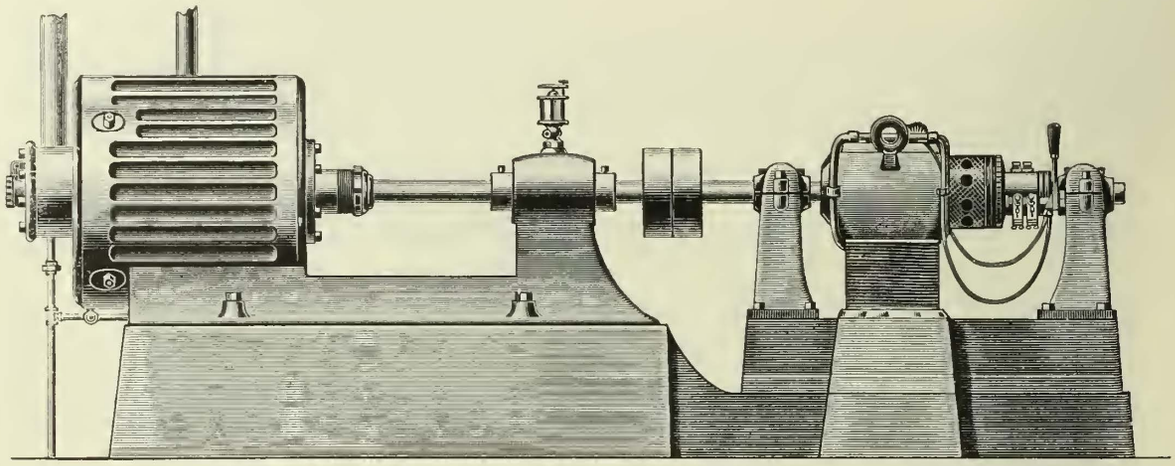


FIG. 1.—AMERICAN HIGH SPEED ENGINE, DRIVING A THOMSON-HOUSTON GENERATOR.

The general appearance of the engine connected to a dynamo is illustrated in Fig. 1. Fig. 2 shows the outer parts of the engine in transparency and the working parts in full lines. In the same engraving 1 is the bed plate; 2, cylinder; 3, cylinder head; 18, follower pin; 5 and 6, partition blades; 53, crank disk; 48, spherical bushing; 64, stuffing box; 67, pulley; A, steam chest; B, exhaust chest; C, live steam pipe; D, exhaust steam pipe.

The cylinder is bolted to the bed and projects into the steam chest, which gives it a live steam jacket, outside of which is a cast iron jacket, which prevents all radiation. The cylinder has a circular opening at its centre through which projects the stem F, located centrally on the piston, and through which steam is admitted from the steam chest (7) to back of the piston, its area being so proportioned as to balance the pressure of the steam acting on the face of the piston, thus preventing the excessive friction without detracting from the action of the steam for service on the piston. The partition blades (5 and 6 in Fig. 2) are four in number, there being two directly opposite those shown dividing the space between the piston and the cylinder head into four compartments. These blades have a pivot connection with the cylinder head, which allows them to accommodate the movements of the piston.

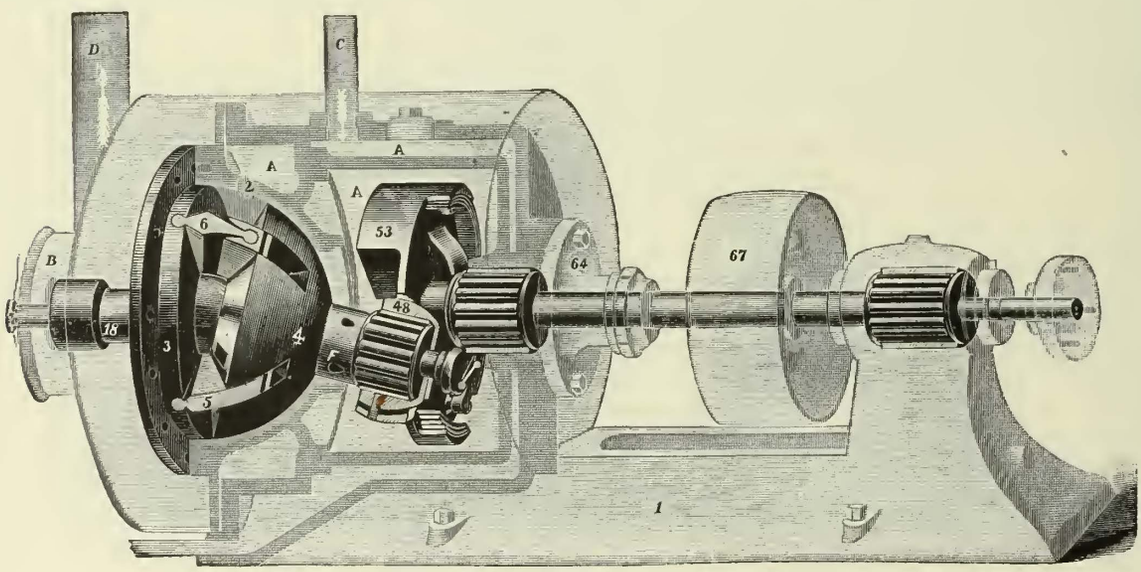


FIG. 2.—WORKING PARTS OF AMERICAN HIGH SPEED ENGINE.

The steam is fed into these compartments successively by means of a main and cut-off valve, which are all cylindrical in shape, and revolve with the crank disk or main shaft, while the piston is stationary, in so far as revolving is concerned.

In Fig. 2 a port will be observed in the compartment between blades 5 and 6; one of these exists in each compartment, and is opened for the passage of steam, and for the exhaust.

From this general description it will be seen that the piston, unlike that of any other engine, has a wobbling or gyrating movement, which imparts a rotary motion to the crank disk, and hence to the shaft, and that as there is no forward or backward movement, there can be no dead centre.

The governor, Fig. 3, is inclosed in the steam chest (A Fig. 2) and is the simplest form of an automatic governor. It consists of two weights, Q, Q^1, Fig. 3, pivoted to the rear side of the crank disk, on diametrically opposite sides of the engine shaft, and connected with the stem of the cut-off valve by steel rods q, q, and a carrier plate R. The latter is secured to the projecting end of the cut-off valve stem, and is provided with two ears r, r, each having on its inner side a spherical socket, in which the spherical head of one of the links or steel rods, q, q, is seated, the opposite spherical heads of the steel rods, or links are

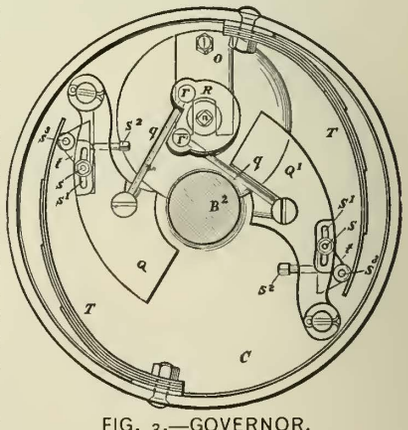


FIG. 3.—GOVERNOR.

seated in spherical sockets in the governor weights. The governor weights swing in a plane at right angles to the engine shaft, while the carrier plate R turns in an oblique plane at right angles to the cut-off valve stem.

The spherical connection of the links, or steel rods, with the governor weights and the carrier plate permits these parts to move freely, although arranged at an angle to each other.

T,T, Fig. 3, are the flat, tapering springs which resist the outward movements of the weights. These springs are secured to the peripheral rim of the crank disk, and bear with their free ends against adjustable bearing pieces or rollers, t, t, secured to the outer sides of the weights. As the governor is inside of the steam chest, the perfect lubrication of the parts is secured.

The engine is compact and self-contained, taking up little room in proportion to power developed. It will work as well vertically as horizontally, and it may be hung overhead if desired, so as to be coupled directly to the main shaft. For marine use, elevators, etc., it is provided with reversing gear, and where a high degree of economy is desired, it is compounded.

A Novel Boiler.

A new type of boiler, devised especially for use with locomotives, but recommended by its manufacturers for the generation of steam for all power purposes, is shown in section and elevation, in Figs. 1 and 2. As will be clear, it is similar to the ordinary tubular locomotive boiler, but is provided with two fire boxes. One of these is at each end of the boiler; and connects with a flue at the opposite end to which it is situated.

The length of the tubes can be made to suit the location and the fuel to be used. If bituminous coal of good quality is to be the fuel, the tubes can be from twelve to twenty feet long, but a length of sixteen feet would probably give the best results.

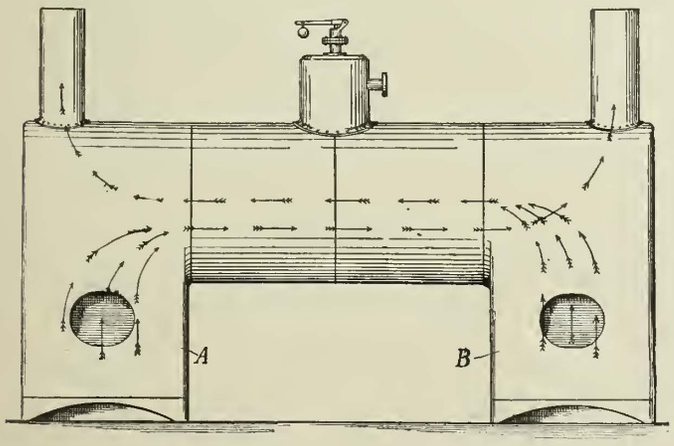


FIG. 1.—DOUBLE TUBULAR BOILER.

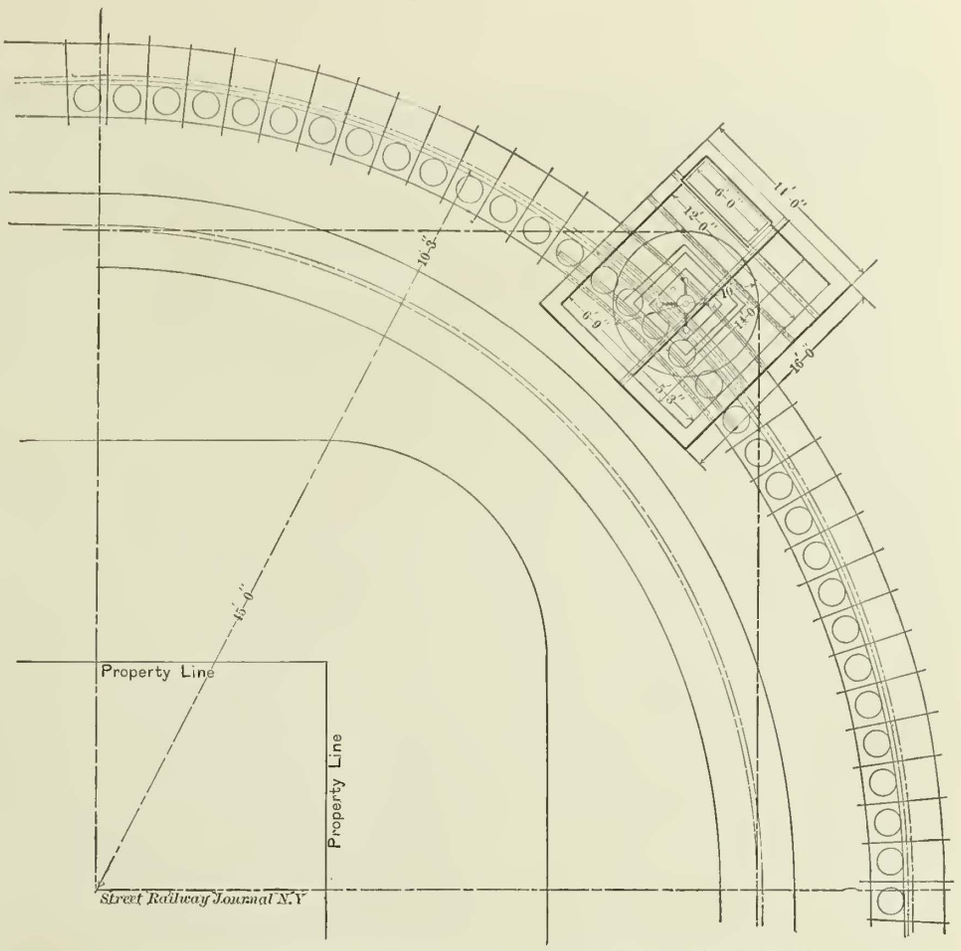
This arrangement not only reduces the strains on the boiler by equalizing the total amount of heat applied at any section, but gives a gain of heating surface in the same space, permitting the use of smaller boilers.

Another advantage claimed is that smaller fires can be better handled, and give better results than large fires, and that this form of boiler gives a fire box of only one-half the size required in the ordinary locomotive type.

Further particulars may be obtained of the inventor, H. C. Goulding, 16 Larned Building, Syracuse, N. Y.

Cable Curve Construction.

An interesting example of curve construction for cable railways in which two methods of construction are combined, is shown in the accompanying diagram. The engraving is from the engineer's plans for the corner of Union and Baker Streets, on the line of the Presidio & Ferries Railway of San Francisco. The line is laid with double track, and the outside conduit is equipped with a number of horizontal sheaves twenty-two inches in diameter, the distance between centres being from twenty-seven and a half inches to three feet and more. The cable for the inside track is carried around a large horizontal sheave ten feet in diameter, the cable running in a blind conduit under the outside track, the pit being 16 × 14 ft.



CURVE CONSTRUCTION—PRESIDIO & FERRIES CABLE RAILWAY.

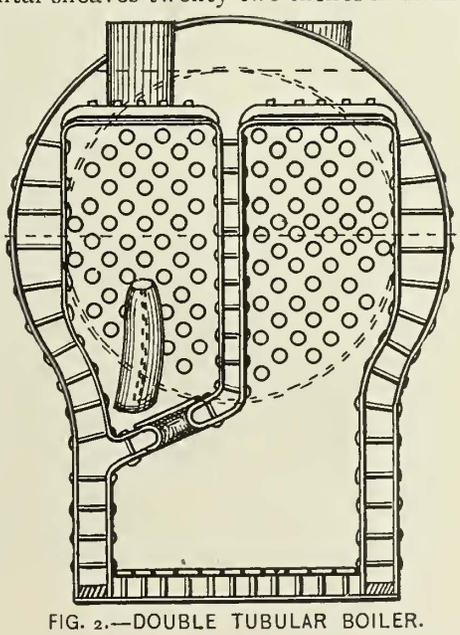


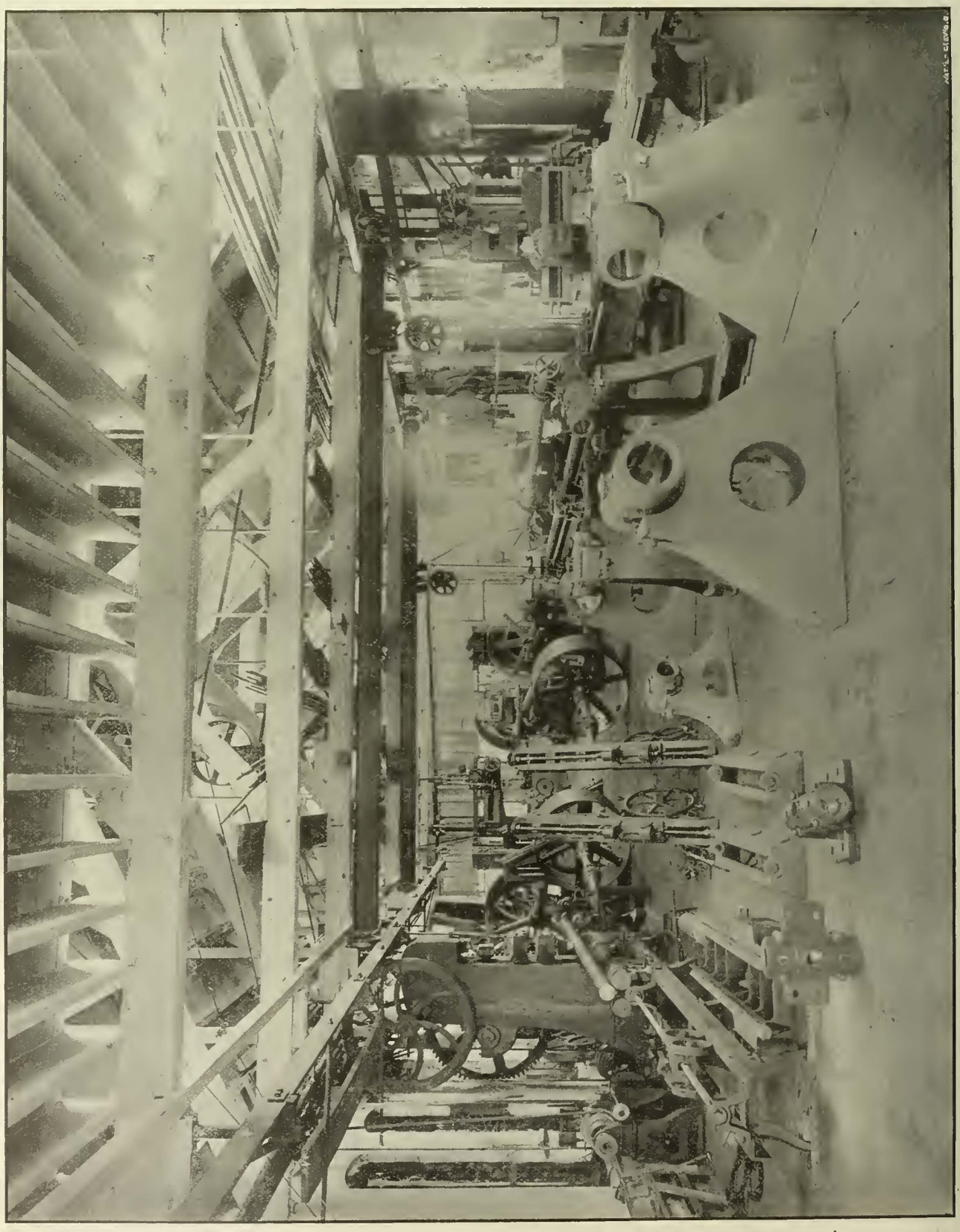
FIG. 2.—DOUBLE TUBULAR BOILER.

The cars on the inside track descend a grade while passing this corner, drop the cable upon entering the curve and pick up the cable upon leaving the curve.

The Duluth (Minn.) Street Railway Co. have amended their articles of incorporation to include the suburbs of Lakeside, West Duluth, Lester Park and New Duluth, in their field of operation.

An Inside Glimpse of the Hill Clutch Works.

In the accompanying two engravings are given views of the interior of two departments of the Hill Clutch Works, and from these a fair idea of the extensive business carried on by this company can be gained. A full idea can only be acquired by an actual visit to the shops themselves, and an inspection of the variety of work carried on.



SHAFTING AND ERECTING DEPARTMENT.—HILL CLUTCH WORKS, CLEVELAND, OHIO.

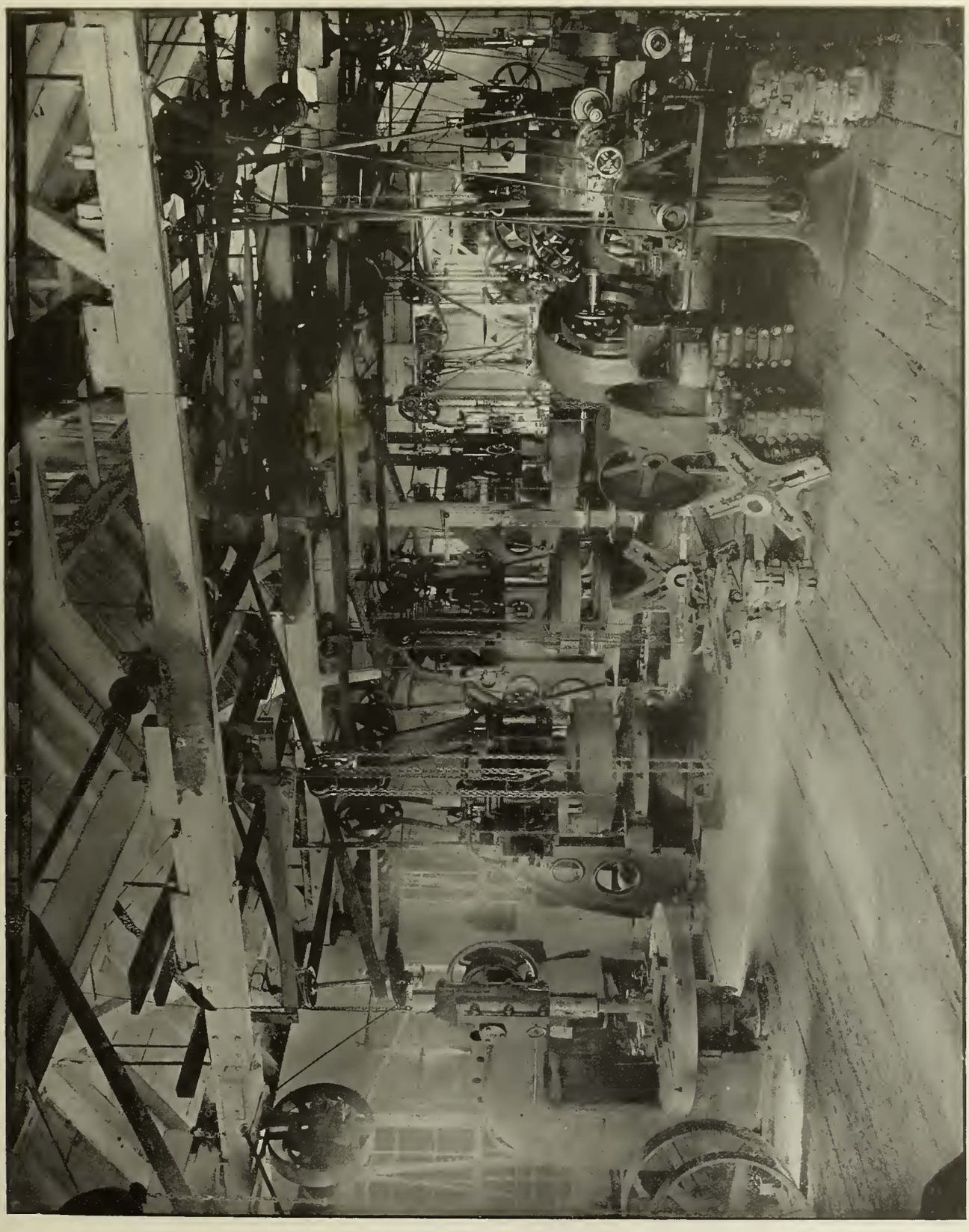
Fig. 1 shows the shafting and erecting room. In this department the shafting is received from the forges and mills in the rough state. It is first placed in the large machine shown on the left, where it is carefully straightened. This machine will straighten a shaft ten inches in diameter. From this machine, it is taken to the lathe, which is located in the right and rear part of the room. Here it is turned perfectly round and polished. This lathe will turn easily a piece of shaft thirty-three feet long and twelve inches in diameter. It is then taken to the key seater, where the necessary key seats are cut. This machine is located in the rear and centre of the room. It is then put back in the straightener and carefully tested, and if found to have been sprung in handling, is made straight once more. This prevents the sending of the shafting away in an imperfect condition.

There is also in this department a large open side planer, used for planing clutches, floor stands, or any other large pieces of machinery, and in the rear part of

the room is a very large radial drill. This room is also made the place where all work is erected and run. By this method of testing, any small mistakes are readily discovered and corrected. The clutches and pulleys are placed on the shaft, and it is then put in its bearings, which are placed as they will be when the machinery is erected in the plant where it is going, thus saving the purchaser a great amount of annoyance and expense.

Fig. 2 shows part of the machine shops. In this department are located the lathes, planers, mills, boring machines, key seat cutters and drills used in finishing the clutches, pulleys, bearings, floor stands, etc. In the back part of this room is a specially designed tool for turning off the wooden shoes used in the jaws of the clutches. When these wood blocks leave this machine they are absolutely correct, insuring a much better contact with the clutch ring, and consequently, less wear on the blocks.

The shops and offices are lighted throughout by electricity.

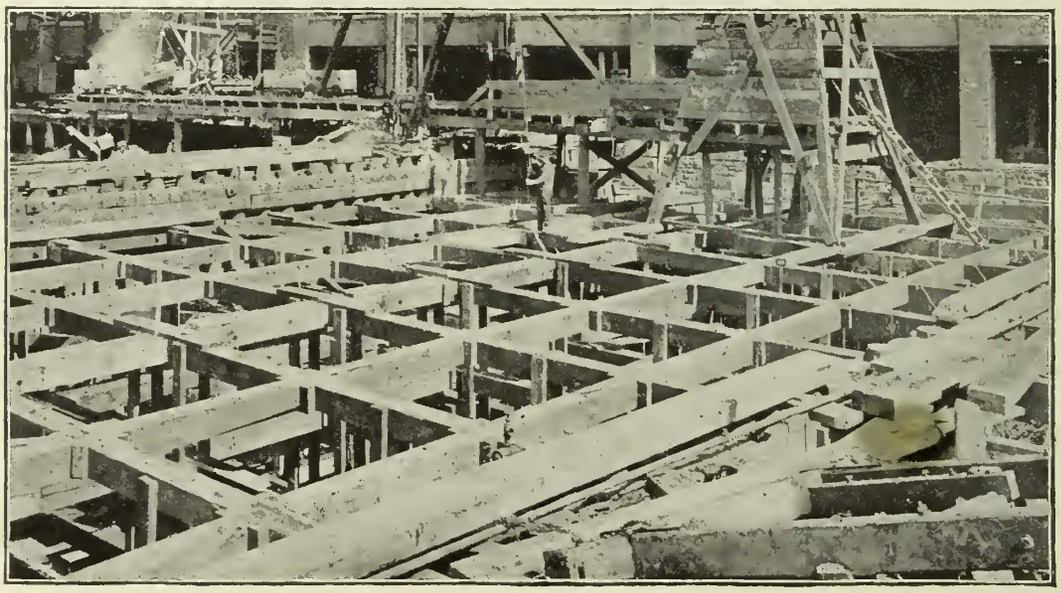


PART OF MACHINE SHOP.—HILL CLUTCH WORKS, CLEVELAND, OHIO.

A DECISION in favor of Mr. John N. Stewart was recently given in his plea for an injunction against the city of Ashtabula, O. The decision was given by the full Circuit Court bench, Judges Woodbury, Laubie and Fraser. The city of Ashtabula, some two years or so ago, tore up his track at night, and declared his franchise forfeited, and Mr. Stewart has been suing for redress, which has been finally granted.

West Chicago Street Railway Tunnel.

Perhaps the most important engineering work now in progress in Chicago is the tunnel, which the West Chicago Street Railroad Co. are building under the Chicago river. When completed, the tunnel will be used by all the cars of the company operating on lines lying south of Madison Street. The excavation is being made entirely in private property, 150 ft. north of Van Buren Street, and extends from the west side of Franklin Street on the east side of the river to the east line of Clinton Street, on the west side, a distance of 1,540 ft., and passes under several large buildings and the tracks of several railroads.



COFFER DAM FOR WEST CHICAGO STREET RAILWAY TUNNEL.

Five hundred and twenty feet have been excavated, and work is now in progress in the river section. The illustration shows the coffer dam which has been built for the purpose of prosecuting the work. At this point the Chicago River is 184 ft. wide from dock line to dock line, and it was necessary to leave a channel of sixty-three feet so that navigation would not be obstructed.

In the space covered by the coffer dam, shown in the engraving, 107 ft. of the arched structure is to be built. Under that portion of the river now used as the channel, the tunnel has already been completed. In the construction of this approach it is necessary to excavate to a point twenty-eight feet below the bed of the river. The earth is removed in cars to an elevator leading to a small tramway track shown at the left of the illustration. The load is then dumped into the river, where a dredger is constantly at work. The delays which attended unloading the cars into the scows demonstrated that it was cheaper to handle the excavated earth twice by dumping it into the river and removing it when convenient by dredgers.

The original plan provided for underpinning buildings under which the tunnel was to be located, and carrying the foundations below the excavation. It was left, however, to the option of the contractor to follow this plan or to take down the structures, and restore them. He decided upon the latter course. The building, which is shown directly back of the coffer dam, has just been restored over the completed tunnel. The structure is 82 ft. in width, 100 ft. deep and 7 stories in height. Two buildings are still to be taken down and restored, the one five stories and basement on the east side of the river, and the other six stories and basement on the west side.

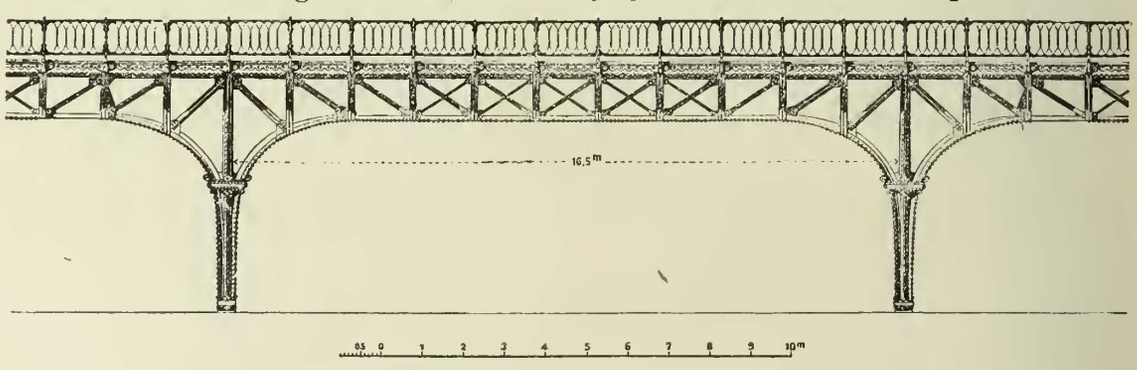
The length of the tunnel proper—that is from portal to portal, and excluding the approaches—is 920 ft. The gradients vary from 5.46 per cent. to 10 per cent. The masonry is of brick in seven rings aggregating thirty-two inches in thickness. Under the railroad tracks for a distance of 200 ft., the masonry is made somewhat stronger. The bricks are laid longitudinally with the tunnel with edges toward the centre and with toothing joints. The work has been carefully watched to see that all joints are perfectly filled by pressing the bricks into the mortar. Joints between courses do not exceed half an inch in thickness, and between the rings are not less than half an inch. The bricks used are hand made and hand burned and are of standard dimensions.

The river section of the tunnel covered by the coffer dam shown in the illustration will be completed June 1. How soon the entire work which was begun in February, 1890, will be finished cannot be estimated, as injunctions prevent the contractors from prosecuting the work at several points.

The cost of the structure, which includes merely the construction work, and excludes the purchase of rights of way and buildings, will be $1,000,000. The tunnel was planned by S. G. Artingstall, and the resident engineer is C. V. Weston. The contractors are Joseph Downey and Charles Fitzsimons.

An Elevated Railway Project in Berlin.

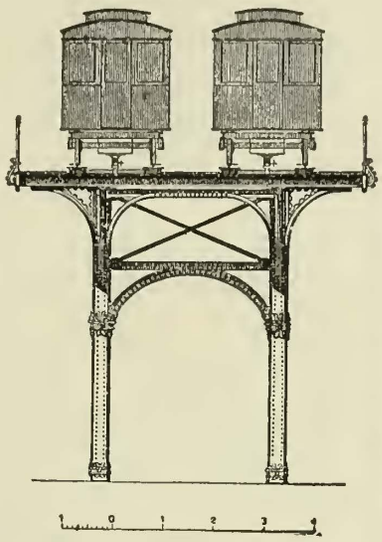
Nearly simultaneously with the proposal of the General Electric Co. of Berlin to construct an electric underground road in that city, as noted in our March issue, comes the proposition of the well known firm of Siemens & Halske to cover the whole of Berlin and its adjacent suburbs with a net work of surface, elevated and underground railways. The chief engineer of this company, Herr Schwieger, has prepared an elaborate set of plans, from which it appears that the aim of the designer was to connect the important centres in the district rather than to follow along the leading lines of traffic as they exist now. Electric power will be used. The minimum radius has been fixed at 327 ft. and the maximum grade at one in forty. The maximum wheel load is assumed to be 1.65



PROPOSED ELEVATED ELECTRIC RAILWAY IN BERLIN.

tons, but 3.3 tons has been taken as the basis of computation for the elevated structures. The standard gauge is adopted, and as the cars have two four wheel trucks like those in use on many lines in this country, it is believed that there will be little trouble in moving around the sharpest curves. Each truck carries a motor, and all the the wheels are to be fitted with electric brakes.

The elevated structure is designed for a double track line. The trusses, of which but two are employed, are eleven and a half feet apart, and supported every fifty-four feet by columns, their combined weight being estimated at 0.4 of a ton per foot.



SECTION OF PROPOSED ELEVATED ELECTRIC RAILWAY—BERLIN.

A Hand Hack Saw.

A hand hack saw, which is capable of cutting a half-inch bar of steel, is always convenient and often a necessary part of the equipment of every street railway. The convenience of having one at hand often repays its cost ten times over. A most convenient saw of this kind is shown in the accompanying cut, and is manufactured by the Millers Falls Co., 93 Reade St., New York. Many thousands of these are in use in all parts of the world, and they will do much of the work of files in one-tenth of the time and at one-tenth of the cost. One saw blade will cut a half-inch bar of steel 250 times, and can readily be replaced when worn out or broken.

Quincy in a Snow Storm.

A heavy snow storm commenced in Quincy, Mass., on the afternoon of March 1 and continued until the morning of March 4. During this time the snow fell in abundance and drifted badly.

It was with hard labor that the West Quincy line was kept open during the storm; but by running the cars night and day, and with the help of a large snow plow drawn by eight horses, it was done.

FIG. 1.—SNOW SCENE IN QUINCY.

On March 2 and 3 neither teams nor cars were able to go through Washington Street on which the Quincy Point line lies. Some of the drifts were thirteen and fifteen feet high. On the fourth, however, the men began to clear the tracks in the morning, and at two o'clock the cars were running in as quick time as ever. In riding through these drifts, nothing but snow could be seen on either side of the car. In the afternoon of the same day about 175 men set to work to open the Neponset line and at eight o'clock that night it was cleared. This line lies on a barren piece of land which is exposed to the wind in every direction, and for half a mile at a stretch there were drifts all along the tracks from six to seven feet high. We are indebted to Mr. Benj. J. Weeks, superintendent of the Quincy & Boston Street Railway Co., for the accompanying views, which show the difficulties with which the company had to contend.

FIG. 2.—SNOW SCENE IN QUINCY.

Atlantic Avenue Electric Contract.

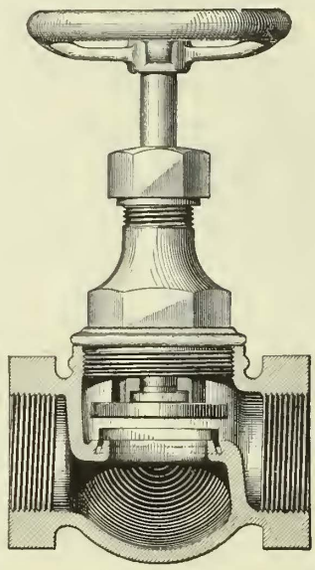
The Atlantic Avenue Railway Co. of Brooklyn, N. Y., have given their order for electric motors to the Westinghouse Electric & Manufacturing Co. The contract is for 100 car equipments or 200 motors of thirty H. P. and four generators of from 250 to 780 H. P., making in all 2,000 H. P. One hundred motors, it is said, will be delivered in June and the remainder in December. The track material will be furnished by several manufacturing firms. The cars are to be ready by July, and the entire plant will be complete before December.

FIG. 3.—SNOW SCENE IN QUINCY.

The Roy Valve.

In the accompanying illustration is shown the Roy valve, which has been designed to avoid many of the troubles often met by steam engineers with this part of their steam equipment.

It contains a method of making a joint that is a radical departure from the usual manner of joint making in a valve body, and assures a tight joint under all conditions. It also provides a seat that will not be injured by the ordinary force of a wrench applied to the valve handle, and which will afterwards be efficient when operated in the usual manner.



ROY VALVE.

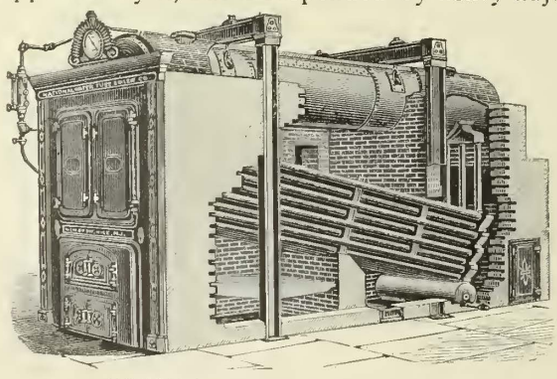
This result is attained by the use of a jointless ring of expansive material inserted in the body, and which is as simple in application as a washer. Any kind of malleable material is used, such as copper for steam, iron for ammonia, and lead alloys of different kinds for water. The ring rests on a conical base, and its action, to compensate for distortion of the joint, is as follows: A ring resting on a conical base will make contact on its entire inner edge, if both ring and base are true. If the base be distorted, the ring will touch on two or more spots, depending on the degree and nature of the distortion. When a pressure is put on the upper edge of the ring by means of a flat disk, the ring is forced outward by the prominent points on the conical base, and drawn inward to fill the depressions. The plane of the top surface of the ring remains undisturbed, but free to move laterally on the face of the disk, and an extraordinary degree of distortion is thereby provided for. The accompanying illustration shows the general arrangement.

These valves are manufactured by the Roy Valve Co., 15 Cortlandt Street, New York.

The National Water Tube Boiler.

This type of boiler has been adopted in a number of electric lighting and power stations, where it has gained a reputation for simplicity of construction, accessibility for internal and external cleaning, durability, and other points important in a generator of steam.

As will be seen from the accompanying engraving, the steam and water drum, while resting on the brick work is not supported by it, but is suspended by heavy adjusting bolts and links from iron beams, which are supported upon four iron columns, placed on suitable foundations. By this system of hanging boilers from overhead beams by means of links and bolts, the entire boiler is free to expand and contract without putting any strain whatever on the brick walls, and, if necessary, it could be removed without disturbing them.



NATIONAL WATER TUBE BOILER.

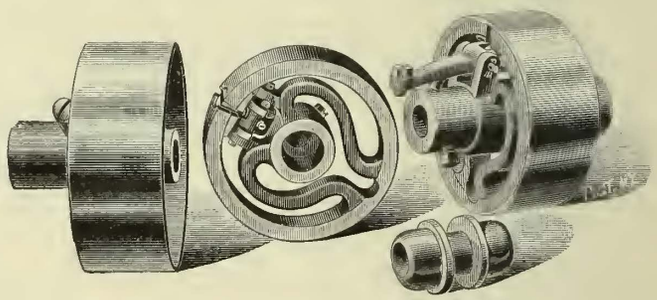
The water tube part of the boiler is composed of a number of sections made up of the best grade, lap welded, wrought iron tubes, expanded into headers by the usual method of expanding tubes. By this means the water contained in the boiler is subdivided into small quantities, and destructive explosions are thereby avoided, as any possible rupture would be but the giving way of a single tube, which, in many cases is less in diameter than that of the safety valve of the boiler. This, in such event, would act as a safety valve to the whole boiler and gradually empty it of its contents.

To facilitate the cleansing of the boiler these headers have suitable openings opposite the ends of the tubes, exposing to view the interior of the tubes. Any or all of the tubes in the section may be removed, if desired, through these openings, without disturbing the header, and new ones replaced in the same manner. If it should ever become necessary, any header may be removed without disturbing the others or removing any part of the walls of the boiler.

For further particulars the National Water Tube Boiler Co. of New Brunswick, N. J., should be addressed.

Friction Clutch for Screw Machines and Lathes.

The accompanying illustration represents a new and improved friction clutch, which has been designed by the Garvin Machine Co. of New York, especially to meet the requirements of their screw machine and turret lathe work. By reference to the cut, it will be seen that the friction proper consists of a spring ring, which is caused to expand by the drawing in of a taper bolt; this bolt being operated by the usual finger and sliding cone. It will also be seen that the friction ring has no direct connection with the hub, being connected thereto by two curved arms, which extend as far as possible to the opposite of the hub. This feature greatly increases the elasticity of the ring, and allows it to fill in all directions, giving a perfect bearing. Double provision is made for taking up all the wear by means of the usual adjusting screw, with set nut on the outer end of the finger, and also by screwing the taper bolt into the nut, which is pivoted to the inner end of the finger. This allows of a readjustment, should the clutch wear sufficiently to use the full length of the outer screw, by screwing down the taper bolt, and returning the outer screw to its original position.



GARVIN CLUTCH FOR LATHES.

The pulleys are made with long and ample bearings; the inner hub extending inside the friction beyond the face of the pulley, and is provided with an efficient, self oiling device.

These clutches have withstood the most severe usage, and have proved especially serviceable under high speeds and heavy loads, giving a quick and positive reversal, with a smooth and easy motion, which latter feature is most important in countershafts, which are constantly reversed.

The board of directors of the Third Avenue (New York) Cable Railway, at a meeting held March 15, decided to close a contract with Mr. Thomas E. Crimmins to complete the work of road construction for that railway. Under the terms of the new contract this part of the work is to be completed by September 1, 1892. The contractor who had charge was Wm. Wharton, Jr., & Co., of Philadelphia.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Lang Lay Cable in Chicago.

Chicago, January 22, 1892.

Editors Street Railway Journal:—

We recently purchased a Cradock Lang lay rope, which was in service some five weeks, when, on account of an unavoidable accident, it was cut in two and so badly kinked for 300 or 400 ft., that the piece had to be cut out, and, consequently, the rope was made too short for our main line. Having no rope of the same lay, we were compelled to remove it, and some time in the future it will be placed in what is known as our South Clark Line, being the proper length tor that place. Everything indicated that the wires were of much better quality than any rope we have had heretofore. J. M. Roach,

Second Vice-President and Superintendent North Chicago Street Railroad Co.

Track Brakes.

Los Angeles, Cal., March 10, 1892.

Editors Street Railway Journal:—

The article in your February number on the subject of track brakes, over the signature of Mr. Pfingst, master mechanic of the West End Street Railway, is from such high authority that it is with extreme diffidence I venture to take issue with him as to the value of track brakes. The article very frankly admits his lack of actual experience in the use of this device, and then proceeds to condemn it. One would hardly have expected such sweeping generalization from the results of so few experiments. Mr. Pfingst apparently views the track brake as an emergency brake, or one to be used when the wheel brakes refuse to work; this is not the view ordinarily taken by those who use track brakes. If I may be permitted to refer to the considerable experience of Pacific Coast roads, I venture the assertion that not one would attempt to operate with one or a dozen wheel brakes and no track brakes. Suppose the wheel brakes are set so tight that the wheels are locked and skidding, the track slippery and the train going with increasing velocity down a 10 or 15 per cent. grade, extra wheel brakes will do no good; but a track brake will stop a train under such circumstances with ease and quickness, and this has been proven in our practice not once, but many times.

Our method is to use the wheel and track brakes together. That is, to stop the car we first apply the wheel brakes and follow this with the track brake; by this means we keep the brakes in working order. We find no difficulty whatever in passing guard rails and switches, as is found by Mr. Pfingst.

I would call attention to the fact that the impetus due to the revolving armature after shutting off the current renders the track brake in electric work still more necessary, and also that the weight of the motor, instead of being deducted from the effective might against which a track brake works, should be added, as the motor is supported at one end on the channel bars extending from side to side of the truck frame. Several years' daily observation of the results of using track brakes has convinced me of the utility of the device and of its economy in many ways, not the least of which is the saving of flat wheels, as Mr. Pfingst very justly points out. As a safeguard I maintain that there is nothing that will take its place; and I believe that any manager who once uses a well designed track brake will not willingly abandon it.

One great element of value in the use of track brakes is the fact that full control of the train is had at all times. With both sets of brakes a train need never be out of the control of the men in charge, and there need be no undue strain put upon either set of brakes. Working one as an auxiliary to the other will prolong the life of car wheels, brake mechanism and rolling stock generally.

Fred. W Wood.

Manager Temple Street Cable Railway.

Return Circuit for Electric Railways.

Lynn, Mass., March 7, 1892.

Editors Street Railway Journal:—

There is some discussion at the present time in the electrical papers, in reference to the advantage of maintaining a good electrical contact between the wheels and rails in electric street railways, in which the rails are used as part of the circuit.

In the early days of the electric railways, the writer saw the difficulty—but necessity—of maintaining a good, uninterrupted contact, and conceived the idea of applying water for the purpose. Later, he applied for a patent, and in June, 1889, was granted a broad patent for an electric railway sprinkler, patent No. 404,559. There are several advantages to be derived from the use of water in this connection, some of which may not have been brought to the attention of street railway men generally. The large saving of power is, of course, one of the chief advantages. Mr. L. E. Marple, of Nashville, Tenn., has stated that on the electric railway in that city he has actually observed in practice a saving of 33⅓ per cent. on a rainy day as compared with a dry, pleasant day. Even this would not represent the actual saving of a wet rail over a dry rail, for the reason that the line leakage is considerably greater during wet weather. A much greater tractive force in generating plant is provided for in electric street railway practice than is provided for in steam railways, for the same number of tons hauled under the same conditions of grade and curvature, the difference exceeding two to one. That this difference is large and ought to be reduced is obvious. The more modern electric street railways provide good rails and a well graded roadbed, so that the excess of power required must be largely due to the bad electrical and mechanical contact between the wheels and the rails. The C^2R loss would seem to be high. It would be a rather difficult matter to determine just what is the average resistance between the wheels and the rails, but, as indicated by the flashing, it is considerable. If, for illustration, we take it as one ohm—and in some cases it would be much higher—it would indicate a loss of 3.3 H. P. when the car is taking fifty amperes Even with comparatively clean rails, the increased resistance caused by dust on the rails is considerable.

In all electric switches, which are not even exposed to much dust, it is deemed necessary to have rubbing contacts to insure perfect electrical connection. By wetting the contact, the same purpose would be served. Wetting the rails softens the dirt on the track and the wheels, in place of being lifted in rolling over it, squeeze it to one side; water acting as a lubricant, excessive flange friction is avoided. The same causes also operate to make the car run much smoother and with less noise. Disagreeable flashing at the wheel is entirely done away with. At one time, the writer remembers seeing an electric car in the evening when there was so much dirt on the track that the flashing was blinding. A sudden shower came up and instantly all flashing ceased. Flashing indicates a varying resistance and, consequently, an unsteady current in the motor. It is a well known fact that sudden variations in the current are bad for the insulation on the motor, and tend to break it down. The motor instead of being propelled by a steady flow of current is jerked along, as it were, by a succession of more or less varying currents. Then, again, flashing is bad for both the wheels and the rails. The intense heat of the arc softens and blisters the iron and a succession of a great many flashes must materially increase the wear on the wheels and to a much less extent, of course—on account of the greater surface—the wear on the rails. If one will examine the wheels of a motor car after it has been run some time, the blisters caused by flashing will, I think, be distinctly noticeable. In connection with wetting the rails, the surrounding roadway can be sprinkled, thus laying the dust and preventing it from blowing on to the rails. In this way also

travel is made much pleasanter and the dust is prevented from getting into the motor and axle bearings.

Other advantages in the way of overcoming defective bond wires and an improved ground return have been mentioned by Mr. Wheeler, in an article in the January Street Railway Journal, and need not be enlarged on in this communication. E. D. Priest.

Public and State Treatment of Corporations.

New York, March 3, 1892.

Editors Street Railway Journal:—

Your correspondent, Mr. J. B., in the last issue of the Street Railway Journal, says so many pleasant and complimentary things of my paper on the above topic, that it seems almost ungracious in me to insist that I have the facts with me in the only issue he makes with any of my statements.

Mr. J. B. claims in substance, as I understand him, that private persons and corporations in the state of New York would be taxed equally if all the personal estate of individuals was assessed and taxed as it should be, without any evasion under the statutes. I claim, on the other hand, that the statutes themselves are tyrannical, cruel and unjust to corporations and the owners of corporate property.

Let us take the case of a street railroad for the purpose of making clear this point. If the nominal capital stock of such a supposed corporation is $1,000,000 and this stock sells at par in the market, it is quite evident that the owners of this stock, and all the world as well, are united in their judgment that all the property of the company whatsoever, real and personal, including its franchise, good will and prospects, is worth just $1,000,000 over and above all its debts and liabilities. This $1,000,000, then, is exactly the cash value of everything it owns on earth of every name and nature. Now for the just and equal assessment and taxation: First of all, the assessors have always, heretofore, assessed the company for the purpose of personal taxation alone to the full amount of the market value of the stock, fixing this value at the price the stock sells for in the open market. In this case, of course, it would be exactly $1,000,000. This, then (less the actual market value of the real estate deducted), should end all assessments against the company for any and all taxation whatever if the corporation is to be treated not as individuals are who evade the law, but as individuals should be treated under the statute. Even then it would be grossly unjust to corporate property, for this valuation includes not only all real and personal estate and franchises of the company but its prospects, good will and also the integrity, ability and efficiency of management which, although incorporeal and not properly taxable at all, make up no inconsiderable part of the value of the stock of the corporation. It is true that from this valuation is deducted the assessed valuation of real estate, or say, 75 per cent. of its market value; and so the other 25 per cent. which enters into and gives value to the capital stock, is taxed as personal estate. Not only that, but it is taxed over and over again every year, as will be shown. But the real estate is, as stated, assessed and taxed by itself. The tracks are again assessed and taxed by themselves, although wholly included in the stock assessment.

The capital stock even, including as it must and always does the full value of the real and personal estate, is again assessed and taxed on the basis of the dividend it pays. Again, a heavy state tax is levied, based on gross earnings. The company is still taxed again for the expenses of the railroad commissioners covering all the cost of this department; and, lastly, the cars in many cases are arbitrarily taxed $50 each, as a so-called license fee, and all these taxes are levied and paid annually. No deduction from any of these taxes is allowed on account of indebtedness, either bonded or floating, as Mr. J. B. supposes. He speaks of "swearing off" taxes. They may be sworn at, but not "sworn off;" for no deductions are allowable under the statute, except stock in other companies, which a street railroad company is not likely to have, or property in another state, which it is not permitted to own. Who shall say then—and upon what grounds—that individual property and the corporate property of street railroads are dealt with equitably and alike in the matter of assessment and taxation in the State of New York?

It may be claimed as a last subterfuge that these assessments and taxes so levied on such corporate property are not legal. But they have been tested in the courts and declared legal in all important and oppressive particulars.

An exact inventory of all the personal estate, to the minutest item, of a New York company was made a few years since, duly verified and each article carefully valued at its original cost, and was presented to the Tax Commissioners for assessment as and for the personal estate of the company owning the same. There was no dispute as to any matter of value or of fact, and no question on this score was raised, but the commissioners assessed the personal estate at more than a $1,000,000 above the actual value of the personal estate so verified and presented to them in this case. The matter was then taken to the Supreme Court, and the commissioners' assessment was, upon full agreement, sustained by the court as in accordance with the statutes governing the taxation of corporate property. It is true that after years of labor, argument and protest the Court of Appeals has at last made one decision which promises some relief from this gross injustice, but no court had done so when I began the agitation of this subject, nor indeed until the last year. It gave me great pleasure to read the article of Mr. J. B. on this subject, and I thank him for all his kind and courteous remarks upon my efforts to elucidate this matter, but the truth, sad and discouraging as it is, must be reiterated until it is understood and appreciated, that tyranny consists in permitting one class of persons to become parasites upon another class by an unequal distribution of burdens, and that other humiliating truth that the great and otherwise glorious State of New York has few equals in her rapid march toward this unjust and wicked consummation. G. Hilton Scribner.

St. Louis Notes.

The earnings per day, for 1891, of the street railways of St. Louis, are herewith presented. They are most satisfactory, as the total per day of all lines shows an increase of 19 per cent. over the total for 1890.

	1891	1890	Increase or Decrease.
St. Louis & Suburban	551	594	—43
Bellefontaine	421	324	97
Union Depot	1,160	921	239
Cass Avenue	452	471	—19
Citizens'	1,213	1,168	45
Fourth Street & Arsenal	69	151	—82
Jefferson Avenue	251	233	18
Lindell	1,499	759	740
Missouri	1,854	1,685	169
Mound City	567	360	207
Northern Central	302	301	1
People's	595	621	—26
Southern	584	361	223
St. Louis	1,479	1,042	437
Union	248	301	—53
Total	11,055	9,292	Inc. 1,763

The Citizens' Railway Co. have applied to the City Council for permission to reconstruct the horse car portion of their road, starting from the terminus of the Eastern Avenue cable division and ending at the city limits, and to operate electric cars thereon; also to operate the Grand Avenue branch of the cable division by electricity. An officer of the company states that the Love underground trolley is to be experimented with on the latter line, thus utilizing the present cable conduit. If success-

ful, it will be adopted. The change is to be made from cable power on account of the adoption of electricity by other roads in the vicinity. The traffic on the cable road will thus be greatly diminished. Besides, more trains are needed on the Easton Avenue cable line, and the latter will be augmented by those on the Grand Avenue division, which will reduce the headway of trains on the former division from two minutes to one minute and a half. Passengers will be transferred at Grand and Easton Avenues where the two lines intersect.

A most important item of news is the consolidation of the Cass Avenue & Fair Grounds, the Northern Central, and the Union railways. The new company is to assume the name of the first of the above three. Numerous extensions are to be made, and a change to electricity is one of the provisions of the bill, which has just passed the City Council. Under the name of the Cass Avenue & Fair Grounds Railway, the corporation have been authorized to extend and construct their tracks from Prairie Avenue westwardly on St. Louis Avenue, and at the end of the latter thoroughfare they are allowed to continue the course westward through alleys and blocks, then again, on St. Louis Avenue to Goodfellow Avenue, the terminus. Provided in the bill is authority to construct the necessary switches, turnouts, sidings, poles, wires, etc., to operate by electricity, and to maintain a speed not exceeding fifteen miles an hour west of Prairie Avenue. One power house is to supply the necessary current, the location of which has not yet been decided upon. But one contract has been let, and that to John A. Roebling's Sons Co., of Trenton, N. J., for the wire. Cars have to be running within two years, but will most likely be in operation within one-half that time, for as soon as the bill passes the House of Delegates, the work of reconstruction will be commenced. Captain McCulloch estimates that the city will receive $5,000 the first year and nearly $20,000 the last year of the franchise. He says the consolidated roads must take in $500,000 the first year or the expense of changing to electricity will not be paid. According to the provisions of the bill, the company is to pay the city each year from January 1, 1893, to January 1, 1895, 3 per cent. of the gross earnings; from January 1, 1895, to January 1, 1900, 4 per cent.; 1900 to 1910, 5 per cent.; 1910 to 1920, 6 per cent.; 1920 to 1925, 7 per cent.

The Bellefontaine railway is at present very busy changing to electricity. All the track has been reconstructed with a seventy-eight pound Johnson girder rail, and ninety-two pound curve rail. The company will extend their line out Florissant Avenue to the cemeteries, later on. An extension has just been completed to the Fair Grounds, which also will operate by electricity. It is expected to have the road in operation by April 14. The Thomson-Houston system has been adopted, and the power station will be on the old stable site. As it will not be finished before the middle of May, current for running the cars will be supplied by the Municipal Electric Light & Power Co. The cars are thirty in number, with twenty foot bodies, and are being built by the St Louis Car Co. The management expects to have the cars make forty-eight minutes better time to the round trip than formerly.

On Monday, February 15, the bill passed by the City Council regulating the stoppage of cars for the reception and discharge of passengers, went into force. It provides that all cars must come to a full stop to discharge or receive passengers when they signal at the proper places, namely, far corners and the centres of long blocks designated by notices in the cars. This novel innovation has its good and its bad points. If the law is violated, the railroad companies will not suffer, but the conductors and motorneers, or gripmen, who will be fined not less than $5, nor more than $25.

The new cars of the St. Louis & Suburban Railway have a rather long wheel base, to prevent oscillation, consequent upon the fast running time that is made in the outlying districts. A number of cars belonging to this company are each mounted on Brill's No. 13 independent rigid motor truck, having both spiral and elliptical springs. It is said the truck is very satisfactory, and that the car rides as smoothly as if it were mounted on bogie trucks, all oscillation being done away with. This is the first appearance of the truck in St. Louis. The railway company are at present engaged in building their Forest Park extension along Union Avenue, from the main line to the park. The construction consists of light T rails placed on rough hewn ties, and the ballast is macadam. On account of opposition of property holders, the City Council will not allow the company to build the tracks in the middle of the street, but one on each side.

The Union Depot Railway Co. are adding several new boilers to their already extensive equipment.

The Lindell Railway Co. are revising and repairing the stringer constructed portion of the Washington Avenue division. This company are rapidly combining their cars, and there are at present on the Washington Avenue division four combination cars, each forty-seven and a half feet in length, or seven feet and a half shorter than a standard passenger coach. One of the cars is equipped with two twenty H. P. Westinghouse S. R. G. motors. It recently ran its maiden trip under the supervision of Mr. Guido Pantaleoni, the electrician. The car has been running for some time now, and is said to be giving excellent satisfaction. Another one of these cars is equipped with two twenty H. P. Short S. R. G. motors, which also is very satisfactory. The railroad company, as is evident, want to make a thorough test and adopt the best motor. Most of their cars are equipped with Edison motors.

The Phœnix Iron Co., of Phœnixville, Pennsylvania, have been awarded the contract for supplying the engines and boilers, and the Thomson-Houston company for supplying the electric appliances for the new power house of the Midland Electric Railway on Cook Avenue.

The suburban residents of St. Louis, who live on the line of the Missouri Pacific Railroad are placed at great disadvantage. After they have expended fifteen or twenty cents for their railroad fare they are landed about a mile and a half from the business centre of the city. There are but few who can expend an extra five cents on the electric cars to reach their places of business; and to do away with this great inconvenience, a novel scheme has been proposed. The following explains it: It is said that the Missouri Pacific company have been negotiating with the Union Depot Railway (electric) for right of way over their tracks to the down town districts and return. It is said the railroad company intend to build large suburban coaches and equip them with electric motors. From the suburban towns to the Union Depot locomotives will haul the cars, the latter will then be detached, adjust their trolleys to the wires, and speed along to the business centre as electric cars, stopping at every corner similar to a street car.

The Mission Railroad Co. will soon begin to build a branch line to Forest Park out the Clayton Road. The trailers at present in use will be turned into motor cars and run on the new branch. The power station equipment of the road is sufficient to supply the new branch, together with the Market Street and Laclede Aveuue lines.

The Fourth Street & Arsenal Railway are to adopt electricity and extend their route farther north than the present Morgan Street terminus.

It is rumored that the St.Louis & Suburban, the Lindell, and the Citizens' Railway companies are each endeavoring to gain control of the St. Louis County Railway. As the city is fast growing into the country this is a valuable property. J. B. G.

Charles Hansel, consulting engineer of the Railroad Commission of Illinois, has been commissioned to promote the interests of the Columbian Fair in Europe by urging railway companies and manufacturers to become exhibitors. Mr. Hansel will sail for Europe soon, and expects to spend several months in Great Britain and on the continent. Director General Davis has declared that all applications for space ought to be presented by July 1, 1892.

Franchises Given to Chicago Street Railway Companies.

The City Council of Chicago has finally given the Chicago City Railway Co. the privilege of improving their service by adopting an ordinance giving them the right to lay a single loop track downtown. It has been contended by the company, that it was simply impossible for them to increase the number of cars on their lines during the rush hours, for the reason that the existing loop was already overtaxed. This statement has been recognized as true beyond all question, but it was only within the last few weeks that the aldermen consented to move in the matter.

At the same meeting the Council passed the crosstown ordinances, which give the South Side company the right to operate cars on several streets by electricity. It is provided, however, that no overhead wires are to be used on Thirty-fifth, Forty-seventh, and Fifty-seventh Streets, and these restrictions are made in connection with each ordinance "provided that no trolley overhead wires shall be used, except upon the consent and approval of and conditions imposed by the Mayor and Commissioner of Public Works."

At the same meeting of the Council an ordinance was adopted, which gave to the West Chicago Railroad Co. and the North Chicago Railroad Co., the right to operate their lines by compressed air, gas, electricity, or any motor or motive power which they may see fit to adopt; provided, that such motor or motive power shall be practically noiseless, and, before using, shall be approved by the mayor and commissioner of public works.

The ordinance was vetoed by Mayor Washburne, who said in his message of disapproval:

> I recommend that it be amended as follows:
>
> In the event of electric power being used, the same shall be placed underground, and its method of construction shall first be approved by the Commissioner of Public Works.
>
> My reason for suggesting this amendment is, that it is eminently desirable that overhead wires in the city of Chicago be displaced in all instances as soon as practicable, and that no grants be given for any overhead system of electric or other wires, when any other method can be adopted.
>
> In some instances in outlying territory, under certain restrictions and a time limit, it might be practicable and advisable to permit some overhead system of electric wires for the use of street car travel. This right, however, should be limited in time and surrounded by such penalties as to compel all companies using overhead wires to place the same or other motive power underground, within a comparatively short period of time.
>
> To permit this ordinance to stand as it is now worded, would allow the use of overhead wires through all portions of our city, where the two said railroad companies now conduct their business; and for these reasons I recommend that the amendment hereinbefore mentioned, be passed before this ordinance becomes a law.

The ordinance was amended as suggested, and passed.

At the same meeting the Council adopted what has been known as the "omnibus" ordinance, giving to the West Chicago company the right to lay track on many crosstown streets, and providing that the roads should be operated by animal power, cable, electricity, or some motor approved by the authorities. If electricity was adopted, the conductors are to be underground. The mayor, at a subsequent meeting of the Council, returned the ordinances, suggesting modifications, which were made, after which the measures were again passed.

The Trolley in Philadelphia.

Last month has witnessed repeated in Philadelphia many of the scenes which occurred in Brooklyn before the final permission was given to use the trolley. The immediate cause of this was the application of the Philadelphia Traction Co. for permission to erect poles and overhead wires for a trolley system over certain of the more populated streets. In the course of the investigation before the railroad committee of the City Councils upon the application, a number of experts and others were called upon to testify as to the relative merits of the trolley system. Among those who appeared in behalf of the system were Oscar T. Crosby, George Westinghouse Prof. Louis Duncan, C. J. Field, E. E. Higgins, Messrs. Ostran and Stern of the Johnson and Edison General Electric companies respectively and Mayor Haynes, of Newark. The applicants also showed a large number of letters from mayors and heads of departments, insurance, brokers and others in cities where the trolley system is in operation and who expressed themselves in favor of the system. Among others who appeared in opposition were the Trades League, the Municipal League, Board of Trade, Lumbermen's Exchange, Master Builders' Exchange and several citizens' committees and associations, as well as private individuals. Prof. Wm. D. Marks gave testimony as an expert for the opposition.

The bills came before the Councils on March 22, and were finally passed by a large majority, and sent to the Mayor on March 23.

In speaking of the matter Mayor Stuart said: "I shall not act hastily. I want to read the ordinances carefully, and will take no action until I have done so."

The ordinances have been sent to Director Beitler, who will, as the head of the Electrical Department, make a report to the Mayor before action is taken.

New Rapid Transit Plan for New York.

A new plan for providing rapid transit in New York City has recently been made public. It is designed in opposition to any underground system which the advocates of the new plan assert can never prove popular or satisfactory in the city of New York. The project contemplates the removal of the top of the New York Central tunnel, from the Harlem River to Forty-second Street, and the construction of an elevated four track road over the existing four tracks, at a height above the level of Park Avenue sufficient to leave traffic on that thoroughfare undisturbed; from this point it is proposed to build a viaduct over private property to the City Hall. The advantages of this plan are concisely stated as follows: The new plan assures plenty of air and light. It will cost less than the tunnels. It will not disfigure streets. The minimum of damage will be done to property. The road will be substantial enough to make safe the running of fast trains over it. It will have convenient connection with every railroad entering New York overland, and, by means of the proposed North River bridge, with the roads terminating in New Jersey.

An Interesting Test of Engines.

Some interesting tests to determine the relative economy of high and low speed engines, have recently been carried out at the power station of the East Cleveland Railway Co., by Charles W. Wason. The types of engines used in this station are stated in another portion of the paper.

Amperemeter and voltmeter readings were taken every fifteen seconds, the amount of water used for steam and of coal consumed were accurately measured, and a careful account of the number of motor and tow cars moved, and mileage made by each were carefully kept, and the condition of the weather was noted. The temperature of the water as it left the heaters, was taken every fifteen minutes.

Owing to the constant and rapidly varying load, it was almost impossible to get the mechanical horse power. In taking a card with the indicator, the load will change before the stroke is completed. The average electrical horse power developed in ten hours for the high speed engine was 563; for the low speed 842. The water consumption for the average electric horse power was: High speed, 43.29 cu. ft.; low speed, 37.69 cu. ft. The amount of fuel used for average electrical horse power per hour for high speed, 6.55 lbs., low speed, 6.75 lbs. The number of pounds of coal consumed per car mile: high speed, 6.57 lbs.; low speed, 6.38 lbs. Total number of motor cars was seventy-one in both cases; total number of tow cars eleven during the high speed test, twelve during the low speed test. Average horse power per car required during the high speed test was 686, low speed was 759.

Contracts Awarded.

The Brooklyn City Railroad Co., of Brooklyn, N. Y., being about to equip their lines for electric traction, as we have before noted, have awarded the following contracts: To the Thomson-Houston Electric Co., of Boston, the complete electrical equipment for 250 electric cars, each car to be equipped with two twenty-five H. P. W. P. type of motor. To the Ansonia Brass & Copper Co., of Ansonia, Conn. and the Simplex Electrical Co., of Boston, the contracts for the trolley, return and feed wires. To W. H. Wallace & Co., of New York, contract for poles, which are to be of the tubular type, twenty-seven feet high, in six, five and four inch sections, swaged at the joints and having a ring shrunk on at each joint. The poles are to be provided with four pin cross arms for supporting feed wires, and eyebolt for the guard wire span. The span wires are to be mostly of Norway iron, but as an experiment a portion of the line will be equipped with bronze wire. The rail joints will be bonded in the ordinary manner, and the return wire will consist of heavy tinned copper wire. The contract has been awarded to the Johnson Co. for sixty-six pound girder rails sufficient to equip one mile of track, with which the Johnson standard rail joint will be employed, and the chairs electrically welded to the rail. To the Lewis & Fowler Girder Rail Co., of Brooklyn, N. Y., to equip nine miles with their sixty-five pound box girder rail. The contracts for the power equipment have not yet been let, but it has been decided to belt direct from the flywheel of each engine to two generators, the shafts of the latter being provided with friction clutches.

Providence (R. I.) Notes.

At a recent meeting of the Advance Club of Providence, President Homer M. Daggett, Jr. of the Inter-State Street Railway Co., described the extensive electric railway system which his company are now installing:

The Inter-State Street Railway Co., according to Mr. Daggett, have a charter from the Legislature of the State of Rhode Island, and a license from the State of Massachusetts to do business in the towns of Seekonk, Attleboro and North Attleboro in that state. They have street franchises from Attleboro, Seekonk, North Attleboro, Cumberland, Lincoln, East Providence and the city of Pawtucket, besides an arrangement to run their cars into Providence under certain conditions.

The system covers about forty-two miles of road, divided as follows: Attleboro to Pawtucket eight miles; North Attleboro to Pawtucket eight miles; Manville and Cumberland Hill to Pawtucket ten miles; Bullock's Point to Pawtucket ten miles; Pawtucket to Providence four miles; Pawtucket, local, two miles. Of these routes they have built thirteen and a half miles of track, and expect to have the two routes from Attleboro to Pawtucket and from North Attleboro to Pawtucket in operation by next April, and the routes from Pawtucket to Bullock's Point in operation by May 30. The other lines will be completed as rapidly as possible.

South Side Elevated Road, Chicago.

The Chicago & South Side Rapid Transit Co. who control the Alley L, are now forming plans for the operation of the road. A general description of the company's system was presented in a recent number of the STREET RAILWAY JOURNAL. It is now stated that trains will be run about May 1, if engine builders do not fail to execute their contracts.

The schedule of the service, as now outlined by the engineers, is as follows: From 6 o'clock to 9 o'clock A. M., four car trains will be run every two and a half minutes., from 9 A. M. until 4 P. M. four car trains will be run every five minutes; from 4 P. M. until 8 P. m., four car trains will be run every two and half minutes; from 8 P. M., until 11 P. M., three car trains will be run every ten minutes; from 11 until 12 P. M., three car trains will be run every five minutes; and from 12 P. M. until 6 A. M.; two car trains will be run every thirty minutes. If found necessary, five car trains will be run every two minutes. It is estimated the road will carry 56,000 persons daily, if every passenger is provided a seat, or double that number if loads such as are carried on trains in New York are transported.

Notes on the Short Railway System.

THE Short Electric Railway Co. have closed a contract with the Bangkok Tramway Co. of Bangkok, Siam, which is one of the most successful and valuable street railway properties in Asia. It will be remembered that the general manager of this company, Mr. Aage Westenholz, visited this country some eight months ago, and made a careful study of the different electric railway systems, and that his company upon his recommendation should adopt the Short system is considered highly complimentary to the Short company. The first portion of the equipment will consist of six motor cars, each equipped with twenty H. P. single reduction motor and generating capacity for a somewhat larger number. The track will be strengthened somewhat, and in places relaid with new and heavier rail, and it is the intention to gradually change over the entire roadbed to conform more nearly to American practice. Mr. Westenholz has sent out a private circular letter to stockholders in Siamese and English announcing the change. Mr. Westenholz' statements in regard to the electric work in this country are of great interest, and his conclusions are evidently based on a careful study of the situation.

THE management of the Houston City Railway Co. with a view of giving its patrons the best possible service, says the Houston *News* in a recent issue, have been experimenting with various makes of electric motors, and some time ago contracted with the Short Electric Railway Co. of Cleveland, O., for one of their gearless type. Car 51, equipped with one of these motors, has been in active service on the Glenwood line about a week, and has made many friends by the excellence of its work. In company with A. W. Dutton, representing the St. Louis Engineering Co., agent for the Short railway company, the *News* correspondent took a trip on car 51, and with the trap doors up examined the working of the motor. Very noticeable features were the absence of noise and any sparking on the commutator, and although the car had made some thirteen round trips, approximately seventy-five miles, the motor was perfectly cool.

THE Short Electric Railway Co. closed a contract for electrically equipping three miles of road for the Spokane & Montrose Motor Railway at Spokane, and furnishing three cars equipped with "gearless" motors, which will take the place of the old steam dummies. Spokane will be the first Western city to adopt gearless motors, although contracts for this system are about to be closed in several other coast cities. This contract was negotiated by Chas. H. Baker & Co., the company's Western agents at Seattle.

THE Short Electric Railway Co. announce that they have recently received orders for original equipment or for additional apparatus from the Beatrice Rapid Transit & Power Co., Beatrice, Neb.; the Janesville Street Railway Co., Janesville, Wis.; the Spokane & Montrose Motor Railroad Co., Spokane Falls, Wash.; the Bloomington City Electric Railway Co., Bloomington, Ill.; the East Liverpool & Wellsville Street Railroad Co., East Liverpool, O.; the Braddock Electric Railway Co., Braddock, Pa.; the Georgetown & Tenallytown Railway Co., Washington, D. C.; the West End Street Railway Co., Rockford, Ill.; the Jamestown Street Railway Co., Jamestown, N. Y.; the South Covington & Cincinnati Street Railway Co., Cincinnati, O.; the Lincoln Street Railway Co., Lincoln, Neb.; the Union Passenger Railway Co., Chester, Pa.; the Ft. Wayne Electric Railway Co., Ft. Wayne, Ind.; the Schuylkill Electric Railway Co., Pottsville, Pa.

THE title which it is said will be adopted by the consolidated Thomson-Houston and Edison companies, is the "General Electric Co."

Obituary.

CHARLES J. VAN DEPOELE

Charles J. Van Depoele, the eminent electrician, inventor and pioneer in electric light and electric street railway work, died at his home in Lynn, Mass., March 18, in the forty-sixth year of his age.

Mr. Van Depoele was stricken with his fatal illness in December, and for over three months had hovered between life and death. Pneumonia was the primary cause of death, although a complication of disorders had developed during his long sickness.

The funeral services took place March 21. The pall bearers were W. N. Sheaf, Franklin James, John Riddall, Elmer P Morris, Theo. De Krieff, Henry Plachere, John Heinze and A B. Hoffmann. Among the many beautiful floral tributes was one representing an electric car with trolley, and with the word Van Depoele on the car body.

Mr. Van Depoele was born in Lichtervelde, Belgium, April 27, 1846. His father was an engineer on a small railway, and it was here that young Van Depoele gained his first mechanical ideas, and later learned his first lesson in electricity.

When about fifteen or sixteen years of age his father

THE LATE CHARLES J. VAN DEPOELE.

apprenticed him to a church furniture and fancy wood carver in Paris. He continued in this business until, in 1871, he came to this country and settled in Detroit, Mich., where he started a shop of his own, employing at one time 200 men.

Becoming interested in the electric light and believing in its commercial practicability, he constructed a dynamo, and in 1880, moved to Chicago, and formed the Van Depoele Electric Light Co., with General A. K. Stiles at its head. The following summer he lighted some of the streets in Chicago gratis, and soon after the company made and carried out numerous contracts.

As soon as this company was fairly started he began advocating the running of street railways by electricity, contrary to Mr. Stiles' wishes, who thought nothing would come of it. Van Depoele was undaunted, and in 1883 he obtained Mr. Stiles' consent to put up a short exhibition railway in Chicago. Seeing the success of this, Mr. Stiles became enthusiastic, and from that time on offered no opposition.

In 1884 he constructed a conduit road at the Toronto (Ont.) Exposition, followed in 1885 by the overhead system in the same place. This system was the first using a grooved contact device traveling along an overhead wire and conveying the current to the motor, which in this case was situated on the forward platform of the car. During the next three years he was busy developing the electric railway, taking out many patents, and building several railways in Toronto, Ont., South Bend, Ind., Minneapolis, Minn., and other places. In 1888 the Thomson-Houston company purchased all of his railway patents, and in March he went to Lynn, Mass., and has been connected with the company ever since as electrician and inventor.

Mr. Van Depoele has also done some very important work in the electric mining field, and it has been through him that the electric percussion drill has been brought to its present state of perfection, he having begun his experiments in that field as far back as 1882.

Though much interested in all branches of electricity, it is the electric railway and the reciprocating business that owes most to him. At the time of his death he was developing and improving his apparatus in the railway field.

His home life was happy, and his many friends among his social and business acquaintances, will deplore his loss. He leaves a wife and four children. The loss of a little son, a child of five years, two years ago, was a blow from which he never recovered. He also leaves a mother in Chicago.

A. D. WHITTON.

A. D. Whitton, late chief engineer of the Philadelphia Traction Co., died at his home in Philadelphia, February 23, after an illness of six months. His wife and two children survive him.

Mr. Whitton was born in Aiden, Scotland, in 1856, and came to this country about ten years ago. After remaining in Baltimore about two years he removed to Philadelphia and entered the service of the Traction company, and built the Market Street cable line of that city. Mr. Whitton, as chief engineer, had superintended the building of nearly all the cable lines that have been constructed by the Philadelphia syndicate, including lines in Pittsburgh, the north and west Chicago lines and the Baltimore line. He also made the original designs for the Broadway (New York) line, but owing to failing health he was not able to superintend the construction, and the work was committed to other engineers, who changed the plans and adopted a different type of construction.

Mr. Whitton was prolific in invention, and patented a number of appliances relating to cable traction. He had a capacity for arduous work, and it was thought by his friends that overwork hastened his death.

While many of his designs are employed on the lines controlled by the syndicate, they have not been generally adopted by other engineers. Mr. Whitton was accustomed to work along independent lines, and did not allow himself to be influenced to any great extent by the opinions of other engineers. We count it a pleasure to have known Mr. Whitton, and whenever our duties called us to his office we have found him most cordial and obliging. His family and associates have our warmest sympathy in this hour of their bereavement.

MELTIRE CAMPBELL.

Meltire Campbell, a superintendent of the Broadway & Seventh Avenue Cable Railway of New York, died February 25, of heart failure, at his home, 453 West Thirtieth Street.

H. W. EDES.

We regret to record the death of H. W. Edes, superintendent of the Houston, West Street & Pavonia Ferry Railway Co., of New York, who died on March 4 Mr. Edes was in the service of the company nineteen years, acting in the capacity of conductor, receiver, bookkeeper and superintendent. He was highly esteemed by the other officials of the company for his faithful and conscientious discharge of every duty. His age was thirty-eight years.

We are informed by a member of J. & W. Seligman, bankers, of New York City, that a recent attempt was made by them to purchase the street railway lines in Cleveland, O., in behalf of Eastern capitalists. The total amount offered was between $6,000,000 and $7,000,000, but the sale fell through.

Underground Electric Lines for Vienna.

In the City of Vienna, Austria, which has recently become considerably enlarged by the absorption of several important suburbs, it is proposed to install an extensive rapid transit system for intramural communication. According to the statements already published in the local papers, an underground system, similar to the City & South London electric subway in London, will probably be adopted. A twin iron tunnel will be constructed, and the cars will be drawn by electric locomotives, the current being supplied from an existing central station or one to be especially erected.

The passenger stations are to be made easily and conveniently accessible for the public by stairs, or at greater depths by elevators, and it has been ascertained that the necessary space for the officials and the public, as well as for access to the stairs and the elevators can be accommodated on the ground floor of the adjacent buildings.

Single Motors for Cars.*

By E. A. Sperry.

I have been deeply interested in the consideration of car equipment where a single motor has been employed. It has seemed to me from the earliest that a single motor was by all means the best; that it was by far better to employ a single motor where possible, and dispense with the complications involved in using two. There is certainly no trouble in obtaining power enough in one, but inasmuch as it has been suggested by some one that the car equipments had been designed in some instances by the so-called electricians rather than by the mechanical engineer, the mechanical difficulties encountered in transmitting the power after it has been generated, and distributing it to the traction wheels of the car, have stood in the way of employing one motor rather than two. Not only have I believed in the employment of a single motor for car equipment, but I have undertaken to put my ideas into practical form. For instance, I have employed a single motor for two wheels upon a car, four wheels, six wheels and eight wheels; and these not on models but upon full grown, full sized car equipments. Some eight wheel car equipments which I have been engaged upon have weighed as high as twelve tons, and have been employed on very heavy grades. These equipments have required different powers of motors. For instance, on an equipment of this class—that is, single motor car equipments—I have installed motors as high as 125 H. P., in those cases running eight wheels. This principle in operation has been very satisfactory—very much so indeed. These equipments have been used on tracks with heavy grades and in severe service in the way of railway crossings and numerous frogs, and in the heavier motors have been used on extremely sharp curves—that is, curves of low radius; and where employed as locomotives they have been attached to very heavy trains and have succeeded in doing the work for which they were assigned; in most instances they have been enabled to do a great deal more work than it was at first supposed they were capable.

I am a firm believer in the single source of power and a system of distribution for that power to the various wheels of the car.

The points I will consider in connection with this matter may be stated briefly as follows: A single motor for car equipment is the better, or the best form, from the fact that it is simpler, less expensive, it has a lighter weight, has a higher efficiency, and it has higher efficiency of transmission after the power is generated; it is more economical of current in other ways, as we will see; more economical of repairs; it can be made to give us more traction, and a single motor permits of more elaborate construction to adapt the motor and gearing to the requirements of service.

As to the first point, that it is simpler. One motor is simpler than two, having one armature, which is the bane of a great many electrical railroads employing but one set of commutator-brushes; and where the motor is geared to the tractive elements of the combination by a single-reduction gearing, there are less journals, less parts, and taken from every standpoint the equipment is simpler.

The point of its being less expensive is one which needs no elaboration. It will readily be understood that for a given potential a larger motor has less windings upon it and is of quite a little less weight for a given capacity. The windings, for instance, in a fifty H. P. motor need only be about half what it is in a twenty H. P. motor, and we all know that the element of time, especially where expert workmen are employed in the construction of any device, is the feature that very largely controls in the computation of the total cost of the articles, and where fewer convolutions and parts are required for the same power, of course considerable can be saved in the equipment.

That the equipment is lighter in weight I have had ample opportunity to observe from the fact that I have seen equipments operated side by side, and have investigated as to the weight of single reduction and double reduction equipment, where one motor and where two are employed, and know that the saving where single motor equipment was employed is between 1,800 and 2,200 lbs.

This factor is one of importance, inasmuch as it has to deal with the wear and tear upon the roadbed and the total amount of power required by the equipment, especially the total amount of dead weight to be pulled about for a certain carrying capacity in live load. For instance, take an extreme case like the Pike's Peak Railroad. The total capacity of that equipment in live load is somewhere between three and four tons weight—that is, the paying load is between three or four tons for hauling thirty-seven tons. In electric car service, especially where the roads are comparatively level, the paying weight can be greatly increased as compared with the total weight of equipment. This can be accomplished to the greatest extent where a single light motor may be employed to develop the traction. It may be stated that in the distribution of this weight (snppose we consider a single motor for car equipment as compared with two motors, each hung upon the axle), where two motors are employed, it is usually customary to hang them directly upon the axle, and the consequence is that in some instances it springs the axle. I came across an instance of this kind recently, and there are numerons instances of the sort. I enquired the size of the axle. I said: "Your axle must be extremely small if the weight of the motor is sufficient to spring it." The means of its measurement not being at hand, we, however, found a wheel that had come off of the axle, and measured the bore, and it was a standard three and a quarter inch steel axle that had been sprung by the hammering action of the motor mounted upon it. The axles are much more readily crystallized when carrying this weight, and, as is well known, the roadbed suffers materially, which is a question of great importance, the one that is being talked of and investigated very extensively at the present moment. It is a question that has seemed to dawn on the street railway people all over the country almost within the last six months, and extreme measures are now being employed to obviate it. They are trying to overcome this bad effect in a number of ways, some of which seem to promise good results.

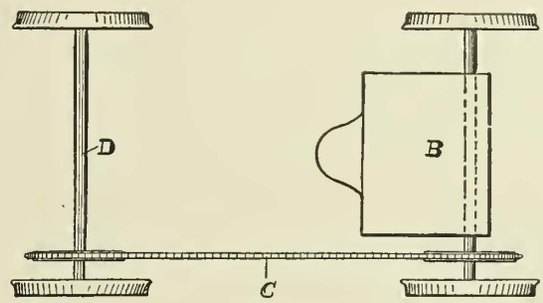


FIG. 1.

Now, there are two methods in which a single motor may be employed. Let us consider B the motor in Fig. 1, in this case mounted directly upon the axle, its end being supported in any of the usual ways, elastic or otherwise. In that case the power from a single motor may be transmitted by gearing or by a sprocket chain C to the other axle, letting the dotted line indicate the sprocket chain. That method was one of the first used by Mr. Van Depoele—the sad news of whose decease has just reached us, and we are all affected with the same feeling of sorrow that so prominent an engineer has passed away. Mr. Van Depoele placed the motor on the front platform of the car and then transmitted the power back through countershafting, first using gearing and then transmitting to one axle by a chain. In numerous instances in Ohio chains were used between two axles, so as to transmit the power to all the axles, thus getting the benefit of all the adhesion. This idea of using a sprocket chain has never proven successful, from the fact that wherever in engineering a sprocket chain is used it requires that the centres shall be adjustable. The distance between the axles in all cases should be capable of adjustment. Of course, it is possible in some instances to use a sprocket chain with an idler, but in that instance it must be a "face wheel" in almost every case. But in the case here our wheels are small as compared to the distance; the idler brings the chains too near together, and the greatest adjustment possible is very small, and has never been found avail-

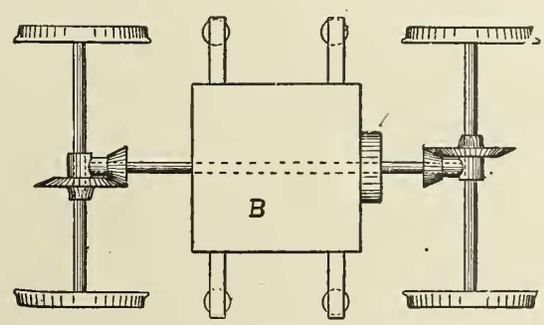


FIG 2.

able. The idea of making both, or one of the axles adjustable with reference to the other, was thought at first not to be good engineering. The proof of this, of course, would be in equipping a car in this manner and watch the operation I have done this and can report, after some months of use, that there seems to be no trouble at all in allowing one axle of a truck to be adjustable. The main difficulty encountered at first was the fact that sometimes one end would be adjusted further than the other. I found that a very simple expedient to remedy that was to provide a small scale attached to the stationary

*Abstract of paper read before the Chicago Electric Club, March 21, 1892.

part of the truck, with a little pointer fastened to the movable pedestal box, and whenever it was adjusted, the pointer would move along the scale, indicating whether the two sides were alike, so that the two axles would not be at an angle.

The other system may be diagrammatically illustrated as in Fig. 2. Suppose B to be a motor, a bevel pinion shaft connected therewith, and a bevel gear to be attached to each axle as shown. The bevel gear on one axle should be in the opposite position to that on the other, so that all the wheels will move in the same direction. It has been thought by some that the use of bevel gearing is objectionable. It has been thought that a bevel gear will not run on pitch lines. A bevel gear I have found by actual tests to be more delicate than a spur gear.

Now to the economy of current. There is one other factor in the absorption of current by two motors per car equipment than the one referring to its direct absorption for the power given. One of the best contemporary authorities on this matter writes as follows: "It is found in practice, that if electric motors, as ordinarily constructed

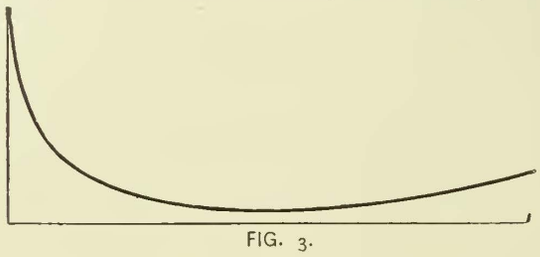


FIG. 3.

and connected in circuit are bolted to the same shaft, or are otherwise applied to the same work so that they must revolve together, the results are unsatisfactory, because of the fact that the load will be unequally or disproportionately divided. This is occasioned by the fact that it is very difficult, in fact almost impossible, to construct electric motors so that they will, with the same rate of rotation, and when supplied with current of the same potential, have precisely the same counter electromotive force. Therefore if two motors are connected, as ordinarily, to the same supplying mains, and operated so that they must revolve together, the motor whose armature produces the lowest counter electro-motive force, will take a larger current than the other motor. The effect of this increased flow of current is to greatly exaggerate or enhance the differences existing between the motors, because the magnetic field of the motor is disturbed by the increased flow, and its counter electro-motive force is thereby still further reduced. This motor, requiring a higher speed to produce a counter electro-motive force, equal to that of the second motor, takes the bulk of the work, and tends to drive the second motor as a generator, and the load is unequally divided between the different motors. It is practically impossible to make motors, running under the conditions mentioned, self controlled by adjustments affecting only their own circuits."

It is a fact in practice, and it has been one of great interest to me, that upon several occasions a street railway superintendent has actually removed one of the motors from a double motor equipment, and has reduced the destruction of armatures, in the neighborhood of 70 per cent.

The next point is economy in repairs, which needs but a passing comment. There are certainly less parts to wear, and if we can, as in a single large motor, run the motor at lower speed, the repairs will certainly be less in number and less in quantity. But when taken in connection

FIG. 5.

FIG. 4.

with the fact that when a single motor is used for car equipment, it is possible to mount that motor in an entirely different manner, and in a manner that is calculated to meet the special requirements of the case, as compared with that where two motors are in operation, it is possible to still further reduce the wear and tear. In the case of single motor per equipment, the motor may be elastically supported, and may be removed entirely from the sledge hammer concussion of the axle. The insulation, which is a large component of every motor, and which consists of cotton thread, something which cannot by any possibility stand the sledge hammer concussion, in this manner may be protected from the concussion and jar which is constantly going on in the axle.

The point which I wish especially to bring out, and I will try to be very brief in reference to it, is that where we have a single motor we are enabled to get a great deal more traction. The office of the motor on the car truck is for traction, it is placed there for the sole purpose of pulling the car about; and this result is accomplished through the adhesion of the wheels on the rails.

Now the friction not only varies with the pressure, irrespective of the surfaces, but also with the velocity; at zero velocity friction is very high. As the friction of quiescence disappears, the curve of friction doubtless comes down, and so along almost parallel, and at high speed it is supposed by some to rise as shown in Fig. 3. Now if this is not so I think it would be very difficult to explain one phenomenon which in Chicago we have excellent opportunity to observe.

It is a fact that the friction brake used in all the South Side cable lines is operated by what is known as the momentum brake system, the invention of Tom L. Johnson of Cleveland. Here a double friction phenomenon exists, one controlling the other. On one of the axles is a loose friction disk which is held up by a lever under the control of a gripman, against the rotating disk, fastened solidly upon the axle, and to the first disk is fastened the brake chain, which applies the other brake shoes to the periphery of the wheels. Now in this case we have the reverse of the old way of trying the experiment, by taking the resistance of the friction of quiescence and having it come down, as motion is given. It is often said that it is a poor rule that does not work both ways. In this brake system if the friction did go up it would be very apparent, much more so than in the ordinary application of brakes. Now what is the fact? When the brake is applied the velocity is very great as compared with the loose stationary disk, therefore we should expect to find the friction low, and we know that the initial reduction of the velocity of the car is not great. But as the train is brought to a standstill the curve of velocity drops off more and more quickly, and at last drops off very suddenly, and if one is standing hanging on the strap, as is usually the case, you feel your body, if you notice carefully, sway further and further, until at last when rest is attained by the car you give a sudden lurch ahead, showing that the resistance undoubtedly comes up, as we should expect it to do if our curve is correct.

When we speak of journal friction, the value of frictional quality is low as compared with adhesion, or the frictional phenomenon connected with adhesion. In the matter of adhesion on an ordinary sixteen foot street car, we have about 13,000 lbs. per square inch applied; whereas in an ordinary journal we have only from 900 to 1,600 lbs. per square inch, which is the highest journal friction in practice. But where we have such a severe application, where only a minute part of the surface is available, and where the wheel would tend to dig itself into or abrade the rail, where the velocity is different, the phenomenon which we know as adhesion takes place, we are enabled to know one point on that curve. For instance, we know that friction between chilled cast iron and ordinary soft steel rails is as high as 24 per cent., even after a slight motion is obtained. Furthermore, that by the application of silicates or sharp sand, it can be raised as high as 42 per cent., even after slipping has set in. The idea of adhesion is undoubtedly one of molecular gear. Suppose a wheel surface to be magnified very greatly. In this case we find that the surface is always more or less rough, and when we reduce it to a molecular surface, it must certainly be rough, as rudely shown in Fig. 4. In this case we have what may be termed a molecular gear, or gear and rack, and as they roll it might be said that the two mesh; this is known as the friction quiescence; we obtain the enormous pull that we observed in the high point of the curve. Now, then, why does the curve come down so rapidly? It seems to me that it may be readily explained by saying that the moment a slip takes place, and we can see by the curve that is the critical moment, these gear teeth are stripped off, and we have what approximates a surface left. We can almost illustrate it by an irregular line, moving the straight surface to the rear when the gear teeth have been stripped. See Fig. 5.

In my judgment this all goes to show that we must arrange our truck and our car equipment so that the first or initial slip will be prevented. It is a fact that has been observed that when a train is running double header, just as soon as the drivers of one locomotive commence to slip on a heavy grade the drivers on the other will immediately commence to slip, although it has no mechanical connection with it whatever. The tractive power, which was very high, and which was exerting itself upon the load tremendously, just as soon as the slip occurs, is reduced and all the load is thrown upon the other drivers, which are not equal to increased duty required. In the case of an eight wheeler the advantage exists in the fact that they are all coupled together and all must rotate in unison. When one driver, tends to slip, it is held back to its place by its rigid attachment to all the other seven that do not happen to tend to slip at the same instant. At the next instant it perhaps finds itself in rigid, direct contact, has its gear teeth in mesh and does not offer to slip, and may tend to hold back some other driver from slipping at that instant, and in that case the sum total of their tractive effects is held up high on the curve. They are held to the rail at the point of adhesion so that their tractive power is very much greater than it is where they are allowed to slip, in which case the tractive power comes down to merely a fraction of its possible value to a point generally denominated *friction*.

Single motor per car equipment admits of constructions rendering available the high tractive power secured by coupling the drivers.

I found further that gearing from such connections is far superior to side rod connections from the fact that lost motion in joints of the reciprocating parts tends to *start* the slip, bringing about a great reduction in tractive capacity.

Street Railway News.

Extensions and Improvements.

Ann Arbor, Mich.—The City Council have unanimously passed a franchise allowing the motor line between Ann Arbor and Ypsilanti to enter the city on the middle of Packard Street, thus overcoming the objections of the Supreme Court, mentioned in our last issue.

Atlanta, Ga.—The people of Marietta are now making an effort o raise sufficient money to induce the management of the Chattahoochee road to extend it to that place.

Baltimore, Md.—The Traction Co. have petitioned for the right to lay a second track upon a number of streets, including Saratoga and Cary, and a single track on Saratoga, Cary and Calhoun Streets.

The North Avenue Electric Railway Co. have petitioned for the right to extend their tracks on Lexington, Eden, McElderry and Bond Streets.

The First Branch City Council have granted the right to use electricity to the Central, or Crosstown Railway.

Boston, Mass.—The West End Street Railway Co. have petitioned for leave to construct tracks on Beverly Street, Warren Bridge, Warren Avenue, City Square, Park Street and Warren Street, and also on Main Street in the Charlestown District from City Square to the Somerville line.

Bradford, Mass.—The selectmen have unanimously granted the Haverhill & Groveland Street Railroad a location to the North Andover line, with the power to operate it by electricity. The Merrimac Valley road also has a location in North Andover to the Bradford line, thus making a continuous line from Methuen to West Newbury.

Brooklyn, N. Y.—The Atlantic Avenue Railroad Co. have purchased a plot of ground on the Gowanus canal for a power station. The site runs from the canal to Third Avenue and is bounded on one side by a small private lateral canal running to within 100 ft. of Third Avenue. The site, including half of Second Street, which is closed, is 635 ft. 9 ins. × 230 ft. in dimensions. There is at present a brick factory building upon it which will be utilized. Concerning the purchase, Mr. Richardson said: "There is hardly a site in the city better adapted for our purpose. We shall put up our power station directly on Gowanus canal. This will be most convenient in taking coal, as it can be directly transferred from the canal boats into the bunks. The details of the power station are not completed, and I cannot tell how much that will cost. It will start in with a capacity of 1,500 H. P. This will be increased, if necessary, to 6,000 H. P."

The Brooklyn City Railroad Co. are making preparations for the extension of their Meeker Avenue line to New Calvary and intend to have the cars running by Decoration Day.

Buffalo, N. Y.—The extension of the electric system of the Buffalo Street Railway Co. out Main Street will be begun as soon as the frost is out of the ground. The Elmwood line will, probably, be equipped soon afterwards.

Canandaigua, N. Y.—The town authorities have been asked for overhead rights by the street railway company.

Canton, O.—The construction of a line on Dueber Avenue has been suggested.

Chicago, Ill.—The South Chicago City Railway Co., under a charter obtained in 1891, will extend their tracks from Ninety-second Street, north on Commercial Avenue and also north on Buffalo Avenue to Seventy-ninth Street, where the two lines converge, and thence north to the southeast entrance on Jackson Park, so that they can deliver passengers at the Forestry Building and Lake Shore for the World's Fair. The above line will be double tracked and also that south of Ninety-second Street, to 106 Street and both sides of the Calumet River, with seventy-five pound girder rail, making altogether about twenty-two miles of single track or eleven miles of street. The motive power will probably be steam, after designs which render the motors noiseless and smokeless. It is expected that this extension will be in operation by July of this year.

Cleveland, O.—The Collamer branch of the East Cleveland Street Railway Co. will be extended to Collinswood.

The West Side Street Railway Co. may erect their power house on Gordon Avenue The work of putting in electricity as motive power will be commenced as soon as the frost is out of the ground. Eight miles of track will have to be relaid, chiefly on Lorain and Detroit Streets, but it is expected that everything will be in readiness to run motor cars by September.

The extension of the East Cleveland Railroad to the village of Collinwood will be built this spring.

Clinton, Mass.—The Clinton selectmen have granted a conditional franchise to the Clinton Street Railway Co. The route, as approved by the franchise, extends over North Main, Water, Union, Chestnut, and other streets. The franchise states that a majority of directors of the road shall be inhabitants of Clinton, and that the corporation shall run its cars as often as the board of selectmen shall determine from time to time. A corporation bond of $5,000 must be given the board before any move is made toward building.

Concord, N. H.—It is understood that the owners of the Concord electric road are already contemplating the extension of their line southward to Garvin's Falls, in case the power there is developed according to the proposed plans.

Denver, Colo.—The City Cable Co. have obtained a permit to grade Curtis, Eleventh and South Eleventh Streets. Work is to be commenced at once and will be pushed with all possible rapidity so that the road may be opened for traffic this summer.

Dubuque, Ia.—J. A. Rhomberg last month bought Mrs. J. J. Linehan's half interest in the Dubuque Street Railway Co., for $142,000. This interest was transferred to a syndicate of leading citizens. The company was reorganized and the directory was enlarged by the addition of several names. A contract for eighteen car equipments has been given to the Detroit Electric Works and the installation of the overhead system will be pushed rapidly forward.

Duluth, Minn.—The street railway company propose to build a line down Garfield Avenue to connect with the Superior Street line. The Douglass County Street Railway Co., of West Superior, will build on the Wisconsin side. It is said a bridge will be thrown across the river at this point, connecting Duluth and West Superior by an electric street railway.

Elizabeth, N. J.—The New Jersey Traction Co. have applied to the City Council for power to extend their line from Jefferson Avenue, through North Avenue to Newark Avenue and along this thoroughfare to the boundary line of Clinton Township in Essex Country.

Eureka Springs, Ark.—The Eureka Springs Electric Light & Street Railway Co., have decided to equip their line with electric power.

Evansville, Ind.—The Evansville Street Railway Co. have been reorganized, and improvements will be made looking, it is said, to the investment of $500,000. Electricity will be substituted for mule power. The officers are: Pres., John J. Shiphard; Vice-Pres., George H. Stockwell; Treas., Thomas S. Krutz; Sec., H. D. Moran. The engineers are Barry & McTighe of New York,

Fall River, Mass.—The Globe Street Railway is to be entirely reconstructed, and the trolley system put in, and by July 1 the road will be in full running order. Three miles of track will be built, a new power house will be erected, and fifty new cars will be put on the road, and the service will be doubled.

Ft. Wayne, Ind.—The City Council has adopted an ordinance granting the street railway company the privilege of using electricity as a motive power. It is provided that work shall begin within four months, and shall be completed within a year.

Grand Island, Neb.—The Grand Island Street Railway Co. are considering the adoption of electric power. O. B. Thomson, secretary, in behalf of the company recently made visits to different electric lines to investigate the merits of the different systems.

Hampton, Va.—About one and one-quarter miles of street railway, to be operated by horses, will be constructed by the East Hampton Development Co.

Harrisburg, Pa.—The Passenger Street Railway Co. have asked permission to extend on certain streets.

Holbrook, Mass.—A meeting of citizens last month voted in favor of granting a franchise to build an electric road from the Brockton line to the Braintree line, through Franklin Street, to the directors of the Brockton Street Railway Co. The company will give bonds to build the road by or before January 1, 1893. The selectmen are in favor of the road, and the franchise will probably be granted.

Houston, Tex.—The Houston City Street Railway Co. have petitioned for privilege to extend their lines over several streets.

Indianapolis, Ind.—By the terms of a recent order made by the county commissioners the Broad Ripple Rapid Transit Co. were given the right of way over Central Avenue, and Washington Boulevard or Alabama Street was left for the Citizens' company. The conditions of the franchise are that on or before March the Broad Ripple company shall exhibit a contract for the building of the road, and shall deposit a certified check for $10,000, guaranteeing the faithful performance of the work. The line must be completed to Broad Ripple by September 1, 1892. The contract binds the Broad Ripple company to allow the Citizens' company to run cars over the tracks on Central Avenue from the city limits to Thirtieth Street. Ex-president Shaffer, of the Citizens' company, will be resident manager, and will be backed by New York capitalists, of whom R. L. Belknap is said to be at the head.

Jefferson, Ind.—It is extremely probable that the street cars will be operated by electricity in the near future.

Kalamazoo, Mich.—The Kalamazoo City & County Street Railway Co. propose extending their line to the asylum.

Kansas City, Mo.—The Kansas City Cable Co. will soon have a new cable for the Troost Avenue line. The rope is being manufactured by the Hazard Manufacturing Co., of Wilkesbarre, Pa., and will be 33,550 ft. long, one and a quarter inches in diameter and weigh 91,697 lbs. This rope will be put in on the Troost line in April, about the same time that the one recently imported from England will be laid in the main line of the road.

It is said that the plans already mentioned for effecting the transformation of the elevated road or interstate rapid transit railway into an electric line have already been prepared and accepted. Also that the contract for the electrical equipment has been let, and that actual work will be begun as soon as possible. The Jarvis-Conklin Mortgage Trust Co. are interested.

Kennebec, Me.—There is on foot a plan to build an electric railroad from this village to Madison.

Kokomo, Ind.—The machinery at the power station of the street railway company will be largely added to shortly.

Lafayette, Ind.—The line of the Lafayette Street Railway Co. has been relaid with fifty-six pound T rail. More cars will be added soon, and several extensions of line will probably be made. The road is reported to be doing a very good business, and the outlook is favorable.

Lancaster, Pa.—The Lancaster City Street Railway Co. have been granted the right by the City Council to extend over certain streets, conditioned upon paying annually to the city fifty cents on every pole which may be erected, and $5 for every car which they may operate.

The Common Council have also granted the West End Railway Co. the privilege of laying tracks on Marietta Avenue, from College Avenue to the city limits.

Leavenworth, Kan.—Warren F. Putnam, president of the National Granite bank of Exeter, N. H., and principal owner of Leavenworth's horse street railroad, was in Leavenworth last month and stated it as his intention to convert the line into an electric road.

Lebanon, Pa.—An ordinance has been recently passed by the Common Council authorizing the Lebanon & Annville Street Railway Co. to extend their road upon certain streets of the city.

Leominister, Mass.—The legislative committee has reported aeorably the bill authorizing the consolidation of the Leominister and Fitchburg street railway companies. The construction of the line to Fitchburg will probably begin now very soon.

Lexington, Ky.—The Passenger & Belt Line Railway contemplate adding one motor car and one and one-half miles of track this year. The company built last year two and three-quarters miles of track.

Lima, O.—Since the purchase of the Lima Street Railway by Amos E. Townsend, Pittsburgh, Wm. M. Brown, Newcastle, Pa., W. W. Hazzard, of Cleveland, O., and W. R. Kimball, of Cincinnati, O., $75,000 to $100,000 will be expended in the reconstruction and re-equipping with the Thomson-Houston system in place of the VanDepoele apparatus. The new company also will increase the number of cars from ten to fifteen.

Logansport, Ind.—A two mile extension will be built this spring. Four cars are now run, but double that number will be operated when the extension is complete.

Lincoln, Neb.—Vice-President Upham of the Lincoln Street Railway Co., has just closed a contract for 200 electric motors, with the Westinghouse Electric & Manufacturing Co. for the sum of $218,000.

Louisville, Ky.—At the annual meeting of the stockholders of the Louisville Railway Co., held a few weeks ago, a large sum was appropriated for the purpose of further extending the electric lines. It was left to the discretion of the Board of Directors what lines should be equipped.

Lowell, Mass.—Workmen of the Lowell & Suburban Street Railway Co. will soon begin to erect poles on Central and Gorham Streets and string wires for electric cars. If the petition is granted by the Dracut selectmen, double tracks will be laid at once to Lakeview. After the Lakeview route is completed it is intended to have electric cars pass through Merrimack, Central and Gorham Streets.

THE selectmen of Chelmsford have given to the Lowell & Suburban Street Railroad Co. authority to extend double tracks to the centre and north villages of that town, and similar permission has been granted by the selectmen of Dracut, the extension to be made in connection with the equipment of the road with electric power on all their tracks in Lowell.

Lynn, Mass.—The Lynn & Boston Street Railroad Co. have petitioned the selectmen of Saugus for permission to run electric cars in that town over existing lines of track, and for leave to equip the lines with electric power, to erect poles for the same, etc.

Macon, Ga.—Messrs. Mitchell & Harris, the owners of the Metropolitan Street Railroad, state that it is to be completed at once. It is also said that a bond has been given to complete the road within ninety days.

Manchester, N. H.—At a special meeting of street railway directors, held last month, it was voted that a committee consisting of Messrs. Williams, Bartlett and Stevens be authorized to procure surveys and estimates of costs extension of the road and to investigate as to the best system of motive power.

Manchester, Va.—The Richmond & Manchester Railway Co. have contracted for the construction of an electric street railway up Hull Street. This will give two lines to Forest Hill Park. Work will be commenced soon.

Milwaukee, Wis.—In response to a call from a committee of the Merchants' Association and certain property owners in North Greenfield, Henry C. Payne has agreed to extend his line from the Soldiers' Home to the State Fair grounds, providing the citizens would erect a separate power house at the end of the present track.

Montreal, P. Q.—W. S. Walker, F. B. McNamee, Wm. Mann, W. J. Withall and F. Thom, shareholders in the Mount Royal Park Incline Co., have petitioned for the privilege of constructing a railway to connect the present mountain elevator with the city street railway system. Also to construct another line eastwards to the corner of Papineau Avenue and Craig by way of Duluth Avenue, Amherst Street, Rachel and Papineau Road to Craig Street. These roads to be double tracked and electric power to be used. Should this application be granted, the intention is to construct the road at an early date.

ROBERT COWANS and R. A. Mainwaring have also petitioned for a route in the municipality of St. Louis du Mile End on Park Avenue and other streets for an electric surface road, also that they may have the privilege of running over the car tracks of the Montreal Street Railway Co. on Bleury from St. Catherine to Craig.

Natick, Mass.—The Natick Electric Street Railway Co. have asked permission to lay tracks, erect poles, wires, etc., on Mill Street, from Pond to West Central, at this point connecting with the location already granted.

Niagara Falls, N.Y.—The Niagara Falls & Suspension Bridge Street Railway Co. will equip their road with electric motors, and will expend $150,000 in improvements.

Neenah, Wis.—C. C. Garland, of Minneapolis, has purchased the plant, franchise and good will of the Neenah & Menasha Street Railway, and will change the same to an electric line. The consideration is said to be about $30,000.

New Orleans, La.—C. V. Haile and W. U. Rosenthal, the committee of the Carrolton Railroad Co., appointed to visit other cities to inspect the different electric systems, have returned from an extensive investigating tour, and state that they are fully satisfied with the rusults attained by electric power.

Newark, N. J.—The Newark Passenger Railway Co. will begin in a short time to equip the Broad Street line with electricity. The company have received a petition from Eighth ward citizens, asking for the early equipment of the Mount Prospect Avenue line, and another from the West End people, asking that something be done on the Bergen Street line. Cars will run by electricity over the present Bloomfield route to Broad Street.

THE Traction company have made application to the Street and Water Board for permission to construct and operate a double track railroad in Frelinghuysen Avenue from Miller Street to the line of Clinton township. The petition was signed by President Thomas C. Barr. This is believed to be the proposed direct electric route to Elizabeth.

Newark, O.—An ordinance has been asked by the Newark City Railway Co., to construct and operate an electric railroad from and along other streets to the corporation limits.

Newburgh, N. Y.—The conversion of the street railway into an electric road is probable. The power to run dynamos will be furnished by utilizing the falls in the Rondout Creek at Eddyville, two and a half miles distant.

Newburyport, Mass.—The Newburyport & Amesbury Electric Railroad Co. are contemplating improving their plant. They will put new cars on the High Street branch. The power at the electric station will also be increased by the addition of a new engine and boiler.

Oakland, Cal.—A number of important street railway improvements are projected or being carried out here, as follows: The Consolidated Piedmont Cable Co. have begun work on several miles of cable extensions. The managers of the Berkeley electric road have begun several miles of crosstown road, and are completing their cemetery extension. The Pacific Improvement Co. are ready to construct their electric road to Berkeley out Telegraph Avenue. The Sessions-Vandercook Electric Road to East Oakland, and the electric road to Haywards are approaching completion, and Theodore Meetz has promised electrical connection with Alameda.

IT has been decided to commence work at once on the Fourteenth street road of the Piedmont Cable Co.

THE Oakland Consolidated Electric Railway Co. will soon begin the construction of a branch line from Thirteenth and Franklin Streets to East Oakland.

Omaha, Neb.—The Dundee Land Co. propose to equip their street car line to Dundee Place with electric cars, and have petitioned for a franchise. The present horse car line to Dundee was built under an ordinance passed several years ago to the Metropolitan Cable Railway Co.

Philadelphia, Pa.—The seven ordinances presented by the Philadelphia Traction Co. to the railroad committee of City Councils, cover nearly all of the territory occupied by the Traction company east of the Schuylkill river. Market, Chestnut and Walnut Streets are not included. The plan is to bring passengers from the northeast, northwest, southwest and West Philadelphia to the centre of the city by electricity. The West Philadelphia franchise has already been secured, but, as it will not allow the cars to come east of the river, passengers will be transferred to cable cars.

IT is reported that the Philadelphia Traction Co. will introduce the trolley system on the Darby branch.

Pittsburgh, Pa.—It has been officially stated that the Duquesne Traction Co. will extend their line farther out in the suburbs of the East End.

Providence, R. I.—The petition of the Union Railroad Co. to lay additional rails and string wires in East Providence, which has been before the Council of that town since last November, has been granted, on condition that any other company, in the discretion of the Council, will have the privilege of using the rails and wires.

Quincy, Mass.—The Quincy & Boston Street Railway Co. have petitioned for right to extend their tracks to North Weymouth, North and South Braintree, East Milton, etc.

St. Louis, Mo.—The Hamilton street railroad syndicate have begun the work of converting their line on South Seventh Street into an electric line.

Salt Lake City, Utah.—The Salt Lake City Railway Co. will soon extend a line north as far as the Hot Springs. It is proposed to extend the First South Street line west to Ninth West, thence north to Ninth North, then one block west to Mitchell, thence north through the Kinney & Gourlay addition to Kinney's North Salt Lake plat, lately filed. This will make the extension two miles long, and then it is only a mile or so to go to the Hot Springs, to which point the road will build at a later date.

San Francisco, Cal.—The Geary Street, Park & Ocean Railroad Co. are making active preparations for beginning the work of extending the cable to Golden Gate Park. Contracts have already been let for the construction of the road, and the iron, rock and cement to be used is being hauled along the line of the proposed extension. Work will be commenced at both ends of the line, as it is the intention to reconstruct the roadbed of the cable line now in operation and to narrow the gauge to conform with that of the Market Street system.

THE Sutter Street Cable Railway Co. propose to extend the Polk Street cable line to Fort Mason, and the Pacific Avenue branch from Devisadero to Central Avenue. The estimated cost is about $250,000.

Savannah, Ga.—A contract has been made with L. H. McIntire to equip the city and suburban railway with an electric system. Thomson-Houston motors will be used. Sixteen cars will be operated.

Application has been made by Captain Johnston of the coast line road, to equip the line with an electric system.

Seattle, Wash.—It is understood that Fred. E. Sander contemplates extending the Grant Street electric railway gradually along the Duwamish and White river valleys until it reaches Tacoma. A fifty-six pound rail set in a chair is being used.

Spokane, Wash.—The steam motor road is to be converted into an electric railway.

Steelton, Pa.—The Citizens' Electric Passenger Railway Co. are considering the project of constructing a road from Harrisburg to Oberlin.

Superior, Wis.—The directors of the Douglas County Street Railway Co. have voted $200,000, to be used in improvements by the company at once. A new brick car house will probably be erected this spring.

Terre Haute, Ind.—The street railway line will probably be soon extended to Brazil.

Toledo, O.—The Consolidated road will soon begin the construction of a belt line, which will take in Monroe Street, Auburn, Central and Collingwood Avenues, Adams and Summit Streets. This will do away with the horse cars on the Adams and Monroe Street lines and almost complete the electric railway service in Toledo.

Troy, N. Y.—The electric line between Troy and Albia will be completed and in operation in the latter part of June, or the first part of July.

Washington, Pa.—If the company receive proper encouragement from property owners, the Electric Street Railway Co. will extend their line eastward on the National Pike.

Waterville, Me.—The work necessary to convert the street railway into an electric road, will be commenced at once.

Woburn, Mass.—The East Middlesex Street Railway Co. will equip electrically the Woburn section of their systems. The Woburn Electric Light Co. have contracted with officials of the East Middlesex and North Woburn Street Railway companies to furnish necessary power to operate the systems. The power will be ready as soon as the street railway people can make use of it. In case there is no opposition, the cars of the East Middlesex line will be run by electricity early in the summer.

New Roads.

Akron, O.—By the first of June, it is now confidentially announced, Akron will be connected with Cuyahoga Falls and Silver Lake by an electric railway. The promoters of the project are W. J. Price, of Chicago; J. A. Long, of Akron, and E. L. Babcock and T. T. Walsh, of Cuyahoga Falls.

Allegheny, Pa.—The Millvale, Etna & Sharpsburgh Street Railway Co., capital $300,000, was chartered last month. The president is J. N. Davidson, and the directors are John H. Dalzell, Joshua Rhodes, George B. Hill and G. W. Henderson. The line will be in harmony with the Manchester system. It will be a single track, twelve miles long, and it will connect Allegheny with Millvale, Etna and Sharpsburgh.

Americus, Ga.—W. E. Staley, J. H. Starbuck and W. K. Wheatley, of Americus, state that Americus' street car system will soon be in active operation.

Anna, Ill.—The Anna, Jonesboro & Asylum Electric Street Railway Co. have been incorporated with a capital stock of $75,000. The incorporators are John H. Spann, John W. Hess, John H. Mitchell and Alexander J. Nisbet.

Annapolis, Md.—Robert Baldwin, John S. Lusk, William R. Cole, and Harry W. Rusk have filed a certificate of incorporation of the Baltimore, Canton & Point Breeze Railway Co. The capital stock is $10,000.

Bartow, Fla.—The Bartow & Plant City Railway Co., have filed articles of incorporation. The capital stock is $220,000. The road will be about twenty-two miles in length. The officers are: J. H. Tatum, president; B. B. Tatum, secretary and treasurer.

Beaver Falls, Pa.—At a recent meeting of the People's Electric Street Railway Co., a committee was appointed to select ground for and ascertain the cost of a power plant, as well as to get estimates on cost of constructing the road from Beaver to Conway. It was decided to begin operations April 1.

The Beaver & Vanport Street Railway Co., capital $15,000, was chartered lately. The length of this road will be two miles, and it will extend from the east side of Buffalo Street, in the Borough of Beaver, to and through the village of Vanport. President, A. O. Meyers; secretary, M. B. Sloan; treasurer, Wm. Wallace.

Belleville, Ill.—Articles of incorporation have been filed of the Belleville & St. Louis Electric Railway Co. The object is to construct an electric railway from Belleville to a point on the Mississippi river in East St. Louis. The principal business office is to be at East St. Louis, the capital stock $200,000, and the first board of directors are George W. Atterbury and John D. Filley, of St. Louis, Mo.; John J. McLean, of Hillsboro, Ill., and others.

Bethlehem, Pa.—A charter has been granted for the South Bethlehem & Saucan Street Railway.

Bryan, Tex.—Guy M. Bryan, Jr., Fred. S. Robbins and S. P. Bryan have procured a charter for an electric railway to be built from Velasco to Bryan Heights, two miles distance.

Buffalo, N. Y.—Articles of incorporation of the Buffalo & Lancaster Electric Railway Co., to build a street railway between Buffalo and Lancaster have been filed in the office of Secretary of State Rice by William J. Volkner, of Buffalo. The capital stock is $200,000, and the directors include George M. Browne, George Bingham, Daniel O'Grady, George A. Davis and John H. Slack. Tracks will be laid covering a distance of twenty miles.

Another company called the Buffalo, Bellevue & Lancaster Railway Co., have also been organized. The capital stock is $90,000, and the directors for the first year are Henry W. Box, James A. Roberts, John C. Conway, John L. Williams, Hardin H. Littell, John N. Scatcherd, Daniel O'Day, all of Buffalo. The road will probably be operated in connection with either the Broadway, Clinton or William Street cars, and will be seven miles long.

The New York Central Railroad Co. have purchased land between Buffalo and Lancaster for repair shops and will found the town of Depew. An electric railway will probably then be built connecting with Buffalo.

Centreville, Ia.—The mining towns of Centreville, Mystic and Forbush are to be connected by an electric car line. An Eastern syndicate have interested themselves in the project, and the citizens of this place, to encourage the scheme, have raised sufficient funds to secure a survey and plan of the proposed route.

Chicago, Ill.—The Northern & Western Elevated Railroad Co. have been incorporated at Chicago to construct an elevated railroad in Chicago from the intersection of Halsted and Thirty-ninth Streets to the intersection of Irving Boulevard and Milwaukee Avenue; capital stock, $10,000,000; incorporators, Leander D. Condee, John A. Rose and Oscar S. Bass.

The Chicago & Edison Park Electric & Street Railway Co., capital stock, $500,000 have been incorporated to build and operate street railways embraced in the vicinity of the towns of Lake, Calumet, Hyde Park, South, North and West Chicago, Lake View, Evanston, Norwood, Maine, Cicero, Jefferson, etc.; N. H. Hanchette, 173 LaSalle Street, Chicago, Ill. is one of the promoters of the enterprise.

The Park Elevated Railway Co. has been incorporated; capital stock, $50,000; incorporators, Henry W. Magee, John T. Condon and Samuel H. McLaughlin.

The Lakeside Dummy Railroad Co. have been incorporated with capital stock of $1,000,000 by Eugene H. Dupee, Lockwood Honore and Arthur A. Bliss.

The West Side Elevated Railroad Co. have been incorporated with a capital of $15,000,000. The company propose to build an elevated road on the West Side. The stockholders include many of those interested in the elevated road on the South Side. The scheme, as proposed, includes a trunk line with two branches. The form of construction agreed upon is identical with that of the South Side company, which was shown in February number of the Street Railway Journal.

Clinton, Mass.—The Clinton Street Railway Co. last month received their long expected franchise from the board of selectmen.

Columbus, O.—M. H. Neil president, and G. W. Meeker secretary of the Columbus & Westerville Railway Co. have asked for a franchise between this city and Westerville.

The Leonard Avenue Street Railway Co. have been organized to operate a street railway by electric, gas, steam, horse or other motive power. Among those interested in the project is Thomas Leonard, of Columbus.

Papers have been prepared for the incorporation of the Columbus & Grand View circuit of the electric street railway system of the city. The purpose is to run one line from Fifth and Grand View Avenues down Third Avenue to Neil and connect there with the Consolidated line. Another branch of the circuit will start from the same point, come down Grand View Avenue and across the projected bridge over the Scioto and thence along Central Avenue to Broad Street and connect with the West Side road there.

Concord, N. H.—There is a rumor that a syndicate of capitalists of large means have under consideration a scheme for establishing an independent electric railroad from Concord to Boston. The project includes the taking of the local railway plants in this city, Manchester, Nashua and Lowell, and the building of such links as will make the contemplated through line. It is further stated that the efforts now being made to secure the construction of an electric line from Lowell to Nashua is a part of the programme.

Dennison, O.—There is talk about a street railway between Dennison and Uhrichsville, connecting the Pan Handle station at Dennison with the Union station of the P., C., C. & St. L. and C. L. & W. railways at West Uhrichsville. Pittsburgh parties are working the matter up, and if a franchise is granted the road will undoubtedly be built this summer.

Detroit, Mich.—It is proposed to give a bonus of $25,000 to the owners of what is known as the North Detroit Street Railway Co. to build a line this year. The company has no corporate existence. The franchise known under its name is owned by William Livingstone, Jr., George H. Russel and Thomas H. Baskerville. It is a franchise for a street railway to run from the junction of Woodward Avenue and Pallister Avenue to North Detroit.

East St. Louis Ill.—The Columbian Underground Electric Traction Co. of East St. Louis have been incorporated with a capital of $1,000,000. The incorporators are D. J. Murname, George L. Van Beek and Stephen Von Puhl.

Ellicott City, Md.—A new road to connect with the Baltimore Traction Co.'s system is projected.

Fond du Lac, Minn.—The Fond du Lac Electric Co. have been organized with a capital stock of $100,000 to operate an electric railway. Coleman Sutherland & Hines of Fond du Lac are interested in the enterprise.

Gloversville, N.Y.—The Cayadutta Electric Railroad Co. were incorporated last month, with a capital of $120,000 to build a street road from Gloversville to Fonda, twelve miles. The directors are Thomas C. Frenyear and C. R. Huntley, Buffalo; A. N. Broadhead, Jamestown; Everett Smith and Charles M. Gibson, Schenectady; G. Levor, A. J. Zimmer and James S. Burr, Gloversville; C. E. Arnold, Albany; Harwood Dudley, Johnstown and J. Ledlie Hees, Fonda, each of whom subscribes for ten shares of the capital stock. The officers for the first year are: President, Everett Smith; first vice-president, C. H. Huntley; second vice-president, A. J. Zimmer; treasurer, J. Ledlie Hees; secretary, Thomas C. Frenyear.

Grand Forks, N. Dak.—C. F. Erroll, of St. Paul, is largely interested in the Grand Forks Electric Railway Co., who propose the installation of a road here. The conditions of the ordinance passed by the Council require the acceptance of its conditions within ninety days, construction to commence ninety days thereafter and one mile to be completed six months later.

Grand Rapids, Mich.—Percy T. Cook has presented to the Council a petition asking for a franchise for a new street railway. The contemplated line commences at the corner of Hall and South Ionia Streets and reaches the centre of the city. Mr. Cook agrees to pay to the city treasurer in each year one and a half per cent. of the gross receipts from said road in lieu of all taxes, assessments and license fees and also to transfer a certain proportion of the earnings over ten per cent.

Harrisonburg, Va.—The Harrisonburg & Bridgewater Electric Railway Co. have been organized; the incorporators are Rivers Talum, E. A. Saunder, W. J. Johnson of Richmond.

Huntington, W. Va.—An electric railway between this place and Ashland, Ky., is proposed. Among those interested are: T. N. Fordyce, of Detroit, Mich., J. H. Sentz, of Spring Hill, W. Va., and T. E. Stout, of Huntington.

Hyde Park, Mass.—The Norfolk & Suffolk Street Railway Co. in which Hon. Moody Merrill, C. G. Chick and J. E. Cotter are interested will probably begin roadbed construction soon.

Jonesboro, Ind.—Work on the Jonesboro & Marion Street Railway will begin as soon as the state of the weather will permit, and by the employment of a large number of men, the company expect to have the cars in operation by July next. Frank E. Snow and William E. Avery, of Detroit, Mich., are the principal owners of the proposed road.

Kenosha, Wis.—John W. Munson has been granted a franchise to build an electric street railway in the city of Kenosha. Work will be commenced as soon as he can secure the consent of the property owners on streets where the road will run.

Keokuk, Ia.—John S. Wise and J. H. Herrick, both of the Edison General Electric Co. of New York, James H. Anderson, James C. Davis and Asaph Buck are the incorporators of a new road called the Keokuk Electric Street Railway. Twenty years is the life of the corporation, and the capital stock is $200,000.

Kingsley, Pa.—The meeting of prominent citizens was lately held to take steps for the building of an electric road from this place to Harford. Mr. Horace Sweet was chairman and Messrs. L. W. Moore and W. B. Guile were appointed a committee to make inquiries.

Kingston, N. Y.—The early building of the proposed electric railroad here is said to be almost assured. The Thomson-Houston Electric Co. will probably furnish the motors, and the Manhattan Trust Co. will furnish the capital. It is also said that the franchise of the Kingston City Horse Railroad Co. will be purchased for $175,000.

Lansdale, Pa.—The originators of the proposed electric road from Lansdale to Harleysville are said to be Lyman Rosenberger and Manassa Clemens. Henry S. Kriebel of North Wales is also an earnest supporter of the enterprise.

Leavenworth, Kan.—A Leavenworth company has been chartered, for the purpose of building and operating an electric street railway between the city and Fort Leavenworth. The estimated length of the line is fifteen miles, and the capital stock $300,000. The directors are Geo. A. Baker, J. C. Lysle, Geo. Burrows, Laurens Hawn, and William Dill, of Leavenworth; W. F. Putnam, Exeter, N. H.; W. A. Patten, Kingston, N. H.

Lenape, Pa.—J. Clempson Sharpless is interested in a proposed electric line here, and has had a survey made for a line from Lenape to Unionville.

Lewiston, Pa.—Among the probabilities spoken of is an electric railroad from this place to Logan.

Lima, O.—W. L. Parmenter, Wilbur Fisk, Thos. Duffield, Theo. D. Robb and F. Langan have applied to the city asking permission to construct two street railway routes, one on North Main Street, the other from the intersection of Tanner and Wayne Streets, to the depot of Pittsburgh, Fort Wayne & Chicago Railroad.

Los Angeles, Cal.—An electric railroad to connect the Julian County and Warner's ranch with Los Angeles is being agitated. The road, if built, will probably have a branch from Santa Ysabel to Warner's to connect with the Temecula route.

Marion, Ind.—Papers have been drawn up for the incorporation of the Marion Electric Railway, Light & Power Co. with a capital stock of $100,000. The incorporators are Dan Babst, Jr., C. H. Norris, W. E. Scofield, E. Huber and D. A. Frank.

Marseilles, Ill.—The Marseilles Electric Street Railway Co. have been organized with $12,000 capital stock. Incorporators are Frank Montgomery, Richard Hughes, and A. J. Gum.

Marquette, Mich.—The Negaunee & Ishpeming Electric Street Railway will be extended to Marquette.

McKeesport, Pa.—An electric street railway is to be built parallel with the Baltimore & Ohio railroad from Boston to Elrods, thence to Christy Park and McKeesport, a distance of about three miles. The line is assured, as several capitalists from this section and others from Pittsburgh, are interested.

Memphis, Tenn.—The Raleigh Railroad Co. and the Citizens' Street Railway Co. both wish to lay tracks on Front Street from West Court Street north.

Millbury, Mass.—The selectmen have received two petitions for an electric railroad from Worcester to Millbury. The first one is from the Consolidated Street Railroad, of Worcester; the other is from H. W. Aiken, Esq., Samuel Winslow, L. L. Whitney, C. D. Morse and others, in behalf of the Worcester & Millbury Electric Railway Co.

Montclair, N. J.—The Montclair & East Orange Street Railway Co. have been incorporated. The road will be two miles long. The capital stock is $25,000. The incorporators are Morris Leeking of East Orange, Thomas Nevins, Josiah O. Ward of Orange; Augustus C. Studer, William Jacobus of Montclair, and Francis M. Eppley of East Orange.

New Albany, Ind,—The Glenview Park Railroad Co. were organized March 4, with a capital of $50,000. The officers are: Jonathan Peters, president; John Crane, vice-president; R. W. Morris, treasurer; E. B. Stosenburg, secretary. The road is to run through State Street to Glenview Park, and will be two miles long and operated by electricity. It will be completed by July 1.

New Britain, Conn.—There is a movement on foot here to organize a stock company for the purpose of running an electric railroad to Bristol.

New York, N. Y.—A bill has been introduced in the assembly permitting the use of Fifth Avenue below Forty-second Street for a street railroad.

An electric street railroad to connect Harlem with City Island has been projected. It is proposed to build a bridge across the mouth of Pelham Bay from Belden Point, City Island, to Locust Point, Messrs. Duryee, Belden and Piepgrass, wealthy residents along the proposed line, are, it is said, pushing the matter.

Newburyport, Mass.—A petition is being circulated asking the legislature for a charter to establish a street railroad from the terminus of the Newburyport & Amesbury Railroad to Haverhill & Groveland Street Railroad.

Niagara Falls, N. Y.—Work on the electric road on the Canadian side will be begun as soon as frost is out of the ground. It is said that the Canadian Pacific Railway is backing the enterprise.

Niagara Falls, Ont.—A bill has been presented to the Ontario Legislature to incorporate the Niagara Falls Park & Queenston Electric Railway & Steamboat Co. The company consists of E. B. Osler, Herbert Carlyle Hammond, both of Toronto; William Hendrie Hamilton and Richard Bladworth Angus of Montreal. The proposed route is through Niagara, Queenston, Queen Victoria Park, Chippewa and Fort Erie. The capital stock of the company is $1,000,000.

J. M. Brinker, of Buffalo, is one of the incorporators of the Niagara Falls & Queenston Railway Co. who propose building a steam or electric railway to Queenston. A bridge franchise across the river is included in the scheme.

Niles, O.—The Mineral Ridge & Niles Electric Street Railway Co., with a capital stock of $50,000,000, have been incorporated by C. F. Whitney, W. W. Rosensteel, Edward Blunt E. J. Ohl and W. T. Williams, of Warren, O., and George Reeves and J. S. Benedict of Niles.

Norfolk, Va.—The City Council have two petitions for street railway franchises before them. One is from the People's Railway Co., and is signed by W. A. Young, M. Glennan, Walter Sharp, P. L. Poindexter, L. D. Smith and Charles Sharp; the other is from the Rapid Transit & Improvement Co., and is signed by F. L. Grandy, their president.

Oxford, Pa.—A citizens' meeting was lately held to further the proposed electric railroad from Oxford via Russellville and Cochranville to Parkersburgh, a distance of fourteen miles. Encouraging addresses were also made by S. R. Dickey, president of the National Bank of Oxford, Dr. J. Willis Houston, Chester Martindale and others. A resolution was adopted pledging the movement hearty support.

Pekin, Ill.—The Pekin Street Railway Co. have been incorporated with a capital stock of $10,000; incorporators, Adolph Fehrman, Otto Koch and Freiderich Schnellbacher.

Philadelphia, Pa.—Last month a new company was incorporated under the title of the Philadelphia Rapid Transit Co., Philadelphia; capital, $300,000. Directors, Edward E. Denniston, Alfred Parrish, John P. Ilsley, Edmund A. Hopkins, William S. Harding, Philadelphia.

Pittsburgh, Pa.—It is said that the Mt. Washington electric road will be built before summer.

Pottsville, Pa.—The time allowed the Schuylkill Electric Railway Co. for installing their road has been extended to March 4, 1893.

Another new electric railway has been chartered here, entitled the Pottsville & Minersville Electric Railway Co. The capital is $100,000, and the projectors are ex-Congressman Charles N. Brumm, John F. Finney, D. D. Phillips and others connected with the Shenandoah, Ashland & Mahanoy City road. The road will be built by a circuitous route between here and Minersville. It will take in the greater part of Mahantongo Street, going down to Railroad.

Reading, Pa.—A charter has been granted to the Reading & Temple Electric Railway Co.; capital, $30.000. The directors include John A. Rigg, Matthias Moyer, F. S. Livingood and W. K. Leaman, all of Reading. The line will be five miles in length, through a number of suburban villages to the north of the city.

At a meeting of the Berks & Dauphin Turnpike Co. at Myerstown, it was decided to apply for a charter for the reconstruction of an electric railway from Reading to Lebanon. A committee on subscriptions consists of George W. Donges, Capt. J. H. Bassler and Joseph Coover.

Redlands, Cal.—The petition of I. N. Hoag and others, for a street railway franchise, mentioned in our last issue, has been granted. The franchise provides that the road shall be put in operation within eighteen months.

Roanoke, Va.—A charter has been granted to the Crystal Street Railway Co.

Rockland, Me.—Shaw & Ferguson, of Boston, have been awarded the contract for building the electric road. The Thomson-Houston company will furnish the motors, the Westinghouse company the generator and the Briggs Car Co. of Amesbury, Mass., the car equipment.

St. Louis, Mo.—It is reported that the St. Louis & Kirkwood Electric Railway Co. have secured connection with the Market street line of cars for their proposed electric line from St. Louis to Kirkwood by way of Sutton, Shrewsbury Park and Webster Groves, and that the construction of the tracks will be commenced early in the spring.

The proposition to construct and operate an electric railway from the limits of the city of St. Louis to Ballwin by way of Clayton and Manchester, is being favorably considered by the people of the county. It is proposed to construct the road over the fields so that a high rate of speed can be had.

Sacramento, Cal.—An electric road from Oak Park to a point near the County Hospital and thence to Florin is under consideration.

San Francisco, Cal.—The San Francisco & West Shore Railroad Co. have been formed to build a road from San Francisco to Half Moon Bay, a distance of thirty miles. Lewis F. Dunand of San Francisco is interested in the project.

Saratoga, N. Y.—Thomas Murray, of New York, has been awarded the contract to build the line of the Saratoga Union Electric Railway. The road must be completed by June 1. The cars to be used will be the Pullman double deckers for lake travel and other kinds for track travel. The company expect to make a schedule time of ten minutes from Saratoga to the lake.

Sioux City, Ia.—The Sioux City & Leeds Electric Street Railway Co., capital stock $200,000, have been formed to construct, maintain and operate street or other railways, in or adjacent to Sioux City, operated by horse, electric or steam power. A. M. Coffman, W. E. Higman, W. M. Stevens, C. C. Peirce, Maris Peirce, E. W. Skerry, of Sioux City, and A. W. Gates Fairbanks, of Boston, Mass., are the promoters.

Spokane, Wash.—Contracts have been let by Francis H. Cook, for the remodeling of the motor line road. The work of reconstruction will soon be commenced by Charles H. Baker & Co., of Seattle, representing the Short Electric Railway Co., and the work will be completed by May 13. The gauge of the road is three feet and six inches.

Taftville, Conn.—The Fonemah Co., intend, it is said, to build an electric railroad from Baltic to Norwich, running through Occum, Limerick and Granville.

Tazewell, Va.—A charter has been granted to the Tazewell Street Railway Co.

Valparaiso, Ind.—Edmo Charles Getty, of New York, on behalf of the Valparaiso City Railway Co. has presented a petition to the Council asking for a street railway franchise.

Velasco, Tex.—The Velasco & Surf Side Railway Co. have been incorporated with a capital stock of $250,000, by W. D. Lee, G. W. Angle, and Frank Caldwell. The company propose to build an electric road from Velasco to Surf Side.

Washington, D. C.—The House recently passed the bill to incorporate the District of Columbia Suburban Railway Co. The incorporators of this company are Gen. Eppa Hunton, Charles E. Creecy, John T. Mitchell, and others. This road is to commence at the dividing line between the District of Columbia, to the State of Maryland on the Bladensburg Road, extending along Maryland Avenue and 15th Street, N. E., thence northward in the direction of Brookland to a point northeast of the Soldiers' Home. The bill stipulates that the line from Bladensburg to Pennsylvania Avenue east, shall be completed within three years. Capital stock $400,000. The motive power is to be either cable, electric or other mechanical power, except steam.

A bill has been introduced in the Senate to incorporate the Union Passenger Railroad Co. with the following incorporators: John G. Slater, Thomas B. Singleton, Morris Keim, and others. This road is to commence at 19th Street, in the southeast. The motive power will be either cable or electricity. The company will have a capital stock of from $300,000 to $500,000.

Waukegan, Ill.—The Waukegan & North Shore Rapid Transit Co. have elected the following officers: President, Dunlap Smith of Chicago; vice-president, A. L. Hendee of Waukegan; secretary, Homer Cook of Waukegan; treasurer, C. E. Simmons of Chicago. The company propose to build and operate seven miles of electric road in Waukegan.

West Superior, Minn.—J. Hagen, R. A. Haste and L. F. Johnson have formed a company with a capital stock of $250,000, to operate a street railway in West Superior.

Winona, Minn.—The Winona City Railway Co., with a capital stock of $100,000, have been incorporated.

Personal.

Mr. William Hazelton, 3d, of Philadelphia, made us a call during March. Mr. Hazelton represents the Short Electric Railway Co., in Philadelphia.

Mr. Henry Alexander, the treasurer of Alexander, Barney & Chapin, has tendered his resignation and will sever his connection with the company April 1.

Mr. William Roseborough has been appointed superintendent of the Rochester Electric Railway. Mr. Roseborough has been connected with the company for twenty-three years.

Mr. H. W. Shurtz, of the Northwestern Electrical Engineering Co., of Portland, Ore., came East last month to be married. While in New York City he called frequently at our office.

Prof. Elihu Thomson recently addressed the Boston Society of Civil Engineers at their annual banquet. He predicted that in time all steam locomotives would be displaced by electric motors.

Mr. William Baxter, Jr., of the Baxter Electric Motor Co., of Baltimore, Md., called at our office recently and mentioned that his company were enjoying their full share of patronage and doing a large business.

Mr. C. S. Clark, manager of the West Side electric road at Kansas City, Mo., has resigned his position to accept the management of the street railway at Augusta, Ga. He will be succeeded by Mr. W. H. McClelland.

Mr. D. B. Dean, formerly of the Electric Merchandise Co., and well known in street railway circles, has made an engagement with the McGuire Manufacturing Co., and will represent them in New York City. Mr. Dean has our best wishes in his new sphere.

Mr. C. E. Wilson, well known from his connection with the Knapp Electrical Works, has just made arrangements to represent the Electric Merchandise Co., Chicago. Mr. Wilson's long experience and large acquaintance will make him a valuable addition to the staff of the company.

Mr. Edward J. Robinson, general manager of the Laclede Car Co., St. Louis, has been spending some days in New York. He reports business in good condition. The cars for the Third Avenue (N. Y.) road have been approved, and some of them will be ready for early summer delivery.

Mr. J. W. Dickerson, formerly editor of the *Western Electrician*, has accepted the position of associate editor of the Street Railway Journal and manager of our Western office. Early in April our Western office will be removed to rooms 535 and 537 "The Rookery," where Mr. Dickerson will be glad to welcome all callers.

Mr. P. N. Hyden, a representative of the Pullman Palace Car Co. recently returned from Sidney, Australia, where he has been for several months superintending the erection, and finishing a train of Palace cars, which were shipped last year (knocked down) by the Pullman Co. through Henry W. Peabody & Co., shipping agents of this to the Government of New South Wales. On leaving Mr. Hyden received complimentary letters from the Railroad Commissioners of the government highly commending his work.

New Publications.

Calendar of the Lunkenheimer Brass Manufacturing Co., Cincinnati, O. This calendar has on its face a representation of the Handy Gate Valve, and as a novelty will be preserved by those who receive it.

Electric Heating is the title of a handsome pamphlet just issued by the Electric Merchandise Co. of Chicago, the selling agents for the Burton electric heaters. The system is thoroughly described, its merits for street railway service are fully presented, testimonials are published from those who have made severe tests of the heaters, and articles which have appeared in electrical journals are reproduced.

Eddy Motor Installations. This publication presents views and brief descriptions of some of the most interesting plants installed by the Eddy Electric Manufacturing Co., of Windsor, Conn. Two complete equipments supplied to the Globe Tobacco Works, of Detroit, and the Globe Printing Co. are very thoroughly illustrated. Manufacturers contemplating the use of electric power will find this a very interesting and instructive publication.

The Vogel Cable System, issued by the Vogel Cable Construction Co. of New York. This pamphlet contains a description and illustrations of the shallow cable system of the Vogel company, including their novel types of grips for single and double rope systems. Views are also given of the construction used at Butte, Mont., where a road built on the Vogel system and with grades of 18 per cent., has been in successful operation for over two years.

Seeger & Guernsey's Cyclopædia of the Manufactures and Products of the United States. Published by the Seeger & Guernsey Co., 7 Bowling Green, New York. Price, $10. This complete and exhaustive cyclopædia is arranged alphabetically according to products and manufactures, and will be found most useful to buyers and purchasing agents of all corporations, as well as to individual buyers on an extensive scale. The volume contains 1,360 pages, is carefully printed and substantially bound. In addition to the regular directory the volume also contains an index to separate articles, commencing with "Abacuses "and ending with "Zymosimeters," and a compact cipher code.

The Milliken Patent Poles. This pamphlet, issued by Milliken Bros., of New York and Chicago, is a third edition, the two former editions having been exhausted by the large demand made upon the manufacturers for copies. The different types of Milliken poles for street railway and electric lighting service are illustrated and described, and several pages are devoted to views of actual construction. In addition, some valuable information is given of the best methods of setting poles, theory of the Milliken pole construction, etc. ; while a report of the recent test made under the direction of Prof. R. H. Thurston, of Cornell University on the Strength of Iron and Steel Poles for Street Railway Work is also included. An idea of some of the iron work construction performed by Milliken Bros. can be gained from the last two illustrations in the book, which show views of the Buffalo (N. Y.) power house roof and the Long Island Railroad passenger station, both during erection.

The Annual Report for the Year 1892 of the Railroad Commissioners for the State of Massachusetts, published by the Commission. This report, which constitutes the twenty-third of the annual reports issued by this commission, covers 336 pages and presents much interesting matter. In the department relating to street railways, we note some interesting statistics in regard to accidents. The total number of accidents occurring on the West End Street Railway for the year ending September 30, 1891, was 204, of which 122 were due to horse cars, and eighty-two to electric cars. Of these fourteen were fatal, divided ten and four respectively, between horse and electric, and 190 not fatal, divided 112 and seventy-eight respectively. The accidents by horse cars averaged one to every 105,528 miles run, and by electrics, one to every 55,953 miles run. The accidents average one in every 985,656 carried. In the part of the report devoted to financial matters, we see that of the fifty-stx street railways, thirty-four declared and paid no dividends. The average rate of dividend on the total amount of capital stock was 5.63 per cent., and the net earnings amounted to 5.7 per cent. on the aggregate of capital stock and gross debt. Passengers were carried to the number of 176,090,189, being an increase of more than 11,000,000 over the number of passengers for the preceding year. The number of passengers carried on street railways in the state exceeded the number carried by the steam railways by more than 68,000,000. The average amount received for the conveyance of each passenger was 5.06 cents. The average cost of carrying each passenger, 4.05 cents.

An Electric Patent Suit.

A suit deserving of more than passing notice has been commenced in the United States Courts for the northern district of New York directed against the Troy & Lansingburg electric road and its officers asking for an injunction and accounting for past infringements of patents 345,845 and 424,298 granted to John C. Henry. These patents were applied for in January and October 1885 and the latter was issued in July 1886, the former, however, not until March 1890, its issue being witheld by the Patent Office on account of interfering patents applied for by Van Depoele and others at a later day. The courts are now sifting the rights of inventors in this art and it is quite probable they will find many infringements. With a liberal interpretation the following claims selected from the Henry patents may be construed to completely cover the trolley system exclusive of the machinery. In patent 424,298, claim 1 is for the use of trolley wires suspended over the track by insulators, and claims 6 and 8 for trolley wires in combination with an under running trolley held against the wire by spring pressure. In patent 345,845 claim 5 is for the combinationof insulated feed wires connected at intervals to the suspended trolley wire. claim 10 for all forms of insulators having passageways for the trolley through them and claim 15 for curve construction where the trolley wires are held in position by guy wires.

A Lecture on Belts.

At the meeting of the Polytechnic section of the American Institute of New York on Thursday, evening, March 17, Mr. Chas. A. Schieren read a paper on the "Art of Tanning Leather and Making Belting." He showed in the lecture the various processes through which a hide passes in the tannery, which were all beautifully illustrated by lantern slides. The various departments through which the hide passes in the tannery, the machinery used for manipulating the leather as well as the grinding and leaching of the bark, were illustrated and thrown on a large canvas by lantern slides. This made the lecture doubly interesting because the audience could get a clearer idea of the manipulation of leather in the tannery.

In the making of belting Mr. Schieren showed a hide of leather from which were taken four pieces of equal length and width ; they had been submitted to a test by a powerful testing machine of the Fairbanks Scale Co. of New York. These pieces were all eighteen inches long and two inches wide, and were numbered. No. 3, being cut from the lower part of the centre, broke at 2,490 lbs. strain, which would give the piece a transverse strength of 14,940 lbs. per square foot. No. 4, cut from the upper part of the centre of the hide, broke at 2,000 lbs. No. 5, cut from the lower part of the shoulder piece, broke at 1,390 lbs. No. 6, cut from the upper part of the shoulder, broke at 1,130 lbs.

The lecturer explained that very many belts were sold and offered in the market which were made from one piece of centre on one side, and a piece of shoulder on the other side. He clearly proved that such belts were defective, because of the shoulder being so much more liable to stretch, and not being able to withstand the strain of a centre piece by at least forty-three per cent., it would be a serious mistake to put the two pieces together for transmission of power, on account of the unequal tension. A belt would be superior if two shoulders were used, or two centre pieces separately. He claimed that a belt made from two centres could withstand a transverse strain of nearly 26,940 lbs. to the square foot, whereas, a belt made from shoulders would hardly stand 15,120 lbs. strain, and such belts would not be reliable, especially on dynamos, or swift running machinery, in fact, for almost any drive where a belt is subjected to severe strain.

Equipment Notes.

Schleicher, Schumm & Co., of Philadelphia, Pa., engineers and builders of the Otto gas engine, have opened an office in Boston, at 93 Pearl Street.

The Ellis Car Co. of Amesbury, Mass., are building a large number of cars for Johnstown, Tenn. This same company have recently delivered two sample cars to the Milwaukee Railway Co., one open and one closed.

The Lewis & Fowler Manufacturing Co. of Brooklyn, N. Y., are, as usual, supplying cars and other appliances demanded for the opening of new roads and the extension of old lines consequent upon the arrival of spring.

The Tramway Rail Co. of Pittsburgh, Pa., report a large call for the many appliances which they manufacture, especially the Samson bridge chair, mentioned in our last issue. A large order for this appliance has recently been received from Peoria, Ill.

Charles H. Davis, consulting engineer at 120 Broadway, New York and 308 Walnut Street, Philadelphia has issued a small folder entitled "Facts and Figures Interesting to Street Railway Men," and giving in convenient form interesting facts and tables.

The Newburyport Car Manufacturing Co. of Newburyport, Mass., number among the orders recently taken for cars some for Brockton, Mass., Allentown, Pa, and Rochester, N. Y. All of these will be equipped with the Reliable Manufucturing Co's. improved ratchet handle brake.

G. F. Whitney, of Boston, Mass., manufacturer of soaps for cleaning paint, cars, etc., reports a large business among street railway companies as well as other consumers. Mr. Whitney makes a specialty of soaps of this class, and tells us that his business is constantly extending.

The Stearns Manufacturing Co., of Erie, Pa., on the first of May, will establish a branch office in Chicago, which will be under the management of their Mr. A. F. Griswold, who has been with the firm for a great many years. Their office will be located in the Rookery Building, No. 1120.

The Lamokin Car Works of Chester, Pa., have, as usual, a large number of orders on their books, and their cars seem to meet the verdict of popular favor. Among recent shipments made by them are cars to Washington, D. C., Derby, Conn., Williamsport, Pa., Altoona, Pa. and Manchester, Va.

The Pennsylvania Iron Works Co., of Philadelphia, Pa., have received the contracts for the construction of two cable power stations for the West Chicago Street Railway Co. One of these is to be erected at the corner of Blue Island Avenue and Twelfth Street, and the other at the corner of Van Buren and Jefferson Streets.

The Goubert Manufacturing Co. of New York, find a great demand for their heaters, which is keeping them very busy at their New York headquarters, 32 Cortlandt Street. Mr. W. W. Nugent, a consulting and contracting engineer of prominence, has been appointed sole agent for this heater, vertical and horizontal, in Chicago, his office being located at 823 Home Insurance Building, that city.

The Eddy Electric Manufacturing Co. of Windsor, Conn., will begin work on the addition to their factory as soon as the weather makes it practicable. The new building will be equipped with the most modern machinery, and will make it possible for the company to treble their output. The addition will give the company facilities for increasing the number of railway generators for which they have lately received several orders.

The Southwark Foundry & Machine Co., of Philadelphia, sole makers of the Porter-Allen high speed, automatic engines, have many calls for this engine in electric stations. The Porter-Allen engine is made simple, condensing and compound, and has achieved for itself an enviable reputation in the line of work for which it is adapted. The company also manufacture reversing engines, blowing engines, centrifugal pumps, boilers, tanks, etc.

The Campbell & Zell Co., of Baltimore, Md., have issued a circular letter stating that they have secured the entire plant known as the Ramsey Engineering Works, located at Locust Point, Baltimore. With these increased facilities, operating in conjunction with their Enterprise Iron Works, at Canton, they state that they are enabled to meet the demand for the Zell improved water tube safety boiler and other apparatus which they manufacture.

The Charles Scott Spring Co., of Philadelphia, Pa., manufacture a high class line of crucible steel springs for cable, electric, and horse cars. Their single elliptical springs, when used in connection with spirals, are claimed to provide the easiest running for high speed electric or cable service. The Charles Scott Spring Co. also manufacture and are ready to deliver on order, spirals of any required size or capacity, as well as graduated springs to fit any truck or box.

Milliken Bros., 55 Liberty Street, New York. manufacturers of Milliken patent poles for electric street railways and electric light work. have recently issued a handsome catalogue of their patent poles, third edition, which is mentioned more particularly in another column. Owing to the great demand for these poles in all portions of the world, this well known firm have made arrangements with parties in England, France and other parts of Europe, to manufacture these goods.

George Cradock & Co., of Wakefield, Eng., write us that they have secured the contract for the cable to be used on the line of the London Tramways Co.,at Brixton,London. This rope will be 30,000 ft. long, and 3.518 ins. in circumference, and will weigh about thirty tons when completed. It will be delivered about the end of April, and will be made on Lang's lay. This company on March 22 installed a cable on the Tenth Avenue and 125th Street line of the Third Avenue Railway Co., New York.

F. P. Little & Co., of Buffalo, N. Y., report that they have just closed a contract with the Western Transit Co., for lighting their city elevators A. and B. This contract includes a 7×12 Rice engine, manufactured by The John T. Noye Manufacturing Co. ; one E. I., cylindrical type, Thomson-Houston dynamo, and necessary wiring and equipment for 300 sixteen C. P. incandescent lights and four arc lights, to be run from the same circuit. They are also to erect a 10×25×13 ft. brick building in which to put the plant.

The Johnson Co., of Johnstown, Pa., have decided to establish an agency for North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas and Tennessee, in Atlanta, Ga., which will be in charge of their Southern agent, Mr. Wm. W. Kingston, whose office will be in the new Equitable Building after its completion, about May 1, next. Until that time he may be addressed at Room No. 10, Y. M. C. A. Building, Atlanta, Ga. This action on the part of the Johnson Co. will be heartily appreciated by their customers in the South.

The Ball Engine Co., of Erie, Pa., write us that they are furnishing a number of street railways at the present time with their well known engines. Among these roads are the Wilmington Street Railway Co., Wilmington, N. C. ; Rome Street Railway Co., Rome, Ga. ; Hoboken Rapid Transit Co., Hoboken, N. J. ; Schuylkill Electric Railway Co., Pottsville, Pa. ; Niagara Street Railway Co., Niagara Falls, N. Y. ; Sandusky Street Railway Co., Sandusky, O. They are also furnishing the Erie Electric Motor Co. with a 450 H. P. tandem, compound engine.

The Pond Engineering Co. have recently closed a contract with John A. Barham, president of the Janesville (Wis.) Street Railway Co. for the complete steam plant, necessary to operate his road by electricity. The plant includes a 14×13 Armington & Sims Engine, with foundation box; 66×16 steel boiler with stack and the usual fittings, a No. 3 Blake boiler and feed pump and a No. 5 Hoppes exhaust heater. The Pond company's contract also included delivery and erection of this machinery in Janesville, with foundations, brick work, pipe connections,etc., all ready for service.

The United States Steam & Street Railway Advertising Co., Carleton & Kissam proprietors, still continue extending their immense plant, having lately closed a lease with the Columbus Consolidated Street Railroad Co., of Columbus, O., for the advertising privilege in all their cars. The company formerly ran the advertising themselves, but concluded that it was more profitable for them to make a long lease with Carleton & Kissam, whose method of conducting the street car advertising business, has met the approval of many of the most prominent street railway presidents in the United States.

The Trenton Iron Co., in addition to the large business which they are doing in the street railway field, have many calls for their wire ropes in other industries. In addition to one line which they recently built for the Holy Moses mine,they have received contracts from the Amethyst Mining Co. for a cable having a length of 8,250 ft., and a capacity of 200 tons per day ; another line of 5,150 ft. for the Smuggler Union Mining Co. in Ouray. Colo., with a capacity of 200 tons per day, and another line for one of the Haggin mines in Guanacevi, Mexico, having a capacity of 100 tons per day, and a length of 5,960 ft.

Thomas H. Fearey, New York State agent for the railway Department of the Thomson-Houston Electric Co., has a pleasant office on the sixth floor of the Kirk Building, Syracuse, N. Y., where correspondence about electric railway business in New York State should be addressed. He has recently closed contracts to equip the Union Electric Railway, Saratoga Springs; the Niagara Falls & Suspension Bridge Railway, and the Buffalo, Bellevue & Lancaster Railway, all to be completed by June 1. Besides the above, orders have been received for additional equipment from the Buffalo Railway Co.; the Rochester Electric Railway; the Troy & Lansingburg Railway, and the Elmira & Horseheads railway.

The Corliss Steam Engine Co. of Providence, R. I., established by Geo. H. Corliss, inventor of the Corliss engine, have supplied many engines to street railway companies. Their high reputation as engine builders is well known, and they seem to make every effort to please their customers and maintain the reputation which they have always had for fair dealing and high classes of goods. Their works have been fully equipped, at great cost, with heavy special tools for the manufacture of their engines. This company are also manufacturers of the Corliss patent vertical tubular water leg boiler, especially adapted for compound and triple expansion engines requiring super-heated steam and at a very high pressure.

The Price Railway Appliance Co., of Philadelphia, write us that their type of rail construction is meeting with much favor wherever it is introduced. At a stated meeting of the Board of Directors of the People's Passenger Railway Co., of Philadelphia, Pa., held November 2, 1891, the following resolution was adopted: "*Resolved*, that the Board of Directors of the People's Passenger Railway Co., for the information of the Price Railway Appliance Co., and that of any other railway company interested in the matter of a perfect track, desire to say, that this company has now in use a track on Eighth Street, from Walnut to Market Street, laid with the Price railway construction No. 5, and that the same is entirely satisfactory to them, and merits their commendation."

The Reliance Electric Manufacturing Co., of Waterford, Ont., who are building the Rae apparatus in Canada, have secured the contract for the equipment of the Toronto & Mimico Electric Railway. This road will start from the terminus of the Toronto City Railway Co.'s lines on Queen Street and extend to the village of Mimico and eventually to Long Branch, a total distance of about seven miles. The road runs along the lake shore for the entire distance. The Reliance company have the contract for the entire equipment exclusive of track. The power station will contain one Armington & Sims engine of the compound condensing type, 125 H. P., and the Rae station electrical apparatus consisting of one eighty-five K. W. generator and necessary appliances. The motors for this road are of Mr. Rae's latest design of single reduction motors, which are at present built only in Canada.

The American Engineering Co. of New York, whose multiple distributing system is in operation on the line of the Coney Island & Brooklyn Electric Railway, and was described in the last issue of the STREET RAILWAY JOURNAL, tell us that their car is still operating very successfully. The line has been visited by a large number of prominent street railway managers, and the president of the railway company, Gen. H. W. Slocum, has expressed himself as much pleased with the results shown. The validity of the patents owned by this company has been attacked in one or two quarters, but the company assure us that all charges of any kind reflecting upon their patents, are utterly false and without foundation. They state that they absolutely own and control all patents used in the construction and operation of the multiple distributing system as installed by them, and that they guarantee every feature of it against legal proceedings.

The Reliable Manufacturing Co., of Boston, Mass., have shipped to the Thomson-Houston Electric Co., of San Francisco, Cal., sixty of the Reliable sand boxes to be used on the San Francisco & San Mateo Street Railway Co., of San Francisco, a new electric road about completed. They have also shipped forty boxes to the Lamokin Car Works, of Chester, Penn., to be applied to large new cars just built for two new street railway companies ; also during the last month the Reliable sand box and Collett ratchet brake handles have been shipped to the Augusta, Hallowell & Gardiner Railway Co., Augusta, Me. ; Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Co., New York ; Federal Street & Pleasant Valley Railway Co., Pittsburgh, Penn. ; Natick & Cochituate Street Railway Co., Natick, Mass. ; Pennock Battery Electric Light & Improvement Co., Peoria, Ill. and others.

The Engineering Equipment Co., of New York, have recently received an order from the Buffalo Street Railway Co., consolidated lines, for three twenty-four inch Underwood cotton leather belts for their power station. These are in addition to the four cotton leather belts of the same make and size now running at this station. These and other Underwood belts running in Buffalo were inspected and found to be doing exceedingly well. The Iroquois and Broezel Hotels are equipped with them and guests of these houses who were attending the Convention were shown the practical working value of Underwood belting. This company write us that suit has been brought by the Builders' Insulating Tube Co., of Lynn, Mass., and the Indurated Fibre Industries Co. against the Interior Conduit & Insulation Co., for infringements of patents that cover the making of pipes, or paper tubing to carry electric wires.

The Robinson Electric Truck & Supply Co., of Boston, have received orders from the Brooklyn City Railroad Co., for forty Robinson radial trucks for the first forty electric cars which are to be put in operation in Brooklyn. These are open cars, thirty-five feet long, and of the regular Robinson type, having twelve benches and seating sixty passengers each. Twenty of the car bodies are being built by the Lewis & Fowler Manufacturing Co. of Brooklyn, and twenty by J. M. Jones' Sons of West Troy, N Y. These cars are to run on the Fort Hamilton division. All the electric cars in Providence, R. I., are equipped with the Robinson radial truck, and have been giving such excellent satisfaction that the Union Railroad Co., on whose lines they are running, has placed a further order with the Robinson company for a full equipment of radial trucks for their open cars, to be used on the Providence lines during the summer. These are only samples of the orders recently received for Robinson radial trucks.

The New Process Raw Hide Co., of Syracuse, N. Y., send us the copy of a letter recently received by them from C. E. Barnes, superintendent of the Plymouth & Kingston Street Railway Co., of Plymouth, Mass., a large user of their gears. In this letter Mr. Barnes says: "Seven months ago I purchased of you some of your gears for trial. I did not have an idea that they would do the work that was represented they would do. I told your representative that they should have a fair trial. In order to satisfy myself and be sure there was no mistake, I took the gears from one of my cars and replaced them by putting on one end of the car gun metal, on the other end your gears.

I have worn two sets of the gun metal off and your gears are in use at this time. They have had seven months' wear, and I think we have about as hard a road as you will find, as we have a large number of heavy grades, and, what is more, there are heavy curves in the grade. I can only say that the gears have gone far beyond my expectations.

W. R. Fleming & Co., of 174 Fulton Street, New York, during the past few months have been equipping a number of steam boats with their "Ideal" self-oiling, automatic cut-off engines, which have met with great success in New York and elsewhere. These engines have been found satisfactory in steamboat service, as can be shown by the long list of boats now being equipped with them. The first boats supplied were the steamships "Yumuri" and "Maverick" of the Ward's line, which, proving to be perfectly satisfactory, have been followed by the Pacific Mail Steamship Co.'s boats, "Havana," "Armeria," "Newport," "Para" and "Rio Janeiro," besides a new vessel not yet completed at Chester, Pa., and another at San Francisco, for which the engines have just been shipped. The Pennsylvania Railroad Co. have the "Ideal" engines on their new ferryboats "New Brunswick," "Cincinnati" and "Chicago." The Spanish steamship line have the same engines on their steamers "Savannah" and "Ciudad Coudal" running between New York and Cuba, these being directly coupled to multipolar dynamos.

The Burton Electric Co. of Richmond, Va., for whom the Electric Merchandise Co. are selling agents, are experiencing a continual increase in their business. During the past winter this factory has been taxed to the utmost to meet the demands of electric railways, many roads having adopted the Burton electric heater. Such great and immediate results were not expected by the company. In fact the demands in this line have seriously hindered the completion of types for house and office heating, as well as such articles as flatirons, soldering-irons, laundry rolls, etc. We understand that these latter pieces have been put into serviceable shape and that the company will soon be ready to fill the numerous orders that they are continually receiving. The Burton company are certainly working along right lines, as shown by the efficiency of their street car heater. In certain cases, too, they have prepared heaters for special uses, and these have been found highly satisfactory, which is additional proof of the same fact. A neat and instructive pamphlet, giving full information regarding the heater, has been published by the selling agents, which should be obtained by people interested in electrical heating.

The Berlin Iron Bridge Co. of East Berlin, Conn., are running their works full time and are very much crowded with orders. Among other contracts which they have on hand is an iron building 80 × 254 ft. for the True Blue Marble Co. at West Rutland, Vt.; an iron building 52 × 170 ft. for the Chester Pipe & Tube Co. South Chester. Pa.; a boiler shop 68 × 201 ft. and a machine shop 72 × 184 ft. for the Dry Dock Engine Co at Detroit, Mich; a boiler shop 115 × 370 ft. for the Wm. Cramp & Sons Ship & Engine Building Co. at Philadelphia, Pa.; all the iron work, including the beams, girders, roofs, etc., for a new building which the National Fire Insurance Co. are building at Hartford, Conn.; an iron boiler house for the Montgomery Furnace at Pt. Kennedy, Pa.; a new casting shop 69 × 167 ft. for the American Tube Works at Somerville, Mass., and also a large roof for the new residence of Joseph D. Potts at Wyebrook, Pa. In bridge work they are building several bridges for the New York, New Haven & Harford Railroad Co., besides a large number of highway bridges in different parts of the country. They have just completed a large iron building for the Delaware Iron Co. at Newcastle, Del., and also a large iron building for the Boston & Montana Consolidated Silver & Copper Mining Co. at Great Falls, Montana. While a great many companies are complaining of slack business, yet the Berlin company seem to have plenty to do, and are employing their full force full time.

The Meneely Bearing Co., of West Troy, N. Y., manufacturers of patented tubular journal bearings, are meeting with great success in the sale of their roller bearings for street railway cars. They have sent us a copy of a letter recently received by them from Mr. John W. McNamara, general manager of the Albany Railway Co., upon which their bearings have been used for nearly two years. Mr. McNamara states that forty-two cars on his road are altogether equipped with these bearings, and that an average of twenty-four cars are in use, upon grades ranging from 3 to 8 per cent. In this connection he states in his letter to the Meneely Bearing Co. that the coal consumption for these twenty-four cars is only 16 per cent. greater than that of a neighboring road operating only twelve cars on a comparatively level line. The Meneely Bearing Co. have also secured a contract to equip all the motor cars of a new railway line to be opened in Troy this spring (the Troy City Railway), and have also received a second order from the Troy & Lansingburg Railway Co. to equip nine motor cars now being built for their line. This bearing is composed of steel tubes grouped closely, though not in contact with each other, about and in alignment with the journal. These tubes are arranged longitudinally in three series, the centre series being of double length and the outside ones being opposite each other while the centre is set in advance. The thrust of the axle is received upon a steel ball set in a groove formed in the cylinder head, and a corresponding recess is formed at the end of the journal. The Meneely Bearing Co. have recently issued a descriptive pamphlet in regard to their device, which gives full particulars and forms very interesting reading.

The Wightman Electric Manufacturing Co., of Scranton, Pa., as our readers well know, have been prominent advocates of high speed for electric cars, on heavy grades, especially where such speed was permitted by the municipial authorities. The time saved by running up grades and on levels, they think, more than repays for the increased consumption of coal or the increase in power consumed. Acting upon this theory the Wightman motor is designed, capable of accomplishing high speeds, while having a high efficiency at all speeds. A letter recently received by them from J. H. Vander Veer, superintendent of the People's Street Railway Co., of Scranton, Pa., which we give below, seems to substantiate this theory. Mr. Vander Veer says: "I have recently made an experiment in street railway practice, in which I think you will be interested. I have fixed up a car, equipped with two of your twenty H. P. motors, in a very attractive manner, and for the last month or so I have been running this car as an extra, on one of my lines running to Dunmore, making trips between the regular cars and running only half way to Dunmore. This car has now become a very popular one with the residents whom it reaches, and I can account for it only by the fact that it makes very rapid time. The up trip, a distance of about a mile and a quarter, averages a grade of 7 or 8 per cent., and I find that with this car we are enabled to go up the steepest points of the grade at a speed very nearly twenty miles an hour. I find, therefore, that the mileage that I can get out of this car is a long way in advance of the mileage made by the other cars; and as I do not have to pay any more for conductors and motormen for this car. it has proved very profitable. As this car runs in between the regular cars, it has to make very rapid time, and frequently the trip has been made in less than five minutes, although there are several curves and switches on the line. I at first thought that such a speed would be dangerous to maintain constantly, but we have not had an accident so far, and I find that it pays much better to run the cars up hill fast, than it does to make all the speed on the down grades. The repairs on your motors, I would say, have been so slight as to be insignificant. This car has your automatic brake connection, and I find that the motorman can run with a great deal more confidence than if the car did not have this arrangement, as he feels that in case of an accident to the brakes and a derailment of the trolley, he would still have a means of stopping his car quickly. It is a curious fact that when our schedule was so arranged that we could make three trips an hour, the receipts of this car were almost double what they are now when making only two trips. This seems to indicate that attractive cars operated at a high speed are requisite to the maximum success of any street railway, and the more there are the better."

R. D. Nuttall Co., of Allegheny, Pa., write us that their business continues to be very good and that thay have many orders from street railway companies on their books. They are now adding some improved gear cutting machinery which they expect will increase their facilities about one-fourth. They are buying the latest improved and expect great results from this machinery, both in the way of accurate work and cheap production. The steel trolley pole which they brought out last October is giving general satisfaction all over the country, and they have sold 3,000 since first bringing them out. Some of the largest street railway apparatus mauufacturing concerns have adopted this trolley pole and the reports on it from all parts of the country are very favorable indeed. This pole is made of the best grade of homogeneous steel, drawn to a taper, and when bent can be straightened without injury to the material composing the pole. Their "rawhide" pinion trade has greatly increased in the past few months, as they have made some vast improvements in the production of these articles. They submit all their rawhide to a pressure of 100 tons in the block before the pinion is made. The flanges are then placed on the pinion and riveted up under a pressure of forty tons. This they think makes a pinion superior to anything now on the market, as the compression strengthens the material almost fifty per cent. They have reports from these pinions from different parts of the country claiming that they are standing up equal to any metal pinion ever used. They have been experimenting a great deal with different grades of iron for gear wheels in the last few months and have added greatly to the strength and durability of their gears. They are also producing a gear now of cast iron that will stand almost equal to steel as far as tensile strength is concerned. They have also added to their factory a department for the manufacture of armatures ready for wiring and commutators of all classes. They are also prepared to re-fill commutators and repair them at reasonable rates. They have also added to their factory a department for rewinding armatures, field spools, etc. This department was forced on them by a great many of their customers, as the latter have had to send armatures to the manufacturers in the East to have this work done. The trade in this line, they say, is increasing daily. They expect this coming summer to reorganize and recapitalize their company and build larger works in the suburbs of the city where they can get room to place their factory all on one floor. They then intend to add greatly to their output and take up different lines, which heretofore they have not been able to handle. They are also making large amounts of bearings for street railway motors of different kinds, and have adopted the best grades of phosphor bronze for this work, and find their bearings are giving general satisfaction wherever used. Their patent composition spring trolley has been in great demand the last month. During the early part of the winter they did not have so many orders for this trolley, but in the last several weeks they have received orders for 145 trolleys complete. They are making these trolleys much better in every respect than the first ones brought out. This trolley was formerly sold with a wood pole for $20. By the addition of a steel trolley pole department to their factory they have been enabled to furnish this trolley complete with steel pole, made throughout of the best material, for $20, with wood pole complete for $18.

WESTERN NOTES.

Walker & Barrett, of Chicago, civil engineers and contractors, have opened an office in the Western Bank Note Building, and will equip street railways on the Judson system.

The St. Louis Car Co. have just put on the market a new electric truck. It is of the extended spring hase type, with many improvements over the various trucks of this kind offered in the past to street railway companies.

The Hoppes Manufacturing Co., of Springfield, O., have issued a handsome advertisement, consisting of a single sheet wall hanger printed in three colors, and showing their live steam feed water purifier and feed water heater.

The Sioux City Engine Works, of Sioux City, Ia., outgrew their capital long since, but in spite of all obstacles the sales were doubled in 1891, and at the beginning of the present year the company had a large number of contracts upon their books, a large and valuable stock of material on hand and excellent business prospects for the future. The business is now to be reorganized.

The Central Electric Co., of Chicago, report activity in their pin and bracket department, their factory at Columbia City being in full operation, and the goods being sent far and near in car load lots. The pin and bracket made by this firm is of approved quality, and has a steady demand. Since this company took the agency for the Interior Conduit & Insulation Co., they have been overwhelmed with orders, the largest buildings in Chicago, St. Louis and Kansas City erected or now in course of construction being equipped with this device. The business in this department of the Central Electric Co., bids fair to be one of their prominent features, and they can be congratulated upon the success already achieved in this department.

The Brownell Car Co., of St. Louis, send us word of many orders which they have recently received for street cars, and mention that their Accelerator type of car seems to be meeting with much favor. They received during January a letter from Charles T. Yerkes, of Chicago, speaking in highest terms of the Accelerator type of car, as mentioned in our last issue, and have since received an order from the road of which Mr. Yerkes is president, for thirty Accelerator cars, giving a practical demonstration of Mr. Yerkes' appreciation of the merits of the car. The Brownell Car Co., have also received an order from the Milwaukee Street Railway Co., for a sample Accelerator car. They are building fifty cars for the Baltimore Traction Co., which they state will be models of beauty and excellence. A number of cars of the Accelerator type built by this company will soon be in operation in Chicago, thirty having been ordered by the North Side Street Railway Co. of that city. One of these cars has also been sent to Milwaukee for trial.

The Detroit Electrical Works have received from the Athens (Ga.) Railway Co. a very flattering testimonial in regard to the operation of their system on the lines of the latter company. General Manager Voss, of the Athens company says: "We have had very little trouble or expense with the bevel gear; in fact, there is no trouble with it when the friction collars are kept well adjusted, which is very simply and easily done. Our cars make less noise and run smoother than those of any other system that I have ever inspected. I have been in the street railway business for some twelve years, and last year, before we began to make any change in our line here, I made a tour of inspection of the different systems." They have closed, among their many other orders, one with the Dubuque Street Railway Co., for six motor cars. These will replace the storage cars which have been in use on that line. They have also closed contracts with the Patrick Land Co., of Omaha, Neb , for four thirty H. P. equipments, as well as all the line construction, in fact, making a complete installation. Mr. H. A. Kinney, formerly of the Omaha Consolidated Electric Co., is now connected with this company.

The Laclede Car Co., of St. Louis, have their various departments full of material for the Third Avenue (N. Y.) cable cars. The joinery shop presented a busy scene recently. Sixty car ventilators were being erected for the above cars, and in the mill material was being cut into an almost endless number of shapes, to be sent to the erecting shop, for entering into the erection of eighty cars. The 200 closed cars for this company are to be built first, because the road will not be in operation before the beginning of next winter, and the open cars will not be needed until the summer of 1893. Among the orders the company have on their books and are now completing, a number of sixteen foot cars for the Colerain Avenue, East End and Browne Street electric railways of Cincinnati, which make eight orders the works have received from that city lately, several twenty-two foot cars for Duluth, Minn., and cars of various sizes for Covington, Ky., Twin City, Mo., Waxahatchie, Tex., Watertown, Wis., and the Perry Manufacturing Co., Ltd., also the first car for the Pendleton, Mount Lookout, & East Walnut Hills Railway Co., a new line to start up in Cincinnati. The works have been equipped with electric lights recently, and a night force will be put on.

The Electric Merchandise Co., of Chicago, are in luck—no, not luck exactly—for their success is deserved and is the result of continual push and hustle. A notable feature of several contracts recently secured by parent companies is that the overhead equipment of the Electric Merchandise Co. has been specified as a necessary factor in the building of the roads. It is observable, too, that in electric railway circles this company are both well and favorably known. Even the East, with its many electrical concerns—sufficient it would seem to supply the needs of local traction companies—has felt the activity of this particular house. The Merchandise company have one advantage in forcing attention, and that is, the concentration of their energies upon a single branch of the electrical business. They are universally known as the "exclusive electric railway supply house." Perhaps, their latest Eastern conquest was at Saratoga, where their fixtures will be used upon the new electric road, but they send us reports of equal success elsewhere. From all accounts their Western business is booming, frequent shipment to the coast, Colorado, Montana, Iowa and nearer points so testifying. The much-talked-of consolidation of the parent companies does not seem to affect the policy of this company. Their evident intention is to do business, and matters look as if they would.

The Pond Engineering Co., owing to increase of business, have found it necessary to remove their Chicago office from 427-429. the Rookery, where they have been located for three years past, to room 8 of the same building. This room is located on the ground floor, and extends from the rotunda to the Rookery court. The front part of the room will be used exclusively for office purposes and the rear for drafting, shipping, etc. Room 8 is one of the best offices in the well known Rookery Office Building, and the Pond company are fitting it up in an elegant manner with a view to the best accommodation and convenience of themselves and patrons. It has also been found necessary to make a change in the Dallas, Tex., office of the Pond Engineering Co., which has just been moved to much more desirable quarters in the Scollard Building, room 211. These changes will, no doubt, be of interest to many friends of the company who will be welcomed with pleasure at the new locations. This company have received an order from the Janesville Street Railway Co. for a complete steam plant necessary to operate the road by electricity. The plant includes an Armington & Sims engine, with a foundation box ; a boiler, with stack and the usual fittings ; a Blake boiler feed pump, and a Hoppes exhaust heater. The Pond company's contract also includes delivery and erection of this machinery in Janesville, with foundations, brickwork, pipe connections, etc., all ready for service.

Electric Railway Equipment in Dubuque.

President J. A. Rhomberg, of the Dubuque, Ia., Street Railway Co., has made important contracts during the last month, in behalf of his road in connection with the change from storage battery traction, to that of the overhead wire. The motors for this road will be furnished by the Detroit Electrical Works, and there will be six equipments. The motor cars will be sixteen feet long, and will be built by the J. G. Brill Co., of Philadelphia. Ten trail cars have been ordered from the St. Louis Car Co.

At the power station there will be two additional generators of the Edison type of fifty kilo-watts each. Some additions will also be made to the power equipment.

An Important Consolidation.

An important consolidation of manufacturers of electrical insulations has been recently effected between The Johns-Pratt Co., of Hartford, Conn., and the Gould & Watson Co., of Boston, Mass. The Johns-Pratt Co. are the manufacturers of the well known insulating material, vulcabeston, now used by all the large electrical manufacturers. The Gould & Watson Co. are identified with the manufacture of moulded mica, well known in the field of electric railway insulation.

These two interests are now combined and the business will be conducted by the Johns-Pratt Co. The product of the consolidated companies will cover every requirement for electrical insulation. Mr. C. Tennant Lee, the inventor of moulded mica, will be consulting chemist of the company, and the H. W. Johns Manufacturing Co., 87 Maiden Lane, New York, with branches at Chicago, Philadelphia, Boston, Atlanta and London, will continue to be the selling agents, as formerly.

A New Car Manufacturing Co.

The Randall Street & Electric Car Manufacturing Co. have recently been organized for the purpose of manufacturing street and electric cars and other railway appliances in Boston. The general manager is I. H. Randall, who for thirty years was with the Metropolitan & West End Street Railway Co. as master car builder.

The present location is at 1,131 Tremont Street, Boston, and the company are capitalized at $150,000 under the laws of the State of Maine. The demand for cars throughout the country for the past few years has been greatly increased by the adoption of electric power, and the manufacture of electric cars and railway appliances constitutes a most important part of the business.

The company expect to have their new catalogue ready for distribution in a short time, and this pamphlet will embrace cuts and general descriptions of articles manufactured by them.

A Trade Paper Changes Hands.

The Baltimore *Manufacturers' Record*, which is one of the most profitable newspaper properties in the South, has recently been sold by its founder, Richard H. Edmonds, and his brother Wm. H. Edmonds, to a company of journalists of wide experience and reputation. The purchasers are Thomas P. Grasty, Edward H. Sanborn, and Walter H. Page, who have also associated with them as part owners, F. S. Presbrey and Albert Fox. Mr. Grasty has for more than three years been the general Southern correspondent of the *Record*, and is widely known as an authority on Southern industrial topics. Mr. Sanborn, who has recently been connected with the Census Bureau, is an expert in iron and steel, has had wide experience in trade journalism, and has been an extensive contributor to industrial and technical papers. Mr. Page is editor of rhe *Forum*, is a Southern man and is interested in many Southern enterprises. Mr. Fox has been on the staff of the New York *Evening Telegram*, and Mr. Presbrey was recently the editor and manager of *Public Opinion*, Washington. The new editors have organized a Manufacturers' Record Publishing Co., with paid up capital of $200,000.

We extend to the new managers of the paper our wishes for the success they deserve.

Annual Meeting of the Short Electric Railway Co.

The annual meeting of the stockholders of the Short Electric Railway Co., and the usual directors' meeting following, were held at the office of the company in Cleveland, O., March 16. The following directors were elected: Sidney H. Short, Myron T. Herrick, J. Potter, John S. Bartlett, James Parmelee, Eugene Griffin, and William B. Bolton. The directors met and elected the following officers for the ensuing year: J. Potter, president; S. H. Short, vice-president and chief electrician; Charles B. Lothrop, secretary and treasurer; E. E. Higgins, general manager; William B. Bolton, general counsel. Mr. S. H. Short, who has been, from the organization of the company its president and chief electrician, was renominated for the presidency, but declined to accept the position. He stated that, owing to the growth of the company, its duties had now become so onerous as to seriously interfere with his technical work and inventions, to which he desired to give his undivided attention. He therefore asked relief from his general business cares.

A New Electric Truck Company.

The Taylor Electric Truck Co., of Troy, N. Y., have just been organized for the manufacture of the Taylor improved electric truck. The company is composed of Mr. Lewis E. Gurley and son, the well known manufacturers of civil engineers' and surveyors' instruments.

The inventor of the truck which this company will manufacture Mr. John Taylor, has devoted much time and study to the perfection of electric trucks. His early inventions have met with flattering success, such railway companies as the Troy & Lansingburgh Street Railway Co., preferring them to all others, and he has recently made and patented several new improvements which have been submitted to practical tests, and which have proved their efficiency in embodying simplicity and durability with easy riding.

The company intend to use only the best materials, and with the personal supervision of Mr. Taylor they hope to suit their customers.

They start with some flattering encouragements, and trust that any railway company desiring trucks will give them a chance to exhibit the good points of the Taylor improved.

The Siemens & Halske Company, of Chicago.

Siemens & Halske, of Berlin, the most important electrical manufacturers in Europe, have for a long time realized that the United States is a most promising field for the sale of electrical apparatus. For some time they have had under consideration a plan for establishing a branch in this country, and arrangements have just been perfected. Recently the Siemens & Halske Electric Co. were organized in Chicago, with a capital stock of $500,000. The officers are: O. W. Meysenburg, president; A. W. Wright, secretary; Arnold von Siemens, George William von Siemens, O. W. Meysenburg, A. W. Wright and Alexander von Babo, directors. Mr. Meysenburg and Mr. Wright are known the country over as contractors and cable railway engineers. They are also heavily interested in the Wells & French company, which manufacture cars. Alexander von Babo is a German, residing in New York, and is the American representative of the parent company in a number of other interests. G. H. Benjamin, of New York, will have charge of all matters relating to patents and patent litigation. George and Arnold von Siemens are the active members of the firm of Siemens & Halske, as Dr. Werner von Siemens has retired from active business, and Herr Halske is dead, his interest having been purchased by the Siemens family.

The new company will probably begin active operations within three months. The plant will be located at the shops of the Wells & French Co., on Blue Island Avenue. Dr. Berliner will be the chief electrical engineer of the company. He is at present in Berlin, but will locate in Chicago within a short time. Plans for the building are being prepared and drawings and patterns for the apparatus and special tools will soon reach the city.

Siemens & Halske claim to have the only practical conduit electric railway, and the American company expect to do considerable work in the railway field. It was while examining the road built on this system in Buda-Pesth, Austro-Hungary, that Messrs. Wright and Meysenburg first came in contact with the house with which they are now connected. Wright & Meysenburg have been negotiating for some time with C. T. Yerkes for the construction of a similar electric line with underground conduit in West Twelfth Street, but the matter still hangs fire, although at one time Mr. Yerkes was on the point of consummating the bargain. The Siemens & Halske Co., however, do not confine themselves to the conduit system, but propose to enter into active competition for the installation of overhead roads.

It has frequently been stated that the conduit system, as constructed at Buda-Pesth, could not be installed successfully in America, as the conditions were so entirely different. This statement, Mr. Wright said to a representative of the Street Railway Journal, was entirely erroneous. The streets of Buda-Pesth were no cleaner, and were not better drained than those of Chicago; and, if the system were successful in the one city, there was no reason why it should not be successful in the other.

The founders of the branch company expect that they will be formidable competitors of companies now engaged in installing railway apparatus, as the corporation will be backed by the parent concern with its capital of $40,000,000.

List of Street Railway Patents

Issued by the U. S. Patent Office, February 23, 1892, to March 22, 1892, inclusive.

February 23.

Automatic Disconnector, Andrew L. Johnson, Richmond, Va. 469,253
Brake for Electric Cars, Edward S. Amrock, Waltham, Mass. 469,383
Brake Handle, Robert L. Fosburgh and John F. Milligan, St. Louis, Mo. 469,401
Cable Grip, Theodor Otto, Schkeuditz, Germany 469,318
Conduit for Cable or Electric Tramways, George S. Morison, Chicago, Ill., and Charles Vogel, San Anselmo, Cal. 469,262
Car Brake, Michael H. Molloy, Milwaukee, Wis 469,423
Commutator-Cleaning Device, William J. Phelps, Elmwood, Ill 468,319
Electric Railway, William S. Smith, Berkeley, Cal. 469,280
Elevated Railway Track, Myron J. Ferren, Stoneham, Mass. 469,371
Method of Utilizing Stationary Cables on Cable Railways, James P. Harper, Kansas City, Mo. 469,330
Overhead Conductor for Electric Railways, Edward M. Bentley, New York 469,353
Pilot for Street Cars, John W. Abrahams, Allegheny, Pa. 469,291
Power Transmitting Device, John Walker, Cleveland, O. 469,491
Pulley, William F. Buswell, San Francisco, Cal. 469,512
Railway Rail Chair, William H. Mattson, Philadelphia, Pa. 469,485
Railroad Tie Plate, Charles H. Dunham, Chicago, Ill. 469,386
Railway Tunnel Construction, Jesse W. Reno, New York 469,453
Street Railway or Tramway, James M. Price, Philadelphia, Pa. 469,392
Trolley for Overhead Railways, Nelson E. Austin, Danbury, Conn. 469,460
Winding Drum for Cable Railways, John Walker, Cleveland, O. 469,338

March 8.

Cable Railway and Grip therefor, Cornelius Bollinger, Harrisburg, Pa. 470,280
Cable Railway Switch, Knud Rasmussen, Denver, Colo. 470,306
Car Wheel and Brake, John A. La Croix, Chicago, Ill. 470,202
Change Receiver, Jacob Ortlieb, Winfield, and Caleb E. Garey, New York. 470,592
Electric Locomotive, Elmer A. Sperry, Chicago, Ill. 470,516
Electric Locomotive, Sidney P. Hollingsworth, Washington, D. C. 470,627
Electric Railway, Elihu Thompson, Lynn, Mass. 470,221
Fare Register, Louis C. De Sloovere, Salem, Mass. 470,373
Insulator for Overhead Electric Railways, Henry D. Winton, Wellesley, Mass. 470,356
Insulator for Trolley Wires, William S. Andrews, New York, and Henry P. Hall, Brooklyn, N. Y. 470,417
Railroad Rail Joint, Charles U. Agner, Morantown, and William D. Armstrong, Carlyle, Kans. 470,459
Railway Construction, Richard W. King, Wichita, Kan. 470,641
Safety Cut-Out, Max Kerstein, Boston, Mass. 470,382
Vehicle, Homer L. Boyle, Grand Rapids, Mich. 470,175
Ventilator for Cars, etc., William Braidwood, Mount Vernon, N. Y. 470,540

March 15.

Automatic Car Brake, William T. Rickman, Fern Bank, Ala. 471,022
Car Replacer, Nelson S. Scott, Taylor, Tex. 471,027
Car Starter, William Grunow, Jr., New York 470,753
Car Track, Charles F. Heath, Jersey City, N. J. 470,935
Car Truck, Edgar Peckham, Kingston, N. Y. 471,061
Car Truck, Edgar Peckham, Kingston, N. Y. 471,062
Contact Device for Electric Railways, Francis O. Blackwell, Boston, Mass. 470,657
Device for Heating Cars, Hugo Newman, New York 471,016
Driving Mechanism for Cars, Thomas A. Edison, Llewellyn Park, N. J. 470,927
Electric Railway Motor, Francis O. Blackwell, New York 470,817
Electric Railway, Edward M. Bentley, Boston, Mass. 470,654
Electric Wire Support, Francis O. Blackwell, New York 470,844
Elevated Railway Plant, St. John V. Day, Terre Haute, Ind., and Charles D. Moody, Webster Groves, Mo. 470,992
Fare Box, John W. Haigh and George Exley, Worcester, Mass. 470,933
Motor for Electric Cars, Francis O. Blackwell, Boston, Mass. 470,656

March 22.

Axle Box for Street Cars, Norman C. Bassett, Lynn, Mass. 471,089
Car Brake, John Taylor, Troy, N. Y. 471,444
Cable Take Up, William B. Upton, Kansas City, Mo. 471,446
Charging Table for Electric Railways, Edward P. Usher, Grafton, Mass. 471,447
Conduit for Electric Railways, Francis O. Blackwell, Boston, Mass. 471,375
Elevated Railroad, Elbert D. Wilson, Birmingham, Ala. 471,452
Electric Railway Signal, Edgar C. Wiley, Bristol, Tenn. 471,230
Street Car Heating Apparatus, James F. McElroy, Albany, N. Y. 471,316
Trolley Pole Catcher, Montraville M. Wood, Chicago, Ill. 471,206
Trolley Wire Support, Elmer A. Sperry, Chicago, Ill. 471,151

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. Street Railway Publishing Company, World Building, New York.

The Wainwright Manufacturing Co. of Massachusetts, of Boston, have recently closed contracts for 16,000 H. P. of their well known heaters, for the Lynn & Boston Electric Railway, the New York Electric Railway, and the Albany Street Railway Co. This is said to be the largest order that has ever been placed for feed water heaters, and is an important testimonial for the type manufactured by the Wainwright company.

QUOTATIONS OF STREET RAILWAY STOCKS.

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 7 Exchange Place, Members of Boston Stock Exchange. Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,406,000	J. & J.	4	1887	87	87¼
West End Com'n	50	$7,150,000	J. & J.	5	1890–1891	76½	77

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Mar. 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co	100	$270,000	New.	...	Oct., 1887	90	95
Union R. R. Co., Prov.	100	2,000,000	Q.—J.	2	1862–1863	190	192
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers. Holyoke, Mass. Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co	100	$360,000	J. & J.	4	.....	200	225
Holyoke Street R. R.	100	150,000	J. & J.	4	.....	190	200
Northampton Street R. R.	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	3	.....	.....	65
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co	100	800,000	Quart.	1½	1867	128	130
Crescent City R. Co	100	1,150,000	"	1¾	.866	90½	91
Canal & Claiborne R. R. Co.	40	240,000	.....	..	1888	23½	26
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	132½	133¼
Orleans R. R. Co	50	185,000	"	2	1868	73½	75
St. Charles Street R. R. Co	50	600,000	"	3	1866	92	94

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	102¼	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93–'99	.....	.....
do do new	1886	40,000	M & N	6	1896	.....	.....
N. O. City R. R. Co	1879	495,200	J & D	6	1903	119	122
N. O. & Carrollton R. R. Co.	1882	300,000	F & A	6	'92–'06	113½	.....
St. Charles Street R. R. Co.	1881	165,000	J & D	6	'89–'01	.....	.....

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4	.....	140	.....
State Street Horse R. R. Co.	25	23,000	J. & J.	3	.....	100	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	20	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co.	1874	20,000	J. & J.	7	Jan., 1894	105	.....
New Haven & W. Haven R. R. Co	1889	50.000	J. & J.	5	July, 1899	100	.....
Bridgeport Horse R. R. Co.	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B.	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C. (Not yet issued)	.....	100,000	M. & N.	5	May, 1910	.....	.....

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co	50	1,250,000	Q.—J.	1½	.....	107	108
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	185	.....
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	175	.....
Coney Island & Brooklyn R. R. Co	100	500,000	.....	...	.....	125	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	106
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	101	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	107	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	103	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	108	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Aug.	1½	1890	112	115
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	10	12

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort.	1865	40,000	J. & J.	5	1905	103	.....
" " " 2d Mort.	1873	20,000	M. & N.	7	1893	102	.....
" " " 3d Mort.	1875	28,500	J. & J.	7	1895	105	.....
" " " 4th Mort.	1880	11,500	M. & S.	6	1905	105	.....
" " " 5th Mort.	1888	50,000	M. & S.	5	1913	105	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	103	104
" " " Debenture.	1891	200,000	M. & N.	6	1901	111½	114
Watervliet Turnpike & R. R., 1st Mort.	1889	350,000	M. & N.	6	1919	105	.....
Watervliet Turnpike & R. R., 2d Mort.	1889	150,000	M. & N.	6	1919	80	.....

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾	.....	25	27
Broadway & Seventh Avenue.	100	2,100,000	Q.—J.	2	.....	205	205
Brooklyn City	10	2,000,000	Q.—F.	2	.....	165	170
Brooklyn Crosstown	100	500,000	A. & O.	4	.....	.....	.....
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	104	1 8
Christopher & Tenth	100	650,000	F. & A.	1¾	.....	115	116
Central Crosstown	100	600,000	Q.—F.	1¾	.....	125	130
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	125	135
42d & Grand St. Ferry	100	748,000	Q.—F.	3	.....	230	240
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	37	40
Eighth Avenue	100	1,600,000	Q.—J.	2	.....	105	110
Houston, W. St. & Pav. Ferry. Leased to B'way & 7 ave	100	1,000,000	Q—F.	2	.....	160	.....
Second Avenue	100	1,862,000	J. & J.	5	.....	95	100
Sixth Avenue	100	1,500,000	M. & S.	3	.....	130	150
Third Avenue	100	2,000,000	M. & N.	4	.....	290	305
23d St	100	600,000	Q.—F.	2½	.....	220	230
Ninth Avenue	100	800,000	.....	3	.....	90	95

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry	.....	700,000	J. & J.	7	July, 1900	110	.....
B'way & 7th Ave., 1st mort.	.....	1,500,000	J. & D.	5	June, 1904	105	107
2d mort.	.....	500,000	J. & J.	5	July, 1914	105	106
Broadway Surface Guaranteed	.....	1,500.000	J. & J.	6	July, 1924	106	107
Additional	.....	1,000,000	J. & J.	5	July, 1905	93	95
Brooklyn City	.....	200.000	J. & J.	5	Jan., 1902	105½	107½
Brooklyn Crosstown	.....	200,000	.....	5	1902	107	109
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	114	116
Christopher & Tenth	.....	250,000	A. & O.	7	Oct., 1888	112	1 4
Central Crosstown	.....	250,000	M. & N.	6	Nov., 1922	118	120
Dry Dock, E. B'way & Battery. 1st mort.	.....	840,000	J. & D.	7	June, 1893	104	106
Scrip	.....	1,200,000	F. & A.	6	Aug. 1914	98	100
42d & Grand St. Ferry	.....	236,000	A. & O.	7	April, 1893	110	112
42d St. Manhat. & St. Nich. Av 1st mort.	.....	1,200,000	M & S.	6	Sept., 1910	112	114
2d mort.	.....	1,200,000	J. & J.	6	1915	38	39
Eighth Ave., Scrip	.....	1,000,000	F. & A.	6	Aug., 1914	105	110
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	109	111
Second Avenue	.....	1,600,000	M. & N.	5	Nov., 1909	102	103
Third Avenue	.....	5,000,000	J. & J.	5	Jan., 1937	110	115
23d St	.....	250,000	M. & N.	7	May, 1893	108	110

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry.(p'd up sh.)	50	$600,000	M. & N.	4	May, '91.	184	190
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Period.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	77	78
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	21	22
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	93½	94½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	112½	.....
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	112½	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City.....	100	$7,000,000	Q.—J.	3	.....	324	325
Chicago Passenger.....	100	1,000,000	A. & O.	2½	.....	91	92
North Chicago City.....	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street.....	100	5,000,000	J. & J.	4	.....	177	178
West Division City.....	100	1,250,000	Q.—J.	8¾	.....	635	.....
West Chicago Street.....	100	10,000,000	Q.—F.	1½	.....	130	130½
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Chicago City.....	.....	4,619,500	J. & J.	4½	.....	98¼	98½
Chicago Passenger..... ...	1883	400,000	F. & A.	6	1903	108	109
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,640,000	M. & N.	4½	1927	95½	96
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100	100½
West Division Railway.....	.....	3,790,000	J. & J.	5	.....	101	101½
" " " Ext....	.....	250,000	J. & D.	6	.....	101	101½
West Chicago Street.....	.....	4,160,000	M. & N.	5	.....	101¼	101½
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	98

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co ...	50	1,500,000	.....	..	.....	.....	28½
Citizens' Traction R. R. Co ..	50	3,000,000	J. & J.	3	.....	63	63½
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	.....	28
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	55	60
Federal St. & Pleasant Valley	50	1,300,000	J. & J.	3	.....	25	.....
Pittsburgh, Allegheny & Man	50	3,000,000	....	...	.....	39¾	.....
West End R. R. Co.....	50	200,000	J. & J.	...	.....	70	.....
Second Avenue R. R. Co.....	50	300,000	J. & J.	3	.....	.....	51
Penn Incline Plane Co..	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co...	50	60,000	.....	...	.....	5	20
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	40	.....
Pittsburgh Incline Co.....	100	150,000	.....	...	.....	115	.....
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Citizens' Traction R. R. Co ..	1887	1,250,000	A. & O	5	1927	107	108
Pitts. & Birmingham Traction Co.....	1889	1,500,000	M. & N.	5	1929	.....	101½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	....	105
Pleasant Valley Ry.....	1891	300,000	J. & J.	5	1919	.....	.....
P., A. & M. R. R. Co.....	1891	1,500,000	J. & J.	5	1931	102	109¼
Duquesne Traction Co.....	1890	1,500,000	J. & J.	5	1930	.....	100
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.....	1889	375,000	J. & J.	5	1919	.....	.....
Pleasant Valley R. R. Co.....	1873	75,000	J. & J.	6	1903	.....	.....
Union R. R. Co.....	1881	100,000	A. & O.	5	1901	.	.....
West End R. R. Co.....	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30,000	.....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.....	1883	125,000	.....	6	1903	102½	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.....	1889	250,000	J. & J.	6	1919	.. ..	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH Broker, 440 California Street, San Francisco, Cal., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.....	100	1,000,000	Monthly	5	.....	116	117½
Central R. R. Co.....	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R.R.Co	100	1,000,000	.....	1	.....	97	105
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	50	70
Ferries & Cliff House R. R. Co.	100	2,500,000	. ....	...	.....	34½	37
Omnibus Cable Co.....	100	2,000,000	Monthly	4	.....	59	61
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	.....	31
Bonds.	**Date of Issue**	**Am't Out-stand-ing.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Ferries & Cliff House.....	.....	650,000	M. & S.	6	1914	.....	107
Market Street R. R.....	.....	3,000,000	J. & J.	6	913	121¼	122½
Omnibus R. R.....	.....	2,000,000	A. & O.	6	1918	115¼	116¼
Powell Street R. R.....	.....	700,000	M. & S.	6	1912	.....	115
Park & Ocean R. R.....	.....	250,000	J. & J.	6	1914	111	114¾
Park & Cliff House R. R.....	.....	350,000	J. & J.	6	.....	94	97½
Cal. St. Cable R. R.....	.....	.....	.....	...	.....	103	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Mar. 18.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.....	100	$324,000	Q.—J.	3	1864	102	103
Cass Ave. & Fair Grounds.....	50	300,000	.....	...	1876	44½	45½
Citizens'	100	1,500,000	A. & O.	1¼	1887	100	105
Jefferson Avenue.....	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	56	60
Missouri.....	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	. .	1890	190	200
Northern Central.....	100	200,000	.....	...	1884	100	105
People's.....	50	1,000,000	M. & S.	6	1889	40	45
St. Louis.....	100	1,000,000	J. & J,	6	1890	250	275
4th Street & Arsenal.....	50	150,000	Jan.	.50	1872	15	25
Union.....	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban.....	100	2,500,000	... .	...	1891	48	50
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Benton-Bellefontaine.....	1880	$500,000	F. & A.	6	1900	102	102½
Cass Avenue.....	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable.....	1887	1,500,000	J. & J.	6	1907	107	108
Lindell...	1890	1,500,000	J. & J.	5	1895–1910	99	100
Mound City.....	1890	525,000	A. & O.	6	1900–1910	105	106
Missouri Cable.....	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort.....	1882	125,000	J. & D.	6	1902	102	105
" 2d mort.....	1886	75,000	M. & N.	7	1902	104	105
People's Cable.....	1889	800,000	J. & J.	6	1889–1914	97½	100
Northern Central.....	1884	200,000	J. & J.	6	1904	100	101
St. Louis Cable.....	1890	1,500,000	M. & N.	5	1900–1910	97½	98
Union.....	1885	150,000	M. & N.	6	1895–1915	102	103
Union Depot.....	1890	1,600,00	A. & O.	6	1900–1910	105	106

PHILADELPHIA STOCKS AND BONDS.—Corrected by ROBERT GLENDINNING & Co., 143 So. Fourth st. (Bullitt Building), Philadelphia, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'..... ...	50	$500,000	Q.—J.	4	1858	255	.....
Continental.....	50	1,000,000	J.—J.	6	1873	120	122
Frankford & Southwark.....	50	1,250,000	Q.—J.	6	1854	204	205
Germantown.....	50	1,500,000	Q.—J.	...	1858	100	101
Green & Coates...	50	500,000	Q.—J.	3	1868	117	118
Hestonville...	50	2,050,000	.....	..	1859	36	36¾
Lombard & South.....	25	500,000	A.—O.	8	1861	55	58
People's Common.....	25	1,500,000	M.—S.	2½	1873	49	50
" Preferred.....	25	750,000	M.—S.	2½	.....	49	.....
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	150	151
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	66	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	83	85
" " (40 pd.)	40					73	75
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	200	205
Second & Third.....	50	1,060,200	Q.—J.	4½	1853	159	160
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	195	.....
Union.....	50	1,250,000	J.—J.	9½	1864	177	180
West Philadelphia.....	50	750,000	J.—J.	10	1857	185	185½
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	114	.....
Baltimore Traction.....	25	5,000,000	.....	...	1889	23	24
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	34	36
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	29	30
BONDS.	**Date of Issue**	**Amount Out-standing**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	109	110
" " Imp.	1892	1,250,000	M.—S.	6	1901	102½	.....
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort..... ...	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & CO., Bankers and Brokers, 26 West Third Street, Cincinnati, Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	110½	111
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	110½	111
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	118	120
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	66	67½
" " " Pref.	100	100,000	.....	6	.....	99½	101

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" "	.....	50,000	J. & J.	7	July, 1893	102	.....
" "	.....	50,000	J. & J.	7	July, 1894	104	.....
" "	.....	50,000	J. & J.	7	July, 1895	.....	110
" "	.....	50,000	J. & J.	7	July, 1896	108	112
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
	.....	50,000	J. & J.	5	July, '96	103½	.....
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	.....
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	104	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	112	.....
" " "	.....	300,000	J. & J.	6	Jan. 1914	107	107½
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	90	92½
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	100	103
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	110	114

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & CO. Bankers, 9 South Street, Baltimore, Md., Mar. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	70	75
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Highlandtown & Point Breeze Ry. Co.	50	180,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	23⅜	23¾
North Balto. Pass. Ry.	25	.....	.....	...	.....	45	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " cons. mort.	.....	1,500,000	.....	5	.....	93	100
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	109½	110
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	110⅛	111

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	273	280
Metropolitan R. R.	50	750,000	Q. J.	...	1864	107	115
Columbia R. R.	50	400,000	Q. M.	...	1870	63	66
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	40	41½
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	32	37
Georgetown & Tenallytown	50	200,000	.....	...	.....	46	55
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	102	.....
do. do. convert.	'83-'91	2,000,000	J. & J.	6	1899-1929	150	160
Eckington & Soldiers' Home.	.....	100,000	J. & D.	6	1896-1911	97	99
Capitol & North O St. R. R.	1891	250,000	J. & J.	5	1921	108¾	115
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	118¼	128

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, March 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	31	35
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	35	37
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	.....	25
Newark (N. J.) Pass. Ry	100	6,000,000	.....	...	1890	29	30

BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	90	95
Buffalo (N.Y.) Ry.	1891	5,000 000	F & A	5	1931	94	97½
Paterson (N. J.) Ry.	1891	850 000	J & D	6	1931	.....	100
Newark (N. J.) Pass. Ry	1890	6,000 000	J & J	5	1930	91	92

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Mar. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	176	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	79	81
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

Financial.

THE Lake Side Electric Railway Co., of Peoria, Ill., have certified to a reduction of capital stock to $8,000.

$ $ $

THE Buffalo (N. Y.) Crosstown Railroad Co. have filed an application for permission to increase their capital from $500,000 to $1,500,000.

$ $ $

THE West Side company, of Chicago, Ill., have issued $1,000,000 in six per cent. debenture bonds, for the purpose of cabling Blue Island Avenue.

$ $ $

THE Stockholders of the Eureka Springs (Ark,) Electric Light & Street Railway Co., at a meeting held March 12, voted to bond the road for $25,000 and install an electric system.

$ $ $

JUDGE MILLER last month ordered the sale of the Central City and Macon & Suburban railways of Macon, Ga., under foreclosure proceedings. The sale was to occur on March 31, and to be for cash.

$ $ $

THE Superior Court has handed down a decree in the foreclosure case of the International Trust Co., of Boston, against the Keokuk (Ia.) Electric Street Railway & Power Co., ordering a sale of the property.

$ $ $

THE stockholders of the Haywards (Cal.) Electric Railway Co. have voted to issue $250,000 of first mortgage bonds, payable in thirty years from March 1, 1892, with interest at six per cent. per annum, payable semi-annually.

$ $ $

THE Cottage City (Mass.) Street Railway Co. have requested permission of the State Railroad Commissioners to increase their capital stock from $15,000 to $25,000, and to issue bonds. The increase will be used to take up the floating debt and the bonds, and to extend the road to Vineyard Haven, a distance of three miles.

$ $ $

AT a meeting of the Second Avenue Electric Street Railway Co., of Pittsburgh, Pa., last month, it was decided to increase the capital stock from $300,000 to $500,000. It was stated that $100,000 of the new stock would be sold at once in order to provide for the floating debt, for the loss caused by the burning of the car stables and for the equipment of the Greenfield Avenue branch, which runs from Second Avenue to Schenley Park. The other $100,000 will be held in reserve for further extensions.

$ $ $

AT a recent meeting of the stockholders of the Citizens' Passenger Railway Co. of Philadelphia, Pa., a formal assent was given to the lease of the road to the Frankford & Southwark Passenger Railway Co. The lease was to take effect on April 1, and the terms are annual payments; for 1892, $115,000; 1893, $120,000; 1894 and 1895, $125,000; 1896 and 1897, $130,000; 1898 and thereafter, $140,000.

THE capital of the Citizens' road is $500,000, par value $50. On January 1, 1891, the amount of capital paid in was $192,500. The dividends since 1885 have ranged from $11 to $17 a share. In 1891 a dividend of $8 a share was declared, but a new car house was paid for out of the earnings.

THE Rochester (N. Y.) Railway Co. last month offered for sale through the German American Bank of Rochester $200,000 of 6 per. cent. gold debenture bonds, payable in 1911, with an option to the company of retiring the same on or after March 1, 1901, coupons payable in March and September. During the twelve months ending January 31, 1892, the gross receipts of the company were reported to have been $673,443.09; operating expenses, $386,909.64; interest on bonded debt and taxes, $191,606.48, leaving an income applicable to dividend of $58,926.97. The steady increase in the business of the company is evidenced by the fact that the gross earnings for January and February of the present year are $20,000 greater than for the corresponding months of 1891.

$ $ $

RECEIVER J. F. CRANK of the Los Angeles (Cal.) cable railway, has petitioned Judge Wade for an order permitting him to pay $12,540, the interest due on the first mortgage bonds of the company, which fell due on Sept. 15, 1891. The receiver shows that the surplus earned by the road for the quarter ending December, 31, 1891, is $15,638.79, a gain of $3,148.14 over the corresponding quarter of the preceding year, and showing also a surplus of $60,440.98 for 1891, as against $10,923.17 for the preceding year, a gain of $49,517.81. Gain in income over 1890, $26,813.23; decrease in expenses 1891, $22,704.58; The average income per diem was as follows: 1889, $703.35; 1890, $908.81; 1891, $982.29. Increase in 1890 over 1889, $205.48; increase in 1891 over 1890, $73.48.

$ $ $

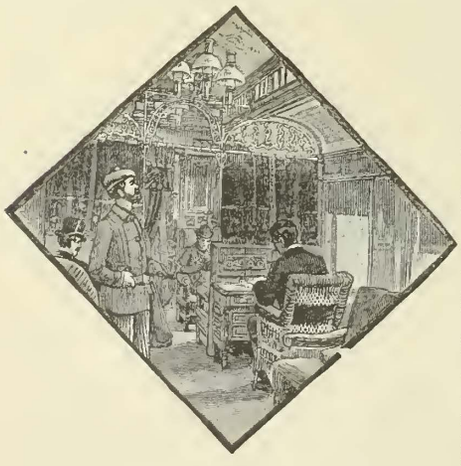
A LEASE from the Essex Passenger Railway Co., of Newark (N. J.) to the New Jersey Traction Co. was recorded in the County Register's office last month. The lease is for 999 years, and covers all the lines, rolling stock, equipment and franchises, etc., of the Essex Passenger Railway system in Newark and its vicinity. The Traction company is to pay rent beginning with $45,000 in 1892, then $60,000 in 1893 and then increasing $30,000 each year to $240,000 in 1899 and subsequent years. The Manhattan Trust Co., of New York, is the agent of the Essex Passenger Railway Co. in the receipt of the rents. The Traction company assumes all existing contracts and obligations and pays the interest on the bonds which are secured by a mortgage to the Solicitors' Loan & Trust Co. for $6,000,000. The officers of the company are as follows: President, T. C. Barr; vice-president, J. I. Waterbury; treasurer, E. C. Clay, and T. H. Wentworth, Jr., secretary pro tem. The executive committee consists of T. C. Barr, J. I. Waterbury, A. Q. Keasbey, S. S. Battin, Eugene Griffin and T. H. Wentworth, Jr. Mr. Waterbury, who is president of the Manhattan Trust Co. of New York, is mentioned in the certificate of incorporation as subscribing for 2,500 of the 5,000 shares issued.

Annual Meeting of The Brush Co.,

The annual meeting of the Brush Electric Co., was held at the office of the company, Cleveland, O., March 15. The following directors for the ensuing year were elected: S. A. Barton, Boston, Mass; J. S. Bartlett, Boston, Mass., Myron T. Herrick. Cleveland, O.; J. Potter, Cleveland; C. A. Coffin, Boston; William B. Bolton, Cleveland, and S. M. Hamill, Cleveland.

The Lake Shore Route.

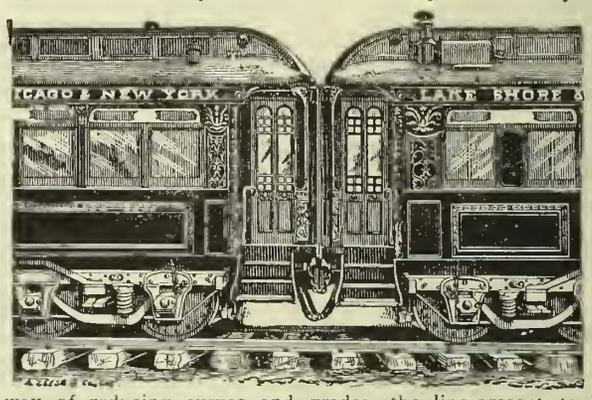
To any person who is contemplating a trip between Buffalo and Chicago, or any two points reached by the extensive railway system of the Lake Shore & Michigan Southern Railway, popularly known as the Lake Shore, we unhesitatingly recommend a trip over the beautiful and picturesque route covered by this railway. To the foreign tourist, a ride on the palatial cars on the Lake Shore means an introduction to comfort and luxuries which will be a surprise and revelation to him. To the American passenger, whether he is accustomed to traveling or not, it will mean a journey with all the usual disagreeable characteristics of traveling eliminated.



This road can truly be called a characteristic, high class American railway, travelers recognizing it as such on account of its well kept tracks, its excellent equipment, its perfect service, and the other requisites necessary to pleasant, comfortable and successful journeys. The main line is 450 miles in length between the cities of Chicago and Buffalo, with branch lines to Oil City and Pittsburgh, Pa., Fort Wayne, Ind., Detroit, Grand Rapids, Lansing, Jackson, Ypsilanti and Kalamazoo, Mich., and other cities. The main line passes through the important cities of Erie, Pa., Ashtabula, Cleveland, Toledo, O., and La Porte, Ind.

This route is the one selected by the United States government to carry the famous fast mail, showing that its reliability and promptness, as well as the high speed maintained by its trains, are recognized among officials at Washington. Three trains daily are devoted almost exclusively to this branch of business. This distinction has led the management of the company to adopt a mail pouch as the trade mark of the route.

The roadbed is probably unsurpassed by that of any line in the country, and with the improvements made during the last two years in



the way of reducing curves and grades, the line presents to-day a thoroughly constructed double track road, practically without grade or curve.

The cars on this line present every improvement which can add to the comfort and safety of the passengers. The vestibule sleepers are of the Wagner type, and the drawing room, buffet, smoking and library cars and standard day coaches are most luxurious in their appointments, and lack nothing which could add to their desirability.

On February 1, 1892, the Lake Shore line began operating its own dining cars. A glance over the menu shows that this department is maintained to as high a standard as the other branches of the service. The table affords the best the markets provide, and is equal in quality and quantity to that of the leading hotels in any large city.

No doubt a large portion of the pleasure experienced in traveling by this route can be attributed to the excellent service of the employes. The cars are in charge of experienced officers and attendants, and it seems to be their purpose to contribute in any way in their power to the comfort of the passengers.

Excellent terminal facilities exist at each end of the route. The magnificent passenger station on Van Buren Street in Chicago occupies a central portion in the city, and is convenient to all hotels, banks, Post Office and street railway lines.

The management of the company, always alert and on the outlook for the latest improvements, have shown themselves willing to adopt, regardless of cost, anything which would have place on a strictly first-class railway line. They expect to be fully equipped next year to carry the large additional traffic incident to the Columbian Exposition at Chicago and have par excellence a line to be selected by visitors to that exhibition.

The management of the Lake Shore is to be complimented on its already efficient service, and also for the uniform and correct manner in which all its numerous trains are handled, its famous fast mail trains, due to its smooth and perfect roadway, and to the prompt and reliable manner in which it takes care of its large and increasing train service.

COMPARATIVE TESTS OF THE BABCOCK & WILCOX AND HEINE SAFETY BOILERS,

At the Plant of the Rochester Railway Co., Rochester, N. Y.

REPORT BY CHARLES E. EMERY TO THE BABCOCK & WILCOX BOILER CO.

915 Bennett Building, New York, March 12, 1892.

The Babcock & Wilcox Co., 30 Cortlandt Street, New York.

Gentlemen:—In response to your request to represent your company as an expert in connection with tests to be made of a Babcock & Wilcox boiler, and of boilers constructed by the Heine Safety Boiler Co., of St. Louis, all in place in the power house of the Rochester Railway Co., at Rochester, N. Y., I hereby report that I arrived in Rochester on the 15th of February, 1892, and examined the plant, but no complete arrangements could be made for the test for several days, on account of the non-arrival of the expert appointed by the Heine company, Mr. J. J. de Kinder, of Philadelphia, Pa. On the 19th Prof. M. E. Cooley, director of the Department of Mechanical Engineering of the Michigan University, at Ann Arbor, Mich., arrived in place of Mr. de Kinder. During that and the succeeding day, an agreement in writing was formulated and signed relative to competitive capacity trials of the two types of boilers.

On February 21, the Babcock & Wilcox boiler was tested, and on February 23 a corresponding test was made of the Heine boilers.

The relative performance of the two types of boiler are shown in the accompanying table, certified by Professor Cooley and myself.

GENERAL RESULTS.

The general results are that the Babcock & Wilcox Boiler exceeded the performance of the Heine Boilers 22.18 *per cent. in capacity, and* 19.5 *per cent. in economy.*

The results for capacity may be obtained by comparing the relative maximum power shown by the different boilers, on the basis stated in line 28 or line 29.

The economy of the two boilers when worked at the rates of evaporation stated, is shown in line 23, where the actual evaporation is reduced to the same pressure and temperature; from which it will be seen that the Babcock & Wilcox boiler evaporated 19½ per cent. more water per pound of coal than the Heine.

BOILERS TESTED.

There are in position in the boiler room of the power house of the Rochester Railway Co. four Heine boilers, rated at 200 H. P. each, and one Babcock & Wilcox boiler of the 12-high type, rated at 416 H P. Drawings with brief descriptions of these boilers are given in the appendix. The steam generated is supplied to high speed engines to operate dynamos furnishing electric current to operate the electric railroad lines of the railway company. Reports had reached your office that the Babcock & Wilcox boiler was not operating satisfactorily, it being claimed that the railroad could be operated with four Heine boilers, but not with two Heine boilers and the Babcock & Wilcox boiler. This led to a request on your part that the boilers be tested competitively, which was in general terms assented to by the Heine company, and consent was given by the Rochester Railway Co.

PRELIMINARY PREPARATIONS.

Your representative on reaching the ground reported that the connection of the Babcock & Wilcox boiler with the stack was indirect, having a very short offset just before entering the latter, with curves of very short radius. While this fact formed no reason why the boiler should not give a fair percentage of increase over its rated power, you decided that as a competitive test was to be made, it should be on conditions designed to test the comparative merits of the boilers and not of abnormal conditions accidentally existing at this particular place. As time was pressing, the flue around the rear of the boiler was cut off and a straight connection made from the side of the boiler to the chimney. The rear flame plates were at the same time extended downward a few inches further to correspond with the customary practice, which for some reason had not been carried out in this case. The boiler was then put in service to permit two of the Heine boilers to be cleaned preparatory to the test. The engineer of the station cut out one Heine boiler and reported to the president of the railroad company that he would not take the responsibility of taking off two Heine boilers, thus squarely reiterating his former claims that he could keep up steam with four Heine boilers rated at 800 H. P., but could not with two Heine boilers in connection with 416 H. P. of Babcock & Wilcox boilers. I arranged, however, to have the change made, and for safety detailed the firemen you had furnished for the test to fire the Babcock & Wilcox boiler for the time being. I soon saw that the fireman of the Heine company was firing the two Heine boilers which were to be kept in use, so for purposes of comparison I weighed the water evaporated by the Babcock & Wilcox boiler. Under these circumstances it proved necessary to force the 416 H. P. Babcock & Wilcox boiler up to 807 H. P. under actual conditions, in order to prevent the steam pressure from falling, although the total quantity of steam required could not have been more than 1,000 boiler H. P. It was then proposed to weigh the water to the Heine boilers. The fireman on those boilers had been firing high in front and probably leaving holes in the fire at the rear. The proposition caused him to level his fires, when the steam pressure rose rapidly and it became necessary to shut the ash pit doors on all the boilers. This incident settled the question that had been raised in the fire room as to the relative steaming capacities of the two kinds of boilers, and it was not broached again. It seems proper to add here that if so-called tests of competing boilers, based on manœuvres of the kind here observed, are reported to boiler companies without a full statement of the facts, the information, however, satisfactory at the outset cannot form a reliable basis for guarantees of performance to be proved by actual tests under impartial management. After the arrival of Professor Cooley on February 19, the details for conducting competitive tests to ascertain the maximum capacity of the two boilers, and in connection therewith the economical results shown when operated at such capacity, were agreed to and were reduced to writing and signed on the 20th. As Professor Cooley had had no opportunity to investigate matters, and Vice-President Foster of the Heine company appeared to take the lead in making the arrangements, I arranged that Mr. Foster should sign the agreement in connection with Professor Cooley, and also requested Mr. Wells, who was present as a business representative of your company, to sign the same in connection with myself. The following is a copy of the agreement:

"Mutual agreement preliminary to test of Babcock & Wilcox and Heine boilers in power station of Rochester Street Railroad Co.

"Rochester, N. Y., February 20, 1892.

"The test to be exclusively in charge of the experts, Dr. Chas. E. Emery and Prof. M. E. Cooley, and during the progress thereof all persons in the fire room to be subject to the orders of such experts.

"The boilers to be tested to be preliminarily operated with a bright fire until properly heated up—the water level in boiler noted, when boiler and feed pump are operating under average conditions; the pump is then to be stopped and fires promptly hauled. A new fire to be immediately started with weighed kindling and coal on bare grates, and the beginning of the test to be noted at the time such fire is started. The duration of the test to be ten hours, as nearly as possible. At the finish the water is to be brought to the same level as when fires were hauled at the beginning, and while the boiler is still steaming and pumps running regularly, the pump is to be stopped, the test closed and fires immediately hauled. The firemen of the Babcock & Wilcox boiler to cease firing not more than nine hours and forty minutes from the beginning of the test, and those of the Heine boiler not more than nine hours and fifty minutes from the beginning of the test, except that such firemen may, with the consent of the experts, fire small quantities of coal to maintain fires during the portions of the test not completed, it being the intent to maintain the fires at the highest temperature which will permit their being hauled promptly at the expiration of the test limit.

"The unconsumed coal and coke hauled from the furnaces at the close of the test to be picked out by hand, weighed dry and deducted from the total amount of coal fired, in making up the statement of results for the final report hereinafter provided for. The steam pressure to be the same, as nearly as possible, at start and finish. The coal as delivered in building to be divided as used and alternate barrows delivered to the boiler first tested, and intermediate barrows to a pile which is to be used in testing the other boiler. One shovelful for each barrowful weighed to be thrown into a pile, and average samples from this pile to be tested for moisture, the proportion of which shall be deducted from the total coal as fired and the balance called "dry coal." The coal delivered to the boiler undergoing test to be weighed and dumped on the floor in charges.

"The water to be weighed and dumped into a receiving tank and brought to the same level at the beginning and end of the test, also at the end of each hour, which is to be done with weighed water for each observation except the first.

"The ordinary observations to be noted at least three (3) times an hour, and more frequently if so arranged.

"A representative of each party to be assigned to record coincidently each class of data, and any disagreement to be immediately referred to the experts.

"The experts to report in duplicate the equivalent weight of dry coal consumed and the equivalent weight of water evaporated into dry steam under actual conditions; also from seventy pounds pressure and 100° F. also from seventy pounds pressure and 212° F., and also from and at 212° F. for the period of the test of approximately ten hours above provided for. And will also report in duplicate the approximate quantity of water evaporated into dry steam in each boiler during each hour and certify duplicate logs showing in detail all the facts above referred to and other customary data.

(Signed.) Chas. F. Foster,
Representing Heine Safety Boiler Co.
(Signed.) E. H. Wells,
Representing the Babcock & Wilcox Co.
(Signed.) Chas. E. Emery,
Expert appointed by the Babcock & Wilcox Co.
(Signed.) M. E. Cooley,
Expert appointed by the Heine Safety Boiler Co."

RECORDS.

During the tests the agreement was strictly adhered to, except in a few minor particulars, which were modified by consent as the first trial progressed. For instance: It being late when the first test was finished, it was agreed not to attempt to weigh back the coal and coke in the fires hauled out during either trial, but to consider the whole as refuse.

It will be observed that provision is made in the agreement for duplicate records of each class of data by representatives of each of the competing parties. Messrs. Foster and Wells were assigned to record in ink in separate books the records of the water evaporated and the coal consumed; Messrs. Nelson and Rowell to actually measure the water; Messrs. McCormick and Wolfenden to actually weigh the coal, and Messrs. Bateman and Hoxie to take the calorimeter and general log readings, leaving Professor Cooley and myself free to assist either party, and attend to the general conduct of the test. The person first named in each case was a representative of the Heine company, and the person second named in each case was a representative of the Babcock & Wilcox Co. Mr. Silbermann, of the Heine company, was detailed to take charge of the laborers in handling the coal, etc., Mr. George Thomas, of the Babcock & Wilcox Co. being also present. A machinist was detailed to attend to the pump. The firemen employed by the Babcock & Wilcox Co., by name Michael Flavin and John Kernan, were loaned for the purpose by Mr. Pierson, manager of the Boston Electric Railways. Mr. Neeley was the principal fireman of the Heine boilers, though two of the station firemen assisted him.

APPARATUS.

The apparatus for measuring the feed water consisted of two large hogsheads, each set on a platform scale. The two scales and hogs-

heads were mounted on cross pieces over a large lower tank provided with a water gauge. The hogsheads were designated tanks 1 and 2. The man operating each tank would permit the same to fill by opening a valve, then close the valve, balance the scale and write the gross weight on a blackboard in plain view; he would then let the water run out into the lower tank, call out when it was empty, shut outlet valve, again balance the scale, and write the final weight or tare opposite the initial weight above referred to. The recorders, seated at a table between the coal scales and water tanks, would record the several initial and final weights of the upper tanks, and the time each tank was emptied, and in connection with the latter observe and record the height of the water in the gauge on the lower tank, and the height of water in the boiler gauge. The difference of time between emptying the tanks was noted in a special column to avoid all possibility of error by the omission of one tank. This was also prevented by the blackboard system, as the record remained there for a considerable period, and could be copied at intervals, after which the two observers compared notes. The coal as weighed was also continuously recorded on a blackboard, the initial or gross weight and the final or tare weight being set down in separate columns. These were also copied in ink by the observers at the recording table, and carefully compared before the figures on the board were erased.

The first charge of coal weighed out was approximately two tons and afterwards successive charges of eleven barrow loads, or approximately one ton, were furnished the firemen as often as required. A timber was laid on the fire room floor parallel with the boilers, and as one charge was being burned another charge was placed back of the timber and thrown over by the laborers when the first one was exhausted.

Nothing of special interest occurred in connection with starting the fires on either boiler. The wood was brought close at hand while the boilers were running regularly, and when everything was ready the water level in boilers was noted, feed pump stopped and preliminary fires quickly hauled and wet down, when the furnaces were immediately wooded and there was sufficient heat in the brick work to start the wood at the rear as it was put in the furnace. The time for the experiment was called in each case when the greater part of the wood was in each furnace and in a general blaze. The time from giving the order to haul fires to the time the wood was well ignited, as previously stated, was for each boiler almost exactly seven minutes, so no advantage was obtained in this way.

TEST OF BABCOCK & WILCOX BOILERS.

The test of the Babcock & Wilcox boiler was started at 11:26 A. M. on February 21, and continued until 9:27½ P. M. No special incidents occurred during the trial of that boiler, except that the gland worked off the stuffing box of one of the feed pump rods, requiring that the pump be stopped for a few minutes, but the water level was soon regained. A small allowance was agreed to for the weighed water that escaped. After fires were well started the coal was fired on the system of coking in front and then pushing back the surplus. In due time the firemen fired heavily over the front of all the fires in rapid succession, the men shoveling right and left handed into the same opening. The fires were most of the time eighteen inches to two feet thick and absolutely white hot in every part, so as to pain the eyes when looking at them, much the same as when looking at the sun. The feature of the firing was the frequent use of a heavy slice bar to break up the coal from the bottom and make the mass porous, so that the great thickness did not represent solid coal. The firemen only removed three or four clinkers during the entire run of ten hours, and at the end there was no difficulty in cleaning the bars and side walls thoroughly, the few clinkers in the fire being in detached masses of moderate size.

TEST OF HEINE BOILERS.

The test of the Heine boilers was started at 10 : 36 A. M., February 23, and continued until 8 : 36 P. M. that evening.

The firing was done more frequently and with much smaller charges than for the other boiler, and it was apparently intended to carry the fires very much lighter. As there were, however, three men shoveling coal, the fires became probably a foot thick during the first half of the test, but were reduced a little afterward. After the fires under this boiler were fairly started, the uptakes of each of the two boilers and the flue leading to chimney were observed to be quite hot, and small openings revealed the fact that they were full of flame. This fire was attributed to various causes, such as the firing of soot in the chimney, to the direct passage of flame through the flues, and to the ignition of gas generated in the furnaces. The latter appears to have been the correct solution, as the flames stopped after a while and recurred only at intervals, being less frequent when the men carried fires somewhat lighter than at the beginning of the test. During the first hour it appeared for a time as if the test would have to be discontinued, as the flues were so hot that the felt was fired on the steam pipes running over the flues and the lower chords of the wooden roof girders became charred. It became necessary to turn on water through a hose to avoid danger to the building, which was repeated several times during the test. At the close of the test of the Heine boiler there was evidently much more coal in the furnaces than during the test of the Babcock & Wilcox boiler, and there were also many more clinkers, quite a fair proportion of the grate surface being covered by them where the firemen were unable to dislodge them during the trial. The clinkers also adhered in large masses to the side and bridge walls. This clinker being very heavy, the difference in the amount of refuse shown in the table does not represent the additional amount of combustible in the fires at the time they were hauled. It is fair to say that the representatives of the Heine boiler claimed that their dampers were thrown out of shape by the intense heat during the first part of the test, and that the draught thereafter was not as great as desired. These claims could not be verified while I was at Rochester, but there was no apparent difficulty in burning all the coal on the grates that was desired. The limitation appeared to be that when more than a certain quantity was fired the quantity of gas carried through to the uptake became so great that when lighted by any cause it created the difficulty previously mentioned, of overheating the flues, which necessitated the use of the fire hose on the adjoining woodwork.

FURNACES.

It should be stated that the particular furnaces used were selected by the railroad company and were not of the kind preferred by either competing boiler company. They were, however, exactly alike for each type of boiler and therefore, gave neither the advantage.

At the conclusion of each test, the different observers compared their records and signed them in duplicate. The general results of the tests are shown in the table herewith presented, signed in duplicate by Professor Cooley and myself. Copies of the general records, which were similarly certified in duplicate, are also furnished.

The tabulated report was, at the suggestion of Mr. Foster, and for convenience, made out on one of the Heine blanks, so some of the minor features need a little explanation.

RATING.

As is well known, the value of a horse power used in rating the Babcock & Wilcox boilers is that fixed by a committee of the American Society of Mechanical Engineers, and which was used previously by the writer in reports of the boiler trials at the Centennial Exhibition, such value being thirty pounds of water evaporated into dry steam at a pressure of seventy pounds from feed water at a temperature of 100 degs. On this basis 333,307 British thermal units of heat are derived from the fuel and imparted to the steam for each horse power. This rating has by common consent come to be called the Association rating. The Heine boiler, on the contrary, is still rated on an older basis, viz., the evaporation of thirty pounds of water at a pressure of seventy pounds from a temperature of 212 degs., which corresponds to only 29,932 British thermal units per horse power. The older horse power used for the Heine boilers is, therefore, only 89.9 per cent. of that furnished by the Babcock & Wilcox boilers, and it follows that in driving engines or in doing a given quantity of work of any kind, the Heine boilers are, on account of their rating, only required to do 89.9 per cent. of the work performed by the Babcock & Wilcox boilers, by the Association rating. In lines 28 and 29 the maximum horse power obtained is calculated respectively for the two ratings, from which it will be seen that the Heine boiler, when, by its own method of rating, developing 666½ H. P. would, by the Association rating used by the Babcock & Wilcox Co., only be doing 598.95 H. P., while the Babcock & Wilcox boilers when developing, according to Association rating, 731.78 H. P. would, according to the Heine method of rating, be developing 814.37 H. P.

Column 30 gives the percentage over rated capacity on the basis shown by the side notes; that is, the power in the Babcock & Wilcox boiler is based on the Association rating, while that of the Heine boiler is based on their own rating. The power for the former was taken from line 28, and that for the latter from line 29. Had the power of the Heine boiler been based on the Association rating, it would only have exceeded its rating by 49½ per cent. So also in the next line the square feet of heating surface per horse power is stated for the different ratings of the two boilers. If the Association rating had been used for both boilers, the heating surface per horse power would have been 4.84 for the Heine boiler, and 6.53 for the Babcock & Wilcox boiler.

QUALITY OF STEAM.

The percentage of moisture in steam in line 32 was obtained by the use of the Barrus calorimeter. On the Babcock & Wilcox boiler a perforated pipe was placed horizontally nearly across the vertical eight inch pipe leading upward from the yoke pipe connecting the three drums. The perforated pipe was, therefore, below the angle stop valve which delivered the steam to the engines. The safety valve was on an equalizing pipe connecting the drums nearer the front. On the Heine boilers it was at first arranged to put a perforated pipe nearly across the centre of the tee fitting, which was connected at the bottom to a saddle on the boiler, at the top to the safety valve and at the side to the main steam pipe through an angle stop a little distance away. The writer, however, objected to this, as a perforated pipe so located would not necessarily be in the main current of the steam, as there was room for a large portion of such current to pass on the inner side of the turn and escape the perforated pipe. On No. 3 boiler, therefore, the calorimeter pipe was run across near the bottom of this tee just above the flange, so as to indisputably be in the main current of steam of the boiler to the engine. Another calorimeter was placed on the No. 4 boiler with internal pipe crossing the vertical run of the tee about three-fourths of an inch below the centre of the lateral branch, and therefore partly out of the current to latter. The Babcock & Wilcox boiler which was first tested being very high, there was considerable vapor in that part of the building, and some drops of moisture showed on the outside of the felting on calorimeter. After running for four and a half hours, Professor Cooley said he feared the calorimeter was leaking, which would vitiate the experiments, and I requested him to change it for one of the same kind he had brought with him from the university. After the experiments with this boiler were completed, in calibrating the instruments, it was found on the contrary that the calorimeter first used was tight and the university one leaked, and so only the first part of the record could properly be used, which showed 1.088 per cent. of moisture. That shown by the leaking instrument during the latter part of the test was much less. In the tests of the Heine boiler the instrument first used on the Babcock & Wilcox boiler was applied to Heine No. 3, and a similar instrument owned by the Heine

company applied to No. 4. Occasionally some very high differences in thermometer readings showed for both of these instruments, but particularly No. 3. These, it was claimed by Professor Cooley, were due to spray falling on the exterior of the instruments when drenching the building with water at the time the flues were overheated. These abnormal readings would have increased the amount of moisture shown by these boilers, and while it could not be demonstrated whether the moisture was from the inside or outside, I yielded the Heine boilers the benefit of the doubt. With such abnormal readings erased, the percentage of moisture, as shown in line 32, was 0.755 of 1 per cent. for boiler No. 3, where, it will be recollected, the cross pipe had been lowered completely into the issuing stream of steam, and 0.484 of 1 per cent. for boiler No. 4, where the connection was nearer the centre of the tee. The instrument on boiler No. 3 was really the official one, but again yielding, the average of the two is given in the main column. The difference in moisture for the two types of boiler is very small, as shown, and would have been much less for the Babcock & Wilcox boiler if it had been thought proper to work up the records from the second calorimeter applied, and greater for the Heine, if all the records had been included.

COAL.

The method adopted, as shown by the preliminary agreement, of wheeling alternate barrows of coal to the Babcock & Wilcox boiler undergoing test and the intermediate ones to a pile which was afterward used in the test of the Heine boiler, gave positive assurance that the quality of coal used during the two tests was the same. The coal as it entered the station being quite wet, having just come in cars from the mines, samples thereof were, as stated in the preliminary agreement, dried. The results of these tests for the coal used in the two boilers were so nearly the same when one or two abnormal results were rejected as improbable, that by agreement the moisture was considered to be 4.442 per cent. during both tests, and this percentage has been deducted from the actual weight of the coal in obtaining the amount of dry fuel consumed, stated in column 9. It would doubtless have been proper to add a similar percentage to the water evaporated in both cases, but it has not been done.

CONSTRUCTION OF BOILERS.

Before closing this report, it will be of interest to discuss the question whether or not the enormous difference in results shown by the two boilers is due in any great degree to accidental conditions which can be eliminated on another trial, or whether there is in the construction or proportions of the two types of boilers sufficient reason to account for differences in results as great or nearly as great as shown by these tests. In the Babcock & Wilcox boilers the products of combustion are caused to pass transversely across and between water tubes, which arrangement is believed to be more efficient than when the gases follow along the heating surfaces. A special feature of the Babcock & Wilcox design is also the arrangement of a number of combustion chambers along the route of the gases to the chimney, in which consumed gases may become ignited and the heat of ignition utilized by additional heating surface across which the heated gases pass transversely as before. To accomplish these conditions, the boiler is high and long and the internal space is broken up into alternate clumps of tubes and combustion chambers. The result as shown on the trial was that there was no evidence of the formation of gas, and the boiler gave fair economy, even when working at nearly double its rated capacity. The Heine boiler appears to have been constructed on a different theory. The tubes are placed in one large clump and divided into longitudinal passages by tiles lying on and between the tubes. The only combustion chamber available is that in the furnace and behind the bridge wall, after which the gases are confined in comparatively narrow channels for the whole length of the route to the uptake. It appears evident that any gases unconsumed before entering the passages between the tubes must remain so, and that such gases are liable to become fired in many ways as they issue from the tubes into the uptake or smoke flues and cause trouble of the kind stated, when attempting large capacity.

HEATING SURFACE PER HORSE POWER.

Independent of these differences in construction, there is an important difference in the proportions of the Babcock & Wilcox and Heine boilers. The Babcock & Wilcox boiler is provided with eleven and a half square feet of heating surface per horse power, of thirty pounds from seventy pounds and 100 degs., or of 333,307 thermal units, as above explained, whereas the Heine boiler ordinarily furnishes only seven and a half square feet of heating surface for each horse power of thirty pounds, from seventy pounds and 212 degs., or of 29,932 thermal units. In this particular case they only furnished seven and one quarter square feet instead of seven and a half as above. It is, we understand, claimed that the heating surface of the Heine boiler is more efficient than that of other boilers, and that, therefore, less is required to do the same work. With all due respect, it should be said that there is nothing new in reducing the heating surface of a boiler, so that such reduced surface is more efficient per unit than a larger surface. *It simply does not pay.* This has been shown again and again in trials of other boilers, and the results of these tests merely confirm what is well known.

VALUE OF HEATING SURFACE.

In any boiler the surface to which the fire or products of combustion is first exposed is most efficient, because the heat is transferred at a maximum difference of temperature. As the gases pass toward the chimney their temperature diminishes, and the potential efficiency of each square foot of surface diminishes. All such surface, however, produces economy so long as it still further reduces the temperature of the products of combustion, whereby less heat is wasted in the chimney and more imparted to the water in the boiler. Reducing the heating surface for a given power merely means throwing away more heat in the stack, in case the combustion be perfect, and throwing away combustible gas and unutilized hot air in case the combustion be imperfect. In the latter case, evidently, the uptake temperature may be low even with reduced heating surface, unless the gas be accidentally lighted. The heating surface of the bottom of a kettle set on a stove is very efficient, but it does not prevent much of the heat of the fire from going up the chimney. A kettle enclosed in a furnace is familiar on the farm. The bottom of the kettle is as efficient as that on the stove, but there is in addition heating surface on the sides which acts to reduce the temperature of the products of combustion, so that with this arrangement a given amount of water can be boiled with less fuel. The heating surface of steam boilers has been progressively increased in the same way, but to a greater extent. At first, boilers were shaped like a kettle, or were cylindrical in form, and the heat was applied on the bottom and sides only. Finally flues were introduced through the cylinders, and the heating surface materially increased, with a large saving in fuel. This type of boiler gives large power for a given weight, and being accessible for cleaning will always be a favorite where these conditions are important, and fuel so cheap that economy is of secondary consideration. Such a boiler is, however, greatly inferior to the higher types of boilers now available, in which much larger proportions of heating surface to power developed are employed, and particularly to the Babcock & Wilcox boiler, which is in addition constructed in such manner as to promote perfect combustion and secure the highest protection against dangerous explosions. Boilers built with reduced heating surface may obtain the higher heating surface efficiency shown by the old flue boilers, but necessarily at the same enormous sacrifice of economy.

The relative losses in economy due to furnishing power with reduced heating surface has been satisfactorily settled when using the best fuel obtainable in the most economical form of boiler possible, by experiments made by the United States Government, collated by the writer in an article on "Boiler Proportions," embodied in the report of the judges of Group XX, Centennial Exhibition, at page 69.

The proportionate loss shown by the equation evolved in the above case when calculations therefrom are based on the same proportional reduction of surface as in the boilers tested, corresponds within less than 2 per cent. of that actually shown during such tests, from which facts the conclusion appears incontrovertible that the reduced economy shown by one type of boiler during the tests under discussion was due to the reduction of heating surface rather than to conditions which developed during such tests.

SAVING AND COST.

In conclusion, it will be of interest to examine the relative original cost of steam boilers in connection with the cost of fuel to be paid for continuously afterward. A little calculation will show that with coal at customary average prices, and boilers operated the customary number of hours in a year, the cost of coal per year will equal approximately the original cost of the steam boilers in which it is consumed. It follows, therefore, that a purchaser may pay for better boilers a price increased in proportion to the saving in fuel, when, as such saving is continuous from year to year, it will pay 100 per cent. interest on the increased cost. For instance: If the purchaser must pay $10,000 for boilers which require $10,000 worth of coal per year to operate a factory, he may pay one-eighth more, or $1,250 additional for boilers that will save one-eighth of the cost of the fuel, or $1,250. per year, when evidently the whole additional cost will be repaid to the purchaser every year, or 100 per cent. interest on such additional cost as stated. On the basis of the trials under discussion one type of boiler showed a superiority of 19½ per cent., which corresponds to a saving of 16.32 per cent. when doing the same work. It follows, therefore, on the principles above explained, that a purchaser could pay 16.32 per cent. more for the more economical boilers and yet receive 100 per cent. interest on the additional investment. These illustrations show what an important bearing the economy of a steam boiler has upon its original cost, and emphasize the fact that builders who furnish a reduced amount of heating surface are really furnishing smaller boilers to do the same work, which, although they can be furnished at less price originally, are, as shown by the trials, of less capacity as well as of less economy, making it very much for the interest of the purchaser to pay the higher price for the larger and more economical boilers provided with more heating surface for the same horse power rating.

STATEMENT FROM THE BABCOCK & WILCOX CO.

New York, February 29, 1892.

To the Agents of the Company:

Herewith please find photographic reproduction of a report of the results of competitive tests of the Babcock & Wilcox boiler, rated at 417 horse power, and of two Heine boilers, rated collectively at 400 horse power, which tests were made on the 21st and 23d of this month, under the direction of two experts: one, Dr. Charles E. Emery, the well-known engineer of this city, appointed by this Company; the other, Prof. M. E. Cooley, Director of the Department of the University of Michigan, at Ann Arbor, Mich., appointed by the Heine Safety Boiler Company, of St. Louis, Mo. The results of these tests agree with the predictions of this Company, and place the Heine boiler, both in relation to capacity and economy, exactly in its proper position as a competitor with the boiler manufactured by this company.

The questions to be settled by these competitive tests were the relative maximum capacity of the two boilers with draft available and the economy shown when operating at such maximum capacity. The question of relative capacity is clearly shown by examining the maximum power developed (see lines 28 and 29 of the table), and the relative economy is shown by examining the weight of water evaporated

Results of Test of Boilers at Rochester Railway Co., N. Y.

		One Babcock & Wilcox.	Two Heine Safety.
1	No. and kind of boiler	3 of 86 ins. diam. and 22 ft. 6 ins. long.	1 of 48 ins. × 19 ft. 7 ins. each boiler.
2	Diameter and length of shell	216 4 in. diam. 18 ft. long.	87 3½ ins. × 16 ft. each boiler.
3	Number, diameter and length of tubes	4784	2200
4	Square feet of heating surface	75.8	74.2
5	Square feet of grate surface	416.0 H. P.	200.0 H. P. each.
6	Rated Capacity	Reynoldsville, Pa., run of mine—bituminous.	
7	Kind of fuel used	10.02	10.00
8	Duration of test—hours	33819 00	33015.00
9	Total amount of fuel used—dry	3375.15	3301.50
10	Pounds of fuel per hour	2279.00	4167.00
11	Total amount of ash, including fires hauled out	6.74	12.62
12	Percentage of ash	126.68	127.16
13	Average steam pressure	1.016	1.111
14	" Draft pressure	29.88	29.97
15	" Barometer	171.80	168.25
16	" Temperature of feed	35.86	33.73
17	" Temperature of air	59.35	49 20
18	" Temperature of room	Pyrometer doubtful.	Pyrometer doubtful.
19	" Temperature of stack	232654.00	189382.00
20	Total amount of water evaporated into dry steam, Actual conditions	23218.96	18938.20
21	Pounds of water evaporated under actual conditions, per hour	6 879	5.736
22	" of water evaporated per lb. of coal. Actual conditions	7 475	6.255
23	" of water evaporated per lb. of coal, from and at 212°	8.015	7.158
24	" of water evaporated per lb. of combustible from and at 212°		
25	" of water evaporated, per sq. ft., heating surface per hour from and at 212° F.	5.270	7.120
26	" of coal per sq. ft. grate, per hour	44.53	44.49
27	" of coal per horse power		
28	Horse power actually developed, {70 lbs. and 100°	731.78	598.95
29	{70 lbs. and 212°	814.37	666.50
30	Percentage over rated capacity	70 lbs. and 100° 75.8	70 lbs. and 212° 66.6
31	Square feet of heating surface per horse power	70 lbs. and 100° 6.53	70 lbs. and 212° 4.35
32	Percentage of moisture in steam	1.088	No. 3, 0.755} av. No. 4, 0.484} av. 0.6195

Rochester, N. Y. February 25, 1892.

Chas. E. Emery, Expert appointed by the B. & W. Co.
W. E. Dooley, Expert appointed by the H. S. B. Co.

per pound of coal (see line 23). These results may be briefly expressed as follows :

Superiority of Babcock & Wilcox Boilers in Capacity (lines 28 and 29) ..... 22.18 per cent.
Superiority of Babcock & Wilcox Boilers in Economy (line 23) ..... 19.5 "

It will be seen that the enormous superiority shown by the Babcock & Wilcox boiler both in capacity and economy is far beyond any difference which can be made by the Heine Company in prices. In fact, the saving in economy, being continuous, is in the nature of interest, and either warrants an enormous increase in the price of the Babcock & Wilcox boiler, or, on the other hand, secures a great saving available for profits or dividends to the purchaser.

The principal questions are thus settled by a mere inspection of the report ; some less important comparisons in the table require a word of explanation. It should be borne in mind that the Heine Company do not sell boilers by the Association standard rating, fixed by a Committee of the American Society of Mechanical Engineers, which is based on the evaporation into dry steam of 30 pounds of water at a pressure of 70 pounds from feed water of 100 degrees temperature, but continue a rating 11⅛ per cent. higher, in which the feed water is assumed to be at a temperature of 212 degrees instead of 100 degrees. Line 28 shows the power developed by the competing boilers under the Association rating, and line 29 that developed by such boilers according to the Heine rating. Line 30, showing the " Percentage over Rated Capacity," is necessarily based on the rating used by each competitor, as indicated in the notes at the left. Evidently by comparing the commercial rating of 400 horse power of the Heine boilers (line 6) with 598.95 horse power actually produced under the Association rating (line 28), the Heine boilers only exceeded their commercial rating by 49.76 per cent. as compared with an excess of 75.8 per cent. by the Babcock & Wilcox boilers.

It is true that the Heine boilers, as shown by line 25, evaporated 7.12 pounds of water per square foot of heating surface per hour and that the Babcock & Wilcox boiler when developing 22.18 per cent. more power only evaporated 5.27 pounds of water per square foot of heating surface per hour, but this is because the Heine Company only furnishes ordinarily 7½ square feet of heating surface per rated horse power, or 7.25 in this case (see lines 4 and 6), while the Babcock & Wilcox Company furnishes 11½ square feet of surface per horse power. The reduction of surface in the Heine boiler makes it cheaper to construct, but this is principally for the benefit of the Heine Boiler Company, and can in no way profit the purchaser on account of the comparatively enormous consumption of fuel, which is a continuous charge and not paid for in the beginning like the price of a boiler. The increase in heating surface also gives the Babcock & Wilcox Company a decided advantage, as shown by the enormous increase in capacity when such capacity is desired. If the boilers were worked nearer their rated capacity both would be more economical, but the Babcock & Wilcox much more so, on account of its greatly increased heating surface. This test shows whether or not the increased heating surface furnished by this Company is of value.

In line 31 the square feet of heating surface per horse power, as will be observed, is also shown according to the two different ratings. If made on Association rating the Heine boiler developed a horse power with 4.84 square feet of heating surface and the Babcock & Wilcox boiler with 6.53 square feet of heating surface, the extra heating surface of the latter showing its value, as before, by the increase in capacity and economy.

The facsimile report is marked " Not for Publication," for the reason that the Heine Safety Boiler Co., through their representatives, at the time of the test, expressed dissatisfaction with the results, though in no wise disputing them, as shown by the signature of their expert, and as the expert of this company at the time agreed to use his influence to prevent the publication of the report by the press of the country, pending another test, if made within a reasonable time, this Company has informed the Heine Company that it will agree to take part in further tests if made complete both for capacity and economy in the same boilers, without alteration between tests, within 15 days from date. In the meantime the agents of this company to have copies of the report of the previous tests for private circulation for business purposes, but not for the purpose of publication in the journals of the country.

It is not expected that the Heine boiler can make much better showing than that in this report. It appears that in forcing the boiler, part of the fuel formed gas, which was periodically ignited in the flue connections to chimney, making them red hot. This is precisely what should be expected with a boiler so constructed, and can best be prevented by not attempting such a capacity.

The increased quantity of refuse (line 11) shown during the trial of the Heine boiler was not due to difference in quality of fuel, but mainly to misjudgment on the part of the fireman, in leaving more coal in the furnaces at the end of test than was the case when the Babcock & Wilcox boiler was tested. An allowance of 4.44 per cent. reduction of weight in coal was agreed upon for both boilers on account of the coal being very wet from exposure to the weather. The extra coal in the furnaces at the end of the test of Heine boiler increased the capacity shown by that boiler, and even if on another trial the same percentage of refuse be obtained for both the boilers the results will, as is evident on inspection, still be enormously in favor of the Babcock & Wilcox boiler both in ecomomy and capacity.

THE BABCOCK & WILCOX COMPANY,
Per N. W. Pratt, *Treas.*

STATEMENT FROM THE HEINE SAFETY BOILER CO.

St. Louis, March 19, 1892.

The Babcock & Wilcox Co., through their agents, are circulating among the steam users of the whole country a fac simile of a sheet of results of test of Babcock & Wilcox and Heine safety boilers recently made at Rochester, N. Y., to which they have added a two page dissertation on the same. On account of this publication and its circulation among possible customers, it becomes necessary for us to make a full explanation as follows :

On May 7, 1890, we closed a contract, through our New York agency, with the Rochester Railway Co. for four of our 200 H. P. boilers, which were subsequently delivered and put into service. These boilers were operated with the greatest satisfaction, and never, to the present time, have cost one cent for repairs nor caused a moment's cessation in the regular operation of the road. Before the boilers were fully paid for the extension of the system outgrew the power, and it became necessary for them to purchase more boilers. The Babcock & Wilcox Co. secured the order for one of their "double-deck" type of boilers, rated at 416 H. P. In due course of time this boiler was erected under their own supervision and connected into the smoke stack. From the day it was put to work it *never* gave satisfaction. Although sixteen H. P., nominal, larger than two of the Heine boilers, it *never* would do

the work of two of them, and as a consequence it was never possible to cut out two Heines for cleaning at the same time, while no trouble was experienced in operating the road with the four Heines when the Babcock & Wilcox required attention. This happened a number of times, and can easily be proven to be a fact.

Bear in mind that the Babcock & Wilcox had been erected, walled in and connected into the chimney under the plans coming from the main office and the superintendance of their erecters.

In January last, it was decided to purchase more boilers, and so great was the dissatisfaction of the railway company with the Babcock & Wilcox boilers, that the order was about to be placed with us, when the Babcock & Wilcox Co. telegraphed and wrote the railway company, stating broadly, that their boiler *was doing and had been doing as much and more than two of the Heines* and offering to demonstrate the same by a test of the two makes, for which they offered to defray all expenses.

When this challenge was laid before us, we consented to go into the matter and agreed to appoint an expert, put our boilers into proper condition and be present and take part in the comparative test, provided it could be made during the first week in February and under existing conditions.

As soon as this arrangement was made the Babcock & Wilcox Co. sent a number of men to Rochester to clean their boiler preparatory to the test. It was reported to us by one of our erecting engineers then in Rochester that they were proposing to make certain changes in their flame plates and stack connection. To these alterations of conditions we protested to the railway company both by telegram and letter, with the result that they told the Babcock & Wilcox Co., that they must run their boiler under the same conditions as existed at the time the challenge was made, and compelled them to stop the work. The Babcock & Wilcox Co., however, secured the consent of some one higher in authority and the changes were made despite our protest. Here we would have been perfectly justified in dropping the whole matter and declining to make the test, but having every confidence in the ability of our boiler to overrun its rated power and to evaporate more water per square foot of heating surface than the Babcock & Wilcox boiler could, we made no further protest and went ahead with the preparations.

Bear in mind that while the Babcock & Wilcox boiler was cut out to permit of these alterations being made, we could do nothing on our boilers.

As soon as their changes were completed they sent their expert (Mr. Chas. E. Emery of New York) to Rochester, and called upon us to test.

The regular practice of the railway company was to fire the four Heines with two firemen, or 400 H. P. nominal, per man, and one man for the 416 H. P. Babcock & Wilcox boiler also. Even after the changes had been made, which certainly made a great improvement in its workings, one man on the Babcock & Wilcox boiler was still unable to make it do the same work that one man obtained from two Heines, and, consequently, we were unable to obtain but one boiler at a time to clean. For this reason, animated with an honest desire to cause no unnecessary delay, we worked our men night and day, and made every effort to get our boilers into condition as soon as possible. For this reason also we made no regular preliminary tests, but only such as we were able to make at very short intervals during the regular operation of the road. While these preparations were being made, the representatives and experts of both companies were engaged in arranging the various preliminaries, and agreeing upon the details of an agreement under which the tests were to be made.

At the first conference, the representative of this company stated to the experts the above facts, and made the further statement that any test which might be made could in no sense be considered as proving anything in regard to the original challenge, for the reason that the Babcock & Wilcox Co. had made changes on their boiler and its setting which entirely vitiated the challenge. Further, that we were willing to go into a comparative test for the purpose solely of demonstrating the greater value of our heating surface, and further, of our ability to overrun *our* rated power to as great an extent as the Babcock & Wilcox Co. could theirs. An economy test was suggested, but we declined going into that matter at all at that time, as it had never been questioned, and no challenge had ever been made upon it. For this reason we at first declined weighing the coal at all, but finally consented to its being done, under the *distinct understanding* that we, on our part, should make no effort at economy, and that such results as might be obtained, should only be used as useful information, and valuable to each company for future tests.

To thoroughly understand the matter, it should be stated here that this company rates its boilers on the purely arbitrary standard of thirty pounds of water evaporated per hour, from 212 degs. F. into dry steam, of seventy pounds pressure, and that the Babcock & Wilcox Co. rates its boilers on another purely arbitrary standard, viz., thirty pounds of water evaporated from 100 degs. F. into dry steam of seventy pounds pressure.

It may be mentioned, as explaining this difference, that another well known company building patent boilers, rates theirs on still another arbitrary standard, viz., thirty pounds of water evaporated from 212 degs. F. at atmospheric pressure.

Either of the above standards is as good as the others, so long as *some* standard is used, for the reason that the smallest of them gives ample steam to generate a horse power in any good modern engine, in reasonably good condition.

The preliminary arrangements were concluded, and the test of the Babcock & Wilcox boiler was made on Sunday, Feb. 21, with the result as shown. Owing to sickness of our men, it was decided to rest on Monday, and make the test of the Heines on Tuesday the 23d, which was done.

Our head fireman is a Western man, entirely unacquainted with Eastern coals, excepting such knowledge as he had been able to acquire during his stay in Rochester, from watching the regular firemen at their work, and from firing himself at such short intervals as offered. He was assisted by the regular firemen of the road, who, although excellent firemen when in their regular work, were totally unacquainted with testing work, and in no sense experts.

A very good start was secured, but immediately afterwards our firemen, in their efforts to get their fires to maximum efficiency in the shortest possible time, got excited, and put altogether too much of the very gassy coal into the furnaces, in fact, much more than they could burn, with the result that the furnaces were converted into gas retorts generating gas in large quantities, which ignited in the breeching, heating it red hot, endangering the roof of the building, and, as was afterwards discovered, bending and warping the dampers into all possible shapes. Of course after this happened, it was idle to proceed, as the second hour's run showed that we were only getting power about 65 per cent. of the rating. Our representative desired to stop the test at this point, but consented to continue the same under *the direct agreement* that all the circumstances should be fully stated in the expert's report, and with the promise of Mr. Emery, the expert of the Babcock & Wilcox Co. that he would use his influence with that company to prevent the use of the information to our disadvantage.

Up to the present time no report of the tests has been made by the experts and the Babcock & Wilcox Co. have clearly violated all principles of courtesy and justice in sending out a strictly *ex parte* statement of results.

After the tests were concluded, our representative challenged the Babcock & Wilcox Co. to go into further tests, which they agreed to do. It is, therefore, a sharp business trick, played with the hope of influencing pending trades in their favor, for the Babcock & Wilcox Co. to issue *any* circular on the matter. Furthermore, it is a violation of professional courtesy, to issue such a paper in advance of the experts' report.

Referring to the Babcock & Wilcox circular in detail we would say as follows :

We offer no comments on the first paragraph, excepting the concluding sentence thereof. The test settles nothing at all excepting the ultimate capacity of the Babcock & Wilcox Co., which all present at the test admit, was reached. We, fortunately, have indisputable records demonstrating the ability of this same size of Heine boiler to overrun its rated power to a much greater per cent. than the Babcock & Wilcox Co. did at the test.

In regard to the second paragraph, we desire to say that it is in direct contradiction to the facts in so far as it refers in any way to economy, and the same remark applies to the third paragraph.

The fourth paragraph is based upon the assumption that their own basis of calculating horse power is the best and only one. It has never been formally accepted or adopted even by the Association, from a committee of which the standard emanated, and is no more binding upon the engineering fraternity than any other. There is no justice in calculating the Heine boilers on the Association basis. They are figured and built on a well recognized standard, large enough to develop a horse power on any well built and well handled engine.

Referring to the fifth paragraph of the circular, we reply that, as aforesaid, any remarks on the economy obtained are unjustified, but that otherwise we are perfectly willing to stand on the record of water evaporated from and at 212 degs. F. per square foot of heating surface, which is the real criterion of the efficiency of the boiler itself.

Babcock & Wilcox boiler,	5.27 lbs. water per hour.
Heine boiler,	7.12 " " " "

showing a superiority of 35 per cent. efficiency in favor of the Heine.

Furthermore, notice the quality of the steam furnished :

Babcock & Wilcox boiler,	1.088 per cent. entrainment.
Heine boiler,	0.619 " " "

or the steam from the Babcock & Wilcox boiler carried over 75.26 per cent. more water than the Heine boiler.

Paragraph six is correct excepting in the deductions. It certainly demonstrates the superior efficiency of heating surfaces constructed as we build them.

Paragraph seven is incorrect. We do not dispute the accuracy of the observation or the results as calculated. We are surprised, however, that no more attention has been paid to the recommendations of Mr. Chas. E. Emery, who, no doubt, has kept his promise made to our representative. No time was agreed upon within which further tests were to be made; on the contrary, our representative stated distinctly that previous engagements would prevent our taking up the matter much inside of three weeks.

Paragraph eight is merely an opinion. Ours differs materially, as may be judged from the fact that we at once challenged them to further tests, and our opinion is based upon results obtained both before and since the test under discussion.

The remarks made by the Babcock & Wilcox Co., in the concluding paragraph, in regard to the different amount of refuse found in the ash pits at the conclusion of the test are also not justified by the facts. Although an earnest effort was made to supply each boiler with the same quality of coal, yet the fact is undisputable that the coal used under the Heines contained a greater proportion of slack, with the result that our refuse contained over twice as much hard clinkers as theirs. Very little attention was paid to this at the time, as under the agreement this matter of economy was not to be considered, and when the experts' report is published it will contain no reference to the matter of economy.

HEINE SAFETY BOILER CO.
By Chas. F. Foster, General Manager.

SPECIAL NOTICES.

FOR SALE.

FOR SALE.—38 lb. girder steel rails (side bearing) for relaying. S. P. S. Ellis, Penn Building, Pittsburgh, Pa.

FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD CO., Washington, D. C.

FOR SALE—STREET CARS.—On account of increase of business calling for larger cars, we have for sale 9 twelve-foot, double-end, box cars, with fare box in each end. Gauge 4 feet 8½ inches. Apply to UNION STREET RAILWAY CO, New Bedford, Mass.

POSITIONS WANTED.

WANTED.—A position as Superintendent or Assistant with an Electric Road, by a young man thoroughly competent in all branches. Address J. E. M., P. O. Box 792, Syracuse, N. Y.

WANTED.—S. P. S. Ellis, Penn Building, Pittsburgh, Pa., representing Johnson Company of Johnstown, Pa., invites correspondence with manufacturers desiring to be represented in Pittsburgh and vicinity.

WANTED.—A man with over 10 years' experience, desires a position to take charge of the inspection and detective department of a street railway company in any part of the country. Can furnish the best of references regarding ability, etc. Address "W. F. G.," care of STREET RAILWAY JOURNAL. 4t

HELP WANTED.

WANTED.—A firm of electrical engineers and contractors would like to be put in communication with a first rate foreman of street railway overhead and track construction. Must be able to take complete charge, keep own accounts, etc. Address "BROADWAY," care of STREET RAILWAY JOURNAL.