THE STREET RAILWAY JOURNAL

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The Yonkers (N. Y.) Electric Railway.

The increase in the earning capacity of a street railway caused by a change from horse to electric power is often considerable, and sometimes changes an annual deficit in the balance sheet to the showing of an annual surplus of earnings over expenses. An instance of how a line in the hands of a receiver, and with operating expenses greater than receipts, can be transformed by the adoption of electric power into a profitable enterprise is shown in the case of the Yonkers street railway. The road was purchased from the bondholders about four months ago by a syndicate who believed in the economy of electric compared with animal power for street car propulsion, and at present electric motors are running on two of the three divisions, and the entire line is being equipped as rapidly as possible.

The electric franchise at Yonkers was secured in the face of great opposition, owing partly to the telephone interests and partly to that element existing in every community in greater or less degree, which is always opposed to improvements of every kind; but it is interesting to note that the divisions equipped with electric power are carrying from two to two and a half as many passengers as when horses were used to draw the cars, and that many of those who at first opposed the installation of overhead wires are now most anxious to have the electric line extended in the direction of their property.

FIG I.—STREET SCENE—YONKERS ELECTRIC RAILWAY.

On the portion of the route equipped with electric apparatus the same rails are in use as when the line was operated by horses. The construction consists of centre bearing tram rails of about thirty-five pounds weight, spiked directly to the stringers and held to gauge by tie rods placed at intervals. The return circuit is made by bonding the rails, and also by the use of the Sabold return system, previously described in these pages. This consists in driving between the rails at intervals of sixty feet a galvanized iron rod, seven feet long, and electrically connecting these rods to the rail bonds on each side. Although there is a deep layer of broken stone under a considerable portion of the track, this method of return seems to give good satisfaction, and no trouble has been experienced with the telephone service, although the latter also uses a grounded return.

The overhead construction was installed by J. G. White & Co., and the trolley wire is supported by tubular span wire poles for a considerable distance within the city. In the outskirts octagonal wooden poles, neatly painted, are employed.

The station is located, with the offices of the company, near the railway station of the New York Central Railroad Co., from which the street railway tracks extend in several directions, and which is about the central point of the street railway system.

The boiler equipment consists of three eighty horse power boilers of the Stirling water tube type, so arranged

that the coal is delivered directly in front of the furnace doors. The feed water heater was supplied by the National Pipe Bending Co. of New Haven. A Worthington pump is also located in the station, but as the pressure from the city main is about 125 lbs., no feed water pump or injector is usually required.

The engines employed are two in number, of 125 H. P. each, single acting, non-condensing, and were supplied by the Ball & Wood Co., of New York. The cylinder dimensions of each are 15×16 ins. The engines give very good satisfaction and maintain a practically constant speed in spite of extreme variations in load. During a short circuit which occurred at one time on the line and caused the generator belt to be thrown off while one engine was running, the latter did not increase its speed perceptibly with entire removal of load. Only one engine is used at one time, and the engines with generators are run on alternate days. It is the intention of the company to always have one engine, generator and boiler in excess of the number actually required to operate the plant in case of an accident to any part of the power apparatus. The present arrangement of the engine room is shown in Fig. 3. The generators are of the Edison make, 100 K. W. capacity each, and were compound wound. The belts were supplied by the Jewell Belting Co., of Hartford, Conn.

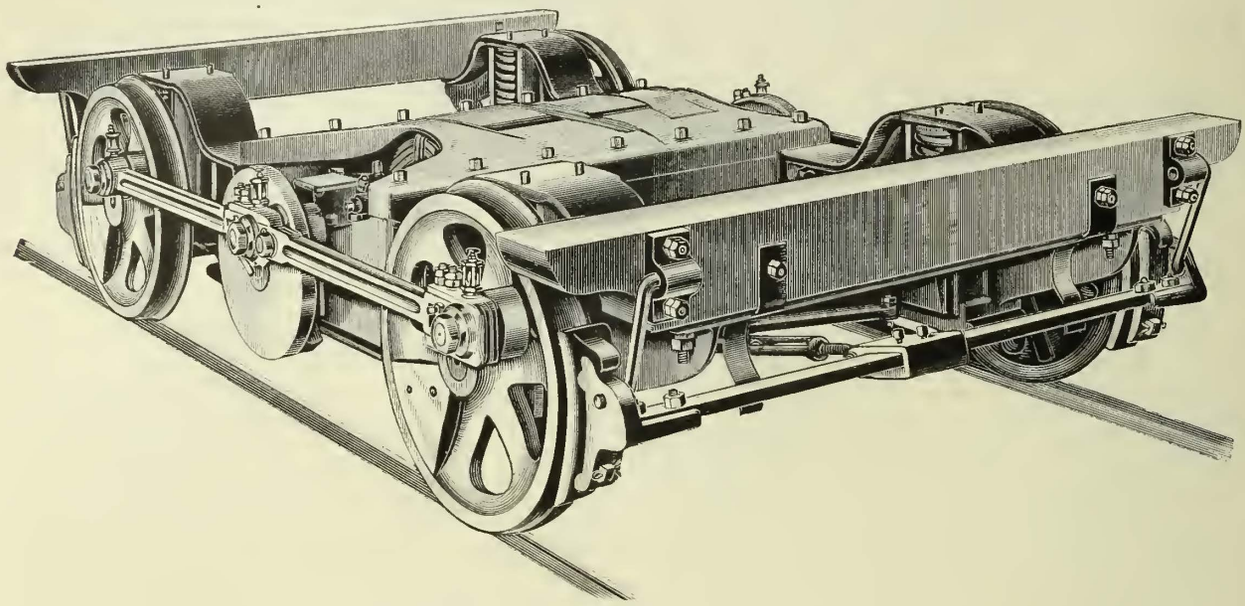


FIG. 2.—EICKEMEYER MOTOR TRUCK—YONKERS ELECTRIC RAILWAY.

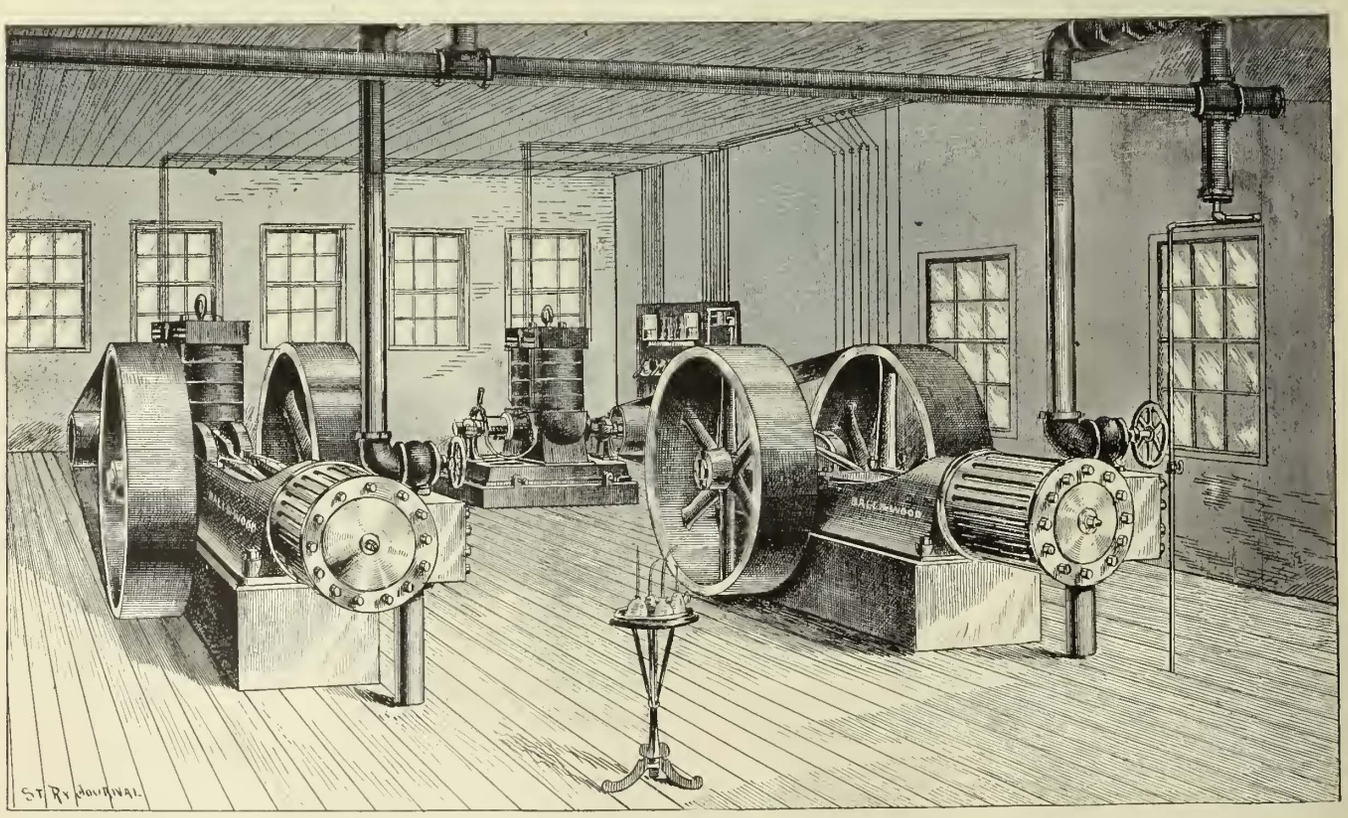


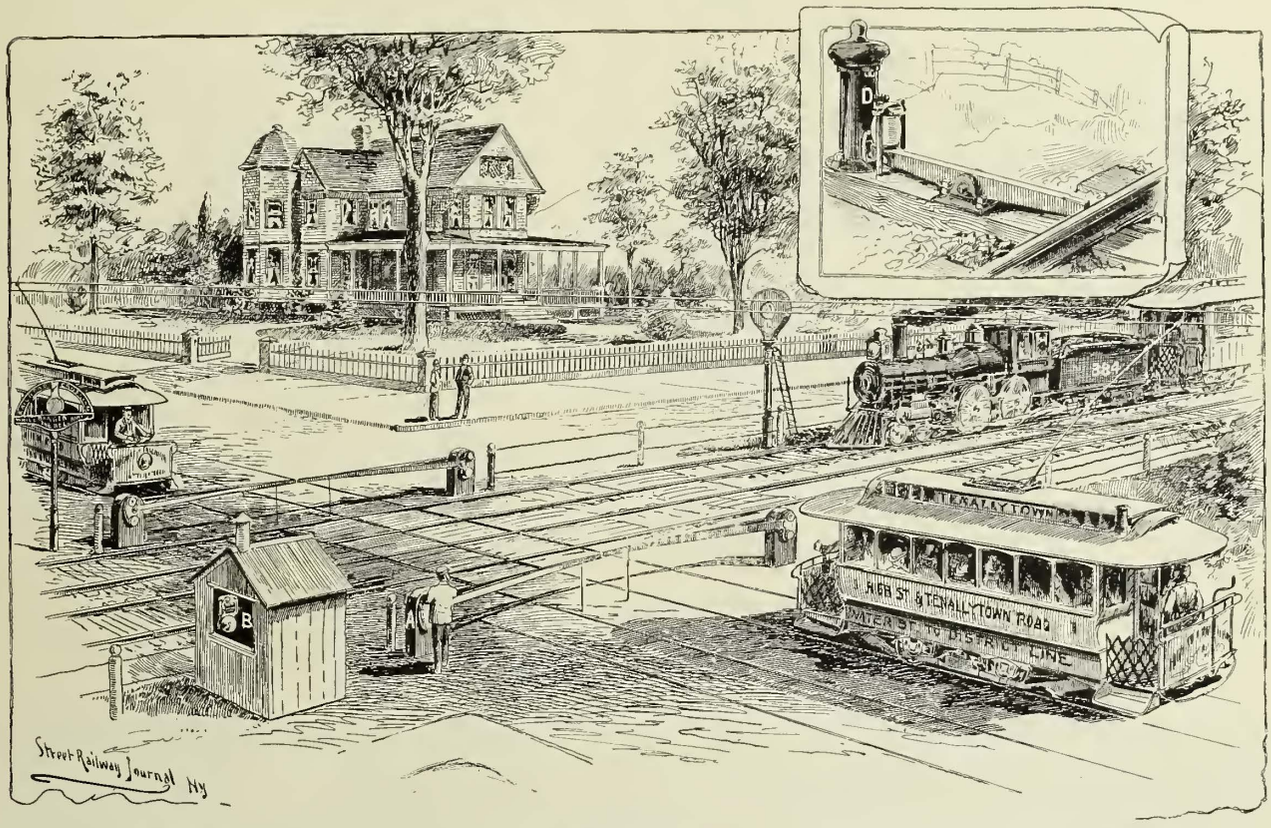
FIG. 3.—INTERIOR OF POWER STATION—YONKERS ELECTRIC RAILWAY.

The electric cars, of which there are at present six in operation, and two being equipped, are extremely neat and tasteful, and were supplied by the John Stephenson Co., Ltd., of New York. The registers were made by the Standard Index & Register Co., of New York, and Smith headlights are used. The motor equipment immediately

attracts attention, and is of the Eickemeyer-Field type, already described in these columns in connection with the plant of the Toledo Consolidated Street Railway in our April issue. The single gearless motor used for driving the car is placed midway between the car axles, and is flexibly supported on them by a frame of special design, so that while the motor is rigid in the direction of travel its entire weight, with that of the frame, is cushioned on springs vertically. As shown in Fig. 1, which gives a street scene in Yonkers, and in Fig. 2, which shows the arrangement of the motor on the truck, the armature of the motor drives the car axles by means of connecting rods, jointed and provided with swivel boxes at their extremities, to provide for any slight vertical motion of the motor owing to its flexible support.

Although the entire weight of the motor truck with twenty horse power motor for a sixteen foot car is about 9,000 lbs., the manufacturers claim that, owing to the fact that its entire weight is cushioned, the pounding on the track is much less than with a lighter equipment, where part, or all, of the weight of the motor is supported directly by the car axle. This enables them, they claim, to operate on a much lighter rail, if necessary, than with other equipments, and upon a roadbed which, like that of the Yonkers electric railway, was originally built for horse traction.

Another important feature of the equipment is that car wheels of small radius can be used, owing to the position of the motor between the axles and the small amount of vertical space required. The car wheels at Yonkers are but twenty-six inches in diameter, making it very easy for passengers to enter or leave the car.



STREET AND STEAM RAILWAY CROSSING PROTECTED BY THE HALL AUTOMATIC DANGER SIGNAL.

Electric Crossing Signals.

The Hall Signal Co., of New York, have devised a type of highway crossing signal which is especially adapted for use on cable and electric lines where there is a possibility of the power failing while a car is crossing a steam track. The automatic signal may be used alone or in connection with safety gates operated by a gate tender.

Ordinarily, an audible signal is all that is necessary, and this usually consists of a signal stand with a bell suitably housed, which is caused to ring by an approaching train, thus warning the car driver in time to prevent crossing in the face of danger. When used in connection with gate, A, it is arranged that a bell in the gateman's cab, B, rings, giving notice of the approaching train in time for the gateman to close the gates before the crossing is reached. In case the gateman fails to close the gates, a signal instrument, C, placed at a suitable distance from the crossing, and which stands at danger when the gates are open, stops the train before it arrives at the crossing.

The operation of the signal will be readily understood by an inspection of the accompanying engraving. The principal, or track, instrument is shown at D and consists of a wooden lever properly balanced and so placed that it will be depressed by the wheels of a passing train, its outer end at the same time forcing upward a piston which moves in a closed chamber, and communicates motion to a lever of the circuit closing apparatus. The piston operates in an air chamber having two apartments connected by a port and so arranged that the confined air constitutes a cushion which prevents the piston rod from being thrown forcibly against the top cap, and also retards its fall and prevents injurious shocks. The track lever is confined between two rubber springs which are so compressed that any weight less than that imposed by the car wheels fails to operate the piston. The circuit being normally open, the operation of the lever conducts the current by means of a wire to the bell, which starts it ringing, and at the same time locks the instrument so that the bell continues to ring until the train shall have reached a second instrument on the other side of the crossing, which breaks the contact and silences the bell. The battery and interlocking instrument are usually located at the crossing. By a simple arrangement of interlocking and track instruments, the bell may be made to ring by the approach of a train from either direction on a single track.

These safety appliances have been in successful operation on a number of lines and seem to present an effectual way of reducing a serious danger element.

THE Baldwin Locomotive Works are at work for the North and West Side Chicago street railway companies on a number of steam motors similar to the one imported from Belgium, and which has been recently running on their lines. The motor cars when finished will draw one trailer each and will operate on the feeder lines.

Chicago City Company's New Loop.

The new downtown loop of the Chicago City Railway Co. has been completed and cars have been operated over it during the last three weeks of June. The fact that the company needed a second loop in the centre of the city has been repeatedly stated in these columns; but the City Council while ready and anxious to criticise the company for failing to increase their facilities, still persisted in refusing a new loop. The old loop was badly overcrowded, as cars from both the State Street and Wabash Avenue systems traveled over it. The public demand finally became so persistent that the council yielded and made such a grant that the company now have a loop for each of their two systems.

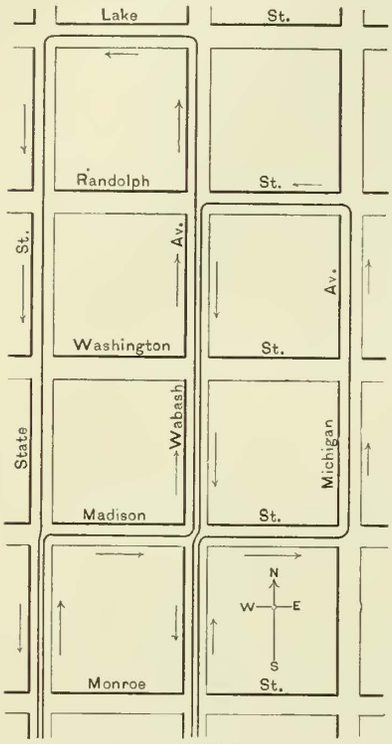


FIG. 1.—MAP SHOWING OLD AND NEW LOOP.

Work was started in the early part of May, and while the company were anxious to complete the undertaking by the middle of June this was feared to be impossible. Thanks to Superintendent Bowen's energetic efforts, the work was finished on the eleventh and cars were running over it the following day. It was a matter of no little public interest, as the Democratic Convention, June 21, Derby Day, June 25, and July 4, promised to make great calls on the resources of the company.

Fig. 1 is a map of that section of the business centre in which the loops of the Chicago City Railway Co. are located. The cars on the State Street line running north, loop on Madison Street, Wabash Avenue, Lake Street and back on State. The new loop, which is traversed by all cars running north on Wabash Avenue, commences at Madison Street, turns east and is completed on Michigan Avenue, Randolph Street and Wabash Avenue. Its length is 3,750 ft.

For five or six days prior to the completion of the new loop it was found necessary to stop all north bound cable trains at Madison Street in order that work might be prosecuted at the curves without interruption. It was therefore necessary to provide complete switching facilities on Wabash Avenue and State Street. It was by no means an easy problem to solve, as the use of a sufficient number of horses to do the work was out of the question as they would have blockaded the street. It was determined to make use of the grip cars to switch the trailers, connecting the two with a long rope. A pair of stout horses were able to do such work as was not performed in the manner indicated. This plan, though adopted with some fear, as there was danger of tripping people, if care was not exercised, worked admirably.

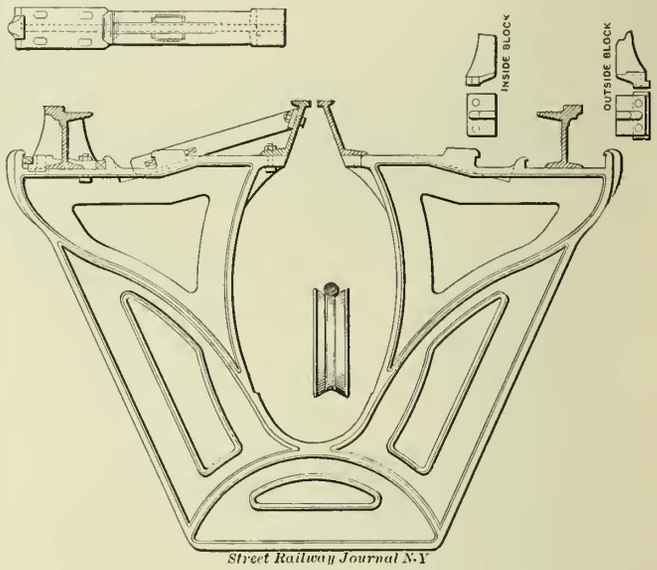


FIG. 3.—CABLE YOKE

For the most part work was prosecuted day and night. Fig. 2 shows the curves at the corner of Wabash Avenue and Madison Street looking north on the former thoroughfare. The photograph was taken on the day before the loop went into use, and it is noticeable that a considerable amount of work remained to be done at that time. It, perhaps, should be stated that work at the curves progressed as rapidly as at any point along the line. The material came to the spot all ready to go together and it merely was necessary to fit it into position.

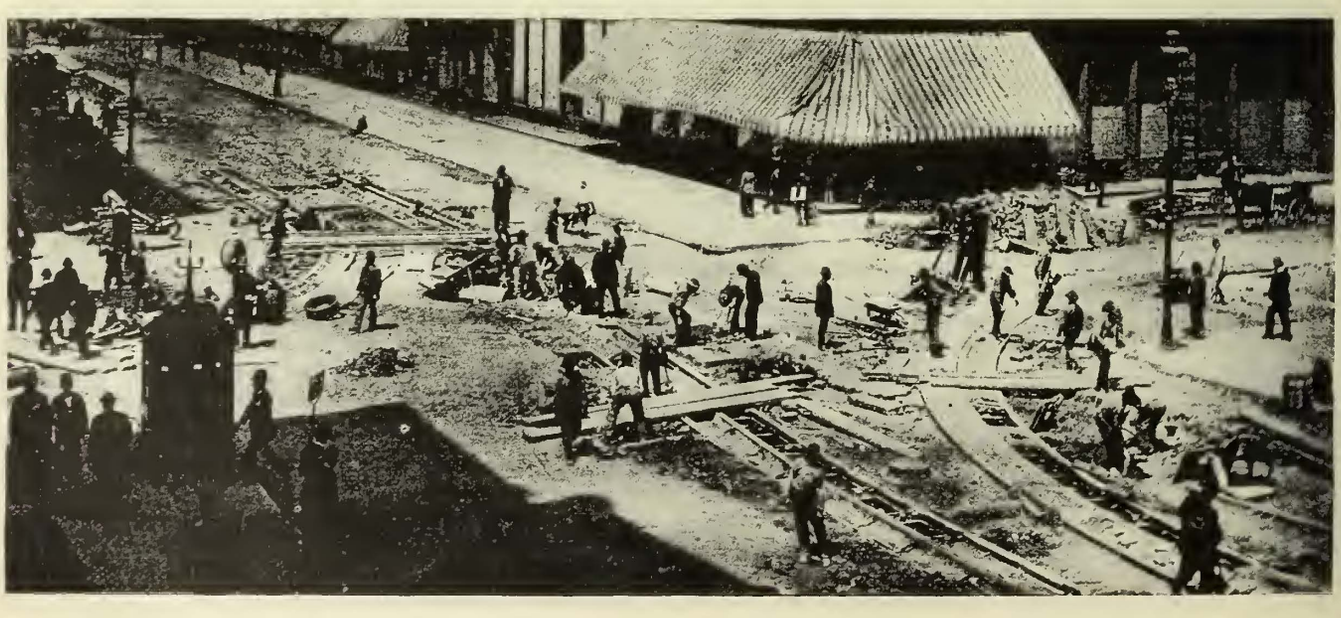


FIG. 2.—CHICAGO CITY COMPANY'S NEW LOOP, CORNER OF WABASH AVENUE AND MADISON STREET.

The construction work on the loop embodied a number of special features, and the curves were entirely new in design. The design of the yokes (Figs. 3 and 4), the adjustment of the rail and the slot and the pulley are all

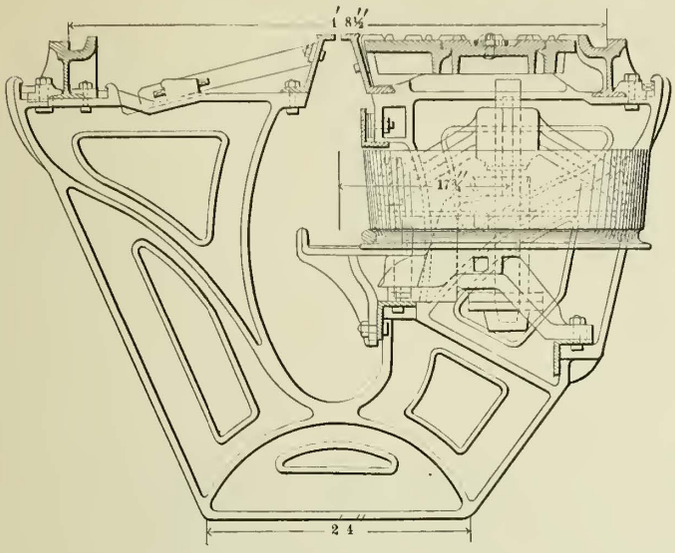


FIG. 4.—CURVE PULLEY AND YOKE.

new. The pulley is especially worthy of note on account of the departure from ordinary construction. It was designed by Mr. Elmer A. Hovey of the company and patented by him. Several months ago a test of the pulley was made on the curve at the corner of Fifty-fifth Street and Cot-

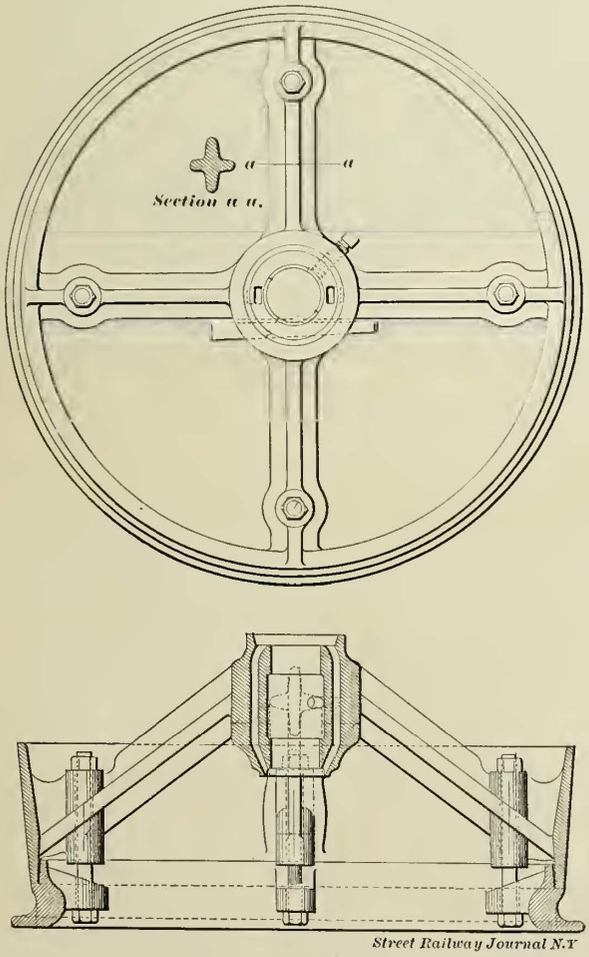


FIG. 5.—DETAIL OF CURVE PULLEY.

tage Grove Avenue. It has been in operation ever since and has given such satisfaction that it was decided to use it in the new loop curves. It is a pulley with dished or beveled spokes and carrying a hub high enough to permit the bearing to come just in the centre of the box (Fig. 5). By its use friction is materially lessened, it is claimed. A pulley thirty inches in diameter can be used and be readily taken out between the rail and the slot. The yokes are set four feet apart, and two angle irons from yoke to yoke are so fitted as to carry a hanger. The box is so held by the latter that it can be readily removed and another substituted. Just a little below the line of the cable is a cast iron guard upon which the cable rests if it becomes slack. It falls back into position again when it is tightened. Over each pulley is a cover reaching from yoke to yoke and resting on them, having in its centre a hand hole (Fig. 6). By means of passages or oil ways through the hub the box below can be oiled without stopping the pulley. The box is babbited, and the shaft,

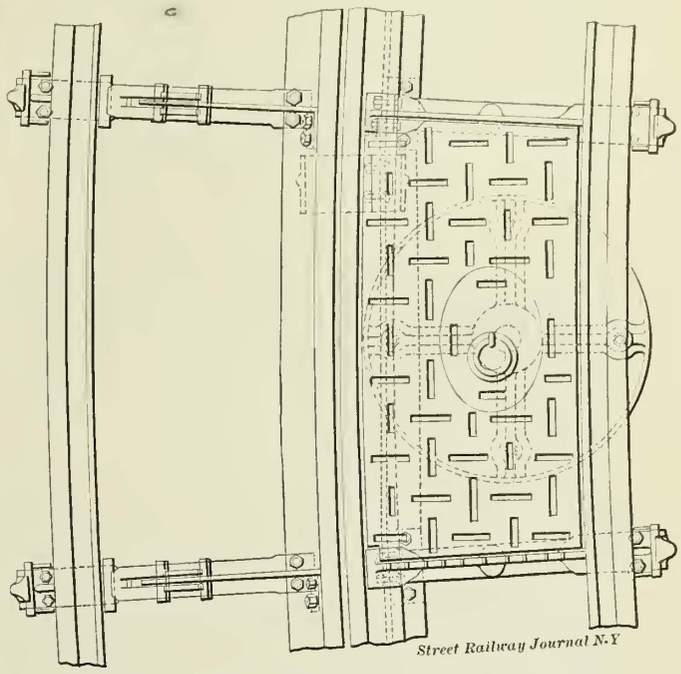


FIG. 6.—CURVE PULLEY COVER AND HAND HOLE.

which is two and three-quarters inches in diameter, cold rolled steel, rests on a step brass bearing. The pulley is provided with a chilled grooved ring which can be easily removed and another substituted. No wear, therefore, comes on the main body of the pulley. This feature of interchangeable rings for cable pulleys has been employed by the company since 1887. In the new loop 127 pulleys of the type here described have been used.

St. Louis & Suburban Railway's Plant.

The career of this company has been one of the most interesting of any in this country. In the year 1885 what was then the St. Louis Cable & Western Railway began the operation of the first cable road in St. Louis. The best streets for traffic being occupied by the horse railways, the company had to take what was at hand. The route selected did not affect the patronage, however, and the cars were crowded all the time. There were defects in the system, as in all others of the earlier cable roads, and one of them, the most antagonistic to the employment of the cable, was an unusual number of curves. Then a novel method of construction was employed, the yokes being joined to sheet iron, shaped like the conduit, and then laid in sections of about thirty feet each. The first girder rail ever used in St. Louis was laid on this road. The yokes were of the old railroad rails correctly shaped. The power equipment was very soon found to be insufficient, and the two 375 H. P. engines were replaced by two of 750 H. P. each. The latest cable winding machinery was employed in the second plant. This has since been sold to the original builders.

In after years electricity came to the front, and was adopted by the Lindell Railway, the cable road's greatest competitor. Travel gradually declined, and this led finally to the adoption of electricity, and the abandonment of the cable and steam divisions. In the meantime the old St. Louis Cable & Western was christened the St. Louis & Suburban. The power station, car shed and

main offices of the company are located at De Hodiamont, and are partly in the city and partly in St. Louis County.

The power station is a substantially built brick structure, running east and west, and measures 199 × 131 ft.

ENGINE AND DYNAMO ROOM.

The engine and generator room (shown below) measures 153 × 131 ft. It is well lighted, having an unusually large number of lantern windows. The engine equipment consists of three 750 H. P. Hamilton-Corliss engines. Two of these were used in the old cable station, and are always run together in the electric station. The cylinder dimensions of the three engines are 30 × 72 ins., and the stroke seventy-two inches. Each engine is equipped with an automatic oiling device. There are two fly band wheels, one belonging to the two (old cable) engines, and the other to the third. The former has a 72 in. face and the latter 60. The weight of each wheel is 40 tons, and each makes 64 revolutions per minute. The engines being slow speed, clutches of the Hill make and shafting are used. The shafting is 9 ins. in diameter, makes 189 revolutions per minute and is equipped with self oilers. The main belts are 72 ins. and 58 ins. wide. Of the pulley belts, two are 34 ins. and ten 16 ins. wide. The belts were made by the Shultz Belting Co., of St. Louis.

The generator equipment consists of twelve compound wound machines of the Thomson-Houston type. Of these ten make 750 revolutions per minute, and two 450. Eight are 75,000 K. W., two 80,000, and two 270,000. The two latter are new machines of the multipolar type, and are of 360 H. P. capacity each. The voltage maintained is 540. On the two large machines is the new device of the Thomson-Houston company for cooling the armatures.

The switchboard is very handsome, being built of antique oak. The switches, rheostats, resistance coils, etc., are all of the Thomson-Houston make. The lightning arresters are at the rear of the board, and are sixteen in number. The entire road is divided into five sections on the board. There are twenty feeders, nineteen of which run east from the power house. All the wiring in the room is placed in a conduit.

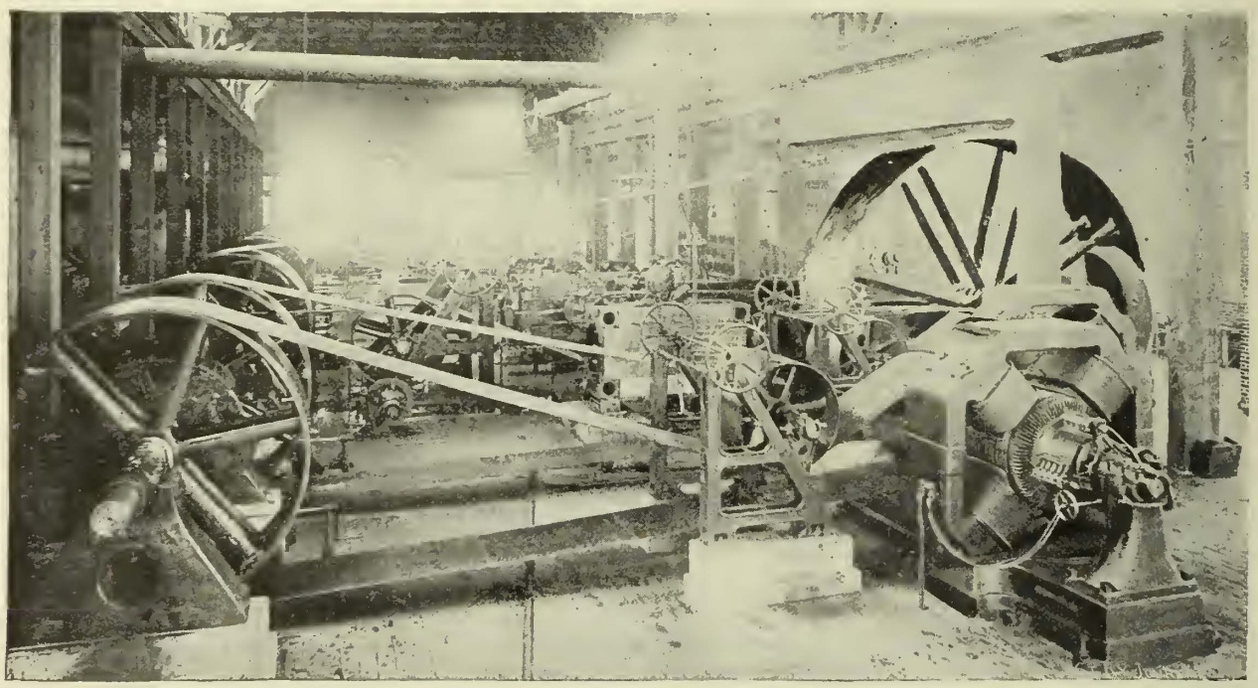
BOILER ROOM.

The boiler room measures 131×46 ft. The equipment consists of four batteries of two boilers each, and each battery is of 375 H. P. capacity. Each boiler is 20 ft. long, has a diameter of 70 ins., and has 25 flues each of 6 ins. diameter. The boilers were made by Rohan Bros. of St. Louis. A pressure of 120 lbs. is maintained. Water is supplied by two No. 10 Hooker pumps. There are two Rohan feed water heaters of 1,200 H. P. capacity, 16 ft. in length, and 54 ins. diameter each. The water is heated to 210 degs. Fah. There are two large cisterns in the boiler room capable of supplying water for a fourteen hours' run.

The coaling facilities are excellent, a railroad switch running into the boiler room, and requiring that the coal be handled twice only. The ashes are removed by means of an overhead traveling bucket with trap door bottom. The steam piping from the boiler room to the engine and dynamo room is partly overhead and partly underground. Each of the four batteries of boilers has an iron smokestack, ninety feet high and fifty inches in diameter. A fifteen ton overhead crane traverses the engine room, thus enabling the easy transfer or uplifting of heavy pieces of machinery.

TRACK CONSTRUCTION.

The company now has in operation 28.22 miles of track. Of this amount a little over eight miles is laid with a special rolled Wharton girder rail, 70 lbs. to the yard, laid in 4 in. steel chairs spiked to sawed white oak ties 5×7ins.×7 ft. The curve rails are of the Wharton girder type, 86 lbs. to the yard, and are placed on oak ties measuring 6×8ins.×7 ft. From 6th and Locust Streets, the eastern or downtown terminus to Van Deventer Avenue, the old cable roadbed is utilized. The concrete forming the conduit was allowed to remain and serves as ballast. The yokes were also retained, and being too far apart for heavy electric railroading, channels were cut between them, and in each a tie was inserted. The rails are fastened to the ties only by means of Wharton high rolled steel chairs, and simply rest on the spokes. The joints are imperceptible on account of their evenness. The Forest Park line, connecting with the main line, and running across Union Avenue to the park, is laid with the same rail and chair. The ties are here placed 24 ins. between centres. From Van Deventer Avenue westward to Florrissant the company uses their private way, acquired in the days of the narrow gauge steam road. Here a 40 lb. T rail is laid, placed on 6×8in.×8 ft. rough hewn oak ties, and spaced 24 ins. between centres. From Van Deventer Avenue to Wells the road is double track, and from Wells to Florrissant, a distance of ten and a quarter miles, single track. A large amount of the double track portion is stone ballasted. The grades on that line are not heavy, none exceeding 7 per cent. On the T rail portion the radii of the curves vary from 400 ft. to 2,607 ft., and on the



INTERIOR OF POWER STATION—ST. LOUIS & SUBURBAN STREET RAILWAY CO.

girder rail portion from 30 ft. to 80 ft. The difficulty in getting around the 30 ft. curves presented to the cable cars may be imagined. The strain was sometimes so great on the grip that stoppage in the middle of the curve was consequent.

OVERHEAD CONSTRUCTION.

The overhead construction is a fine piece of work. That portion of the road now extending from Sixth and Locust Streets to Van Deventer Avenue is equipped with 300 iron poles measuring 30 ft. in length, and of three sections whose diameters are 6 ins., 5 ins. and 4 ins. There are twenty Phœnix pattern corner poles. On the Union Avenue line are used forty-five centre poles of the Phœnix pattern. From Van-Deventer Avenue to Florrissant, 940 ft. and 410 ft., white cedar poles are used. All the iron poles were sunk in concrete placed in holes six feet deep. The trolley wire in use is No. 0, guaranteed 97 per cent. pure. The span wire is No. 4 galvanized steel, the supplementary wire No. 4 soft drawn copper and the feed wire No. 00, three braid, hard drawn copper wire. The span wire for the guard wires is No. 8 annealed steel, and the guard wires themselves are No. 9 of the same material. The guard wiring only extends from Sixth and Locust Streets to Van Deventer Avenue.

The track wiring extends along the wagon tread of the rails, in the girder rail construction, and is connected to every joint. At every 125 ft. it is connected with the

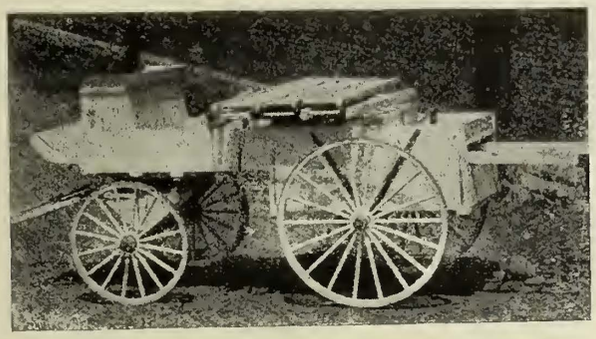


FIG. 1.—"HURRY UP" TOWER WAGON.

old cable yokes, which in turn connect with the sheet iron which formed the old conduit. In the T rail construction from Van Deventer Avenue to Wells, each rail has a No. 4 copper wire, connected at each joint with bond wires. The two supplementary wires are laid thirty inches helow the track and joined every quarter mile. From Wells to Carsonville there is one supplementary wire, and from Carsonville to Florrissant, none. There are two lightning arresters along the line, grounded to old car wheels and the supplementary wires. That portion of the road west of the power station is provided with automatic circuit breakers, so that any trouble arising in that direction will not interfere with the city portion of the system.

ROLLING STOCK.

The car equipment consisted, before the company's car shed was burned, of sixty motor, sixty trail and thirty twenty-eight foot cars. The motor and trail cars have sixteen foot bodies, and are twenty-four feet over all. Each motor car is equipped with two Thomson-Houston fifteen horse power S. R. G. motors. An equipment of twenty-eight foot cars has been ordered, each of which will be propelled by two twenty-five horse power motors of the above type. The twenty-eight foot cars first mentioned are remodeled double deckers that were used on the old cable road. The upper story has been taken off.

The company's extensive car shed, burnt during the past month, an illustration of which appears in another part of this issue, was 500 × 150 ft., and capable of accommodating 150 sixteen foot cars. S. L.

MR. CRUMP of Columbus, Ind., will build a three-quarter mile extension to his road this summer, and will convert three miles of mule line to electric. He will probably require four or five electric cars.

"Hurry Up" Tower Wagon.

Tower wagons have proved themselves such a necessary portion of the equipment of every electric street railway that a new type is particularly interesting. In the accompanying engravings Fig. 1 shows a "hurry up"

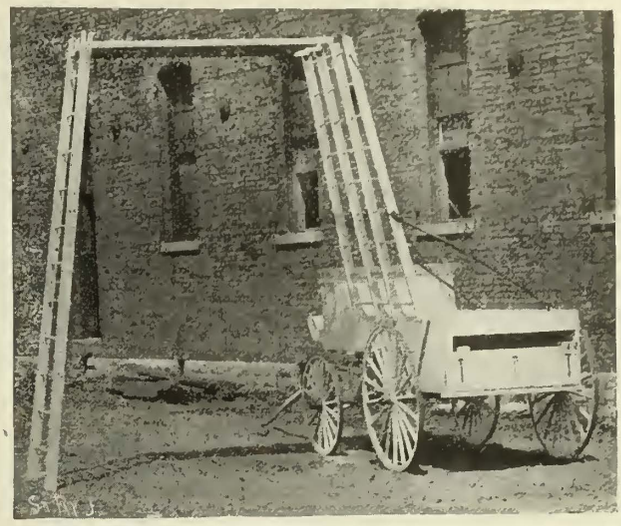


FIG. 2.—"HURRY UP" TOWER WAGON.

wagon, built by G. S. Blakeslee of Chicago, folded up as it usually stands at the barn ready for instant use. It will be readily seen that the wagon is so compact that there is nothing to prevent the team starting at a moment's notice, and at a full run. When the break in the wire is reached it is but the work of a few moments to elevate the tower and stretch the ladder, which can be easily done by two men.

Fig. 2 shows the top raised and everything ready for work. As will be seen, the bridge is formed over the track so that there need be no interruption of the traffic, since the cars can pass directly under the platform where the man is at work. In this position the wagon is especially valuable in case of fire, since the operators can take

FIG. 3.—"HURRY UP" TOWER WAGON.

the hose belonging to the fire department, climb the ladder and spread it across the platform thus removing it from the way of the cars which can continue to operate. Fig. 3, shows the arrangement when the wagon is on the track.

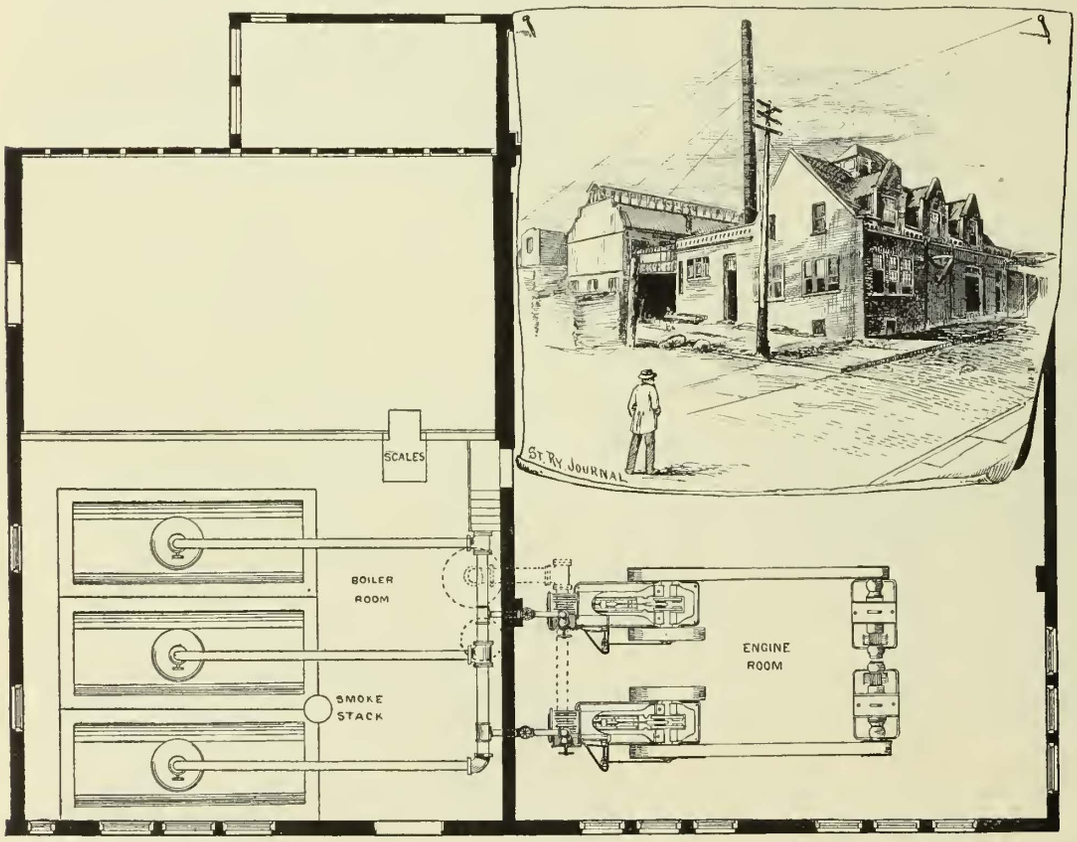
THE Capitol, North O Street & South Washington Railway Co. of Washington, D. C., have requested permission to change their name to the Belt Line Railway Co.

The Electric Railway at Wilmington, N. C.

If electricity has shown itself a desirable agent for the operation of street cars in our larger cities, it has also certainly demonstrated its advantages in the smaller cities and towns of this country, and in many localities has shown its ability to earn a living in towns of 10,000 inhabitants or less.

One of the first of the small towns in the country to install an electric railway system was Asheville, in North Carolina, and the success of this line was widely felt throughout the Southeastern states, and led to the direct electric equipment of a number of other lines in the same state. Of the five cities in North Carolina, which have as high as 5,000 population, four have possessed electric railways for a considerable time, and on May 1 the latest line was opened in Wilmington, the principal town of the State, having a population of 23,000 inhabitants.

For four years the Wilmington Street Railway Co. have had in operation in that city seven small horse cars over about four miles of track; and in December last this line was purchased by a syndicate, several of whom had been instrumental in the organization of the Asheville and other North Carolina roads.



PLAN AND EXTERIOR VIEW OF POWER STATION—WILMINGTON ELECTRIC RAILWAY COMPANY.

The track of the old horse car line had been laid with a thirty-two pound T rail laid upon cross ties, four feet apart. In rebuilding for electricity a mile of this track which lay on a paved street was taken up, and in its place there was substituted a forty-five pound Lewis & Fowler rail placed on ties two feet six inches between centres. Throughout the rest of the route the original rail was used, but the track was resurfaced and the number of cross ties was doubled. The contract for reconstructing the roadbed and building the overhead lines was let to J. G. White & Co., of New York. Situated as Wilmington is, in the heart of a yellow pine region, wooden poles were, of course, employed in the overhead construction.

The power station, shown on this page, was erected with the view of having a substantial, neat and conveniently arranged building at the least possible cost. The main building is of brick, and the whole of the lower floor, 68 × 45 ft. is reserved for the engines and generators. At present a temporary partition is run across one end, forming an engineer's store room and the superintendent's office. This leaves ample room for the accommodation of five 15 × 16 in., high speed engines and their generators. Should a sixth be required later, the wooden partition can be removed, and the superintendent's office located on the second floor.

Immediately adjoining the engine room are the boiler room and coal bin. The former is of sufficient size to accommodate three horizontal, return tubular boilers, built by the Union Works of Erie, Pa., and the latter will hold a cargo of from 450 to 500 tons of coal. Adjoining the engine and boiler rooms is the car shed which has room for twelve cars, and a freight track for the delivery of coal by rail.

The engine equipment consists of two 130 H. P., simple condensing engines built by the Ball Engine Co. of Erie, Pa., who were also the contractors for the supply of the boilers and the rest of the engine equipment. The feed water heater is of the Goubert pattern, and one Davidson, 300 H. P., independent air pump and condenser is used. The condenser and heater are so connected that they may be used together or separately, or the engines may be run non-condensing. Much attention was given in the designing of this station to its adaptability in future growth. In all additions of engines and boilers the distance between them is maintained at a minimum. The steam and exhaust pipes are of such size that should the entire engine room be fully occupied no changes would be required in the present pipe connections. The water for condensing purposes is obtained from Cape Fear River. The station electrical equipment consists of two Edison, 100 K. W., railway generators directly connected to the engines by Jewell belts.

The subject of ventilation, an important consideration in a Southern climate, was carefully considered and provided for. Located at the junction of two streets and facing the river, the corner fronting on the streets was reserved for the engine room, so that the windows would catch all the air possible. The engine room floor is five feet above the ground line, and the air openings are ample. An air shaft 9 × 16 ft. is carried through the second story and roof to a cupola, with the result that there is always a strong upper draft. This air shaft is also arranged so that it will ventilate the company's offices. The architect of the station was C. S. Luce of New York, and the contract price for the building complete, exclusive of engine, generator and the boiler foundations, was $10,000, with extras such as changes, office fittings and other minor improvements amounting to $200. The foundations for the engines and boilers consist of thirty feet spiles capped with 12 × 12 in. timber and planked with four inch board, on which is a layer three feet five inches thick of concrete. The cost of these foundations and of the dynamo foundations, was about $1,400, making the total cost of the power station, exclusive of machinery, in the neighborhood of $11,600.

The electric car equipment consists of six eight seat open cars and two sixteen foot closed cars, built by the Lewis & Fowler Manufacturing Co., of Brooklyn, and

equipped with two horse power, S. R. G., Thomson-Houston motors. Four of the eleven horse cars purchased with the road are being overhauled and repainted for use as trailers.

In addition to the equipment already described, the company under their exclusive franchises have constructed along the water front a dummy line, which when completed will connect all the railways entering Wilmington with the wharves, warehouses and principal mills of the city. This line will be operated by the Baldwin compound steam motor recently described in these pages. The officers of the Wilmington Street Railway Co. are C. A. Lieb, president; J. H. Barnard, vice-president and general manager; B. F. O'Connor, secretary; J. G. White, treasurer.

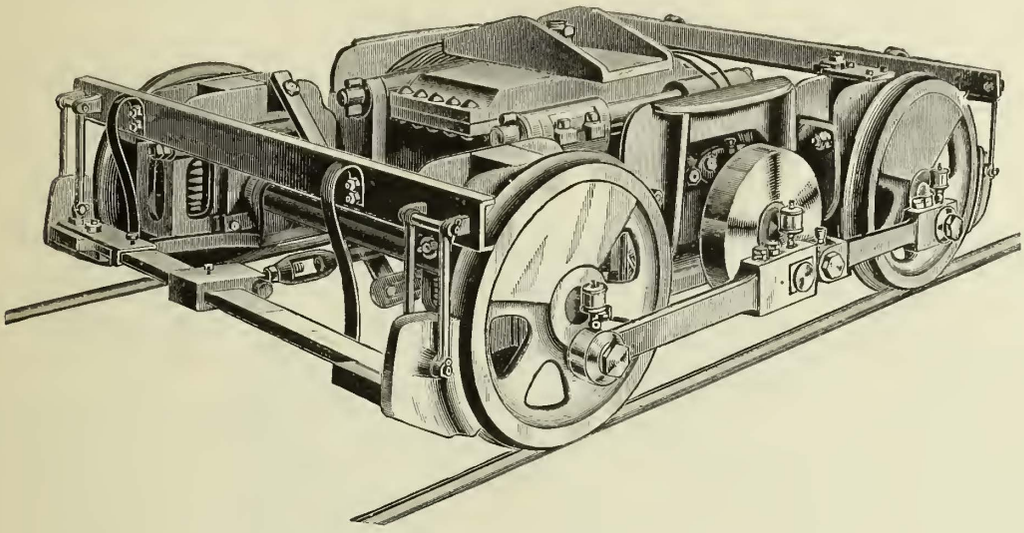


FIG. 1.—EICKEMEYER-FIELD BOGIE TRUCK FOR LONG CARS.

Eickemeyer-Field Bogie Truck for Long Cars.

The latest type of Eickemeyer-Field electric motor bogie truck for long cars having a wheel base of four feet eight inches, is shown in Fig. 1. The motor and its arrangement are the same as with a single truck car, and consist essentially of a gearless machine mounted in a frame of special design and arranged to drive both axles by means of parallel rods.

The motor is of the iron clad type; the steel castings, which entirely surround the field coil, protect them from accidental injury and also act as a part of the magnetic circuit. The field coils are not mounted on pole pieces, but surround the armature, making the length of the magnetic circuit as short as possible and utilizing all the lines of magnetic force. The field is commutated for speed regulation, and when the coils are in parallel has a resistance of less than half an ohm. The armature has a resistance of three-quarters of an ohm, and is built up of wrought iron discs and wound with coils of No. 9 B. & S. wire, so arranged that the separate armature coils do not cross each other, and any one can be removed. This arrangement secures perfect electrical and mechanical balance in all positions of the armature; each coil is of the same resistance, and every convolution in the same relative position with reference to its opposite convolution.

The motor itself is mounted in the square cast iron frame in such a manner as to allow of easy inspection or repair, a removal of but four bolts allowing the motor to be run from under the car body. The thirty horse power motor, such as is used on the truck shown, has a speed of 150 revolutions per minute, when a car is running at twelve miles per hour. The frame supporting the motor is a single, nearly square casting, and is entirely closed underneath, so that no mud or moisture from the street can reach the electrical apparatus. It is

Street Car Service at the Minneapolis Convention.

The visitors to Minneapolis during the recent Republican Convention, as well as the citizens of that city generally, were unanimous in their commendation of the excellent way in which the street railway company took care of the immense crowds during convention week. At the termination of the sessions in the large hall the number of persons who required transportation immediately was of course tremendous; but it was a noticeable fact that the service was ample for the occasions, and would-be passengers were kept waiting for accommodation for only a very short time. The average number carried during the days of the sessions by the cars was 100,000, and the maximum number in one day was 175,000. Another interesting fact is that though the number of passengers carried was very large, and the streets were crowded with thousands of foot passengers and hundreds of carriages, there was no accident of any kind.

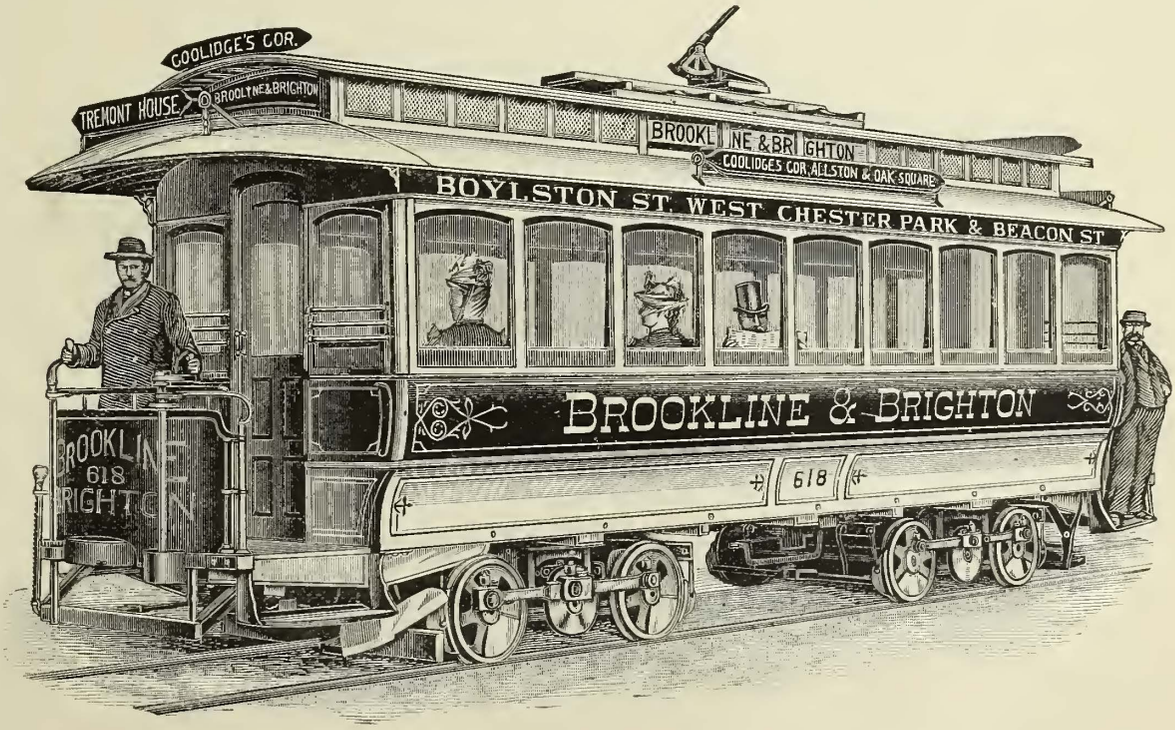


FIG. 2.—CAR ON WEST END STREET RAILWAY, BOSTON, EQUIPPED WITH EICKEMEYER-FIELD MOTORS.

spring supported and cushioned on the axles vertically while rigd horizontally.

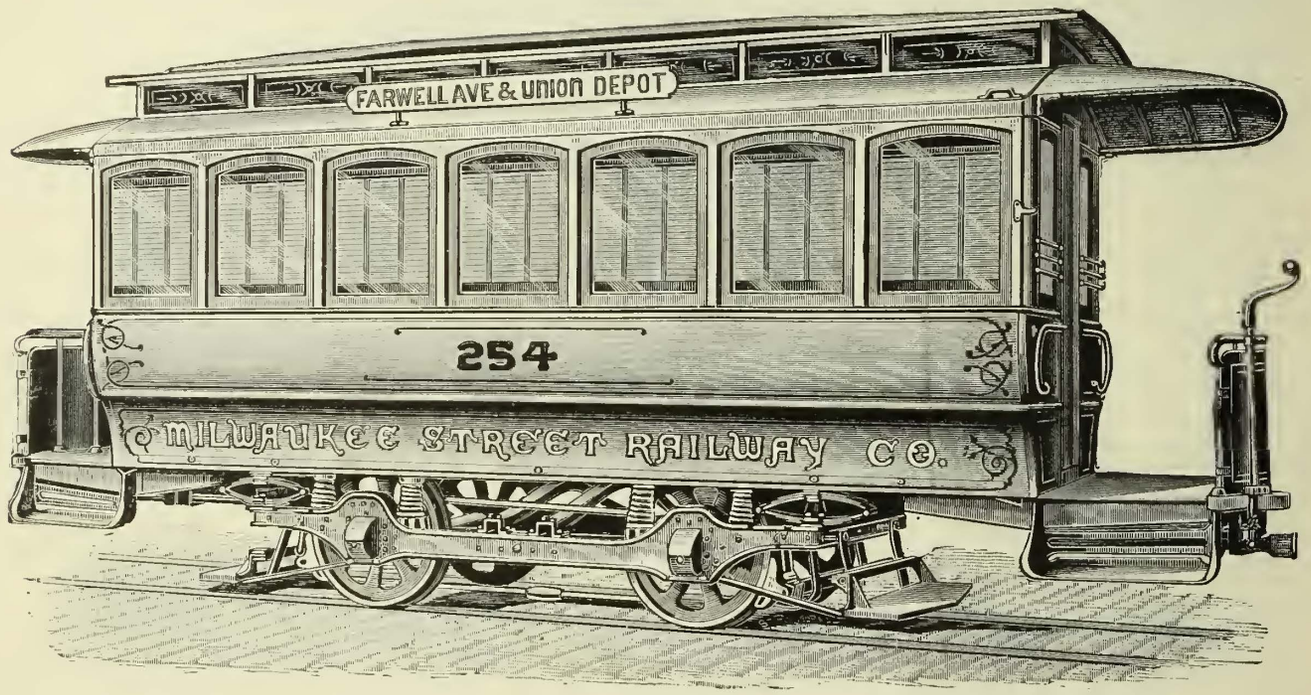
Connecting rods being used to transmit power from the armature shaft to the wheels, the rod to one wheel is jointed near the disc pin and provided with swivel boxes at its extremities so that no matter what track irregularities are encountered there is no consequent binding of parts or undue friction.

Owing to the location of the motor between the two axles where ample space is available, the car wheels on this truck are only twenty-four inches in diameter, and the lowest part of the motor frame is four inches above the ground, making the car easy of access for passengers.

New Electric Equipment at Cleveland.

The track construction on the line of the Woodland Avenue & West Side Street Railway Co., which have recently decided upon the adoption of electric power, will be of the most substantial description. The company have adopted for their roadbed a 98 lb. girder rail rolled by the Johnson Co., of Johnstown, Pa.

The dimensions of the rail will be 8½ ins. high, 2 ins. head, 3 ins. tram, 1⅛ ins. height of head and 5½ ins. base of rail. This rail will be spiked directly to oak ties, 5 × 8 ins., and placed 2 ft. between centres The ties at joints will be 5 × 12 ins. The fishplate will be very wide and have a



NEW CAR FOR MILWAUKEE STREET RAILWAY COMPANY.

Fig. 2 shows an Eickemeyer-Field thirty-three foot car in operation on the West End Street Railway, Boston, Mass.

Car for the Milwaukee Street Railway Co.

The accompanying engraving shows one of the electric cars recently built by the Milwaukee Street Railway Co. by the American Car Co. of St. Louis. As will be seen from an inspection of the engraving, the car presents a very neat appearance. There are seven windows on each side, the name of the company is on the lower concave, and the route on which the car will run is designated on a sign carried on the roof.

The length of the car body is eighteen feet seven inches, and the interior is fitted up very handsomely and tastefully. The car body is mounted on one of the latest type of trucks manufactured by the McGuire Manufacturing Co., of Chicago, and it will be equipped with two Edison motors.

IN a recent interview, Mr. Charles T. Yerkes, of Chicago, said that the Love electric conduit on his lines has been giving very good service in spite of the very wet weather which Chicago has experienced during the Spring months. Two cars are now running on the section of road equipped with the conduit, and they are carrying more passengers, and at a less cost, than was formerly done with four horse cars.

THE streets of Chicago were filled by thousands of visitors during the Democratic Convention in the latter part of the month, and the facilities of the street railway companies were taxed to the utmost. The latter gave a splendid service, and handled the crowds in a most excellent manner.

bearing above and below. It will lap on three ties and have in all sixteen bolts which will be in two rows and staggered.

A section of the rail is shown in this column, see Fig. 1. About a mile of track will be laid with an 82 lb. rail on chairs until all the 98 lb. rail necessary for the road can be secured. The motors, as already mentioned, will be of the Westinghouse type, two twenty-five horse power motors being provided for each car. The car bodies will be supplied by the J. G. Brill Co. The original order was for fifty cars, but the company finding it impossible to equip all their lines this year reduced the number to forty. The bodies are 21 ft. long, 29 ft. over platforms, and are mounted on Brill's improved No. 13 trucks which have elliptical springs at the extreme corners of the truck, and a 7 ft. 6 in. wheel base. The cars are finished in solid

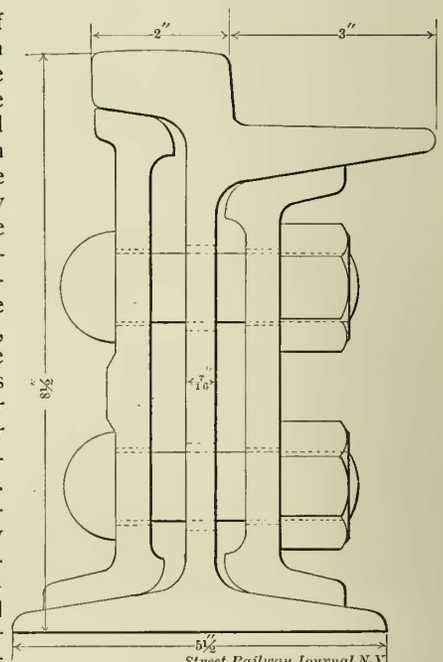


FIG. 1.—SECTION OF RAIL—WOODLAWN AVENUE LINE, CLEVELAND.

polished mahogany throughout, with decorated veneer ceilings, automatic spring roller curtains, spring seats upholstered with Wilton carpet, and solid bronze trimmings both inside and outside. They will be heated with six Burton electric heaters placed under the seats in each car.

The arrangement of the seats was to secure facility in the receipt and discharge of passengers, and, as will be seen from the accompanying diagram, Fig. 2, the plan decided upon differs materially from that of the ordinary car. The platforms have steps at one side only, being at the right hand rear corner platform and the left hand forward corner, the other two corners being enclosed by the dashboard which extends to the corner posts of the car. There

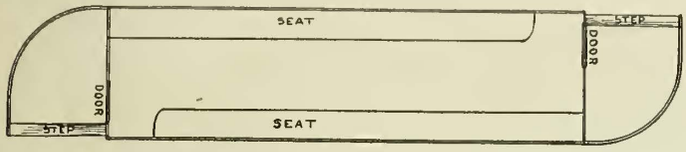


FIG. 2.—PLAN OF CAR—WOODLAWN AVENUE LINE, CLEVELAND.

is one extremely large door at each end of the car at the corner next to the step, the balance at each end of the car being occupied by one large window. One end of each seat is cut off about eighteen inches next to the door, thus providing large passageways direct to the step and reducing the seating capacity of the car only two persons.

The engines, which will be employed at the power station, will be of the upright, triple expansion type, of 500 H. P. capacity each, and will be supplied by the Globe Iron Works Co., of Cleveland. They will be coupled direct to Westinghouse generators. The boilers will also be supplied by the Globe Iron Works Co. and will be of the marine type.

The Sharpsburg (Pa.) Electric Railway.

One of the latest electric street railways in the city of Pittsburgh is the branch and extension of the Citizens' Traction railway. The Citizens' Traction is one of the oldest street railway corporations in Western Pennsylvania, and its president is John G. Holmes, also president of the American Street Railway Association.

Until 1888 the road was operated by horses. In the latter part of that year, however, the management decided to transform the main lines, running from the "down-town" district of the city to the East End and Lawrenceville, respectively, into cable lines. One of the branch roads of the company, running from Lawrenceville to Sharpsburg, a distance of four miles, was, until recently, operated by horses. It is this branch, which has since been changed into an electric road, and which was operated by that method for the first time on December 8, last year. Small as this electric road is in comparison with many others, since it only runs ten cars, there are many points about it which make it extremely interesting.

Fig. 1 shows exterior of the power house of the electrical branch. In the boiler room is a battery of three 125 H. P. tubular boilers operated by Murphy stokers. The engine room is entered from the boiler room, and is very handsome in appearance. The floor is of hard wood highly polished and covered with varnish and shellac. Long strips of India rubber matting are laid upon the places where there is the most walking.

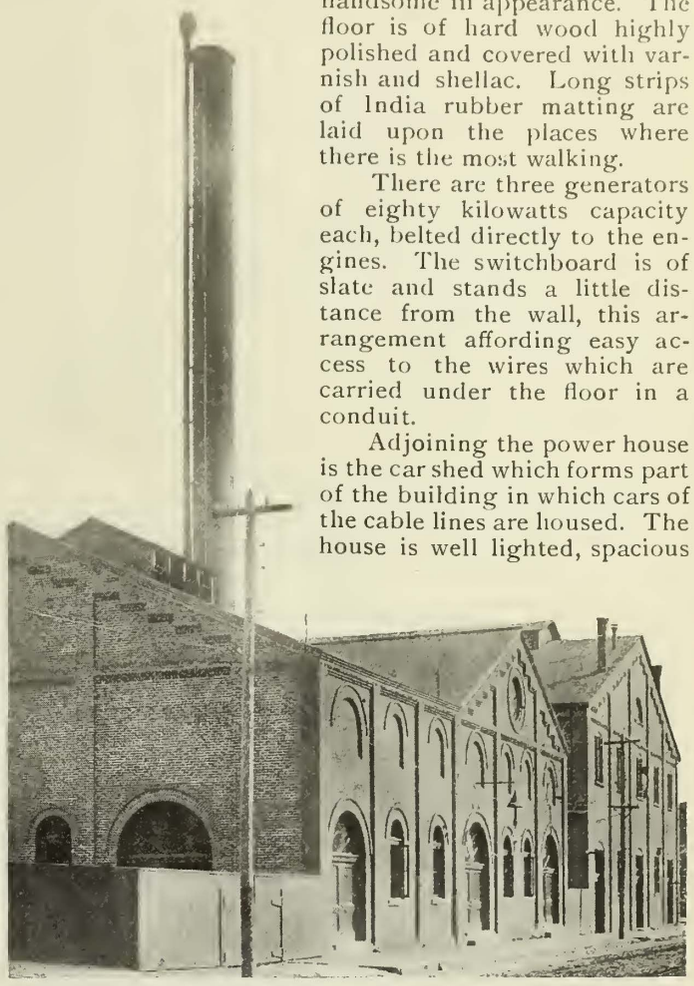


FIG. 1.—EXTERIOR OF STATION—SHARPSBURG ELECTRIC RAILWAY

There are three generators of eighty kilowatts capacity each, belted directly to the engines. The switchboard is of slate and stands a little distance from the wall, this arrangement affording easy access to the wires which are carried under the floor in a conduit.

Adjoining the power house is the car shed which forms part of the building in which cars of the cable lines are housed. The house is well lighted, spacious and is arranged so as to afford an easy inspection of the cars before and after each round trip. It is one of the rules of the company that no car shall leave the shed until it has been submitted to an inspection so that there is no doubt that everything, from the wheels to the trolley pole, is in good working condition. This may seem somewhat exacting, and may possibly be considered by some as superfluous, but the managers of the road feel convinced, from experience, of the wisdom of the course.

FIG. 2.—BRIDGE ACROSS ALLEGHENY RIVER—SHARPSBURG ELECTRIC RAILWAY.

In the basement of the car shed the company have a complete machine shop fitted with drill presses, lathes and planers. All the machines in this shop are operated by Westinghouse direct current electric motors (United States type). This machine shop has been established by the company for use of both the cable and electric divisions.

The line operated consists of nearly four miles double track. The roadbed is laid with Johnson girder rails, resting on three feet of solid concrete bottom. Fig. 2 presents a view of a bridge by which cars cross the Allegheny river.

Improved Short Single Reduction Motor.

So much attention has been given by the technical papers to the double reduction and gearless motors manufactured by the Short Electric Railway Co. that the merits of the single reduction motor manufactured by the same company have been to a considerable extent overlooked; but, from the increasing demand for the single reduction motor it may reasonably be inferred that this machine is likely to outstrip its more popular rivals.

This motor did not spring clean cut from the inventor's brain, but, like most important inventions, it has been improved by successive steps and along lines suggested by the behavior of the different parts in actual service. This fact is strikingly apparent when its graceful lines are studied and the careful designing of each separate part is noted. Hence our illustrations, Figs. 1 and 2, are not of a new motor, but of one that has been in service a considerable time and which has earned by economical and efficient service a clear title to the claims made for it.

Having had the opportunity of watching its performance in service and of studying the successive steps in its manufacture at the company's shops at Cleveland, we are able to present from original sketches this improved motor to the street railway public.

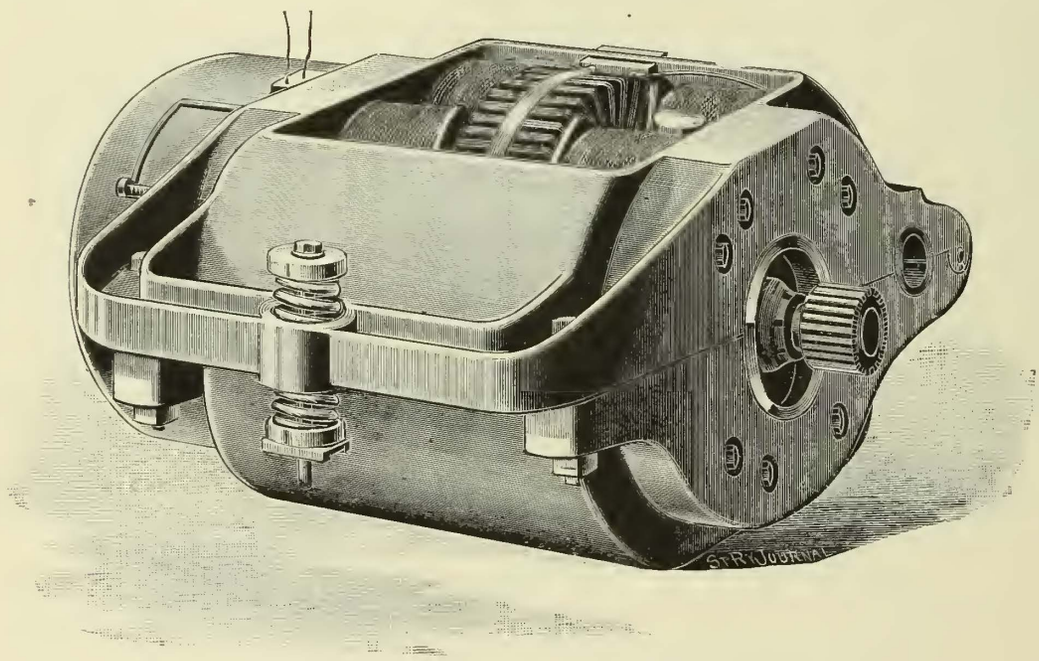


FIG. 1.—VIEW OF SHORT SINGLE REDUCTION MOTOR, IMPROVED TYPE.

THE FIELD MAGNETS.

have the same general shape as those employed in the other types of Short motors, but the cores and pole shoes are cast in one solid piece of soft steel which is afterwards annealed, and which has very high magnetic qualities, the tests showing it capable of being forced up to 130,000 C. G. S. lines per square inch, or 20,200 per square centime. The coils are wound directly upon the core, from which they are carefully insulated by a composite insulation nearly one-fourth of an inch thick consisting of layers of shellacked paper, rubber cloth, mica and duck. The wire is supported at the ends and securely held in place by means of brass heads which are firmly secured to the core.

THE ARMATURE CORE

is eighteen and a half inches in diameter and about four inches wide, and is built up, as are all the ring armatures of this company, by winding a ribbon of sheet iron directly upon the hub, the turns of iron being insulated from each other by a ribbon of tissue paper which serves to prevent the formation of eddy currents in the core. The hub is of bronze and has a long bearing upon the shaft, as shown in the engraving, to which it is securely fastened by means of a key and two set screws.

The bobbins are wound with flat wire about twice as wide as it is thick, which renders them strong and stiff mechanically, the shape of the wire not affecting its electrical qualities. The bobbins are carefully insulated from the core by composite insulation of the same description as that used on the magnets, about one-eighth of an inch in thickness. This, when the shellac is dry, becomes a hard, compact sheet, both mechanically and electrically strong, and not liable to be affected by moisture. The armature is composed of forty-eight bobbins wound with a continuous wire, but each is divided into three sections, and each section is connected by means of soldered copper strap and a flexible, composed of fine German silver wires, with a commutator bar, there being three times as many bars as bobbins. The bobbins being thus subdivided there is, comparatively, a small number of turns of wire between the consecutive commutator segments, which obviates in a great measure the spark, due to self induction. The bobbins, being raised above the core, provide for ample ventilation of the whole motor, as the projections of the bobbins serving as paddles to draw the air on one side down into the frame, and expel it on the other. For this reason the armature will stand a higher current density than if the matter of ventilation was neglected. The method of armature winding followed in the Short type of motors makes it possible, should any one of the forty-eight bobbins happen to burn out, to rewind it without disturbing the others or removing the armature from the shaft.

The object of employing German silver wire for the connections, or flexibles, as they are called, between the bobbins and commutator bars is because it is mechanically stronger and less liable to crystallize from the jarring of the truck than copper wire. It is not so good a conductor as copper, but this deficit is made up by using a larger flexible. The flexibles are insulated by rubber tape which is laid on very thickly by hand, thus insuring perfect insulation, and are led from the armature to the commutator bars over a wooden sleeve which covers all intervening metal parts. A layer of rubber cloth is first placed upon the sleeve, and the flexibles being in position they are interwoven with strips of tape, so as to hold them firmly in position and prevent any possible motion which might tend to rub through the insulation. A covering of twine is then wound over them, and finally a covering of heavy duck with shellac.

THE COMMUTATOR

is nine inches in diameter, and is composed of 144 bars. The bars are stamped out of hard drawn copper plates having the proper bevel. This material is considered by the manufacturers best both electrically and mechanically, because it is a better conductor, stands the wear of the brushes, does not eat away so rapidly from the sparking, and when in place there are no burs to cut through the mica insulator. The construction of the commutator is such that there is complete protection from injuries due to flashing, the continuous metal parts which hold it together being separated from the bars either by mica or a very long air space. On the outside a mica ring insulates the bars from the commutator head and projects a quarter of

an inch beyond the ends of the bars, leaving the head out of the way of any flash that might occur at the brushes. On the outside the commutator body is entirely covered by the shaft wires and the insulation protecting them.

The commutator body and head are of cast iron, and the head is secured by means of bolts which provide for its being held firmly in position. Mica is employed as an insulating material in the manufacture of the commutator, and this is prepared by carefully splitting the sheets into the ultimate leaves which are again laid with shellac so as to prevent the possibility of a metallic vein in the mica from completing a circuit between the bars. The flexibles being connected with the commutator bars the armature is placed in a lathe and the commutator trued up to the centres on which the shaft was turned. It is then mounted on ways and balanced, after which and inspection, it is ready for testing.

THE BRUSH HOLDERS

are of a novel type and so constructed as to hold the ordinary carbon brush with an even, light pressure square upon the commutator. To secure this two clock springs are employed,

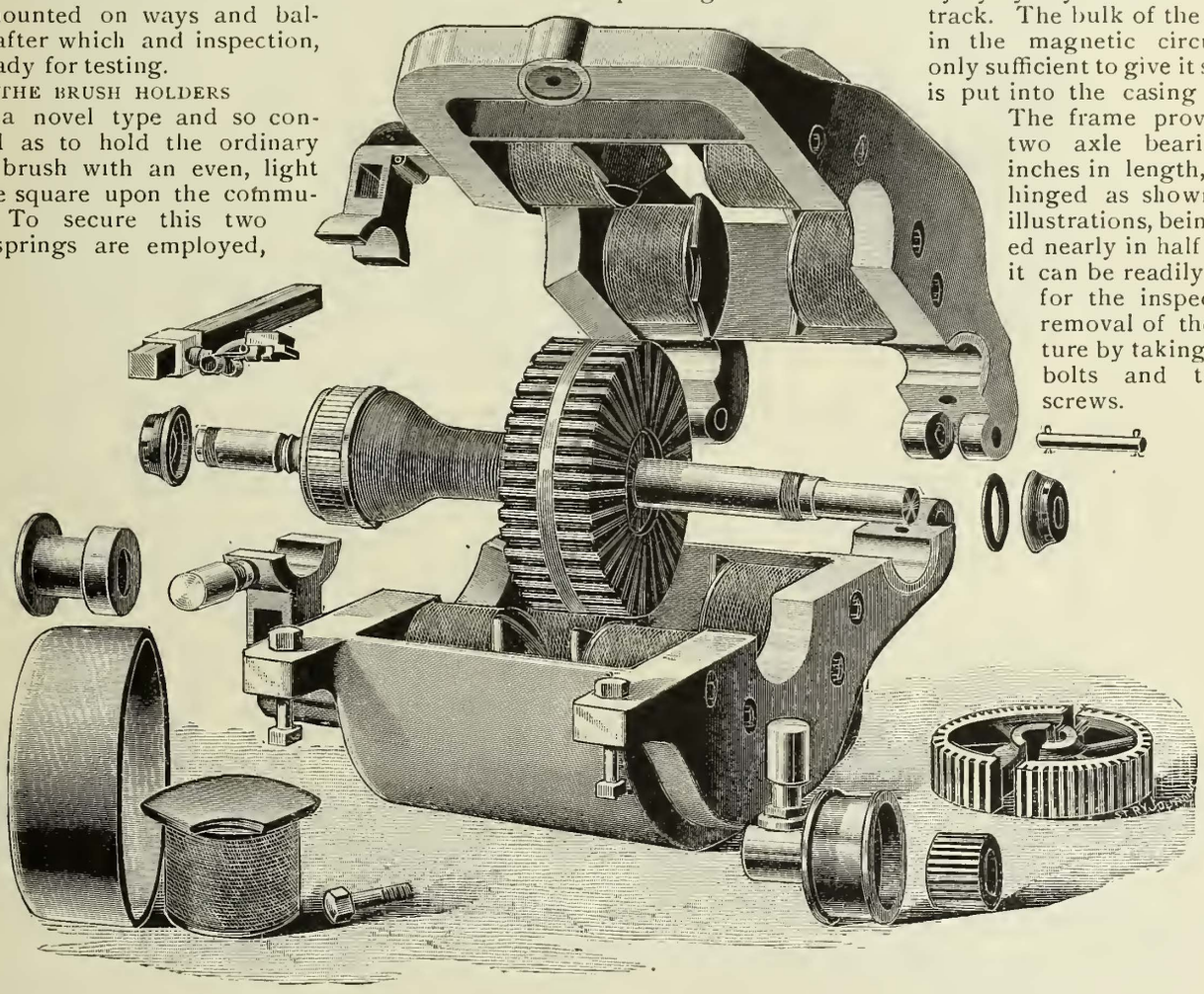


FIG 2.—PARTS OF THE SHORT SINGLE REDUCTION MOTOR—IMPROVED TYPE.

which are coiled in circular boxes, one on each side of the brush holder, their free ends connecting with a clip which bears upon the centre of the brushes, thus allowing them to follow quickly and freely any irregularity in the commutator, and the pressure being light the tendency to heating and squealing is generally decreased.

THE ELECTRICAL CONNECTIONS,

which are of heavy, insulated Clark cable enclosed in garden hose, are brought in at two places. Those for the armature are led through a fibre block just above the commutator, and thence through the wooden bars which support the brush holders to the brushes, being entirely protected from mechanical or electrical injury. The field connections are brought to two terminal binding posts at the end of the motor next to the hinges from whence the current is distributed in due proportion among the magnets.

THE JOURNAL BEARINGS

are inserted in light iron castings which rest, one in a chamber bored out of the frame at the pinion end of the shaft, and the other in the overhanging arm of the frame at the commutator end. Brass bushings are provided, which are forced into the castings by hydraulic pressure. The journal castings are provided with a chamber which constitutes an oil guard, a ridge being turned on the shaft within this chamber so that the centrifugal force throws off the oil and prevents the waste from working into the casing and reaching the commutator.

The armature is kept in a central position by two hardened steel collars which take the thrust either way, and which are held in position by means of drop forged thrust nuts securely locked by a split pin and all in convenient position for centering when the motor is placed upon the car.

THE FRAME OR CASING

is of cast iron, and is practically waterproof and also proof against mechanical injury by any obstruction on the track. The bulk of the metal is in the magnetic circuit, and only sufficient to give it strength is put into the casing proper. The frame provides for two axle bearings six inches in length, and is hinged as shown in the illustrations, being divided nearly in half so that it can be readily opened for the inspection or removal of the armature by taking out two bolts and two cap screws.

THE GREASE CUPS

are of the ordinary compression type, but are extra large and require to be filled only at long intervals.

THE GEARING

teeth are of the epicycloidal type, having great strength, the pinion being cut from the best hammered steel, and the split or axle gears being cut from steel castings carefully selected.

SPECIAL CLAIMS

for this motor are: Thorough mechanical protection of all parts by the casing; a thorough ventilation without the necessity of openings in the casing; a sparkless running of the commutator; ease of rewinding the armature; accessibility of all parts when the case is swung open on its hinge; quiet running and high average efficiency.

THE Trenton Passenger Railway Co. recently started the first part of their road in operation with electricity. The work is in charge of the Field Engineering Co. The first equipment will consist of twenty cars, which will be rapidly increased to a total of about fifty or sixty cars. Col. Lewis Perrine, Jr., is president of the road.

Car House Burned at St. Louis.

On Monday, June 13, about 9:20 P. M., fire broke out in the extensive car shed of the St. Louis & Suburban Railway at De Hodiamont, just within the city limits of St. Louis. By the time the first of the fire engines had arrived the flames had gained uncontrollable headway, and the efforts of the firemen were confined to saving the power house, which adjoins the car shed on the north, and which can be seen on the right in the engraving. The destroyed building was 500 ft. long and 150 ft. wide. In the western portion 40 × 50 ft. was occupied as a paint shop, and here some valuable iron and wood working machinery was lost as well as the tools and effects belonging to the workmen. A short time after the fire broke out the stock of oil in the paint shop exploded, and carried the flames eastward. Adjoining the shop was the emergency fire pump, which, however, was of no use.

In the car shed proper were thirty-two motor cars valued at $180,000, and trailers and eight wheel cars valued at $30,000, or a total loss on cars alone of $160,000. The loss on the shops in the rear of the building and on the building itself was $60,000, making the total loss $220,000. The origin of the fire, is unknown, but is attributed to spontaneous combustion among greasy rags in the paint shop.

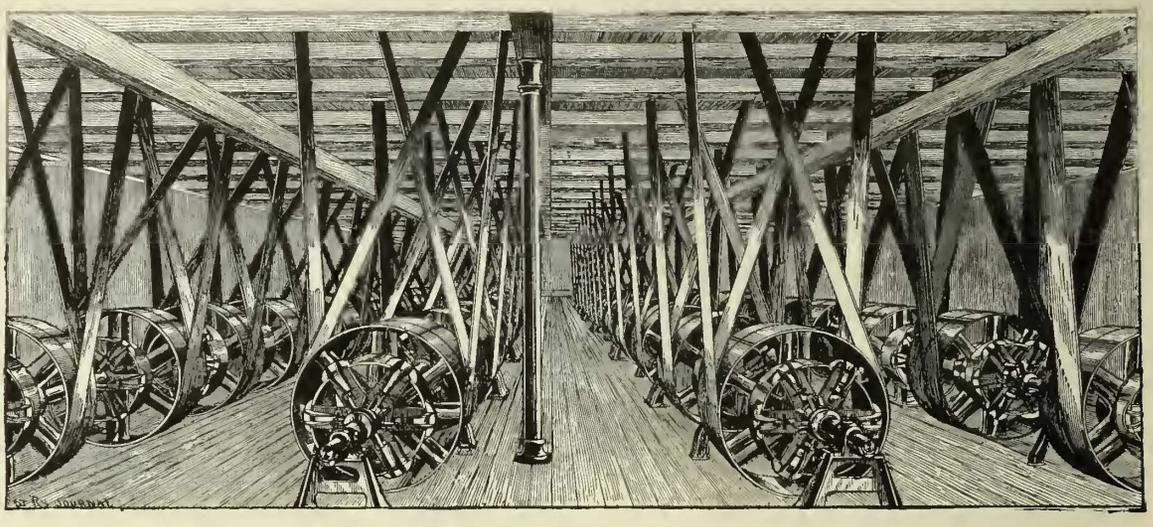
The power house not being damaged, the company are in shape to do business, there having been fifty cars on the road at the time of the fire and ten having been rescued.

The company will rebuild immediately a shed exactly similar to the one destroyed, and a new paint shop separated from the shed and situated between it and the power house. An equipment of thirty twenty-eight foot cars has already been ordered from a St. Louis builder, each of which is to be propelled by two twenty-five horse power Thomson-Houston S. R. G. motors.

S. L.

Shafting for Power Transmission.

The electric station of the Municipal Light & Power Co. of St. Louis, said to be the largest electric station in the world, is especially interesting to the street railway manager on account of the extensive system of power transmission by shafting used. The station supplies current to nearly 3,000 arc and 10,000 incandescent lamps, and this latter number will be increased to 50,000 as soon as possible.



SHAFTING—MUNICIPAL LIGHT & POWER CO.'S STATION, ST. LOUIS, MO.

The second floor of the building, of which a view is given herewith, is equipped with 400 ft. of six inch, hammered iron shafting, ground and polished, divided into eight sections of fifty feet each, and set up in four parallel lines on floor stands which are bolted to double I beams below. The bearings of the shafting are self-aligning and adjusting, and vary in length from eighteen to thirty-two inches. Each shaft is driven by a forty-eight inch, double leather belt, running over a steel rim pulley fifty-six inches in diameter, fifty-two inch face.

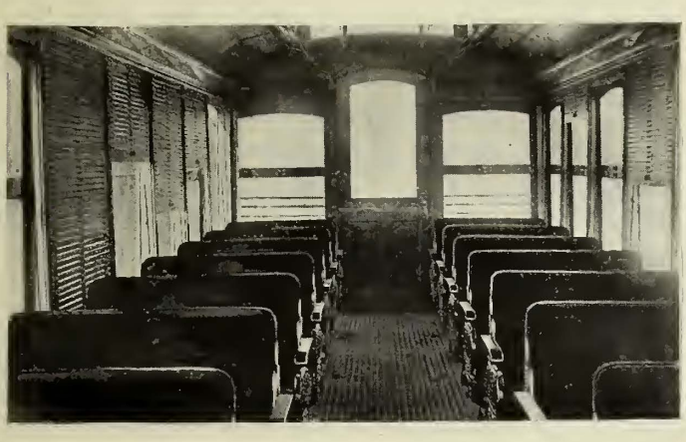
RUINS OF CAR HOUSE—ST. LOUIS & SUBURBAN STREET RAILWAY CO.

On each shaft is placed seven double crown friction clutch pulleys, fifty-two inches in diameter, with twenty-two-inch face, from which lead fourteen ten inch belts to the floor above to drive the dynamos. The clutch mechanism is operated from the dynamo floor by a simple lever device. Each engine belt has a patent steel rim tightener pulley, thirty-six inches in diameter, with a fifty-two inch face, which is operated from the shafting floor to tighten or loosen the belt. All the castings are exceptionally smooth and well made, and the boxes are lined

with babbit metal, reamed and bored, with deep oil grooves. The oil is fed to each bearing by a system of pipes, and carried thence by drain pipes to the oil filter in the basement, from which it is pumped to the fourth story to be used again. All the transmitting machinery on this floor was made and set up in place by the Falls Rivet & Machine Co. of Cuyahoga Falls, O., and it is an interesting fact that, while only one man is required to care for it during operating hours, no time has been lost from any mechanical defect of the shafting or pulleys since the plant was started.

A Combination Car.

A new type of combination car has recently been added to the rolling stock of the Newton Street Railway Co., of Newton, Mass., from the works of the Combination Car Co., of Waltham, Mass. Over all the car measures thirty-three feet, the length of the car body is twenty-five feet,



INTERIOR OF COMBINATION CAR—NEWTON STREET RAILWAY.

its extreme outside width eight feet ten inches and inside width six feet ten inches.

There are nine large windows on each side, and it is in the arrangement of the windows that the Combination Car Co.'s patents apply. The bottom of the sash is about the height of the arm to a car seat. The window frame is made in two horizontal sections and drops by a double slide into the side of the car, making it practically an open car. Slat curtains are also provided, which shut out sun or rain, without at the same time excluding the air. These curtains roll into spaces over the window frame, which are covered by a narrow panel so hinged that the curtain is easily accessible if there should be any trouble with it. The windows are also provided with spring guards to prevent rattling. The change from open to closed cars can be made rapidly.

The seats are arranged on each side of the centre aisle, and a seating capacity for thirty-two persons is provided. The car itself is handsomely painted in white and maroon with gilt lines. The sides and ceiling of the interior are beautifully and carefully finished in oak with a delicate figuring in pressed wood.

THE Oshkosh (Wis.) street car line has been sold, it is said, to a Detroit firm which will put in electricity.

Whytehead Joint Chair and Fishplate.

The combined box joint chair and fishplate, shown with section of track in Fig. 1, was designed by H. E. Whytehead, general manager of the tramways, North Staffordshire, England. The inventor has aimed at making

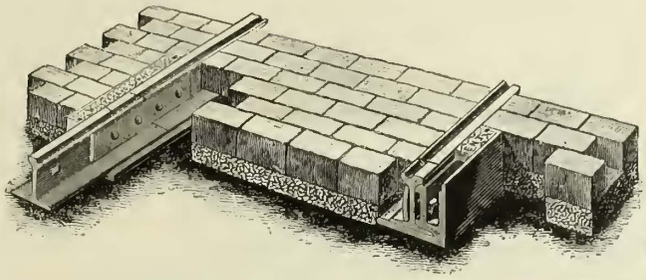


FIG. 1. WHYTEHEAD JOINT CHAIR AND FISHPLATE. FIG. 2.

the maintenance of tramway track more easy by reducing the number of bolts and nuts to a minimum, and by so arranging the parts that these nuts are accessible with but little more trouble than on an ordinary roadway line. Mr. Whytehead believes that no form of locknut can be relied upon to maintain the tightness of a rail joint under traffic, and that the only reliable plan of doing so is to tighten the nuts periodically. In Fig. 2 another arrangement is shown in which a chair is dispensed with, the rail being bolted direct into the sleeper, the recess for the nuts being formed in one of the fishplates.

Street Railways in Pennsylvania.

For the year 1890 140 street railway companies made reports to the State Board of Railroad Commissioners, according to the annual report just published by this body. This year the number has been increased to 207. The stock capitalization of these corporations is reported at $34,622,120.26, an increase of $7,956,541.67 during the year. The companies have a funded and floating debt of $16,699,488.88, a capital of upwards of $50,000,000 being invested in the street railways of the commonwealth. The returns show that the cost of these roads has been $19,945,127.13. The combined length of the lines is 683.32 miles, an increase during the year of 96.72 miles. The total number of cars is 2,722,148 having been added during the year. While the electric and cable systems are supplanting the horse cars, there are still 11,666 horses in use; an increase of 954 over the previous year.

The number of cars propelled by electricity is 335, while the horses are still dragging along 1,050 cars. In 1890 there were carried 219,505,616 passengers. In 1891 the number was increased to 237,781,172. The total receipts for the year were $12,631,433.60.

COMBINATION CAR—NEWTON (MASS.) STREET RAILWAY.

New Electric Motor Controlling Switch.

The question of the best method of controlling the speed of an electric motor on a street car by varying the amount of current going through it is an important problem. A method easily thought of is by the use of a resistance in the circuit, but this is, of course, decidedly wasteful; in fact, it involves the consumption of nearly as much energy when the motor is running at a slow speed as when running at a high speed, although the work given out by the motor in the two cases is very different. It has, consequently, been customary to modify this method of regulation by providing in addition a device for changing the effective winding of the field magnets so as to vary the counter electromotive force at different speeds. In some cases these two methods of regulation by means of resistance and alteration in field magnet strength have been combined in a system of commutating sections of the field magnet coils by which the coils themselves offer a greater or less resistance to the passage of the current. In other cases a combination of the two methods has been effected by having a separate resistance external to the motor, and then in addition, providing a switch to cut off a section of the field magnet coils or shunt a portion of the current around them for the highest speed.

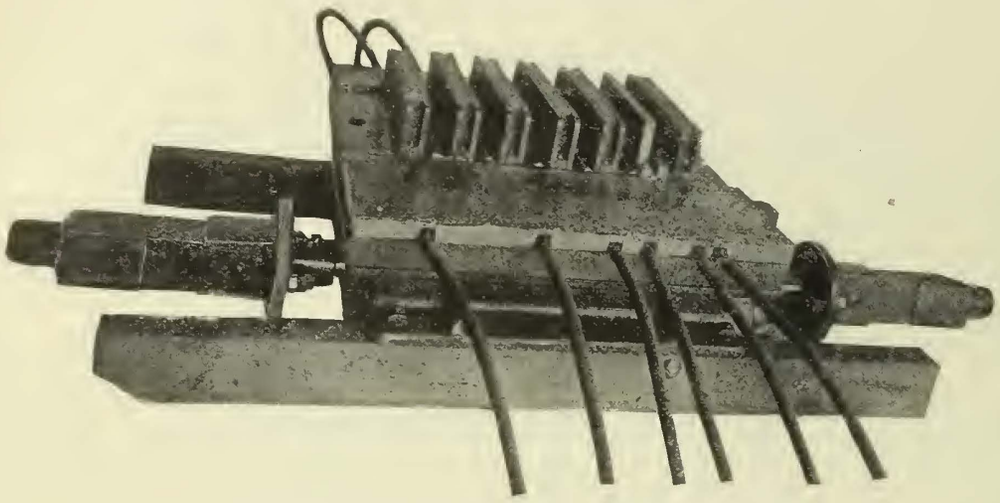


FIG. 1.—TOP VIEW—NEW MOTOR CONTROLLING SWITCH.

Believing that a still better method of motor control could be devised, engineers of the Thomson-Houston Electric Co. have been engaged in a long series of experiments, with the result that this company have recently placed on the market a new controlling switch which is shown in the accompanying engravings. In a number of instances where this controlling switch has been used for some time, it is claimed that a saving of 30 per cent. in consumption of current has been effected; and when it is realized that this means a saving at the central station of over 300 H. P. out of 1,000 H. P., the great importance of this new device cannot be doubted.

The principle upon which the new controller is based is the shifting of the connections of two motors from series to multiple, so that for slow speed the two motors will be in series, giving in consequence a high counter electro-motive force (that of each motor being in series with that of the other) at a low rate of speed, while for higher speed they are connected in multiple, in which condition highest speed and power are obtainable with equal economy.

Fig. 1, shows a top, and Fig. 2 a bottom view of the new controller. As will be readily understood from an inspection of the illustrations, the apparatus consists of a longitudinal shaft acting upon a series of switch levers to produce the various connections necessary to place the motors in series or parallel. This controller is to be placed at any point beneath the car and operated by a mechanical connection from either end of the vehicle. In this apparatus the mechanical and electrical details have been worked out with the greatest care, and it was permitted to go on the market only after satisfactory tests had been made proving the efficiency and reliability of the device. The Thomson-Houston company have for some time owned controlling patents of this type of controller; the most important being No. 385,055, dated June 26, 1888, and No. 393,322, dated November 20, 1888.

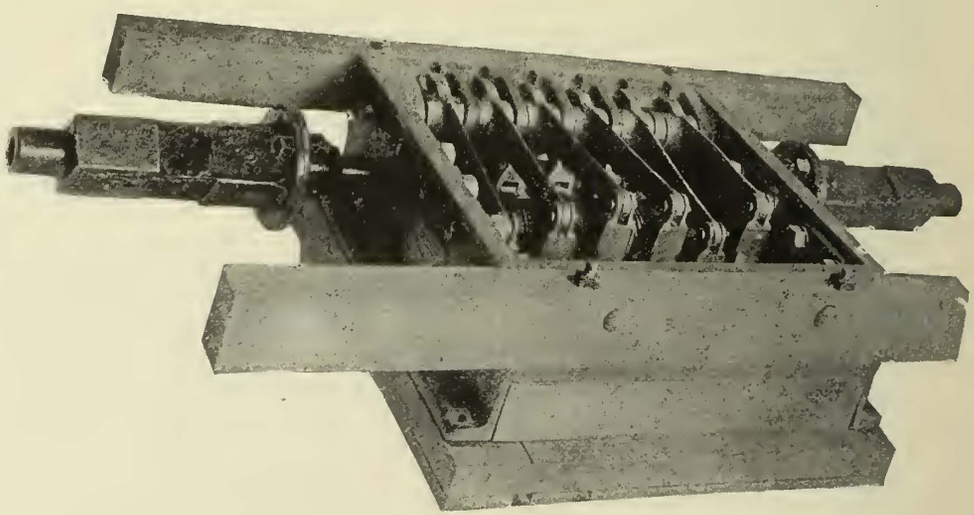


FIG. 2.—BOTTOM VIEW—NEW MOTOR CONTROLLING SWITCH.

The New York Rapid Transit Plan Approved.

The commissioners appointed by the General Term of the Supreme Court to decide whether the underground railroad proposed by the rapid transit commissioners should be constructed according to the plans proposed, and in lieu of the consents of the abutting property owners, filed their decision last month. The commissioners were David McClure, Robert Maclay, and Benjamin Perkins.

The commissioners decided in favor of the construction of the roads as proposed by the Rapid Transit Commission, except as to that part from Ninety-Sixth Street to Jerome Park which was left detached by the special act of the Legislature which withdrew from the operation of the Rapid Transit Act that portion of the road which it was proposed to construct under Madison Avenue from Forty-third to Ninety-sixth Street. The routes approved and which will now be built if the franchises can be sold are from the Battery to Fourteenth Street and continuing on the west side to the city line near Yonkers, with a loop under Main Street, City Hall Park, Park Row and Chambers Street, and a branch extending from Fourteenth Street partly under Park Avenue, to a point near the Grand Central Depot on Forty-second Street.

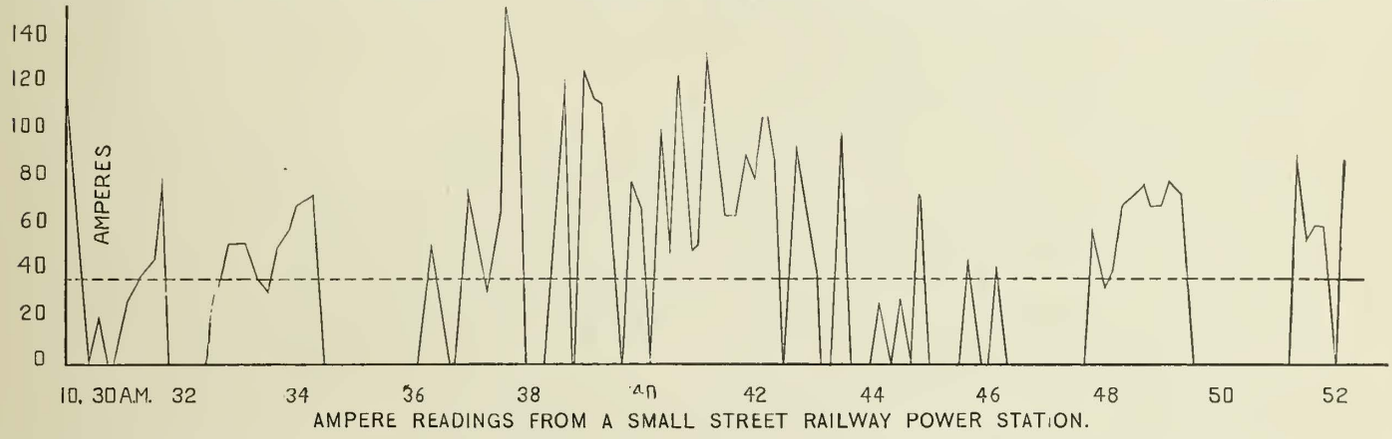
It is expected that the rapid transit commission will now soon ask for bids for the construction and operation of the road under the franchise.

THE Denver (Colo.) Tramway Co. are erecting a large electric power station on 32d Street. It will be 165 × 110 ft. and will contain an engine room 110 × 92 ft.

Points on Small Power Stations.

By Wm. Lee Church.

BEAR IN MIND THAT THE ENGINE IN AN ELECTRIC RAILWAY POWER STATION IS NORMALLY AN UNDERLOADED ENGINE, NOT AN OVERLOADED ENGINE. That the above statement is not made more prominent is wholly the fault of the printer, and not of the emphasis which the writer desires to give it. Strange to say, a belief precisely the opposite of this seems to be floating vaguely in the minds of most railway men. It would seem, somehow, that the abruptness of the load, and the momentary excess which is found every few minutes, have been confused in the mind, so as to take the place of the working facts which exist. It is true that an electric railway engine gets frequent and heavy overloads for an instant, but no more than ought to be comfortably taken care of by the flywheel and a proper steam distribution, provided the engine is intelligently adapted for the work. But this overload has little *direct* bearing on the economy of the engine; in part, because the overload lasts but a moment, and in still greater part, because a heavy load is, as a general statement, an economical load, within limits depending somewhat upon the type of engine. With reference, however, to the *fuel duty* of the engine, it is not the overload which is to be principally considered, but the variations of load; and of these variations the minimum load plays by far the greater part in the final economy.



AMPERE READINGS FROM A SMALL STREET RAILWAY POWER STATION.

To put the matter in another light, we would say that the maximum load determines the size of the engine, and the minimum load determines its duty. At this point the investigator is likely to jump to the false conclusion that the *average load for the day* represents the true performance of the engine upon which he can base his estimate of fuel consumption. This certainly seems reasonable, but nothing can be further from the truth. To make the point clear, we will have recourse to another ampere diagram taken from a small station operating a country line over numerous grades. In this diagram it will be observed that for fully 20 per cent. of the time there is no load whatever on the engine other than its own friction and that of the generator. At such times the cars are all, for the moment, on the down grade, the circuits open and the ampere meter at zero. This particular diagram is necessarily confined to a section of but a few minutes' run, but the same action was continuous throughout the day. Now the *average* horse power for this run would reduce to the power represented by the dotted lines, equivalent to thirty horse power, but this average of thirty horse power resulted from a continuous fluctuation from 0. H. P. to 125 H. P., and out of this arise some pertinent questions.

Assume that you are about to equip a small power station, and that you are aware of the probable fluctuation of load. Sufficient experience is now available to make this assumption a reasonably safe one. For present purposes we will go to the extreme, though not uncommon case, represented by the diagram and assume that your maximum load will be 125 H. P. It is manifest that you are compelled to select an engine of a rating certainly not less than 100 H. P. at the determined steam pressure, in order that it may pull over the high spots without sensible diminution of speed. Being limited by this rigid necessity, you next propose to estimate beforehand what your probable coal account will be, since the final statement of the operating account will contain this as a large item. Shall we reckon the fuel duty on the basis of the rating of the engine, say, 100 H P.? Manifestly not; because the engine gets no chance to work at its rated horse power except at brief and infrequent intervals. Shall we reckon the duty of the engine on the basis of the average of its power throughout the day, as per the dotted line? Assuredly not; and let us see why. If you jump to conclusions again, you would figure something as follows: "My engine is a 100 H. P. engine, but it will average only twenty-five horse power throughout the day. Now, if it were running at its rated horse power it would consume, say, twenty-five pounds of water per horse power per hour (it is assumed to be a compound non-condensing engine of the ordinary type not capable of meeting a fluctuating load); but since it is operating at an average load of about 25 per cent. of its rating, I will allow that it will use as high as thirty pounds of water per horse power per hour; or a total of 13,500 lbs. water, or say 1,340 lbs. coal, or, with banking fires, about 1,500 lbs. of coal for an eighteen hour run, equal, with $3 coal, to $2.25 per day; and this is what I will figure on in estimating my expense account." And in figuring this way, you would figure exactly wrong, and forever thereafter you would wonder why you were burning so much coal. Moreover you would gently curse the engine under your breath. Now, as a matter of fact, *your power averages itself, but your fuel duty does not*, and this is what you never thought of.

Suppose we examine this point. A fuel duty under a continuous rated load, if your engine is a non-compound, non-condensing engine of the slow speed variety, would be, perhaps, twenty-eight pounds of water, or as low as twenty-five pounds with the ordinary compound engine. But even if the engine ran *continuously* at the *average* load of twenty-five horse power, its performance would be not better than forty-five pounds, which will be fully demonstrated in another paper. Unfortunately, even this condition, bad as it is, almost never exists for more than a moment, but in fact the engine is alternately anywhere from 25 per cent. overload down to no load at all—that is, no effective load. Under the rated load or thereabouts, you would be getting from twenty-five to twenty-eight pounds; under a *continuous average* load, if you had it, you might even get forty pounds, but under the actual conditions of fluctuating load, out of which your average load is only *computed*, not *created*, you are getting anywhere from thirty to seventy-five pounds and varying every moment. If you will now average the fluctuating duties due to the fluctuating loads, instead of averaging the load first, and then assuming a duty based on that, you will find that instead of thirty pounds, you will consume at least fifty pounds of water per hour for every electrical horse power delivered. This means coal and dollars, and if you never knew it before, you will know it when you come to divide your coal bills by the car mileage. Perhaps I ought not to have taken so extreme a

case, though an actual and common one, but all small stations suffer under these conditions, and the larger stations only modify them.

This condition of things, already bad enough, is further aggravated by the power required to drive a more or less extended line of countershafting, which power is a constant, and becomes a proportionately greater factor as the effective load becomes lighter. This subject, however, will be treated more fully in another article. The conditions outlined above, as has been said, are found in greatest intensity in the smaller class of stations and on hilly roads, and to a certain extent become modified as the station becomes larger, the extremes of fluctuation being toned down by overlapping of a greater number of cars. The fluctuation is by no means reduced as much as is popularly supposed, and it is at present a question in the writer's mind whether 1,000 H. P. is not the smallest unit, on the single engine plan, which can with safety be considered in the hope of economical results. It is these small and moderate sized stations which the writer has most heavily on his mind ; the big stations get the best attention and treatment, although, I humbly submit, not necessarily the best judgment. The smaller stations are apt to be tinkered up by home talent to save money (?), or laid out in a general sort of haphazard style by some one more interested in the contract than in the engineering results. The fact of the matter is, that the small station has the heaviest odds against it in respect to earning capacity, anyway, as is the general law with all small enterprises ; from which it follows that it should, *per contra*, receive the most painstaking engineering in order to offset this disadvantage and raise its intrinsic operative efficiency to the highest point. In short, give me the small stations and I care not who builds the big ones.

We therefore return to our original proposition, and once more repeat that the engine in the power station of an electric railway is essentially an underloaded engine and not an overloaded engine, and must be so treated. Having established this premise, the next and reasonable thing would be to examine the essentials of an engine capable of giving a high duty under light loads, or, more properly speaking, a uniformly high duty under all and wide variations of load. It has been well settled that no ordinary type of engine, compound or otherwise, can accomplish this desired result, even approximately, and since it has fallen in the writer's way to be connected with the development of certain improvements in precisely this direction, it will be the proper object for the next article to make the nature of these improvements somewhat plain.

Series Electric Traction.*

BY NELSON W. PERRY, E. M.

In long lines, the bugbear of the multiple arc system of distribution is the drop in potential at the further end. The potential may be amply sufficient near the generating station, but it becomes less and less as this proximity is departed from, until, at the further end, the lights which burned brightly near the station dim down to scarcely more than a dull red, and the cars are operated under heavy loads with difficulty or not at all. There are two remedies for this drop in potential at hand — either to increase the amount of copper in the feeders, which within commercial limits is but a partial remedy, or to increase the pressure, using the same amount of copper which, when the multiple arc method of distribution is employed, introduces as many difficulties as it obviates. There is still a third remedy, and that is to employ the constant current method, in which, under all circumstances, the current remains the same and the pressure varies as the work performed.

If energy can be much more advantageously distributed to long distances by the constant current method for arc lamps, why should this method not commend itself to the ever increasing distances to which our electric street railroads are reaching?

The answer is that the constant current method, as heretofore developed, has not been sufficiently elastic to meet the requirements, and although the generation of a constant current involved much less complex machinery, and the cost of distribution to distant points necessitated a much smaller initial outlay, still the difficulties introduced by this method largely outweighed all its advantages.

The system which I am about to explain may properly be described as consisting of a circuit interrupted by a series of breaks in multiples of two, or one consisting of a circuit interrupted by breaks in multiple series with each other. The conception then would be like Fig 1.

But in order that a current shall pass around this circuit, it is necessary that *one* of the breaks in each multiple shall be normally closed. It matters not which one is closed; so our plan would now look like Fig. 2.

If a translating device should successively occupy each of these breaks, it would receive current during the time that its terminals con-

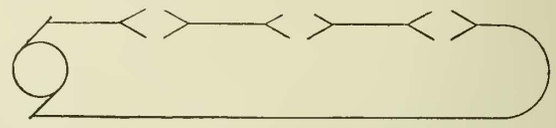


FIG. 1.

nected the ends of the two broken wires, in proportion to the relative conductivity of the two paths open to the current. But we are not satisfied to have a portion only of the current pass through our motor— it is necessary that *all* the current must so pass. We must, therefore, make the resistance of the other branch infinite during the time in which the motor is bridging, through its terminals, the break, or, in other words, the normally closed branch must be broken.

If, therefore, we place an electro-magnet in *series* with the normally broken branch, so that when vitalized it will open the switch in the normally closed branch, and allow it to close again by gravity or

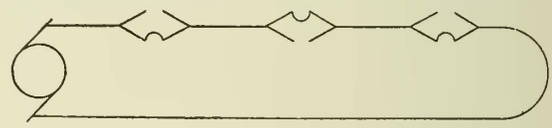


FIG. 2.

otherwise, when the magnet is devitalized, we have provided in a crude way for operating traveling translating devices in series. Our conception now would be represented somewhat by Fig. 3.

By this arrangement, the moving device only receives a momentary impulse as its terminals touch the ends of the break, and would have to rely upon its acquired momentum to carry it to the ends of the next break.

It is desirable, however, that the moving device be impelled by as nearly a continuous force as possible, instead of by a succession of momentary impulses. Instead, therefore, of having the ends of the nor-

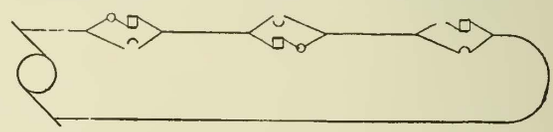


FIG. 3.

mally open break face each other as represented heretofore, we may extend these wires for some distance parallel with each other, and our plan assumes the form shown in Fig. 4.

And it is desirable that the interval of time during which the device is without current, viz., that occupied in passing from one break to the next, shall be as small as possible. This naturally suggests having the normally open breaks all on the same side of the normally closed breaks, and if these parallel wires be continued so as to overlap those constituting preceding and succeeding breaks, a car or other moving translating device may pass from one break to another without even

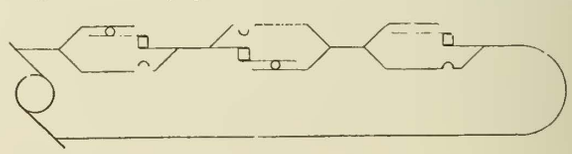


FIG. 4.

momentary interruption of current. In Fig. 5, the lower line which I call the "feeder," contains all of the normally closed breaks, represented by mercury cups normally connected electrically by a fork taking into them, which constitutes a double pole switch actuated by an electro-magnet in the manner to be described.

The upper pairs of wires, which, it will be seen, are merely the parallel extensions of the other possible path for the current, are in multiple with the path through the mercury cups. One of each of these pairs of wires, which will hereafter be denominated sections, is connected to the feeder wire on one side of the mercury cups, and the other has a similar connection on the other side. The two wires of each section normally without electrical connection with each other, constitute what has been termed the "series of breaks normally open." If, however, these two wires be connected electrically through the terminals of a motor, the latter will be in multiple with the mercury cups and momentarily receive only the current due to the relative conductivity of the path thus offered. By the arrangement shown in Fig. 5 the

*Abstract of paper read at the Chicago Meeting of the American Institute of Electrical Engineers, 8th, 1892.

electro-magnet which opens the mercury cup switch is in series with the motor circuit, and the latter no sooner receives current than the former is actuated, the switch is opened and the whole of the current which was momentarily divided between the two branches, is diverted to the motor.

If the corresponding wires of the succeeding sections be caused to overlap without making electrical connection with each other, and these laps be staggered as shown, a means is provided whereby the motor prepares the succeeding section for occupancy before wholly passing out of the one it is about to leave, and accomplishes this with-

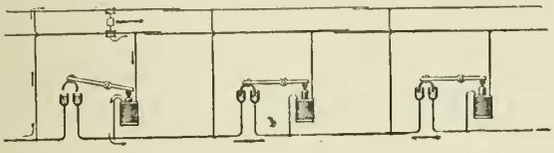


FIG. 5.

out interruption to the current. When the motor is in the position represented in Fig. 5, there is but one path for the current, viz., around the open switch in the feeder and through the electro-magnet by which it is kept open, back again to the feeder.

As the motor proceeds to the right, one of the terminals first embraces the lower lap, thus offering two paths for the current—one passing through the switching arrangement that controls the section the car is about to leave, and the other through that controlling the section it is about to enter. As it progresses still further this terminal passes beyond this lap at about the same time that the other terminal embraces the other lap. This leaves the first switch without current and the succeeding switch is automatically opened. There is no break in the circuit, however, even during the short interval occupied by the

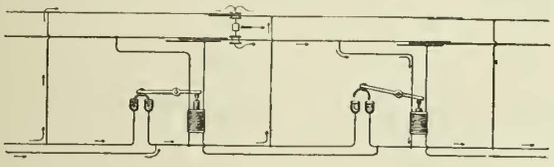


FIG. 6.

two switches in acting, for while the further terminal embraces the further lap, both of the switches concerned are short circuited.

Before the further terminal has passed beyond the lapping portion of the two succeeding wires, the first switch will have closed and the succeeding switch will have been opened, thus diverting all of the current to the section upon which the motor has now entered.

On single track roads where turnouts are required, the turnout constitutes merely an additional section to one side of the main line, which is skipped by the car keeping the main track, and taken by the other car in passing, It, like every other section, has its own individual controlling switch, and when both the main track and siding are occupied by cars, their motors are arranged in series with each other.

But the plans thus far discussed possess serious faults. In them

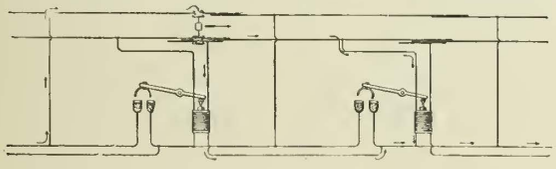


FIG 7.

we have provided a means by which a car may leave one section on a given road and enter another one on the same or another road without breaking the main circuit, *provided the car is always going in the same direction.* In all of the cuts thus far, the car is supposed to be going from left to right, and the switches are arranged accordingly; but, if we examine the drawings again, it will be found that in the plan suggested in Fig. 5, if the car were going in the opposite direction, the circuit would be momentarily broken as it left one section and would fail to divert the current to the section it was entering. In Fig. 6 however these difficulties seem to be removed.

It will be noticed in Figs. 6 and 7, as in the first plan described, the trolley wires of adjacent sections are lapped, and that these laps are staggered; that parallel to, but insulated from, the nearer laps, is placed a subsidiary wire which short circuits the switch to the right. The switch controlling magnet, as is shown, has two coils wound cumulatively, and may be operated either by the current passing through the subsidiary wire, by that passing through the nearer trolley wire, or by both when it takes both paths.

THE Boston *Daily Traveller* makes the following mention of our last issue: "The June number of the STREET RAILWAY JOURNAL (the *World* Building, New York) is filled with most valuable matter, much of it being finely illustrated. The importance of this magazine to all in any way interested in street railway management can hardly be overestimated, covering, as it does, the entire field ably and in a manner to interest all readers."

A New System of Electric Propulsion.*

BY H. WARD LEONARD.

If in a street railway system we could operate from the constant potential system a shunt wound motor running at a constant speed, and could interpose between this motor and the axle some device equivalent in its effect to an infinite number of different sets of mechanical gears, so that we could make use of any reduction desired, it would enable us while using a constant power to increase the torque as we decreased the speed, and *vice versa*, which is just what is desired in railway practice where the least torque is required when at full speed on the level and the greatest torque is required at the slow speed in starting and in operating on a grade. Numerous and very ingenious devices have been invented for accomplishing this variable mechanical reduction, but on account of the complication, noise and unreliability they have never proved successful.

The writer has recently devised an electrical method of securing all the results which could be obtained from such a set of gears described, with a freedom from the noise, wear, complication and rigidity which such a set of gears would necessarily involve.

Following is a general description of the arrangement proposed, as indicated by Fig. 1:

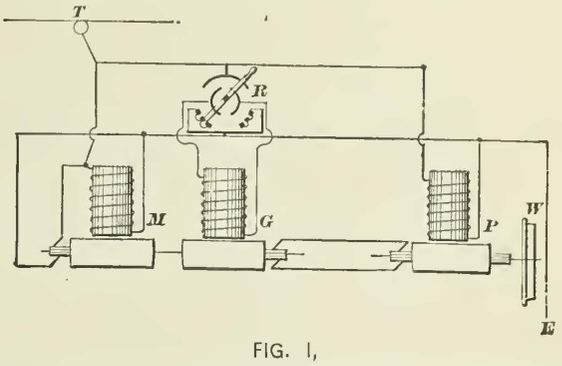


FIG. 1,

T, Trolley. M, motor portion of power converter. G, generator portion of power converter. P, the propelling motor for the car. R, the regulating and reversing rheostat in field of G. E, the connection to ground. W, the car wheel.

Each axle is driven by a gearless motor, either directly or by means of a connecting rod. The fields of these motors are excited directly from the constant E. M. F. of the line and independently of the armature circuit. Beneath the car and between the axles there is suspended a motor-generator, each armature winding being in a separate field. The motor portion of the motor-generator—which will, for convenience, be called the power converter—is shunt wound and connected just as a shunt motor is for use upon ordinary constant potential circuits. The field of the generator portion of the power converter has its field connected across the line and has inserted in it a regulating and reversing field rheostat. This field circuit is independent of the armature circuit. The generating armature of the power converter is in metallic connection with the armatures of the propelling motors. It will be noticed that this circuit, including the armature, is a distinct and separate metallic circuit having no connection with the line in anyway.

Suppose, now, that our shunt motor is running at full speed and that our controlling rheostat in the generator field circuit is at its central position, so that the generator field circuit is broken. Although the generator armature is being driven at full speed, it is revolving in a field having no magnetism except the residual magnetism, and hence produces practically no volts. Let us now move our controlling switch so as to place the generator field across the line, but with a resistance in series with the field of ten times the resistance of the field coils. We now get a slight excitation of the field and a development of volts at the brushes of, perhaps, forty volts. This voltage will produce a current through the armatures of the driving motors dependent upon the ohmic resistance of this current only, and hence, even at this low voltage, a large current will be produced, which being in a field full of strength will cause a torque sufficient to start the armature. The speed of the armature will, of course, be governed by the counter E. M. F. which its revolution produces in its strong field; and hence, just as in the case of a shunt wound motor, its speed will be practically constant so long as the E. M. F. supplied is constant.

If we now gradually increase the magnetic field of the generator by cutting out resistance by moving the controlling switch, we will gradually raise the E. M. F. of the armature circuit, and with it the speed of the driving motors. Since these armatures are revolving in a constant field, the torque they produce will be exactly proportional to the current in them, and the current will automatically flow exactly as is required to produce the necessary torque to maintain a speed such that the counter E. M. F. will approximately equal the E. M. F. supplied by the power converter. Thus it will be seen that the speed of the car will be dependent upon, and proportional to, the E. M. F. supplied by the power converter, and the torque or tractive effort will be dependent upon, and proportional to, the current supplied by the power converter.

Let us suppose that sixty amperes flowing through the armatures in fully excited fields will produce a torque sufficient to move the load when upon a grade. It is evident from what we have seen that forty volts from the power converter will produce this current. Hence, by

*Abstract of a paper read at the Chicago meeting of the American Institute of Electrical Engineers, Chicago, June 8, 1892.

an expenditure of 2,400 watts in the secondary circuit, or a total power, including field excitation, etc., of about eight horse power, we can start a fully loaded car upon a grade.

Under the existing systems, we would need the same sixty amperes in the same fully excited field, but would necessarily use the full voltage of 500 volts, and, therefore consume energy represented by 30.000 watts, as against possibly 6,000 in this system. The current from the line in starting the car under ordinary conditions by this system would be about twelve amperes at 500 volts, instead of from sixty to 100 amperes at 500 volts.

It will be evident from what has preceded that with this power converter system we can propel a car upon any practicable grade with a consumption of power no greater than is required to operate the car at full speed upon a level, by merely reducing the speed to the required extent.

Following is a tabulated statement (Table 1) showing the results we may expect to obtain by this system in operating with fully loaded car under three different conditions: First, at twelve miles per hour on level; second, at three miles per hour on 5 per cent. grade; and third, at one mile per hour on level.

TABLE I.

DUTY OF CAR. SHOWING VARIOUS LOSSES EXPRESSED IN WATTS.

Various Losses Involved.	8 Tons at 12 Miles per Hour on Level. Full Speed, 1-6 Full Torque; Armature Current, 10 Amperes.			8 Tons at 3 Miles (or 5 Tons at 5 Miles) per Hour on 5 per cent. grade. ¼ Full Speed, Full Torque; Armature Current, 60 Amperes.			8 Tons at 1¼ Miles per Hour on Level. 1-10 Full Speed, 1-6 Full Torque; Armature Current, 10 Amperes.		
	Power Converter.		Driving Motors.	Power Converter.		Driving Motors.	Power Converter.		Driving Motors.
	Motor part.	Gen. part.		Motor part.	Gen. part.		Motor part.	Gen. part.	
Field	250	275	250	250	60	250	250	25	250
$C^2 R$ in armature	160	60	60	250	2000	2000	20	60	60
Friction	60	60	120	60	60	30	60	30	10
Foucault currents, hysteresis, etc.	200	400	200	200	50	50	200	10	10
Total	670	795	830	760	2170	2330	530	125	330
Total watts wasted		2295			5260			985	
Watts of work done		4000			6000			400	
Total watts absorbed		6295			11260			1385	
Amperes at 500 volts		12 6			22.5			2.8	

In arriving at the losses, as indicated, the motor part of the power converter has been assumed as having the following features:

E. M. F. 500 volts, current capacity for ten hours' continuous duty, fifteen amperes; resistance of shunt field winding, 1,000 ohms, armature resistance, 1.1 ohms.

The generator portion of the power converter and the driving motor are assumed as having the following features:

E. M. F. 500 volts; current capacity for ten hours' continuous duty, forty amperes; resistance of field 900 ohms; armature resistance, 0.55 ohms.

The rolling friction with gearless motors on good level track is assumed as twenty pounds per ton. Car is assumed to be eight tons in weight full loaded and five tons for moderate load.

TABLE II.

SHOWING PROBABLE COMPARATIVE FIRST COST PER CAR BY PRESENT AND PROPOSED SYSTEM.

	Present System.	Proposed System.
Steam plant, generators and conductors per car (steam plant 1,000, generators 700, conductors 500	2200	1100
Motors (two 15 H. P. equipments)	1800	1400
Power converter	0	900
Controlling switches, cables, rheostats, etc	200	30
Total first cost per car	4200	3430
Saving in favor of proposed system per car		$770

The features of the proposed system which seem, at first sight, to be very objectionable are: The increased cost of the car equipment and the fact that we are adding an additional machine, having two fields, two armatures and three bearings; but, as we have seen, there is only an apparent increase in the first cost, for the saving in the generators and distributing plant far exceeds the additional cost of the car equipment; and the use of the motor-generator for elevators, traveling cranes, etc., has demonstrated that, as regards the attention it requires and the depreciation it suffers, it has a marked advantage over the rheostat or commutated field used in the present methods of operation.

Coming Development of Electric Railways.*

By Frank J. Sprague.

It is a trite but mistaken saying that electricity is in its infancy. It dropped its swaddling clothes when Morse sent the first telegraphic message. It put aside dresses and pinafores when the dynamo machine and arc light were invented. The incandescent lamp, the telephone, the art of welding, the transformer, are incidents of buoyant youth. The modern electric motor and electric railway mark a vigorous manhood.

The truly marvelous development of electric applications of every kind, the accomplishment of many things which in ignorance of the very art, or lack of knowledge, of what are now well known facts, and more particularly the great commercial development of the transmission of power, whether for stationary purposes or for electric railways, has led to many a foolish prediction and idle boast.

This is no age of inspiration, nor time for hopes never to attain fruition. It is above all things a practical age, perhaps too practical, but nevertheless one in which commercial enterprises to be successful must promise either a new field of development or economies in older fields.

It would, perhaps, have been proper in making my inaugural address to so representative a body as that of the electrical engineers, that I should touch upon the special discoveries and experiments which have recently attracted attention, but there have been so many enthusiastic and brilliant workers, that neither the time at my disposal nor the knowledge I possess would permit me to do justice to their work; hence, it seems better to take up a subject with which I have been more particularly identified, which to-day commands so much attention, and concerning which there are such conflicting opinions. While finding encouragement in the achievements of our profession, I think the time opportune for a word of caution.

Electric street railways are no longer experimental nor is their success problematical. Their history for five years is that of an almost unequaled development. Almost within a decade has occurred the first working of a practical electrical railway. In a third of that period there have been put in operation or under contract more than 450 roads, equipped with nearly 6,000 cars and over 10,000 motors, and with over 3,000 miles of track. There is made a daily mileage of not less than 700,000 miles, and over a billion of passengers are carried annually. At least $75,000,000 have been invested in this industry alone; 30,000 horses in a single year have been relieved from the slavery of street car propulsion; stables are disappearing, and streets becoming cleaner; luxurious cars are running on smooth, well built and rigid roadbeds. Dividends have been increased, expenses reduced, investments enlarged, the unproductive has become productive, the impossible possible. Land values have been increased, habitable limits extended, homes created and time saved.

We no longer hear seriously of the dangers of the trolley wire, the failure of service. Not only have the smaller towns adopted what is the only available means of current supply, but the larger cities are following their example. St. Louis and Baltimore, Minneapolis and St. Paul, Buffalo and Rochester, Boston and Brooklyn have fallen into line, and latterly even Philadelphia seeks an improved street service, and in New York public interest is being aroused.

The general feeling of opposition to poles and wires ought not, however, to act as a barrier to such reasonable and proper introduction of an overhead system of supply as the conditions now existing in that city very properly warrant.

Among the numerous places in New York where an overhead system could be put in perfect operation are: Central Park west, the Boulevard from Fifty-ninth Street up, a part of the First and Second Avenue lines, the Third, Sixth and Ninth Avenue lines, and all the suburban extensions from the annexed district.

In these large cities, however, one condition should be insisted upon, and if this condition is met in the proper spirit then much of the objection which has been raised against an overhead system must necessarily disappear.

The construction must be of the very best. The only overhead line allowed should be a contact wire with sufficient strength; the main conductors and the feeders should be put underground in proper conduits. There would then be overhead only a wire necessary for the smallest duty and of the requisite strength. In many streets, of course, the cable will hold its own until an electric conduit or surface contact system shall be proven satisfactory.

Impressed by the great development of this industry and brought face to face with the changes it has wrought, the query is continually made. Will the electric motor replace the steam locomotive? It is similar to the older questions, will the telephone replace the telegraph? Will the electric light annihilate the gas systemn? And in all soberness a like answer can be made It will not, but it will, as the electric light and as the telephone have done, create a field of its own, and will replace a portion of the service now done by steam.

It seems to me that the growth of electric railways will proceed something in this order: First, the street systems in the various towns, then connecting lines between adjacent towns following the line of the highways, then longer connecting lines either on the track of existing steam lines, or growing bolder, on exclusive rights of way on the same order. Then will come suburban traffic on a larger scale, and freight transfer system, and finally the more ambitious projects of trunk line service under limiting conditions, such as I will specify.

It has been very properly said that a man will make the first long

*Abstract of address delivered at the meeting of the American Institute of Electrical Engineers, Chicago, June 6, 1892.

ride on electric railways by transferring from one town system to another through connecting links rather than on individual roads.

But, evidently, this natural process of evolution does not offer scope enough for the more enthusiastic, and we are now and again treated to an ideal electric road to be built on plans boldly defying both geography and the abodes of civilization. An air line route according to rules of surveying allowed only in Russia and on the Desert of Sahara; abolition of the grades and street crossing; rigid and continuous rails; loaded cars of light weight, each operated by its own motor and making but few or no stops; unlimited potentials and undiscovered resistance to insulation; new physiological and engineering laws; indestructible material; unheard of powers of braking and new methods of train operation and signaling; around all a clear atmosphere, above all a perpetually smiling heaven, and behind all an unlimited bank account and the unlimited confidence of the investor.

These are some of the characteristics of such a road, but perhaps it is only fair to ask, Given some of these conditions, what would be the capacity of steam traction?

Rapid Transit Plans in Sydney, New South Wales.

The Parliamentary Standing Committee on Public Works, of New South Wales, recently presented a volumnious report covering 298 closely printed pages in regard to a proposed cable railway in the city of Sydney, from King Street via William Street to Ocean Street. The report carefully considers the relative advantages of cable and electric power, and gives the views of a number of experts in street railway engineering.

As a result the committee recommend the construction of a double track cable line, and their report reads in part as follows:

The total length of the line would be 2 miles 24 chains, the gauge 4 ft. 8½ ins., and the steepest gradient 1 in 9, which can be improved to 1 in 12.

The estimated cost of the tramway, inclusive of rolling stock and land, is about £80,000, the estimated annual earnings £35,000, the estimated annual working expenses £17,000, and the interest on cost of construction and depreciation, £7,600. These figures show the total annual expense as £24,600, and deducting this from the amount representing the annual earnings, there is an estimated annual net revenue shown of £10,400, which is equal to nearly 13¾ per cent. per annum upon the cost of construction.

The railway commissioners report very favorably of the tramway, and anticipate an even larger return than is shown in the estimate of the engineers. They set down the annual expenses at £23,000, and the value of the passenger traffic at £35,000, which would leave an estimated annual profit of £12,000, a sum equivalent to a profit of 15 per cent. They say that "a considerable increase of traffic would probably follow the opening of the line, as it would be a marked improvement on any existing mode of conveyance, and would tap sources of traffic hitherto not reached.

At the opening of the inquiry a request was made by the minister for public works, through the under secretary of the department, that the proceedings of the committee should be stayed until a report had been received and forwarded to the committee from Sir John Fowler on the working of tramways by electricity. Impressed with the importance of recent developments in electrical tramways, and the advisableness of having the subject carefully inquired into, if only for the reason that the committee's investigation and decision might influence the questions of both the construction of our tramways and the type to which the existing tramways might be converted, the minister, after consultation with the commissioners for railways, had moved Sir John Fowler to report upon it, and it was thought desirable that the committee should await the receipt of this report rather than deal with the subject of cable tramways exclusively. The committee agreed to the postponement of the inquiry for a month, and having at the end of that period received Sir John Fowler's report the inquiry was resumed, and continued uninterruptedly until the passing of a resolution to await the result of experiments with an electrical tram between Randwick and Waverley. These experiments were made, and the inquiry based at this point chiefly upon information gained during experiments, was continued until intimation was made to the committee that the minister for public works intended to obtain through an officer of the department, specially appointed for the purpose, a report upon all matters of importance connected with both cable and electrical tramways, as they are in America at the present time. As it was probable that this report would contain some very necessary information with regard to the exact relative positions of cable and electrical tramways in America, and to the cost of maintaining electrical tramways, and the profits derived from them—information not obtainable here—the committee decided to defer coming to a decision in the matter of the tramway referred to them, until this report should be received, and in the meantime they were able to examine a witness occupying an important official position in connection with the Melbourne cable tramways. In this manner the inquiry became very comprehensive. The attention of the committee was throughout closely directed to the proposal referred to them by the legislative assembly, but in view of the request of the minister of public works, and of the report obtained from Sir John Fowler, it was thought desirable to investigate as far as possible the claim of electrical tramways to consideration, in order to ascertain whether in the construction of our tramways in the city the electrical system would be perferable to that of the cable.

EXISTING CABLE TRAMWAYS.

According to the evidence before the committee, cable tramways, so far as they have been constructed, have proved profitable; but they have been very expensive in construction, and to some extent in working and maintenance.

(1.) *At North Shore.*

The North Shore Cable Tramway is now paying about 4 per cent. the secretary of the railway commissioners states, if the cost of the land be left out of consideration. Some of this land the commissioners could, if thought advisable, sell to recoup the government for a large part, if not all, of the expenditure upon land in connection with this tramway, and consequently it is not out of place to set aside the cost of the land when considering the return which the tramway is making. This tramway was an exceptionally expensive line. It cost about £70,000—between £20,000 and £30,000 of it was for land—and it is one and a half miles in length. The cost of working the line is 2s. per car mile, and the earnings about 2s. 4d. The proposed tramway under the consideration of this committee would cost considerably less than the North Shore line in construction, the earnings would be very much greater and the cost of maintenance, in proportion to the earnings, would be less.

(2.) *In Melbourne.*

Desirous of obtaining all the information available with regard to the construction and working of the cable tramway in Melbourne, the committee wrote to the Melbourne Tramways Trust and the Melbourne Tramway & Omnibus Co. At first it was proposed that a sectional committee be appointed to visit Melbourne for the purpose of obtaining the information wanted, but as the sectional committee could exercise no power under the Public Works Act outside New South Wales, and, therefore, could not enforce the giving of evidence in Melbourne, it was considered that as much information could be obtained by correspondence as by a personal visit, and the proposal to send a sectional committee was, therefore, not adopted. Letters were sent to the chairman of the Melbourne Tramways Trust, and the chairman of the Melbourne Tramway & Omnibus Co., asking them for information upon every point which it appeared to the committee was important to a right understanding of the tramways in Melbourne, and though all the information asked for was not supplied, as the directors of the company considered it was not to the interests of their shareholders that some of the questions asked by the committee should be answered, sufficient was obtained to prove that the Melbourne tramways are very successful in their operation; that though the cost of construction has been large, the cost of maintenance is comparatively small, and that the profits are large and satisfactory. The cost of the roadway complete, including permanent way, tunnels, concrete, etc., is given at £20,000 per mile; the cost of cables £500 per mile and the cost of engines and machinery about £6,000 per mile. The cost of each centre of driving power has varied, according to the traffic and length of line, from £9,000 to £30,000. The cost of land for engine houses has also varied very much. The engine houses have cost from £6,500 to £15,500. The total maintenance per car mile the replies to the committee's questions do not give, nor is the percentage of profit realized on the tramways stated. The directors of the company do not consider it advisable to give this information, but some idea of the profit made may be obtained from the report of the directors to the shareholders, presented at the annual meeting of the company on August 29, 1890, a copy of which report the secretary to the company forwarded to the committee. The balance sheet and profit and account shown in the report are, to June 30, 1890, and the profit, including £10,093 7s. 6d., carried forward from the last year, and £2,137 0s. 6d. from sales of freehold properties, is set down at £156,935 13s. 4d. From this four quarterly dividends of 4 per cent. each had been paid, amounting to £64,000, leaving £92,935 13s. 4d., and this it was proposed to apply by a transfer to the reserve fund of the profit on properties sold, £2,137 0s. 6d., a payment of a dividend of 2s. per share, £80,000, and carrying forward a balance of £10,798 12s. 10d. In addition to this it was intended "to make a further issue of £160,000 shares without premium to the members of the company, in proportion to their present interests, say, two new shares to every ten shares now held, to be allotted on application and payment of 10s. per share, placing them on an equal footing with existing shares, carying dividends from July 1 last." Mr. H. T. Jordan, who has been treasurer of the Melbourne Tramways Trust since the formation of the trust in 1884, gives the average cost of constructing the cable tramways in Melbourne, including track, engine power, land, buildings, legal, administrative and engineering expenditure, but not including rolling stock, as £35,000 a mile. This cost of £35,000 may, he points out, seem heavy, but a large portion of the amount has consisted of the expense of alterations for drainage, etc., alterations to gas and water pipes, and the widening of two bridges across the Yarra. Judging by results, he says, the tramways in Melbourne have given eminent satisfaction, and they have been very remunerative. The Melbourne tramway system is carried out by two bodies, the Melbourne Tramways Trust, composed of the representatives of the municipalities in which the tramways are laid, and the Melbourne Tramway & Omnibus Co. The trust constructs the tramways, borrowing money necessary to cover the cost; the company takes the tramways from the trust on completion, and conducts the traffic and maintains the lines. From the earnings on the tramways the company pays the trust the interest, 4½ per cent. due on the loans obtained for the construction of the lines, which interest amounts to £67,500 per annum, and for the first ten years of the company's possession or lease of the lines, it pays the trust another 1½ per cent. as a contribution to a sinking fund, which amounts to £22,500 a year. During the second ten years the company pays to the sinking fund 2 per cent. extra, and in the third ten years 3 per cent. extra; all the time keeping everything connected with the tramways in good running order. This money, so paid by the company, is invested by the trust in municipal debentures, or in mortgages on city property, and it is computed that at the end of thirty years the money will pay off the total cost of the

system and enable the tramways to be handed over to the municipalities free of further expense except that of maintenance. The lease to the company is for thirty years, and it will expire in 1916.

(3) *In America.*

America has more largely adopted the cable system of tramways than any other country, and it appears to have been profitable there. Mr. Maxwell Bury has given some of the most important evidence relative to cable tramways in America, and in addition to this evidence it will be found of advantage to read the correspondence between himself and American railway and tramway authorities which Mr. Bury has laid before the committee. Mr. Bury's evidence is principally based upon what he considers to be reliable information from America, and he represents that cable tramways can be worked at much less expense than electric tramways. "The conclusion they have come to in New York," he says, "is that cable tramways can be worked for 2d., and in some instances 4d., a mile less than electric tramways"; and he declares that cable tramways are in great favor in America, and that they have held their ground better than any other system that has been introduced. On the authority of a letter to him from Messrs. Strong and Trowbridge, of New York, he states that over seventy miles of cable trams are to be laid in New York City, and this in the face of repeated trials, and the tremendous efforts of the electric people to introduce the electric system. Mr. A. D. Mosstudd, secretary to the American Cable Railway Co. of New York, writing to Mr. Bury, on September 13, 1890, also bears testimony to the progress of cable tramways in New York in spite of the efforts made to push forward electrical tramways, and Mr. C. B. Holmes, president of the Chicago City Railway Co. has informed Mr. Bury, under date October 1, 1890, that cable tramways are invariably found preferable to tramways of any other description under circumstances which require certainty, speed and economy. Where the travel is sufficiently heavy to warrant the expense of building a cable line, the cable, he says, will do the work so much more cheaply and reliably that there is scarcely any comparison between it and the electric system. Mr. Thow, during his visit to America, found cable tramways in extensive operation in Chicago and San Francisco, there being about thirty-five miles of cable road in the former city and ninety in the latter. He saw them also in New York, Pittsburgh and Denver. San Francisco is similar to Sydney in respect of heavy grades, though some of the grades upon the tramways there are far steeper than anything here. In many places 1 in 5¼ exists, and yet the average speed upon the San Francisco tramways generally is, allowing for stoppages, about seven and a half miles per hour. Cable tramways have been in operation in San Francisco for seventeen years, and up to the present there is no electrical tramway there. In Chicago, also, the cable system has been very successful. As far as Mr. Thow's observation went, wherever cable tramways have been constructed in America they appeared to have given satisfaction. Most of the original tramways in America were worked by horse traction, and the extensive change which has taken place from horse tramways to tramways on the electrical principle has been due chiefly to the smaller cost of constructing an electrical tramway compared with that which has to be incurred in the construction of a cable tramway. In no instance, as far as Mr. Thow could learn, had a cable tramway in operation in America been converted into an electrical tramway. The first cost of laying down a cable tramway is great; but that having been incurred, the cost of maintenance does not appear to be higher than that of other tramway systems, and the service performed by the cable tramway is, as a rule, uninterrupted and thoroughly satisfactory.

ELECTRICAL TRAMWAYS.

Evidence as to Electrical Tramways.

7. The evidence which has been before the committee with reference to electrical tramways will be found somewhat voluminous, but the subject was regarded of such importance as to justify the committee in obtaining the fullest information upon it available. Sir John Fowler's report, though conveying a good general idea of the different systems of electrical tramways in operation, was not sufficient to enable the committee to come to a decision in the matter, and the evidence of witnesses in the position of experts who had had a recent personal acquaintance with the construction and management of electrical tramways, was regarded as a very important part of the inquiry. This evidence, supplemented by the report of the officer of the railway department who specially visited America, though it does not give information upon all essential matters connected with the electrical tramways, will be found to very fully explain many points of interest which in any proper consideration of these tramways it is necessary should be rightly understood. So far as the committee have been able to do, they have obtained information on every point important to be considered in an inquiry as to the superiority or otherwise of electrical tramways over those worked with the cable, or as to the advantages or otherwise of constructing electrical tramways in the streets of Sydney. The principal heads under which the committee have sought information respecting these tramways may be stated as follows:

(*a*) The nature of electrical tramways.
(*b*) How they have progressed in construction.
(*c*) Cost of construction.
(*d*) Cost of working.
(*e*) Extent to which they have been profitable.
(*f*) Probable position of these tramways in the future.
(*g*) Their suitableness or unsuitableness to the route of the proposed tramway.

Nature of Electrical Tramways.

(*a*) An electrical tramway, described in general terms, is a tramway which finds its motive power in electricity generated at an established station, when necessary machinery has been erected and conveyed to the cars by wires which may be suspended over the cars or placed in a conduit or groove under them; or by what are called accumulators, which are first charged with electricity at the generating station and then placed in the cars. The principal kinds of electric tramways in operation are:

(1.) The conduit system (as at Blackpool, England).
(2.) The accumulator system (as at Barking, England).
(3.) The overhead wire system (as shown in the systems known as the Thomson-Houston and the Sprague).

There are some other descriptions of electrical tramways in existence, but in comparison with the three kinds mentioned they are of little importance.

In England, Sir John Fowler states in his report, there are, broadly speaking, two systems of electrical tramways in use, applicable to street traffic. One of these is that of underground conductors (without accumulators) to convey the electric current from the generating station to the motors on the cars; the other is that of accumulators, charged at a generating station by fixed plant. The first of these systems is in operation at Blackpool and Northfleet, and the second at Barking and Birmingham. The Blackpool and Northfleet tramways have been in operation for some years, and have been a commercial success, inasmuch as a fair return has been paid on the invested capital, but Sir John Fowler points out that they have not been adopted in other English towns, and therefore cannot be said to be regarded with favor generally; and "though well worked out electrically" he does not consider them applicable to a city like Sydney. The accumulator system is specially suitable, Sir John Fowler states, for introduction on an existing tramway, as it involves "no alteration in the permanent way or street surface, no large outlay of capital beyond the generating station and accumulators, and no interference with existing street traffic." This accumutator system, as carried out at Barking, is the only system, so far as English experience is concerned, which, in his opinion, furnishes a basis for adoption in Syduey. At Barking the system has been in operation for the last four or five years; at Birmingham for less than one year. Improvements in accumulators, Sir John Fowler says, are continually being made, and he anticipates with some confidence the introduction of storage batteries considerably superior to any existing type. He is of opinion, however, that in the matter of electric traction for street tramways, America is much in advance of England, and this advancement is due mainly, if not wholly, to the adoption of overhead wires from which the electrical power is conveyed to the cars. The overhead wire system of electrical tramways is in operation extensively in some of the principal cities and towns of the United States. The wires, generally about three-tenths of an inch in diameter, are suspended from insulated cross wires placed 125 ft. apart and stretched from the tops of two poles, or it may be iron posts twenty feet high, one on each side of the road, the cross span having a deflection of two feet. In some instances the wires are suspended from brackets instead of from cross wires. The electricity is conducted fom the wire to a motor beneath the car floor, by means of a lever or pole on the roof of the car, this lever holding a grooved pulley or trolley firmly against the wire. By this method the electricity passes from the wire to the lever, and thence through the motor, where the electrical power is directly applied to the propulsion of the car, to the earth, the wheels and running gear acting as conductors. As the rails furnish ample contact, the return is made through the earth after the manner of ordinary telegraph circuits. The trolley wires are held in position over curves in the track by means of guy wires, and the trolley lever or pole, being sufficiently flexible, conforms to the lateral movements necessary to keep the trolley in contact with the overhead wire while the car is rounding the curves. A change of route, or the running of the car from one track to another, is managed by having at all branches of the tramway switches of the ordinary kind in the track and switches serving similar purposes in the wires overhead, so that the trolley wheel runs in the same direction as the wheels of the car. Two attendants, or conductors, travel with each motor car—one to collect tickets and fares, and the other to drive, the driving being very easily managed by the use of brake handles. The different descriptions of electrical tramways can be very well understood from detailed information, with illustrations from photographs and engravings, published with this report as an appendix.

How Electrical Tramways Have Progressed in Construction.

(*b*) At the end of 1889, according to Sir John Fowler's report, there had been constructed in the United States by the two principal electrical tramway companies, 106 electrical railroads, with 636 miles of track, and 1,063 motor cars; and eighty-six other roads, representing a mileage of 217 miles, were under contract and construction. At the date of Mr. Thow's visit to America, between December, 1890, and February, 1891, there were at work and under construction or translation 320 roads, representing 2,800 miles of track and 3,860 motor cars. In 1885 there were three electric roads in operation, with seven and a half miles of track, and thirteen cars. A large proportion of these electrical tramways are converted horse tramways; very few, probably none of any importance, are converted cable tramways.

Cost of Construction.

(*c*) The cost of constructing an electrical tramway on the overhead wire system, which is the system commonly adopted in America, cannot be given very definitely. Mr. Thow, in his report, states that "for Sydney, where the poles would have to pass through existing pavements, the expenditure for overhead apparatus of the best class would probably reach £1,400 per mile," the cost of track and of pro-

viding engine power, cars, etc., depending upon the circumstances connected with the locality where the tramway is to be constructed, and the magnitude of the installation and traffic to be dealt with. Sir John Fowler estimates the cost, by making use of the rails at present laid down in Sydney, and having a service of one car every five minutes, at £5,500 per mile of double track ; but Mr. P. Bedford Elwell, in the belief that the traffic in Sydney would require two cars every four minutes in a large portion of the system, states the cost of construction, "doubling all except the overhead wires," at £9,800 per mile. The track itself is little or no different from that of other tramways. The cost of construction on the conduit system, which Mr. Elwell favors for heavy traffic in Sydney—though under further examination he somewhat modified this view—would be, he is of opinion, about £3,000 or £4,000 a mile, including everything ; and according to Sir John Fowler £4,000 or £5,000. In the total outlay the expenditure upon the conduit system would be, Mr. Elwell states, about 30 per cent. more per mile than the total cost of the overhead line, or about £8,000 per mile. As opposed to this, Professor Threlfall is of opinion that the cost of an electric system with underground conductors would be about the same as that of the cable system, as in each system there would be about the same care necessary to arrange the conduit and place the wire satisfactorily. Mr. Gustave Fischer of the tramway construction branch, department of public works, gives the cost of laying down the permanent way for an electric line, on the overhead system, along the route of the proposed cable tramway, including the erection of wires and posts, at about £30,000. The same weight of rails, he states, is as necessary for the electrical system as for the cable or the locomotive system, and then there is the additional expense for wires and posts, which he considers would be about £1,200 a mile. The total cost of an electrical tramway along the route proposed, with complete equipment, would be, he estimates, £60,000, as compared with £80,000, the estimated total cost of the cable tramway.

Cost of Working.

(*d*) Various statements have been made to the committee as to the cost of working electrical tramways, but no evidence has been given or information laid before them sufficient to show conclusively what this cost of working is, and so far as they have been able to ascertain, it is, in the present condition of electrical tramways, very difficult to get accurate information on this point. This difficulty is said to be due to the circumstance of the companies controlling the electrical tramways in America being subject to the municipal authorities of the localities in which the tramways are laid. A provision in the agreement between the municipalites and the companies requires the latter to reduce the fares upon the tramways, immediately a certain rate of profit has been reached, and to avoid this reduction the companies are said to conceal the actual profits made, and consequently the actual working expenses incurred. Mr. Gustave Fisher, who has given considerable attention to the subject, states that electric cars could be run in Sydney for 6d. a car mile, and he estimate that the annual cost of the electric system for motive power and car repairs would be about £6,000 less than for a cable tram, while the permanent way repairs and maintenance, and the cost of conducting traffic, would be about the same as for the cable system. According to this, £6,000 would be saved annually by adopting the electric system, besides the saving in the cost of construction and in interest. The cost of working an electrical tramway increases as the time interval between the running of the cars is extended. Mr. P. Bedford Elwell agrees with Mr. Fischer in his estimate of working cost ; Mr. Elwell giving it as "between 5d and 6d., as nearly as possible."

Extent to which Electrical Tramways Have Proved Profitable.

(*e*) The same indefiniteness which surrounds the matter of working cost attends the question of profitableness. Nothing has been before the committee to show them free from doubt that the electrical tramways in America have been worked at a satisfactory profit. It is right to say that the information given or produced by some of the witnesses examined, leads to the inference that the tramways have been profitable, but there is nothing before the committee which directly shows it. Professor Threlfall, who spent some time in the United States examining the electrical tramways, never heard, he says, of an electrical tramway there which paid a dividend; but he was informed that the stock of the companies had gone up in value, That, he admitted, might happen without a dividend; but, as already stated, the plea put forward for not publishing particulars of dividends or working expenses is the fear that it may lead to the companies being despoiled by the municipalities. Mr. Thow, in his recent visit to America, met with the same difficulty experienced by Professor Threlfall. He obtained copies of published statements by various companies concerning their operations, but they are not sufficiently explicit to afford the information required.

Probable Position of Electrical Tramways in the Future.

(*f*) Judging from the manner in which the number of electrical tramways in America has increased, and from evidence which shows that efforts are constantly being made to effect improvements in electrical traction, there appears to be every probability that electrical tramways will be an assured success in the future. The principal objections at present to the system which is most in use are the unsightliness and inconvenience of the overhead wires. While the overhead wire system is the easiest and cheapest to construct and to work, the wires and poles necessary in connection with it are in many instances a blemish in the general attractiveness of streets or roads, and an obstruction to many of the operations carried on in large towns or cities. In crowded narrow streets they may be a source of considerable danger. If a desirable method be discovered by which these wires and poles may disappear and be replaced by wires laid underground, or if the electrical tramway on the accumulator principle should be so improved that the weight of the accumulators would be materially reduced, the permanent success of electrical tramways is certain. Both these great improvements on the present systems are possible. Theoretically the accumulator system is preferable to all others; practically, in consequence of the enormously heavy accumulators that have to be carried in the cars, it is at present a failure. Professor Threlfall does not see much margin for improvement in the efficiency of the electrical machinery, but there is, in his opinion, room for improvement in the mechanical details of the machinery, and in the means of carrying the current to the point where it is to be used. He mentions a new system with which a considerable amount of success has lately been obtained in experiments made. In this the track is laid with a third or central rail, this third rail being put down in sections of such length that the greatest number of sections that can be connected by the electrical current with the car at one time are shorter than the length of the car. The electric current passes to the car through the third rail from a conduit under the track, but having no opening, and this passage of the electrical power is effected by means of a magnet carried by the car. As the car passes along the rails the magnet attracts a strip of iron attached to the conductor, making a contact with that portian of the rail, but with no other. Mr. Thow, in his report says, regarding improvements in electrical tramways generally, that "we may confidently indulge the hope that in a few years improvements in details will be made to an extent which will greatly reduce both first cost and maintenance. Already," he states "the Thomson-Houston company has produced a new motor which has only one reduction or armature speed, with one set of toothed gearing instead of two. The armature runs at half the speed of the present types, and its arrangement is simplified so as to permit more perfect protection of the machinery from dirt, and more perfect lubrication of the parts subject to the greatest wear and tear." And he anticipates that important improvements will follow in other channels.

Suitableness or Otherwise of an Electrical Tramway for King Street and William Street to Ocean Street.

(*g*) The question of the suitableness or otherwise of an electrical tramway for the streets, through which lies the route of the proposed cable tramway, referred to the committee by the Legislative Assembly for consideration, depends principally on the nature of King Street. That street is so crowded with traffic that many persons can be found, and some were among the witnesses examined by the committee, who doubt the advisableness of laying down there a tramway of any description; but when in addition to the objection on the ground of traffic, there is that of increasing the number of posts and overhead wires, the prospect of an electrical tramway in the street proving satisfactory is very doubtful. The posts to sustain the wires for the tramway would have to be placed either at the edges of the pavements or in the middle of the street. If they were placed at the pavement edges they would inconveniently increase the number of posts already there, and possibly the wires would interfere with the overhead telegraph and telephone wires. If the posts were placed in the middle of the street. or anywhere in the street between the pavements, they would probably seriously interfere with the passage to and fro of horses and vehicles. William Street is better adapted for an electrical tramway on the overhead wire system, because the traffic in that street is comparatively small; but in William Street (as in one part of King Street) there is a steep ascent, which it has not been satisfactorily shown a tramcar loaded with passengers, and moved by electrical power, would be able to ascend at an appreciable speed. The narrow streets, called William Street North and William Street South, beyond William Street, would also present obstacles to the satisfactory working of an electrical tramway, and it is only along the wide and not much frequented road which passes Rushcutters' Bay and extends to Ocean Street, Woollahra, where the space and absence of traffic and steep grades would make the success of a tramway on the overhead wire system probable.

MATTERS OF IMPORTANCE OUTSIDE THE IMMEDIATE INQUIRY.

Some Other Points of Importance in the Evidence.

8. Some points appear in the evidence which are of importance in relation to the subject of tramways generally, but are not such as are necessary for the committee in the present inquiry to deal with in any way other than by drawing attention to them. The question of leaving tram construction and working to private enterprise is one matter, the idea in the Municipal Council of Sydney that the council should receive some share of the profits from tramways laid down in the streets of the city as compensation for the cutting up of the streets is another; and a third is the question whether any tram construction should be carried out before the extension of the railway into the city, and a site for a new central railway terminus has been determined. These and other matters of some prominence, upon which the committee do not consider it their duty to express an opinion, will be found referred to in different portions of the evidence, and will repay perusal.

DECISION OF THE COMMITTEE.

As the result of a careful consideration of the whole of the evidence which has been before them, the committee have decided, by seven votes to five, to recommend to the Legislative Assembly the construction of the proposed cable tramway. This decision has been arrived at mainly for three reasons : Because the majority of the Committee regard King Street as unsuited for an electrical tramway on the overhead wire system ; because, notwithstanding the number of electrical tramways in America, and the testimony given in their favor, they consider these tramways to be still in the stage of experiment, or that at least they have not yet reached that point of development which would justify their introduction on this route; and because cable tramways are a proved success both in capacity to deal with a large traffic and in paying satisfactory profits. The grounds upon which they regard King Street as unsuited for the overhead wire system have already

been mentioned. The opinion that electrical tramways are not yet sufficiently developed to justify their use along this route is based upon the incompleteness of the information obtainable as to the cost of working them, the amount of profit made, and their power to successfully deal with a heavy traffic over steep grades. An examination of the evidence given by witnesses who have appeared before the committee, and of information afforded in appendices to the evidence, will show that while many statements as to cost of working are given, they are not of that character which would cause them to be accepted as absolutely reliable, and they are greatly inconsistent with the results shown in the operations of the electrical tramway between Randwick and Waverley. That tramway, constructed under the direct supervision of officers connected with the Thomson-Houston company of America, on plans specially obtained from that company, and operated upon by electrical engineers in their service, with electrical machinery and cars manufactured by the company, has not been a success. Though no expense was spared in connection with the experiment, and every opportunity was afforded the Thomson-Houston company to make the tramway successful, it has not reached expectations either in regard to capacity for dealing with traffic or in reasonable cost of working; and the noise and motion of the cars have been subjects of comment. On these points the evidence of the locomotive superintendent of tramways, and a return furnished by the secretary to the railway commissioners, and published in the appendix, will be found interesting. The grade on this experimental line is in one place as high as 1 in 17. Some explanation of the failure of the line may be found in the evidence of Mr. Gustave Fischer, to the effect that the machinery is underpowered. Mr. Thow, in his report concerning his observations in America, says that no doubt need be entertained as to the power of electricity to mount grades of 1 in 12, but from what he could learn it had not been thoroughly proved by any direct experience that electricity was able to move over such grades "a sufficient load at a sufficient speed to satisfy every commercial requirement in Sydney." The point of the whole question, he says, "is a multiple of speed and weight, because on these depend the popularity of any tramway system, and it seems to me we have to settle that point definitely for ourselves." He therefore suggests "that an experimental line be laid over 1 in 12 grades in Sydney, and that bogies fitted with motors of at least fifteen horse power may be obtained to suit one of our existing car bodies, so that the point in question may be exhaustively worked out." If the result of this experiment should be successful, then he would favor electrical instead of cable traction for Sydney. The committee do not consider it advisable either to go to this expense or to await the time that would be occupied in this second experiment before closing their inquiries respecting the proposed cable tramways referred to them. The third reason which has influenced the committee in their decision with reference to the tramway now under consideration is the great success which has attended the operations of cable tramways. In this regard the cable tramways of most importance are those of Melbourne. The system in that city is undoubtedly successful in meeting the requirements of a large traffic, and in paying large dividends. What those dividends are cannot be precisely stated, but there is sufficient evidence to show that they are considerably more than ordinarily is regarded as satisfactory. In America, also, notwithstanding the extension of the electrical tramway system, the cable tramways appear to hold an unassailed and satisfactory position; and in the vicinity of Sydney, at North Shore, a cable tramway has proved itself fairly satisfactory in spite of many difficulties. Cable tramways are undoubtedly more expensive in first cost than electrical tramways, but this first cost may, it now appears, be materially lessened by reducing the size of the tunnel in the roadway in which the wire cable runs; and in the expense of working the two systems there appears to be little, if any, difference. The reduction in the size of the tunnel for the running of the cable is indicated in evidence relating to an improved method of cable tramway construction recently patented by the engineer connected with the tramway system in Melbourne, by which improvement a saving in cost of construction will be effected, it is stated, of no less than £7,000 a mile. Mr. Thow considers electrical tramways to be safer than cable tramways, but the evidence generally does not support this opinion.

Further Evidence in Support of Cable Tramways.

10. Since the decision of the committee in this inquiry, and in relation to the proposed tramway through George, Pitt and Harris Streets, Sydney, further evidence has been given by Mr. H. T. Jordan, treasurer of the Melbourne Tramways Trust, on the subject of cable tramways, and this further evidence supports the opinion of the committee that the proposed tramway from King Street, *via* William Street, to Ocean Street, should be constructed upon the cable, as preferable to the electrical system. He states that the working expenses of the cable system will probably be less than those of the electrical system.

ACCORDING to *Le Journal des Transports*, the General Omnibus Co., of Paris, who operate both street cars and omnibuses are about to make a series of experiments in electric traction on several of their street railway lines, with a new type of accumulator. If these experiments give the results expected the system will be extended. The company also contemplate the installation of a number of compressed air motor cars on several of their lines. Construction upon these motors has been commenced and permission has been obtained from the municipalities for their use.

Bookkeeping and the Classification of Street Railway Accounts.

From Advance Sheets of "Street Railways" (Trams).

BY C. B. FAIRCHILD.

Whatever benefits may accrue to a community from the existence of a street railway, the prime motive with the projectors and operators is *revenue*, and every means that tends to increase the net income should be carefully considered. No department of the service is more important or more responsible for securing this desired end than the accounting department. Any neglect in properly organizing or conducting this department will be as fatal to the financial success of a street railway company as would neglect in the operating department. Aside from matters relating strictly to the accounting for everything received, the accounting department incidentally gains considerable statistical information relating to the exact nature and extent of the numerous labors performed and the precise cost of movements, which furnishes the best obtainable data from which to rate the degree of skill and economy exercised in each department, and by each class of officials and employes. In order to properly conduct it, an efficient clerical force is necessary, and the work should be done in accordance with proper rules and regulations, and the items should be combined and condensed as much as possible. In order to assist in this direction the following analysis of accounts is presented (see next page), which is based on the requirements of the Railroad Commissioners of the State of New York, under which all the street railway companies of the state are required to make annual reports to the Board. The requirements of other states may vary, but the same basis of division under different heads, and the same system of keeping accounts can be used, whatever the local requirement or personal fancy may be.

The following notes may be added in explanation of the analysis. They indicate the individual accounts that should be carried to the various headings.

3. COST OF ROAD AND EQUIPMENT.

1. SUPERINTENDENCE AND GENERAL EXPENSES.—To include salaries and personal expenses of general officers and superintendents, with their respective assistants and clerks, furniture, stationery, fuel and other office supplies.

2. ENGINEERING.—To include wages of engineers, draughtsmen and assistants, with office and other expenses.

3. RIGHT OF WAY.—To include cost of obtaining franchise, salaries and expenses of agent in securing consents, with all payments for right of way.

4. REAL ESTATE AND BUILDINGS.—To include cost of all real estate and buildings used exclusively for railroad purposes, together with all necessary furniture and fixtures.

NOTE:—*All real estate not so used should be charged, as an investment, to an account kept for that purpose.*

5. ROAD BED AND TRACK.—To include the cost of preparing the foundation, cost of all material and labor of distributing and laying same, including paving and wiring.

6. OVERHEAD CONSTRUCTION.—To include cost of poles, wire and insulating devices with expense of placing same.

7. ROLLING STOCK.—To include the cost of cars and trucks built or purchased, cost of grips, motors, wiring, trolley, switches, furnishings, etc.

8. AUXILIARY APPLIANCES.—To include cost of snow plows and sweepers, with electrical equipment or grips for same, wagons and other vehicles.

9. POWER PLANT.—To include cost of engines, boilers, cable winding drums, pit machinery, tension devices, generators, switchboards, shafting, belting, cranes, foundations, pumps, piping and labor of securing all in position, with heating and lighting appliances.

10. CABLE AND CARRYING SHEAVES.—To include cost of wire ropes, with carrying and terminal sheaves and placing the same ready for operation.

11. REPAIR SHOPS.—To include cost of iron working and wood working machinery, tools and power, if it is independent of the power plant, and the expenses of setting the machinery and appliances

12. ADDITIONS AND BETTERMENTS.—To include such expenditures as actually increase the construction or equipment, and such expenses for renewals or repairs as exceed what is necessary to make good any depreciation of road and equipment.

ANALYSIS OF ACCOUNTS.

1. History.
2. Capital Stock and Funded Debt.
3. Cost of Road and Equipment.
   1. Superintendence and general expenses.
   2. Engineering.
   3. Right of way.
   4. Real estate and build'gs.
   5. Roadbed and track.
   6. Overhead construction.
   7. Rolling stock.
   8. Auxiliary appliances.
   9. Power plant.
   10. Cable and carrying sheaves.
   11. Repair shops.
   12. Additions and betterments.
4. Income.
   1. Earnings
      1. Passengers.
      2. Express and mail.
      3. Advertising.
   2. Other sources
      1. Sale of manure, old material, and disabled animals.
      2. Interest and rents.
      3. Surplus of previous year.
5. Operating Expenses.
   1. Miscellaneous
      1. Salaries of general officers and clerks.
      2. Office service and supplies.
      3. Insurance.
      4. Legal.
      5. Injury to persons and property.
      6. Contingent.
      7. Franchise account.
   2. Transportation
      1. Car service.
      2. Car barn.
      3. Lubricants and waste
         1. For cars.
         2. For power house.
      4. Supplies.
      5. Wrecking, sanding, sweeping and cleaning of conduits.
      6. Stable and power house.
      7. Provender and fuel.
   3. Maintenance of way and structures.
      1. Repairs and renewals of r'dbed and track.
      2. Repairs and renewals of overhead wire.
      3. Repairs and renewals of buildings, docks and wharves.
   4. Maintenance of rolling stock and power equipment.
      1. Repairs and renewals of cars and vehicles.
      2. Repairs and renewals of cable sheaves and grip dies.
      3. Repairs of harness and stable equipment.
      4. Horse shoeing.
      5. Renewals of horses and mules.
      6. Repairs of electric car equipment
         1. Motor armature.
         2. Gears and pinions.
         3. Trolleys.
         4. Miscellaneous.
      7. Repairs of power plant
         1. Steam.
         2. Cable.
         3. Electric.
      8. Tools and machinery.
      9. Miscellaneous.
6. Fixed Charges.
   1. Interest.
   2. Rent.
   3. Taxes.
   4. Franchise charges.
7. Balance Sheet.
   1. Assets
      1. Cost of road.
      2. Cost of equipment.
      3. Real estate and buildings.
      4. Stocks and bonds.
      5. Franchise.
      6. Other permanent investments.
      7. Cash on hand.
      8. Bills receivable.
      9. Open accounts.
      10. Supplies.
      11. Sinking fund.
      12. Sundries.
      13. Profit and loss (surplus).
   2. Liabilities
      1. Capital stock.
      2. Funded debt.
      3. Interest due and accrued.
      4. Dividends unpaid.
      5. Audited vouchers.
      6. Pay rolls.
      7. Open accounts.
      8. Bills payable.
      9. Sundries.
      10. Profit and loss (deficit).
      11. Deficit of previous years.

4. INCOME.

1. EARNINGS.

a. From Passengers.—To include cash receipts for fare and sale of tickets.

b. From Express and Mail.—To include returns for transporting freight—express or mail.

c. From Advertising.—To include receipts for advertising in cars, buildings or on tickets.

2. OTHER SOURCES.

a. Sale of Manure, Old Material and Disabled Animals.—To include receipts from the sale of worn out animals, old materials and manure.

NOTE. *Receipts from these sources may be credited, if preferred, under "Operating Expenses" to the account to which the new material purchased to replace the old is charged. If the old material is not sold or replaced it may be debited to the "Supply" account and when used again or sold this account should receive credit for the same.*

b. Interest and Rents.—To include receipts for interest on securities or loans and receipts for buildings, grounds, leased lines or tracks, and powerleased to other parties.

c. Surplus of Previous Years.—To include the net income, less the payments made therefrom on the business of the previous year.

5. OPERATING EXPENSES.

1. MISCELLANEOUS.

1. SALARIES OF GENERAL OFFICERS AND CLERKS.—To include salaries of general officers, heads of departments, division superintendents and wages of their respective assistants and clerks.

2. OFFICE SERVICE AND SUPPLIES.—To include the expense of heating and lighting the general offices, wages of porters, messengers, advertising, printing of blanks, tickets and circulars, stationery, blank books, tools, etc.

3. INSURANCE.—To include cost of insurance on any property used for railroad purposes, cost of guarantee against accidental bodily injuries or death of employes, passengers and the public, cost of conducting employes' mutual aid association, including expense of collections.

NOTE. *Insurance on property other than that used for railroad purposes should be charged against the property insured. The cost of guarantee may be charged to "Injuries to Persons and Property," if preferred.*

4. LEGAL.—To include salaries, fees and expenses of attorneys and all legal expenses of every kind.

NOTE. *A portion of legal expenses may be divided up between "Injuries to Persons and Property," "Real Estate" or "Franchise" as the services are rendered."*

5. INJURIES TO PERSONS AND PROPERTY.—To include payments made for damages to or destruction of property (not belonging to the company), for persons killed or injured, wages of the employes while disabled, medical attendance or any other expenses (except legal) incident thereto.

6. REMOVAL OF SNOW AND ICE.—To include cost of labor, salt and other expense incident thereto.

7. CONTINGENT.—To include any miscellaneous expenses or rents incurred exclusively in the operation of the road for which other provision is no made.

8. FRANCHISE ACCOUNT.—To include cost of repaving streets, over and above the repairs to pavements, which are chargeable to maintenance of way.

2. TRANSPORTATION.

1 CAR SERVICE.—To include the wages of all men employed on or about the cars while in service, chief conductor, inspectors, starters, with their respective aids.

2. CAR BARN.—To include wages of barn foremen and all persons employed for shifting, cleaning or inspecting cars, tools for same, cost of heating and lighting barns and sheds.

3. LUBRICANTS AND WASTE.—To include oil, grease, tallow and other lubricants, and waste employed on the journals of cars and motors, and on the engines, shafting, winding drums, generators and pumps in the power house and on the rope and carrying pulleys.

4. SUPPLIES.—To include such supplies as are not charged to repairs, such as conductors' punches and portable registers, flags, lanterns, switch sticks, etc.

5. WRECKING, SANDING, SWEEPING AND CLEANING CONDUIT.—To include the cost of replacing derailed cars and removing obstructions and wrecks, with the wages of men employed especially for this service, and cost of tools. Cost of sweeping track, cleaning conduit, sand ing track from car or by special means.

6. STABLE AND POWER HOUSE.—To include the wages of foreman, engineer, electrician and all employed in and about the stable or power house.

7. PROVENDER AND FUEL.—To include the cost of feed and the labor of grinding, cutting and preparing for use, and cost of bedding, medicine and veterinary services. Cost of fuel employed in the power house, with freight charges on the same, water rates and cost of pumping.

3. MAINTENANCE OF WAY AND STRUCTURES.

1. REPAIRS AND RENEWALS OF ROAD BED AND TRACK.—To include cost of all material and tools (rails, ties, paving blocks, sand, etc.), with the cost of labor, (wages of roadmaster, foreman and laborers) in maintaining, repairing and placing new material for track, joints, switches, bonds and supplementary wire, and tracks in buildings.

2. REPAIRS AND RENEWALS OF OVERHEAD CONSTRUCTION.—To include cost of repairs and renewals of poles, all wires and all suspension and insulating appliances.

3. REPAIRS AND RENEWALS OF BUILDINGS, DOCKS AND WHARVES.—To include cost of all material and expense of distributing same, and all labor performed in repairs of offices, stables, stations, buildings, scales, car and repair shops, power house and any other buildings, turntables, cranes, pits and wharves.

NOTE. *Repairs to buildings or other property not used for railroad purposes are to be charged against the property.*

4. MAINTENANCE OF ROLLING STOCK AND POWER EQUIPMENT.

1. REPAIRS AND RENEWALS OF CARS, SWEEPERS SNOW PLOWS AND OTHER VEHICLES.—To include cost of material and labor in repairing, renewing or rebuilding cars and appurtenances belonging thereto, such as trucks, grips, brakes, journal boxes, springs, scrapers, pilots, sand boxes, signs, wheels and axles. Cost of new cars purchased to make good any depreciation.

2. REPAIRS AND RENEWALS OF CABLES, GRIPS, DIES AND SHEAVES.—To include cost of ropes, splicing and placing the same in line; cost of lining and renewing carrying pulleys and terminal sheaves.

3. REPAIRS OF HARNESSES AND STABLE EQUIPMENT.—To include cost of material and labor in repairing or renewing, or of new harness or stable equipment purchased to make good any depreciation.

4. HORSE SHOEING.—To include cost of material and labor and cost of adjustable shoes.

5. RENEWALS OF HORSES AND MULES.—To include cost of horses and mules purchased to replace those worn out.

6. REPAIRS OF ELECTRIC CAR EQUIPMENT.

a. Motor Armatures and Fields.—To include the cost of new material and the labor of removing, repairing, replacing and making all connections for these parts, and the cost of new armatures and fields purchased to make good any depreciation.

b. Gears and Pinions.—To include the cost of repairs and renewals, with the labor of removing and replacing, and the cost of new gears and pinions to take the place of those discarded.

c. Trolleys.—To include the cost of repairs, renewals, labor and new trolley poles and wheels to replace those damaged or destroyed.

d. Miscellaneous.—To include repairs of motors and fields other than those above noted, and repairs and renewals of all auxiliary electric appliances, such as switches, lightning arresters, rheostats, pans, brush holders, brushes and fuses.

NOTE.—*If preferred, the cost of brushes and fuses may be charged to supplies under the transportation expenses, as, strictly speaking, they are not repairs.*

7. REPAIRS OF POWER PLANT.

a. Steam Plant.—To include cost of repairs of engines, boilers, pumps, steam pipe, belts and shafting.

b. Cable Plant.—To include cost of renewals and repairs to winding drums, gears and tension apparatus.

c. Electric.—To include cost of renewals and repairs to generators and their parts, with the labor of removing and replacing; also renewals of switchboard equipment and all connections.

8. TOOLS AND MACHINERY.—To include cost of repairs and renewals of repair and car shop equipment.

9.—MISCELLANEOUS.—To include all expenses of maintenance of equipment not provided for as above.

6. FIXED CHARGES.

1. INTEREST.—To include all payments made on account of funded or floating debts.

2 RENTS.—To include rentals of leased lines and buildings, stables, power houses, sheds and buildings for railroad purposes.

3. TAXES.—To include such as are assessed on property used in the operation of the road, on earnings, capital stock, and other than the foregoing.

4. FRANCHISE CHARGES.—To include any payments made to the city on gross earnings, in a consideration of franchise.

BOOKS.

Having properly analyzed the accounts, the bookkeeping becomes a comparatively simple matter. Two

principal books only are required; the number of auxiliary books, or report blanks, will depend upon the extent and number of departments into which the business is divided. The principal books are known as Journal or Distribution Book and Ledger.

that the various charges under the several headings do not take up the room on the ledger, but are condensed under the one heading, the details appearing only in this distribution book. The following embrace all the ledger headings that are employed in a set of books that represent the business of a very large system of animal traction:

Form B.		January 1892		Operating Expenses.																								
Date	Check or Voucher No.			Roadbed & Tracks	Repairs of Building Fixtures	Repairs of Cars and Vehicles	Repairs of Motors	Repairs of Harness	Horse Shoeing	Renewals of Horses	Cost of Provender	Mill Expenses	Salaries of Officers and Clerks	Wages of Conductors and Car Employees	Wages of Depot Employees	Fuel for Cars and Depots	Gas and Light	Fuel for Power Station	Depot and Stable Supplies	Printing & Office Expenses	Damages	Legal Expenses	Water Supply	Insurance	Removal of Snow & Ice	Rents	Contingencies	Interest	
1	28129	J. Brown Paymaster	Pay Roll Week ending Jan. 1		314.50	1244.86	232.39	114.38	947.00			98.00	686.92	19997.48	8968.19		190.56				38.36				71.80				32905.04
	28130	Del. Car Wheel Co.	Wheels			537.50																							537.50
2	28131	John Doe	54 Horses							5090.00																			5090.00
	28132	Richard Doe	7193 Bushels Corn @ 40¢ & Elevating								2899.00																		2899.00
4	28133	James Peters	314 tons Broken Coal @ $4.45															1397.30											1397.30
5	28136	James Fox	302 tons Nut Coal @ $3.50													1057.00													1057.00
7	28138	W. D. McHugh	13739 lbs. Straw @ 80¢ p. 100; 257296 " Hay " 48¢ " "								1343.73																		1343.73
	28140	Geo. Seaman	Lumber	962.00																									962.00
	28141	Wm. Van Buren	Sand	162.00																									162.00
8	28142	Wilson & Co.	Stable Brooms																27.69										27.69
	28143	Pure Water Co.	Water																				67.40						67.40
	28144	Evans & Co.	Insurance to Jan. 1893																					1764.00					1764.00
9	28145	Chas. Matthews	Castings &c.	412.00		54.00																							466.00
10	28146	W. D. Field	Stationery																	29.47									29.47
11	28147	J. C. Smith	Investigating patent infringement claim																			764.29							764.29
12	28148	John Jones	Traveling Expenses																								75.40		75.40
14	28149	James Carey	Salt																						460.00				460.00
15	28150	Thos. Green	Rent for Waiting Room and Transfer Office																							50.00			50.00
	28151																									75.00			75.00
				1536.00	314.50	1836.36	232.39	114.38	947.00	5090.00	4242.73	98.00	686.92	19997.48	8968.19	1057.00	190.56	1397.30	27.69	29.47	38.36	764.29	67.40	1764.00	531.80	125.00	75.40		$50132.82

The JOURNAL OR DISTRIBUTION BOOK may be kept in different ways. One form of ruling is shown in Form B, headed "Operating Expenses." This method requires that the pages of the Journal be about 28 × 17 ins., which is bound with a number of divisions to correspond with the number of ledger headings required. Each division is ruled to suit the number of sub-headings required, and a tag is inserted to mark the beginning of the divisions. By this method the sum total is carried to the debit of an account under "Operating Expenses" in the ledger, so

Capital Stock,
Bonds,
Treasurer,
Profit & Loss,
Passenger Earnings,
Miscellaneous Earnings,
Supplies,
Construction.
Equipment,
Real Estate & Buildings,
Operating Expenses,
Interest,
Taxes,
Accounts Payable,
Accounts Receivable.

The same thing is done with the "Equipment Account." A division of the distribution book has a heading, and under it the various columns show cost of cars, horses, motors, etc., and at the end of each month the sum total is carried to the account called "Equipment" in the ledger.

The same for "Construction;" the columns showing amounts expended for rails, roadbed, etc. By this means the details of all expenses, whether on account of capital, Track," etc. At the end of each month an inventory is taken of the supplies on hand and deducted from those various accounts, thereby showing the exact amount of expenditure for those repairs, cost of feed, etc., leaving the supply account debited with the amount of supplies actually on hand. By this means the company will always know what supplies are on hand and paid for, and the various accounts will only be debited with the amounts actually used.

(A) RECEIPTS. ..... *1892.*

Name of Conductor.	L. F.	Tickets.	Fares.	Total.	Brown Street Line.	White Street Line.	Green Street Line.	Fifth Street Line.	Office	Miscellaneous.	Total.

DISBURSEMENTS. ..... *1892.*

	L. F.	Check No.	A. V. No.	Sundries.	Audited Vouchers.	Miscellaneous.	Total.	Balance in Bank.	Cash on hand.

(C) TRANSPORTATION.

Date.	L. F.	A.V. No.		Sundries.	Audited Vouchers.	Supply Account.	Cash.	Car Service.	Transportation.

FORM E.

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	For Year.
Miles between Termini	11.692	11.692	11.692	11.692	11 692	12.407	12.407	12.407	12.407	12.407	12.407	12.407	12.109
Miles of Single Track	23.384	23.384	23.384	23.384	23 384	24.814	24.814	24.814	24.814	24.814	24.814	24.814	24.218
Miles Run by Cables	31.926	28.881	31.989	31.089	33.670	33.466	35.029	34.958	34.202	35.325	33.793	35.214	399.542
Average Number of Trains Run	44 6	45.9	45.6	46.3	45.2	45.8	45.4	45	43.8	43.8	41.3	41.2	44.6
Total Number of Round Trips	22,531	20,706	22 644	22,291	23,006	21.612	22,993	22,533	21,021	21,451	19,300	19,910	259,998
Car Mileage	363,962	334,376	365,884	360,068	373,048	369,967	393,101	385,835	360,240	367,504	331,823	342,905	4,348,713
Passengers Carried for Revenue	826,003	718,801	794,653	927,339	959,810	979,723	1,039,362	1,024,325	1,028,523	1,126,949	830,566	871,967	11,128,021
EARNINGS.													
Car Fares	$41,300.15	$35,940.05	$39,732.65	$46,366.95	$47,990.50	$48,986.15	$51,968.10	$51,216.25	$51,426.15	$56,347.45	$41,528 30	$43,598.35	$ 556,401.05
Advertising	181.10	182.15	182.70	181 25	181.95	184.80	184.25	185.00	183.27	182.85	182.40	181.65	2,193.37
Rents											30.00	15.00	45.00
Miscellaneous													
Total Earnings	$41,481.25	$36,122.20	$39,915.35	$46,548.20	$48,172.45	$49,170.95	$52,152.35	$51,401.25	$51,609 42	$56,530.30	$41,740.70	$43,795.00	$ 558,639.42
OPERATING EXPENSES.													
Car Service and Expense	$13,846.82	$12,831.95	$13.715.22	$13,209.43	$13,000.71	$12,836.00	$13,097.42	$11,903.08	$10,533 29	$11,063.05	$10,174.8[illegible]	$10,735.45	$ 146,947.31
Injuries to Persons and Property	2,532.07	1,722.86	1,570.33	4,209.29	2,804.10	1,982.78	2,013.23	1,102.39	1,493.29	1,031.82	987.57	3,053.94	24,503.67
Car Licenses	274.97	285.41	285.41	308.33	304.17	304.17	306.25	308 32	293.80	308.42	277 92	241.65	3,538.82
Repairs of Cars	797.75	727.68	851.49	664.70	580.89	730.29	677.49	732.55	570.41	729.97	1,013.70	835.78	8,912.70
Repairs of Grips	435.72	421.10	541.04	567.44	552.39	511.14	387.79	479.19	445.29	418.23	460.99	512.19	5,732.71
Motive Power	10,890.97	11,566.46	10,640.03	9,040.57	10,032.50	11,023.82	11,224.05	10,552.25	10,991.21	12,143.05	12,155.20	12,174.85	132,475.86
Maintenance of Track and Buildings	718.34	716.76	534.35	573.45	571.73	596.21	1,134.89	1,394.42	835.12	736.40	683.24	803.62	9,198.53
General and Miscellaneous	3,226.35	2,337.16	2,703.91	2,179.89	1,996.73	2,535.21	1,132.54	2,260.04	2,199.97	2,296.72	2,355.94	2,484 67	27,709.13
Advertising and Attractions		36.40	406.90	76.88	129.59	289.87	349.54	325.11	810.05	733.08			3,160.42
Taxes	869.55	1.048.10	884.58	870.10	873.45	887.16	1,178.84	707.45	513 00	67 54	579.97	166.11	8,645.85
Total Operating Expenses	$33,592.54	$31,693.88	$32,133.26	$31,740.08	$30,846.46	$31,696.65	$31,502.04	$29,664.80	$28,685.43	$29,532.18	$28,689.42	$31,048.26	$ 370,825.00
Per Cent. of Earnings	80.98	87.74	80.50	68.19	64.03	64 46	60.40	57.71	55.58	52.24	68.73	70.89	66.38
Cost per Car per Mile	9.2c	9.5c	8.8c	8.8c	8.3c	8.6c	8c	7.7c	8c	8c	8.6c	9c	8.5c
Net Earnings, 1891	$ 7,888.71	$ 4 428.32	$ 7,782 09	$14,808.12	$17,325.99	$17,474.30	$20,650.31	$21,736.45	$22,923.99	$26,998.12	$13,051 28	$12,746.74	$ 187,814.42
Net Earnings 1890	$ 3,924.27	$ 6,428.11	$ 8,566.09	$15,764.01	$24,034.54	$23,274.26	$21,845.93	$20,997.25	$23,981.41	$22,212.06	$16,702.27	$14,641.19	$ 202,371.39
Increase	$ 3,964.44							$ 739.20		$ 4,786.06			
Decrease		$ 1,999 79	$ 784 00	$ 955.89	$ 6.708.55	$ 5.799.96	$ 1.195.62		$ 1.057 42		$ 3 650.99	$ 1,894.45	$ 14.556.97

operation, interest, taxes etc., are entered in the distribution book, and each month the sums total are carried to these various accounts in the ledger, the items of which can be found in detail by reference to the distribution book.

In keeping supplies, the purchases may be made and charged to the various operating accounts for which supplies are purchased; for instance, provender and the cost of preparing the same for use under "Cost of Provender;" hardware, wheels, car equipment, etc., to "Repairs of Cars;" rails and other supplies for track to "Repairs of

The receipts may be kept in the same book by having a department for "Passenger Receipts," with the pages ruled so as to show the receipts from different divisions of the system, and another department for "Miscellaneous Receipts." In this case no cash book is required, as the check stubs and petty cash book show all cash payments.

A Cash Book, of which Form A will serve as a model, may be used if preferred. This is headed on its opposite pages "Receipts" and "Disbursements." The "Receipts" side in the cash book shows the name of the conductor, the amount of cash for tickets, the amount

of "cash fares," the "Total" of the two foregoing; the total for line each being carried into the column under its proper head; tickets sold in office are entered under "tickets" and carried to "office" column; any other receipts are entered under "Miscellaneous." The total line receipts each day are carried to the total column as are all other receipts. The "Disbursements" side shows the name and the check number, and when an audited voucher is paid the number entered under "A. V. No." and the amount entered under "Audited Vouchers," and the total audited vouchers for the day carried to the "Total" column. For other disbursements the check number is entered under "Check No." and the amount under "Sundries;" for instance, if it is pay roll, which is divided into ten different parts, each part is entered separately and the total carried to the "Total" column. Any other payment would be entered under "Miscellaneous," and the amount under that head carried to "Total" column each day. The two columns "Balance in Bank" and "Cash on Hand" are merely memoranda to show at a glance the two items.

(D) THE PEOPLE'S RAILWAY.

Statement of Operating Expenses for 189

General Expenses.			
Salaries of General Officers			
Salaries of Clerks in General Office			
Miscellaneous Expenses, General Office			
Stationery and Printing			
Insurance			
Legal Expenses			
Injuries and Damages			
Contingent Expenses			
Stable Expenses			
Transportation Expenses.			
Car Service			
Car House Expenses			
Oil and Waste for Cars			
Operation, Power House			
Coal, Power House			
Oil and Waste, Power House			
Light and Fuel, Cars			
Maintenance of Way and Buildings.			
Repairs of Roadway and Track			
Renewals of Rails			
Renewals of Ties			
Repairs and Renewals of Paving			
Repairs of Overhead and Sup. Wire			
Repairs of Buildings			
Maintenance of Equipment.			
Repairs of Cars			
Repairs of Electrical Equipment:			
(*a*) Armatures and Fields			
(*b*) Gears and Pinions			
(*c*) Trolleys			
(*d*) Sundry Repairs			
Repairs of Steam Plant			
Repairs of Electrical Plant:			
(*a*) Dynamos			
(*b*) Switchboard			
Tools and Machinery			
Miscellaneous Expenses			
Fixed Charges.			
Interest			
Rent			
Taxes			
Receipts for Month			
Expenses for Month			
Surplus			
Construction and Equipment.			
Building Construction			
Track and Roadway Construction			
Overhead Construction			
Car Equipment			
Snow Plows and Sweepers			
Power Station Equipment			
Tools and Machinery			
Improvements and Betterments			
Cash on hand			
Supplies			
Floating indebtedness			

At the end of the month posting may be done direct from the cash book to the ledger of the totals of the several lines, and the total of the "Office" column and the items under "Miscellaneous" to the several accounts to which they belong. The "Disbursements" side items are posted separately to the ledger, except the "Audited Vouchers" which can be posted in bulk.

A modification of the journal, shown in Form B, can be made to conform more nearly with the analysis given on page 415. In this case the divisions of the journal may be given the first sub-heading (General Expenses) under operating expenses, and the columns ruled to correspond with the final sub-divisions. This will necessitate a few more accounts in the ledger, or the items may be combined and posted under "Operating Expenses."

In order to reduce the size of the journal page, and for other reasons, Form C may be employed. With this method the journal is divided and classified to correspond with each ledger account; for instance, "General Expenses," "Transportation," "Maintenance of Way," "Structures," etc., and to each division is assigned a certain number of pages.

The name of the division "Transportation" is printed on the top of each page of that division, and on the margin of the first page of each division (see Form C), and the preceding leaves are cut out after the manner of an index, and at the beginning of each division a leather tag is placed, which extends beyond the leaves and on which the name of the division is printed, and serves as a ready refererence to any division. The sub-head "Car Service" is printed, in the last column, and a sufficient number of pages are devoted to each of the sub-divisions.

Each item chargeable to any account is entered in full, the audited voucher number, name of the firm, from whom the purchase was made, the article, so that all items charged to any account are readily referred to without consulting any other book, the audited voucher number being entered so that the original bill may be referred to with very little trouble.

The three columns headed "Sundries," "Audited Voucher" and "Supply Account," represent the principal credit accounts, and at the end of each month the totals of each account are posted to the debit side of the ledger and the grand totals of the three columns for the month are posted to the credit side of the ledger account represented. Items that do not come under either printed head can be all carried into the sundries column and posted direct to the ledger.

The ledger is ruled in the usual form, and does not differ from those used in ordinary bookkeeping.

As an aid to forming the divisions and subdivisions of the journal, the accompanying Form D is presented, which is a monthly statement made from a journal kept in the manner last described, and, it will be seen, is composed of five departments with their sub-divisions. The analyses of accounts given in this form do not correspond in all respects with that given on page 415, but are very satisfactory.

The auxiliary books or blanks may be ruled to suit the different accounts for which they are to be used; for instance, the record of armature repairs is made from the armature repair tag, which is sent to the office from the repair shop, and which is illustrated with other blank forms in this connection. The following are the points to be noted: 1. Armature No. —, 2. Extent of Damage, 3. Date Damaged —, 4. Cause of Damage, 5. From Car No. —, 6. Motorman, 7. Repaired by—, 8. Time Consumed, 9. Placed in Car No. —, 10. Date Same was Replaced.

Books for the daily and weekly horse report and power house reports with engineer's log book and others are also necessary.

Form E is offered as a desirable model from which a manager may make a summary of an annual report to his board of directors. The form is reproduced without altering the figures from the annual report of the manager of a large sreet railway system.

The Operation of Electric Railroads Without Compensation to the Abutting Owner.

By J. K. Blake.

A highway has been defined as "a passage, road or street, which everyone has a right to use. It is created (1) by legislative authority, or (2) by dedication. It is simply an easement or servitude, carrying with it as its incidents * * * * the right of use for sewerage, distribution of light and water, and for the furtherance of public morality, health, trade and convenience. The owner of the land retains the fee, and all the rights of property, not incompatible with the public enjoyment.* The most common use of the highway is that of public travel.

When the highway is created by enactment, compensation is required under the United States Constitution. This compensation is considered as the just return to the private owner for the loss of such enjoyments in the land as the public will deprive him, by its future use of the same. This return, therefore, is regarded as a complete and adequate one, paid all at once, for such enjoyments as the property owner loses now and will be deprived of in the near future. One of these enjoyments is the sole use of the land for passing and repassing. When the public has acquired, (by payment of the compensation), the present and future use of the enjoyment, it has a right to use the highway by any methods of traveling, whether they are the same as those in vogue at the time of the purchase of the enjoyment, or not, provided they do not encroach on any of the enjoyments, for which the owner has not been paid and has not, therefore, given up. In other words the highway may be used by the public in any way, in the line of public travel, whether such methods were contemplated by the public or not, when the land was taken, provided there is no deprivation of the enjoyments still remaining in the possession of the private individual.

When the land has been acquired by dedication, the owner gives up such rights as are necessary for the public use of a highway, retaining all others in himself. These can only be taken from him after proper compensation.

Besides the usual methods of travel, there are three which may be considered as not unusual to a public highway and concerning which the question might arise, whether they were directly in the line of public travel, and as such be entitled to the use of this enjoyment which the public have obtained. These are, (1) steam railroads, (2) horse railroads, (3) electric railroads.

A comparison of the incidents of the use of all three is necessary to determine their respective rights. It has been decided that the use of the first cannot properly be classed under the head of ordinary public travel on the highway,† the chief reason being that it excludes the public from a use of that part of the road which the rails occupy, both on account of the fear of accident and the construction of the track. On the other hand horse railroads do not so exclude the public, and have been held in the line of ordinary public travel.

"The placing of the tracks level with the surface of the street, the condition of the street between the rails * * * present practically no interference with the use of the entire street for all kinds of vehicles"‡

This description of track applies equally well to that used by electric cars, and in this respect they are as clearly in the line of ordinary public travel as horse cars. The only change has been in the motive power, and this has been held (where a horse railroad was changed to an electric road) not to change the character of the railroad nor increase the servitude.§

Does the erection of poles and wires along the line, however, impose an additional burden, for which the former owner has not been already compensated? It has been recently held, in the case of telegraph poles erected on the road side, that these are a burden for which an abutting owner may receive compensation, the reason being given that they were not in the line of public travel.* Surely poles and wires which directly supply the motive force and are the direct means of facilitating public travel, are not open to this objection, and their erection without compensation certainly cannot be opposed on this ground.

The poles ought in no way to hinder the access of an owner to his premises, for they should always be placed to accommodate abutting owners, but in case this was impossible it seems as if some compensation should be made to the property owner in proportion to the inconvenience suffered. For while he has lost the right to exclude others from the highway, he has not given up that of passing and repassing to his own private property.†

The slight danger and noise attendant upon the use of an electric road have been decided to constitute no additional servitude.‡ It seems, however, that the owner's easement of light and air may, to some extent, be taken away by such poles and wires, and though it has been held in a number of cases, that any improvement in railways which impairs this easement by reason of the structure of the same, affects property, and compensation must be made therefor; still it would seem that the obstruction of a single pole, either eight or ten inches in diameter at the most, from which the wires are supended in the middle of the street, would hardly constitute such an obstruction to the owner's light and air as would justify anyone in setting in motion the ponderous machinery of the law to obtain damages so slight. *De minimis non curat lex.*

When the poles are erected in the middle of the street, as they sometimes are, no land of the abutter is actually taken,§ and surely he is in no way deprived of either light or air thereby.

It may be contended, that since the cars might be propelled by a current supplied, not from an overhead wire but by storage batteries, or from a wire laid in a conduit underneath the street, the erection of poles is unnecessary and therefore unjustifiable. The relative values of these three systems however, is a mooted question, and as Vice-Chancellor Van Fleet decided, with the concurrence of the rest of the court in *Halsey* v. *Rapid Transit Co.*, it appears from evidence that in the present state of the art these (poles and wires) constitute the best if not the only means, by which electricity can be successfully used for street car propulsion.‖ Even should it be shown that some other than the overhead system was the best, it might still be debatable, whether a corporation is bound to use the latest and most approved means of locomotion, provided (as in the case of electric roads), the present means is otherwise entirely within the line of ordinary public travel on the public highway.

The whole subject may be summed up in this way: Electric railroads with the necessary poles and wires are in the line of usual public travel. The poles can be erected so as to make the burden on the land practically nothing, and, therefore, no compensation is necessary.

They might, however, be so situated as to materially interfere with access or light and air, and it would seem as if in such cases some compensation ought to be paid to the party injured.

*Bouviers Law Dict.
†Story *vs.* N. Y. El. R R., 90 N. Y. 122. R. R. *vs.* Hambleton, 40 Ohio.
‡Randall 2s. Jacksonville St. R. R. 25 Mass. 50.
‡Green *vs.* Inhabitants of Trenton, N. J., Supreme Court, January, 1892.
§Mt. Adams Inclined R. R. *vs.* Winslow, 3 Ohio, Circuit Court, Rep. 425.

*Pacific Postal Tel. Cable Co. *vs.* Irvine 49 Fed. Rep. 113.
†But Dillon's Munic. Corp. p. 716, note 1, says, where the fee of the street remains in the municipal corporation "mere inconvenience of access occasioned by an authorized use of the street gives to the owner no ground for a private action," and cites Kellinger *vs.* St. R. R, 50 N. Y. 206.
‡Lonergan *vs.* Lafayette St. R. R., Circuit Court, Ind.
§Halsey *v.* Rapid Tras. St. Ry. Co., 47 N. J. Eq. 380.
‖Confirmed in Lockhart *v.* Craig St. Ry. Co. 21 Atl. Rep. 26 (Penn. Sup. Ct

Strike in Cleveland.

The employes of the East Cleveland and Broadway & Newburgh street railroads went on strike during the latter part of last month.

They claim that the agreement which ended their strike of a few weeks ago does not operate satisfactorily. They accordingly presented a demand asking for more pay and longer hours, and that no one not a member of the K. of L. be employed. The demand was refused and at the time of going to press the strike was still on.

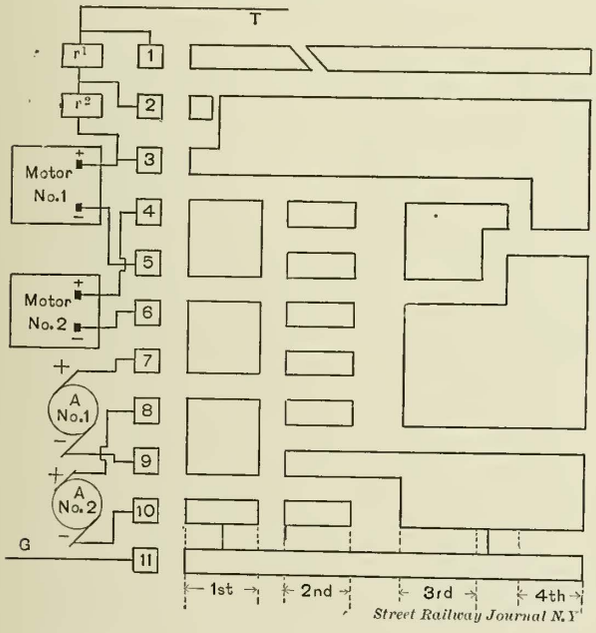
A New Method of Controlling Street Cars.

BY M. D. LAW.

Having seen a partial description of a series multiple street car switch, I present the following as an explanation of the series multiple street car switch which was designed by Mr. David Mason, engineer of the Edison General Electric Co.'s Schenectady works. The writer had the pleasure of assisting Mr. Mason in the experiments with this switch.

A resistance of from six to ten ohms is used, divided in two equal sections, one to carry ten, and the other twenty amperes. These resistances are placed in series with each other and in series with the trolley wire. Then the switch is so arranged that the first point will place the two resistance coils, fields and armatures in series. A slight move of the switch handle will short circuit one resistance coil.

The second point first drops one motor entirely, and finally drops the second resistance coil, allowing the car to be operated by one motor, which is sufficient power to handle a car on anything less than a 7 per cent. grade. The connections are so arranged as to use one motor in one direction, and the other in the opposite, allowing the



motors a large amount of rest and time to cool, thus reducing the number of burn-outs.

At the time of passing from the second to the third point, both motors are entirely thrown out of circuit by a dead point, which must be long enough to completely kill the motor which has been in use. At this point, the armatures of both motors are thrown in parallel and the fields in series, and at the fourth point both armatures and fields are thrown in multiple, giving the full force of the motors. It must be borne in mind that the separate coils of the field magnets are coupled in multiple at the motor.

It is found with a switch of this description, that the car starts very smoothly and will do the most of town running with the motors in series, while the voltage in in the motors is but one-half that on the trolley line. This method of operating has many advantages. The car being under perfect control at starting, in fact, the switch handle can be moved very slowly on the first, second and fourth points without sparking. It is better to make the movement at the third point rapidly, not only to save sparking, but so as not to have the motors lose speed, for at that point they are both momentarily thrown out of circuit.

Another great advantage is that the car can be operated on 30 per cent. less current. Only one point is used on reverse, and that with motors in series, the resistance being commutated the same as on the forward side. This is found to be all that is necessary, as it gives sufficient power to slide the wheels, and does not strain the motors and gearing in making an emergency stop.

The accompanying diagram will give a clear idea of the switch. The figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, represent the contact points on an ordinary three or seven point Edison switch, with the connecting wires from these points to the resistance coils, armatures and fields of two motors, the points r1 and r2 being the resistances. The remaining contact strips to the right of these figures represent a cylindrical switch laid out flat, the dotted lines at the bottom showing the different points.

It is very noticeable that the majority of street railway lines are being constructed in the same slovenly manner that electric light wires have been erected, and I suppose that we must submit to a large number of accidents before street railway companies will learn that only first class construction will pay. One of the principal faults is that of putting up the span wires without any insulation in them between the trolley wire and the pole. The one insulation between the trolley line and the span wire is not sufficient; there should be an insulator placed on each side of the trolley wire, so that when a telephone or telegraph wire drops over the span wire it can cause no trouble, for in such case the trolley pole is liable to leave the wire while the car is in motion, and in drawing down at the span wire it makes contact between it and the trolley wire, and an accident or fire is the result. Should guard wire be used, and this precaution taken, it would very much reduce the number of accidents. Let us have first class construction and thus stop the cry against the trolley.

Some street railway companies seem to think that after the trolley wire is once up over the street it requires no further care, but such is not the case. Great care should be taken to keep the line in its proper position over the track, for if it is not in line with the position that the trolley naturally takes, the trolley wheel will rub it on one side and soon wear the wire to such an extent that it will not stand the strain and drops into the street. It is cheaper to keep the trolley line and wheels in good condition than to put up a new line every year or two.

Stock Watering as a Business.

The get-rich-quick method of doing business is peculiarly American. It frequently "takes the breath away" from the average foreigner to see how Americans crowd results into a short period of time. This appetite or tendency is one of the incentives of stock watering, which process may fitly be described, when legitimately done, as capitalizing profits rather than assets. There are numerous ways of looking at this class of business, but the more important are two; one is from the standpoint of the operator who shares in the distribution, and the other from the standpoint of the one who does not. The consequent antagonism between the two is now one of the greatest obstructions business reorganizations have to contend with, and there are few signs that this conflict will cease until the subject is thoroughly ventilated in the press and understood in all parts of its bearings. The instinctive fear of those who are sharing in the watering process, which is founded upon the particular just described, is one of the reasons why more is not known about a subject which forms the active base among the numerous corporative reorganizations that are now taking place in all parts of the country. But there is nothing to hide so long as it is honestly conducted, and when it is otherwise, that is, when all the stockholders do not participate in the division of a watered stock, the stockholders themselves are as much interested in its exposure as they are in the exposure of any crime.

There is no questioning the statement that stock watering is closely interwoven with the great majority of the country's business affairs; and what is more, the outlook is that the process is here to stay; for never before in our history has so much of it been done as during the past few years. Next in importance, the act is deemed by investors perfectly legitimate, and the proof that such is

their general opinion, is that they daily invest large sums of money in undertakings which they know to be organized under that method. A few years ago it was a common occurrence for a concern which wished to organize as a stock company to capitalize itself at the exact cost of the plant, or its market value, added to the sum of money necessary to run the business. To day this is rarely, if ever, done except the concern is starting new in a business; and even then, if the undertaking is large it is more frequently capitalized on prospective profits rather than on actual resources. But that is an outside form of stock watering, and not a part of that to be seen in the larger undertakings of the day, which may more fitly be described as reorganizations or enlargements of existing institutions.

Of course stock watering frequently yields large sums of ready money to the organizers, for the process is the issuance and selling of capital stock on the future. Investors as a class are willing to so look upon the matter, and accept it as any merchant would an ordinary business risk. The investor well knows that the money he invests is a risk taken in the prospective earnings of a company, and if he is satisfied that those earnings are as good or better than any he can get elsewhere, the question of whether the stock is watered or not is a secondary consideration. This means that an investor is not deterred from making an investment because a stock is watered, because his whole attention is drawn toward earnings rather than the cost of resources. He well knows that a concern might have cost in cash any given sum of money, but if that concern was improperly managed, or otherwise possessed poor earning power, the fact of original cost being large does not in itself assure his dividends. The proof of this state of things is in the numerous instances of well known corporations which have added no water to their stock; to-day these instances do not bring one dollar per share more in the stock market in consequence of their self-imposed restraint, than do corporations which earn just as much money on their watered capitalization. We could cite many instances in support of this conclusion, but they would occupy space to little purpose, for they are well known by the average investor.

Now, be it noticed, right here we directly strike into the root or motive for stock watering, which is a recognition on the part of corporation promoters that the investor invests his money upon earnings, and not upon auction values of plants. This is the key note to the whole business, and it must be confessed that it was not much understood in this country until a comparatively recent date. So long as the investor thinks the assets of the corporation are large enough to properly conduct the business, he ignores them altogether.

We refer more particularly to investors' standpoint, because no one else is supposed to be interested in this form of doing business, the issue of the effects of a concern's doings on the outside public being another question. The investor in a business is its owner; he practically becomes a limited partner in it, and so long as the concern is situated to afford him a fair return on his money, he commonly ignores all else. Of course this investor is deeply interested in any stock watering which may take place after he has entered the concern, and if anything of the kind is attempted without his knowledge, and without allowing him a division in it, strictly speaking that is legally and morally a crime. That this has been done in certain cases is well known. Certain officers have secretly increased the issue of a stock and put it on the market for sale without giving any part of the proceeds to the other stockholders. This is a state prison offence in every or nearly every state in the Union, and naturally to be condemned by investors as well as all honest people. But when the stock is watered and an equal division is made of the increase among all stockholders, whether outsiders are informed of the matter or not, it strictly speaking is perfectly allowable; although in several states, any kind of stock watering, whether an equal division is made among the stockholders or not, is illegal. Laws have been passed against this business more from a misunderstanding of it than for any other reason, and the effects of such adverse legislation is to drive those who contemplate anything of the kind into other states where the law does not interfere.

It is well known on the stock exchange that a good 4 per cent. stock will sell for more money, proportionately, than an 8 per cent. stock; that is, if a concern is paying 8 per cent. dividends on $1,000,000 capital, and its stock is quoted at 120, should the concern vote to water its stock by doubling its capital to $2,000,000, while, of course, receiving no additional money to represent it, the stock, now becoming 4 per cent., is usually sold on the exchange for more than 60, which figure the stock watering would justify. Commonly 70, 80 or even 90 is paid for 4 per cents. under just such circumstances; which particular being well known among observers, is in itself a frequent cause for stock watering. The reason for this unreasonable state of affairs is that investors, as a class, are over or unreasonably suspicious of high dividends. For some reason, which they may best explain to their own satisfaction, they feel more secure in obtaining their dividends if such dividends are reasonably small. Of course this is nonsense, but investors have their little superstitions like some other people, and the corporation organizer feeds on the weakness accordingly.

Gas Motors in Chicago.

During the past two years a series of tests has been made in Chicago with the Connelly gas motor, with a view of determining its capability as a substitute for animal traction on the horse lines, and as an auxiliary to the cable line. Mr. Yerkes, in a recent interview with a representative of the STREET RAILWAY JOURNAL expressed himself well satisfied with the operation of the motor and stated that his companies have concluded to use them extensively on their lines. About twenty of these motors, according to Mr. Yerkes, are now being built and will be introduced at once upon the lines of the North and West Chicago street railway companies. They will be built by the Connelly Motor Co., of Illinois, in which Mr. Yerkes said his companies have purchased a controlling interest, a large plant will soon be in operation manufacturing these motors, the machinery for which is now being installed.

The motor car which has been in operation in Chicago during the past winter was of ten horse power. For a short time it ran on the Clark Street cable lines between the cable cars drawing one trailer. It also operated on the Dearborn Street line, where, in addition to a heavy traffic, there is a 5½ per cent. grade as well as two curves. On the last trip that it made it drew two trailers filled with passengers, starting from the Lincoln Avenue barns and making the round trip on the Clark and Wells Streets cable line, running between the cable trains. After more than three months' service it has recently been temporarily withdrawn to serve as a model for the new motor cars which are being built.

The motors, which are to be built to act as auxiliary to the cable cars and to run on the cable lines, will be of twenty horse power each and will draw two trailers. For all feeder lines, the motor cars will be of ten horse power and will draw one trailer. The success of this motor is attracting much attention in railway circles in Chicago.

This announcement will greatly interest many of our readers who have been watching the progress of the Connelly motor, and awaiting the result of its practical running on Mr. Yerkes' lines. That there is a great demand and a large field for an economical independent motor is well known, but the difficulties in the way of securing such a motor have been thought by many to be insurmountable. The endorsement and adoption of this motor by the Chicago companies is made after a series of practical tests, covering a period of more than two years.

THE Jersey City & Bergen Railroad Co., of Jersey City, N. J., have closed a contract with the Ball & Wood Co. of New York for three of their improved cross compound engines of 300 H. P. each.

Work on the Third Avenue (N. Y.) Cable Line.

The contractors are advancing the work of making over this important line for cable traction as rapidly as circumstances will allow. A person unacquainted with the details can form little idea of the difficulties that are met with as the work progresses, in the way of substructures in the street and treacherous formation that are encountered in the power house excavations, taxing to the utmost the ingenuity of the superintendent, engineer and contractors. In a previous article we have noted that it had been found necessary to put new and deeper foundations under a number of the posts which support the elevated lines in the vicinity of the power house and terminal pits. The next most serious difficulty, and one attended with enormous expense, is the moving of numerous gas and water mains. On the Bowery near Fifth Street a nest of five large gas and water pipes was encountered near the surface, which cross the line at the curve and continue parallel to the tracks for several hundred feet. It was found necessary, not only to lower these pipes below the foundations for the yokes, but, in the case of the water mains, the company are required to provide a brick subway along which access can be had to the mains for a considerable distance, as the water commissioner will not allow pipes to be placed where access cannot be readily had to them. This subway is being built up with brick walls, and is roofed with I beams carrying brick arches between. As the excavation progresses the pipes are supported by chains swung from cross timbers. In the case of the gas pipes the street railway company will provide one twenty-four inch main in place of the twelve and fourteen inch mains now being removed.

At several other points on the Bowery, cross mains are encountered which are being lowered one after another as they are met. In excavating for the pit machinery in front of the power house on Sixty-fifth Street, a thirty inch water main will have to be lowered below the pit foundations for a distance of about 300 ft. At the Bayard Street station the pit excavation encountered five sixteen inch, two twelve inch and one eight inch gas main, a twenty inch water main, an electric subway, several six inch pneumatic tubes and a large sewer.

It has been decided to entirely tear down the rear portion of the stable building on Sixty-fifth Street to make room for the power station. In previous notes we stated that the outside walls and a portion of the stalls would be retained until the power house proper had been equipped; but so much difficulty has been encountered in shoring up the walls that it has been decided to tear out the entire rear portion of the building and erect the power house complete over the old foundations, and the work of demolishing the stable building is now nearly completed, and excavation is well under way.

A large number of the new cars which are being built by the Laciede Car Co., of St. Louis, have been delivered, and the officers of the company express themselves as exceedingly satisfied with their appearance.

It is found in operating the horse cars over the grooved rail which is provided in the cable construction that it requires very much more power to haul the cars, and the horses are being worn out more rapidly than before. The increased draft is no doubt largely due to the sand which finds its way upon the rail from the new pavement, and is not entirely chargeable to the grooved rail. Some of the tilting or rope replacing sheaves are being installed at various points upon the line, and are of a special design, having been invented by Mr. J. H. Robertson, the superintendent of the lines. They are arranged to operate automatically from a lever in the track which is depressed by the wheel flange. These pulleys are to be placed at all points where it will be necessary to pick up the rope.

The company are in the market for a suitable switching motor for transferring the cars at the 125th Street car barn, and at present are considering the merits of the Connelly motor, and also of a storage battery motor. The purpose of the company to provide pits under each of the storage tracks prevents the use of animal power for doing the switching, so that a motor of some kind is a necessity. One of the most serious difficulties, as the work progresses, is that of providing for the traffic of the different horse car lines on the Bowery. The numerous turnouts and switches required are provided at very serious expense. It is expected that the line will be in operation before Christmas.

Baltimore (Md.) Notes.

The Lake Roland Elevated Railway, so called because part of the line is on a viaduct has been acquired by Messrs. Jarvis & Conklin, of Kansas City, and the work on the electric equipment is being advanced as rapidly as possible. Contracts have been let and the railway will be in operation before long. The elevated structure will be supplied by the Pennsylvania Steel Co., and, it is said, in all over 3,000,000 lbs. of steel, exclusive of rails, will be used in its construction. The Pullman Car Co. will supply the cars and J. G. White & Co. have charge of the electric equipment.

Work on the new power station of the Traction company on Gilmore and Mosier Streets is being pushed forward. The station occupies a building formerly used as a church, and the machinery, which is being installed by the Robert Poole & Son Co., possesses a number of novel features. Rope transmission will be employed, and both drums of a pair will be driven direct from a split pinion. The two parts of the pinion will be mounted loose on the shaft and driven by a compensating gear which will equalize the power transmitted to the two drums. The arrangement of the machinery is also very compact. The engines were supplied by the Corliss Steam Engine Co., of Providence. The Traction company hope to have the station in operation by August 1.

During June negotiations were concluded by which the property, franchises, etc., of the Baltimore Union Passenger Railway Co., the Baltimore & Hampden Railway Co., and the Highlandtown and Point Breeze Railway Co. were assigned to the City & Suburban Railway Co. The transfers were made under an agreement entered into by a majority of the stockholders on June 7. Mr. Nelson Perin is president of the new company, and their capital stock is $3,000,000.

The site for the power house for the Blue line of the City Passenger Railway Co, has been secured on North Charles Street, between Lanvale Street and Lafayette Avenue. The plans for the machinery are being finished and the building will be commenced as soon as the plant is laid out. Work on the other divisions is being carried rapidly forward.

The Curtis Bay Electric Railway has commenced operations, and is carrying large numbers of passengers.

Record of Service of Two Hauling Cables, New York & Brooklyn Bridge Railway.

Below will be found a record of the service of two of the hauling cables used on the New York & Brooklyn Bridge, which were manufactured by the John A. Roebling's Sons Co. No. 2 has, up to the present time, shown the greatest endurance of any of the cables used on the bridge, except No. 5. The latter is still in use and promises to serve for a long time to come.

Designation.	Service.		Miles Hauled.	Ton-Miles Hauled.	Average Load Hauled. Tons.	Remarks.
	Days.	Years.				
No. 2.	607	1.66	120,232	25,492,862	212	Removed.
No. 5.	415	1.14	88,590	26,502,183	299	In Use.

PARTIES desiring to secure space for exhibiting supplies, or who desire to secure hotel accommodations at Cleveland for the next meeting of the American Street Railway Association, which is to be held on October 19, next, should apply at once to Mr. H. J. Davis, secretary of the Local Committee, care of the Brooklyn Street Railway Co., 1,301 Pearl Street, Cleveland, O.

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THE STREET RAILWAY JOURNAL

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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.

As Traffic Promoters, handsome and highly finished cars are doubtless important factors in many localities. As to their universal value, opinions differ, as will be seen by reference to a number of replies to a direct question upon the subject, which are to be found in another column. In our opinion, the only way to settle the question as it applies to any locality, is to try the experiment. Wherever it has been tried it has proved of decided advantage, and we have never heard of a line going back to plain cars after trying the others. As to the employment of shabby and dirty cars no one can present advantages that will justify in any locality such a practice.

A New Breed of street railway employes would seem to be a desiratum with some of the street car lines in the state of Ohio. From one city we learn of a conspiracy on the part of a number of conductors to rob the company by changing the combination of the alarm punch, the practice having been going on for years, and by which the company has been defrauded out of large sums. Some of the lines of another city, we learn as we go to press, are idle because of a strike on the part of the employes, the alleged grievance being that the company refused to yield to the demand that only union men be employed. Organized labor can never command the respect of the public, and its demands should not be conceded by employers, until it has shown its ability to purify the *personnel* of its assemblies. When it can guarantee the honest and faithful performance of duties on the part of the individual every employer will be glad to yield to its demands.

Another Trolley Accident is a bold type heading that one sees occasionally in such of the daily papers as refuse to become reconciled to the electric system of traction. It matters not what the nature of the accident, whether it be a derailment, the butting into a too tardy truck, or the breaking of a wire, it is always classified under the one head. Notwithstanding the fact that the total number of accidents for a given period is less than under a former system of traction, either horse or steam power, and the traffic is far more acceptable to the patrons, and less objectionable to the residents along the line, these papers never lose an opportunity to display this favorite heading and to magnify every accident on the trolley line. If an individual were to cling to his prejudices and preconceived notions of things and refuse to be convinced in the face of overwhelming testimony, as do the impersonal publications, he would lose all standing with his fellows. Accidents will happen with any system of traction; even were a car to be hauled by a yoke of oxen, it is only a question of time when injury would be done to some person or to property, but they are not as common in the long run with electric traction as with horse or steam power.

The Directory of Street Railways, heretofore published in the STREET RAILWAY JOURNAL, is omitted this issue for the first time. It is our intention that it shall hereafter be published quarterly, and it will appear next with our September issue. This will, we think, be an advantage to all interested, because it will enable the publishers to make a better and more accurate Directory in every respect. Our friends who have been in the habit of sending us corrections monthly will hereafter be troubled but once a quarter. We trust this change will not in any way inconvenience those who have constantly been using the Directory as a reference, as, with a little care, they will soon learn to know just in which issue to expect the Directory. We take this occasion to thank our friends for the help they have given us, and, as in the past, we shall in the future use every effort to make the Directory better and more accurate in every way. We trust that all concerned will see to it that their roads are properly reported once every three months to the office of the STREET RAILWAY JOURNAL.

Accidents are an Unfortunate but an inseparable accompaniment to the operation of any railway, street or trunk line, where great forces have to be controlled by fallible operatives. The use of safety appliances and the employment of care will reduce the danger to passengers, employes and the general public, but it may confidently be said that even the best regulated transportation system is not absolutely free from casualties. Most street railway companies keep for their own information a list of the accidents occurring on their roads, and the authorities of some states compel the steam railway companies to keep a public record of such occurrences. The question whether this plan should be extended to the street railways was recently broached in the legislative halls of one of our neighboring states and was met with proper opposition by the representatives of the street railway interests. That such a plan, if carried out, would result in much injustice which would more than counterbalance any supposed advantages there can be no reasonable doubt. A record of the kind proposed would be simply an invitation to lawyers of a certain class to bring damage suits against the railway company for every person injured, and would prevent many accident cases from

being settled out of courts. Every large city, and many smaller ones for that matter, contains many lawyers of the class that haunt the city court house offering their services to the prisoners, and it is this class who would most profit from such a public record, and from whom both the victims of an accident and the street railway company should be protected.

The Skill and Ingenuity of engineers engaged in constructing cable lines are often taxed more severely, and their ability is measured more by the manner in which they deal with the emergency cases which arise as the work progresses, than in making the general plans for the system. Among the emergency cases are included the means to be provided so that the traffic on their own, the parallel or cross lines, shall not be interrupted, the moving of gas pipes, water pipes and sewers, and the excavation for terminal pits where the street traffic is dense. Unfortunately, the conditions being different in almost every city, engineers have new problems to meet, and since they cannot avail themselves of the experience of other engineers who have dealt with similar problems, the work is frequently attended with a degree of expense far beyond the estimates, and out of proportion to the general work on the line. We know of no branch of engineering that needs the accumulated experience of others so much as this work of dealing with emergency cases as above outlined. Knowledge gained in experience of this kind, if withheld, does not benefit the individual, for the reason that he may never again be called upon to use it, but if it were contributed to a common fund every one would be benefited, and new lines would be relieved of excessive outlays which accompany this work, which in nearly every case is now largely experimental. We hope this suggestion will induce such engineers as have successfully dealt with some of these difficult problems, to tell their experience by making it public through the columns of the STREET RAILWAY JOURNAL.

One of the Most Important Questions of the day is how to harmonize the relations between a community and its chartered servants, those corporations that are to a certain extent doing a public business. It is recognized on every hand that these relations are not so straitened as they formerly were, and that some of the men at the head of our great corporations are being looked up to and respected as public benefactors. This improved state of affairs is, in our opinion, due largely to the growing practice of publishing annual reports which set forth the affairs of the companies and show to the public that the net income from operations is not as fabulous as imagination is accustomed to picture it so long as a business is surrounded by an air of mystery. As the practice of making public the affairs of corporations becomes more general, so much more will the relations between the community and corporations harmonize. The day has passed when large fortunes can be made quickly from a public business, and capitalists must recognize the fact that only a limited income can be expected from investments in this direction, but it may be expected that this income will be large in proportion as the community is taken into the confidence of the corporation. On the other hand, the community should not only be just but generous in its dealings with such companies as undertake transportation in any shape, by giving them a place to put their lines, and in case of strikes providing the full protection of the police and military forces if necessary. It should never be possible for a strike to interrupt the operation of a rapid transit line. If necessary let the accounts of the companies be subject to the inspection of the public officers, and when a certain liberal per centage of income is realized, follow with a lowering of fares; but the companies should be exempt from taxation except on real estate. Experience shows, as we have often noted, that taxes of whatever nature come out of the public in the end from economies that are met by indifferent service, while on the other hand the service will improve in proportion as the companies are unrestricted.

Census Bulletin No. 55, which purports to give the relative cost of building and operating the different systems of street railways, was issued in April, 1891, and contained a statement that it would be followed soon by the publication of statistics of street railways. The public have been waiting very patiently for this second publication, but so far as we are informed it has not yet made its appearance. In the meantime, nearly every writer who has treated on rapid transit subjects in the popular magazines has drawn liberally on No. 55 for his statistics. We have had our suspicions from the first that there was something wrong with this bulletin, for the reason that its conclusions were very much out of harmony with the data that we were able to collect. That we were not alone in our suspicions, the letter of our correspondent printed in another column fully confirms. We have made considerable effort to locate the roads numbered in the bulletin, and think that we have been able to identify most of them, and from what we know of the lines, and from records, we have come to the conclusion that the bulletin in question is an aggregation of errors. When lines are said to have a grade of from 70 to 80 per cent., one naturally suspects that equally glaring errors may have crept in under other heads. We do not charge the Census department with having falsified the returns, by any means, but that there has been a looseness on the part of street railway companies in making returns, so that grave errors doubtless existed in the forms from which the bulletin was compiled. A case in point is that of one of the lines reported, which we think we have identified, for which the returns made to the department were filled out by one of the junior clerks in the company's office, and the officers of the company did not know that a return had been made, or, if they did know, did not take the trouble to verify the figures. We think the Census department in justice to itself should give the names of the lines referred to, and this would aid those interested to judge of the accuracy of the reports. Statistics of this kind are very valuable and often influence the investment or withholding of a vast amount of capital, so that it is important that they be reasonably accurate, but averages made from such statistics as are compiled in the bulletin are very misleading.

The Municipal Control of Street Railways is a favorite topic among many writers on economical subjects. It was not many months ago that a gentleman who makes an especial study of municipal administration, contributed to a leading magazine an article in which he described Glasgow as a model city. In the course of the essay he treated of its street railways, and commented with the fullest approbation on the fact that the system was owned

by the municipality. The roads are operated by a company whose lease expires in two years. The article, which attracted no little attention at the time, is recalled by the visit to this country of a member of the town council of Glasgow, who seeks information regarding the operation of street railways. His particular mission was to inspect the cable system of Chicago. While he admired the splendid work done by the system, he was not prepared to recommend its adoption by his city. The statements that he makes, however, indicate how much better off are the people of Chicago in the matter of transportation than are the residents of the Scotch city, in spite of the fact that Chicago is confronted by a serious problem of intramural transportation, the solution of which has been the study of various commissions. We do not believe in the principle of the municipal ownership or operation of railways, and the fact that Glasgow makes more money out of the local system than does Chicago from the car licenses, does not signify to us. The general question of municipal control needs no re-argument here. The point that interests us just now, is that relating to the prime considerations in street car service, judging from the passenger's point of view. How unenterprising the Glasgow management is, may be judged from the fact that the people have to depend solely upon horse cars and omnibuses. No step has been taken toward the introduction of either electricity or the cable. In Chicago where private enterprise alone is dominant, cable, electric motor and steam are employed, while new systems of traction which promise improved service are constantly being tried. The rolling equipment is far superior to that operated on the Glasgow tracks. In the matter of fares, too, Chicago has the decided advantage. For the expenditure of five cents the Chicagoan can secure transportation on several lines for a distance of about eight miles, where for the same distance in the Scotch city the fare would amount to sixteen cents, according to the schedule of two cents a mile. Were such a fare exacted in Chicago imagine the violent remonstrance of the average passenger! Chicago has nothing to learn from Glasgow; but the latter city may well question whether the principle of municipal ownership in all respects works to the advantage of the people generally who are interested in street railways solely as a means of cheap, convenient and rapid transportation. We have said that the general principle of city control needs no consideration here, but we cannot refrain from asking what would be the result if street car systems in Chicago were under the control of the City Council, seven of whose members are on trial for bribery at the time this paragraph is written.

"Nothing is Impossible," say the engineers; "only give us a banker's order and we will construct any public or private work that may be demanded for human convenience or happiness, but we cannot always guarantee that the income from operation will pay for the investment." The question of income being considered, the services of the engineer who advises when not to build is frequently of more value than those of one who boastingly undertakes to do a work in which doubt is an important factor. A case in point is that of the proposed, much advertised, straight, hundred miles an hour electric road between St. Louis and Chicago. We have given this matter little attention heretofore, because we considered the idea too visionary, and the details of operation as presented by its promoters too indefinite to merit serious consideration, but since the matter has been brought into prominence through a lecture recently delivered by the originator of this bold scheme before the New York Electric Club, and, hence, has been considered by some to have the endorsement of the club, it seems fitting that we should caution our readers or such of them as contemplate taking stock in the enterprise, to receive the proposition *cum grano salis*. So much stigma attaches to the memory of those who in the early days of railroading ridiculed the idea of steam propulsion that critics nowadays are very cautious about expressing an opinion regarding new methods of transit lest they in turn become the butt for ridicule. In reference to the project under discussion, we are willing to take our chances, however, for the details of the plan are so absurd and violate so many electrical and mechanical principles, while the cost of the enterprise is placed at such a low figure, and is confessedly confined to only one favored locality with a coal mine and water power ready made, for which "no one couldn't send in no bill for," that the proposition deserves ridicule if not contempt. As to the cost, which is stated to be $6,000,000 for the 248 miles, a few figures will demonstrate its absurdity. The roadbed, it is admitted, must be equal to that of a steam line, which, with ballast, proper drainage and suitable rail would cost at least $50,000 per mile, or $12,400,000, to which must be added the cost of rolling stock and electrical equipment. But a 200 H. P. motor with a weight of only 6,000 lbs. and a speed of 500 revolutions, is, in the language of another, a very great feat indeed ; but this is outdone by the current transformer scheme and multiphase system which starts with 500 volts at the generator, steps up to 25,000 volts, when it is brought down to 3,000 volts and led along the trolley wire. It would seem that it would not require a 200 mile line to demonstrate all this; there are plenty of long electric lines now in operation that would no doubt avail themselves of this saving in current transmission, and on which one or more cars could be run to demonstrate the practicability of the scheme before entering upon the equipment of the proposed line. We would not advise the Chicago & Alton or the other steam lines that now operate between the two cities to advertise their rolling stock or other stock for sale at present, nor the government as yet to cancel its mail contracts with these lines. It is safe to say that until after the Columbian Exposition is closed there will be sufficient traffic to keep all lines reasonably employed.

The Relative Merits of a cable or electric system of traction for a proposed line in Sydney, New South Wales, have been strikingly set forth in a voluminous report recently published by the Parliamentary Standing Committee on Public Works of that far away country. This report is the record of, probably, the most thorough investigation that has ever been made relative to rapid transit schemes, and could never have been made or published, owing to the expense, had it not been done under government auspices. The report gives *verbatim* the questions and answers put to and given by experts who were summoned to give testimony in the matter. Because of its value and for other reasons we surrender considerable space to the publication of the conclusions of the committee which decided, by a vote of seven to five, to recommend the cable system for the line under consideration. The decision of the committee, relating as it does to a particular line, is doubtless a wise one, for owing

to numerous grades it is doubtful if the line could be operated successfully by any electric method; but had the question been in reference to a system for the entire city or for the other cities of that country, then we think an injustice would have been done to electric traction, had the same opinion prevailed. We base our judgment in this matter on the fact that important additional evidence could have been secured in favor of electricity, while some of that given and which seemed to have great weight with the committee was unfortunate in that it was based on defects which could have been remedied. We refer to the electric line between Randwick and Waverly in the same country, which was constructed of material sent out to the Melbourne Exposition a few years since and was not put in service under the direct supervision of the Thomson-Houston company, and, as the report states, it has not reached expectations either in regard to capacity for dealing with traffic or in reasonable cost of working. Another feature which had great influence with the committee was the lack of reliable evidence as to the cost of operating electric lines, and the report on this subject reflects very seriously on American railway managers. We quote from the report in this matter: "It is, in the present condition of electric tramways, very difficult to get accurate information on this point. The difficulty is said to be due to the circumstance of the companies controlling the electrical tramways in America being subject to the municipal authorities of the localities in which the tramways are laid. A provision in the agreement between the municipalities and the companies requires the latter to reduce the fares upon the tramways, immediately a certain rate of profit has been reached, and to avoid this reduction the companies are said to conceal the actual profits made, and consequently, the actual working expenses incurred." This, not being true to any great extent either in regard to agreement or the practice of concealment, will at once be seen to be unfair testimony. We admit there is difficulty in getting reliable statistics relative to operating expenses, but it is owing, as we have frequently shown, to the constant additions that are necessarily made to nearly every line that has been put in operation, and usually, the method of bookkeeping employed by the companies does not separate strictly operating expenses from the cost of betterments. From the reports of such companies in states which require annual reports to be made to the boards of railroad commissioners, reliable statistics can be had. The report under discussion shows the necessity of some concerted action on the part of electric supply companies and the management of electric lines, looking to the compiling and publishing of reliable statistics relating to operating expenses. This emphasizes the necessity, as we have frequently noted, of a uniform system of keeping accounts and of committing this work to competent clerks who will care for details and render trustworthy reports. It is unfortunate that an industry that is developing so fast in our own country and is proving a boon to hundreds of towns and thousands of people should be denied to the dwellers on the other side of the globe, because its merits, looked at from so great a distance, seem to be distorted. We hope that the report which we publish will stir up the electric companies to look more carefully after their interests abroad.

THE Fitchburg (Mass.) & Leominster Electric Railway has been put in operation.

Electric Power on the New York Elevated Railway System.

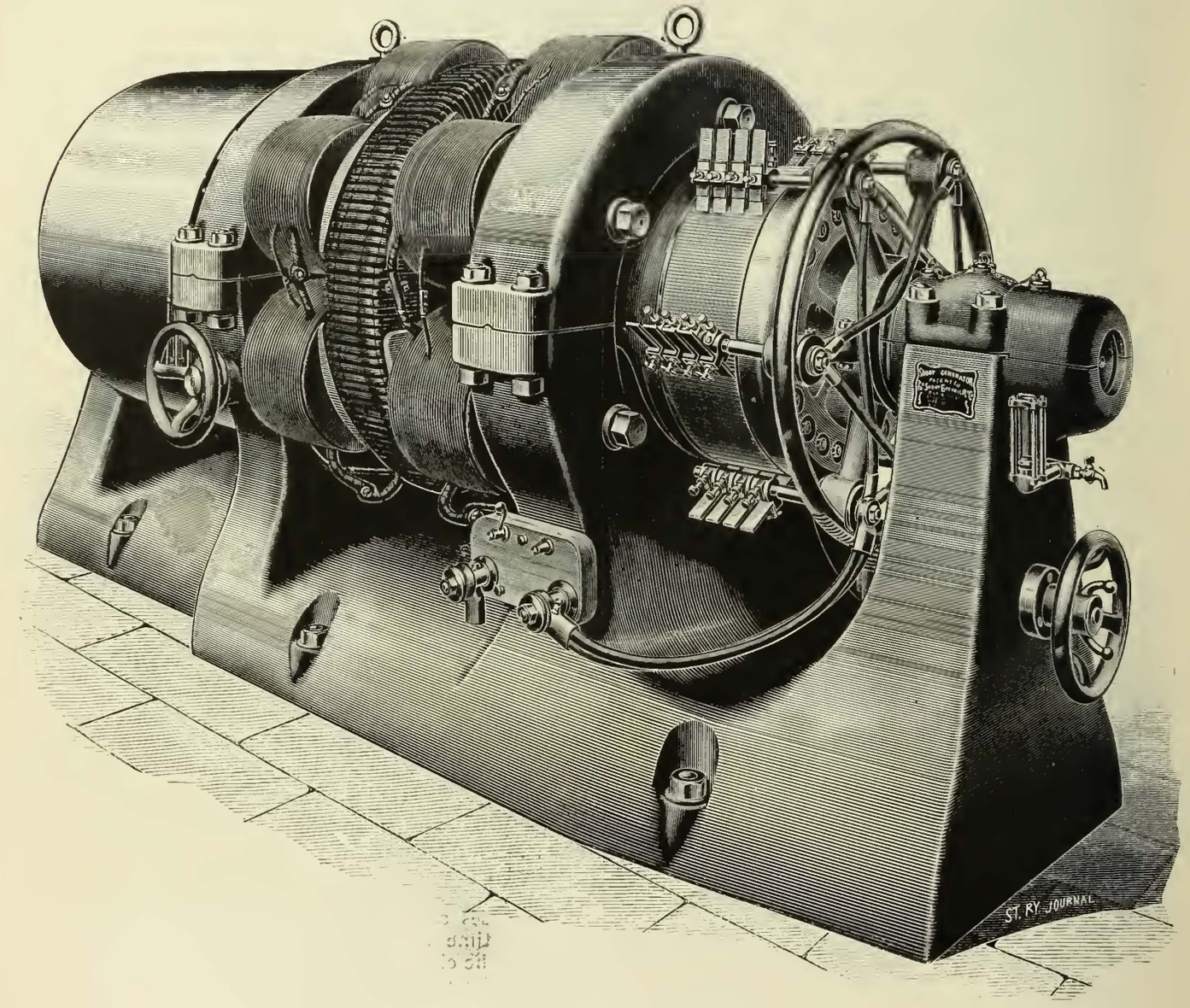
The elevated railway system in New York has long seemed to electrical engineers an ideal place for demonstrating the advantages of electric motors for a metropolitan transit system, and as our readers will remember, some of the earliest experiments with electric traction of Field, Sprague, Daft and others were with cars on this railway. Although these experiments were not followed by the adoption of electric motors on the road, they convinced the managers that in many respects electric power was preferable to steam power, and in view of the important improvements which have been made with electric motors during the past few years, it has seemed for some time that a change of motive power, which was undesirable a few years ago, might at the present time be made to advantage. The managers of the New York elevated railway system, therefore, through Col. F. K. Hain, recently requested and obtained from the New York office of the Short Electric Railway Co., of Cleveland, a proposition for the equipment of a portion of their system with electric power. The proposal made by the Short company includes all of the Third Avenue division of the system, the division upon which the greatest traffic occurs, it being considered by the electric company more desirable to install their system on a crowded division of this kind rather than upon the suburban branch, as first proposed. The plan is to build a number of electric locomotives about the same length as the present steam locomotives and capable of drawing the same load, *i. e.*, five loaded cars or more. The locomotives will have six driving wheels, each pair of which will be supplied with power by a fifty horse power gearless motor, similar in general arrangement to the street car gearless motor, but differing in some details made necessary by the different conditions. The supply of electricity will be taken from a novel third rail carried near the surface of the ties and protected carefully against possibility of short circuit. The rails will probably be used for the return, and feeders will be arranged so that the destruction of a portion of the track owing to the walls of the building falling on the elevated railway, or other cause, will not result in interruption of the supply of current on other sections of line. The power stations, of which there will probably be three or more, will be located near the East River, where the real estate will not be so expensive and where the facilities for the receipt of fuel, etc., are the best. After the equipment of the sections of road where there is a great amount of traffic, it is the intention that the trains drawn by the electric locomotives will run between the steam motor trains until the entire system shall be equipped. The principal advantages claimed for the use of the electric system besides that of economy and the obviation of smoke, gases and cinders, as well as escaping steam, are that less time is required to get up speed, and the decision of the elevated railway managers upon the proposition will be awaited with interest. Professor Short and Mr. E. J. Wessels, the Short company's general Eastern agent, have had several conferences with Vice-President Hain recently, and very likely there will shortly be a definite outcome in substantial shape, from their conferences.

THE West End Street Railway Co., of Boston, finding that their fifteen horse power electric motors were too small for their long cars, and having, in consequence of the substitution of long for short cars a surplus of electrically equipped short cars, have offered a number of these for sale. The cars for sale include sixteen foot open and closed cars equipped with single and double reduction motors. The company are also disposing of some of their double reduction motors mounted on four wheel swivel trucks.

THE mayor of Denver, Colo., is considering a proposition from the Denver Tramway Co. of that city to sprinkle the streets over which the cars run, by electric power sprinklers.

New 300 H. P. Generator.

Our illustration gives an excellent idea of the new 300 H. P. generator lately put on the market by the Short Electric Railway Co., Cleveland, O. This generator is capable of delivering a current of 500 amperes at a pressure of 500 volts. The field magnet frame is of a new design, thirteen feet in length and weighing ten tons. The field magnets twelve in number are bolted to this frame and are similar in construction to those of the four pole machine described in our September 1891 issue. The armature, which is mounted on a shaft thirteen feet in length, is of the well known ring type built by this company and is fifty inches in diameter. The construction of this armature was also fully described in our September 1891 issue. The shaft runs in self oiling and self centering bearings. The centre bearing is provided with six thrust collars. The box in which this bearing runs is provided with a new device by means of which it can be easily adjusted. On the lower half of the box there is cast a feather which moves in a similar groove in the frame, and it is operated by a screw which extends through the frame. This screw is provided with a hand wheel and jam nut by means of which it can be easily held and adjusted. The commutator is of large diameter, 24 inches and contains 200 bars. The brushes are six in number and are carried and adjusted in a novel manner. A split wheel is provided in the lower side of which are gear teeth which mesh into a pinion mounted on the shaft which extends from the frame. On the outer end of this shaft is a hand wheel and jam nut by means of which the brushes can be easily and quickly adjusted and held. This generator is designed to run at 300 revolutions belted and 250 revolutions when connected direct to an engine.



NEW SHORT 300 H. P. GENERATOR.

The Foundations for the Houston Street Station, Broadway (N. Y.) Cable Railway.

The decision by the managers of the Broadway & Seventh Avenue Cable Railway to rent the upper stories of the main cable power station, now being erected at the corner of Houston Street and Broadway, for offices and business purposes, necessitated a special construction of the foundations in order to avoid any vibration of the building by the operation of the machinery. It was, therefore, decided to make the foundations of the building entirely independent of those for the machinery, so that any throbbing and vibration of the latter would not affect the former. The plan decided upon, and now being carried out is as follows: The floors of the building proper are to be supported on forty-five interior piers and twenty-eight piers on a line with the exterior walls, which will be self supporting.

The exterior piers will consist of steel columns fixed on a grillage of iron bars, the latter resting upon stone walls. The interior piers are to be constructed as follows: Large cylinders of wrought iron or steel are to be sunk into the earth and filled with sand below and concrete above, and on the top is to be a grillage of iron beams.

The latter will be level with the tops of the cylinders, which are only six feet in length. Resting on the grillage will be massive iron bases, weighing in the neighborhood of 3,000 lbs. each. Steel columns will surmount these bases. The cylinders, except a few for supporting the court of the building, will vary in interior diameter from eight feet six inches to twelve feet. There is a two-fold object in their use; they will prevent the sand foundation from spreading laterally, and they will also divide the sand on which the building is to be supported from the sand foundation of the machinery floor, the latter being the principal reason.

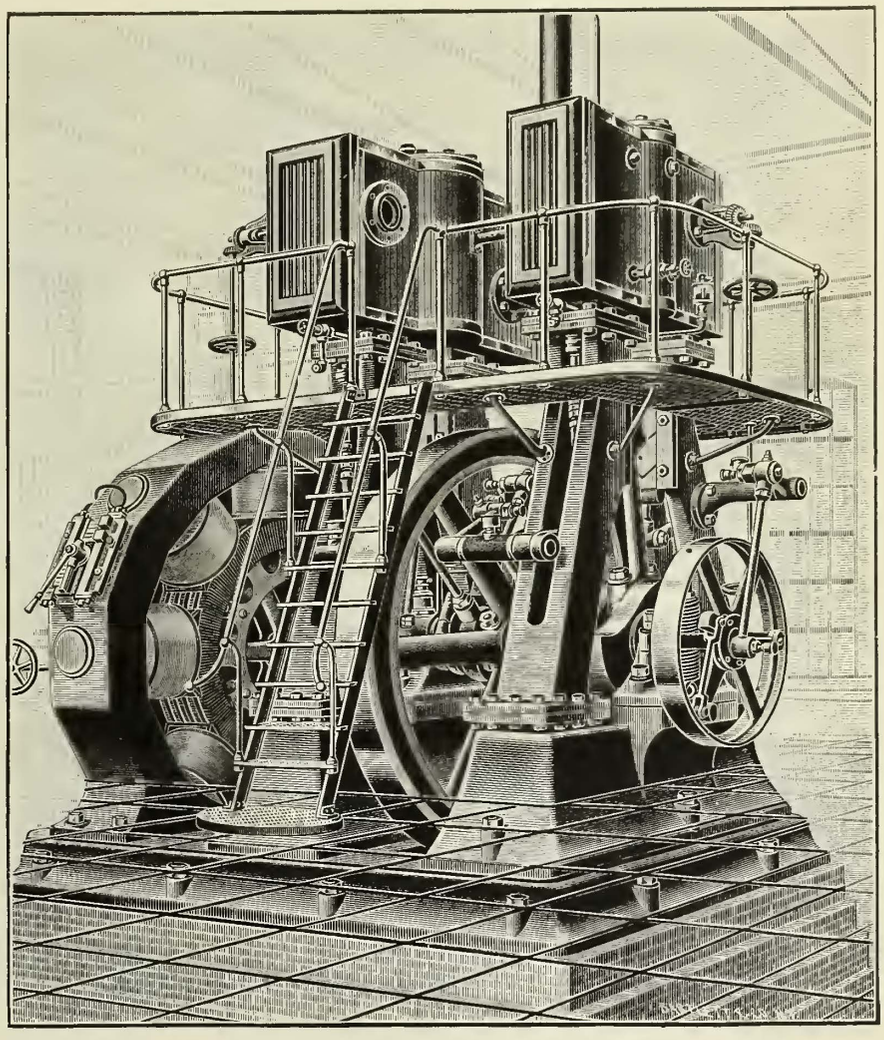
In order to have room for the driving wheels on the machinery floor, as has been already stated, it has been necessary to excavate to a depth of forty-two feet below the street level. Bridges of iron beams, resting on brick walls, are to be constructed around the columns supporting the building. The purpose is to prevent any part of the machinery floor, which will rest partly on the bridges and partly on the sand foundation, from touching the main columns. Thus all of the weight of the machinery floor will compress the sand not used to support the building. The latter will compress only the sand under the main columns.

Direct Connected Engine and Generator.

On this page is shown a multipolar electric generator, connected directly to the shaft of an engine built by the Lake Erie Engineering Works of Buffalo, a description of which was published in these pages some time since. The engine was designed with especial reference to direct connected multipolar generators, and the illustration gives a general idea of the appearance of the engine when adapted for electric railway service and driving one single generator on the low pressure side.

These engines are built, arranged for direct connection, in sizes from 50 to 5,000 H. P. units, and of either compound or triple expansion type. A number of the smaller sizes are already in use, driving by direct connection lighting dynamos in office buildings, a place where economy of space is an important consideration.

The Field Engineering Co., the Eastern representatives of the Lake Erie Engineering Works, expect to have several of the larger sizes running in electric railway service, connected direct to multipolar generators, at an early date.



DIRECT CONNECTED ENGINE AND GENERATOR.

A POINT of interest to stockholders in business corporations was decided June 17 by the N Y. Court of Appeals, in the case of Thomas Commerford Martin *vs.* The W. J. Johnston Co. Ltd. Mr. Martin, who was and is a stockholder in the W. J. Johnston Co., believing that its affairs were being improperly managed, obtained from the Supreme Court a writ of mandamus requiring the company to exhibit its books to him and to allow him to make extracts or memoranda therefrom. The company resisted the application, claiming that Mr. Martin was not a stockholder; that he had no right in any event to make extracts from the books, but only to inspect them; and that his motives for the examination were improper, as he was interested in a rival corporation.

The case was very strenuously litigated by the company, but the court mentioned has finally affirmed the decision of the general term, that Mr. Martin was entitled to the granting of the application as fully as was allowed.

New York Street Railways in 1891.

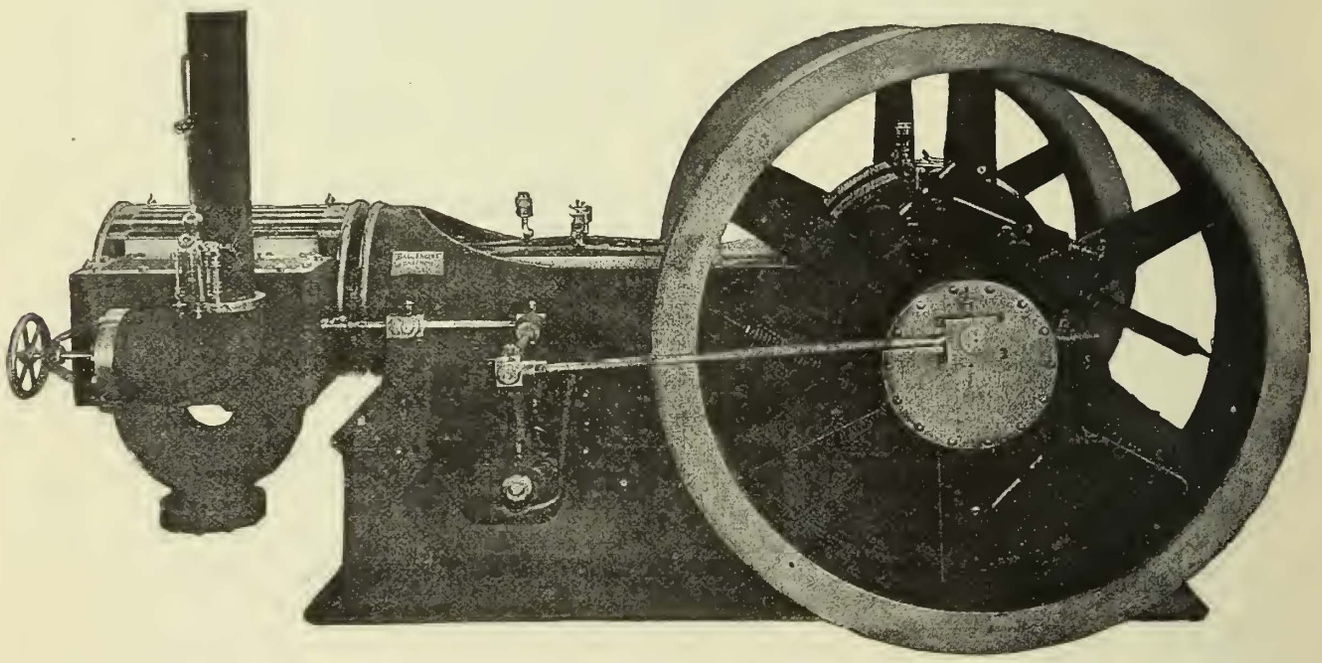
The second volume of the ninth annual report of the Board of Railroad Commissioners, of the State of New York, for the fiscal year ending June 30, 1891, which was transmitted to the Legislature on January 12, 1892, contains some very interesting statistics in regard to the street railways of the state as well as of the steam railways. We find in the state 105 companies reported as operating surface street railways. These show total gross earnings from operation of $20,153,973.66, and total operating expenses $14,914,204.72, giving net earings from operation of $5,239,768.94. The net earnings from operation during the year ending June 30, 1890, was $4,851,044.76. Nineteen roads reported a deficiency from operation during the year, and only twenty-five less than one-quarter paid dividends. The average rate of dividend paid was 8 per cent. In 1890, ninety-five roads were reported as in operation, of which eleven reported a deficiency. Twenty-nine paid dividends. The roads paid a total of $938,676.22 as taxes.

A FEW weeks ago a delegation from British Columbia waited on the Government, at Ottawa, and asked that the rails used in electric railways which weighed over thirty pounds be admitted free of duty under the same classification as rails used for locomotives. The Government forwarded the reply recently, stating that electric railways are classified as tramways, and the rails used for electric railways are duitable irrespective of weight. The decision is of interest to all Canadian cities which have electric railways, inasmuch as when an electric railway company wishes power to make a crossing over another railway, it is in the same position as an ordinary railway, and must make application to the Railway Committee of the Privy Council.

Heavy Duty Engine for Electric Railway Service.

The extremely varying load which a steam engine in an electric railway power station is so often called upon to carry, calls for the fulfillment of special conditions, prominent among which are great strength and prompt acting of the governing mechanism. It was through lack of one or both of these essential points that some of the engines in the early installed stations have showed themselves unfit for the task assigned them.

In the accompanying illustration is shown an engine recently brought out by the Ball Engine Co., of Erie, Pa., especially for electric railway service. It will be seen that this engine is, for its cylinder capacity, of great strength and weight, the makers claiming that the engines they build are, for the horse power, the heaviest engines made. The connecting rod and crank shaft are of forged steel. The crank shaft is eight inches diameter in the crank pin and in the journals. The crank pin boxes are lined with strictly genuine babbit; the crosshead boxes of pure copper and tin. The crosshead pin is of tool steel. The system of oiling the running parts is very simple and thorough. The valve, which has been used by this company with such success in the past in their electric light engines, is continued in the heavy duty engine. This engine has shown in practice perfect regulation under conditions where the variation in load on the generator from zero to the full capacity has occurred during less than five seconds of time. The makers of this engine, working on the theory that the electric railway interests demand a strictly first class engine, are using the very best possible material and workmanship throughout, and claim to give perfect satisfaction.



HEAVY DUTY ENGINE FOR ELECTRIC RAILWAY SERVICE.

Opening of the South Side Elevated Road, Chicago.

The South Side Elevated Railroad in Chicago was opened for regular traffic on June 6; and since that time the company have been giving an excellent service. The business, which was large from the very start, is bound to increase materially as the public appreciates the satisfactory operation of the road. The formal opening of the line took place some days previously, when the company invited, first, a party of gentlemen and subsequently a party of ladies to enjoy a trial trip over the line.

The management has studied carefully the operation of the New York elevated roads which serve in almost all respects as models for the Chicago system. The stations are radically different; so far as completed they are built under the track. They are of brick and terra cotta. The passenger entering the station takes a stairway which divides at the first landing, that on the east side leading to the platform for trains going downtown, and that in the opposite direction to platforms for trains south bound, and were illustrated in February, 1892, issue of the STREET RAILWAY JOURNAL.

The ticket sellers are young women, and one is employed at each station, together with a male ticket collector, who receives tickets in a "chopping" box of the same pattern as those used in New York City.

As an indication of the fact that the New York roads have served as models, it may be stated that the very gong which announces the departure of trains is the same in tone as that used on the Manhattan.

The coaches, which are similar to those in use in New York, have one improvement. The doors are constructed on the double sliding pattern, and when one is pushed back both open. The platforms are wide, and the cars can be emptied in a short time.

The facilities for handling passengers at the downtown terminus are not as good as could be desired. There is an excess of steep stairway and a lack of opportunity for purchasing tickets. There is a lack of provision for separating passengers entering and leaving the platform, and confusion and delay are the result. These are minor criticisms; as a whole the system is admirable.

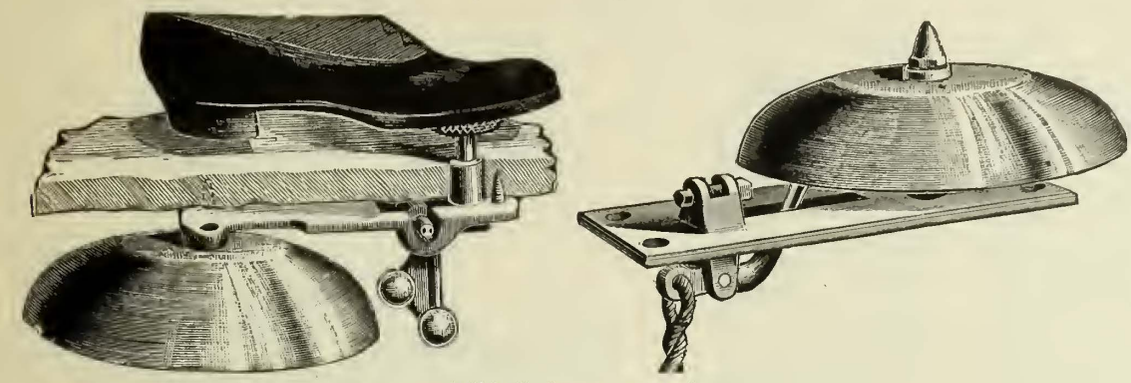
The compound engines made by the Baldwin company are performing satisfactory service. But little complaint is heard on the score of noise or smoke.

The road at present is operated only from Congress Street on the north to Thirty-ninth Street on the south, but eventually it will be extended to the World's Fair grounds at Jackson Park. Work on the extension is now in progress.

It may not be out of place in this connection to review briefly the history of the company. The Chicago & South Side Rapid Transit Co. was organized January 5, 1888. An ordinance for a franchise was introduced in the Council two months later, and after two months' delay was adopted. Efforts were then made to secure funds, and the attempt was at first entirely unsuccessful. A part of the bonds was then sold to a New York syndicate. In January, 1889, the Chicago City Railway Co. issued $500,000 of 4½ per cent. bonds with which it was believed that $500,000 of the bonds of the L company and a part of the stock was purchased. Work was prosecuted for many months, but the company finally exhausted their resources, and a halt on construction was called. At a meeting at the Union League Club, in December last, of local capitalists, sufficient money was pledged to warrant the completion of the road as far as Thirty-ninth Street, and its complete equipment, and work was resumed at once.

Rolled Steel Gongs.

Two new types of gongs for street car use in which the bell is of rolled steel, have recently been brought out by the Pittsburgh Steel Hollow Ware Co., of Pittsburgh, and are illustrated herewith.



ROLLED STEEL GONGS.

The diameter of the gong is eleven inches. As will be seen, both the type for foot use and that adapted to be rung by a cord overhead are simple in arrangement, and having few parts and no springs are not liable to get out of order. The rolled steel is guaranteed not to crack or lose tone in use. The gongs have been adopted by a number of prominent street railways, and are working satisfactorily.

The Fulmen Lightning Arrester.

A new lightning arrester, constructed on the principle of making the arrester consist of a magazine of inexpensive discharge plates, so arranged that upon the destruction of one set another will automatically come into position to receive the lightning discharge, has recently been brought out by C. S. Van Nuis of New York. The apparatus, ready for operation, is shown in Fig. 1. There is a porcelain base with four channels, two to receive the wire terminals, one connected to line and the other to ground. This constitutes the stationary part of the apparatus, and it may be attached to the station wall, car body or cross arm as the protection sought may demand.

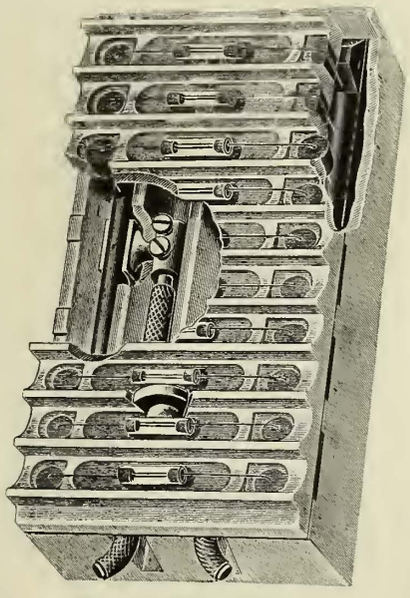


FIG. 1.—FULMEN LIGHTNING ARRESTER.

A corrugated cover of porcelain containing a series of fuse arresters is attached to the base by a simple lug and spring bolt, so that the two are held rigidly together,

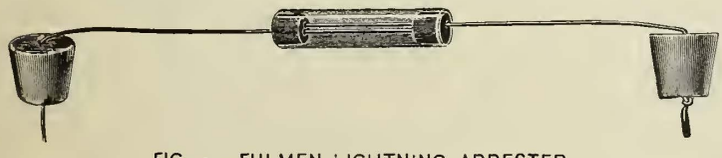


FIG. 2.—FULMEN LIGHTNING ARRESTER.

but can be quickly detached for reloading with new arresters when necessary.

The arrester proper is shown in Fig. 2, and consists of two small brass wires two and a half inches long, their inner ends lapping each other a short distance and separated by a very small space. These form the discharge plates of the arrester and are held in position and kept clean and dry by sealing them into a small glass tube. Two soft rubber plugs serve to attach the arrester to the porcelain cover, by fitting tightly into properly spaced holes, and the outer ends of the wires are so knotted and cut to length that, with the cover in position, they approach but do not touch the carbon rods which form the line and ground terminals. To bring the fuse arrester into operative position, a wedge shaped piece of carbon is brought to rest against each end of the top fuse, at the same time making connections with the carbon rods. In this position the arrester offers a free passage to earth for a lightning discharge, but will not ground the normal current. In operation, the arc caused by the lightning discharge starts a short circuit which immediately consumes the wire and allows the two carbon wedges to drop and adjust themselves to the next arrester. As shown in the cut, there are fuses for ten consecutive discharges, which are considered more than sufficient for one locality during a severe thunder storm. The fuses are replaced with the cover detached, avoiding possibility of a shock from contact with the wires. The destruction of the fuse in circuit is complete, when acted upon by lightning and the dynamo current as described, but the remaining fuses and porcelain pieces remain unharmed, as they are totally fireproof and not in electrical connection.

National Fare Box.

It is predicted that a great many street railway companies operating a small number of motor cars will find it necessary to dispense with conductors and depend upon the fare box as a collector of nickels. A fare box to serve its purpose well must keep its fares after they are deposited, and this claim is made particularly for the improved form made by the National Fare Box Manufacturing Co., Chicago. The box is thoroughly illustrated by the accompanying cuts. The especial feature of the box is that shown in Fig. 1. From the roof of the box hangs an automatic closing door, A, on hinge, B. When the door is pushed back it discloses the opening of spout, C, into which the fare is deposited. At the same time that the swinging door is pushed back, the platform, D, which is attached to the bottom of the swinging door, passes under the lower end of the spout (inside of box), this disclosing the bottom of the spout at the same moment that the top is uncovered, so that when a coin or ticket is dropped into the spout it remains there until the swing door is released and falls back into place, by its own weight, over the mouth of the spout; and at the same moment the platform, being attached to the door, swings from under the spout, and the coin or ticket drops to the first dump or hopper. A gong rings when A is pushed in. The arrangement being such that the top or bottom of the spout is always closed, it is impossible to withdraw any coins.

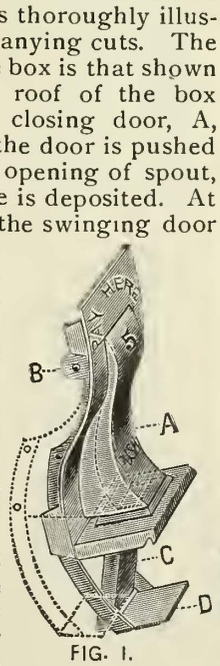


FIG. 1.

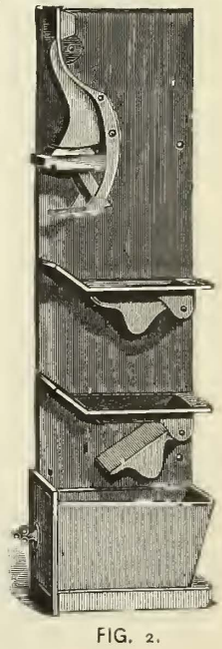


FIG. 2.

There are two drops for fares as, Fig. 2 shows. The fare falls into the upper drop and is turned into the second by the driver, the latter holding all the fares for

the entire trip. The construction is such that when the driver turns the lower drop, the upper one turns also, so no money can be left in the latter.

The cash drawer in the bottom is locked by a Yale lock. The key cannot be taken out of the drawer until it is locked, which will guard against the possibility of a collector leaving it unfastened. By opening this drawer, and removing a screw, the glass and frame in the front part of the box can be taken off, the drops taken out, and the box easily cleaned. The fare box is twenty-two inches in height and six and a half inches wide. Fig. 3 shows the fare box as viewed by the passenger; and Fig. 4, the appearance with top locked, when the car is going in the opposite direction and when the other fare box should be used.

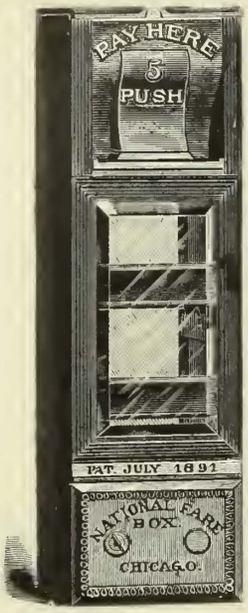


FIG. 3.

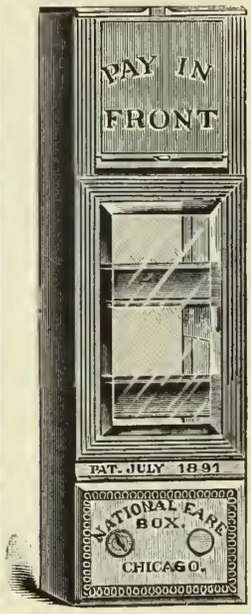
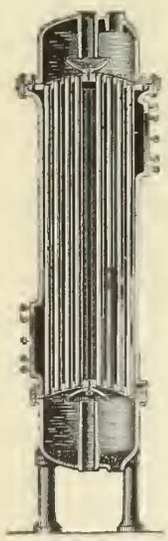


FIG. 4.

An Improved Feed Water Heater.

The Goubert Manufacturing Co., of New York, have introduced an improvement in their feed water heater, consisting of arched or convex tube plates. In this form the plates are strong enough to resist any pressure that can be brought to bear upon them without depending on the tubes as stays. By this improvement the tubes are relieved of all strain at the joint, and absolute security is obtained against the cracking or bulging of the tube plates. Our illustration shows a sectional view of this heater in its improved form.

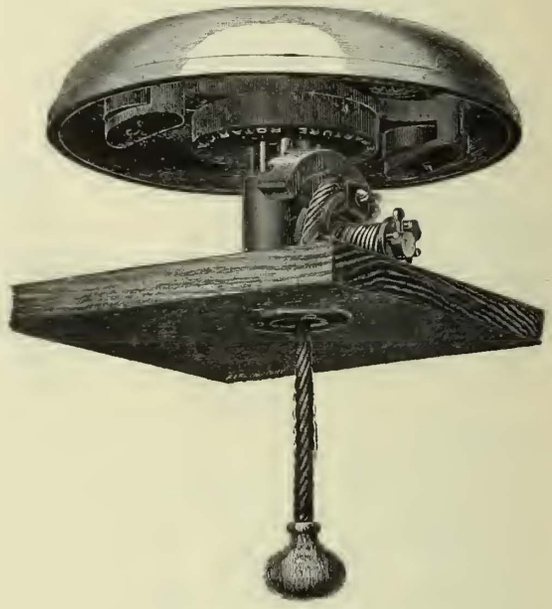

GOUBERT FEED WATER HEATER.

Elevation of Illinois Central Tracks in Chicago.

The Illinois Central Railroad Co. have decided to accept the ordinance of the Chicago City Council requiring them to elevate their tracks from Fifty-first to Sixty-seventh Streets, a distance of about two miles. A vexatious problem to the World's Fair authorities is thus removed. It, perhaps, should be stated for those unfamiliar with the location of the World's Fair grounds at Jackson Park that the tracks of the Illinois Central are at present but a few hundred feet west. If the tracks were not elevated all the carriages, pedestrians and street cars would, of necessity, have to cross the tracks at grade unless viaducts were constructed. During the fair, when trains will be passing almost continually, a crossing at grade would be, of course, out of the question. It has been assumed that eventually the company would be compelled to elevate their tracks, but even if an effort at compulsion had been made when the Fair project had first assumed definite form they might have made a successful resistance for several years; so the World's Fair authorities are congratulating themselves on the removal of an obstacle that menaced the success of the Exposition. This improvement means that the cable cars of the City Railway Co., going to the Fair, will pass under the elevated tracks.

Overhead Car Bell.

An overhead car bell on the same principle as the New Departure Rotary bell has recently been brought out by the New Departure Bell Co. and is for sale by

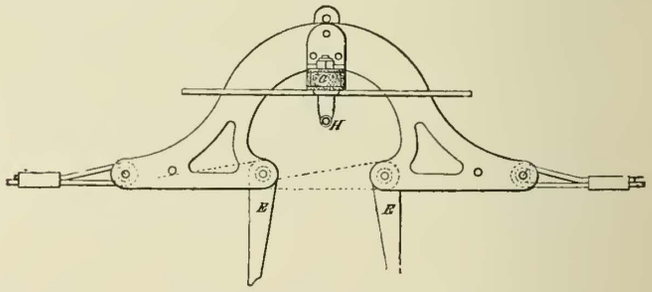

OVERHEAD NINE INCH BELL.

John H. Graham & Co., of New York. An illustration of the device is presented herewith. The diameter of the gong used is nine inches, and it is made of bell metal. The bell is especially adapted for use in places where a foot gong could not be employed. The bell gives the same succession of blows as the standard foot rotary gong.

Insulated Trolley Crossing.

A new type of insulated crossing for intersecting trolley wires has been recently patented by R. M. Jones, of Salt Lake City, the general details of which are shown in the accompanying engraving.

The trolley wire for one road is at H, where it is separated from the rest of the frame by the insulating material shown at C. The rest of the frame forms part of the second railway circuit. A car, using the upper trolley



INSULATED TROLLEY CROSSING.

wire, has uninterrupted access to it, since the arms, E E, are normally held in the position shown, through the force of gravity.

When a car, however, passes the crossing upon the line, of which the frame of the frog forms part of the circuit, one of the arms, E E, bridges the aperture, taking the position shown by the dotted lines.

As the crossing works equally well for cars going in both directions, it is particularly adapted for use at the intersection of single trolley lines belonging to competing companies.

THE Brooklyn City Railway Co. have recently completed the construction of a handsome fireproof building at the corner of Montague and Clinton Streets., which they will occupy for office purposes.

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.

The $350,000 Cable Road and the $46,000 Electric Road.

June 17, 1892.

EDITORS STREET RAILWAY JOURNAL: -

In April, 1891, the Census Office published Bulletin No. 55, entitled "*The Relative Economy of Cable, Electric and Animal Motive Power for Street Railways.*" It fell like seed on prepared soil, tilled by husbandmen with every resource of modern agriculture from the electric plow and cultivator to the arc light, and the crop, forced day and night, has nourished thousands.

The average man wearies of indefiniteness. He finds relief in the unqualified. He accepts thankfully a definite outline for Heaven, and he rejoices in a rule without exceptions.

When the electric man found or thought he had found in Census Bulletin No. 55, that a cable road costs $350,324.60 and an electric road $46,697.59 per mile he was at rest on that point for the time being. There was nothing to do but to spread the glad tidings. He has built cable roads since without number (usually for a business most unfavorable for their financial success) and they have all cost $350,324.60 per mile of line; and their operating expenses have been 14.12 cents per car mile, "or with interest added" just 20.91.

Turning to the source of the information, Census Bulletin No. 55, we find the first cable road mentioned cost $683,846 per mile of line; a figure so far superior to the stereotyped $350,324.60 that I can't help thinking of the exclamation of Clive when he recalled some of the wealth of India he had *not* appropriated: "By God, Mr. Chairman, at this moment I stand astonished at my own moderation."

At the first blush it seems as if the only thing to do with a road that has swallowed 13,676,920 nickels "per mile of line" is to close the slot, stretch the trolley wire, and try to save something out of the wreck. But the last lesson of this case may be that it is a healthy sort of a system that can stand up under such a load. I shall have more to say of this later.

Further investigation reveals the fact that the cost of roads was fixed forever by taking the average of ten cable roads and ten electric roads. They are given below.

The last column in each table, "cost per mile of line" is added by the writer. It may be noted that the figures given for Electric No. 10, a storage battery line, are not used in any of the "averages" of the Bulletin.

Upon what principle the selection of roads was made I know not. The cables range from $159,000 to $684,000 and the electric from $9,000 to $99,000.

On a slight examination of these tables it will be apparent that to draw any useful conclusion from them as to "the relative economy" of cable and electric railways is work for the man who can solve the problem, "Given

A.—CABLE RAILWAYS.

1.—DESCRIPTION AND COST.

No.	DESCRIPTION. LENGTH. Length of Line—Street Length (Miles).	LENGTH. Length of all Tracks, including Sidings (Miles).	STEEPEST GRADE. Per Cent.	STEEPEST GRADE. Length in Feet.	NUMBER OF CARS. Grip.	NUMBER OF CARS. Trail.	NUMBER OF CARS. Average Total Used at Once.	Indicated Horse Power of Engines.	Total Cost of Road and Equipment.	Cost per Mile of Line.
Total,	75.22	142.92	.....	.....	601	832	583	13,300	$26,351,416.62	
1	8.50	17.00	10.00	1,300	116	380	118	1,450	$5,812,693.77	683,846
2	5.75	11.50	10.40	412	65	76	50	500	1,467,000.00	255,111
3	5.50	11.00	70.00	500	46	10	32	1,175	2,628,586.59	477,925
4	3.20	6.40	4.00	2,250	26	47	40	1,500	1,219,615.63	381,130
5	11.69	23.38	13.94	566	76	141	106	3,400	4,028,735.37	344,631
6	10.15	20.40	18.53	1,000	71	119	77	1,300	2,649,735.84	261,058
7	8.86	10.10	80.00	413	58	8	48	425	1,510,495.84	170,485
8	8.57	17.15	4.00	1,600	81	....	36	1,250	2,257,860.34	263,461
9	2.72	5.44	2.15	200	12	....	10	200	433,097.71	159,227
10	10.28	20.55	15.50	150	50	51	66	2,100	4,343,595.53	422,528

B.—ELECTRIC RAILWAYS.

1.—DESCRIPTION AND COST.

No.	DESCRIPTION. LENGTH. Length of Line—Street Length (Miles).	LENGTH. Length of all Tracks, including Sidings (Miles).	STEEPEST GRADE. Per Cent.	STEEPEST GRADE. Length in Feet.	NUMBER OF CARS. Motor.	NUMBER OF CARS. Tow.	NUMBER OF CARS. Average Total Used at Once.	Indicated Horse Power of Engines.	Total Cost of Road and Equipment.	Cost per Mile of Line.
Total,	55.56	67.22	.....	.....	118	34	78	2,370	$2,426,285.12	
1	11.71	16.35	12.50	7,920	47	..	32	1,050	1,156,354.28	98,749
2	4.11	7.54	5.20	475	12	15	9	125	266,730.10	64,898
3	5.00	5.22	6.50	1,200	12	4	6	80	125,801.27	25,160
4	10.00	12.13	8.00	800	21	6	14	450	382,600.00	38,260
5	6.00	6.36	6.00	500	7	4	4	300	115,694.20	19,282
6	3.00	3.26	7.50	300	4	..	3	100	95,225.16	31,742
7	4.25	4.50	4.00	500	6	..	5	80	73,000.00	17,176
8	2.80	2.80	6.50	250	3	2	2	....	106,407.15	38,003
9	4.25	4.50	3.00	300	4	3	2	150	65,368.44	15,381
01	4.44	4.56	7.00	300	2	..	1	35	39,104.52	8,807

the captain's name and the year of our Lord, to find the longitude of the ship."

The writer has a decent respect for "averages." He knows the statistics of the last twenty years afford a fountion for an estimate on the fires, murders, and gasoline stove explosions, for the next five. But everybody who has used averages, not like a machine, but for some real purpose and with some interest of his own at stake, is alive to the fact that from the fires of the 1st, 11th and 13th of last month we cannot guess whether next Wednesday will bring burnt window curtains or Chicago in ashes.

If the tables had included every road built to date would they show the relative cost of the average cable road and the average electric road? Yes; just as statistics now available show the relative cost of the average boat built on the Clyde and the average boat built along the Erie Canal.

Would they throw any light on the necessary investment under each system to handle a certain business? Without the application of considerable intelligence to the study of details, no. Can you substitute a $46,000 electric road for a $350,000 cable? Can you substitute for the average Clyde built steamer the much cheaper boat of the Erie Canal? *That is the impression persistently cultivated for the last fifteen months by the street railway papers, the engineering papers and the monthly magazines.*

We find on inspection that the $46,000 electric road consists of one mile of single track (certainly unpaved), plus one-quarter mile of side track, with 2.93 cars, all told, making 177 car miles per day. This is a car each way every twelve or fourteen minutes. Little confidence will be placed in these figures by those familiar with the carelessness, the incomprehensibleness of returns made on blanks sent out for such information as is embalmed in these tables. But that this is closely the $46,000 worth of electric road can be verified by the papers and books of writers on the electric railway.

The cable roads appear to have nineteen cars to the mile and to make 847 car miles per day. Again I say the figures of the Bulletin are of little worth. No distinction is suggested between four wheel and eight wheel cars. Of the latter, road No. 8 has eighty-one, No. 9 probably twelve, No. 4 a large number, No. 1 a large number, and so on. I have little doubt that, reduced to equivalent numbers of "standard cars" and miles, we shall find the cable figures at least twenty-one cars and 1,000 car miles per mile of line per day, or a car each way every two and a quarter minutes.

Now, the nine electric roads averaged in the table have 62.66 miles of track. If we consider this as 31.33 miles of double track, for the purpose of closer comparison with the cable road, the $46,000 swells at once to $76,170. If we leave them otherwise as they stand and add three-quarters of a mile of (cheap) second track and pave them like the cable roads the $46,000 becomes easily $76,000. If we add fifteen or eighteen cars to the three, an added investment of $150,000 per mile is necessary; not for cars alone, but for the cars and what is necessary to run them. We are now beginning to fit up the canal boat for the business of the other boat.

If we add a horse railroad absorbed, what kind of a figure does that cut in "cost of road and equipment?" A

A.—CABLE RAILWAYS.

2.—STATISTICS OF OPERATION.

No.	Length of Time Covered by Operating Statistics (Months).	Car Mileage.	Number of Passengers Carried.		Operating Expenses.		
			Total.	Per Mile Operated.	Total.	Per Car Mile (Cents).	Per Passenger Carried (Cents).
Total.....	..	23,272,654	101,995,695	1,355,965	$3,286,461.64	14.12	3.22
1	12	6,290,172	36,218,807	4,261,036	$1,063,834.59	16.91	2.94
2	12	1,653,303	10,030,491	1,744.433	355,415.13	21.50	3.54
3	12	1,413,280	8,229,809	1,496,329	200,093.65	14.16	2.43
4	12	1,404,000	4,607,587	1,439.871	145,299.39	10.35	3.15
5	12	4,698,120	12,662,044	1,083,152	441,151.59	9.39	3.48
6	12	3,355,435	9,505,979	936,550	344,229.99	10.26	3.62
7	12	1,244,750	8,113,655	915,762	272,721.43	21.91	3.36
8	12	1,595,650	6,781,683	791,328	225,069.39	14.11	3.32
9	12	310,331	1,346,820	495,154	57,697.94	18.59	4.28
10	12	1,307,613	4,498,820	437,628	180,948.54	13.84	4.02

B.—ELECTRIC RAILWAYS.

2.—STATISTICS OF OPERATION.

No.	Length of Time Covered by Operating Statistics.		Car Mileage.	Number of Passengers Carried.			Operating Expenses.		
				Total.	Per Mile Operated.		Total.	Per Car Mile (Cents).	Per Passenger Carried (Cents).
	Mos.	Days.			For Period Covered.	Per Year.			
Total.	..	..	2,442,106	8,031,214	.....	222,648	$326,961.26	13.21	3.82
1	6	..	702,720	2,752,382	235,045	470,090	$95,109.48	13.53	3.46
2	9	23	317,656	826,756	201,157	248,047	31,030.30	9.77	3.75
3	12	..	257,793	1,041,978	208,396	208,396	28,531.04	11.07	2.74
4	12	..	634,000	1,680,000	168,000	168,000	94,700.00	14.94	5.64
5	6	..	92,400	465,713	77,619	155,238	12,640.57	13.68	2.71
6	12	..	85,668	323,244	107,748	107,748	19,694.47	22.99	6.09
7	12	..	186,400	400,000	94,118	94,118	15,550.00	8.34	3.89
8	12	..	71,375	221,415	79,077	79,077	10,114.76	14.17	4.57
9	12	..	74,340	259,509	61,061	61,061	12,470.87	16.78	4.81
10	11	..	19,754	60,217	13,562	14,795	7,119.77	36.04	11.82

few horse railroads from "Poor's Manual of Street Railways, 1891," will show how they *may* figure:

HORSE RAILROADS.

NO.	ROAD.	"COST OF ROAD AND EQUIPMENT" PER MILE OF LINE.
1	Binghamton & Pt. Dickinson	$5,167.
2	Babylon, N. Y.	7,547.
3	Atlantic Ave., Brooklyn	185,720.
4	Brooklyn City & Newtown	192,787.
5	Rochester Ry. (Not Rochester Electric)	206,527.
6	Dry Dock & East Broadway	284,985.
7	Central Park, North & East River	290,122.
8	Broadway & Seventh Avenue	515,609.

When the electric road begins to absorb horse railroads "costing" perhaps $185,000 to $500,000 per mile, and when tunnels, bridges and viaducts come in, as already they do in some of the ten cable roads selected for Census Bulletin No. 55, the $46,000 electric road will cease to be "standard" even on paper.

Turning to Operating Expenses of the twenty roads we find the tables A2 and B2 opposite.

Any general manager of a cable road reading this statement of cable railway operating expenses must congratulate himself.

The writer has studied the subject and he does not happen to know of a road whose "operating expenses," exclusive only of interest on bonds, come up to ten cents per "standard car" mile, unless it be the solitary instance of one of the Los Angeles roads; but he does know of cable roads operating at from 9.5 cents down to 6.4 cents with four wheel cars.

To examine a few of these cases in detail: No. 4 operated both eight wheel and four wheel cars. Its 10.35 cents would probably reduce to less than 9.5 cents per "standard car" mile. No. 5 has four wheel cars; its operating expenses are given 9.39 cents, but the company's annual report for 1891 gives 8.50 cents. No. 8 has eight wheel cars only. It operating expenses are given as 14.11 cents. In the company's annual report for 1891, the figure is 13.70 cents per *combination car mile*, which is equivalent to 6.85 cents per "standard car" mile.

Turning to the electric roads: No. 1 gives its operating expenses as 13.53 cents. This is an instructive case. The operating expenses of this road were given in the STREET RAILWAY JOURNAL *Souvenir*, October, 1891, as follows, "based on the experience of the last six months of 1890":

Conductors and motormen	6.80
Motor and electric repairs	1.68
Mechanical repairs	1.14
Motive power	1.54
Overhead system	.45
Maintenance of way	1.08
General expenses	.88
Stables	.46
Officers' salaries	.84
Interest	2.71
Tolls	.25
General labor	2.43
	20.26

and the report continues in the words of the president of the road, "*separating the above into strictly operating expenses and fixed charges, we have operating expense* 12.74 *cents per mile*," *etc.*

Now I detect nothing in this 20.26 not properly included in operating expenses but "Interest 2.71"; and I would like to see the process by which that 20.26 is boiled down to 12.74. This report is copied in full in *The Electric Railway* without correction or comment. The same company's operating expenses are given in the STREET RAILWAY JOURNAL March, 1892, for the year 1891, as "22.35 cents per mile or, excluding interest, 19.79 cents." It seems probable that at the time the report was turned in to the Census Office as 13.53 cents this company had not yet learned what "operating expenses" means.

A recent work on the electric railway says: "At the time of the Buffalo convention our managers and superintendents made statements concerning their operating expenses which actually staggered one another. One would state that on his line operation cost so much per mile; another would state that it cost his company a different sum per mile. The first had included, perhaps, the repair of cars with the wages of motormen and conductors, while the second might have omitted repairs of cars and included the cost of operating the power house, with or without the cost of repairs on the dynamos. There was and is now no way in which a comparison can be made between the costs of operating our various street railways. * * *" (Note, that they "staggered one another," and consider what the effect must be on men unaccustomed to taking 500 volts with a smile and "It never touched me!")

A writer in the *Street Railway Gazette*, April 23, 1892, says: "It should be stated that these estimates * * * include the cost of the car drivers, which is a very considerable amount, and is not infrequently omitted in estimates of cost of traction."

In a pamphlet on a certain new motor I find,

"ESTIMATED COST OF OPERATING, INCLUDING INTEREST ON INVESTMENT AT 6 PER CENT.

Cable system	8.9	cents	per	car	mile.
Horse "	9.8	"	"	"	"
[Our] "	2.7	"	"	"	"

Remarkable as our figures may seem we still think they can be greatly reduced." It is fair to say of this case that the cost per car mile was merely estimated, as it was found on trial impossible to make a whole car mile by the system. But what *this* writer understood by operating expenses, we can only guess.

With the exception, possibly, of "Rent of Leased Roads," of all the items on which the question arises I would omit from operating expenses only "Interest on Bonds" Such interest should be considered apart because it is a large item with a most indefinite relation to cost of road or cost of operating. But the West End road omits "Taxes;" and in a long list of reported electric expenses, I miss both "Taxes" and "Car Licenses;" and whether "Miscellaneous Expenses" does not cover a multitude of sins of omission, it is hard to guess, but we have seen on high authority what the possibilities are. Will any man be satisfied with comparison of things so indefinite?

Next we note that the price of coal and rates of wages are ignored by nearly every electric writer.

COST OF COAL AT A FEW PLACES.

Scranton, Pa. (culm coal)	.10	per	ton.
Pittsburgh, Pa. (slack alone)	.65	"	"
Allegheny, Pa. (nut and slack)	.95	"	"
Cleveland	1.25	"	"
Denver	2.10	"	"
Richmond	3.00	"	"
Providence	4.25	"	"
San Diego	7.92	"	"
San Francisco	8.50	"	"
Los Angeles	10.50	"	"

These are specimens. From ten cents to 100 times ten cents.

On the lines of a certain company operating both cable and electric cars I find the coal burned, per 1,000 passengers, 600 lbs. for the cable to 2,200 lbs. for the electric. But if the former had the $8.50 coal of San Francisco and the latter the $1.25 coal of Cleveland, the electric exhibit would be very respectable.

Wages on cable roads are, speaking generally, from 33 per cent. to 50 per cent. higher than on the electric; for the reason that the cables are in large cities and the electric in the small towns and country.

On nine electric roads I find the average wages:

Engineers	26	cents.
Mechanics	21	"
Conductors and motormen	16	"
Labor	13	"

and nearly 70 per cent. of all expenses wages.

Sticking to conductors and motormen, in November, 1891, we find at Terre Haute, Ind., conductors striking for an advance on 11 cents and motormen tired of 12.5 cents. On another electric road I find conductors and motormen rated at 9 to 11 cents. On another:

Motormen	$25.00 per month
Conductors	37.50 " "

There is hardly a cable road paying gripmen less than 20 cents and some of them pay 22½ to 25 cents per hour for both conductors and gripmen.

It is easy to see how idle a comparison must be which neglects cost of coal and rates of wages. The mere variation in the last item may count for three or four cents per car mile in favor of the suburban electric against the Metropolitan cable road.

Having thus merely pulled up a few weeds, I defer further cultivation of the field. I intend to show, among other things, that for the small business now done by the cheap, half built electric road with its occasional car, the cable system cannot compete; that for a cable railway business the cost of a cable road is not ten times, or five times, or two times, or one and a half times the cost of an electric road; that in such a business the saving of $1 in interest may mean the losing of $5 or $15 in net revenue. And when I get through perhaps we shall not so often find in papers that ought to know better, the $350,000 cable road versus the $46,000 electric.

CABLE RAILWAYS.

(To be continued.)

Handsome Cars.

We recently addressed the accompanying letter to the managers of a few street railway companies. Some of the replies follow, and will be found of great interest as bearing upon this subject.

NEW YORK, May 20, 1892.

DEAR SIR:—We should be pleased to have you give us for publication in the STREET RAILWAY JOURNAL your opinion of the relative merits of highly finished, handsome street cars, as traffic promoters, in comparison with the ordinary plainly finished cars.

We would like to have you give any points relating to the subject that are the outcome of your experience or observation. Very truly yours,

STREET RAILWAY JOURNAL.

OFFICE OF
THE TWENTY-THIRD STREET RAILWAY CO.,
621 West 23d Street.
NEW YORK, June 1, 1892.

EDITORS STREET RAILWAY JOURNAL:—

Replying to your favor of May 21: As a result of my experience and observation, I have no hesitation in stating that in my judgment, handsomely finished street cars tend to promote traffic. The most popular lines are those equipped with handsome cars, neatly uniformed conductors, good horses, harness, etc. Very truly yours,

THOS. H. MCLEAN, General Manager.

MINNEAPOLIS STREET RAILWAY CO.
MINNEAPOLIS, MINN. May 25, 1892.

EDITORS STREET RAILWAY JOURNAL:—

Your letter with reference to cars received. There can be no question but what large, nicely furnished cars will greatly increase the traffic on any road. We have noticed this very perceptibly when we have increased the size of our cars. We have always had our cars finished in the very best manner, and we think it a good business policy for any road to adopt. Very truly yours,

C. G. GOODRICH, Vice-president.

WEST CHICAGO STREET RAILROAD CO.,
89 West Washington Street,
CHICAGO, May 23, 1892.

EDITORS STREET RAILWAY JOURNAL:—

Answering your favor of the 21st concerning highly finished cars, I do not believe that such cars as I understand by your inquiry to be meant, give any additional travel. I do, however, believe that street cars should be made plain and comfortable and always kept clean.

My experience with a handsome street car is that people do not pay much attention to it; but if handsome or plain, a dirty car attracts their attention very quickly.

In my judgment a plain, clean and comfortable car is the best adapted for street railway purposes.

Respectfully, etc., JNO. B. PARSONS,
Vice-president and General Manager.

OMAHA STREET RAILWAY CO.
OMAHA, NEB., May 30, 1882.

EDITORS STREET RAILWAY JOURNAL:—

Replying to your inquiry of 21st inst. relative to the merits of "highly finished, handsome street cars as traffic promoters:"

Nearly all street railway managers, so far as my observation goes, have settled on a strong, durable, light weight car, elegance in fittings being a secondary consideration. In practical street railway parlance all men are equal. The artisan with his tools has the same consideration as the rich, and to my mind, based somewhat on our own experience, the cars with what would be called a "handsome make up" draw very little, if any, better than the plainer ones, besides requiring a larger repair account. We have always believed in a thoroughly good car, kept in the best repair possible, with a reasonable degree of elegance. Respectfully,

W. A. SMITH, General Manager.

THE
MILWAUKEE STREET RAILWAY CO.
MILWAUKEE CITY DIVISION.
209 West Water Street.
MILWAUKEE, June 2, 1892.

EDITORS STREET RAILWAY JOURNAL:—

When I first came to this city from New York, some four years ago we had very old fashioned horse and mule cars, and you can well imagine how odd they looked to me. Our business was comparatively small (so were the cars), but now we have our lines almost completed with electricity and have the finest cars that can be built. First we ordered sample cars from all the best makers from the East and West, and together with handsome new cars, fifty in number, made by the Brownell Car Co., of St. Louis, Mo., and now in operation, the road presents a very handsome appearance; the cars being handsomely upholstered and lighted by handsome clusters of electric lights, and our business has improved greatly. I am of opinion that if you have highly finished, handsome cars and everything looks inviting and you are giving the public good rapid service, you will do all the business you can take care of. This has been my experience out this way. I came out here from New York to improve the service, and I have labored hard to bring it up, and I think (not to be conceited) that I have accomplished something. People out this way are riding who never patronized a mule or horse car. Give the people good, clean cars, nicely finished (with rapid transit) and every one will want to ride. Very truly,

GEORGE W. HOMMELL, Manager.

Plain vs. Contracting Chill, for Making Cast Iron Wheels.

The report of the committee of the Master Car Builders' Association on cast iron wheels, which was presented to that body on its recent session in Saratoga, is of considerable interest to street railway men.

To the questions sent out by the committee in a circular letter, answers were received from sixteen railways and thirteen wheel makers. Among the questions and answers of most importance were the following:

"Do you use what is known as the "contracting chill" in the manufacture of cast iron car wheels, and if so, what percentage of your product is made in such chills, and whose design of contracting chill do you use?"

Of the sixteen railways, eleven use the contracting chill, two the plain chill and three did not reply. Of those using the contracting chill, one uses the Canda, one the Whitney and nine the Barr. Of the thirteen wheelmakers, five are using or arranging to use the Barr chill, one the Whitney, one the non-expansive chill and

five the plain chill. This gives a total, of both railways and wheelmakers, of fourteen using the Barr chill, two the Whitney, one the Canda, one the non-expansive and seven the plain chill.

"Do your foundry or service records show that there is any advantage in using the contracting chill which is not had with the older form of fixed chills, either in percentage of loss, or uniformity and quality of product?"

Those using the contracting chill and its products agree (with one exception) that foundry loss is decreased. Some place it is as high as 50 per cent. The one exception is a road that was noted for its success with cast iron wheels before the introduction of contracting chills. It is of the opinion of the committee that the evidence at hand goes to prove an advantage in this respect. As regards uniformity and quality of product, nothing can be said by the committee.

Do you grind or balance wheels before you ship them to the purchaser, or before you put them in service?

Of the twenty-nine who answered the letter, seventeen grind all or a part of their wheels, four neither grind nor balance, and eight did not reply. The committee regrets that this question was not more generally and fully answered, as upon it, in their opinion, exists about the only difference of any importance between the advocates of the contracting chill and the plain.

What do you consider the proper depth and distribution of the chill on wheel?

It appears from the replies to be generally considered that a model wheel should have a five-eighths inch chill. The practice varies, however, from three-eighths to one-eighth inch on the tread, and from one-fourth to three-fourths inch in the throat.

The Paper on the Gearless Motor Before the Chicago Electric Club.

Some misconception has been occasioned by an engraver's error in the published account in our May issue of Professor Short's paper on the gearless motor read this spring before the Chicago Electric Club. The error referred to was in the block before we received it and occurred in numbering the ordinates of the curve on page 314, Fig. 7, giving the horizontal effort and speed. As the curve appeared in the printed article the ordinates numbered were 500, 1,000, 1,500, etc. As they appeared on the blue prints distributed by Prof. Short while reading his paper they were numbered 50, 100, 150. It is not surprising that the curve as it appeared in print occasioned comment, as according to it the motor was rated at ten times its proper capacity. As the cut was sent us by the Secretary of the Chicago Electric Club, we considered ourselves justified in assuming it correct.

Street Railway News.

General.

Asbury Park, N. J.—The charter of the electric street railway company allows them to run cars on Sunday. This the company have recently commenced to do, and all the ministers living there have signed a remonstrance against Sunday cars, and some of the people opposed to work on Sunday have threatened to appeal to the State authorities.

Baltimore, Md.—The City Passenger Railway Co. have purchased a location for the North End power house for the Blue Line cable.

A DEED has been recorded conveying to the Baltimore Traction Co. all the property, rights and franchises of the North Baltimore Passenger Railway Co. and the Baltimore & Pohawtan Railway Co. The Traction company purchased all the shares of capital stock of the North Baltimore Co. some time ago, and secured a legal title to the property by the deed.

Beatrice, Neb.—The Beatrice Rapid Transit & Power Co. lately secured an extension of the contract for the purchase of the old company's interests. The extension also carries with it the right to proceed with the equipment of the old line for electric service.

Brooklyn, N. Y.—The new steam branch of the Brooklyn City Railroad running from Ridgewood to Richmond Hill, on Myrtle Avenue, has been formally opened. The new electric line on Hamilton Avenue is also running very successfully.

Chicago, Ill.—Alderman Sexton recently introduced in the Council an ordinance changing the name of the Chicago & Evanston Electric Railway Co. to the Chicago North Shore Street Railway Co., and amending the ordinance so as to permit the company to place a double track on Evanston Avenue and Clark Street.

THE first fatality on the South Side Elevated Road occurred June 19, when Leroy Barker, a fireman on Engine 4, was struck by his locomotive and killed.

Colorado Springs, Colo.—The rapid transit company have received five of the six new cars ordered from the Pullman Palace Car Co.

Fishkill, N. Y.—Work on the Citizens Street Railway Co.'s line has been commenced by the contractor.

Harrisburg, Pa.—Judge Simon, June 4, granted the city an injunction restraining the Harrisburg Street Railway Co. from changing their motive power from horses to electricity.

Lancaster, Pa.—The Lancaster & Lititz Electric Railway Co. have decided to start at once to build their road.

Lebanon, Pa.—On the Lebanon & Annville Street Railway the total number of passengers carried during May was 72,811, over 6,500 of whom were carried on Memorial Day. This is an increase over April of nearly 15,000, or about 400 per day.

Lowell, Mass.—The new power station for the Lowell & Suburban Street Railway Co. will have a capacity of 2,000 H. P. Its equipment is to consist of six Thomson-Houston generators. Three Cooper-Corliss cross compound engines will furnish motive power at the station. The entire work is being done by the Thomson-Houston Electric Co. of Lynn, under the direction of C. W. White,

Memphis, Tenn.—The injunction suit of the Citizens' Street Railway Co. against the Raleigh Springs Railway Co., which was appealed to the United States circuit court was recently decided by Judge Jackson at Nashville. He refused to grant the injunction, but requires the Raleigh Springs company to give bond in the sum of $10,000 to cover the amouut of any damage that may be done by the company in building its road over the street in controversy.

Mineral Ridge, O.—The contract to build the street railway from Mineral Ridge to Niles has been let to the Thomson-Houston Electric Co. The road is to be in running order by the 15th of September.

Newark, N. J.—The Newark & South Orange Street Railway Co., purchased by a Newark syndicate recently, are commencing the re-equipment of their road. The Field Engineering Co. have been appointed their engineers in charge of construction, and the contract for motors and generators has been awarded to the Westinghouse Electric & Manufacturing Co., car bodies to the John Stephenson Co., trucks to J. G. Brill Co., engines and boilers to local manufacturers, poles to Syracuse Tube Co. The road will be equipped with about forty cars and the station will have 1,000 H. P. capacity. Everything is being done by the company to make their equipment a model one in every respect, and a private car, which is to be named after Judge Krueger, will be one of the features.

New Britain, Conn.—Dolan Brothers, managers of the Tramway Co, have bought the entire stock of the company and are now sole owners.

New Orleans, La.—Notice has been published that on September 6 the extension of the franchises for twenty-five years, now owned by the Crescent City Railroad Co., will be sold at public auction to the highest bidder.

Norfolk, Va.—A. D. Field of the Lewis & Fowler Co. has returned to Brooklyn after the completion of the construction of a section of track for the Norfolk City Railway Co. The Company are well satisfied with their new rails, and the way they are laid.

Plainfield, N. J.—The Plainfield Street Railway Co. are rapidly completing their line, and by August 1 electric cars will be running through all the principal streets. The promoters will extend the line into the suburbs. North Plainfield has petitioned to have the road extended into its streets, and this will be done.

Pittsburgh, Pa.—The Thomson-Houston Electric Co., of Pittsburgh have taken a ninety day's option on the two Mt. Pleasant electric street railways. The prospects are now very bright for an electric road to be built in the near future.

Red Bank, N. J.—The Red Bank & Seabright Street Railway Co. who proposed to build a surface road between Red Bank and Seabright before summer, have abandoned the enterprise. A number of residents of Red Bank, Fairhaven and Oceanic, through which towns the road was to run, opposed the movement.

St. Louis, Mo.—In a recent copy of the St. Louis *Globe-Democrat* there was an item on the saving of a child's life in that city, on June 1, by one of the cable street car fenders manufactured by the Brownell Car Co. These fenders are in use on all the cars manufactured by the Brownell Car Co., St. Louis and elsewhere, and have been instrumental in protecting in many cases against accident and loss of life.

Saginaw, Mich.—The street railway company here charge four cents for regular tickets, carry mail carriers for two and a half cents, firemen for one cent and policemen free. They also sell labor tickets for two and a half cents.

Sandusky, O.—A new 100 H. P. generator was recently placed in position at the power house for the Sandusky Street Railway Co.

Saratoga Springs, N. Y.—A suit of the village of Saratoga Springs against the Union Electric Railway Co., brought to test the legality of the franchise of that company, will be tried at Ballston Spa next October.

Scottdale, Pa.—Eastern capitalists want to purchase the charter and rights of the Scottdale, Everson & Broadford Street Railway. The road will be built.

Tallahassee, Fla.—R. L. Bennett, president of the Tallahassee Street Railway Co. is arranging to construct a belt line around Tallahassee, with dummy service both ways.

Wheeling, W. Va.—A majority of the shares of the Wheeling and the Citizens' railway companies was sold last month to capitalists from Cincinnati and Cleveland. The purchasers known in the transaction are W. R. Kimball of the Thomson-Houston Electric Co. of Cincinnati; W. W. Hazzard and James McClymondo of Cleveland, and A. M. Jolly and A. R. Lyda of Beaver Falls. The presidents elected at the following meeting were: Wheeling Railroad Co., W. R. Kimball; Citizens' Railway Co., John J. Jacob.

Winnipeg, Man.—The construction of the electric street railway has been commenced. It is to be finished by the end of July.

Worcester, Mass.—Pierce Bros. of Leominster have been awarded the contract for the electric supplies for the road from Worcester to Millbury.

Extensions and Improvements.

Albany, N. Y.—The Albany Railway Co. want permission to lay tracks down Clinton Avenue, from North Pearl Street to Broadway, to make connection between the two lines.

Anderson, Ind.—The Anderson Electric Street Railway Co. have applied for a twenty years' franchise. The company now hold an eight year franchise, but promise, if a twenty year franchise is granted, to extend the electric line all over the city where horse cars are now run.

Ashland, Wis.—The Ashland Lighting Co. and the Ashland Street Railway Co. have consolidated. The purpose is to change the motive power of the street car line to electricity.

Beverly, Mass.—It is quite probable that the Beverly & Danvers Street Railway will soon be put in operation and fitted with a new system of electric cars.

Binghamton, N. Y.—The Binghamton & Port Dickinson Railroad Co. have received permission to run their road through the the city of Binghamton, towns of Union and Dickinson with electricity.

Camden, N. J.—The Camden Horse Railroad Co. will extend their line a distance of three miles and will add eight electric cars during the coming year.

Chester, Pa.—The Union Railway Co. will extend their line fifteen miles, and will add twelve motor cars soon.

Chattanooga, Tenn.—The Chattanooga electric railway will add ten miles of electric road and five cars during 1892.

Chicago, Ill.—A petition and ordinance was lately presented in Council granting to the West Chicago Street Railway Co. right to lay tracks along Crawford Avenue between North and Grand Avenues.

THE Jefferson & Urban Rapid Transit Co. desire an extension of their franchise. The line now runs on Kedzie Avenue to Maplewood, and they desire to go a mile and a half farther north to strike Avondale.

THE Alley "L" company are considering an extension of the line to Englewood, in response to a demand of the citizens of that place.

Columbus, Ga.—The North Highland Railway Co. contemplate the extension of their line three miles during the next few months, and will install six electric cars.

Concord, N. H.—The Concord Street Railroad Co. have purchased land for a new park in the vicinity of Penacook, to which the electric road will be extended.

Covington, Ky.—The South Covington & Cincinnati Street Railway Co. expect to add from forty to fifty new cars and from ten to twelve miles of electric road during the coming season.

Dayton, O.—The Oakwood Street Railway Co. will probably extend their horse line half a mile soon.

THE Wayne & Fifth Street Railway Co. are relaying part of their line with a sixty-five to seventy pound Johnson girder rail.

Decatur, Ill.—The City Electric Railway Co. will build one mile of electric road during 1892.

Duluth, Minn.—The Duluth Street Railway Co. propose to build sixteen miles of electric road during 1892, and will add about the same number of electric cars.

Durham, N. C.—The Durham Street Railway Co. contemplate changing from horse to steam dummy power, laying a heavier rail and extending their track two miles.

Erie, Pa.—The Erie Motor Co. have purchased a site for a new car house to cost $6,000. It will be 80 × 100 ft. and will have a capacity of fifty cars.

The Erie Electric Motor Co. are extending their lines.

Findlay, O.—The Findlay Street Railway Co. are contemplating the installation of electric power on their horse line.

Fort Wayne, Ind.—In addition to the new power station of the Fort Wayne Electric Street Railway Co., a car house 30 × 150 ft. will be built adjoining, and another building 64 × 150 ft. will be built at the east terminus of the line on Washington Street.

THE Fort Wayne & Belle Isle Street Railway Co. have let contracts for the equipment of the road with the trolley system.

Framingham, Mass.—The Natick & Cochituate Street Railway Co. have applied for permission to extend their tracks into the village of Saxonville in the town of Framingham, where connections will be made with the Framingham Union Street Railway and the Natick Electric Street Railway.

Harrisburgh, Pa.—The East Harrisburgh Passenger Railway Co. will put another 500 H. P. engine in the plant between Steelton and this city. Two 268 H. P. Edison generators will also be substituted for the smaller ones now in use. These additions are due to the extensions being made.

THE ordinance granting the Citizens' Passenger Railway Co. the right of way on certain streets has been passed finally by both branches of Councils.

Hoboken, N. J.—The electric extension of the North Hudson Railway Co. will include about four miles of track and sixteen electric cars. The company are also in the market for a considerable number of horses.

Holyoke, Mass.—The Holyoke Street Railway Co. will extend their line one and a half miles soon and add four cars.

Hutchinson, Kan.—The street railway company are arranging for motor cars, owing to increased business.

Kansas City, Mo.—Arrangements have been made for changing the motive power of the Kansas City & Independence Rapid Transit line to electricity. The Thomson-Houston system will be used.

Lancaster, O.—The Lancaster Street Railway Co. have recently completed their track construction on Broadway, which gives a length of three and three quarters miles. They expect to have this in operation by electric power by September 1.

Lawrence, Mass.—The directors of the Merrimack Valley Street Railway Co. have asked for the right to lay a double line of tracks through Broadway from the corner of Essex Street to the Methuen line, and also through South Broadway to Andover Street.

Leavenworth, Kan.—The Leavenworth & Suburban Railway Co. expect to commence an extension eight miles in length, soon.

Leominster, Mass.—The Fitchburg & Leominster Street Railway Co. have nearly completed four and a half miles of electric road on which they expect to operate eight cars.

Long Island City, N. Y.—Patrick J. Gleason, president of the Long Island City & Newtown Railroad Co. has made application to the Highway Commissioners of the towns of Flushing and Newtown for a franchise for an electric railway.

Manchester, N. H.—At a meeting lately of the directors of the Manchester Street Railway it was decided to build a railway to Lake Massabesic, with electricity as the motive power.

McKeesport, Pa.—Fifty-six electric cars will probably be added soon to the rolling stock of the McKeesport & Reynoldton Passenger Railway Co.

Medford, Mass.—The West End Street Railway Co., of Boston, have applied for electrical railway rights through the town.

THE North Woburn Street Railroad Co. have also applied for right to operate their cars by electricity through the town.

Memphis, Tenn.—The Citizens' Street Railway Co. have applied for permission to lay tracks on Front Street from Court to Poplar.

Milwaukee, Wis.—The Milwaukee Street Railway Co. have decided to give the contract for 200 motor cars to the Pullman Car Co.

Moline, Ill.—President Louderback, of the Davenport & Rock Island Railway Co., has expressed his willingness to extend the Elm Street electric car line eastward to Thirty-eighth Street, there meeting the Moline Central, the city of Rock Island will raise the grade of the bridge on Fourteenth Avenue.

New Haven, Conn.—Hoadley B. Ives has asked permission to double track the Fair Haven & Westville Railroad from Quinnipiac Bridge to the terminus of the road in Fair Haven.

Newark, N. J.—The Newark Passenger Railroad Co. have asked the Clinton Township Committee that they be granted a franchise to build a street railroad on Frelinghuysen Avenue from the Newark City line to that of Elizabeth.

New York, N. Y.—The syndicate of street railways, headed by John T. Crimmins, are making preparations for immediate and costly extensions. They have asked permission to use electric power on part of Ninth and Sixth Avenues. Crosstown lines are proposed at 96th Street, 116 Street and 145th Street. In addition to the lines mentioned, the company will ask for the consent of property owners to the extension of the Avenue C line from Stanton Street along Pitt to Grand, and into and along Gouverneur Street to Madison Street, to connect with the line to the City Hall and Postoffice.

THE Houston Street, West Street & Pavonia Ferry and the Chambers Street & Grand Street Ferry railway companies will lay some new track soon.

Newton, Mass.—The Newton Street Railway will build two and a half miles more of electric road.

Oakland, Cal.—A contest has been waged in the City Council between the Piedmont Cable Co. and the Oakland Consolidated Street Railway Co. for a franchise for the use of Washington Street, south of Eight, for a street railway, which has resulted in favor of the Piedmont company.

IN return the Oakland Consolidated Co. applied to the Supervisors of the county for a franchise for a road from Mather Street and Web-

ster Avenue to the Piedmont Springs. This line will compete with the Piedmont company.

THE Consolidated Piedmont Cable Co. will build five miles of electric road and four miles of cable road during 1892, and will add seven electric cars.

Olean, N. Y.—The Olean Street Railway Co. expect to equip that line with electricity soon.

Paterson, N. J.—The Paterson Electric Railway Co. have asked for permission to extend their railroad on Clay Street from its present terminus at Madison Avenue along to the Erie railroad crossing. The newly organized People's Park Railway Co. want the same location.

Petersburg, Va.—The Petersburg & Asylum railway are changing from horse to electric power, and have adopted the Thomson-Houston system. They expect to have ten cars running by July 1.

Pittsburgh, Pa.—The Allegheny Traction Co. have received the right to make extensions over certain streets on which the Transverse Railway Co. had authority to construct lines.

THE Citizens' Traction Co. have a scheme which will compete with the Pittsburgh, Allegheny & Manchester's Millvale, Etna & Sharpsburg road. The idea is to run a line from Lawrenceville over the Forty-third Street Bridge into Millvale. From there it will go to Etna.

Plymouth, Pa.—Preparations are being made by the Wyoming Valley Traction Co. to extend the electric railroad tracks through to the lower end of the borough.

Providence, R. I.—A large meeting was recently held by the citizens of Lakewood and Pawtuxet, when the question of securing the extension of the electric line across the Pawtuxet Bridge and through the Warwick side of that village and over to Lakewood was discussed.

Richmond, Va.—The Richmond Railway & Electric Co. will extend their Clayton Street line across the new Barton Heights viaduct.

Rochester, N. Y.—The Rochester Electric Railway Co. will add one-half mile of track and four trail cars soon.

San Francisco, Cal.—The Market Street Cable Railway Co. have received permission to make several important extensions.

Sarnia, Ont.—The Sarnia Street Railway Co. are extending their line to Tunnel Station, a distance of two miles, and are installing a forty-five pound T rail.

Savannah, Ga.—The Electric Railway Co. have leased the line of the Savannah & Isle of Hope line, and it will be equipped with electricity or steam to Thunderbolt.

Sherman, Tex.—The Sherman City Railway Co. may extend their line shortly.

Springfield, Ill.—The Bates Machine Co., of Joliet, are building a 450 H. P. engine for the People's Electric Railway Co. It will be in position at the power house by August 10. A foundation for another dynamo is also being laid at the power house.

Springfield, Mass.—A contract for ten new motor equipments has been given by the street railway company to the Thomson-Houston company.

St. Cloud, Minn.—The Thomson-Houston Electric Co. will put in a branch line of electric railway from this city to Sauk Rapids. The project had been given up once on account of lack of support from Sauk Rapids property owners, but they have at last made the concessions asked for.

St. Joseph, Mich.—The St. Joseph & Benton Harbor Electric Railway & Light Co. will build three miles of electric road and increase their rolling stock by six cars during the coming season.

St. Joseph, Mo.—The People's Street Railway Electric Light & Power Co., will add fifteen electric cars soon.

St. Paul, Minn.—It is said that an extension of the street railway will probably be built to Como Park.

THE St. Paul Street Railway Co. propose to add thirty electric cars and seven miles of electric road during the year.

Tampa, Fla.—The Tampa Street Railway & Power Co., a new company, of which J. H. Ahearn, of Tampa, is president and J. R. Rutter, of Philadelphia, vice-president, have come into possession of the street railway. The purchase price was $100,000. They propose to supplant the present system with electricity and build eighteen miles of new road in the city and suburbs.

Terre Haute, Ind.—The Board of County Commissioners have granted the Terre Haute Street Railway Co. the right to construct a street railroad track on certain streets. The company have the right to use either electricity or animal power.

Tonawanda, N. Y.—The Tonawanda Street Railway Co. will build ten miles electric road and add eight electric cars during the coming year.

Topeka, Kan.—The Topeka Railway Co., which is the consolidated company formed by the union of the Topeka City Railway Co. and Topeka Rapid Transit Railroad Co., will change their entire horse car line to electric during 1892.

Troy, N. Y.—The Gilbert Car Manufacturing Co. have just finished five fine excursion cars for the Troy City electric railroad.

Utica, N. Y.—The Utica & Mohawk Street Railway Co. expect to relay one mile during the coming season.

Waterbury, Conn.—The Waterbury Street Railway will be equipped immediately with electric power if necessary rights can be obtained.

Watertown, N. Y.—The Watertown Street Railway expect to purchase eight electric cars.

Webb City, Mo.—The Twin City Street Railway Co., have decided to equip their road with electric power and add several miles of track.

Wilmington, Del.—The Front & Union Street Railway Co. now operated by the Wilmington City Railway Co. will probably be changed to an electric road this season.

New Roads.

Austin, Tex.—A franchise for a street railway, to be operated, presumably, by electricity, has been granted to J. Seyes Haulenbeck.

Bay City, Mich.—At a recent meeting of the Common Council two aldermen stated that a new corporation stood ready to encircle this city with a system of electric railways. This corporation is the West Bay City Electric Railway Co. who will ask permission of the Common Council to use certain streets.

Brooklyn, N. Y.—The Brighton & Bensonhurst Electric Railroad Co. were incorporated recently with a capital of $250,000. This corporation is a reorganization of the Sea Beach & Brighton Railroad Co., which was purchased by Henry W. Slocum, William Marshall, Henry W. Slocum, Jr., and Dennis Sullivan under foreclosure sale.

Canton, O.—A plan is on foot to build an electric railway from this city to Cleveland by the way of Akron, taking in several summer resorts. The line will be some sixty miles in length. It is proposed to have the line in operation before the close of the summer.

Chester, Pa.—There has been chartered the Chester & Darby Electric Railroad Co. of Chester; capital $50,000. Some of the incorporators are Edward Mellor, Philadelphia; Charles H. Warren, Fall River, Mass; Henry C. Davis, New York; Edward A. Colby, Newark, N. J.

Chicago, Ill.—The Chicago & Suburban Rapid Transit Co. have filed articles of incorporation. The incorporators are Irus Coy, James H. Ashby, C. P. Caldwell, M. J. Tearney and George C. Lagear, of this city. It is proposed to build a railroad from Lake Street, near Halsted, south to 130th Street, near Blue Island, with a branch west on Thirty-ninth Street. The capital stock is $5,000,000.

Columbus, O.—An ordinance has granted a twenty-five year franchise to the Columbus & Westerville Railway Co. to build and operate a street railway from here to Westerville.

Columbia, Pa.—The Columbia & Marietta Electric Railway Co. has been incorporated; capital, $50,000. The line will extend from Columbia to Marietta. Directors, Joseph H. Black, Robert T. Ryon, James A. Ryon, Columbia; J. K. Sigfried, George W. Ryon, Pottsville; James Duffy, Marietta.

Covington, Ky.—The new street railway company will build an electric line from Covington to Independence and possibly on to Walton.

Cuyahoga Falls, O.—A company with a $100,000 capital stock has been incorporated under the name of the Cuyahoga Falls & Akron Railway & Power Co. The incorporators are W. J. Price, G. F. Parmelee, G. F. Harris, James Anthony and C. M. Hubbel, who are Chicago and Kansas City capitalists. They announce that the line will be built and in operation August 1.

Defiance, O.—The project of building an electric road from Defiance to Evansport is in favor. D. Coy of this city is interested.

Delaware, O.—A company to construct and operate an electric system has been incorporated. Among the incorporators are J. K. Newcomer, V. T. Hills, J. D. Van Deman and B. W. Brown. The capital will be $60,000.

Denver, Colo.—A franchise has been granted to the South Side Railroad Co. to construct an electric line from the city limits to Fort Logan. John C. Montgomery, James Leonard, Stanberry Sherwood, Frank B. Gibson and Calvin B. Butler are incorporators. The capital is placed at $150,000.

D. F. CARMICHAEL, John A. Thompson, Jerr N. Hill, Edward A. Reser and D. J. Carmichael have organized the Platte Valley Electric Railway Co. for express, freight and passenger traffic between Brighton and Denver.

Duluth, Minn.—The Lakeside Railway Co. have been organized with a capital of $100,000 by Charles H. Graves, Daniel G. Cash and John N. Currie, of Duluth, Minn.; William C. Sargent and George F. Chester of Lakeside.

El Paso, Tex.—J. N. Carnes, of Charleston, W. Va., has petitioned the City Council to grant him and his associates the right to construct a system of electric street railways through the streets of the city, connecting the business portion with the new military post at Fort Bliss.

Harvey, Ill.—The Harvey North Side Street Car Co. have been incorporated, with a capital stock of $30,000, by Joseph C. Bloodgood, John H. De Voe and others.

Hot Springs, Ark.—Articles of incorporation have been filed by the Fountain & Suburban Street Railroad Co., of Hot Springs, with a capital stock of $25,000. The corporators are R. Shurray, C. J. Fraser, W. D. Bell, O. L. Kirkpatrick and W. H. Ammons.

Kingston, N. Y.—The Kingston City Electric Railway Co. have asked consent to construct and operate a surface railroad on the trolley system.

Lancaster, Pa.—At a special meeting lately of the Board of Directors of the Lancaster & Lititz Electric Railway it was decided to begin the work of construction at once.

Liverpool, N. Y.—The question of an electric road between Syracuse and Liverpool is being agitated. Louis T. Hawley, Duncan W. Peck, H. A. Moyer and others are interested in the scheme. The intention is to connect the road with the People's line. If this cannot be done, it is proposed to build an independent line into the city east of the People's line.

Mansfield, O.—The Citizens Electric Railway, Light & Power Co. have been granted an electric railway franchise on certain streets.

Mt. Vernon, O.—A proposition has been submitted to the City Council by Howard Harper, of this city, and John Short, of Columbus, to build an electric railroad on the principal streets of this city. The company propose to construct the line at once, if granted the free right of way for twenty-five years.

New Bern, N. C.—A new company has been incorporated, entitled The New Bern Water, Electric Light & Railway Co., the incorporators are William C. Clarke, of Wakefield, R. I. ; Richard P. Williams, of New Bern ; Frank S. Arnold and Robert S. Fletcher, of Providence. Their capital may not exceed $160,000.

New Kingston, Pa.—The New Kingston Street Railway Co. is incorporated, with a capital of $15,000. The road will extend from Pamassno to New Kingston. Directors are : Samuel E. Moore, Bernard F. Rafferty, James P. Anderson, Howard Childs, Joseph P. Chappean, Pittsburgh.

New York, N. Y.—The scheme to connect the Cortlandt Street Ferry with the Broadway surface road by a line of street cars is practically assured. The necessary consents have been secured, and the necessary legislation enacted, and it is expected that the laying of the tracks will soon begin.

THE Fiftieth Street, Astoria Ferry & Central Park Railroad Co., have applied for a franchise to lay a number of tracks in uptown streets. It is said the company will use storage batteries.

Neenah, Wis.—Articles of incorporation have been filed by the Neenah & Menasha Street Railway Co. The capital is $150,000, and the incorporators are Colonel Garland, of Minneapolis, W. W. Reid, Curtis Reid and Silas Bullard of Menasha. The scheme is to put in an eletcric line from Neenah to Appleton through Menasha.

Newark, N. J.—Articles of incorporation have been filed of the Passaic & Newark Electric Railway Co., with a capital of $100,000.

Newtown, L. I.—The Flushing, Newtown & Long Island City Railroad Co. were incorporated last month to operate a street service from Hunter's Point to Flushing, L. I. The capital stock is $100,000. The directors are D. S. Jones, Frederick N. Smith, H. F. Jones, N. D. Swedley, G. E. Payne, A. N. Rankin, H. L. Davis, John Miller, Charles D. Durkee, S. M. Cord, Charles D. Buckingham, F. W. Scott and H. M. Thomas.

Niles, O.—The City Council has passed an ordinance granting the Trumbull Electric Street Railway Co. a franchise.

Oakland, Cal.—Robert Fitzgerald, J. L. Davie, W. H. Mackinnon and E. L. Fitzgerald have asked for franchises to build and maintain an electric railroad in this city and to Berkeley.

Oskaloosa, Ia.—A franchise has been granted here for an electric street railway.

Painesville, O.—An ordinance lately passed authorizes the Painesville, Fairport & Richmond Street Railway Co. to construct and operate a single track street railroad.

Paterson, N. J.—The People's Park Railway Co. have petitioned the Board of Public Works for permission to construct an electric road through People's Park and part of South Paterson. This company is composed of parties who are directors and officers in the Patterson Central Electric Railway, viz. : President, William Strange ; vice-president, William Pennington ; treasurer, James A. Morrisse, secretary, John R. Beam.

Philadelphia, Pa.—The bill granting permission to the Centennial Passenger Railway Co. to construct a single track railway to connect the Fairmount Avenue, Green Street & Girard Avenue lines of the People's company has been introduced in Councils.

THE Fair Hill Railroad Co. were recently chartered. Capital, $100,000. J. W. Dubarry is president.

Pittsburgh, Pa.—The Penn Street Railroad Co. of Pittsburgh is chartered. It is to be a branch of the Citizens' Traction Co. It will be an electric road about five miles in length. It will connect the boroughs of Brushton and Wilkinsburg with Pittsburgh. The capital stock is $30,000, divided into 600 shares of the value of $50 each. The directors are: James Y. Donnell of Allegheny City, John G. Holmes, H. S. A. Stewart, William B. Holmes and George C. Wilson of Pittsburgh.

THE South Side is to have a new road to the city, and it will connect with the Duquesne Line. It is the Suburban Rapid Transit Railway Co., who are building an extension from the toll gate on Brownsville Avenue down to Eighteenth Street.

Pontiac, Mich.—The Common Council of this city has granted a franchise for a street railway from Pontiac to Timber, Case and Orchard Lakes. The franchise was granted to M. D. Mills and George W. Barbour of Detroit, and John D. Norton, William G. Hinman and Thaddeus A. Smith of this city.

Portland, Ore.—A contract has been awarded to O. Pike & Co. for the construction of the Barnes Heights & Cornell Mountain Railway.

Portsmouth, O.—The City Clerk has issued an official notice that sealed proposals for the construction and operation of a street railroad will be received until July 7.

Salt Lake City, Utah.—Samuel J. Paul and others have asked the Council to grant a street railroad franchise to any reliable person desiring to build and equip a road in the southeastern part of the city.

A PARTY of engineers have been figuring on a street railway line, to start from Capitol Hill and run thence up City Creek Cañon to a point about 500 ft. down to the cañon from the city water works. It is said electricity will be used on the line.

Sharon, Pa.—An electric railway is to be built from Sharon to Sharpsville at a cost of from $60,000 to $80,000.

Shickshinny, Pa.—A charter has been granted for the Shickshinney & Huntington Valley Electric Railway Co. About six miles of road will be constructed running from Shickshinny to the Patterson Grove camp ground.

Wakefield, Mass.—The Wakefield & Stoneham Street Railway Co., which was organized in June, 1889, propose to build their tracks and commence operations this summer. The railway will be about two and a half miles in length. The motive power will probably be electricity. The capital stock is $10,000. The present officers of the company are: President, Charles F. Woodward; secretary, Ezra M. Southward ; treasurer, Daniel G. Walton.

Williamsport, Pa.—A line is projected to Wildwood cemetery by the Citizens' Passenger Railway Co., which was chartered lately. J. Henry Cochran is president of the new company.

A CHARTER has been granted the East End Passenger Railway Co. with a capital of $12,000. The road will be two miles in length and will be operated by electricity. John M. Young is president of the company and Thomas Lundy, John Boyer, John Hadtner and John R. T. Ryan, directors.

Personal.

Mr. J. W. Godfrey, general manager of the New York Insulated Wire Co , was in Chicago recently.

Mr. Antoine Bournonville, with Alfred Moore of Philadelphia, left for Europe on a vacation trip last month.

Mr. Charles E. Newton, secretary of the Jewell Belting Co., of Hartford, Conn., made a short stay in Chicago last month.

Mr. W. H. Delany, formerly connected with the Lewis & Fowler Girder Rail Co., has severed his connection with that company.

Mr. Albert E. Hay, president of the Robinson Machine Co., of Altoona, Pa., was in Chicago recently, making arrangements for opening an office and salesroom in that city.

Mr. W. F. Matteson, formerly with Wm. Hood of Chicago, has accepted a position with the Patton Motor Manufacturing Co., and will look after the equipment built for the Denver & Golden Company.

Mr. Charles T. Yerkes, president of the North and West Side Chicago street railway companies, sailed for Europe last month on the steamer "City of New York." Mr. Yerkes expects to be gone about three months,

Mr. Boyer Parks, at present trackmaster of the Baltimore City Passenger Railway Co., laid the first street railway tracks in Baltimore on May 25, 1859, and has been continuously engaged in track construction and maintenance until the present date. Mr. Parks is hale and hearty, and from every indication is still good for many years of active service.

Mr. John W. Fowler, president of the Lewis & Fowler Manufacturing Co., of Brooklyn, met with an unfortunate accident last month, by being thrown from his carriage while driving, and breaking his leg. Mr. Fowler is now at his summer residence, Northport, L. I., and at the time of going to press was feeling well and recovering as rapidly as possible under the circumstances.

Mr. H. L. Cargill has severed his connection with the Thomson-Houston Electric Co. and has accepted the position of secretary with the Duplex Street Railway Track Co., of New York. When his resignation was tendered, the managers of the Thomson-Houston company expressed regret that Mr. Cargill had decided to leave their service, but united with his former associates and other friends in wishing him all success in his new position.

Mr. Edwin A. Moore, erecting engineer of the Pennsylvania Iron Works Co. who will have full charge of the erection of all the machines which this company are furnishing for the different cable power stations in New York, is now in New York City. He is engaged at present in preparing the foundations at the Fifty-first Street station of the Broadway & Seventh Avenue Railroad Co. for the machinery which will soon be put in place.

Obituary.

Mr. E. V. Cavell died at Nassau, N. P., June 7. Mr. Cavell was well known among the street railway fraternity, was for a long time editor of the *Street Railway Gazette* of Chicago, and had recently been connected with the *Street Railway News* and *Electrical Age* of New York. His death was not unexpected. He had gone to Nassau during March in the hope of receiving some benefit from the climate, but without avail. Mr. Cavell was a native of England, where he was born about thirty-four years ago.

New Publications.

Code Book of the Interior Conduit & Insulation Co. of New York. This book gives a complete list of appliances in different sizes manufactured by the Interior Conduit & Insulation Co., and described in their catalogue No. 7, together with a code word for each, facilitating ordering by telegraph.

Directory for the Year 1892 of the Compania de Tranvias de Merida Sociedad Anonima.

This pamphlet of the Street Railway Co. of Merida, Yucatan, is published annually, and its especial purpose is to give information in regard to the routes of cars, etc., to the general public of Merida, though other interesting matter is also contained within the covers. The street railway company of Merida was established in 1880, and now has a capital of $400,000 with about fifteen and three-quarters miles of track and thirty-eight cars in operation.

Experiments with Alternate Currents of High Potential and High Frequency, by Nikola Tesla. Published by the W. J. Johnston Co., Ltd. *Times* Building, New York. Price $1.00.

This little volume gives an accurate account of Mr. Tesla's experiments in this interesting branch of electric science, as described by himself in his lecture some months ago before the English Institution of Electrical Engineers in London. It is largely to Mr. Tesla that the scientific world is indebted for what it knows in this direction, and his results and statements of the possibilities in the use of these currents will be read with the greatest interest.

The Railroad Law of the State of New York; compiled by R. C. Cumming and Michael Danaher, 1892. Price $1.00, postpaid. Half leather binding. J. B. Lyon, law publisher, Albany, N. Y.

This volume, of 294 pages, contains the railroad statutes of the State of New York, including the general corporation law, the stock corporation law, the sections of the code of criminal proceedure of the criminal code applicable to railroad companies, the rapid transit act, the interstate commerce act, etc., as revised by the statutory commission and enacted by the Legislatures of 1890 and 1892. The laws governing street railway companies occupy a considerable portion of the volume. The work is supplied with a complete index.

Verbatim Report of the Tenth Annual Meeting of the American Street Railway Association Held at Pittsburgh, October, 21-22, 1891, published from the office of the Association, Brooklyn, N. Y.

The report of the tenth annual meeting of the American Street Railway Association is issued uniform with former reports and gives all the proceedings at Pittsburgh in the same accurate and complete manner as in preceding years. The volume, as customary, has a frontispiece, an engraved steel portrait of the past president. This is especially worthy of favorable mention as the likeness of Mr. Watson is excellent. Included in the volume are also the constitution and by-laws of the Association and the list of members with their offices.

Les Chemins de Fer et les Tramways, by Adolph Schoeller, published by J. B. Baillière et Fils, Paris. 362 pages.

The first fourteen chapters of this volume, which forms a part of a series called the "Contemporary Scientific Library," issued by the same publishers, are devoted to steam trunk lines, their appliances, etc., the last five being respectively on elevated and underground steam railways, inclined plane railways, dummy lines, other surface street railways and the South London Electric Railway. These chapters, though very brief, show that Mr. Schoeller is conversant with the great advances made in this country in street railways, especially in electric railway practice, as well as with the details of recent European installations. The book is popular in character and is illustrated by a number of engravings.

Catalogue and Price List for 1892 of Presses, Drop Hammers, Shears, Dies and Special Machinery. Published by E. W. Bliss Co., Ltd., Brooklyn, N. Y.

That the manufacturing business carried on by this company is extensive will be readily believed by a glance at this catalogue. It contains views of punching, shearing, embossing and other varieties of presses, lathes, drop hammers, screw and milling machines; in fact, all the apparatus required for sheet metal working, besides many other machines for metal work as well as other articles such as fire boxes, soldering coppers, etc. The company was established in 1867, and besides their own extensive plant and business acquired in 1890, those of the Silas & Parker Press Co. of Middletown, Conn. At the end of the catalogue, which contains 392 pages and is bound in cloth, are contained a number of valuable tables of wire gauges, decimal equivalents of common fractions, etc., besides a complete table of contents

Rules for Exhibitors at the World's Columbian Exposition.

As our readers probably know, everything relating to street railways, surface, underground and elevated, at the World's Columbian Fair at Chicago, comes under the department of transportation exhibits, with the single exception of electric motors which must be shown in the department of electricity. Cars and other supplies for electric roads belong to the transportation department—a provision which may seem to be arbitrary, but which was found to be necessary. Street car and other short line systems form group 81 of Department G, which is divided into four classes as follows:

Class 504. Cable roads and cars. Construction, equipment, methods of operation. Grips and other appliances.

Class 505. Electric railway cars. Systems of track construction, equipment and supplies for electric roads, methods of operation, appliances and furnishings.

Class 506. Cars for street railways or tramways operated by horse power or other means of propulsion not specified. Construction. Equipment and supplies. Methods of operation.

Class 507. Elevated and underground railways. Plans, models and maps, showing systems of construction. Systems of operation and maintenance.

The following information for exhibitors is taken from the official circular of the chief of transportation department and will doubtless prove of interest.

SPACE.—Blank applications for space and copies of the rules and regulations of the Exposition may be had by writing to or calling at the office of the director-general and application should be made before July 1, 1892 There is no charge for space.

POWER.—A limited amount of electric power (or compressed air) will be furnished free of charge. Steam will be furnished for testing car heating systems and similar purposes—but not as motive power. As no shafting will be erected in the building, power must be taken direct, and the exhibitor must furnish his own motors.

TRANSPORTATION RATES.—The principal railway and steamship lines of the United States have agreed to charge the regular full rate on all exhibits going to the Exposition, but to return the same, if unsold, free of charge. Some lines have agreed to charge half rate each way.

AWARDS.—The following extract from the adopted report of the Committee on Awards of the World's Columbian Exposition fully explains the subject:

"The committee recommend that awards shall be granted upon specific points of excellence or advancement, formulated in words by a board of judges or examiners, who shall be competent experts; and the evidence of these awards shall be parchment certificates, accompanied by bronze medals.

"The awards of these boards of judges or examiners will thus constitute an enduring and historical record of development and progress as represented by the exhibits in question; the parchment certificate will, by sufficient terms of identification, evidence the award, and the bronze medal will serve to the exhibitor as an enduring memento of his success. These exhibits, which in the opinion of the juries and examiners do not possess sufficient excellence or intrinsic development to warrant awards, will simply be scheduled in the general catalogue of the Exposition. * * * * * * * It is recommended that there should be but one class or kind of medal; that they should be made of bronze; that they should be works of art and selected from competitive tests by the Committee on Fine Arts of the Commission, or the Joint Committees on Fine Arts of the Commission and the Local Directory, if they should seem more desirable. * * * * * The awards and the appointments of all judges and examiners for the Exposition, by the express terms of the sixth section of the act of Congress, approved April 25, 1890, fall within the exclusive jurisdiction of the Commission."

FOREIGN EXHIBITORS should in all cases apply to and deal with the commissions appointed by their own governments. In case no such government commission has been appointed, direct communication is invited by the chief of this department.

Equipment Notes.

The John Stephenson Co., Ltd., have received a number of large orders recently, and are shipping cars to many sections of the country.

Mr. James F. Shaw, formerly connected with the Newburyport Car Manufacturing Co., has opened an office for street railway supplies at 53 State Street, Boston, Mass., where he will be pleased to see his friends.

Reed & McKibbin, of New York, include among their recent orders that for the electrical equipment of an extension to the Easton, (Pa.) electric railway. They are also at work on the electrical construction for a railway at Fall River and for one at Camden, N. J.

The Newburyport Car Manufacturing Co., of Newburyport, Mass., have recently made shipments of cars to Fall River, Mass.; Allentown, Pa.; Brockton, Mass.; Providence, R. I.; Boston, Mass.; New Haven, Conn.; Norwich, Conn.; Pawtucket, R. I.; Salem, Mass., and other places, and have already taken orders for cars for the winter trade.

The Lewis & Fowler Manufacturing Co. of Brooklyn, are taking care of a large number of orders, and the many departments of their works are very busy in turning out cars, registers, trimmings, and other street railway supplies manufactured by them. They tell us that in spite of their many orders, they have been delivering goods at the times promised. Their orders are from many sections of the country.

Robert A. Keasbey, 58 Warren Street, New York, well known through his magnesia sectional coverings for steam pipes, boilers and all heated surfaces, has issued a June circular, which is very interesting, and which he will be pleased to send to any steam user upon application The circular contains mention of a number of reductions in prices in the articles sold by Mr. Keasbey. This gentleman writes us that his business during the last spring has been very satisfactory and that he has filled many orders for his magnesia coverings.

The R. D. Nuttall Co. of Allegheny, Pa., write us that they find business very good, and have received many orders this spring for their electric railway supplies. They have recently made a contract with the Brush Electric Co. by which they have secured the gear plant of the latter company and will supply all the gears which will be used by the Brush company on the new equipments manufactured by them during the next six months. These gears will be of steel. The R. D. Nuttall Co. have in view the construction of a new factory at an early date. They at present employ 125 men in their works, the greater part of whom are kept busy night and day.

John H. Graham & Co. of New York, agents for the New Departure Bell Co. of Bristol, Conn., are meeting with a large success in the sale of their rotary bell for street cars. Among other orders which they have recently received are some from the Paterson Railway Co. for the equipment of all the cars on that line; from the Columbus, O., Consolidated Street Railway Co. for about forty bells; from the Wilkesbarre & West Side Street Railway, fifteen bells; and from the Omaha Street Railway Co. They have also recently supplied the John Stephenson Co., Ltd., with a considerable number of their bells for some new cars which the latter company are building.

S. A. Day, of New York, has sent out the following circular, signed by W. R. Brixey, the recently appointed manager: "Having undertaken the general management of the long established business of S. A. Day (successor to A. G. Day), manufacturer of the celebrated Kerite insulated wires and cables, I am prepared, after an experience of thirteen years in superintending and improving their manufacture, to supply materials of the highest standard attainable. My personal close study and contact with the practical part of this business will ena ble me to meet the wants of customers in every detail, and I bespeak a continuance of favors so generously accorded in the past.

The Lewis & Fowler Girder Rail Co. of Brooklyn, are crowded with orders, and the company have recently been obliged to install some extra machinery for special work. In order to insure the delivery of goods under contract, the company were recently obliged to refuse a few orders for special work; but they advise us that by the installation of the machinery already mentioned they are now able to take care of all orders which may be sent them in the future. They tell us, that besides the companies which have installed their rails and have sent in additional orders, they have a large number of companies on their books who are about to instal the rail for the first time.

The Field Engineering Co., of New York, who are one of the largest company of constructing engineers in the country, and who make a specialty of the complete equipment of large roads, report that they are doing this year the largest business they have ever done. They have recently increased their capital stock to $50,000, and have also made several changes in their management. Mr. J. R. Craven has taken the position of secretary of the company, other officers remaining the same, this being really an addition to their force. Mr. E. J. Cook, their constructing engineer, is in charge of their engine business. They are making a specialty of the compound and triple expansion engines for large power station work, manufactured by the Lake Erie Engineering Works, at Buffalo, N. Y.

G. F. Whitney, of Boston, manufactures a soap which is widely known among railroad men as one of the best for cleaning cars. His liquid soap for wheels and axles removes the dirt and oil without injury to the paint and for repainting it leaves the work dry and perfect. His painters' white soap is intended for inside work, and is giving the best of satisfaction among a large number of roads. His amber soap is intended for cleaning the varnished surfaces, which will not be effected by it, and he claims can be washed and made ready in quicker time than with any other cleanser. Those who have not received his circular should send for it at once as it contains an offer that is worth trying, in the line of a paper weight clock,which is both handy and useful. His office and factory are at Long Wharf, Boston, Mass.

J. G. White & Co., of New York, are engaged on construction work for nearly a dozen prominent street railway companies in different sections of the country who are installing electric plants. Among the contracts for electric equipment, which this firm have closed since our last issue, are the following: for the equipment of the Lake Roland Elevated Railway of Baltimore, Md., of which about sixteen miles will be new track laid with the Duplex Street Railway Track Co's. system; for the electric equipment of seven miles of track for the Union Passenger Railway Co. of Baltimore, and for the reconstruction of the Newport, (R. I.) electric railway. At this latter city a new station will be erected for the Newport Illuminating Co., from which direct and alternating current incandescent lamps, arc lamps, stationary electric motors and electric railway cars will be all supplied with current involving an extensive distributing service.

The Ball Engine Co., of Erie, Pa., send us the following among their recent shipments: Santa Cruz Electric Light & Power Co., Santa Cruz, Cal., one 200 H. P. tandem engine; Risdon Iron Works, San Francisco, Cal., one 200 H. P. cross compound, two 200 H. P. tandem compound, one 35 H P. simple engine, one 50 H. P. simple engine; one 60 H. P. simple engine; Sandusky Electric Light Co., Sandusky, O., two 130 H. P. simple engines, one 100 H. P. simple engine; Portland Railway Co., Portland, Me., one 250 H. P. simple engine; East Liverpool Western Electric Co., East Liverpool, O., one 200 H. P. simple engine; Electric Light Co., St. Peter, Minn., one 100 H. P. tandem compound; Fremont Electric Light & Power Co., Fremont, Colo., one 80 H. P. simple engine and steam plant complete; Johnson Co., Johnstown, Pa., two 300 H. P. simple engines; one 200 H. P. simple engine, one 100 H. P. simple engine; Jackson Gas Light Co., Jackson, Miss., one 100 H. P. simple engine and steam plant complete.

The Corliss Steam Engine Co., of Providence, R. I., have received an order for two tandem, compound, condensing engines, each rated at 650 H. P., from the Lake Roland Elevated Railway Co. of Baltimore. The diameter of the cylinders is 20 × 36 ins, and the stroke five feet. The Pennsylvania Iron Works Co. have given them an order for an eighty-four inch Corliss patent vertical, tubular, water leg boiler; three of the Corliss eighty-four inch boilers have been ordered for the Havemeyer Building, Smith & Co., contractors, New York, and six eighty-four inch boilers are being constructed for the Lake Roland Elevated Railway Co. of Baltimore. Last month a 22 in. and a 40 × 60 in. engine and six eighty-four inch boilers were sent to the Jarvis-Conklin Mortgage Trust Co. of Kansas City. The 28 in. and 72 × 72 in. cross compound engine, with a 120,000 lb. wheel, were shipped to the Benedict & Burnham Manufacturing Co., of Waterbury, Conn. This flywheel was one of the heaviest ever cast in this country.

The J. G. Brill Co., of Philadelphia have been doing an active business in the West. They have recently taken the contract for thirty cars and trucks for the Fort Wayne & Belle Isle road, on which the Thomson-Houston system will be used. The road will be in operation about September 1. The company are also filling the contract for 180 cars, taken by Mr. Andrews for the Chicago City Railway Co.; the cars are to be used on the State Street and Cottage Grove Avenue lines. The open cars are being received at the present time, and the closed cars will be delivered September 1. As the Chicago City Railway Co. have not purchased cars for many years, but have built all their own cars, the award of the contract was a feather in Mr. Andrews' cap. J. F. Peavey, president of the Sioux City Street Railway Co., was recently in Chicago and placed with them an order for a number of the latest type of Brill trucks. The Chicago office of the J. G. Brill Co. has been moved from 225 to 309 Phenix Building.

The Berlin Iron Bridge Co., of East Berlin, Conn., have received the contract from Samuel F. Hodge & Co.,of Detroit, Mich., for the construction of their new foundry. It is claimed that this will be the most perfect and best appointed foundry in the Northwest. The general dimensions of the building are 86 × 161 ft. On each side there is a wing twenty-three feet in width. The centre of the building is controlled by a traveling crane with a travel the full length of the building. The wings of the building are controlled by jib cranes, so that when completed every inch of the building will be controlled by power, either from the traveling crane or from jib cranes. The construction will be entirely of brick and iron. The are also building a new machine shop for the Solvay Process Co., at Syracuse, N. Y. The building will be fifty feet wide by 300 ft. long and three stories high. The side walls will be of iron and brick (combination construction) with iron floors and iron roof covered with the Berlin company's patent anti-condensation roofing.

The Reliable Manufacturing Co., of Boston, have recently received an order from the Lowell & Suburban Street Railway Co., of Lowell, Mass., to equip their entire line of new cars with the Collett ratchet brake handle. Sixty-five sets were shipped during June, and the rest will be sent forward as soon as the cars are ready. The manufacturing company have been busy the past month filling orders for the Reliable Collett ratchet brake which is giving good satisfaction and seems to be growing more popular every day. Among the companies to which the brake handles have been shipped during June are the Merrimac Valley Horse Railroad Co., Lawrence, Mass.; Briggs Carriage Co., Amesbury, Mass.; Portland Street Railroad Co., Portland, Me.; New Haven & West Haven Horse Railroad Co., West Haven, Conn.; Gloucester Street Railway Co., Gloucester, Mass.: Steinway Railway Co., Steinway, N. Y.; Lowell & Suburban Street Railway Co., Lowell, Mass.; Newburyport Car Manufacturing Co., Newburyport, Mass.; Black Rocks & Salisbury Beach Street Railway Co., Newburyport, Mass; Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Co., New York City; Boston & Revere Street Railway Co., Boston, Mass.; Allentown & Bethlehem Rapid Transit Co., Allentown, Pa. The company are now manufacturing a track switch to be operated from the platform of electric cars, they are about ready to be put upon the market. It is claimed to be just what is wanted.

The Lamokin Car Works of Philadelphia, have closed a large number of orders recently, among which are the following: With the Williamsport, Pa., Passenger Railway Co., two eight seat open motor car bodies, two sixteen foot closed, palace, mahogany finish, vestibule car bodies were delivered to this road this month, being the fifth order from this company; the York Street Railway Co., York, Pa., four sixteen foot closed car bodies; the Citizens' Passenger Railway Co., Harrisburg, Pa., four eighteen foot, palace, vestibule cars, complete with Robinson motor truck of Altoona. These cars are to be a duplicate of the Milwaukee palace car and will have Cochran's patent observation window in vestibule; Rome, Street Railway Co., Ga., one sixteen foot closed car body, and one eight seat open car body; the Bristol, Tenn., Belt Line Railway, two sixteen feet closed car bodies, mounted upon Robinson motor trucks of Altoona, Pa., Edison motors. Among their recent deliveries the Lamokin Car Works number the Akron,O., Street Railway Co., five nine seat, closed end, open car bodies, and the Zanesville, O., Street Railway Co., four nine seat, open, closed end car bodies. The increasing inquiries and orders for the cars manufactured by the Lamokin Car Works speaks well for the great improvements which they have made in the method of construction. All their closed car bodies now bear upon the corners, at guard rail their trade mark, "Patented March 8, 1892," this referring to the steel corner tie plate.

W. R. Fleming & Co, new *Mail and Express* Building, New York City, agents for the Harrisburg Foundry Machine Works, have handed us a list of a recent contracts for furnishing Ide and Ideal engines. These sales, of course, represent only a comparatively small proportion of the United States, and as the other agents of the Harrisburg Foundry & Machine Works, as well as the factory themselves have also been shipping a large number of engines, it is safe to infer that the engine is growing rapidly in favor. The list of the last few weeks' business done by W. R. Fleming & Co. alone equals over 2,500 H. P., and includes the following shipments: One 70 H. P. standard Ideal engine, one 150 steel horizontal tubular boiler, Edison Electric Light Co., No. Plainfield, N. J.; three 100 H. P. standard Ide engines, Pope Manufacturing Co., Hartford, Conn.; one 55 H. P. standard Ideal engine, Wild & Williams, New York City, N. Y.; two 225 H. P.

standard Ideal engines, Clarion Mills, Pa.; one 30 H. P. standard Ideal engine, one 50 H. P. standard Ideal engine, Naval Observatory, Washington, D. C.; one 12 H. P. standard Ide engine, Whitlock Coil Pipe Co., Elmwood, Conn.; one 55 H. P. standard Ideal engine, one 60 H. P. standard Ideal engine, Century Club, New York City, N. Y.; one 150 H. P. special railway Ideal engine, one 50 H. P. special railway Ideal engine, one 55 H. P. standard Ideal engine, Chillicothe Street Railroad & Lighting Co., Chillicothe, O.; two 60 H. P. standard Ideal engines, Hotel St. Lorenz, New York, N. Y.; five 25 H. P. standard Ideal engines, Pacific Mail Steamship Co., New York City, N. Y.

The Pierce & Miller Engineering Co., is the name of a new company having headquarters at 42 Cortlandt Street, New York, and organized to succeed to the business of the well known firm of Pierce & Thomas. The new company have issued the following notice: "The firm of Pierce & Thomas having gone out of business, and F. M. Pierce having purchased the interest of R. H. Thomas, their successor, the Pierce & Miller Engineering Co., will continue business at the old stand, 42 Cortlandt Street, New York City. F. M. Pierce, the president of the company, has associated with himself the valuable men in the old firm, i. e., John D. Miller, vice-president, formerly special partner in the firm of Pierce & Thomas, and for many years associated with Mr. Pierce in the management of the Ingersoll Rock Drill Co., of New York, and Kennedy & Pierce Machinery Co., of Denver, Colo.; F. Schmerber, chief engineer, also with the old firm, and with Mr. Pierce as designing and constructing engineer of the Ingersoll Rock Drill Co.; W. B. Hadley, electrical engineer, formerly superintendent of installation department of the Edison Electric Illuminating Co., New York.; W. H. Stalnaker, secretary and treasurer, formerly treasurer of the Valentine Varnish Co., New York. This new company will continue as the general sales agents of McIntosh & Seymour automatic engines; Porter Manufacturing Co., engines and boilers; T. M. Nagle and the Pennsylvania Boiler Works, engines and boilers; Young-Brennan Crusher Co., rock and ore crushers. They will also go more extensively into the business of engineering and contracting for complete steam plants for electric railway lighting and manufacturing purposes, also for mining machinery and the construction of plants for the equipping of mines and for the concentration and milling of ores, and in all work the new company will adhere closely to the policy adopted by Pierce & Thomas, i. e., of furnishing first class machinery specially adapted to the work it has to perform, and first class engineering and construction work, where contracts are to be executed, having in view first the economical and convenient operation of the plant, in line with the best engineering practice." The company have established a branch at 543 Drexel Building, Philadelphia, in charge of G. S. Jones, manager. They are now employed installing many steam plants for electric railways, among which are the following: 2,000 H. P. for the Globe Street Railway Co., of Fall River, Mass.; 500 H. P. for the Rock Creek Railway Co., Washington, D. C.; 800 H. P. for the Merrimac Valley Street Railway of Lawrence, Mass.; and 600 H. P. for the Rochester Railway Co., Rochester, N. Y.

WESTERN NOTES.

The Emerson Electric Manufacturing Co., of St. Louis, report an active business at the present time.

The Stirling Boiler Co., 612 Pullman Building, Chicago, have been doing an excellent business of late.

Hoffman & Billings, of Milwaukee, have sold a 24 × 48 in. Corliss engine to the Suburban Railway Co. at Portland, Ore.

The Broderick & Bascom Rope Co., of St. Louis, recently received an order for the rope for the Washington & Georgetown road of Washington, D. C.

The Electric Appliance Co., of 242 Madison Street, Chicago, are now carrying the goods of the Mica Asbetile Co. and will represent that company in the west.

The Falls Rivet & Machine Co. of Cuyahoga Falls, O., have established an office in New York City at 18 Cortlandt St., where they are represented by Mr. J. H. Long.

Wm. H. Bryan, M. E., late general superintendent of the Pond Engineering Co., has opened an office in the Turner Building, St. Louis, as consulting mechanical and electrical engineer.

The Economic Railway Equipment Co., have been organized at Chicago. The capital stock is $500,000, and the incorporators are Webster P. Moore, J. D. McIlwain and Elmer E. Kaufman.

The Cushion Car Wheel Co. has recently sold wheel equipments to several electric railways. Among the number are the Calumet Railway at Chicago and the Blue Island Electric Railway.

L. K. Hirsch, 549 Rookery, recently purchased 10,000 tons of rails suitable for street railway purposes, and is quoting favorable prices. Mr. Hirsch reports a large business in second hand railway material.

The E. P. Allis Co., of Milwaukee, have received the contract for two engines for the East Liverpool & Wellsville (O.) railway. Two Allis engines are already operating successfully in the power station of the railway.

The Standard Railway Supply Co., of the Monadnock Building, Chicago, Garson Myers, manager, are doing a large business in steel gongs. Orders are received from all parts of the country, and the bells are giving entire satisfaction.

The Lane & Bodley Co., of Cincinnati, will supply the complete power plant, including three 300 H. P. compound condensing engines, water tube boilers, pumps, shaftings, etc., for the New Orleans & Carrollton company's new electrical equipment.

Ramsay & Kenyon, of St. Paul, agents for the Belleville Steel Co. and Tudor Iron Works, have furnished all track material for four miles of street railway for the Gallatin Light, Power & Railway Co. of Bozeman, Mont. The track will be laid with thirty-five pound steel rail with angle joints.

Dorner & Dutton, of Cleveland, O., write us that their appliances are meeting with a large demand, and that they have received a large number of orders for their solid forged iron motor trucks. Their department is now crowded with orders, over 100 orders having been received during May and June.

The Enterprise Electric Co. have recently been organized in Chicago, with headquarters at 313 and 315 Dearborn Street. The president of the company is M. C. McKinlock. The company will handle electrical supplies of all kinds. They are local agents for Day's Kerite wire, western electric weatherproof wire.

Kohler Bros., Chicago, representatives of the Eddy Electric Motor Co. report an active demand for the company's products. G. A. E. Kohler has recently returned from a trip to the East. He visited the factory at Windsor, Conn., and states that the work on the new building is progressing so satisfactorily that he hopes that the company can soon make motors rapidly enough to supply the demand.

The American Car Co., of St. Louis, are working to their full capacity. Among the orders now on their books are ten cable trail cars for the Missouri Railroad Co., St. Louis; electric cars for the Cicero & Proviso Electric Railway, Chicago; Central Railway, Peoria, Ill.; Milwaukee Street Railway, Milwaukee, Wis., and thirty open motor cars for the Omaha Street Railway, Omaha, Neb. The company are busy shipping 150 open cars to the North and West Chicago street railroads.

The St. Louis Car Co. are prepared to do quick work, and the local railway companies are ready to take advantage of the fact when necessary. On the night of June 14, the car house of the St. Louis & Suburban Railway Co., at De Hodiamont, burned to the ground, and all the cars enclosed in the structure were completely destroyed. As soon as all hope of saving the cars was abandoned, Mr. Charles H. Turner, president of the company, gave an order for forty motor cars with double trucks to the St. Louis Car Co. An order for the electric motors was telegraphed the same night to the Thomson-Houston Electric Co., with instructions that they be sent at once.

Arthur S. Partridge, who has had many years experience in the manufacture of street cars, and with a prominent street railway supply house, has established himself in the latter business with headquarters in the Bank of Commerce Building, St. Louis. He represents many of the best known manufacturers in the country, and is prepared to furnish promptly and at bottom prices, every article used in the construction and operation of electric and horse railways. His experience and established business character, together with the high class of material produced by the parties whom he represents, will insure thorough satisfaction to parties who favor him with their patronage.

The Shultz Belting Co., of St. Louis, have sent us a copy of a recent letter received by them from Mr. Charles H. Turner, president of the St. Louis & Suburban Railway Co., St. Louis, Mo., in which he says: "In answer to your inquiry, will say we are running two of your seventy-two inch main driving belts, each 154 ft. long; two thirty-four inch and ten sixteen inch generator belts, all heavy, double, and we are happy to state that we have never been stopped or delayed one moment on account of the belts. They are giving us entire satisfaction, running noiseless, straight, smooth and driving full power. The seventy-two inch developing from 200 to 300 H. P. more than your guarantee; in fact, we believe that we have as good, if not the best belted power station in this country."

The St. Louis Car Co., of St. Louis, are at present very busy, and the majority of their orders are for electric cars. The company now have orders on their books for over 400 cars. Among the street railways represented are the Atlantic Avenue railroad, of Brooklyn fifty eighteen foot cars; sixty for the Union Railway, New York; thirty twenty-eight foot cars for the St. Louis & Suburban Railway, St. Louis; fifty for New Orleans; thirty for Trenton, N. J.; twenty-five for Louisville, Ky.; thirty for Evansville, Ind.; thirty for Wilkesbarre, Pa.; twenty for Galveston, Tex.; twenty for Savannah, Ga.; twenty grip cars for the Mt. Auburn Cable Railway, Cincinnati, O.; ten motor cars for Calumet, Mich.; ten for the Southern Railway, St. Louis, Mo.; twenty for the City of Mexico and Pueblo; also minor orders for West Superior, Mich.; Sioux City, Ia., Asbury Park, N. J.; Anderson, Ind.; Marinette, Wis.; Cedar Rapids, Ia., and a large number of smaller orders. The car company have just completed a new paint shop 210 × 200 ft., capable of accommodating 100 cars. On the streets in the immediate vicinity of the works tracks are to be laid and overhead wires strung, so as to try every new car turned out of the shops before it is shipped. Cars can thus be propelled to the railroad tracks for shipment.

The Railway Equipment Co., of Chicago, report business as rushing in all departments. They have added largely to the established business of the Electric Merchandise Co., whose business they purchased some few weeks since. Owing to the fact of the standard appliances of this company having such an established reputation, a very large number of late contracts for equipment have been made with the understanding that such appliances will be used. The company report a largely increased business over the last season, but having increased their manufacturing facilities, they are able to guarantee immediate shipments. The managers of the company having devoted their entire time and attention to "electric railway supplies only" for several years, are prepared to furnish reliable and complete information to parties about to equip electric street roads. Such inquiries are

given the most careful attention, are answered fully and without charge. The company number among the recent orders they have received for appliances, two from the street railway companies of Evansville, Ind., and New Haven, Conn. They have also secured the contract for the appliances to be used on the North Baltimore Railroad, Baltimore, Md. The company have opened a New England office at 116 Bedford Street, Boston, which will be in charge of Mr. Charles E. Rowe. They have also opened a New York office in charge of Mr F. L Perine at 77 Cortlandt Street. They report for the last week orders for the complete equipment of roads in New Haven, Conn.; Brooklyn. N. Y.; Baltimore, Md.; Evansville, Ind.; Chillicothe, O.; Pittsburgh, Pa.; Hamilton, Can.; Augusta, Ga.; Kokomo, Ind., and Put-in-Bay, O. They have also made during the same time large sales for extensions of present roads. The business of this company is constantly increasing. The standard material of their manufacture is known to be reliable, and their facilities for promptly filling orders are exceptionally good. This company will be located after July 1 in their new quarters, Pullman Building, Michigan Avenue. The company will have excellent facilities for transacting business, in a most advantageous location and in one of the best buildings in Chicago. The offices will be handsomely fitted up, and the company will be in good shape to handle the business in railway supplies, which is increasing rapidly.

Robinson Radial Truck and the West End Railway Co.

We are informed on good authority that the West End Railway Co. of Boston have recently made application to the Robinson Electric Truck & Supply Co. for a license to build, at their own shops, the Robinson radial truck for more extended use on the lines of the West End Railway.

It is well known that for more than two years the West End Railway Co. have been making a thorough test of the Robinson radial truck, as well as of nearly every other truck in the market, having more than fifty of the Robinson radials in daily use during that time.

A part of the proposition made by the West End company to the Robinson company, embodies the immediate addition of 130 more of the long radial cars to the West End equipment, and the use of the radial truck under all long cars which the West End company may build hereafter, and to pay the Robinson company an agreed upon royalty for every radial truck built by the West End company.

It is not stated whether the Robinson company have decided to accept or decline the West End's proposition. The Robinson company, however, have heretofore generally insisted on building the radial truck exclusively under their own auspices.

The Robinson radial truck could not have a higher endorsement than the one implied by the above proposition of the West End company, made after such an exhaustive test of the Robinson radial in comparison with other trucks.

New Quarters of the Railway Equipment Co.

After much trying delay, the Railway Equipment Co., of Chicago, are ready to welcome their patrons to their elegant quarters in the Pullman Building. The rooms have been in the hands of the decorator and finisher for several weeks, and everything possible has been done to make them beautiful and comfortable. The offices front upon Michigan Avenue and are on the ground floor. To the immediate left of the entrance is what might be called the visitors' parlor—a space enclosed by a neat railing and containing table and chairs for the comfort and convenience of callers. This office fronting on Michigan Avenue makes a pleasant waiting room for visitors. The general manager's office is also in front and just back of the visitors' parlor and is well lighted and ventilated by one of the large avenue windows.

To the rear of the general manager's office is that of the secretary and treasurer, agreeably accessible to customers. Next in order upon the right is the bookkeeping department, with the necessary desks and files. Enclosed by the bookkeeping department is a neat space for the use of the stenographers. The purchasing agent occupies the rear of the main office on the left, where he is conveniently near the store rooms and shipping department. A youthful usher at a desk to the right of the doorway is at your service upon your entrance. The same side of the office furnishes enclosed desk room for the salesmen, and also a space for a large show board, where is exhibited all the various pieces used in electric railway construction. If one desires to see quantity rather than to examine the quality of the company's wares, a door at the farther end of the offices admits him to a store room where bins and shelves, filled with the many devices handled by the house, line the walls. Much of the more bulky material is kept in the spacious store rooms in the basement. The rooms are well lighted by electricity throughout, and will make a delightful home for the new company. Moving into such commodious and pleasant quarters is the natural outcome of the growth of the company's business, and a witness of their popularity with the trade.

Three years ago, under another name, but with the same general manager in charge, the company started in a unique business, the handling of electric railway supplies exclusively, and since then have done an ever increasing business. Less than a year ago their quarters were found insufficient, and were doubled; again it became necessary to better the facilities. Irrespective of the pushing qualities of the company, their prosperity is undoubtedly largely due to their honest intention to furnish the best possible quality of material to purchasers.

All friends of the Railway Equipment Co., and of the general manager, Mr. W. R. Mason, will extend congratulations upon the appearance of their new home and bright prospects.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, MAY 24, 1892, TO JUNE 21, 1892, INCLUSIVE.

MAY 24.

Advertising Card Rack, Delavan S. Foote, Chicago, Ill.....475,726
Cable Grip, George F. Elliott, U. S. Navy.....475,684
Chair for Railway Rails, Maynard E. Clemons. Attleboro, Mass.....475 539
Electric Locomotive, Thomas A. Edison, Llewellyn Park, N. J.....475,491
Electric Locomotive, Thomas A. Edison, Llewellyn Park N. J.....475,492
Electric Locomotive, Thomas A Edison, Llewellyn Park, N. J.....475,493
Electric Motor Car, William H. Patton, Chicago, Ill.....475,702
Electric Railway, Thomas A Edison, Llewellyn Park, N. J.....475,494
Signal for Street Cars. Charles H. Smith, Lansingburgh, N. Y.....475,474
Switch for Overhead Wires, Alphonzo O. Hoyt and Paul W. Leffler, Minneapolis. Minn.....475,504
Switch for Street Railways, Russell H. Snively, Louisville. Ky.....475,475
Traction Engine, Julius J. D. McNamar, Newark, O.....475,597
Trolley for Electric Railways, John W. Newhouse. Indianapolis, Ind.....475,467

May 31.

Cable Grip, Julius Schirra. Pittsburgh, Pa.....475,896
Car Axle, David M. Miller, Fairfield, Cal.....475.965
Conduit for Electric Railways, Walter F. Carr and Charles F. Ferrin, Minneapolis, Minn.....476,128
Device for Automatically Operating Power Car Brakes, Brenton C. Rowell. Boston, Mass.....475 893
Electric Railway Motor, Jabez F. Shawhan, Detroit, Mich.....475,970
Grip Mechanism for Duplex Cables, Andrew Bryson, Jr., New York, N. Y., John H. Pendleton and Alfred R. Benn, Brooklyn, N. Y.....475.846
Hanger for Electric Railway Wires, Charles B. Elliott, Boston, Mass.....476,192
Rail for Railways, John T. O'Shea, Cleveland, O.....476.165
Safety Attachment for Railway Trolleys, Melvin A. Yeakley, Cleveland. O.476,028
Swivel Pull-off for Overhead Wires, Charles B. Elliott, Boston, Mass.....476,193

JUNE 7.

Brush Holder for Dynamo-Electric Machines and Motors, Frank B. Daggett, St. Joseph, Mo.....476,368
Car Step, Frank H. Stanwood, Chicago, Ill.....476,323
Car Truck, Frederick A. Baier, St. Louis, Mo.....476 596
Conduit for Electric Railways, William Bradley, Fort Wayne, Ind.....476,603
Electric Locomotive, Thomas E. Adams, Cleveland, Ohio.....476 437
Elevated Railroad. Elphalet L. Arnold, Georgetown, Tex.....476,720
Equalizing Device for Car Trucks, John A. Brill, and Walter S. Adams....476,244
Fare Register, Joseph H. Greenleaf, New Haven, Conn.....476,741
Frictional Gearing for Street Cars, George B. Brayton, Chicago, Ill.....476,243
Motor Truck for Cars, William A. McGuire and Moses G. Hubbard. Jr., Chicago, Ill.....476,480
Rail Joint, John N. Lewis, Coulee City, Wash.....476,753
Railway Rail Joint, Gustave Bouscaren, Cincinnati, O.....476,241
Station Indicator, Rudolf G. Hourtney, Chicago, Ill.....476,537
Tramway Switch. John R. Wiggington, Washington, D. C.....476,713
Trolley Support, Spencer C. Crane, Philadelphia, Pa.....476,367

JUNE 14.

Anti-Friction Bearing for Car Axles, Henry B. Williams, Rochester, N.Y., 477,037
Car Heater, William C. Baker, New York, N.Y.....476,973
Conductor for Elevated Railways Thomas A. Edison, Llewellyn Park, N. J.....476,989
Electric Locomotive, Thomas A. Edison, Llewe'lyn Park, N. J.....476,987
Electric Railway, Richard W. Barkley, Brooklyn, N. Y.....476,776
Elevated Railway, Adolphus Davis, London, England.....476,982
Electric Railway, Charles P. Tatro, Spokane. Wash.....476,935
Heating Apparatus for Cars or Buildings, William C. Baker, New York, 476,972
Means for Propelling Electric Cars, Thomas A. Edison, Llewllyn Park, N. J.....476,986
Pole for Electric Wires, Julius Meyer, New York, and Carl Binder, Chicago, Ill.....476,889
Rail Cleaning Attachment for Cars, Palmer Wardman, East Saginaw, Mich.....476.909
Railway Spike, John M. Fennerty, Washington, D. D.....477,171
Street Railway Switch, Martin A. Cutter, Allegheney, Pa.....477,046
Trolley for Electric Railways, Thomis A. Edison, Llewlleyn Park, N. J....476,985

JUNE 21.

Car Wheel, William Halles, Albany, N. Y.....477,539
Chilled Cast Iron Car Wheel, Luther R. Faught, Philadelphia, Pa.....477,.24
Feed Regulator, William Gribben and Joseph M. Galgh, Crosswell, Mich..477 327
Feed Water Heater, Joseph Bell, Troutdale, Ore.....477,491
Fender for Street Cars, Bartholomew Sullivan, Boston, Mass.....477,467
Heating Apparatus for Cars, James H. Sewall, Chicago, Ill.....477,464
Journal Box, Edward Jones and Chalkley Dawson, Bellaire, and Henry Stanton, Flushing, O.....477,329
Mechanism for Propelling Cars, Elmer E. Miller, Canton, O.....477,260
Motor Tram Car, James M. O'Kelly, New York.....477,444
Rheostat, George K. Cummings, Chicago, Ill.....477,247

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.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, June 18. Stock quotations are per cent. values.

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	.....	109	.....
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	240	.....
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	187	190
Coney Island & Brooklyn R. R. Co	100	500,000	.....	...	.....	140	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est 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	.....	104
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., June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	113	115
Watervliet Turnpike & R. R. Co	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est 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	104	.....
" " " Debenture.	1891	200,000	M. & N.	6	1901	109½	111
Watervliet Turnpike & R. R., 1st Mort.	1889	350,000	M. & N.	6	1919	112½	115¼
Watervliet Turnpike & R. R., 2d Mort.	1889	150,000	M. & N.	6	1919	108	109½

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, June 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾	.....	28	30
Broadway & Seventh Avenue	100	2,100,000	Q.—J.	2	.....	197	200
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1	.....	125	130
Christopher & Tenth	100	650,000	F. & A.	1¾	.....	134	135
Central Crosstown	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	112	116
42d & Grand St. Ferry	100	748,000	Q.—F.	3	.....	250	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	49	52
Eighth Avenue	100	1,600,000	Q.—J.	2	.....	240	.....
Houston, W. St. & Pav. Ferry. Leased to B'way & 7 ave	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue	100	1,862,000	J. & J.	5	.....	112	115
Sixth Avenue	100	1,500,000	M. & S.	3	.....	190	200
Third Avenue	100	2,000,000	M. & N.	6	.....	204	207
23d St	100	600,000	Q.—F.	2½	.....	250	.....
Ninth Avenue	100	800,000	.....	3	.....	128	133

Bonds.	Date of Issue	Amount.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry	.....	700,000	J. & J.	7	July, 1900	110	113
B'way & 7th Ave., 1st mort.	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.	.....	500,000	J. & J.	5	July. 1914	104	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	6	July, 1924	105	.....
Additional	.....	1,000,000	J. & J.	5	July, 1905	95	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	116	120
Christopher & Tenth	.....	250,000	A. & O.	7	Oct., 1898	108	110
Central Crosstown	.....	250,000	M. & N.	6	Nov., 1922	115	117
Dry Dock, E. B'way & Battery. 1st mort.	.....	840,000	J. & D.	7	June, 1893	100	101
Scrip	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort.	.....	1,200,000	J. & J.	6	1915	57	59
Eighth Ave., Scrip	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	100	107
Second Avenue	.....	1,600,000	M. & N.	5	Nov., 1909	103	105
Third Avenue	.....	5,000,000	J. & J.	5	Jan., 1937	112	114
23d St	.....	250,000	M. & N.	7	May, 1893	102	104

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,406,000	J. & J.	4	1887	87½	88
West End Com'n	50	9,085,000	J. & J.	5	1890–1892	74	74½

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, June 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co	100	$270.000	New.	...	Oct., 1887	92½	95
Union R. R Co., Prov	100	2,000,000	Q.—J.	2	1862–1863	200	210
Providence Cable Tramway	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers. Holyoke, Mass. June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.	100	$350,000	J. & J.	4	.....	245	250
Holyoke Street R. R.	100	200,000	J. & J.	4	.....	200	225
Northampton Street R. R.	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.	50	$100,000	J. & J.	3	.....	.....	55
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est 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., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
*Carrollton R. R. Co	100	800.000	Quart.	1½	1867	128	135
Crescent City R. Co	100	1,150 000	"	1¼	866	98½	99
Canal & Claiborne R. R. Co.	40	240,000	.....	...	1888	22	25
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1880	134¾	137
Orleans R. R. Co	50	185,000	"	2	1868	57	63
St. Charles Street R. R. Co	50	600,000	"	3	1866	93	94½

Bonds.	Date of Issue	Amount Out-standing.	Inter-est 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	122½	124
N. O. & Carrollton R. R. Co.	1882	300,000	F & A	6	'92–'06	117	.....
St. Charles Street R. R. Co	1881	165,000	J & D	6	'89–'01	.....	.....

* Bids on Carrollton R. R. are ex privilege of new stock.

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. June 18. Stock quotations are prices per share.

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	.....	35	.....
State Street Horse R. R. Co.	25	23,000	J. & J.	3	.....	25	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	26	.....
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 Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co.	1874	20,000	J. & J.	7	Jan., 1894	104	.....
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	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, June 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	202	205
BONDS.	Date of Issue	Amount Out-standing.	Interest Period.	%	Principal Due	Bid.	Ask'd
Montreal St. Ry.	1885	£60,000	.....	5	1965	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., June 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	85	86
Louisville St. Ry. Co., com.	100	5,000,000	.....	...	Jan. 1891	22	23
BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	97	95
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	114	.....
Central Passenger Ry. Co.	1888	400,000	M. & N.	6	1908	114	.....
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., June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	397	.....
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	97	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	213	.....
West Division City	100	1,250,000	Q.—J.	8¾	.....	635	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	168	.....
BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	98½	99
Chicago Passenger	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,640,000	M. & N.	4½	1927	95¾	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100⅝	.....
West Division Railway	.....	3,790,000	J. & J.	5	.....	101	.....
" " " Ext.	.....	250,000	J. & D.	6	.....	100	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101¼	101¾
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	95½	.....

PITTSBURGH STOCKS AND BONDS.—Corrected by KEA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, June 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co	50	1,500,000	.....	...	.....	28	.....
Citizens' Traction R. R. Co	50	3,000,000	J. & J.	3	.....	62¾	63
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	26¾	27
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	.....	5-½
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	25⅝	26
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	44	.....
West End R. R. Co.	50	200,000	J. & J	...	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	J. & J.	3	.....	51	.....
Second Avenue R. R. Co.	50	300,000	.....	...	.....	28	28½
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	.....	...	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co	1887	1,250,000	A. & O	5	1927	109	.....
Pitts. & Birmingham Traction Co.	1889	1,500,000	M. & N.	5	1929	101¼	101⅝
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	107	.....
Pleasant Valley Ry.	1891	1,250,000	J. & J.	5	1919	.....	102
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	105	.....
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	102½	102¾
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
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	103½	.....
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., June 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	.....	.....	115
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	95	.....
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	50	75
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	.....	40
Omnibus Cable Co.	100	2,000,000	Monthly	4	.....	.....	59
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	25	26½
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	100¾	110
Market Street R. R.	.....	3,000,000	J. & J.	6	1913	122½	.....
Omnibus R. R.	.....	2,000,000	A. & O.	6	1918	113½	.....
Powell Street R. R.	.....	700,000	M. & S.	6	1912	110	.....
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	114½	115
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	94	.....
Cal. St. Cable R. R.	.....	.....	.....	...	.....	104	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., June 18. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine	100	$324,000	Q.—J.	3	1864	125	150
Cass Ave. & Fair Grounds	50	300,000	.....	...	1876	45	46
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.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine	1891	$500,000	F. & A.	6	1911	102	102½
Cass Avenue	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	106½	107½
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	97	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	1,000,000	A. & O.	6	1900-1910	105	10-

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'	50	$500,000	Q.—J.	4	1858	260	270
Continental	50	1,000,000	J.—J.	6	1873	125	126
Frankford & Southwark	50	1,250,000	Q.—J.	5	1854	210	212
Germantown	50	1,500,000	Q.—J.	2¼	1858	102	103
Green & Coates	50	500,000	Q.—J.	3	1858	120	121
Hestonville	50	2,050,000	.....	...	1859	33	35
Lombard & South	25	500,000	A.—O.	8	1861	55	60
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	65	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	84	85
Ridge Avenue	50	750,000	Q.—J.	5	1872	220	230
Second & Third	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	196	200
Union	50	1,250,000	J.—J.	9½	1864	182	185
West Philadelphia	50	750,000	J.—J.	10	1857	185	190
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	116	117
Baltimore Traction	25	5,000,000	.....	1	1889	22½	23
Buffalo (N. Y.) Railway	100	6,000,000	.....	...	.....	34	36
Newark (N. J.) Passenger	100	6,000,000	.....	...	.....	26	27
BONDS.	Date of Issue	Amount Out-standing	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	110	111
" " Imp.	1892	1,250,000	M.—S.	6	1901	105	106
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	106	107
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., June 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, June 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	110½	110¾
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	109¾	110¼
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	118	120
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	40
Cin. Inclined Plane Ry.	100	500,000	.....	...	.....	89	90
" " " Pref.	100	100,000	.....	6	.....	99½	100

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	101	103
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	104½	105
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	116	.....
" " " "	.....	300,000	J. & J.	6	Jan. 1914	107	108
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	90	92½
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	95	100
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., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	75	80
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	22	22⅛

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)	1899	1,500,000	M. & N.	5	1929	110	110⅛
Balt. Trac Co., No. Balt Div	1892	1,750,000	J. & D	...	1942	106	106¼
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	110¾	111

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	305	335
Metropolitan R. R.	50	750,000	Q. J.	...	1864	90	105
Columbia R. R.	50	400,000	Q. M.	...	1870	60	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	38	42
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	36	41
Georgetown & Tenallytown	50	200,000	.....	...	.....	.....	95
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	103	105
do. do. convert.	'83–'91	3,000,000	J. & J.	6	1899-1929	149	150
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	100	.....
Capitol & North O St. R. R.	1891	240,000	J. & J.	5	1921	105	109
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	.....	120

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, June 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	36	37
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	38	40
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	.....	25
Newark (N. J.) Pass. Ry	100	6,000,000	.....	...	1890	28	29

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	1941	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	93½	94

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., June 18. Stock quotations are prices per share.

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	.....	170	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	.....	86½	87⅜
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

Financial.

THE Lebanon (Pa.) & Annville Street Railway Co. will issue $100,000 of 4 per cent. bonds.

$ $ $

THE stockholders of the New Orleans & Carrollton Railroad Co. have voted to increase the capital stock of the company to $120,000.

$ $ $

THE Detroit Electrical Works have reduced their capital stock from $1,000,000 to $750,000, and all of the latter amount has been paid.

$ $ $

ISAAC ROSS was appointed receiver of the Fort Townsend (Wash.) Belt Line by Judge Hanford last month, upon application by certain creditors.

$ $ $

THE East Oakland (Cal.) Street Railroad Co. have issued bonds for $250,000, for thirty years at 6 per cent. per annum, with interest paid semi-annually.

$ $ $

THE Watertown (N. Y.) Street Railway Co. for the first quarter of 1892 make this report: Gross earnings, $3,281.08; operating expenses, $3,817.25; fixed charges, $1,125.

$ $ $

THE stockholders of the Fresno (Cal.) Electric Street Railway Co. are requested to meet on July 15, to take steps toward issuing $500,000 bonds for the immediate construction and operation of the road.

$ $ $

The Lancaster (O.) Street Railway Co. at their stockholders' meeting on June 18, voted to increase the capital stock of the company from $30,000 to $50,000, and equip the road with four electric cars.

$ $ $

THE Connellsville (Pa.) Street Railway Co. have recently placed $50,000 worth of 5 per cent. interest bearing bonds on the market. The money is to be used in the betterment and equipment of the road.

$ $ $

THE West End Street Railway Co. of Boston have declared a semi-annual dividend of 5 per cent. on the common stock, payable July 1. The new stock recently sold at auction shares in this dividend.

$ $ $

THE new loan of the Baltimore (Md.) Traction Co. for the electrical equipment of their North Baltimore division, consisting of $1,750,000 of fifty year, gold, 5 per cent. bonds, which were sold at 105, were heavily over subscribed.

$ $ $

THE California Street Cable Railroad Co., of San Francisco, have reported to the Board of Supervisors that their gross receipts from the Hyde Street branch for the first fourteen months of operation, ending April 30, 1892, were $150 302.45.

$ $ $

THE Dunkirk (N. Y.) & Fredonia Street Railroad Co. have issued $40,000 in twenty year 5 per cent. bonds in sums of $1,000, $500

and $100 each, interest payable semi-annually at the Fredonia National Bank. The bonds were put on sale at par.

$ $ $

THE capital of the Niagara Falls (N. Y.) & Suspension Bridge Railway Co. may be increased from $100,000 to $250,000 under a decision of the Board of Railroad Commissioners. The capital actually paid in is given as $65,000, and the debts and liabilities as $61,500.

$ $ $

The New York State railroad commission last month granted the application of the Fiftieth Street, Astoria Ferry & Central Park Railroad Co. for an increase of capital from $500,000 to $1,500,000. It is the intention of the company to extend their route one and one-half miles, making it thirteen miles.

$ $ $

THE City & Suburban Railway Co., of Memphis (Tenn.) have issued $65,000 in 6 per cent. twenty year bonds. This is at the rate of $10,000 per mile and is part of a total loan of $125,000, $60,000 of which will be issued later. The company have recently consolidated with the East End dummy line, and will use part of the amount realized from the sale of the bonds for the electrical equipment of the old steam line.

$ $ $

A RUMOR has been in circulation in Chicago that a new company was to be organized for the purpose of acquiring a controlling majority of the stock of the City railway company and the Alley elevated railroad company, and the leasing of these two properties to the new organization, making a practical consolidation, and forming the basis for a large issue of new securities. The rumor was denied by officers of the Chicago City Railway Co.

$ $ $

THE daily returns for May of the Pittsburgh Traction Co., which is controlled by the Philadelphia syndicate, show a gain of $28,465 during this month in an aggregate of $65,379. This comparison, according to the Philadelphia *Stockholder*, is without important significance because the mileage is not the same as at the corresponding period of last year, and also because the business in 1891 was done on three cent fares on account of the fight with the Magee lines.

$ $ $

A PERSON who looks at the stock quotations in the STREET RAILWAY JOURNAL of about a year ago will find these figures: Chicago City Railway Co. 308; North Chicago Street Railroad Co. 151; West Chicago Street Railroad Co., 118. The quotations at the time this paragraph is written (June 18) are as follows: Chicago City Railway Co., 397; North Chicago Street Railroad Co., 213; West Chicago Street Railroad Co., 168. The market has within the last few months been exceedingly active and at times almost given up to these securities.

$ $ $

A GREAT deal of talk is current in reference to private negotiations alleged to be in progress for large blocks of street railway stocks in Chicago. A local financial paper claiming to speak with authority says: "Two of the three great properties are concerned in this deal, and it is believed the third also. It is too early to speak definitely of the matter, and it is still possible that nothing of great public interest will come of it. The movements of the parties interested, do, however, unquestionably have some influence on the current quotations of street railroad securities."

$ $ $

Notice has been given that on and after June 23, the New York Guaranty & Indemnity Co. of New York, are prepared to deliver to the holders of trust receipts issued for shares of the stock of the Edison General Electric Co. and shares of the common stock of the Thomson-Houston Electric Co., certificates for common stock of the General Electric Co. of New York, at the rate of exchange already stated, namely: One share of the common stock of the General Electric Co. for each share of the stock of the Edison General Electric Co., and three shares of the common stock of the General Electric Co. for every five shares of the common stock of the Thomson-Houston Electric Co.

$ $ $

THE quarterly report of the Troy (N. Y.) & Lansingburgh Co. for the quarter ending March 31, 1892, shows: Gross earnings from operation $86,114.20; operating expenses, exclusive of taxes, $47,570.33; net earnings from operation $38,573.87; income from other sources, $295.30; gross income from all sources, $38,869.27. Deduction from income: Interest on funded debt, $4,252.33; taxes, $1,894.13; rentals, $1,587.50, total $7,723.96; net income from all sources, $31,145.31. For the corresponding quarter in 1891 the net income from all sources was 11,199.69. The operating cost for the quarter ending March 31, 1892, was 55.22 per cent. of earnings, exclusive of taxes, as against 77.26 per cent. for the corresponding quarter of the preceding year. Including taxes, it was 57.41 per cent. of the earnings, as against 79.72 per cent. for the corresponding quarter of the preceding year.

$ $ $

$500,000 of 6 per cent. first mortgage gold bonds, of the Trenton (N. J.) Railroad Co., Consolidated, are offered for sale by Gay & Stanwood of Boston. The operations of the company by horse power for 1891 are given as: Gross receipts from all sources $131,969.52; operating expenses $86,464.82; net earnings, $45,404.69; interest on all outstanding bonds (190,000) at 6 per cent., $11,400; net surplus for the year 1891, $34,104.69. The company own and operate twenty-eight and one-half miles of track, and the real estate owned by them is valued at $144,400. A sinking fund has been arranged by which $10,000 bonds come due and are payable in 1906, and $10,000 more annually up to and including 1915. In 1916 $15,000 will be retired and the same amount annually thereafter up to and including 1925; $20,000 become payable in 1926, and the same amount for the five succeeding years, so that over one-third of the mortgage is retired prior to 1931, when the remaining $650,000 bonds mature.

$ $ $

ARRANGEMENTS have been completed for the issue of $1,800,000 bonds by the National Street Railway Co., of Illinois, a Chicago corporation which controls the principal street railway lines of St. Louis. There are four purchasers, including N. W. Harris & Co., of Chicago. each taking $450,000 of the issue. The new issue of bonds will be secured by a mortgage on the lines of the Cass Avenue & Fair Grounds Co. and will be guaranteed by the National Railway Co. In addition to that there will also be a lien on a controlling interest in the stock of the St. Louis Street Railway, which is owned by the National Railway Co. and is worth, according to its present market value, $1,250,000. The consolidated road on which the bonds are a first mortgage is twenty-seven miles long, and there will be built seven miles of extensions. The Northern Trust Co. will be the trustee of the bonds which will be issued immediately and the proceeds deposited with the trust company. Of those proceeds $550,000 will be used to redeem a like amount of first mortgage bonds issued by the companies before consolidation; $400,000 of those will be redeemed in thirty days and the other $150,000 as soon as practicable under the terms of the mortgage. The remainder of the $1,800,000 will be used to equip the line with electricity and will be paid out by the trustee on engineers' certificates. The bonds run for twenty years and are payable in gold. An annual sinking fund of $10,000 is provided. The price paid for the bonds is not made public, but they will be retailed by the bankers who purchased them at two or three points below par.

Simple vs. Compound Engines.

An editorial observation in *Power* in regard to the choice of simple engines for the large cable plants now being put down for the Broadway and Third Avenue cable roads in New York City has called out the following communication to the editors from an engineer and designer whose long experience with cable propulsion impresses an expression of his opinion with especial value.

"EDS. POWER:—In a recent editorial you wrote: 'It is a noticeable fact, and one for which it is hard to account satisfactorily, that the large plants of the Broadway and Third Avenue cable roads in New York are all to have simple engines.' Permit me to indicate a probable reason therefor.

"On the Brooklyn Bridge cable, published accounts show that the power required in a day's run varies from sixteen horse power less than nothing to 569 H. P. That on the surface lines you mention, the variation in power applied will not be so great as on the Bridge Railway, is quite certain; that, however, they will be of a range and quickness which would prevent the economical working of a compound engine, ever so wisely proportioned for the work to be done, I think is equally certain. To you, as a steam power expert, I submit these questions which designers of cable driving plants have had to answer, namely: (1) What sum of money shall be set apart, to defray the entire cost of supplying continuously the power required by a cable railroad; that is, to institute the plant, keep it in operation, make the necessary repairs, and renew the several members—boilers, engines, and driving machinery—as they wear out? and (2), Will this sum be less with compound than with simple engines? You will notice that therein is included much more than consideration of the economical working of a compound engine under the favorable conditions for which it is designed. The practical answer to these questions, by conservative engineers, like myself, has drawn forth your criticism. I am confident that they, and I am sure I, will gratefully thank you if you will in the columns of Power, conclusively set forth the nature and extent of error we have made."

REPLY.

While we have a great deal of respect for the opinion of our critic, we are still unable to believe that the conditions of ordinary cable road service are such as to preclude the benefits of the compound system, The fluctuations of the bridge service in its demands for power are extremely variable and severe. Every condition about the bridge road is, however, such as would conduce to extreme variation. The trains, which are composed of three or four heavy cars, ascend a steep grade to the crown of the bridge, and descend upon the other side, so that with two trains approaching each other at the crown we may have a pull on the cable necessary to draw them up the grade; and after they have passed, both will be pulling upon the cable and the engine as they descend. With the complications which must occur in service with the heavy traffic all one way at certain hours it is easy to see how, with this symmetrical arrangement of steep grades, the load may change very abruptly and to an excessive amount. The cable, too, is comparatively short, and runs under the best conditions as to friction, so that the load of the cable itself is a much smaller proportion of the whole load than it would be upon a street railway, where from 50 to 85 per cent of the power is constantly applied to the propulsion of the cable. We cannot imagine any combination of circumstances upon a long street car line with a large number of single light cars upon both the out-going and in-coming cables, and with its greater constant load from the cable itself, which would approach the conditions of the bridge service, or, as our correspondent says, "prevent the economical working of a compound engine ever so wisely proportioned for the work to be done." Compound condensing engines are used with en-

tirely satisfactory results, both as to behavior under load and to economical efficiency, upon cable roads and upon the equally severe service of rolling mill work ; and it would hardly seem as though, with an available initial pressure of 150 lbs. and the refinements which the compound engine now possesses for proportioning the load between the cylinders, automatically if necessary, the fluctuations should be such as to deprive the low pressure cylinder, even of a non-condensing compound, of enough initial pressure to warrant its addition, for any appreciable portion of the time. Compound non-condensing plants are in successful use for driving electric railways, where the conditions as to fluctuation of load are fully as severe as in cable service. The compound engine, too, offers advantages in the better distribution of pressures, avoiding the shock of early cut-offs and long expansions in single cylinders ; their cost of installation is not excessively above that of single cylinder engines of the same power, and an attendant who is capable of taking charge of a large cable station at all should be qualified to run them. If space is a consideration, either of the companies who furnished the single engines could have furnished compounds of equal power which would have taken less space, as will be seen by designs which we have recently published from both. The subject is one which will bear discussion, however, and we shall be pleased to hear from any of our readers who have opinions or experience in the matter. —*Power.*

SPECIAL NOTICES.

FOR SALE.

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.—Position as Foreman or Superintendent of a Horse or Electric Railroad by a man who has had 16 years' experience as such. Can give the best of references. Address, "W," care of STREET RAILWAY JOURNAL, New York. 1t

WANTED.—Position as Superintendent of Stable for Street Railway Company, by a man of thirty-eight years' experience. Best of references as to ability. Address, "STABLE SUPERINTENDENT," care of STREET RAILWAY JOURNAL, New York. 1t

WANTED.—Position as electrical engineer for street railway or electric light plant. Seven years experience; can give best of references. Address "J. W.," care STREET RAILWAY JOURNAL, New York.

WANTED.—Position as Manager or Superintendent of a Street Railway. Can give the best of references. Twenty years' experience. Twelve years as Superintendent in last position. Address, "W. G. H.," care of STREET RAILWAY JOURNAL, New York. 2t

WANTED.—To take charge of Electric Power House and Line Work of some large Electric Street Railway Company, any City in East or West. Have had extensive experience. Address, "MGR. POWER STATION," care of STREET RAILWAY JOURNAL, New York. 1t

WANTED.—Position as M. M. or Superintendent of an Electric Railroad by man who has had large experience in steam and electric railroading. At present superintendent electric railway equipment factory. Address "RAILROADER," care of STREET RAILWAY JOURNAL, New York.

MISCELLANEOUS.

WANTED—To trade six miles No. 1 electric equipment for horses and cars or horse car equipment complete. Satisfactory reasons given on application. "TRADER," care STREET RAILWAY JOURNAL, New York. 3t

PROPOSALS WANTED.

PROPOSALS will be received for the COMPLETE ELECTRICAL EQUIPMENT of a Street Railroad Six Miles in length, now operated with horses. Full particulars will be furnished upon application. The work must be finished by September 5th, and the right will be reserved to reject any and all bids.

1t Address, **F. N. DERBY, Sup't, Salem, Oreg.**

Trial of The Angomar Motor.

The Angomar motor of the Kinetic Power Co., illustrated in the April issue of the STREET RAILWAY JOURNAL, has been tested of late on the tracks of the West Chicago company in Chicago. The results of the experiments were embodied in a report which were certified to by Arthur P. Dodge, general manager of the Kinetic Power Co., B. S. Smoot, engineer and machinist of the company and J. L. Blessing of the West Chicago Street Railroad Co. The report was as follows :

1. May 25, 1892, 11:55 P. M. Started with one long, open, nine foot wheel base trail car from Rockwell Street cable power house with 170 lbs. steam pressure ; proceeded east on West Madison Street to and down through the Washington Tunnel and around the regular cable downtown loop, returning to the Rockwell power house at 12:55 A. M., having then 145 lbs. steam pressure. Distance of trip seven miles. Water level in motor receiver lowered one and three-fourths inches by evaporation. Could readily have duplicated said trip once and probably twice upon one charge of water. Amount of fuel in fire box twenty-six pounds of anthracite coal which was about one-half consumed.

2. May 26, 1892, 8:40 P. M. Started from power house with similar trailer, the motor having a steam pressure of 165 lbs. and in its fire-box thirty-seven pounds of anthracite coal which was about two-thirds consumed. Proceeded east, as above, through same tunnel and loop ; thence west on West Madison Street to West Fortieth Street through cable loop house and returned to Rockwell, where the trailer was dropped ; thence to Western Avenue and Van Buren Street ; thence back north on Western Avenue, making a "Y" north of Madison Street, thence to Rockwell power house, arriving at 10:15 P. M., with 135 lbs. steam pressure. The water charge was lowered by evaporation (and the numerous leakages around cylinders, branch and throttle pipes, etc., which of course in no wise relate to the power principle), three inches. The water connection for charging motor takes water from feed pipe at the bottom of stationary boiler giving into motor dirty water, sediment, etc., and there are not as yet any means of taking a charge of dry, hot steam, as desirable. On this second trip we made forty-five stops, and both cars were crowded.

A Luxurious Car.

Speaking of the Private Compartment Cars, we quote from the San Francisco *Daily Report* of January 20, 1892, the car being identical with those in daily service on the New York & Chicago Limited over the Lake Shore Route :

"Isn't this too lovely for anything !" exclaimed a very pretty Oakland girl yesterday afternoon as she entered the Wagner compartment car attached to the Wagner vestibule train of sleepers which brought out the Eastern press delegates last week.

A D. R. reporter, standing near, at once became interested, for whatever receives so favorable a comment from an æsthetic damsel residing in the Athens of the Pacific must needs be lovely. The girl was right. Standing in one of those luxurious compartments, with everything so bright, attractive and comfortable, an irresistible desire to travel in a Wagner car seized the reporter. "All the comforts of home" and everything that the heart of the traveler could desire was there. Hot and cold water within two feet of him as he reclined indolently on what in the daytime was the most comfortable of lounges and at night is miraculously changed into the softest and most sleep inducing kind of bed. Cut off from the curious stare of his fellow travelers, the tourist can gaze his fill at the passing scenery and, when wearied of that, he can turn his gaze inward and amuse himself by wondering how the ingenuity of the Wagner people must have been taxed to devise so many comfortable things and put them in so small a space.

Even the most æsthetic tastes could not find subject matter for offense in a Wagner compartment car. All the colors blend nicely, the dark, handsomely stained wood of the car harmonizes with the elegant frieze covering of the seats.

The compartment car is in the same style as those run on the famous limited train between New York and Chicago. It has ten connecting staterooms, furnished in different styles of woods, upholstered with silk damask to correspond with the wood. The seats are covered with the finest kind of frieze plush.

The car is steam heated, and each compartment is lighted by gas and contains a lavatory, hot and cold water, closet, etc.

Oh, yes—the reporter forgot about that pretty Oakland girl. He was just in time to catch her last sentence as she stepped off the train, and this was it, honor bright : "I vow, I'll never travel in a Pullman sleeper again."

Visit of Electrical Engineers to Chicago.

The ninth general meeting of the American Institute of Electrical Engineers was held in Chicago June 6, 7 and 8. The Eastern delegation, which reached the city by special train, was large, and the visitors greatly enjoyed their stay in the city. Several papers relating to street railway work were presented, the most important of which are given in abstract in another portion of this issue. The visitors enjoyed two excursions. The first was that to Pullman, where they were shown through the immense works of the Pullman company. On Wednesday afternoon they visited the World's Fair grounds at Jackson Park.