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The Engineer and the Public Library

The old adage that knowledge consists in either knowing a thing or else knowing where information regarding it may be found is nowhere truer than in modern engineering. So fast is this great field of man's activity becoming specialized that nearly every branch now has its own literature, professional organizations, clubs and educational courses, and the engineer who would keep in touch with the most advanced practice in any particular line must utilize every possible facility which can be given him, finding it a heavy task at best.

Numerous writers have emphasized the importance of the technical journal, the published index of engineering literature, and the technical club, institute or society, but little stress has been laid upon the possibilities of the public library in recording and filing engineering progress. That great opportunities exist in this field, no engineer who has spent hours in the search of some elusive formula or process in library archives can deny.

Nothing is further from the purpose of these suggestions than to belittle the present excellent technical equipment and painstaking service which are found in many of the large city libraries of to-day. The limited resources of the smaller libraries place them in a different class of intellectual tools, and what should be possible in a great metropolitan library is no more to be compared with the limited opportunities of the small one than the relative output of a steam shovel and a day laborer.

It is certain, however, that there is room for the application of more modern methods in the engineering sections of many large libraries. In cities where large universities, colleges and technical schools are situated, or where manufacturing and industrial interests in general are powerful factors in the life of the community, the employment of an engineering librarian would be the means of a marvellous gain in operating efficiency. By devoting his entire time to the proper recording and filing of engineering progress, such as given in the technical journals, consultations with engineers, manufacturers, mechanics, mathematicians, chemists, physicists, students, in short, the whole engineering fraternity, in regard to the location of the exact information for which they are seeking, the annual saving of valuable time effected would many times pay the liberal salary which he should receive. It is difficult to realize the number of such consultations per week which would come to pass if one or more of the great city libraries should organize a department of engineering literature with a skilled statistician of engineering experience at its head.

The argument that the present demand does not warrant such a course is of feeble import. Few trained library attendants can realize the number of times each week that the library falls short of its full usefulness through the failure of both knowledge seeker and attendant to find the particular information desired. Few but the unsuccessful hunter of information can fully realize the immense advantage of being able to find what is wanted within a few moments, or even seconds, through the perfected organization of the engineering librarian's new department. Month by month it would grow more valuable, until at last it would stand complete to the very week of each publication, with all important preceding engineering literature at its disposal.

Certainly the industrial engineering enterprises which constitute such an important factor in the material prosperity of this country warrant more attention, in the way of service, from our public libraries, than they are now receiving. The results of the last two decades especially, in engineering and inventive enterprise, form a frequent topic for the popular orator in discoursing upon the advantages which those living at the opening of the twentieth century enjoy in material comforts and well being. But what facilities are offered to the engineer and inventor in the average public library to keep himself informed as to the present status of many of the engineering industries? This may possibly be due, to a certain extent, to the fact that much of such information is, and necessarily must be, in periodical form. Nevertheless, it is an anomoly that most public and university libraries in America offer far greater opportunities for studying lapsarianism or the habits of the ancient Ninevites than the latest developments in electrical engineering or train resistance.

Many engineers find it necessary at their own expense to keep up libraries and engineering indices of the branches in which they are most interested, knowing that it would be impossible to secure such data as they require from the public library in their own city, but such a course of duplication necessarily involves a great waste of labor, and, as stated before, could well be replaced by some kind of library action.

Some form of the card catalogue would, of course, be the

key to the situation. Every item of useful authentic information published in the engineering world should finally be indexed in the work of the department chief and his assistants. Every recognized engineering book of worth should be reviewed and its hidden secrets hinted in the card catalogue and in the monthly library bulletins.

Finally, as the work of the department became known in other cities of the country, a central headquarters for the supply of engineering indexed cards, data and literature to libraries in many places might be formed. Transacting its business by mailing printed cards of standard size to all the libraries of the country which could pay the moderate cost of the service, it would save an enormous amount of repetitive work and become an institution of ever-present value to the engineering profession. It would make use of all the present sources of indexed information, including them in its comprehensive and extended operations, and by its own sub-divided output would supplement them to an extent that would gradually render it the most complete treasury of engineering record in the United States.

Should Labor Unions Incorporate?

The recent outbreak among the trolley men of Bridgeport, following closely upon the outrages that were perpetrated in Waterbury under similar conditions, has attracted universal attention throughout the State to the demand that labor unions be placed under restrictions which will insure the fixing of responsibility where it belongs for the action of the organization, its members and sympathizers. The high-handed policy adopted by the union in the trolley fights has opened the eyes of many unthinking citizens to the true condition of affairs, and made them withdraw their countenance and support from the organization because of the methods employed in furthering its ends. More than that, it has impressed them with the belief that measures should be taken to restore order and respect for law, to protect the lives and property of individuals and corporations and to recognize the inherent right of every individual to work and dispose of his labor according to his own wishes.

The discussion on this subject has given additional interest to the measures proposed in the Connecticut Legislature, and advocated in other States, providing for the incorporation of labor unions. This plan has always been opposed by professional agitators, whose principal occupation is stirring up strife, and especially since the decision of an English court imposing heavy damages upon an organization of railway employees for entering into a conspiracy against a corporation and placing it under a boycott. It is not certain that the rule established in the now celebrated Taff Vale case would not apply to officers and members of labor unions engaged in similar conspiracies in their private and official capacities, but if the unions were incorporated they could certainly be reached and punished for any violation of the law. In support of the measure it is contended that if incorporation is desirable for large aggregations of capital, it should be advantageous to large bodies of workmen, and it is pointed out that if incorporated capital is responsible before the law for its acts incorporated labor should be as well, and that both should pay the penalty for wrong doing. Just now the labor unions are denouncing the employers who are forming an organization for their own protection, on the ground that the new combination is a "conspiracy." What then is the entire labor movement? It would be well for both organizations to incorporate and transact their business strictly within the limits of the law. Another advantage the workmen would enjoy is the fact they could then consistently claim recognition of their organization as a responsible body.

The movement is intended to prevent violence, threats, intimidation, boycott, attempts to prohibit the employment of a person in any place made vacant by laborers or workmen in a so-called strike, and is in the interest of public health and safety. It would prevent a strike on a public corporation engaged in the operation of a steam railroad, trolley line, gas or electric light plant.

It is not the intention to deprive individuals of their right to quit work, but to prevent a simultaneous cessation of labor by all the employees of a public corporation, thereby endangering the health and safety of a whole community.

In other countries where transportation business is carried on by the government the employees in these departments are not permitted to join unions, although they are not prevented from entering associations formed for their improvement and advancement. This position is justified on the grounds of the public welfare, and it is pointed out that if employees in such branches of the public service as the postoffice, the police or the army and navy were permitted to go on strike, a condition of anarchy would prevail. Yet the interruption of transportation would be equally serious to the business interests and to the comfort and convenience of the public. Because of this fact it was provided in the proposed legislation that thirty days' notice be given by every employee of a trolley or steam railroad line before being permitted to withdraw from the service. Such a rule would enable the operating company to make provision for carrying on the business; but this, of course, is directly opposed to the labor union policy, and any relief coming in this manner must be secured in spite of their organization and not because of any help received from it.

Overcrowding and Ventilation

Regulations governing the operation of electric railways in English cities are coming in for modification to some extent, but innovations have not been altogether favorably received. The most important subject under consideration at present is the question of carrying more passengers than the seating capacity of the cars provides for, and this, naturally, leads to an investigation of the facilities for ventilation. In many places the local authorities have approved of the carrying of more passengers than can be seated, especially on rainy days, but even under these circumstances protests have been made, and in one instance the medical fraternity has been appealed to, with the result that an interesting discussion has been precipitated. A canvass of the opinions expressed showed that as an abstract proposition the practice of overcrowding the cars and the manner of ventilating them now in vogue constitute, in the minds of the gentlemen consulted, a menace to public health. Thirty-six physicians condemned outright the practice of standing in the passage way and the present system of ventilation as well; twenty-nine opposed overcrowding, but found no fault with the ventilators, provided they be kept open, while only five considered that the convenience afforded to the community by taking an excess number of passengers outweighed the disadvantages of overcrowding, yet at the same time these five were opposed to the system of ventilation. Out of seventy-six replies received only six favored permitting passengers to stand and the present method of ventilation, so that on the question of public health the medical testimony is almost unanimous in opposition to the innovation.

In this country overcrowding is tolerated in large cities as a necessary evil, and under certain conditions is expected, as, for instance, during the rush hours and inclement weather. It is generally admitted that in rainy weather much more harm would be done by requiring patrons to stand on street corners awaiting cars in which they could find seats than in hurrying them home, no matter how crowded the cars might be, and even though patrons might suffer some inconvenience and discomfort for a short time. It would simply be out of the question to enforce such regulations as obtain in England in a large American city, and one cannot comprehend how such restrictions could be imposed under the conditions that exist in New York or Chicago, for instance.

In the matter of ventilation there is much to be desired, especially during the cold weather, when it is necessary to keep windows and doors closed. The deck windows afford little relief, especially in the long trips, when ventilation is most needed, and they give rise to many complaints because of the drafts that they produce. The investigations in England will be followed with interest in this country, as the subject is being brought to the attention of the operating companies in the larger American cities.

A Question of Salary

The influence of salaries and wages in the operating expenses of a large electric railway system affords many opportunities for thought on the part of the controlling management. As there is no feature of the work which appeals more directly and vitally to every employee of the company than does the question of compensation, we believe that it deserves the most earnest consideration on the part of those who hold the power of financial decisions in their hands.

It is doubtless true that the faithful performance of certain specified duties in street railway work implies an average market price, so to speak, for that particular work, whether it be running a car, inspecting equipments, turning switches or keeping clerical records. Unless the conditions on different roads vary to a large extent as regards the character of work required, it is reasonable to assume that wages, at least, may be regarded as much alike, provided the cost and standard of living in the compared communities are similar. We also assume that the owners and managers of the electric railway systems in this country are, in the main, anxious that the great body of their employees should be contented with the conditions under which they work, fairly paid, and assured of such comforts and pleasures of life as are consistent with their earning capacity.

Executive work of responsibility usually carries with it compensation in some degree proportional to its value. It is commonly understood in business circles that ability of this kind in vigorous practice commands a good price. We believe, however, that, as a rule, the heads of departments in many street railway installations are underpaid from the manager down, due largely to the fact that the responsibility of their work is generally underestimated by the non-technical directors of the companies.

It is manifestly difficult for anyone to appreciate thoroughly conditions which surround a class of service which is unfamiliar to him. Operating expenses in the aggregate are far more significant to the non-technical mind that when considered in detail. Watt-hours per ton mile are about as intelligible to the active business man whose interests in the road are purely financial as the accounts of a Chinese laundry to the average American citizen. All that the director asks is that operating expenses shall be shaved as close to the jugular vein of traffic as safety will permit. It is often very hard for such a director to see that the efficiency of the manager or of the heads of some of the departments exerts a profound influence upon the cost of operation. Take the engineering department, for example, for this is usually a conspicuous illustration of non-appreciation. Far too often is this force regarded as simply an organization of highly skilled and educated mechanics, and far too seldom are the salaries in this department adequate in view of the hard and responsible work required. An illustration or two will throw additional light upon the matter.

One of the large street railway companies of this country lost its electrical engineer by resignation several years ago. Following his departure, the work which he carried on was taken up by another engineer in the company's employ, with increased responsibility. Neither the salary nor the title of the first man has ever been accorded the second, to the best of our knowledge. There can be little enthusiasm possible in working under such conditions. Another large company refuses to pay to its chief mechanical and electrical engineer's assistant, an able man of several years' experience, and a technical graduate in electricity, as large *wages* as are earned by an experienced motorman or conductor on its lines! We cannot believe that state of affairs is the result of anything but ignorance of the real conditions. However conscientious a man may be there is no doubt that adequate compensation, supplemented by reasonable hope of advancement, is a wonderful stimulus to extra effort, and a potent factor in actually lowering the expenses of operation, as far as the individual employee is concerned. Few of a company's workers are in a better position to eliminate wastes of various kinds than the active engineers of the machinery and electrical department, and we believe that the day is gradually approaching when laymen will awaken to the fact that engineering is a profession of high responsibilities and opportunities, that it is entitled to compensation comparable with the rewards obtained by reputable legal and medical practitioners, and that the services of technical experts are indispensable to the highest success of modern industrial undertakings. In addition, that unless compensation and appreciation are adequate, the short-sighted organizations which pay stingy salaries to some of their best employees will find themselves ultimately stalled in a bog of depreciation from which the only escape will be through the payment of heavy sums of money for new and revised equipment.

Electric Railway for the St. Louis Exposition

Prospective visitors to the Louisana Purchase Exposition, in St. Louis next year, are to be congratulated on the decision of the management of that exposition to construct an electric railway for transportation within the grounds rather than depend on automobiles or other inadequate means of transporting large crowds safely, which were proposed. It would certainly have been a great misfortune if the exposition had been deprived of adequate means of local transportation within its boundaries, and the electric railway offers the only economical and satisfactory method of accomplishing this at present known. The area devoted to the modern "World's Fair" is so vast that it is not only helpful but essential to the comfort of all visitors to have a quick, safe and cheap method of moving from one part of the grounds to another, and this can best be supplied by an elevated or depressed electric road.

THE THREE-PHASE RAILWAY AT VALTELLINA

Although this railway has been discussed to a considerable extent in public print, comparatively little positive information has been published as to its electrical equipment and the results secured in operation. This has been due partly to the fact that the contractors, Ganz & Company, of Buda-Pest, realizing that the equipment was a radical departure from anything which had previously been put in service, took the conservative attitude not to describe many of the details of operation until they had been tested in actual service, and partly because the owners of the line, the Adriatic Railway Company, have also been disinclined to allow full particulars of the equipment to be made public. The road has now been in operation since September, 1902, and the novel features and extent of the line warrant a more extended account than has yet appeared in the technical press.

The line consists of three divisions. The first extends along the east shore of Lake Como, from Lecco to Colico. It then divides, one division extending north to Chiavenna, the other east to Sondrio, along the Veltlin Valley or the Valtellina. The sections enumerated have following lengths:

Lecco to Colico, 38.95 km, about 24 1-3 miles.
Colico to Sondrio, 40.79 km, about 25½ miles.
Colico to Chiavenna, 26.57 km, about 16¾ miles.

The grades on the line are inconsiderable, as shown by the accompanying profiles, Figs. 2 to 4, which indicate them in tenths of 1 per cent. The steepest is near Chiavenna, where a grade of 1.995 per cent is reached. The curves, however, are numerous, as the curve diagram under each profile will show. Being a converted steam line there is a considerable freight business, and especially in the summer season a large passenger traffic. This consists for the most part of tourists, who arrive from Switzerland over the Splügen Pass, or from the Engadine through Valbegraglia to Chiavenna. The Sondrio division is also a part of the through route by diligence from Austria and Southern Germany to Italy for tourists from the Tyrol.

The physical difficulties in the installation of a satisfactory overhead system for the three-phase circuits were enormous, due principally to the large number of tunnels, especially on the Lecco-Colico division. Half of this division is on curves, and about 30 per cent of it is in tunnels. The heaviest grade on the entire line, as shown in the profile, is about 2 per cent, the smallest curve-radius on the line is 1000 ft., and at switches is 500 ft.

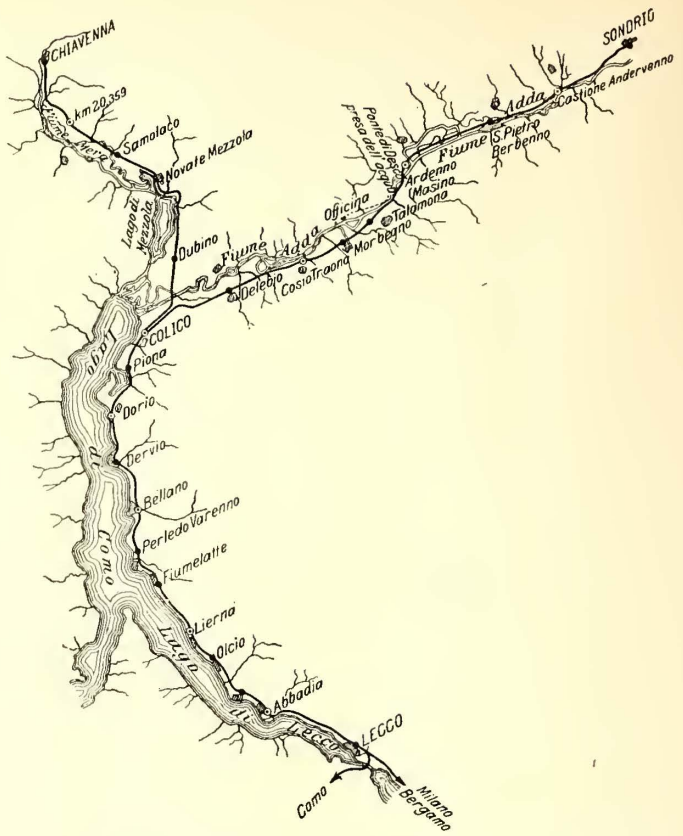


FIG. 1.—MAP SHOWING ROUTE OF VALTELLINA RAILWAY

It was largely on account of these conditions that the directors of the Rété Adriatica, or Adriatic Railway, decided to test the merits of electric traction for heavy railroad service first on these lines.

POWER STATION

The power plant has been erected at Morbegno, where three-phase current at a tension of 20,000 volts is produced

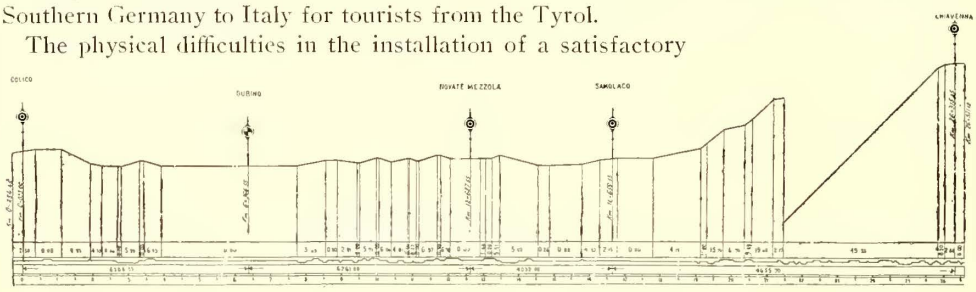


FIG. 2.—PROFILE FROM COLICO TO CHIAVENNA

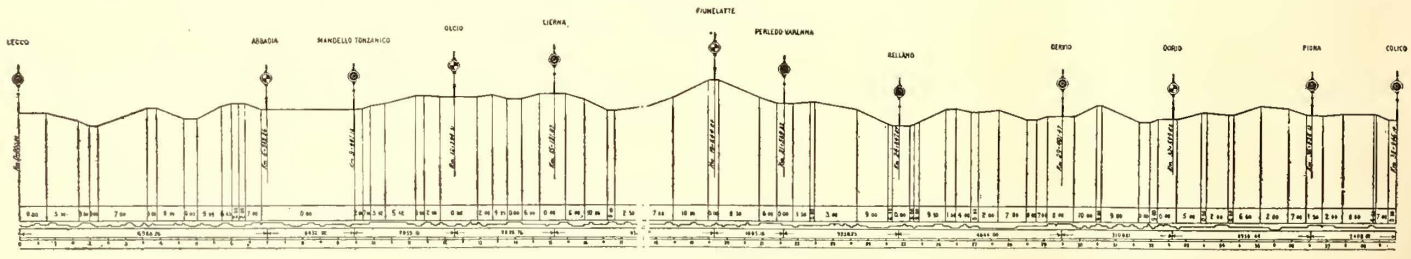


FIG. 3.—PROFILE FROM LECCO TO COLICO

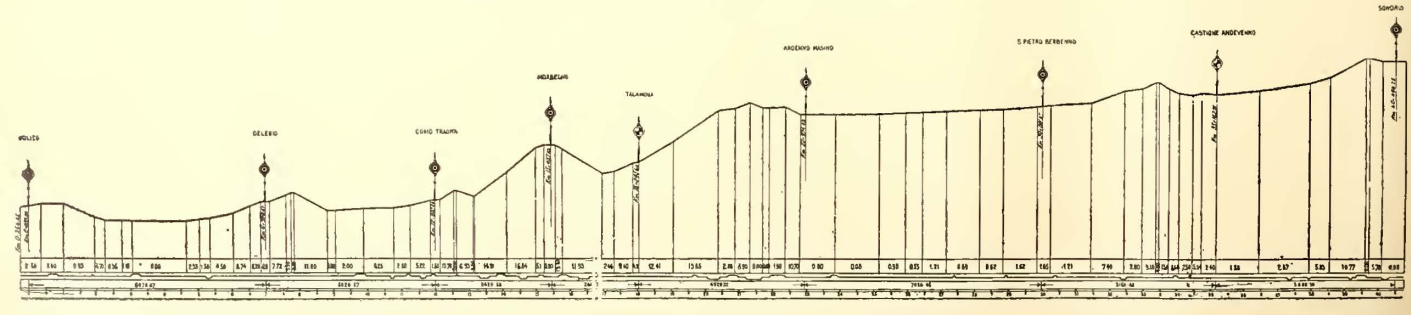


FIG. 4.—PROFILE FROM COLICO TO SONDRIO

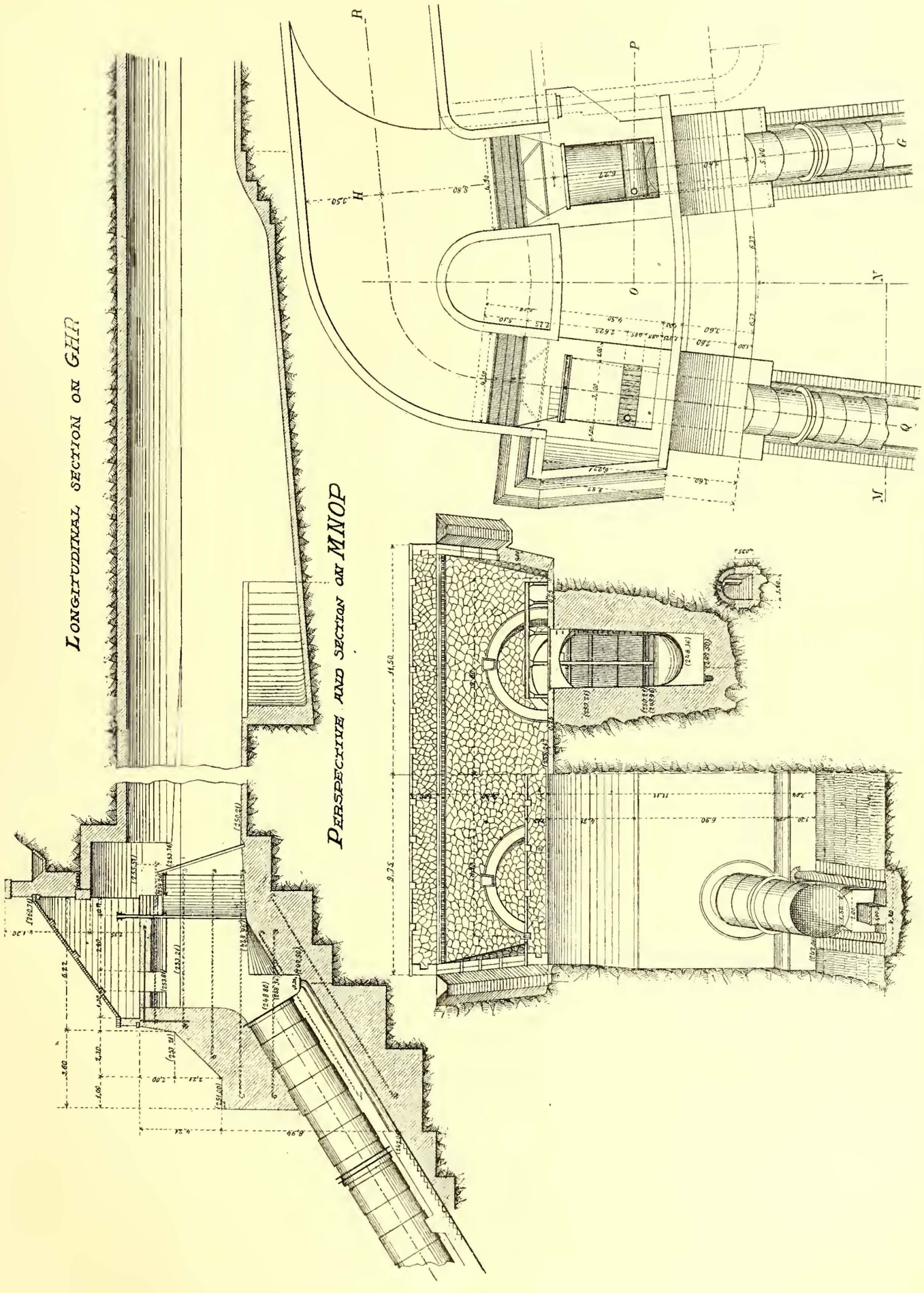


FIG. 5.—PLAN AND SECTIONS OF DAM

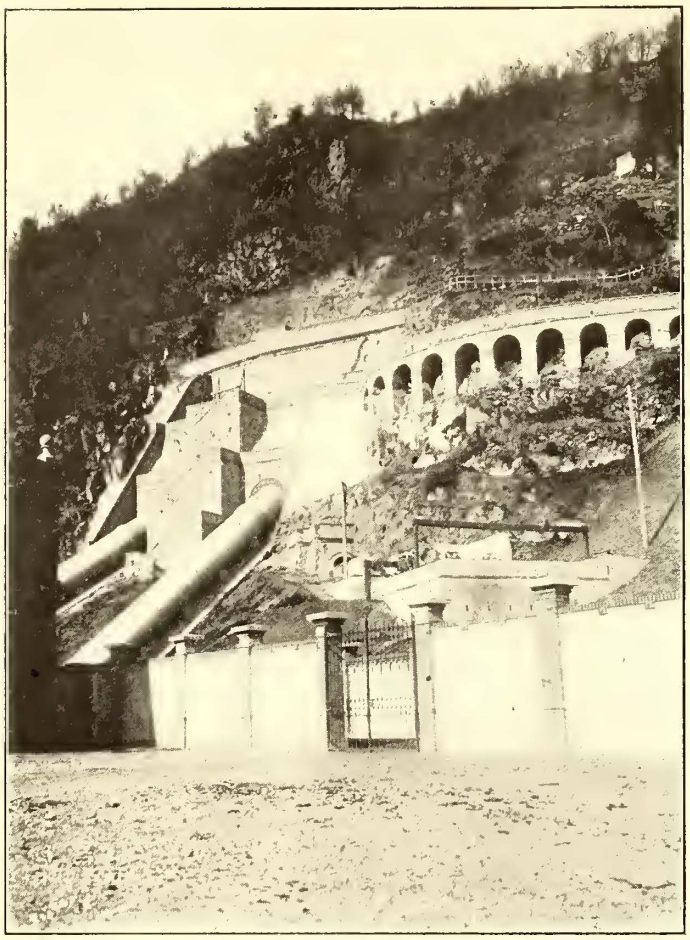


FIG. 6.—VIEW OF DAM

direct, that is, without step-up transformers, and led to the sub-stations located along the line, where the current is reduced to 3000 volts, which is the tension used on the two trolley wires.

Power from the River Adda is used for motive power in the station. The distance from the dam to the point of use is about 5 km (3⅛ miles), and the head available is 107 ft. The minimum volume of water is 5500 gals., so that the lowest amount of energy available is 7500 hp. The water shed from which this water is taken has an area of 980 sq. miles.

At Desco where the water is empounded the Adda divides into two arms, of which one has been thoroughly shut up and the other adapted for the weir. At this point the Adda preserves the character of a mountain river, carrying a great deal of gravel and sand, especially at high water. For this reason a sluice-weir has been chosen. At high water these sluices are entirely open, so that the water will freely flow into the head-race without stowing; at low water the head-race-level, by means of sluices, is constantly kept at the high-water mark, the water passing through two openings into the first tunnel, thence into the head-race. The latter is built partly of masonry and partly through rock as a tunnel. Its total length is 16,200 ft., and it has an average fall of 1 in 1000.

The first gravel sluice is situated at a distance of 3000 ft. from the mouth of the first tunnel, the second between the

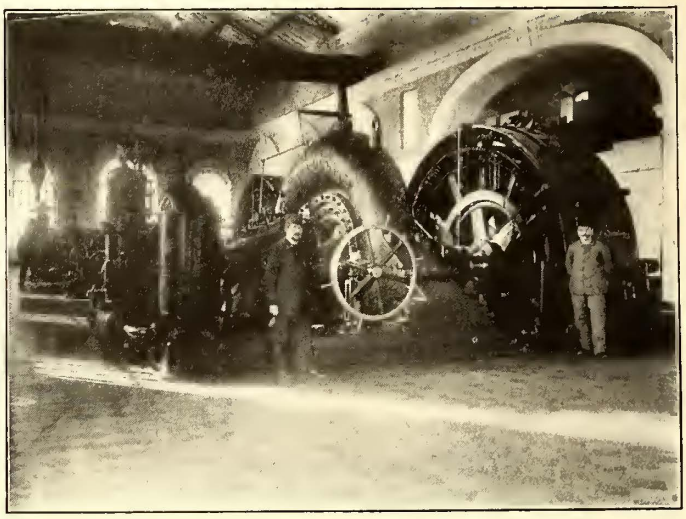


FIG. 8.—INTERIOR OF POWER STATION

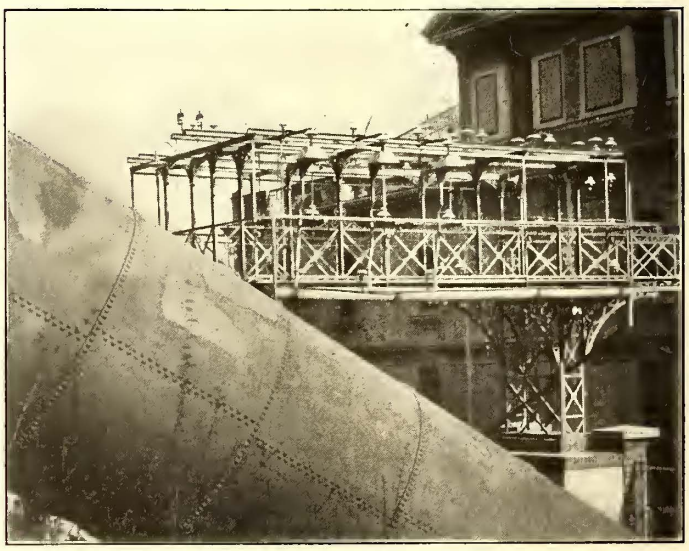


FIG. 10.—WATER JET LIGHTNING ARRESTER

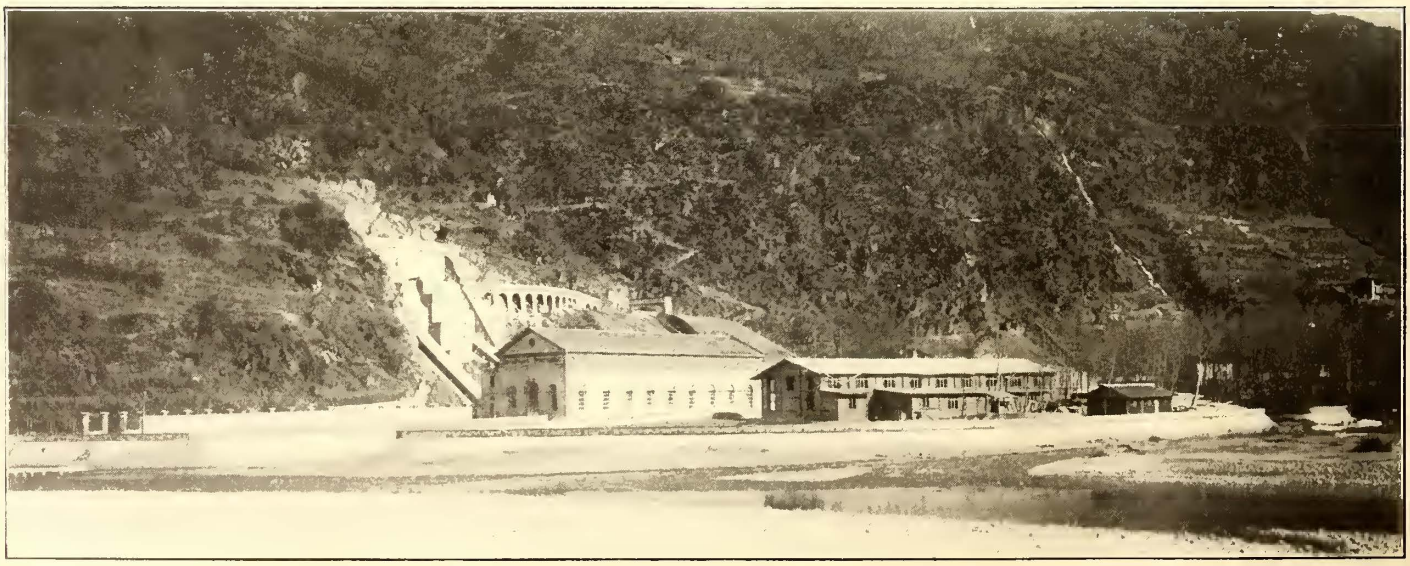


FIG. 7.—POWER HOUSE AT MORBEGNO

tunnel before the last and last one, and the by-pass gate directly in front of the water sluice, so that any excess water at a low load of the turbine can freely flow off. This by-pass gate is of sufficient size to permit of the whole volume of water, i. e., 5500 gals. per second being discharged.

In the final tunnel the canal has a width of 23 ft., and here, for a length of 82 ft., it is 16 ft. 6 ins. deep, so that the velocity of the water is reduced from 8 ft. per second to 2 ft. 4 ins. per second, and at this point any further gravel or sand carried by the water can be removed.

From this basin the water, see Figs. 5 and 6, is conducted by two riveted pipes of 225-ft. length and 8-ft. 3-in. diameter, and at an incline of 45 degs. to the turbine house. Each pipe there divides into two parts, the branches leading to the turbine of 2000 hp each. The tail-race has a length of 330 ft. and a width of 66 ft.

The power station contains three turbo-generator groups of 2000 hp each. A fourth unit will be erected when necessity arises, and will have a capacity of from 3000 hp to 4000 hp. The Francis turbine, supplied by Ganz & Company, is used, and runs at a speed of 150 r. p. m., under a net head of water of 100 ft., which at high water, when the water is discharged back, may be reduced to 89 ft., or even in exceptional cases to 86 ft.

The turbines are of the inward-flow type, and the water is conducted to the blades through Fink adjustable guide blades. Adjustment can be done by hand or with a centrifugal governor and a relay. The guide blades can also be adjusted from the switchboard by means of a chain acting on the relay governor; this method is followed when putting the generators in parallel. The blades are moved by oil acting on a piston under a pressure of ten atmospheres. Each turbine is coupled direct to an oil pump, which forces the oil into an oil reservoir. The gov-

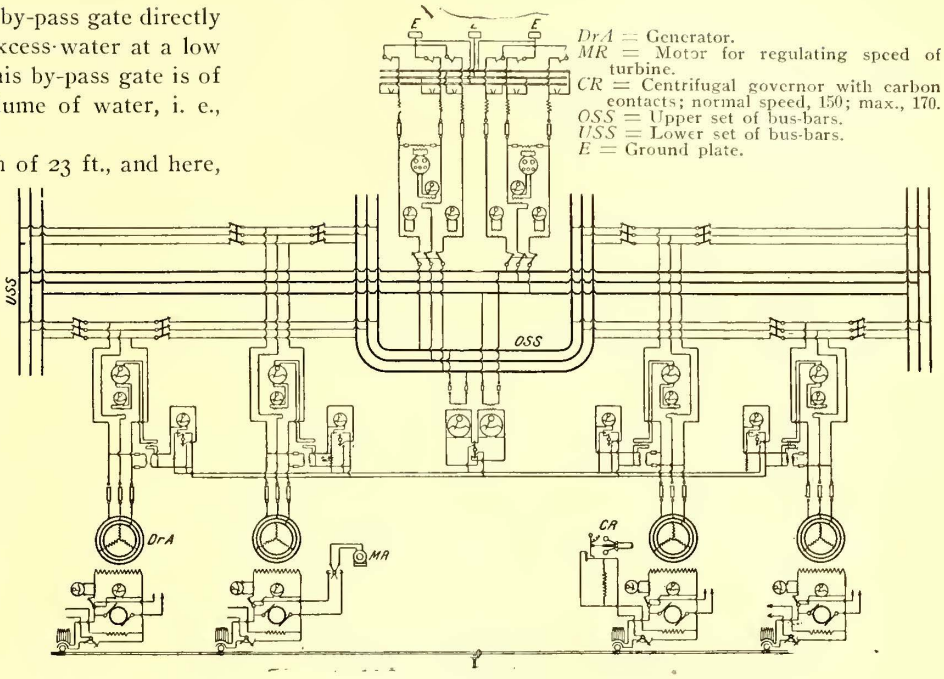
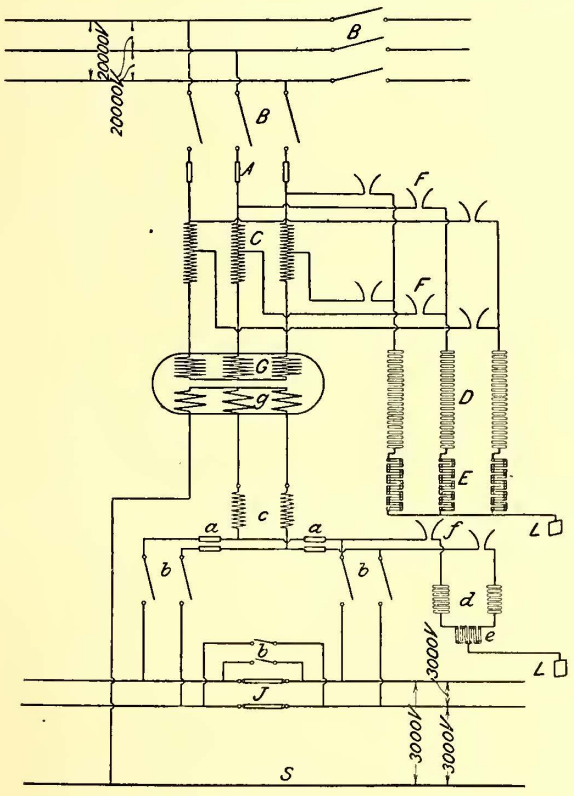


FIG. 9.—WIRING PLAN OF POWER STATION



A = Fuses for 20,000 volts.
a = Fuses for 3000 volts.
B = Switch for 20,000 volts.
b = Switch for 3000 volts.
C = Choke coils for 20,000 volts.
c = Choke coils for 3000 volts.
D = Wurts zinc plates for 20,000 volts.
d = Wurts zinc plates for 3000 volts.
E = Carbon rheostat for 20,000 volts.
e = Carbon rheostat for 3000 volts.
F = Horn arresters for 20,000 volts.
f = Horn arresters for 3000 volts.
G = Transformer for 20,000 volts.
g = Transformer for 3,000 volts.
J = Section insulator.
S = Track.
L = Earth plate.

FIG. 11.—DIAGRAM OF CIRCUITS IN TRANSFORMER SUB-STATION

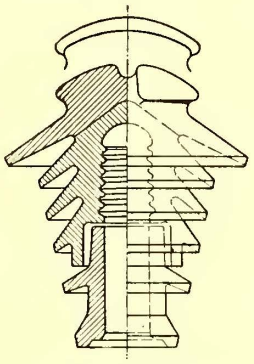


FIG. 12.—FEEDER INSULATOR FOR 20,000 VOLTS

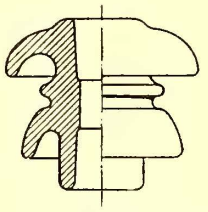


FIG. 13.—SPAN WIRE INSULATOR FOR 20,000 VOLTS

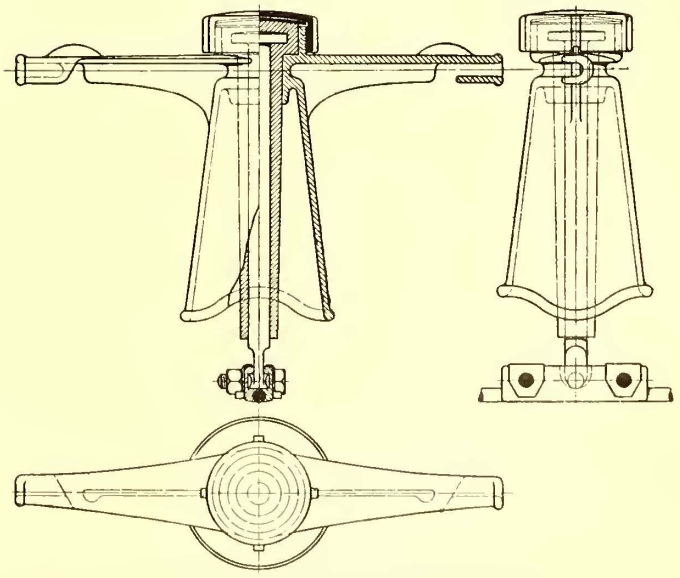


FIG. 14.—HANGER AND EARS FOR 20,000 VOLTS

ernor, which is of the centrifugal type, acts on a valve, which either connects the two cylinders of the controlling piston with the oil reservoir or with the suction storage of the oil pumps.

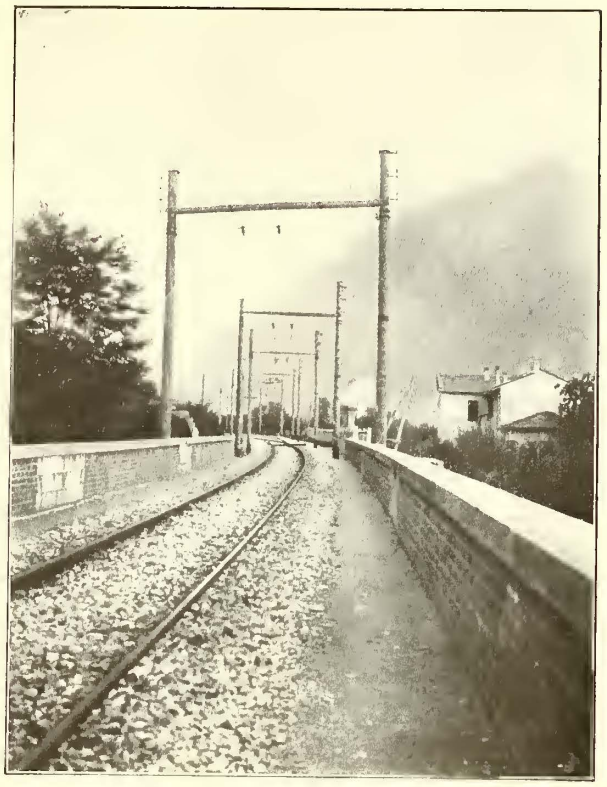


FIG. 15.—SPAN-WIRE CONSTRUCTION

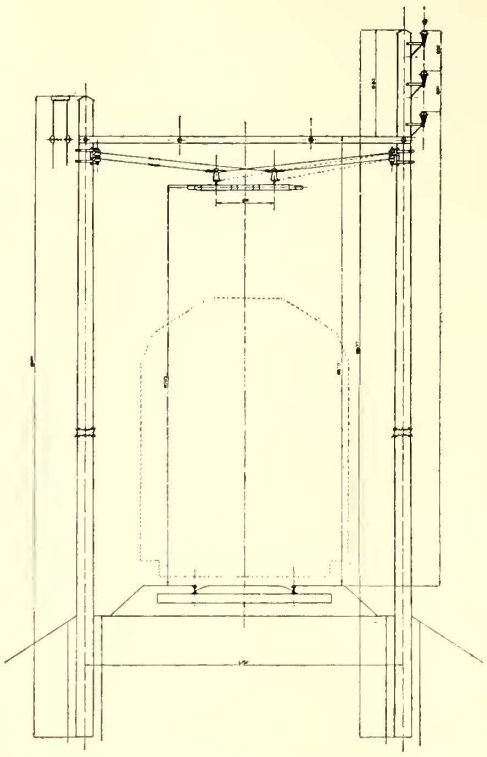


FIG. 16.—SPAN-WIRE CONSTRUCTION

The three-phase generators, Fig. 8, supplied by Schuckert, of Nuremberg, generate at a normal load, and a lag of phase of cos 0.7, three-phase current of 1050 kw at 20,000 volts and 15 periods. When passing over from no load to a load of 1500 hp the voltage at a constant number of revolutions decreases only 15 per cent. At a sudden change from full load to no load the voltage rises only 10 per cent. The short circuit current is six times that of the normal. The generators are designed to be able to stand a short circuit for 120 seconds without injury.

In case of the turbine-governor failing to act the direct-coupled exciters are provided with an automatic switch, which inserts the resistance in the exciter circuit when the turbines run away, thus avoiding injury from an increase in voltage in the main circuit. This arrangement prevents the voltage exceeding 25,000 volts, even if the number of revolutions should be 250 per minute. This provision was made not so much to protect the alternator against injury as to avoid damage to the switchboard apparatus from the high voltage. The total weight of the alternator is 153,000 lbs., of which 97,000 lbs. is the weight of the rotary part, including the shaft.

The switchboard is designed for four generators and two sets of bus-bars. The plan of connections and the arrangement of the apparatus on the switchboard may be seen from Fig. 9. At present only one set of bars is used, the other being intended for testing the generators by means of water rheostats. Well-insulated underground conductors lead from each alternator

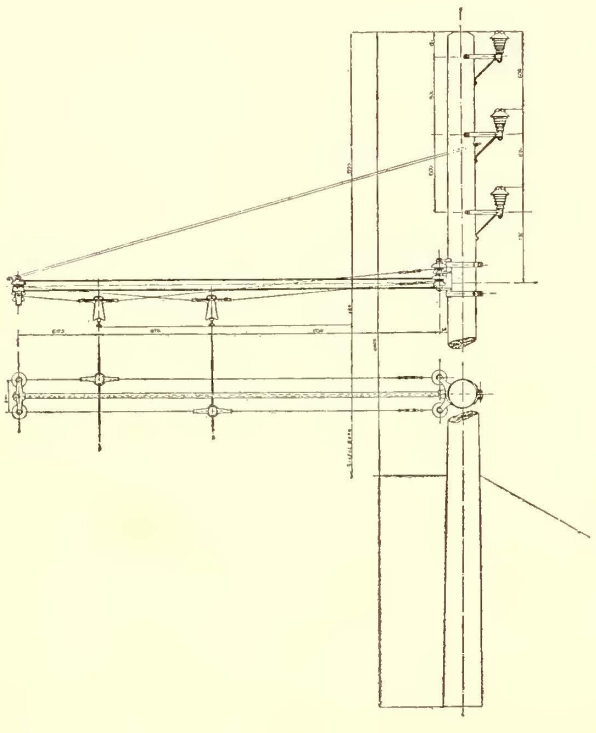


FIG. 17.—SINGLE-BRACKET POLE

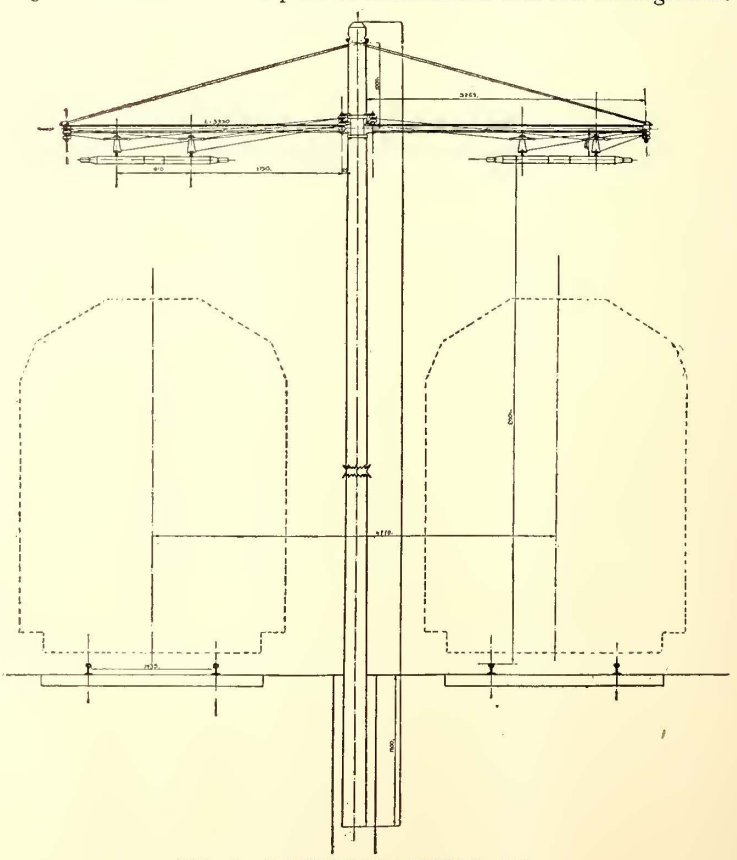


FIG. 18.—DOUBLE-BRACKET POLE

to the two sets of bus-bars on the switchboard. All of the apparatus mounted on the front of the switchboard is for low-tension service only, so that there is no occasion for the operating staff coming in contact with the high-tension current.

All high-tension switches are handled from the front side of the switchboard except the switches for the outside circuits, which are behind it.

A novel form of lightning arrester is used where the outside wires enter the station. It is shown in Fig. 10, and consists of three water jets, each 15 mm (9-16 ins.) in diameter, which discharge static electricity readily, but through which there is a leakage from the station of only about 1-10 amp. at 20,000 volts.

TRANSMISSION LINE

From the central station the three primary conductors at 20,000 volts lead across the Adda to Morbegno, where they divide. Towards Sondrio the lines are carried to Castione, and consist of three soft copper wires of 7-mm diameter. In the other direction, i. e., toward Colico the conductor consists of three wires each of 8-mm diameter. At Colico the conductor again branches, one set going north to the last transformer station on this section, which is situated at a distance of 3.1 miles before Chiavenna is reached, and south to Abbadia. These conductors consist of soft copper wires of 7-mm diameter. The primary conductors and the distribution of the transformer station are illustrated in Fig. 11. The pole line consists of larch poles, with a minimum diameter of 10 ins. at the upper, and a minimum diameter of 1 ft. at the lower end. Before the erection the poles are burned and tarred at their lower ends. At the stations the platform poles are set in cast-iron bases. The high-tension wires are carried, as a rule, on the trolley wires, but on the side away from the track. They are spaced 24 ins. apart. The high-tension wires are not, as a rule, carried through the tunnels but over them. High-tension switches, installed in each transformer station, enable the primary conductors to be divided into sections.

FIG. 19.—DOUBLE-BRACKET CONSTRUCTION

The contact-wires consist of two hard-drawn copper wires of 8-mm diameter and 3 ft. apart. The rails are used as a third conductor, and are connected by 6-mm copper bonds. The contact-wires are fixed at a height of 20 ft. in open stretches and at 16 ft. in tunnels, and are suspended by ambroin insulators attached to galvanized steel wires of 5-mm diameter. Separate span wires are used for each conductor. The ends of these span wires are attached to porcelain insulators of special type (Fig. 13).

The ambroin insulators consist of a cast-iron bell, holding a steel bolt embedden in ambroin, and having at its lower end a mechanical clip. Fig. 14 shows the section of this insulator.

On curves of 3000-ft. radius and less the contact-wires are suspended on double poles with span connection, Figs. 15 and 16; on curves of greater radius and on tangents they are mounted on single-bracket poles, Fig. 17, and in the stations on double-bracket poles, Figs. 18 and 19.

To prevent collisions at stations a section of the contact-wire of 1000-ft. length on each side of each station is isolated by section insulators, Fig. 20, and is disconnected unless the semaphore shows clear. The switch in the station, by which this section is made alive, cannot be inserted until the corresponding semaphore or the distance signal has been adjusted at "line free." In addition the Webb-Thomson train staff system

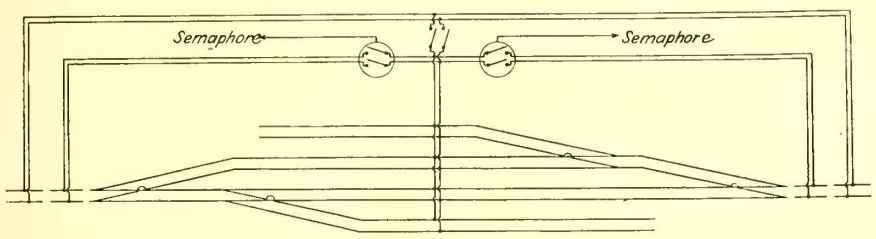


FIG. 20.—OVERHEAD WIRING AT A STATION

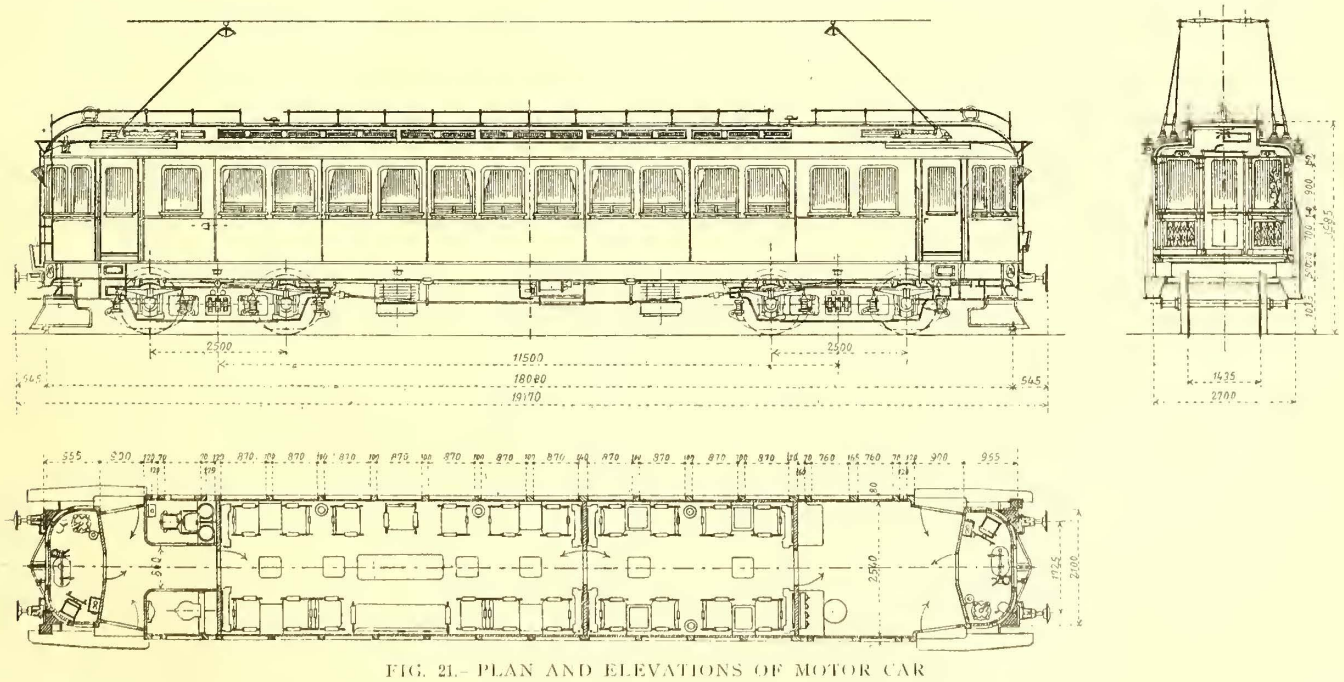


FIG. 21.—PLAN AND ELEVATIONS OF MOTOR CAR

is used between stations. The primary and contact-wires are protected by Siemens horn lightning arresters with water rheostats in the earth circuit.

TRANSFORMER SUB-STATIONS

The system of distribution at the sub-stations has already been shown in Fig. 11. In each station there is one 300 kw transformer, except at the Abbadia sub-station, where there are two. Each sub-station is divided into two rooms; in the outer are located the cut-outs, switches and one small fan for cooling the transformers, as well as the lightning arresters for the primary and secondary conductors. The ratio of the transformion is from 6:1. The transformers also have several windings, which supply the current at 14 volts for running the small fan-motors.

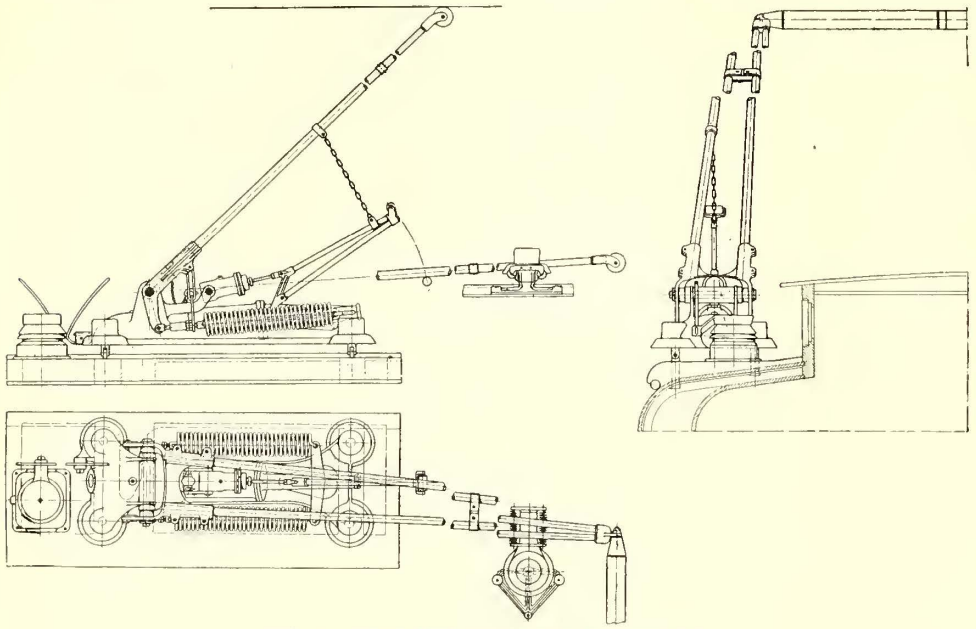
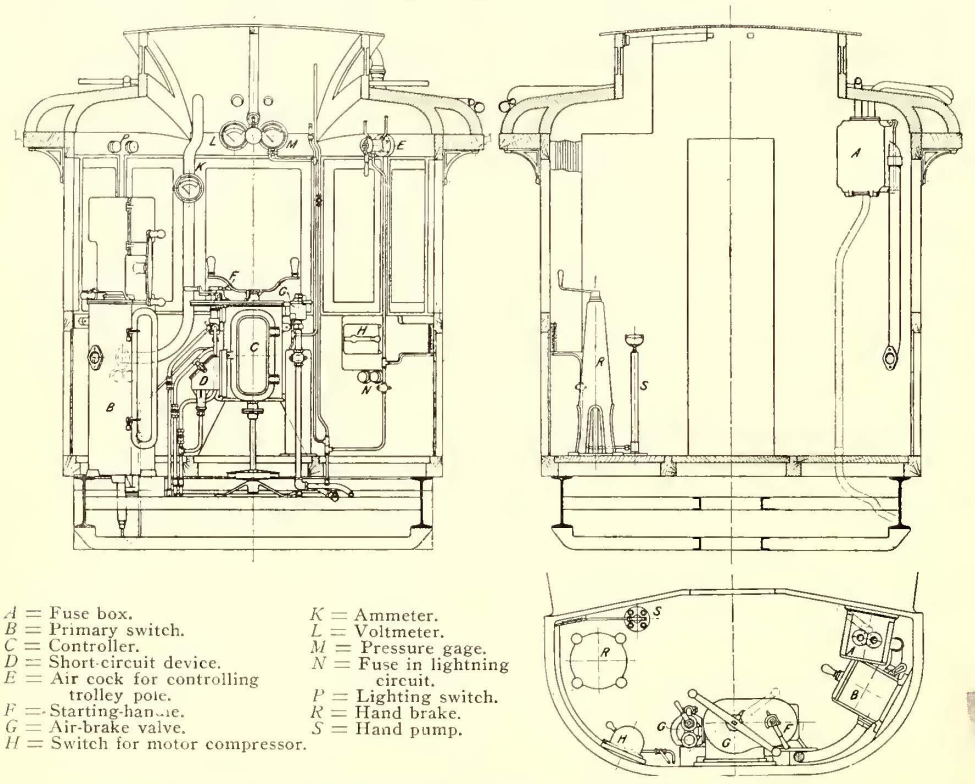


FIG. 22.—TROLLEY AND TROLLEY STAND



A = Fuse box.
B = Primary switch.
C = Controller.
D = Short-circuit device.
E = Air cock for controlling trolley pole.
F = Starting-handle.
G = Air-brake valve.
H = Switch for motor compressor.
K = Ammeter.
L = Voltmeter.
M = Pressure gage.
N = Fuse in lightning circuit.
P = Lighting switch.
R = Hand brake.
S = Hand pump.

FIG. 24.—SECTIONS AND PLAN OF MOTORMAN'S CAB

MOTOR CARS AND LOCOMOTIVES

The express and passenger trains are hauled by motor cars, the freight trains by electric locomotives. The company has already decided, however, to use electric locomotives for certain express trains of 250 tons, which run at from 37 miles to 44 miles, and of freight trains of 400 tons, which run at from 18.5 miles to 22 miles on grades of 1 per cent.

The weight of the motor cars, including the electrical equipment, is 53 tons, and they are able to haul from five to seven trail cars of 10 tons and 12 tons dead-weight, at a speed of 40 m. p. h., up grades of 1 in 100. Of the ten motor cars five are finished as saloon cars for use on express trains. The other five are fitted with second-class and third-class accommodation. Each car contains a baggage compartment and accommodations for the air compressor.

The current collector or trolley, Fig. 22, consists of two rollers of electrolytic copper of 3⅛-in. diameter and 2-ft. 1⅝-in. length, insulated from one another, running on insulated ball bearings and mounted on an insulating rod. The current is taken off by copper contacts rubbing on both ends of each roller and led into the cars by means of insulated cables. The trolley frame is made up of Mannesmann tubing, attached to the car roof by means of porcelain insulators. Compressed air is used to raise and lower the trolley, and glycerine dash pots are provided to control the speed of movement. Each car carries two trolley poles, one for each direction of running.

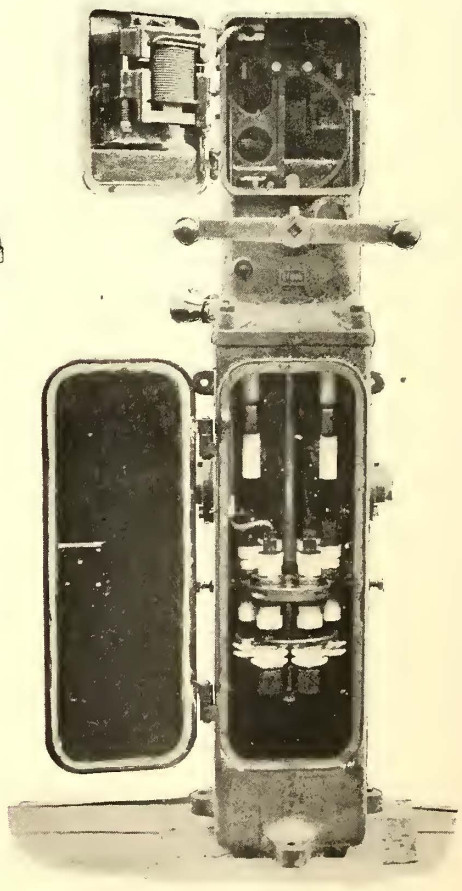


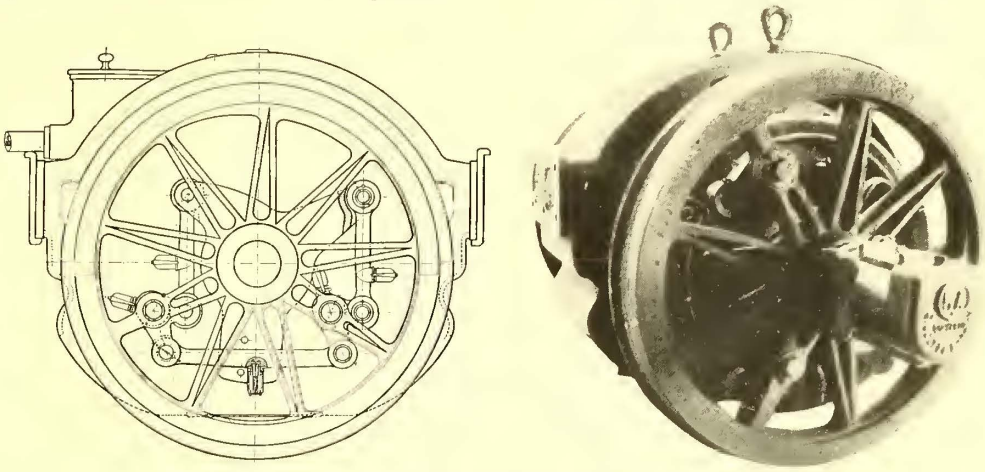
FIG. 23.—SWITCH FOR PRIMARY CIRCUIT OPEN

The current, at 3000 volts, is carried into the car, as already mentioned, by flexible cables, which, within the car, are encased throughout in metal tubes, the latter being grounded to the truck. A branch from the high-tension circuit leads to a 8-kw transformer, which supplies current at 100 volts to the

motor of the air-compressor as well as for the lighting, heating and the fan-motors. The main conductors terminate in high-tension switch boxes, located in each motorman's compartment. Either side can be cut out by the operation of a switch.

The primary switch is of the plug type, with six contacts. These contacts are attached to a plate, which can be raised or lowered, and can also be turned 120 degs. by means of a switch-lever projecting from the switch-box, thus providing for reversal of direction of the run. This lever can only be moved if the switch is current-less. The primary switch, which is shown open in Fig. 23, can be disconnected or inserted in the circuit, either manually or pneumatically. The plug contacts, which are shown in the engraving, have worked very satisfactorily, and the blowing out of the arc by the rarefied air produced when the plate is raised has been very efficient, and seemingly has caused little destruction to the contacts.

There is no access to the parts carrying the high tension except in the box containing the fuses and primary switch. To prevent all possibility of the motorman touching these parts while the current is on the box is kept locked, and the key is put in the valve connected to the air cylinder operating the trolley, whence it cannot be removed unless the trolley-valve lever is so adjusted that the current collector is in the "down" position. It might happen, however, that the motorman would open the box of the primary switch, withdraw the key, and then put it in the air valve and raise the trolley. To avoid this the lock has been so devised that the key cannot be withdrawn when the door is open.



FIGS. 25 AND 26.—METHOD OF MOUNTING MOTOR ON WHEEL

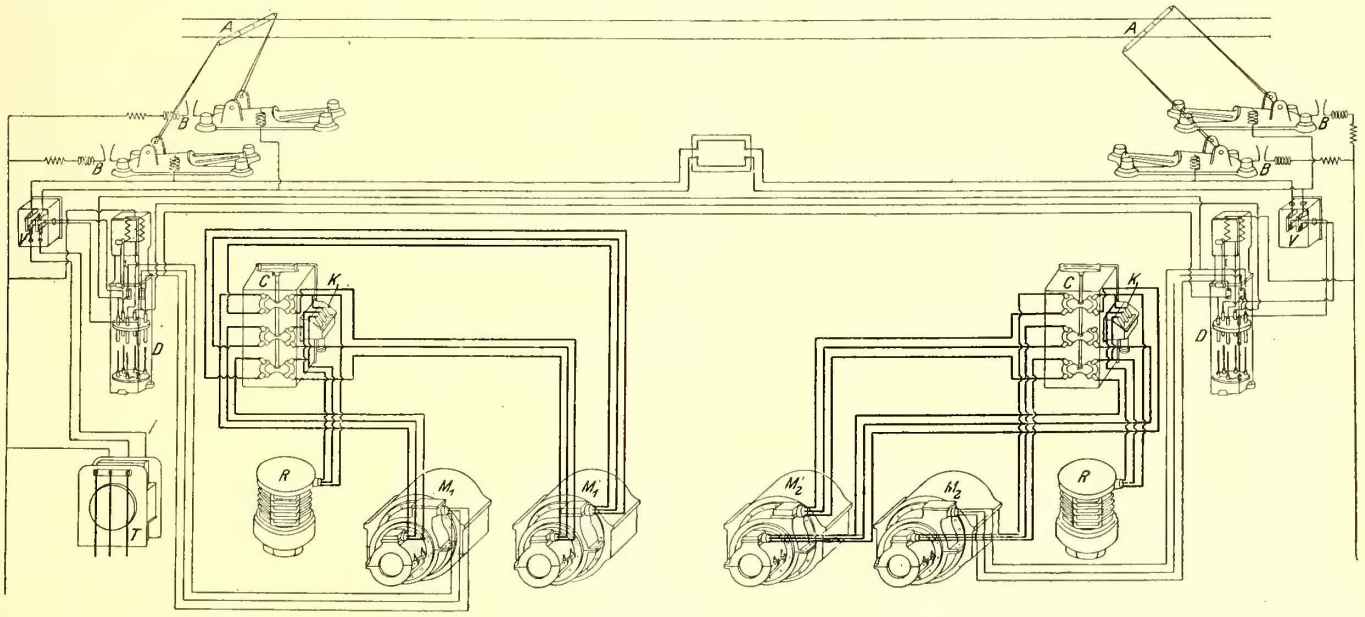
MOTORS

Each truck carries one high-tension and one low-tension motor, the stator of which is connected to the truck and suspended by springs, while the rotor is connected to the driving wheels by means of a linked coupling. This coupling, shown in Figs. 25 and 26, allows a certain amount of independent movement to the car axle, while the angular speed of the wheels remains constant. The rotor is mounted upon a hollow shaft, the interior diameter of which is such as to allow a movement of the car axle corresponding to the play in the bearing springs. The hollow shaft is journaled in the side frame of the stator. This arrangement assures that all parts of the motor are spring-borne.

The high-tension current is carried to the stator. The winding of the rotor is so dimensioned that its induced current has a tension of only 300 volts. The starting and variation of the speed is consequently performed with a circuit of 300 volts only.

It will be remembered that the number of revolutions of three-phase motors is a constant, depending upon the periodicity and the number of poles of the motor. However, if we have two motors we can secure an efficient half-speed by leading the induced current from the rotary part of one motor to the stator of the other. Fig. 27 shows the plan of the connections of a car. The connecting and disconnecting of these two motors is performed by a starting device, Fig. 28, of which there are two in each car, i. e., one for each direction of the run, and which are mechanically connected together by means of a chain and wire rope.

The lever of the starting device is constructed for three positions. When in the "off" position the motors are disconnected and the air-cocks cannot be moved, when at "low speed" the motors are put in cascade connection, while when put at



A = Trolley.
B = Lightning arrester.
C = Controller.
D = Switch for primary circuit.
K = Short-circuiting device.
M_1 M_2 = High-tension motors.
M^1_1 M^1_2 = Low-tension motors.
R = Water rheostat.
T = Transformer for heaters, lighting circuit and air compressor.
V = Fuse box.

FIG. 27.—DIAGRAM OF CONNECTIONS OF MOTOR CAR

"high speed" only the high-tension motors are in circuit.

At starting rheostats (Fig. 29) are inserted in the circuit of the rotor through the three slide rings. The resistance diminishes proportionately as the speed of the motor approaches

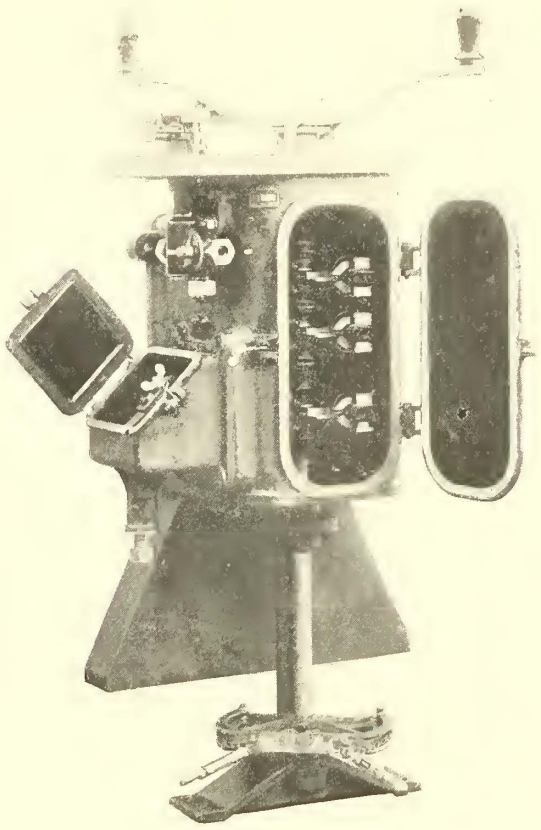


FIG. 28.—SWITCH FOR STARTING

synchronism. The rheostat is of the liquid type, with the electrolyte forced in and out by compressed air. It consists of a cast-iron box with cooling flanges, into which are hung three groups of sheet-iron plates with indented lower edges. The electrolyte used is a solution of soda. As this is forced into the rheostat box the motor starts, its speed increasing in the same measure as the immersed surface of the sheet-iron plates increases. When the water-level has attained its maximum height, the motor will run at full speed, at which moment the circuits of the rotor are automatically short-circuited. The short-circuiter is likewise actuated by pressed air. To increase the cooling surface of the rheostats they are provided with cooling pipes. The liquid in the rheostat is raised by adjusting the air-cock of the controller.

The details of starting the motors are as follows: First, place the switch-lever of the controller-device at "low speed" and open the air-cock, and with small throttle valve enable the air to enter. This does two things, it (1) closes the primary switch of the 3000-volt circuit and (2) allows the water level in the rheostat to rise slowly or more rapidly, according to the position of the throttle valve until the rotor is short-circuited. The car will then run at half-speed. If "high speed" is desired it is necessary first to shut the air-cock, which disconnects the primary current. The controller lever is then adjusted at "high speed," thus disconnecting the low-tension motor. The motorman then moves his air-cock and throttle valve, again closing

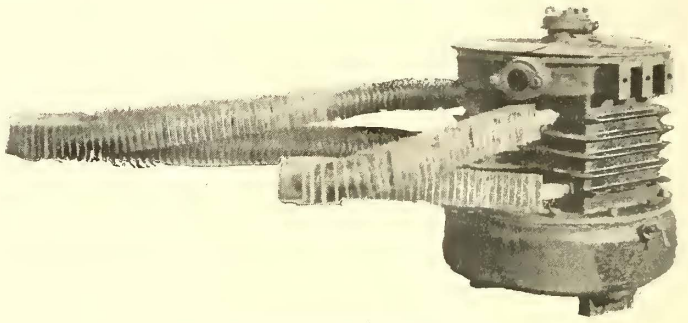


FIG. 29.—STARTING RHEOSTAT

his main switch and admitting the electrolyte until the car reaches full speed. The method of regulating the speed, as will be seen, is in many particulars similar to the series parallel-connection of continuous-current motors. When starting the

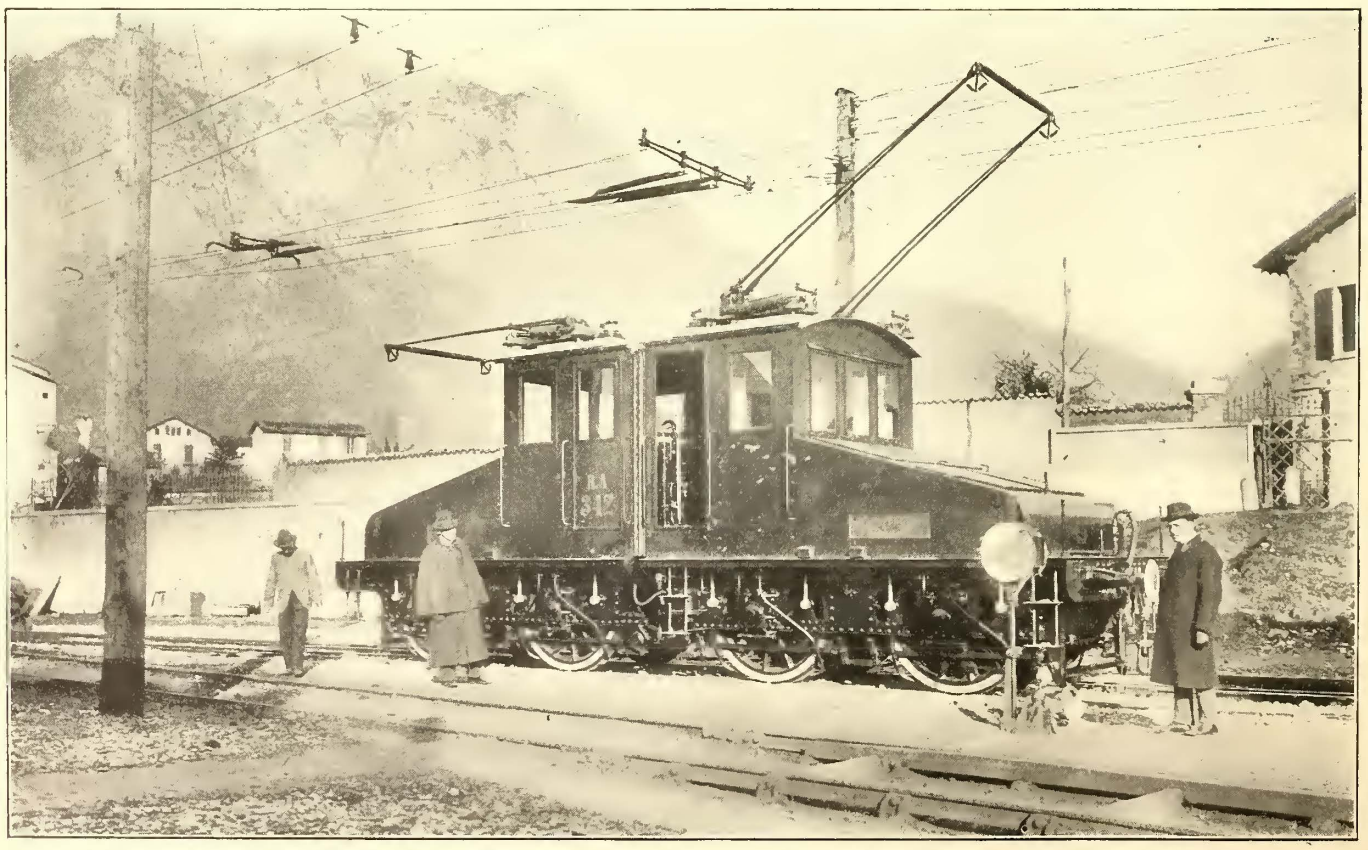


FIG. 30.—THREE-PHASE LOCOMOTIVE

motorman watches the ammeters and voltmeters, mounted close in front of him, and accordingly regulates the speed of the starting with the throttle valve. The switch-lever and air-cock of the starting device are mechanically so dependent upon one another that it will not be possible to operate the handles except in the order described above. Moreover, it is impossible to move the air-cock unless the switch-lever has been adjusted exactly in its position for low or high speed. The motorman's cab also contains a fuse box, Westinghouse brake lever, hand-brake lever, air pump to be operated by hand, in order to allow of the current collector being raised, also if there is no pressure in the air tank, and a valve for the air whistle.

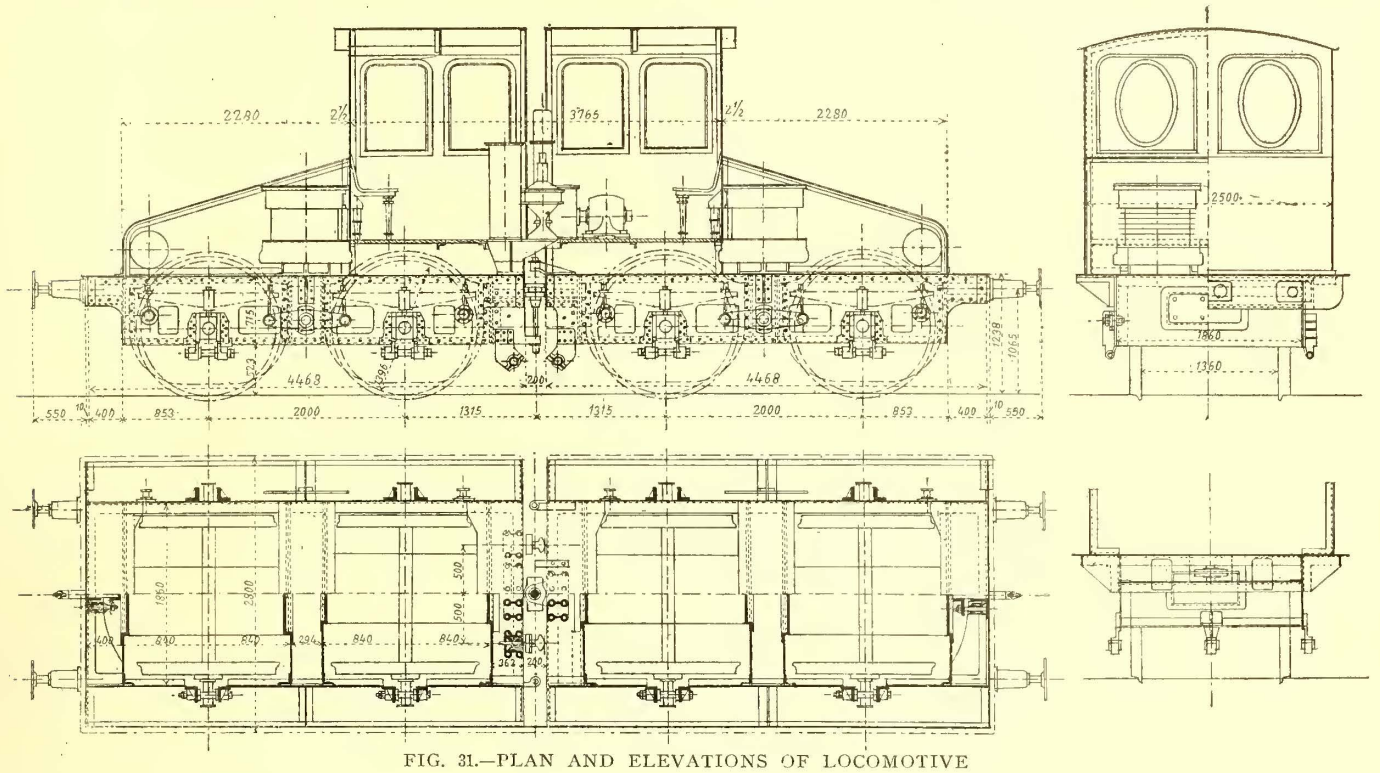


FIG. 31.—PLAN AND ELEVATIONS OF LOCOMOTIVE

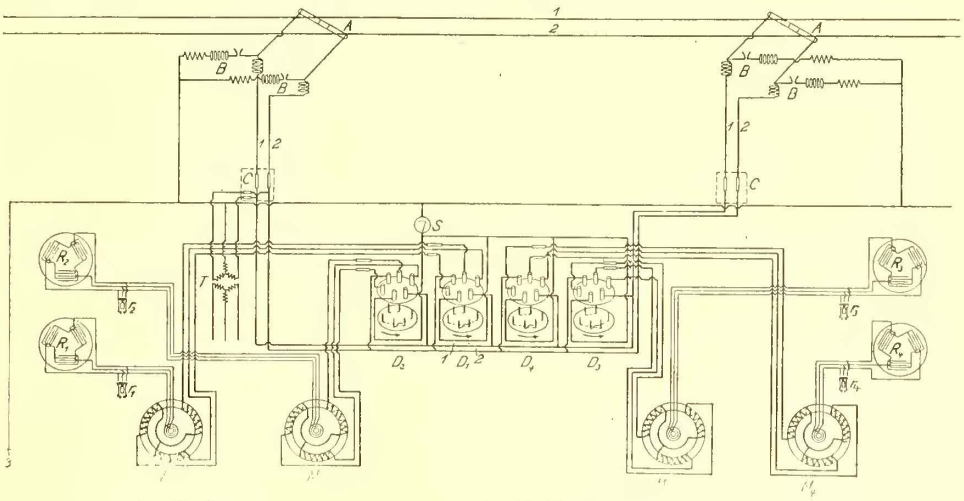
The air compressor, together with the motor, the air tank and starting automatic switch are, as already stated, located in a separate compartment. The air compressor supplies the air for the whole of the electric apparatus, viz., main switch, rheostat, signal whistle, etc., and also for the Westinghouse brake.

LIGHTING, HEATING AND VENTILATION

The 100-volt circuit of the 8-kw transformer leads to a small switchboard in the baggage room. Conductors are lead off from here for the lighting, heating and ventilation circuits. Small ceiling clusters and arm brackets, provided with three-phase incandescent lamps and ordinary incandescent lamps for continuous current at 23 volts, serve for the lighting. There is in the car a small accumulator battery, so that the car will be also lighted when the trolley is lowered. There is also on the switchboard in the baggage room a switch for the accumulator battery. The heaters are of the usual type. For the ventilation of the first-class cars there are provided low-speed ventilators with two blades driven by motors.

LOCOMOTIVES

The locomotives used for freight service, Fig. 30, have four axles, consist of two trucks flexibly connected together. Each of the four axles is provided with a high-tension motor of 150-hp capacity, of construction and coupling identical to those of the motor car, except that the locomotive is designed for one speed only. The motors, according to the variations of the tractive effort, as observed on the ammeter, may individually be disconnected or connected up. In the insides of the locomotive there are located the air compressor, together with the transformer belonging to it, which simultaneously supplies the current for the lighting, the automatic switch for the air pump, a hand-operated air pump, the triple valve of the Westinghouse brake and a hand brake. The rheostats are located within the ends of the locomotive frame. Fig. 32 shows the scheme of connections of the locomotive.



A = Trolley.
B = Lightning arrester.
C = Junction box.
D = Controllers.
$M_1\ M_2\ M_3\ M_4$ = Motors.
$R_1\ R_2\ R_3\ R_4$ = Liquid rheostats.
$r_1\ r_2\ r_3\ r_4$ = Short-circuiting devices.
S = Ammeter.

FIG. 32.—DIAGRAM OF CONNECTIONS OF LOCOMOTIVE

The weight of the locomotive is 46 tons, it is capable at a speed of 18 m. p. h. to develop a normal traction force of 13,300 lbs. and maximum 17,600 lbs., and will, therefore, be able to convey normally up gradients of 1 in 100 an additional load attached of 400 tons.

During switching both trolleys are in raised position, for there is no trouble at low speeds in using both for either direction of movement.

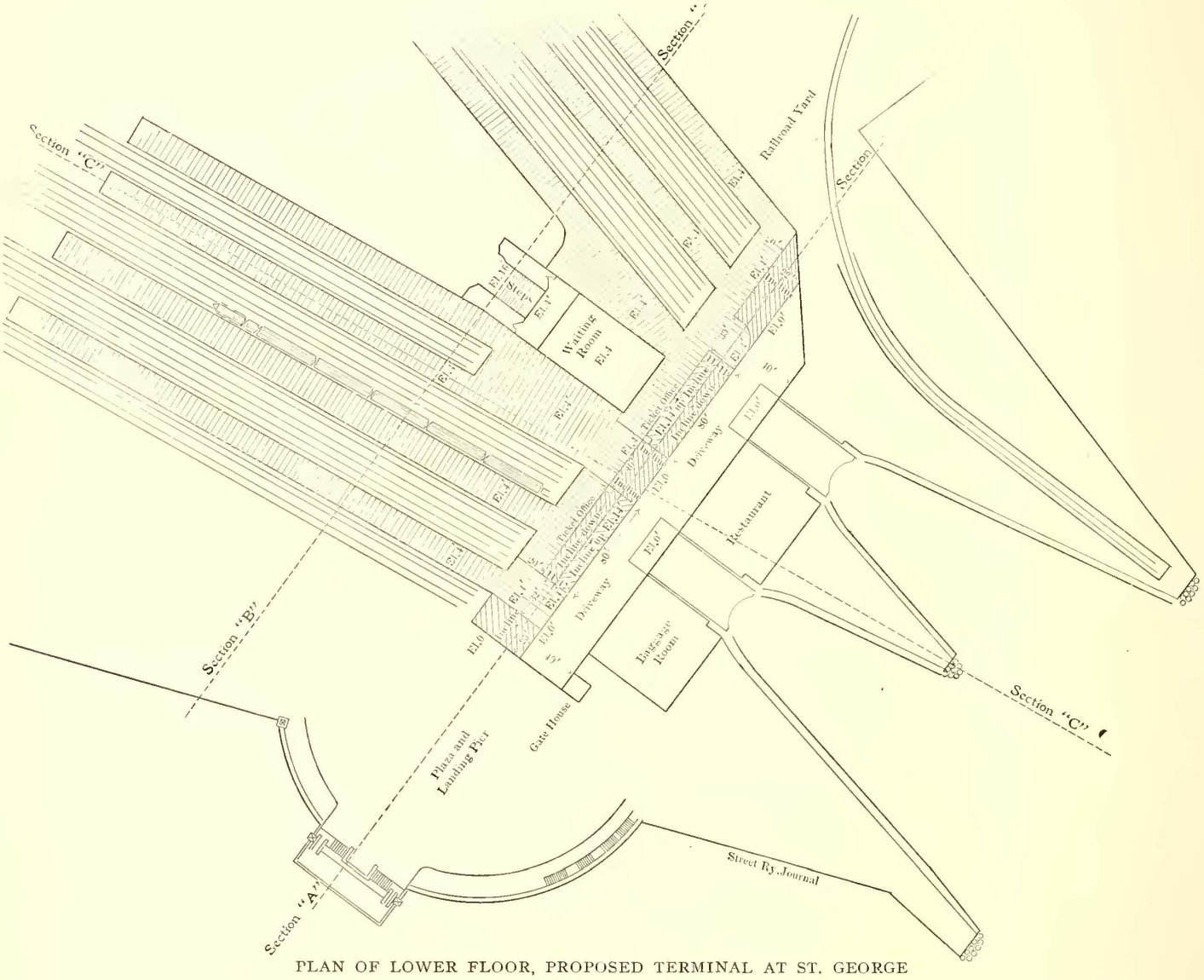
THE PROPOSED TERMINAL AT ST. GEORGE, STATEN ISLAND

Staten Island, which comprises Richmond, one of the five boroughs composing the city of Greater New York, is connected to Manhattan by a ferry with boats sailing on a headway, in busy hours of the day, of fifteen minutes. The fare from Manhattan to St. George, at which the boats land, is 5 cents. At St. George the passengers can change to either a steam railroad belt line or to an electric road. The steam railroad is operated by the Staten Island Rapid Transit Company, which is controlled by the Baltimore & Ohio Railroad Company. It is a double-track line with stations about a mile apart, extending the entire length of the northern and eastern shores of the island, and with a branch reaching across the island to the southwestern extremity at Tottenville. There are two electric railway companies on Staten Island, known as the Richmond Light & Railroad Company, formerly the Staten Island Electric Railway Company, and the Staten Island Midland Railroad Company. These companies were until recently operated independently, but within a year both have come under the ownership of H. H. Rogers, and are under the same management.

The ferry between Manhattan and Staten Island is being operated under a lease from the city authorities by the Rapid Transit Ferry Company, which is affiliated with the Staten Island Rapid Transit Company, the steam line. The ferry company also owns the terminal at St. George, where the change is made to trains. The facilities for this transfer have been very good so far as changes to the steam trains are concerned, but have been very poor for the passengers desiring to ride on the electric cars. Nevertheless, the total traffic of the electric lines last year was considerably larger than that on the steam line.

The ferry franchise expires on June 1, 1904, and there has been a vigorous fight as to which company should lease the ferry. This question is settled by the city authorities, who, through their ownership of the Manhattan docks, reserve a monopoly of the ferry franchises of the city. Both companies appeared as bidders.

Dock Commissioner Hawkes, before whom the proposition first came, recommended that the franchise of the Rapid Transit Ferry Company be renewed, the principal argument in favor of this course being that that company owned the present ferry terminal at St. George, which, in some respects, seems the best point for a boat landing. On the other hand, the consolidated electric railway companies, through their president, Charles L. Spier, offered to run a line of boats to Tompkinsville, agreeing to install larger and faster boats than those at present in use. The proposition of the electric railway interest was by far the more popular one with the residents of Staten Island, who felt that the owners of the electric system were much more enterprising, and both able and willing to give a much better service than their steam railroad competitors. A number of mass meetings were held in favor of the proposal of the electric railway company, and several deputations of residents of Staten Island called on the Mayor in favor of it. This agitation has led to the formulation of a third plan, which has received the endorsement of the Mayor, the Presi-



PLAN OF LOWER FLOOR, PROPOSED TERMINAL AT ST. GEORGE

dent of Richmond Borough and other prominent city officials. This contemplates the purchase of the existing St. George terminal by the city and the erection at that place of a large and improved terminal with equal facilities for the steam and electric systems. If this is done it is thought that the interests

Works and have received the endorsement of Bridge Commissioner Lindenthal and the engineer for the Board of Rapid Transit Commissioners, William Barclay Parsons. They are, therefore, of considerable interest, as representing the judgment of these engineers and of the city authorities as to the

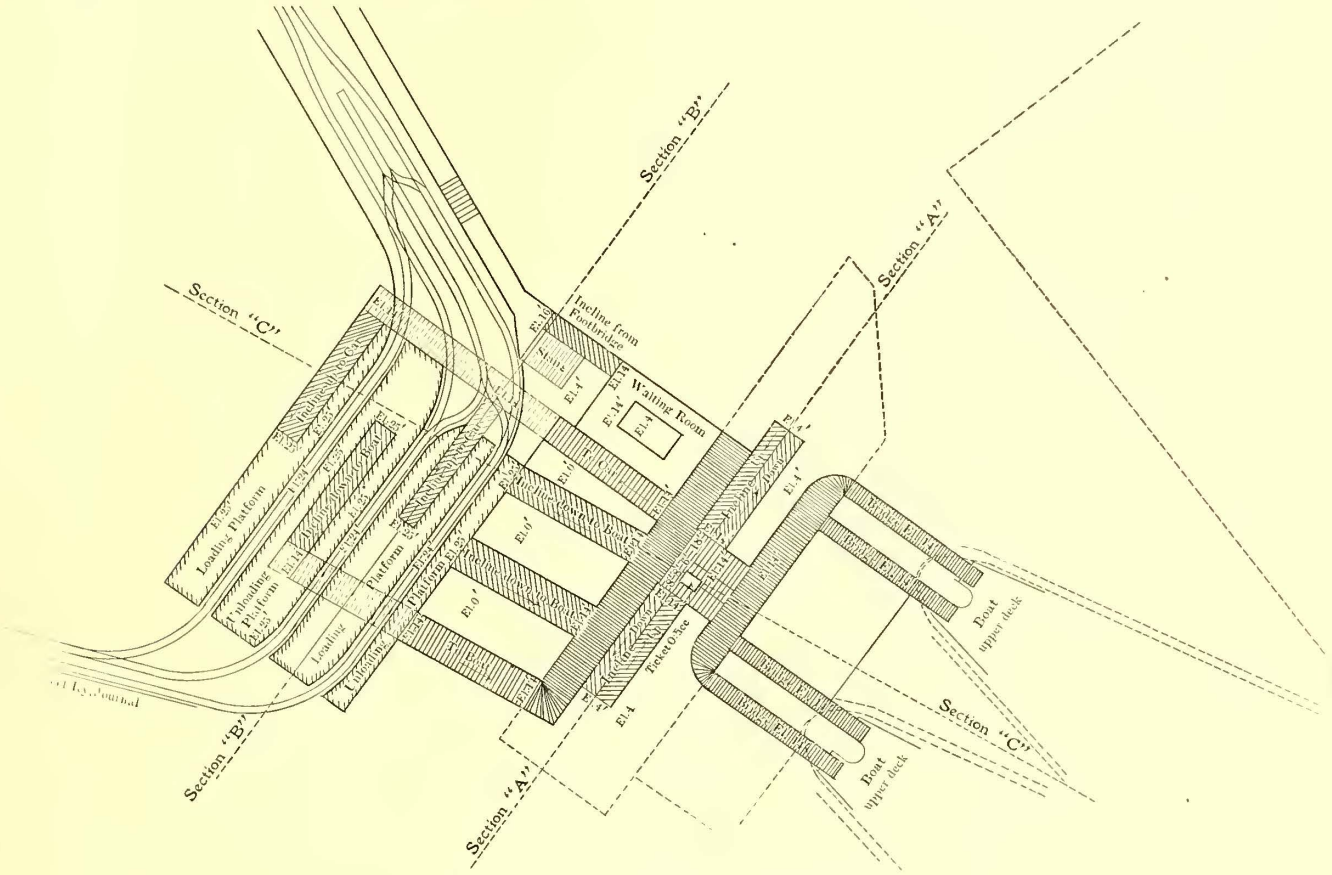
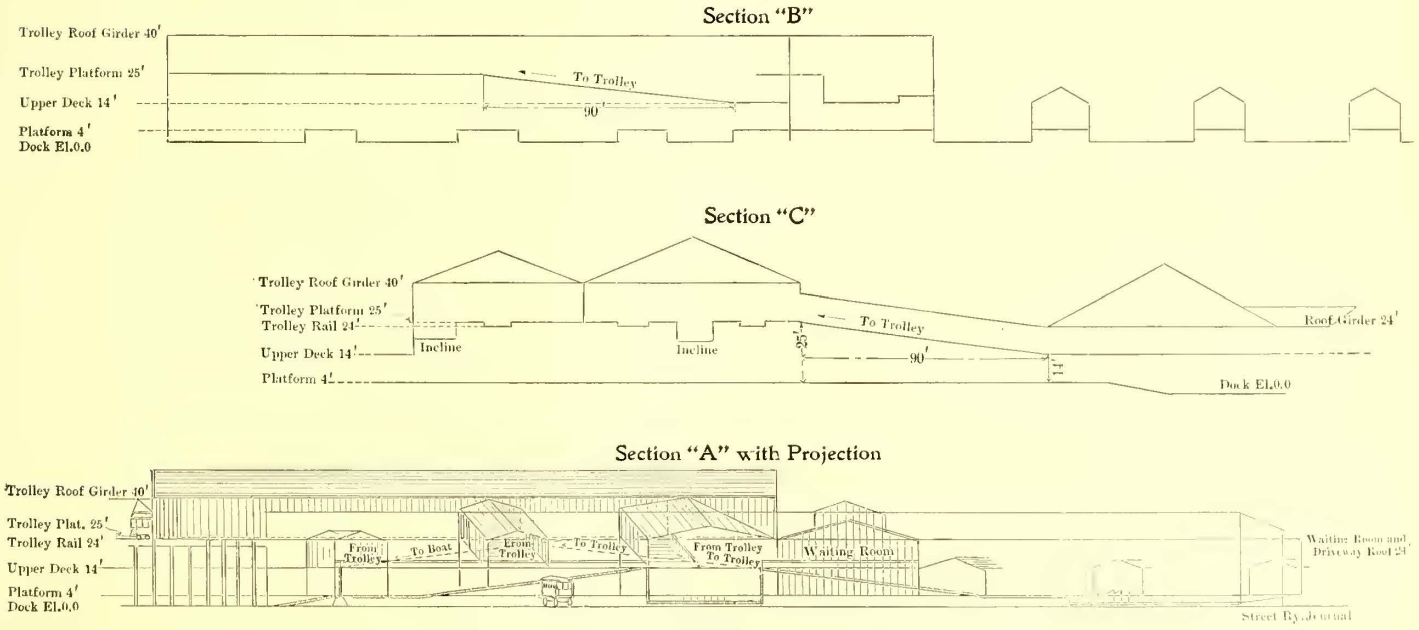


FIG. 2.—PLAN OF UPPER DECK LANDING



SECTIONS OF PROPOSED FERRY LANDING AT ST. GEORGE

of both companies and also of the residents of Staten Island will best be conserved. The ferry franchise can then be leased to any responsible bidder upon terms which will not infringe the rights of either of the transportation companies on Staten Island. The Legislature has already passed a bill authorizing the city to carry this proposition into effect, and plans for a union terminal have been prepared

These plans have been drawn up under the direction of the President of the Borough by the Commissioner of Public

most desirable form of combined steam, electric railway and ferry terminal under the conditions existing at St. George.

As will be seen from the plans, Figs. 1 and 2, and the sections, Fig. 3, the ferryboats, which are double deckers, will be provided with both main deck and upper deck landings. The latter are 14 ft. above the former, and one on each side of the boat, making two to the slip or four in all. The steam railroad terminal is on the main dock level, the platforms being at a level of 4 ft. above the dock level and reached by a slight in-

cline. The steam railroad terminals consist of ten stub tracks on the east and six stub tracks on the west, of which seven on the east and four on the west have platform accommodations, while the other tracks are for switching and storage purposes. Each platform is of sufficient length for a train of nine cars.

The electric railway terminal is directly above the steam railroad terminals and can be reached either from the upper deck landing or from the dock or ground floor of the terminal by means of inclines. There are four electric railway platforms, two for unloading and two for loading. About twenty cars can load and unload at the platforms at the same time. Passengers to the boats, if landed on the outside platform, descend directly by an incline with a descent of 11 ft. in 88 ft. to a passage way leading to the upper decks of the boats, or if discharged at the inside platform, descend an incline of the same grade and then through a level passageway about 170 ft. long to the same point. It will also be seen that the loading platforms are reached by an entirely different passageway and also by inclines.

The principal features to be commended in the terminal arrangement, as will be seen, are quickness in loading and unloading, owing to the entire separation of the incoming and outgoing passengers and the fact that as soon as the electric cars have discharged their passengers at one side they can load them from the other side, and also safety in loading, as inclines have been used in all cases in place of steps and all grade crossings of passengers with steam or electric cars have been eliminated.

The elevations given in the diagrams herewith are all from the dock level as a datum line.

A CARD PURCHASING SYSTEM

BY W. R. GAITHER

On many roads, as in many mercantile houses, where the voucher system of payment is in use, it is customary to do a great deal of work in purchasing supplies which is quite superfluous and unnecessary.

The following outline of this work may be recognized by many readers as describing what they themselves do:

1. Drawing up the order on the firm of whom goods are to be purchased in ink, giving it a number in numerical order, regardless of the character of supplies.

2. Taking an impression copy of this by the old reliable letter-press wet method.

3. Indexing this impression book.

4. Making a written record of the order in a suitable record book and checking off the goods when received, or looking up the impression copy and checking it off in the impression book.

5. Posting the bills, items and prices to the account in a ledger kept for the purpose, with the persons or firms of whom goods were bought; or, in other words, keeping a personal account ledger with your supply houses.

6. Sending the bill out to the storekeeper to be checked up.

This procedure has been shortened up by many. It is the purpose of this article to describe a system which has become almost a standard among mercantile houses in some parts of the country and deserves the consideration of street railways in general. It has been adopted by the writer on the South Chicago City Railway for all purchases and is known as the card system. It consists of the following slips:

1. An order form is made in triplicate after the fashion of the railroad bill of lading, with which all are familiar. Each slip is of a different color, and one of them is of stiffer paper than the others, to be retained in the company's files and stand handling.

2. They are used with hand pencil or pen and carbon paper, and three copies produced at one writing. One goes, of course, to the supply house, the other to the company's storekeeper, and the third is filed in a cabinet behind an alphabetical index card.

3. When the bill comes in the duplicate order card is taken out of the above unfilled order part of the cabinet, and simply the prices and extensions carried out on it from the bill, comparing bill and order at the same time. The body of the order itself shows the goods, making it unnecessary to copy the wording of the bill. This completed card is then filed in another cabinet, or part of the same cabinet, behind an alphabetical index card, and sub-index card of the party's name, and then constitutes a part of his account.

In the meantime the storekeeper checks his goods by his triplicate order slip, and the bills need never go out of the office for his use unless so preferred. There is no work with the copying-press, no intermediate order record and no personal account ledger. On the other hand, your unfilled orders are before you, indexed for easy reference, and also your filled orders, the latter serving also as a buyers' guide.

The simplicity and completeness of this system becomes apparent immediately upon its substitution for the old method. The live orders are constantly before those concerned with them, and the filled orders become the account of the firm from whom goods were purchased.

GROSS RECEIPTS FOR 1902.

A summary of the earnings of the street railway companies of the United States reporting in this year's number of our annual, "American Street Railway Investments," shows a gratifying increase over 1901. There are thirty-eight companies which report a gross income of over $1,000,000, as compared with thirty-four last year, and every company in this number shows an increase in gross earnings over the previous year. This is somewhat remarkable, as 1901 was considered a successful year, while there were several causes which affected the earnings during 1902. Of these, the anthracite coal strike, which lasted about five months, was the most serious, as it not only had the effect of increasing operating expenses of many lines, but rendered necessary a reduction in car service to husband the supply of fuel available.

The following table of 268 companies has been compiled from the reports given in "American Street Railway Investments," and shows the gross receipts for 1901 and 1902. The fiscal year is not the same in all cases, but the report, as given, is for the period most nearly approximating the calendar year.

The companies are arranged in five groups; the first contains thirty-eight properties, each having received in 1902 gross receipts amounting to $1,000,000 or over; second, nineteen properties, showing in 1902 gross receipts of between $1,000,000 and $500,000; third, eighty-eight properties, showing in 1902 gross receipts of between $500,000 and $100,000; fourth, sixty-five properties, showing in 1902 gross receipts of between $100,000 and $50,000, and fifth, fifty-eight properties, showing in 1902 gross receipts of between $50,000 and $25,000.

The average rate of increase of the receipts in 1902 over 1901 is, in the first group, 8 per cent; in the second group, 16.3 per cent; in the third group, 14.2 per cent; in the fourth group, 10.4 per cent, and in the fifth group 17 per cent. The general average increase for 1902 over 1901 for the 268 companies compared is 9.0 per cent.

As all of the street railway companies in the United States are not obliged to make annual reports of their earnings to the State authorities or do not do so, it is impossible to state whether this increase would hold good for the entire country.

This list includes only those companies whose statistics are available.

COMPANIES HAVING GROSS RECEIPTS FOR 1902 OF OVER $1,000,000.

NAME OF COMPANY.	1901.	1902.
*Interurban Street Ry. Co., New York	$14,720,767	$15,098,776
Union Traction Co., Philadelphia, Pa.	13,431,680	14,118,158
Brooklyn Rapid Transit Co., Brooklyn, N.Y.	12,135,559	12,788,168
Boston Elevated Ry. Co., Boston, Mass.	10,869,495	11,321,030
Manhattan Ry. Co., New York	10,253,271	11,291,711
Pittsburg Rys. Co., Pittsburg, Pa.	6,995,923	8,024,510
Chicago Union Traction Co., Chicago, Ill.	8,158,810	7,942,470
St. Louis Transit Co., St. Louis, Mo.	5,783,913	6,452,218
Chicago City R. R. Co., Chicago, Ill.	5,900,271	6,413,182
Massachusetts Elec.Companies, Boston, Mass.	5,778,133	6,090,168
United Railways of San Francisco, Cal.	5,143,113	5,565,216
North Jersey Street Ry. Co., Jersey City, N. J.	4,172,647	4,437,310
International Ry. Co., Buffalo, N. Y.	3,129.094	4,426,675
Twin City R. T. Co., Minneapolis, Minn.	3,173,976	3,612,211
Detroit United Ry., Detroit, Mich.	2,942,238	3,501,754
Third Ave. R. R. Co., The, New York	2,655,725	2,951,202
Milwaukee Elec.Ry.& Lt.Co., Milwaukee, Wis.	2,442,342	2,776,294
Cleveland Electric Ry. Co., Cleveland, O.	2,296,898	2,524,949
Washington Ry.& Elec. Co., Washington, D.C.	2,178,575	2,345,419
Montreal Street Ry. Co., Montreal, Que.	1,900,680	2,046,209
Metropolitan West Side El. Ry .Co., Chicago.	1,753,313	2,040,005
Jersey City, Hoboken & Paterson Ry. Co., Hoboken, N. J.	1,859,931	1,975,525
Toronto Ry. Co., Toronto, Ont.	1,661,118	1,834,908
Louisville Ry. Co., Louisville, Ky.	1,617,059	1,771,887
Coney Island & Brooklyn R.R. Co., Brooklyn.	1,471,268	1,507,713
South Side Elevated R. R. Co., Chicago, Ill.	1,362,231	1,483,841
United Traction Co., Albany, N. Y.	1,340,208	1,479,608
Los Angeles Ry. Co., Los Angeles, Cal.	1,102,675	1,475,211
Toledo Railways & Light Co., Toledo, O.	1,311,084	1,459,091
Northwestern Elevated R.R.Co., Chicago, Ill.	1,100,864	1,410,999
Capitol Traction Co., Washington, D. C.	1,251,360	1,402,040
Connecticut Ry. & Ltg. Co., Bridgeport, Conn	1,140,323	1,274,820
Worcester Consolidated Street Ry. Co., Worcester, Mass.	1,031,235	1,220,256
Cincinnati, Newport & Covington Ry. Co., Cincinnati, O.	819,206	1,103,995
Birmingham Ry. Lt. & Pr. Co., Birmingham.	931,539	1,076,767
Rochester Ry. Co., Rochester, N. Y.	1,000,259	1,068,222
Union Ry. Co. of New York City, N. Y.	919,131	1,024,259
American Railways Co., The, Philadelphia, Pa	844,297	1,009,496
Total, 38 companies	$146,579,211	$159,336,273

*These figures include the Metropolitan Street Ry. Co. from July 1, 1901 to Apr. 2, 1902, and the Interurban Street Ry. Co. from Apr. 1. to June 30, 1902.

COMPANIES HAVING GROSS RECEIPTS FOR 1902 BETWEEN $1,000,000 AND $500,000.

NAME OF COMPANY.	1901.	1902.
Fair Haven &Westville R.R. Co., New Haven.	$644,528	$986,334
Union Traction Co. of Indiana, Anderson, Ind.	752,524	962,266
Springfield St. Ry. Co., Springfield, Mass	753,810	844,665
Forty-Second Street, Manhattanville & St. Nicholas Ave. Ry. Co, New York, N. Y.	701,177	839,144
Lake Street Elevated R. R. Co., Chicago, Ill.	786,462	815,284
Hartford Street Ry. Co., Hartford, Conn.	745,173	785,587
Northern Ohio Traction & Light Co., Akron, O.	617,011	745,043
Lehigh Valley Traction Co., Allentown, Pa.	547,178	740,017
United Power & Transportation Co., Phila.	632,475	720,560
Syracuse Rapid Transit Ry.Co., Syracuse, N.Y	621,299	693,284
Washington Water Power Co., Spokane, Wash.	556,998	638,967
Wilkesbarre & Wyoming Valley Traction Co., Wilkesbarre, Pa.	606,226	634,216
Charleston Consolidated Ry., Gas & Electric Co., Charleston, S. C.	549,520	608,470
Portland R. R. Co., Portland, Me.	477,598	605,802
Dry Dock, East Broadway & Battery R. R. Co., New York, N. Y.	588,540	585,975
New York & Queens County Ry. Co., Long Island City, N. Y.	494,301	548,464
Duluth Superior Traction Co., Duluth, Minn.	453,704	538,030
United Traction Co., Reading, Pa.	421,558	509,212
Central Crosstown R.R. Co., New York, N.Y.	482,471	500,252
Total, 19 companies,	$11,432,553	$13,303,572

COMPANIES HAVING GROSS RECEIPTS FOR 1902 BETWEEN $500,000 AND $100,000.

NAME OF COMPANY.	1901.	1902.
Camden & Suburban Ry. Co., Camden, N. J.	$411,002	$493,305
Des Moines City Ry. Co., Des Moines, Ia.	397,840	483,150
Harrisburg Traction Co., Harrisburg, Pa.	393,771	466,530
Savannah Electric Co., Savannah, Ga.	407,348	458,365
Thirty-Fourth St. Crosstown Ry. Co., N. Y.	397,949	456,841
Lake Shore Electric Ry. Co., Cleveland, O.	358,180	455,352
Scranton Ry. Co., Scranton, Pa.	614,022	*422,561
Sacramento Elec., Gas & Ry. Co., Sacramento	376,970	419,781
Fonda, Johnstown & Gloversville R. R. Co. Gloversville, N. Y.	344,927	411,944
Elgin, Aurora & Southern Traction Co., Aurora, Ill.	361,665	410,431
Trenton Street Ry. Co., Trenton, N. J.	337,217	366,459
Houston Electric Co., Houston, Tex.	241,371	360,018
Schenectady Ry. Co., Schenectady, N. Y.	215,962	350,907
Conestoga Traction Co., Lancaster, Pa.	270,533	344,227
Holyoke Street Ry. Co., Holyoke, Mass.	303,666	336,853
Union Street Ry. Co., New Bedford, Mass.	272,895	326,125
Halifax Elec. Tra'y Co., Ltd., Halifax, N. S.	251,644	314,161
Ottawa Electric Ry. Co., Ottawa, The, Ont.	313,171	310,192
Terre Haute Electric Co., Terre Haute, Ind.	293,930	307,824
Chester Traction Co., Chester, Pa.	295,915	305,048
Cleveland, Elyria & West, Ry. Co., Cleveland.	249,260	300,846
Niagara Gorge R. R. Co., Niagara Falls, N.Y.	82,160	279,436
Johnstown Passenger Ry.Co., Johnstown, Pa.	204,286	274,168
Elizabeth, Plainfield & Central Jersey Ry. Co., Elizabeth, N. J.	236,082	250,711
Manchester Street Ry. Co., Manchester, N. H.	212,138	235,172
Lewiston, Brunswick & Bath Street Ry. Co., Lewiston, Me.	221,532	230,957
Exeter, Hampton & Amesbury Street Ry. Co., Exeter, N. H.	105,298	227,496
Westchester Electric R.R.Co., New York, N.Y.	185,285	222,596
Sioux City Traction Co., Sioux City, Ia.	199,183	222,045
Yonkers R. R. Co., Yonkers, The, N. Y.	189,503	221,781
Richmond Light & R. R. Co., S. I., N. Y.	214,063	219,118
Binghamton Ry. Co., Binghamton, N. Y.	206,447	217,661
Erie Electric Motor Co., Erie, Pa.	185,847	214,172
Lincoln Traction Co., Lincoln, Neb.	188,255	213,926
Atlantic Coast Elec. R. R. Co., Asbury Park.	220,661	209,124
Southwest Missouri Elec. Ry. Co., Webb City.	203,630	206,799
Tampa Electric Co., Tampa, Fla.	176,055	203,146
Fitchburg & Leominster Street Ry. Co., Fitchburg, Mass.	196,544	201,247
Schuylkill Valley Traction Co., Norristown, Pa.	84,720	197,279
Cleveland, Painesville & Eastern R. R. Co., Cleveland, O.	164,971	189,187
Albany & Hudson R. R. Co., Hudson, N. Y.	122,386	187,882
Wilkinsburg & E. Pitts. Ry. Co., Braddock,	35,962	183,787
Twenty-Eighth & Twenty-Ninth Sts. Crosstown R. R. Co., New York.	177,370	180,927
Middlesex & Somerset Traction Co., New Brunswick, N. J.	162,819	180,681
People's Gas & Electric Co., Burlington, Ia.	169,940	178,744
Jacksonville Electric Co., Jacksonville, Fla.	169,803	173,209
Newport & Fall River St.Ry.Co., Newport, R.I.	213,129	170,076
New Jersey & Hudson River Ry. & Ferry Co., Hackensack, N. J.	103,589	166,442
Elmira Water, Light & R. R. Co., Elmira, N.Y.	92,121	162,232
Pottsville Union Traction Co., Pottsville, Pa.	173,209	161,649
Beaver Valley Traction Co., Beaver Falls, Pa.	147,992	161,604
Altoona & Logan Valley E.R. Co., Altoona, Pa.	127,263	155,462
London Street Ry. Co., London, Ont.	141,846	154,704
Interstate Consolidated Street Ry. Co., North Attleborough, Mass.	174,701	148,299
Rockland, Thomaston & Camden St. Ry. Co. Rockland, Me	90,193	145,786
Lexington & Boston St.Ry. Co., Boston, Mass.	119,535	145,093
Northampton St. Ry.Co., Northampton, Mass.	133,429	144,846
Camden, Gloucester & Woodbury, Ry. Co., Camden, N. J.	125,365	142,410
Milford & Uxbridge St.Ry. Co., Milford, Mass.	118,029	142,380
Alton Ry., Gas & Electric Co., Alton, Ill.	128,894	142,021
New Castle Traction Co., New Castle, Pa.	122,180	139,629
Meriden Electric R. R. Co., Meriden, Conn.	133,154	139,283
Staten Island Midland R. R. Co., S. I., N. Y.	144,814	137,914
Newton St. Ry. Co., Newton, Mass.	129,750	134,300
Dartmouth & Westport S.R.Co., New Bedford,	119,545	132,991
Hartford, Manchester & Rockville Tramway Co., Hartford, Conn.	126,811	131,465
Schuylkill Traction Co., Girardville, Pa.	128,359	130,757
Montreal Park & Island Ry. Co., Montreal.	128,678	130,160
Lehigh Traction Co., Hazleton, Pa.	133,812	129,653
Consolidated Railways, Light & Power Co., The, Wilmington, Del.	51,856	126,425
N. Y. & North Shore R. R. Co., Brooklyn.	117,482	125,077
Holmesburg Tacony & Frankford Electric Ry. Co., Philadelphia, Pa.	112,139	120,430
City Passg'r Ry. Co. of Altoona, Altoona, Pa.	95,980	117,560
Fairmount Park Transportation Co., Phila.	111,576	116,864
Jamestown St. Ry. Co., The, Jamestown, N. Y.	110,716	116,117
Hoosac Valley Street Ry.Co., No. Adams, Mass.	100,803	116,111
Haverhill & Amesbury St. Ry. Co., Haverhill.	116,396	113,175
Norwich Street Ry. Co., Norwich, Conn.	95,378	111,811
Pittsfield Electric St. Ry. Co., Pittsfield, Mass.	87,071	111,697
Ithaca Street Ry. Co., Ithaca, N. Y.	99,552	111,090
Phila. & West Chester Traction Co., Phila.	100,166	110,409
Rochester & Sodus Bay Ry. Co., Rochester.	77,992	107,700
Columbus Railroad Co., Columbus, Ga.	103,617	106,183
Williamsport Pass. Ry. Co., Williamsport	93,780	104,656
Fries Manufacturing & Power Co., The, Winston-Salem, N. C.	87,847	103,660
Woonsocket St. Ry. Co., Woonsocket, R. I.	97,692	102,962
Springfield & Eastern S. R. Co., Palmer, Mass	72,169	102,788
Orange County Traction Co., Newburgh, N.Y.	98,336	102,222
Total, 88 companies,	$16,546,196	$18,898,211

*Decrease due to strikes of employees and anthracite coal miners.

COMPANIES HAVING GROSS RECEIPTS FOR 1902 BETWEEN $100,000 AND $50,000.

NAME OF COMPANY.	1901.	1902.
Pittsburg, McKeesport & Greensburg Ry. Co., Greensburg, Pa	$59,227	$99,308
Atchison, Ry., L. & P. Co., Atchison, Kas.	90,463	97,328
Poughkeepsie City & Wappinger's Falls Electric Ry. Co., Poughkeepsie, N. Y.	89,163	93,740
Citizens' Elec. St.Ry.Co., Newburyport, Mass.	95,696	92,390
Brockton & Plymouth Street Ry. Co., Brockton, Mass.	85,128	90,333
Bridgeton & Millville Traction Co., The, Bridgeton, N. J.	75,832	90,241
Montville Street Ry. Co., Montville, Conn.	78,611	90,038
York Street Ry. Co., York, Pa.	76,250	89,035
Orange & Passaic Valley Ry.Co., Orange, N.J.	82,895	88,835
Auburn City Ry. Co., Auburn, N. Y.	84,633	88,647
Syracuse, Lakeside & Baldwinsville Ry. Syracuse, N. Y.	81,096	87,855
Sanford & Cape Porpoise Ry. Co., Sanford, Me.	64,094	83,847
Camden & Trenton Ry. Co., Camden, N. J.	48,717	81,990
Commonwealth Ave.St.Ry.Co., Newton, Mass.	85,010	81,315
Portsmouth, Kittery & York Street Ry. Co. Portsmouth, N. H.	76,798	80,537
Natick & Cochituate St. Ry.Co., Natick, Mass.	72,224	79,751
Delaware Co. and Philadelphia Electric Ry. Co., Philadelphia, Pa	77,913	79,136
Danbury & Bethel St. Ry. Co., Danbury, Conn.	74,434	78,380
Concord St. Ry. Co., Concord, N. H.	70,275	77,929
Milford, Attleboro & Woonsocket Ry. Co., Milford, Mass.	75,464	75,461
New London St. Ry. Co., New London, Conn.	65,283	72,471
Shamokin & Mt. Carmel Electric Ry. Co., Shamokin, Pa.	64,183	71,478
Newton & Boston St. Ry. Co., Newton, Mass.	64,912	70,793
South Middlesex St. Ry. Co., Natick, Mass.	69,425	70,405
Syracuse Suburban R. R. Co., Syracuse, N.Y.	60,747	70,106
Lebanon Valley Street Ry. Co., Lebanon, Pa.	63,025	69,901
Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co., Geneva, N. Y.	63,912	66,955
Bangor Street Ry. Co., Bangor, Me.	67,155	65,888
Tarrytown, White Plains & Mamaroneck Ry. Co., White Plains, N. Y.	62,261	65,737
Newtown Electric St. Ry. Co., Newtown, Pa.	53,713	64,587
Marlborough St.Ry.Co., Marlborough, Mass.	59,103	64,559
Woronoco Street Ry. Co., Westfield, Mass.	61,091	64,489
Stamford St. Ry. Co., Stamford, Conn.	58,768	64,233
Wellesley & Boston St. Ry. Co., Newton, Mass.	60,809	62,825
Warren St. Ry. Co., Warren, Pa.	41,904	62,332
Warren, Brookfield & Spencer Street Ry. Co., Brookfield, Mass.	61,264	61,595
Worcester & Webster St. Ry. Co., Worcester,	56,563	61,437
People's Tramway Co., Putnam, Conn.	56,180	60,560
Southern Boulevard R. R. Co., New York.	52,303	60,505
Augusta, Winthrop & Gardiner Ry. Co., Augusta, Me.	41,553	60,110
Chippewa Valley Electric R. R. Co., The, Eau Claire, Wis.	53,077	60,104
Amsterdam St. R. R. Co., Amsterdam, N. Y.	54,658	60,051
Portsmouth Electric Ry., Portsmouth, N. H.	53 628	59,204
Seattle & Renton Ry. Co., Seattle, Wash.,	49,601	59,040
Burlington Traction Co., Burlington, Vt.	57,435	57,963
Bangor, Orono & Oldtown Ry.Co., Bangor, Me.	53,656	57,680
Allentown & Kutztown Tr. Co., Allentown.	43,601	56,850
Doylestown & Willow Grove R. R. Co., Doylestown, Pa.	41,688	56,487
Peekskill Lighting & R. R. Co., Peekskill, N.Y.	43,936	56,352
Gardner, Westminster & Fitchburg Street Ry. Co., Gardner, Mass.	54,137	56,106
Olean Street Ry. Co., Olean, N. Y.	52,018	56,040
Worcester & Blackstone Valley Street Ry. Co., Worcester, Mass.	32,229	55,811
Waterville & Fairfield Ry. & Light Co., Waterville, Me.	45,062	55,783
Olean, Rock City & Bradford R.R. Co., Bradford, Pa.	42,654	55,044
Black River Traction Co., Watertown, N. Y.	55,084	54,323
Tamaqua & Lansford St. Ry. Co., Lansford, Pa.	54,679	53,153
Raritan Traction Co., Perth Ambov, N. J.	32,945	53,023
Bristol & Plainville T'way Co., Bristol, Conn.	69,086	52,728
Northampton & Amherst Street Ry. Co., Northampton, Mass.	43,510	51,891
Greenfield & Turners Falls St. Ry. Co., Greenfield, Mass.	44,865	51,617
Meriden, Southington & Compounce Tramway Co., Meriden, Conn.	46,617	51,208
Citizens' Traction Co., Oil City, Pa.	15,086	50,455
Washington Elec. St.Ry. Co., Washington, Pa.	42,496	50,402
Bradford Electric St. Ry., Co., Bradford, Pa.	45,300	50,099
Van Brunt St.& Erie Basin R.R.Co., Brooklyn.	48,258	50,055
Total, 65 companies	$3,903,313	$4,408,531

COMPANIES HAVING GROSS RECEIPTS FOR 1902 BETWEEN $50,000 AND $25,000.

NAME OF COMPANY.	1901.	1902.
Waverly, Sayre & Athens Traction Co., Waverly, N. Y.	$17,700	$49,953
Biddeford & Saco R. R. Co., Biddeford, Me.	42,799	48,870
Kokomo Street Ry., Light & Power Co., Kokomo, Ind.	38,006	48,790
Rochester & Suburban Ry. Co., Rochester, N. Y.	40,705	48,521
Harrisburg & Mechanicsburg Electric Ry. Co., Harrisburg, Pa.	35,525	48,201
Middletown-Goshen Electric Ry. Co., Middletown, N. Y.	48,707	48,113
Athens Electric Ry. Co., Athens, Ga.	39,729	48,050
Torrington & Winchester Street Ry. Co., Torrington, Conn	42,921	47,251
Norton & Taunton Street Ry. Co., Norton, Mass.	51,341	46,512
Monmouth County Electric Co., Red Bank, N. J.	36,334	46,352
Wilkesbarre, Dallas & Harvey's Lake Ry. Co., Wilkesbarre Pa.	43,543	45,028
Hartford & Springfield Street Ry. Co., Thompsonville, Conn.	25,206	44,709
Lewistown & Reedsville Electric Ry. Co., Lewistown, Pa.	33,725	44,473
Fulton St. R. R. Co., New York City	45,921	43,694
Dunkirk & Fredonia R. R. Co., Fredonia, N.Y.	35,423	43,302
City Electric Ry. Co., The, Rome, Ga.	41,238	42,544
Ohio River Electric Ry. & Power Co., Pomeroy, O.	38,066	42,528
Newark & Hackensack Traction Co., Rutherford, N. J.	47,393	42,406
Lawrence & Reading Street Ry. Co., Lawrence, Mass.	33,833	41,228
Oswego Traction Co., Oswego, N. Y.	36,531	41,017
Charleroi & West Side St. Ry. Co., Charleroi Pa.	21,489	40,598
Georgetown, Rowley & Ipswich Street Ry. Co., Georgetown, Mass.	37,992	40 514
Middletown St. Ry. Co., Middletown, Conn.	37,590	40,113
Oil City St. Ry. Co., Oil City, Pa.	43,241	39,290
Bennington & Hoosick Valley Ry. Co., Hoosick Falls, N. Y.	37,076	38,216
Citizens' R. R., Light & Power Co., Fishkill, N. Y.	36,772	37,866
Phillipsburg Horse Car R. R. Co., Phillipsburg, N. J.	33,745	37,813
Framingham Union Street Ry. Co., Framingham, Mass.	36,596	37,736
Cortland County Traction Co., Cortland.N.Y.	31,624	37,617
Athol & Orange Street Ry. Co., Athol, Mass.	36,199	37,298
Springfield Electric Ry. Co., Springfield, Vt.	33,957	37,065
Sea View R. R. Co., Wakefield, R. I.	23,383	36,569
Farmington Street Ry. Co., Hartford, Conn.	33,099	36,301
Kittanning & Ford City Street Ry. Co., Kittanning, Pa.	29,745	35,865
East Taunton Street Ry. Co., Taunton, Mass.	28,167	35,334
Punxsutawney Passenger Street Ry. Co., Punxsutawney, Pa.	31,561	34,950
Franklin Electric Street Ry. Co., Franklin, Pa.	23,777	34,424
Corning & Painted Post Street Ry. Co., Corning, N. Y.	30,803	33,899
Southbridge & Sturbridge Street Ry. Co., Southbridge, Mass.	28,329	33,532
Pottstown Passenger Ry. Co., Pottstown, Pa.	28,396	32,945
Shamokin & Edgewood Electric Ry. Co., Shamokin, Pa.	19,336	32,066
Titusville Electric Traction Co., Titusville, Pa.	26,418	31,552
Tarentum Traction Passenger Ry. Co., Tarentum, Pa.	26,058	31,525
South Orange & Maplewood Traction Co., Orange, N. J.	20,413	31,072
Webster & Dudley Street R. R. Co., Webster, Mass.	23,193	30,439
Millville Traction Co., Millville, N. J.	16,093	30,333
Elmira & Seneca Lake Ry. Co., Elmira, N.Y.	30,917	29,903
Meadville Traction Co., Meadville, Pa.	29,576	29,591
Hamburg Ry. Co., Hamburg, N. Y.	21,932	29,563
People's Street Ry. Co., Nanticoke, Pa.	25,137	28,580
Haverhill, Georgetown & Danvers Street Ry. Co., Georgetown, Mass.	27,002	28,459
Cumberland Valley Traction Co., Harrisburg, Pa.	17,975	27,114
Citizens' Electric Co., Eureka Springs, Ark.	24,282	26,938
Calais Street Ry. Co., Calais, Me.	24,376	26,790
Bangor, Hampton & Winterport Ry. Co., Bangor, Me.	24,703	26,681
Troy & New England R. R. Co., Troy, N.Y.	27,782	26,456
Sunbury & Northumberland Electric Ry. Co., Sunbury, Pa.	21,447	25,074
Cohoes City Ry. Co., The, Cohoes, N. Y.	26,102	25,065
Total, 58 companies	$1,850,929	$2,166,688

THE USE OF TIMBER BY RAILROADS

At the meeting of the New York Railroad Club, held on April 17, a paper was presented by Dr. Hermann von Schrenk on "The Use of Timber by Railroads and Its Relation to Forestry." Dr. von Schrenk stated that over 110,000,000 ties were used last year by railroads for renewals, and that in consequence of the large amount of timber annually consumed large users will soon be unable to depend upon local supplies. He said that not only will the price be higher but the consumers will also have to pay the higher freight rates incident to getting timber from distant sections.

After this preliminary statement Dr. von Schrenk took up the following points: First, the proper management of existing tracts of forest lands so as to yield a constant supply without destroying the forest; second, replanting cut-over or treeless areas not fit for agricultural purposes; third, timber preservation, involving the chemical treatment of timber to obtain longer life, and, consequently, insuring the cutting of smaller quantities from the existing forests.

Under the first point the speaker told of the results obtained in Europe through scientific forestry in contrast with the wasteful manner in which the forests have been denuded in the United States. He said that American lumber companies have begun to realize this fact and are adopting advanced methods of cultivation. It was his opinion that in many cases it will pay railroad companies to buy timber tracts for cultivation from which they can draw their annual supplies, and be certain that they will not be subjected to annoying delays and high prices.

Regarding the second point, tree planting, this could, in many cases, be done on land not fit for agricultural purposes. While individuals and private corporations are not likely to set trees which cannot be utilized for many years, yet species like the catalpa, eucalyptus, locust, the osage orange and others, can be used for fence posts in eight to ten years, and for ties and poles in from twenty to twenty-five years. Of course, the kind of trees to be set depends upon the climate, condition of the soil, etc. Dr. von Schrenk felt that this will be undertaken by railroad companies as soon as they are convinced that such work will yield good financial returns. He said that it is the duty of the State and national governments to undertake the cultivation of large tracts of slow-growing trees, and to assist the work of private corporations. Recently several railroads started to set catalpa trees for ties and fence posts, and in proper climates and on properly selected lands he believed this tree will doubtless show ample returns on the investment.

Referring to the third point, timber preservation, Dr. von Schrenk said that a large share of the new timber bought by railroad companies was for replacing similar timber which had become unfit for further use. If proper methods of preservation be used, the life of the timber will be greatly increased, thus reducing the cost of renewals.

He stated that wood used for structural purposes by a railroad will give out sooner or later because of wear, decay and fire. Such timber must then be replaced. Renewals involve the cost of new timber, the labor of removal and replacing and the cost engendered by the disturbance. By preserving wood in such a way, for instance, as to double its length of service, the cost of a new piece will be saved, one-half the renewal expense and one-half of the third expense item, plus the interest on the sum of all the savings, from which the cost of the preservative process must be subtracted.

Successful preservation, the speaker said, depends upon such factors as what timbers ought to be preserved, the preserving methods to be used, the manner of application, etc. As a general rule porous woods, which, when not treated, soon decay, can be used much longer if properly treated, while wood not porous, and usually longer lived, will not receive much benefit, because the preservatives cannot penetrate them so easily. He cited an experiment made by the French Eastern Railroad. Untreated oak gave an average life of twenty years. The treatment added five years to this. Untreated beech lasts four to five years, while the treated beech has given an average life of over thirty-five years.

Dr. von Schrenk concluded from the various experiments made that short-lived porous timber well repaid the cost of treatment. He believed that similar results can be obtained in the United States, especially as there is still plenty of porous timber to be had. The following tentative list of long and short-lived timbers which enter or may be considered as possible sources of ties, poles, posts, etc., was given:

Long-lived dense timbers.	Short-lived porous timbers.
White oak.	Red and swamp oaks.
Long-leaf yellow pine.	Beech.
Locust.	Hemlock.
Ash.	Loblolly and lodge-pole pines.
	Gum.
	Tamarack.
	Fir.
	Maple.

Regarding the preserving methods to be used, Dr. von Schrenk said that the principal methods now in use are creosoting or tar oil treatment, burnettizing or treatment with zinc chloride, combined zinc chloride and tar oil treatment in its various forms, the Hasselmann process or boiling in copper-iron aluminum-sulphate. He considered tar oil to be the best where the user can afford to use it. In wet climates, he said, the combination process involving zinc chloride and tar oil is probably better than zinc chloride alone. The Hasselmann treatment, while it has shown no conclusive results, is so cheap that very little risk is involved in trying it.

Regarding the manner in which the preserving should be done, he said that all timber should be thoroughly seasoned before treatment. Seasoning tests had shown that aside from the better condition into which the timber was brought by drying, great saving resulted in other directions. A loss of 39 per cent meant a corresponding saving in freight. All timbers should be piled in as open a manner as possible, so as to allow the water to evaporate. After the timber is seasoned care should be taken as to the quantity of preservative injected, and a careful examination should be made at frequent intervals to determine the purity of the preservatives used. After treatment all timbers treated with a water solution of a salt should be seasoned carefully before being laid in the track, or exposed to decay-producing conditions. Careful records should be kept during all stages of the operations, and when ties are finally laid or poles set they should be marked in some permanent fashion so that reliable records may be kept to determine the return which any treatment has given. The speaker advocated the use of marking rails for this purpose, and stated that several large railroads had already adopted the suggestion.

In conclusion Dr. von Schrenk said that the general work of timber preservation will have to be placed in charge of men specially trained for such work, and he felt confident that when the necessity for such men arises the schools of forestry will be able to furnish them.

Dr. von Schrenk's paper was followed by one by Professor B. E. Fernow, entitled "Railroad Interests in Forest Supplies."

Professor Fernow said that it requires the annual growth of 40,000,000 acres of well-kept forest to keep in shape the present mileage (about 260,000 miles) of the United States. These figures do not include the lumber consumed in car building.

To give an idea of what the freightage of forest supplies meant the speaker said that more than one-half of the present lumber products, 50,000,000 tons, will have to be moved by rail, and probably for not less than 200 miles in the average, so that 6000 million ton-miles will probably not be an over-

statement, representing, with other forest materials added, a freight bill of not less than $100,000,000.

Professor Fernow said that the evils which have attended the rapid extension of railroads with regard to timber supplies, are not to be sought for so much in the decimation of wood supplies needed for their construction, but rather in the wasteful manner in which the exploitation of forests in general has proceeded to furnish the freight. In the absence of home markets it became necessary to cut wastefully. Only the better sizes and better grades would bear the long transportation; the rest had to be left in the woods. Moreover, the competition of supplies from the many new openings kept wood values low, and had the same tendency to induce wasteful cutting. Combined with other causes of waste the price of timber has steadily increased.

Professor Fernow stated that much can be done by the railroads to preserve the timber supply. Economy in the use of wood has already been begun by replacing wooden trestles and bridges by iron or masonry. In the use of railroad ties an improvement is also noticeable, but progress so far has been half-hearted. He said that this condition is probably the fault of the railroad financiers, who cannot figure the financial advantage of a higher present investment which will insure longer life and less operating expenses.

Professor Fernow said that starting with a raw tie at the impossible price of 20 cents lasting six years, which time, according to his canvass, is better than the average, it can be shown that both the sixteen-year treated tie and the twenty-eight-year treated tie are considerably cheaper by their mere longer life if the saving in renewals is added; and in this the saving in maintenance and in avoiding losses due to imperfect ties is left out of consideration entirely. Moreover, he believed that the cost of such treatment is placed unnecessarily high, at least higher than when its use has become more general.

The speaker asserted that the places where ties can be bought for 20 cents at present are probably not many, for white oak jumped in Chicago from 45 cents to 65 cents in two years, and cedar ties from 36 cents to 50 cents. He felt confident that from now on nothing less than 50 cents will buy a tie with a life of five years. Such a tie, if impregnated by the zinc chloride process at a cost of 50 cents with an addition of tie-plates at 15 cents and the substitution of bolts for spikes, may be made to cost $1.40, as against 75 cents for the untreated and unprotected tie, and if the former lasts only sixteen years, which would be less than it can be made to last with this protection, if properly attended, such a tie, at 5 per cent, would mean an annual saving of 7.19 cents, or round $194 per mile, a clear dividend wasted by the unprotected tie. To this must be added a further saving in maintenance and by avoiding accidents and wrecks, delays and losses, accasioned by imperfect ties.

Regarding metal ties, Professor Fernow believed that the experiments made by the Pennsylvania Railroad were not conclusive as to their merits. Experience on 35,000 miles of metal track had demonstrated tolerably well the essentials of a properly constructed metal track. It would appear that the inverted trough pattern with closed ends is the most successful and generally commendable form of tie.

As regards the cost, he made the following general calculations: An efficient metal tie for a perfect track with a a 100-lb. rail—the standard track of the future—weighing with its fastenings 150 lbs. (efficient ones for lighter rails and traffic weigh 130 lbs.), may cost as much as $2.60 in place, and when taken out would have a scrap value of say 40 per cent of that cost, or $1.00. Such a tie properly bedded, according to all experience, would, as far as atmospheric influences are concerned, last practically forever, but it would have to last mechanically only about thirty years to make it, by the mere length of its life, cheaper than the protected wooden tie lasting sixteen years and costing $1.40. If, as it is proper at the present time for long-time investments, interest is figured at 3½ per cent, and in this calculation the metal tie has been placed at a disadvantage. Again, great reduction in maintenance expenses and in losses avoided by safety and efficiency, as against even the protected tie, assure still greater economy of the metal track in the long run.

Dr. P. H. Dudley, in the discussion which followed both papers, remarked that the decay of timber is due to the growth of fungi, which can only be prevented by thoroughly seasoning and using preservatives for all timber. He said that a cross-tie in England costs $1.25, and when well creosoted they are in service from twenty years to twenty-one years. In Belgium oak is extensively used for cross-ties. The bark is removed from the log, sawed in half, and on the upper rounded portion a seat is made for the tie-plate. The entire heart and sap-wood is impregnated thoroughly with creosote, and the ties last from twenty years to twenty-five years. Beech cross-ties are used in France. This forms one of the best woods for cross-ties, when thoroughly treated, in use. Under flat-bottom rails, with screw spikes, twenty years to twenty-five years' service is secured from them.

Better rail fastenings are needed, he said, to secure the rails to the cross-ties than ordinary spikes. This is for the purpose of reducing the looseness of the rail on the cross-tie. This will lessen the strains in the rails, and also the injury to the permanent way. With the broad topped rails which are used the wheel treads, as they pass over the rails, hold them in a vertical position, and do not depend as much upon the spike for the lateral stability, as upon the proper distribution of the weights under the moving wheel loads. With round-topped rails this statement does not apply, as in that case the lateral stability must be secured by the spike or chair. While the spike forms what may be termed a secure fastening, without broad-topped rails, it is not rigid. There is too much looseness between the rails and the cross-tie itself to derive the advantage of the increased weight of the superstructure completely as one of the elements to augment the stability of the track. With a more efficient rail fastening and treated cross-ties the combined stability between the locomotive and the permanent way could be increased.

The advantage of treated cross-ties, beside increasing their durability and preventing waste of timber, would become apparent in many other ways by reducing operating expenses upon the railroads. The rails or the cross-ties can be considered no longer as of importance to the trackmen, for their relations extend to all departments of the railroad. This is shown by the introduction of the stiffer rails, which have not only helped to make the permanent way of greater smoothness and stability, but have at the same time permitted the introduction of larger locomotives and cars, with reduced operating expenses.

ALTERNATING CURRENT FOR RAILWAY WORK

New York, May 20, 1903.

Editors Street Railway Journal:

On page 740 of your issue of May 16, a statement is made purporting to give my views, as recently stated before a meeting of the American Institute of Electrical Engineers, at Chicago, in favor of direct-current power houses for railways. This statement would lead one to believe that I had recently changed my opinions regarding the advisability of the use of alternating current for heavy railway work.

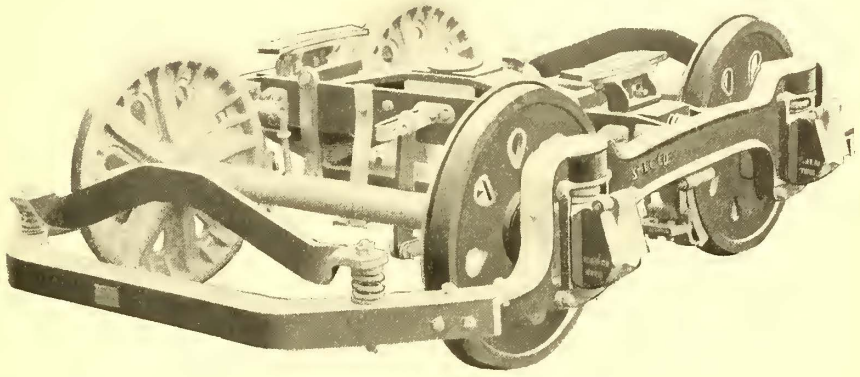
What I meant to convey by my remarks, and what I believe should have been understood from what I actually said, was that I believed in a number of alternating-current power houses, distributed along the line, feeding alternating current directly into the working conductor at a sufficiently high pres-

sure to allow these power houses to be located a reasonable distance apart, for by so doing the use of step-up and step-down transformers, rotary converters and the entire sub-station equipment would be eliminated. This, of course, assumes the use of alternating-current motors on the cars, the practicability of which, I think, will soon be demonstrated. Since I have so strongly advocated the use of alternating-current motors for railway work for some years, and am still in favor of them, I dislike to find myself quoted as being apparently against them.

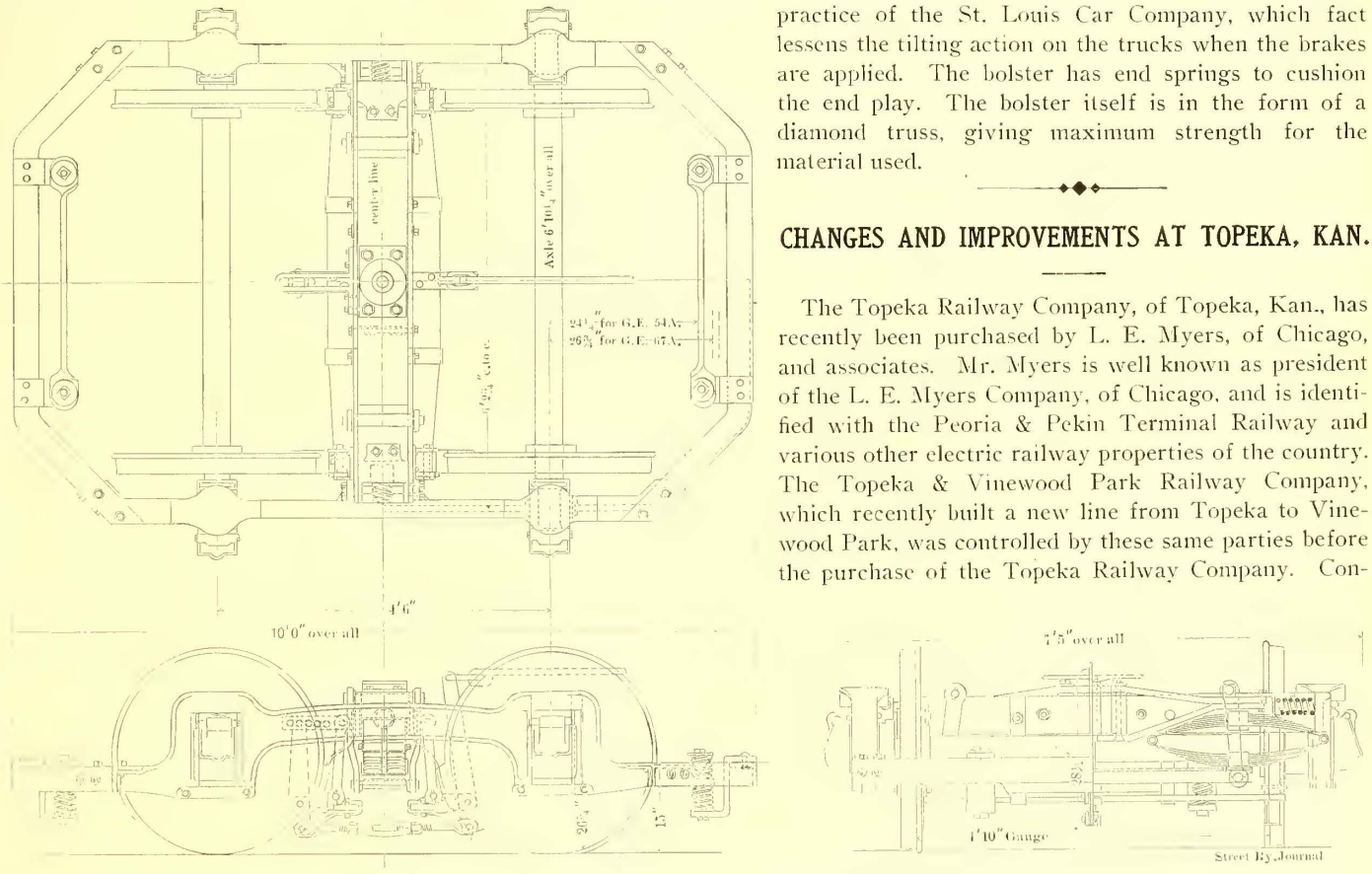
BION J. ARNOLD.

A SHORT WHEEL BASE TRUCK FOR CITY SERVICE

There are many places in city service where a swivel truck with a short wheel base is desirable. A short wheel base not only makes the rounding of curves easier, as far as the amount of power consumed and the wear on wheels and track are concerned, but it also frequently permits the car body to be hung nearer to the ground, which, of course, is always desirable, as it makes the car easy to board, and saves time when a car is stopping for passengers. A short wheel-base truck, which is known as the No. 47 truck of the St. Louis Car Company, is illustrated here by dimensional drawings and by the accompanying engraving from a photograph of this truck. The wheel base is 4 ft. 6 in., which, of course, necessitates outside-hung motors. This is the truck which is being used on 120 new cars of the St. Louis & Suburban Railway, and also on fifty new cars which are being built for the Detroit United Railway. It has a spring bolster with elliptic springs on each end, similar to a standard M. C. B. passenger truck. This bolster is hung from a rigid truck frame, which truck frame is supported on spiral springs over each journal box. The point to which special attention is called in this truck is that the side frames, which are cast steel, are machined off at the ends where they are bolted to the angle-iron end frames. The joints being machine-fitted in this way a very rigid truck frame is secured, which gives little trouble from the working loose of the bolts which hold the frame together. The constant small vibrations to which the truck in city service is subjected makes this feature especially valuable for a city truck. The brake-shoes are inside-hung, in accordance with the usual present practice of the St. Louis Car Company, which fact lessens the tilting action on the trucks when the brakes are applied. The bolster has end springs to cushion the end play. The bolster itself is in the form of a diamond truss, giving maximum strength for the material used.



SHORT WHEEL BASE TRUCK



PLAN, SIDE ELEVATION AND SECTION OF SHORT WHEEL BASE TRUCK

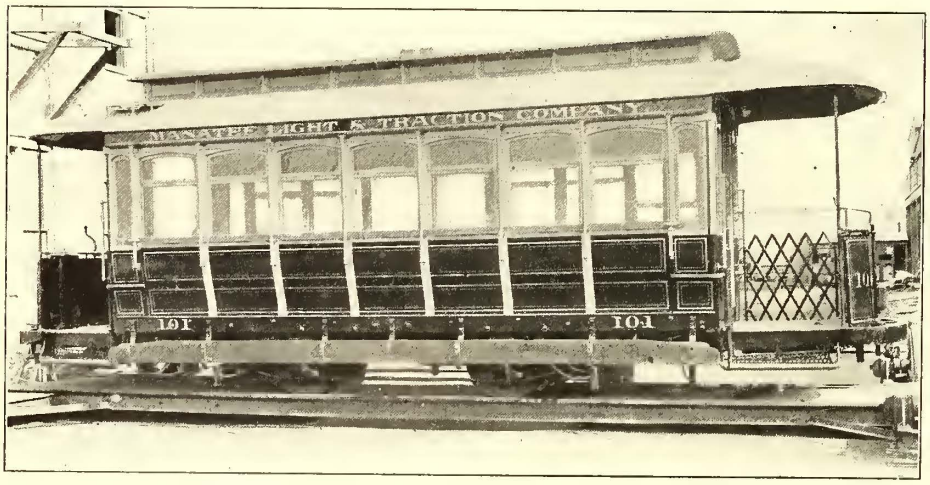
CHANGES AND IMPROVEMENTS AT TOPEKA, KAN.

The Topeka Railway Company, of Topeka, Kan., has recently been purchased by L. E. Myers, of Chicago, and associates. Mr. Myers is well known as president of the L. E. Myers Company, of Chicago, and is identified with the Peoria & Pekin Terminal Railway and various other electric railway properties of the country. The Topeka & Vinewood Park Railway Company, which recently built a new line from Topeka to Vinewood Park, was controlled by these same parties before the purchase of the Topeka Railway Company. Contracts for about $400,000 of improvements on the lines of the Topeka Railway have been let to the L. E. Myers Company. The track will all be relaid with 8-in. Shanghai T-rail on rock ballast. Twenty-five new cars will be purchased and the power house overhauled. A 500-kw direct-connected unit will be put in the power house and entirely new boilers. The Topeka Railway is capitalized at $1,250,000, and has a funded debt of $450,000 in 4½ per cent first mortgage bonds. It has 37 miles of track.

CONVERTIBLE CARS FOR FLORIDA

The American Car Company, of St. Louis, has recently completed an order of convertible cars (Brill patented) for the Manatee Light & Traction Company, of Braidentown, Fla. Braidentown is on the west coast, at the mouth of the Manatee River, which flows into the sea at the opening of Tampa Bay. During the season there is quite a large population. A short steam line connects several towns to the north and south, and with the trolley lines makes the place a busy center for one of its size. The climate, though warm, is subject to the severe Gulf storms, which are accompanied with high winds, necessitating more protection than the curtains of ordinary open cars afford. Apparently this convertible car is suited to widely different climatic conditions, for in a recent issue the same type of car was described as used in the State that is farthest from Florida, and where the temperature goes many degrees below zero in the winter.

The Manatee cars are 20 ft. 7 ins. long over the end panels, and 29 ft. 7 ins. over crown pieces. From the end panels over the crown pieces is 4 ft. 6 ins. The width over the sills is 6 ft. 10 ins., and over the posts at the belt is 7 ft. 9 ins. The side



CONVERTIBLE CAR FOR MANATEE, FLA.

sills are 5¼ ins. x 6 ins., plated with ⅝-in. x 6-in. steel. End sills are 4¼ ins. x 6 ins. Thickness of corner posts 3¾ ins., and side posts 3⅝ ins. The cars are equipped with folding gates, sand-boxes, angle-iron bumpers, gongs, ratchet brake handles, radial draw-bars and revolving seats, all of which are patented specialties of Brill manufacture. The cars are handsomely finished inside with ash in natural color, and the ceilings are of neatly decorated birch. They are mounted on Brill 21-E trucks with 33-in. wheels, and wheel base of 7 ft. The weight of a car and truck is about 14,000 lbs.

A STREET RAILWAY GUIDE FOR ROCKFORD, ILL.

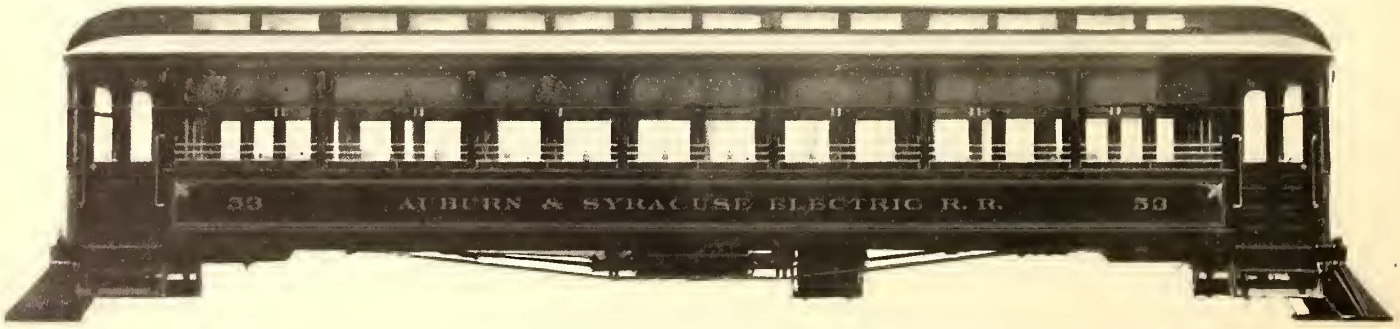
One of the enterprising printing companies of Rockford, Ill., the Clark Company Press, has issued a pocket street railway guide for the city of Rockford, with the aid of J. H. Groneman, general passenger agent of the Rockford & Interurban Railway. The idea carried out in this guide is not one that would be applicable in a very large city, but for small cities works out very well. Each street railway route is taken by

INTERIOR OF CONVERTIBLE CAR

itself, and there is given, first, the name of the route, after which follows the time the cars on this route leave the waiting room, past which all cars operate, the time the cars on the route leave the outer terminal, the time the first car leaves the waiting room, and the time the last car leaves the waiting room. Then is given a list of the streets which the route intersects, then a list of the points of interest passed by the cars of the route. In the middle of the book is a two-page map of Rockford, with the street railway lines in red.

INTERURBAN CARS FOR CENTRAL NEW YORK

The accompanying illustration shows the body of a handsome 50-ft. interurban car recently built by the G. C. Kuhlman Car Company for the Auburn & Syracuse Electric Railroad Company for operation on the lines between those cities. This is the first car completed in the order for the equipment of this road. It is 50 ft. long over all and is constructed according to the regular Kuhlman standard. The car is finished in solid mahogany with trimmings of heavy bronze, pantasote curtains and birdseye maple head lining highly decorated. It is furnished with Hale & Kilburn walk-over grab-handle seats, and is equipped with four Westinghouse 75-hp motors and the L-4 controller. The Auburn & Syracuse Company, it will be remembered, purchased the handsome private car built by the same company and exhibited at the Detroit convention. This car will be used on special occasions.



50-FT. INTERURBAN CAR FOR AUBURN AND SYRACUSE

FINANCIAL INTELLIGENCE

WALL STREET, May 27, 1903

The Money Market

The feature of the money market last week was the surprisingly large movement of currency to this city from the interior. According to estimates, net receipts from this source amounted to at least $5,000,000, which was considerably the largest total for any week this season. Had it not been for this timely help, bank reserves would have undergone a heavy reduction through the combined effect of gold exports and withdrawals of cash to comply with the 10 per cent trust company reserve requirement which must be satisfied by the 1st of June. As it was, the banks lost in last Saturday's statement $1,300,000 cash, but, loans decreasing upwards of $5,000,000, surplus reserve slightly more than held its own on the week. Shipments of gold to Europe and South America have amounted altogether during the current month to more than $10,000,000. It is true that this heavy outgo has not been felt to the extent that might have been expected in softening foreign exchange rates. The check to exports of cotton, occasioned by the very high prices, is still the main reason why the ordinary supply of commercial exchange bills is so scant, and, as this week's developments have demonstrated, it is a more powerful influence in the market than the recent large purchases of our securities for Europe's account. Nevertheless, demand sterling has fallen off enough from the high level of a week ago to leave only a doubtful profit upon further shipments of gold. The chances are, therefore, that, while more gold will go out later on, exports for the present will no longer be attempted. The lowering of the Bank of England rate last Thursday made the situation decidedly easier from our market's point of view. In consequence of the halt in the gold engagements, the very large currency arrivals from the interior, and the enormous stock market liquidation, money rates have hardened only slightly during the week. Call loans are supplied abundantly at 2½ per cent, and, although offerings of time loans are not as free as they were a short while ago, sixty and ninety-day money is obtainable at 4 per cent and six-months money at 4½. It does not seem likely that there will be any change in these quotations for several weeks at least.

The Stock Market

Another violent outburst of liquidation carried stock prices during the past week to the lowest levels of the season. In fact, many of the leading issues reached the lowest figures since 1901. The remarkable feature about this decline is that it was not accompanied by any outside developments which could satisfactorily explain it. The simple truth seems to be that a number of prominent speculative interests found themselves in a position where they were forced to let go hurriedly a large quantity of stocks. To understand this one must remember the fact that there are vast issues of new securities which were left on the hands of underwriting syndicates when the investing public withdrew from the market a year ago. Not being able to realize readily on these assets, some of the individual syndicate members have been compelled to let go their holdings of marketable stocks in order to protect their commitments in stocks which were unsalable. With prices down thirty to fifty points from last September, it goes without saying that enormous losses have had to be taken, but inasmuch as these losses have fallen upon a comparatively few rich men, and not upon the community in general, the results have not been as serious as might ordinarily be supposed. Not a single failure of note has occurred during all this time, simply because the rank and file of commission house clients have not been heavily involved in the break. Undoubtedly prices have reached a level where they are attractive to investment buyers, and sooner or later the market will find an equilibrium where prices will certainly not be any lower than they are now. But since investment purchases are slow at such a time in comparison with the offerings of stocks from speculative hands, no one can safely venture to predict just when bottom will be reached. The formation of a powerful underwriting syndicate to take over the $90,000,000 new Pennsylvania stock has removed one very considerable source of uneasiness. The steadiness displayed by Pennsylvania shares during the last few days indicates a much more confident feeling on the part of outside investors, and the best opinion is that the worst is over so far as this stock is concerned. In other quarters of the market there is also pretty good evidence that the selling has culminated. New York Central and the Erie shares particularly may be mentioned in this connection. It is only in the Western railroad issues that the position is still uncertain.

Of the local traction stocks the heaviest selling of the week occurred in Brooklyn Rapid Transit, chiefly because there is a larger speculative element in this than in the other members of the group. In both Manhattan and Metropolitan liquidation has been comparatively light and both stocks have rallied well whenever pressure was removed from the general market. When normal conditions are restored it will probably be found that the available supply of both these stocks is very small around current prices.

Philadelphia

Street railway specialties in Philadelphia were not much troubled by the week's liquidation in other quarters. In some cases prices have actually advanced as compared with a week ago. Union Traction and Rapid Transit have been the strongest stocks on the list, the first-named, after a decline to 45½, recovering quickly to 46⅛, while the second rose three-eighths of a point to 11⅝. The holders of Rapid Transit stock are given until July 6 to meet the call on the $3,000,000 subscription payment. A friendly feeling exists in speculative circles toward both stocks on account of the rapidly increasing earnings of their property. Philadelphia Traction is off a half a point to 96½. American Railways on a few scattered sales kept steady at 47¼. Philadelphia Company common was pressed for sale, falling from 42⅝ to 41¼. Only a single transaction in the preferred is reported at 48. Union Traction of Indiana common sold at 75 and on the next sale went to 80; the preferred changed hands at 51½. Other sales of the week include Fairmount Park Transportation at 26, Consolidated Traction of New Jersey at 67½ and 67⅜, Railways General at 3¾, Indianapolis Street Railway at 82¼, Pittsburg Traction preferred at 51½, San Francisco Railway preferred at 53⅞, Rochester Passenger at 75 and Thirteenth and Fifteenth Street Passenger at 317. Bond sales include Electric People's Traction 4s at 99, People's Passenger 4s at 104¼, Philadelphia Company Consolidated 5s at 102, Union Traction of Indiana 5s at 101½ to 101, and Newark Passenger 5s at 116.

Chicago

Prices have been rather irregular in Chicago during the week. Scarcely any sales at all have occurred in Union Traction, but the bid price has dropped a point to 3⅜. Most of the principals in the affairs of the company have left the city. West Chicago and North Chicago, on the other hand, have rallied, the former selling up as high as 65 and the latter as high as 125. City Railway sold down from 204 to 200½. The president of the company has declared himself in favor of a speedy settlement of the franchise matter, hoping, he says, that everything possible will be done on the part both of the city and the railroad company toward reaching a business-like solution of the problem. Among the elevated stocks Lake Street has been the strongest of any around 5½, the main consideration being the progress of the reorganization plans. Northwestern showed renewed weakness, selling down to 20⅝. Metropolitan common rose at one time to 24, but fell back to 23. The preferred sold at 70. South Side changed hands at 103.

Other Traction Securities

The Boston market for traction securities has been unsettled, but not, on the whole, any lower. Boston Elevated holds very steady around 145¼, and so does West End common around 91½ and the preferred around 112½. Massachusetts Electric common sold as low as 28½ and the preferred was firm at 86 to 86¼. Very little business has been transacted in Baltimore during the week. United Railways issues have varied very little, the stock selling at 12¾, the income bonds from 68 to 68¼, and the general mortgage 4s at 93¼ to 93. Knoxville Traction 5s sold at 101, and North Baltimore Traction 5s at 121. Sales on the New York curb during the week comprise American Light & Traction common from 79 to 78½, the preferred from 98½ to 97 to 97½, St. Louis Transit at 25½, Camden and Trenton at 3, Washington Traction common at 11⅜ and 11½, Nassau Electric 4s at 83½, and New Orleans 4½s at 83½.

Detroit United led in the selling at Cincinnati last week. The sales were only 365 shares, but the range was unusual, opening

at 81¼, dropping to 75½, and then strengthening to 79. Cincinnati Street Railway was comparatively quiet, the sales numbering 321 shares at a range of from 134½ to 133½. Columbus Railway common is enjoying a strong demand, but only two lots came out at 102; a short time ago this stock was selling at around 85. The preferred was in good demand at 106. Cincinnati, Covington & Newport common ranged from 36½ to 37½ on sales of 350 shares. In the bond list Zanesville Railway, Light & Power Company led, $31,000 worth selling at the old figure, 101. Columbus, Delaware & Marion bonds sold to extent of $27,000 at the same figure. Twelve thousand dollars worth of Northern Ohio Traction 4s sold at 62¼, a decline from last sales. In Cleveland $8,000 worth of the Northern Ohio Traction 4s sold at 61 and 61½, the lowest yet reached. Miami & Erie Canal bonds sold at 56, also a low mark. Cleveland City was the most active stock. The first sale after the announcement of the consolidation was at 109, ten points above last sale. It advanced to 110, and then reacted to 108. Heavy offerings at these favorable figures caused the stock to decline to 103, where it became inactive. Sales were 1120 shares. Cleveland Electric reached the high point of 86½ and then dropped back to 83. Sales numbered only 260 shares. One block of Northern Ohio Traction sold at 22½, a decline of 1⅜ from last sales. Toledo Railway & Light sold off in sympathy with New York, fifty shares going at 29½, as compared with 32½ for recent sales. Detroit United weakened for the same cause, a small lot selling at 79½.

Iron and Steel

The iron market continues in a somewhat unsettled condition, with prices for pig-iron still tending downward. Business in this department, however, is very light, which takes away considerably from the significance of the decline. It is well understood that owing, first, to the anthracite coal strike, and, second, to the freight blockade, the pig-iron quotations of last autumn and winter were abnormally high. That prices should be seeking a normal level again, therefore, should not be disquieting. The placing of the Steel Corporation's order for 200,000 tons of pig-iron for the second half year at $19.35 per ton, promises to have a steadying effect upon the market. Business in the steel trade keeps up very well, with special activity in structural material and tin plates. Quotations are as follows: Bessemer pig-iron $19.50 to $20.00, Bessemer steel $30.50, and steel rails $28.00.

Metals

Quotations for the leading metals are as follows: Copper 14¾ to 15 cents, tin 28 7-16 to 28⅝ cents, lead 4⅜ cents, and spelter 5¾ cents.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	May 19	May 26
American Railways	47½	47
Aurora, Elgin & Chicago	a29	a29
Boston Elevated	145	145
Brooklyn Rapid Transit	64¼	61⅝
Chicago City	200	200
Chicago Union Traction (common)	4½	3½
Chicago Union Traction (preferred)	32	32½
Cleveland Electric	82½	75
Columbus (common)	100	100
Columbus (preferred)	105½	105⅞
Consolidated Traction of New Jersey	67	67
Consolidated Traction of New Jersey 5s	108	107¾
Detroit United	a81	76¾
Electric People's Traction (Philadelphia) 4s	99	99
Elgin, Aurora & Southern	a56	a56
Lake Shore Electric	10	10
Lake Street Elevated	5	5¼
Manhattan Railway	138¼	137⅞
Massachusetts Electric Cos. (common)	28½	28¼
Massachusetts Electric Cos. (preferred)	85½	85¼
Metropolitan Elevated, Chicago (common)	23½	21½
Metropolitan Elevated, Chicago (preferred)	70	68
Metropolitan Street	130	129¾
New Orleans Railways (common)	—	—
New Orleans Railways (preferred)	—	—
North American	95	92
Northern Ohio Traction & Light	23¼	22
Northwestern Elevated, Chicago (common)	21	20½
Philadelphia Rapid Transit	11	11½
Philadelphia Traction	97	96¾
St. Louis Transit (common)	26	24½
South Side Elevated (Chicago)	103	102
Syracuse Rapid Transit	—	—
Syracuse Rapid Transit (preferred)	—	a79
Third Avenue	120	120
Toledo Railway & Light	a30	27½
Twin City, Minneapolis (common)	109	104½
United Railways, St. Louis, 4s	84¼	84½
United Railways, St. Louis, preferred)	77	73¾
Union Traction (Philadelphia)	45⅞	46⅛

a Asked.

COMPARISON OF STEAM AND ELECTRIC RAILWAY STATISTICS

The New York Commercial Advertiser has grouped the report of the Census Bureau for the street railways of the United States, as published in a recent issue of this paper, with similar figures for the steam railroad industry in the following table:

	Electric Railroads	Steam Railroads
Number of companies	987	2,057
Length of line, miles	16,648	197,237
Length of track, miles	25,589	265,352
Total cars	67,199	1,550,833
Officers and employees	138,183	1,071,169
Salaries and wages	$84,636,275	$610,713,701
Capital stock	1,216,277,989	5,806,566,204
Funded debt	929,328,656	5,881,580,887
Total capitalization	2,145,606,645	11,688,147,091
Earnings from operation	241,584,697	1,588,526,037
Operating expenses	139,012,004	1,030,397,270
Income from operation	102,597,693	558,128,766
Income from other sources	2,907,156	179,746,449
Net income	30,955,233	241,511,318
Passengers carried	4,813,466,000	607,278,121
Passengers killed	1,216	282
Passengers injured	47,428	4,988

Notice is drawn to the fact that while there are ten times as many miles of steam track as of electricity, that the gross receipts from operations of the electric lines were approximately one-sixth the receipts of the steam lines, so each electric line made earnings per mile greater by four-tenths than the steam lines. Also, that the electric lines are capitalized at one-fifth the capitalization of the steam lines, or more than twice as much per mile.

NIAGARA FALLS CONVENTION OF A. I. E. E.

The annual convention of the American Institute of Electrical Engineers will be held this year at Niagara Falls on June 29, July 3. The papers to be read on electric railway topics are all set for the morning of June 30, 1903, and are as follows:

1. High-Speed Electric Railway Problems, by A. H. Armstrong.
2. Storage Battery Industrial Locomotives, by Frank L. Sessions.
3. Predetermination in Railway Work, by F. W. Carter.
4. Car Run Tests, by W. E. Goldsborough and P. E. Fansler.
5. Some Recommendations Concerning Electrical and Mechanical Specifications for Trolley Line Insulators, by Samuel Sheldon and J. D. Keiley.
6. The Storage Battery in Sub-Stations, by W. E. Goldsborough and P. E. Fansler.

Papers will be read on electric power transmission topics and other allied subjects.

STRIKE AT MONTREAL

The employees of the Montreal Street Railway and the Montreal Light, Heat & Power Companies went on strike Saturday, May 23. The railway company controls the urban transportation facilities of the city and suburbs, while the power company controls the electrical field, except a few small private plants. The chief contention is recognition of the unions, though both sets of men demand an increase in wages. The street railway and electric light men struck last February when a settlement was made by which the men received an advance in wages. Agreements signed then are repudiated. Both companies absolutely declined to receive deputations representing the unions.

THE CONSOLIDATION AT CLEVELAND

The details of the consolidation of the Cleveland Electric Railway Company and the Cleveland City Railway Company are rapidly being perfected. It has been announced that the original plan of merging the two companies into one concern will probably be abandoned, and that instead the present charter and name of the Cleveland Electric Railway Company will be retained, that company simply buying all the assets and assuming all the liabilities of the Cleveland City Railway Company. To do this it will simply be necessary to increase the capitalization and authorized bond issue of the Cleveland Electric, and application for permission to make this change will be made at once. If this plan proves successful, as it undoubtedly will, the consolidation will be greatly simplified and will become operative within sixty days. The combined capitalization of the two companies at present is $23,400,000, and this will probably be the capital stock of the new company. President Andrews, of the Cleveland Electric Railway, announces that universal transfers will be issued within a very few days. As a matter of fact, these transfers have been printed and are ready for instant distribution. Regarding the possibilities of applications for new franchises and the granting of reduced fares, the officials decline to be interviewed, and it is believed that as has already been intimated in the STREET RAILWAY JOURNAL, the question of reduced fare will be made the basis for application for extended franchises at some later date.

While it has not been officially announced, it is generally understood that Senator Mark Hanna, at present president of the Cleveland City Railway, will become chairman of the board of directors of the company, and that Horace Andrews and John J. Stanley will be president and general manager respectively.

Accountants for the two companies are at work tabulating figures which will be used as the basis for new schedules. The number of through lines will be increased in order to reduce the use of transfers to a minimum. One change that has been decided upon is to extend the St. Clair Street line to connect with the Euclid Beach Park line, thereby taking a great deal of heavy traffic off of the Euclid Avenue line, besides saving at least a mile in the route from the center of the city to the popular resort mentioned. Another aim in changing routes will be to shunt as many cars as possible away from the Public Square, thereby reducing the congestion at this point. The changing of routes will, of course, necessitate the entire reclassification of runs and the systems of handling cash and transfers.

The retirement of Senator Hanna as president of the Cleveland City Company will practically remove him from active street railway work. For more than twenty years he has been closely identified with this work, and has devoted a great portion of his time to it. As chairman of the board, his duties will pertain almost wholly to the finances of the big company and to the outlining of policies. Matters of detail will be left to others.

Mr. Andrews, as president of the company, will be one of the most important factors in the street railway world. As is generally known, he is identified with the Utica & Mohawk Valley Railway, one of the largest city and interurban systems in New York State, besides being interested in other railway properties in several sections of the country. He is a director in the Lake Shore Electric Railway Company, and was recently offered the presidency of that corporation, but he declined to accept, preferring to devote his energies to the development of the Cleveland city system.

PROVISION MADE FOR JOINT OPERATION BY AN INDIANA CITY

The city of Crawfordsville, Ind., has recently passed an ordinance which provides that all street or interurban cars coming into the city shall be operated over the lines of one company or system. The passage of the ordinance settles a contest for a franchise between the Consolidated Traction Company and the Indianapolis & Northwestern Traction Company, and the franchise itself is of general interest because of its almost unique provisions. The ordinance gives the Consolidated Traction Company the right to build on all of the principal streets in Crawfordsville, and it might be construed as an exclusive franchise. The section of the ordinance that provides for the construction of but one system within the city says:

> The purpose of this ordinance is to require all street railway or interurban cars entering the city of Crawfordsville and operating therein by electricity to use the tracks and overhead construction of one system or company, in order that the public safety may be subserved and the best interests of the public and the city of Crawfordsville may be promoted, and to this end said Common Council has ordained and doth hereby ordain, in consideration of the acceptance of this ordinance by said Consolidated Traction Company, its successors and assigns, shall be given the right to build a line on the said streets of the said city herein mentioned to meet any other interurban or electric company seeking entrance to said city, and that when such line is so built by said Consolidated Traction Company, its successors or assigns, said other interurban company or companies seeking entrance to said city shall be required to enter said city over and upon the lines of said Consolidated Traction Company, its successors or assigns.

The ordinance provides for a toll of 4 cents to be collected by the Consolidated Traction Company from such other companies as enter the city over its tracks—2 cents for each passenger coming into the city, and 2 cents for each passenger going out of the city—one-half of this amount to go to the city for the use of its streets.

THE STRIKE AT BRIDGEPORT

On May 26 the strike of the employees of the Connecticut Railway & Lighting Company at Bridgeport was as far from a settlement as it was the day the motormen and conductors went out. The company positively refuses to submit the difficulty to arbitration, and it is upon this basis that the strikers hope for a settlement. The police seem to have the situation thoroughly in hand, and the company each day is steadily increasing its service. On May 21 all the lines were in regular operation throughout the day, and since that date a limited service has been operated at night. Remembering the demonstrations and riots of the previous Sunday, special precautions were taken to provide adequate protection on Sunday, May 24. Two hundred deputy sheriffs were on hand, with instructions to make arrests at the first show of violence, and it was rumored that the police had riot guns within easy reach. There was not the slightest sign of disorder, however, and cars were operated from early morning until 8 o'clock at night. On Monday the electricians and linemen of the company went out on strike in sympathy with the conductors and motormen. The company has filled the places of these men, and its service has not been interrupted. The strike has, of course, completely paralysed trade, people from the neighboring towns avoiding the city altogether. The directors of the Bridgeport Business Men's Association, in consequence, have thoroughly canvassed the situation, and have decided to call a meeting of the association for Thursday, May 28, when a liberal discussion of the question will be had.

LUNA PARK, CONEY ISLAND—SUGGESTIONS FOR STREET RAILWAY PARKS

At Coney Island, that pleasure ground of innovations, to which New York's millions flock for amusement in the warm weather, there has just been opened to the public, grouped in one enclosure and under one management, a series of attractions that for their diversity and originality will satisfy the most exacting searcher for pleasure and recreation. This small city, or New York's World's Fair, as it has come to be known, officially is called Luna Park. The attractions presented are for the most part so elaborate that adoption of them for street railway parks is out of the question, except by large companies; but the street railway manager who visits New York this year will be repaid by visiting the new park, for there is sure to be suggested to him by the attractions ideas that may be carried out by him on a less elaborate scale.

The park covers twenty-two acres of land. At the entrance is a monster arch covering half of an entire city block, and at each top corner gracefully rest mammoth monoliths. From these, as far as the eye can see, rise from the ground, prettily shaped structures down the Court of Honor at the right of which is a Venetian City, true to detail in its architectural design and with a grand canal making its course along the fountain line, upon the waters of which are the boats with the gaudy attired gondoliers, singing to the music of guitar and mandolin. On the other side from the entrance to the Court of Honor are situated the three illusion spectacles. First of all is a Trip to the Moon, which, since the Pan-American, has been made complete in every idea. Next is a monster battle ship, with its turrets, and awe-inspiring guns protruding from the breastworks behind, high above the heads of those walking about the park. Within its walls, which are shaped to represent Fort Hamilton and New York Bay is presented a costly scenic spectacle, known as the War of Worlds. This shows an attack upon New York Harbor by the navies of the Allied Powers, with their own ultimate destruction and defeat. Passing an electric fountain, there is presented to view a larger building than any exposition has ever before constructed. Inside this one may make a trip with Jules Verne, "Twenty Thousand Leagues Under the Sea," on a journey from Luna Park to the North Pole, at which point the boat finally glides under the water, with a submerged iceberg, at the top of which is discovered an Esquimaux village with Esquimaux dogs

and sleds and Polar bear enjoying life amid icebergs made possible by a refrigerating plant. The passengers alight and are guided around the cities of ice, by the Esquimaux. After touring through innumerable grottos an iceberg theatre is discovered where by means of thirty-eight different scene-drops forty-six hundred electric lights and a gauze-scene panorama 3½ miles in length a delightful transformation is witnessed, beginning with King Frost, and terminating with the beautiful scene of the Aurora Borealis.

Around in the different parts of the grounds are the scenic rivers and babbling brooks, Japanese gardens, Old Germany, Little Ireland, with every county made of the real sod from the natural counterpart across the sea, the Grand Casino, Alhambra and Convention Hall, the Infant Incubators, the Hippodrome with Wormwood's Monkey Theater; the Mile a Minute Shoot the Chutes, a new sensational ride; Sea on Land, a Chinese Theater with a new Ching Ling Foo, the Midnight Express, by which one may take a trip on a real railway train from Luna Park to Buffalo, Filipino Village, Hindoo Village, Japanese Village, Singalese and Hawaiians. Two immense circus rings stand out at either side of the electric tower in the lagoon. In each of these strange and wonderful acts are going on all of the time. Over the water at a height of 200 ft. are aerial artists of every kind, high wire walkers, and trapeze performers.

CHICAGO CITY RAILWAY TAKES UP FRANCHISE NEGOTIATIONS

The local transportation committee of the Chicago City Council met May 21 for the first time since election, and the following communication was received from President D. G. Hamilton, of the Chicago City Railway Company:

Frank I. Bennett, Chairman Committee Local Transportation, City Council, Chicago:

Dear Sir—The city having secured the enabling legislation it sought, the way is now open, as I understand it, for a settlement of the "traction question," and the Chicago City Railway Company asks your committee to take up negotiations at once to that end.

The company asks for immediate action with the more confidence because the interests of the public as well as the company are involved. The question of time is one which is perhaps of even more importance to the citizens generally than to the company. That portion of the public which this company serves is demanding a more efficient service, and this service the company is anxious to give as soon as possible. Not only the personal comfort and convenience of the individual citizen are involved, but very many business interests, other than those of this company, are dependent upon the speedy settlement of this matter.

No undue haste is urged, only the proper expedition of a business affair in which so many interests are concerned. The requirements which the city will demand of the company in the way of improved service mean the expenditure of a large amount of money. The necessary changes in tracks and equipment cannot be completed quickly. Power houses must be built, machinery constructed, rails laid and new cars put on. It is no small undertaking, and the time when the better service can be given depends primarily, as a matter of course, on the time when authority is given to start the work.

Believing that your committee will take the same view of the need for all proper expedition in this matter, this company desires simply to offer a suggestion as to the method of procedure.

The character, importance and variety of the questions involved have already been fully discussed before your committee, and the apparent differences of opinion are perhaps more of form than substance.

Among these questions is the one of what is a proper disposition to be made of the existing valuable rights of the company in the streets of the city under existing ordinances, and which it is expected to waive or merge in the rights granted by the proposed ordinance.

The question as to the kind of compensation to be made is also involved. Upon this there is a division of public sentiment. Some citizens hold to the view that it should be a direct money payment to the city. Others insist that the money should be expended by the company in paving the streets it occupies. The proper policy to be pursued is wholly for your consideration and determination, the company being willing to accept either alternative.

These questions cannot be intelligently determined without taking into consideration, among other things, the company's liability under the proposed ordinance for license fees, taxes, street paving, street cleaning, sweeping and sprinkling, and what disposition is to be made of the railway at the expiration of the grant.

It is therefore respectfully suggested that your committee appoint a subcommittee, who, with your legal counsel, may meet the officers and counsel of this company for the purpose of formulating for discussion by your whole committee a concrete statement of the terms of ordinance for the settlement of the "traction question." Respectfully,

D. G. HAMILTON,
President Chicago City Railway Company.

A sub-committee will probably proceed at an early date to take up the matter with the Chicago City Railway Company. The Chicago Union Traction Company presented no communication at the meeting.

Sub-committees of the local transportation committee were appointed on franchises, subways, service, and elevated railways.

The Northwestern Elevated Railroad Company asked for a franchise to extend the road north to the city limits.

THE IOWA RAILROAD COMMISSIONERS' REPORT

The report of the Iowa Railroad Commissioners for the year ending June 30, 1902, has just been issued. This is the first report of that commission to be made since the law put interurban electric railways under the jurisdiction of the commission. The Waterloo & Cedar Falls Rapid Transit Company is the only electric road included in the report this year. This company operates an interurban line between Waterloo and Cedar Falls, some rural lines, and the Waterloo city lines. The following figures are given regarding this company:

WATERLOO & CEDAR FALLS RAPID TRANSIT COMPANY

Year ending June 30, 1902

Number shares stock	6,000
Par value	$600,000.00
Miles of road	40
Stock per mile	$15,000.00
Number stockholders	2
Bonds issued	$400,000.00
Bond issue per mile of road	10,000.00
Net miscellaneous income	13,248.73
Cost of road and equipment	611,075.52
Cost of road and equipment per mile	15,276.89
Actual present cash value of road and equipment	1,024,776.30
Gross income	64,334.93
Operating expenses	36,685.64
Income from operation	27,649.29
Interest on funded debt	20,500.00
Taxes	214.00
Income from other sources	13,248.73
Total income	40,898.00
Total passenger revenue	52,859.26
Total freight revenue	11,475.67
Total passenger and freight earnings	64,334.93
Maintenance of way and structures:	
Repairs of roadways	$2,824.91
Renewals of ties	51.56
Repairs and renewals of bridges and culverts	142.94
Repairs and renewals of buildings and fixtures	145.86
Other expenses	843.13
Total	$4,008.40
Maintenance of equipment:	
Repairs and renewals of passenger cars	$5,894.86
Repairs and renewals of shop machinery and tools	598.47
Total	$6,493.33
Conducting transportation:	
Superintendence	$1,812.62
Engine and round-house men	2,266.17
Train service	10,942.31
Train supplies and expenses	230.89
Loss and damage	41.70
Injuries to persons	1,658.65
Advertising	677.42
Other expenses	4,964.62
Total conducting transportation	$22,594.38
General expenses:	
Salaries of general officers	$1,294.97
Insurance	423.76
Law expense	570.60
Stationary and printing	71.50
Other expenses	1,228.70
Total general expenses	$3,589.53
Percentage of expenses to earnings	57.02

POWER STATION COSTS IN GLASGOW AND DUBLIN

Some figures are presented herewith of the cost of power at the large generating stations in Glasgow and Dublin, which figures may be of interest to American readers, although the conditions are somewhat different from those in the United States. Both stations were designed by H. F. Parshall.

Referring first to Glasgow, the system consists of a generating station equipped entirely with three-phase generators. Energy is transmitted at 6300 volts to five sub-stations located at different parts of the system where it is transformed and converted to continuous current of 550 volts by means of rotary convertors. The result for December is given as follows: The total cost of operating per kilowatt-hour, generated in the power stations, is .25 d. or 0.5

cents; the cost at the sub-station switchboard is .29d. or 0.58 cents per kw-hour. The cost of supply sub-station costs, maintenance of plant in generating station and sub-station, maintenance of cables and overhead system, is 0.732 cents per kw-hour.

The Dublin generating station is designed on lines similar to those of Glasgow, but four-fifths of the energy generated is supplied directly to the tramways, while one-fifth is generated and transmitted to sub-stations for transformation and conversion. The cost per kilowatt-hour during December, including operating, maintenance, and repairs, is 0.76 cents per kw-hour at the generating station, and 0.788 cents per kw-hour, including sub-station costs.

THE CHICAGO ENGINEERING & CONSTRUCTING COMPANY

The Chicago Engineering & Constructing Company, with a capital of $250,000, has acquired the established engineering and contracting business of the well-known firm of Weston Brothers, Chicago. This firm, which consisted of Charles V. Weston and George Weston, was organized two and a half years ago to carry on a general engineering and contracting business. It has paid special attention to examinations, consultations and reports upon proposed and existing steam, electric and elevated railways, and has carried on the construction in many instances. Among the recent accomplishments of the firm, may be mentioned the designing of the intramural transportation system for the Louisiana Purchase Exposition at St. Louis, which has been adopted, and the very important assistance rendered to Bion J. Arnold in the preparation of his report to the local transportation committee of the Chicago City Council, for which they received due credit in the report.

The officers of the company will be Charles V. Weston, president; George Weston, vice-president; George A. Yuille, secretary and general manager, and Hervey B. Hicks, counsel. Messrs. Addison E. Wells, Fred A. Wells and Edward B. Burling, all of Chicago, together with the above-named officers, will make up the board of directors. Messrs. Charles V. Weston and George Weston are already so well and favorably known to the profession that a reiteration of their past accomplishments seems unnecessary.

George A. Yuille will be recognized as the former vice-president and general manager of the West Chicago Street Railroad Company, and an officer of other street railroad properties in Chicago. His service has covered both the construction and operation of properties, and he is known to those familiar with this field as a manager of great force, tact, skill and ability. His connection with the new company will enable it to reorganize existing properties and bring them up to the best modern standard of practice.

Messrs. Addison E. Wells and Fred A. Wells are known throughout the country as leading building contractors, in which field they have been engaged for many years. They operate under the name of Wells Brothers Company, and are now carrying on the construction of large buildings in Chicago, Baltimore, Philadelphia, New York, and elsewhere. Their connection with the above company is an assurance to the business world of its stability and a warrant of conservative and efficient management.

For a number of years Hervey B. Hicks, who is a Chicago attorney, was engaged in engineering service on Western railroads and irrigation works, and recently has made a special study of the electric railway field, all of which will make his services peculiarly valuable to the new organization. Edward B. Burling is a member of the firm of Bentley & Burling, Chicago attorneys.

The Chicago Engineering & Constructing Company is now carrying on the supervision of construction of several electric railroads, among which may be mentioned the line from Rockford to Freeport, Ill., and is preparing plans and specifications for extensions of existing properties. It is prepared to make surveys, estimates, plans and specifications; examinations and reports upon proposed or existing properties, with recommendations for improved operation when desired.

It will take contracts to construct steam, electric and elevated railways, bridges, buildings, tunnels, subways, viaducts, wharves, piers, manufacturing, gas and electric light plants, and will make a specialty of creating new electric railway properties delivered with operating organization perfected and in actual operation. After making investigation of the physical condition and operating practice of existing properties, the company will undertake the rehabilitation of such properties, reorganize operating forces and bring up entire systems to modern standards of practice, at the same time developing revenue-producing possibilities which have been overlooked or neglected, and reducing operating expenses to a minimum. On account of the rapid construction of electric railroads during a period when so many improvements in type and economical operation have been made, there is a large field for activity in this line. The offices will be at 711 Merchants' Loan & Trust Building.

THE STRIKE AT DUBUQUE

A strike began on the lines of the Union Electric Company, of Dubuque, Ia., May 6. May 5 a committee representing the newly organized division of the Amalgamated Association of Street Railway Employees of America presented the following agreement to General Manager F. L. Dame, and requested him to sign it:

Memorandum of agreement entered into between the Union Electric Company, of Dubuque, Iowa, party of the first part, and the Amalgamated Association of Street Railway Employees of America, Division 329, of Dubuque, Iowa, party of the second part.

Witnesseth:

1. That in the operating of lines of the party of the first part, both parties hereto agree that all business shall be transacted between the properly accredited officers of each party hereto.

2. All difficulties hereinafter existing between the parties hereto shall be settled by the respective committees appointed by the parties hereto.

3. In all cases where members are laid off or discharged from the service of the company a copy of the charges against said employee shall be furnished the secretary of the association within forty-eight hours and where men are suspended as punishment the superintendent shall notify the proper officer of the association of how long they intend to suspend said member or members.

4. Any member of this association under this agreement laid off as punishment and after investigation found not at fault shall be reinstated in his former position and be paid for the total number of days that he is laid off by the company at the number of hours per day that his run on the time table calls for.

5. In case the association suspends a member who is an employee of the company for any violation of their laws or rules they shall request his suspension in writing signed by the officers of the association. The officers of the company shall suspend the employee thus requested at once without pay until such time as the association request his reinstatement.

6. That all conductors and motormen shall be members of this association and must be turned in for initiation within thirty days from the time they were put on to practice; they shall take out a permit card from the association, paying a compensation of one dollar for the same.

7. That when a regular man is pulled off his run and an extra man put in his place, the extra man shall be paid the same wages as regular run calls for, and when an employee is called for special duty he shall receive full time regarding the period of time either under or over the hour.

8. That all members of this division be given free transportation over the company's lines either by passbook or card.

Mr. Dame told this committee that he had no authority to sign such an agreement, and would refer it to the board of directors; and that on account of the absence of some of these directors it might not be possible to give them an answer inside of a week. This was apparently satisfactory to the committee. At the end of the conversation Mr. Dame requested two members of the committee, who were respectively the president and secretary of the union, to turn in the company's property, as they had been discharged several days previously for violation of the rules. On the succeeding day the other three members of the committee waited upon General Manager Dame and demanded peremptorily the reinstatement of the two men in question, and one other. This Mr. Dame promised also to refer to the board of directors; but the committee demanded an immediate answer, "yes" or "no", and failing to secure this, left with the intimation that the cars would be stopped. Later in the day a committee from the Trades Council presented the same demand to the management, and received the same answer. Between 5 and 6 p. m. the manager received a telephone message that unless the men were reinstated, the cars would stop at 8 p. m., and the cars were taken to the barn at this time. The company immediately notified the men that those in the employ of the company at the time of the strike who desired to return to work the next day at the required time could do so, and advertised locally for men. Failing to obtain these locally, the company attempted to start the cars with outside men several days later, but were successful in running only about two hours, when the cars were stopped by rioters, with but little attempt on the part of the police to protect the cars. When operation of the cars was begun, the firemen of both the railway and lighting stations walked out, but new men were substituted. After the cars had been stopped, the men drove the firemen from both stations; but the company has been able to keep its lighting plant in operation. There seems to be some question whether this strike is endorsed officially by the officers of the Amalgamated Association, or whether it is not proceeding on local authority only.

The reply of the company to the demands of the committee was as follows:

To the Employees of the Union Electric Company—Gentlemen:

On May 5 a committee representing "Amalgamated Association of Street Railway Employees of America, Division 329, of Dubuque, Iowa," called upon General Manager Dame, and submitted to him a form of agreement or contract between said division and the Union Electric Company, and asked that same be executed by said company. Mr. Dame informed the committee that he would present the matter to our board of directors as soon as a meeting could be had.

We recognize the right of every man to join or not to join any organiza-

tion, and we are ready at all times to hear and consider complaints whether made individually, or collectively, by our employees in any matter touching their welfare or our mutual benefit.

We are willing to investigate any case of suspension, and if the same is found to be unjust, to reinstate such suspended employees, without loss of rank or pay, on account thereof.

In the matter of free transportation of employees, our present rules are those of the American Street Railway Association, and there are objections to making a change, but we will try to make some arrangement on this point that will be satisfactory.

We cannot, however, agree to discharge competent and trustworthy employees, simply because they decline to join any organization, nor can we insist that employees shall become members of any organization—in short, we see no fair, just and practicable way, except to leave to each employee absolute freedom to join or not to join any organization as he himself may determine. We use the language of the anthracite coal strike commission in which all interests were represented and whose finding was unanimous. "The commission adjudges and awards: That no person shall be refused employment, or in any way discriminated against, on account of membership or non-membership in any labor organization, and that there shall be no discrimination against, or interference with, any employee who is not a member of any labor organization by members of such organization."

The contract submitted to us by your committee is, in substance and spirit, such that we cannot properly agree to.

UNION ELECTRIC COMPANY,
By F. D. STOUT,
President.
J. R. LINDSAY,
Secretary.

Shortly after the strike began the company made a proposition to leave the entire matter to a board of arbitration. The strikers replied to this, wishing a board composed of one selected by them, another selected by the company, and the third by these two. As the reinstatement of the three men was the cause of the strike, and not the refusal of the company to sign the agreement, the company agreed to leave this matter of the discharge to such a board; but before the company's answer was in the hands of the Mayor, the strikers withdrew their proposition on the ground that they had no confidence in the good faith of the company.

THE ORGANIZATION, METHODS AND WORKS OF THE ST. LOUIS CAR COMPANY

It is always of value to inquire into the methods and secrets of success of the successful business man or the successful business institution, and to learn what are the essential elements which have gone into the make-up of a great industry.

The St. Louis Car Company was started at St. Louis in 1887. Its growth for the first ten years of its life was steady, though not as remarkable as during the last six years, during which latter time it has advanced so rapidly as to be the wonder to every one who has visited the works in recent years. That this company has grown so rapidly, is an evidence of systematic and up-to-date methods of manufacture and modern equipment, as well as a study of shop costs and methods which will admit of large orders being bid for at very low rates.

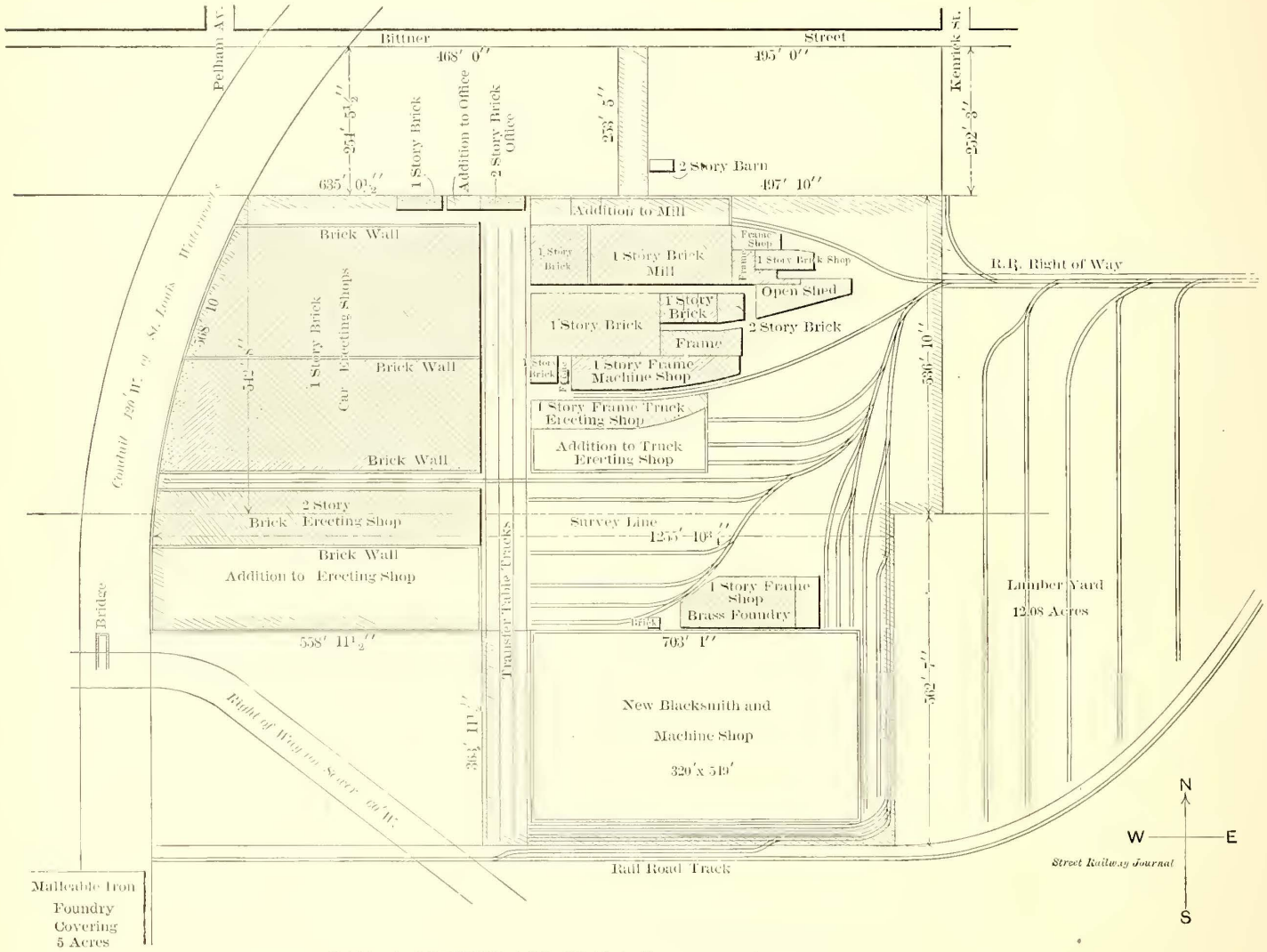


FIG. 1.—PLAN OF PRESENT AND PROPOSED PLANT OF ST. LOUIS CAR COMPANY

In the first place it will be well to consider the arrangement of the company's present plant, the methods for handling material, and the proposed extensions and improvements. The company originally started works in the southern part of St. Louis. In 1898 new shops at Baden in the northern part of the city were erected. The present manufacturing equipment is therefore thoroughly modern. In Fig. 1 is shown a plan of this company's present plant, together with the addition which will be made immediately. The shaded portions show the buildings of the present plant. The new buildings are not shaded. The company's property is entered by railroad tracks from the east. The eastern portion is devoted to lumber yards. Near the lumber yards at the northern end of the property is the mill where all the wood-working machinery is located. A 50 per cent addition to this mill, as indicated, is being built. Adjoining the mill are buildings devoted to blacksmith and machine shops, where the truck work is done, as this part is very much crowded. Because of the increase in the company's truck business, new blacksmith and machine shops, 320 ft. by 549 ft., are being built in the southern portion of the yards. South of the machine and blacksmith shops there is an erecting shop for the truck work, which is to be more than

doubled, as seen by the plan. The large brass foundry is in the southeast corner of the present yards. The other additions already mentioned consist of an extension of the office, and an extension of the car-erecting shops.

It will be seen from the plans that all of the car-erecting and painting is done in the buildings to the west of the transfer table which serves the plant. On the east side of the transfer table are the mill and machine shops and all truck work. The lumber in coming into the plant is first unloaded into the lumber yard at the eastern part. It is then taken as used onto cars operated by the company's electric locomotives or push cars, and delivered to the wood-working mill. The parts, after having the machine work completed in the mill, are loaded on push-cars and taken to the cabinet shop directly opposite the mill. Adjoining the cabinet shop, which is in the northern part of the car-erecting shops, is the immense floor space of the erecting shop given to the actual putting together and painting of cars. The cars are not moved from the time their erection is begun until they are entirely completed. All the erecting, painting and finishing is done with the car in the same spot. The two transer tables serve as an extremely easy means of switching material, trucks or cars from one division of the plant to another, as the transfer table practically serves every building in the plant. Of course there are tracks through all of the buildings, but these are not indicated in the accompanying plan. All the switching of cars in the yards is done with the company's electric locomotives, one of which is seen in Fig. 2 hauling out a train of twelve finished cars.

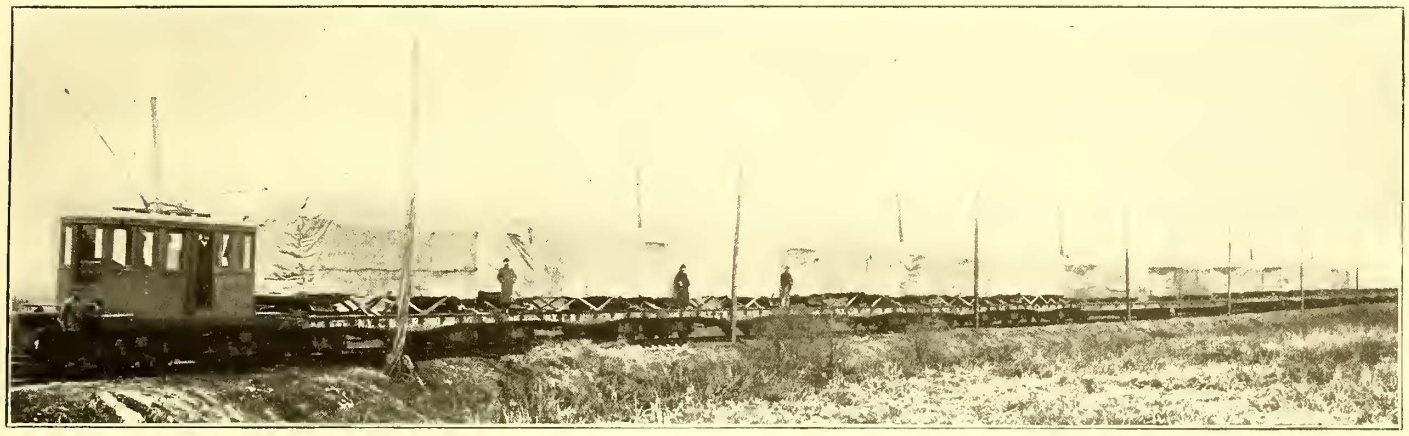


FIG. 2.—ELECTRIC LOCOMOTIVE HAULING TWELVE CARS

The capacity of the car-erecting shops allows from 228 to 356 car bodies to be on the floor under way at one time, depending upon the size of the cars. At this plant 2250 men are now employed, which number will be immediately increased to 2750 if the men can be obtained. The capacity of this plant now is about 3000 cars per year.

As recently noted in these columns, the St. Louis Car Company has purchased the works of the Laclede Car Company, and the Laclede plant will be used to fill the smaller orders received by this company, since the St. Louis Car Company's large plant is better adapted to the filling of large orders than is the Laclede plant. This Laclede plant has a capacity in its erecting shops for fifty cars, and the output capacity is about 500 cars per year. At the Laclede plant 250 men are employed, which will be increased to 500.

The growth of the St. Louis Car Company's business, which has been so phenomenal, is as follows: In 1887, capacity, 600 cars per annum; 1898, 1000 cars per annum; 1900, 1500 cars; 1902, 2400 cars; 1903, 3500 cars. The latter figure, of course, includes the Laclede plant. Besides this there is the large output of trucks. Altogether the company is capable of turning out $5,000,000 worth of cars and trucks a year. The figures given are, of course, the capacities of the present shops. As will be seen by the plans in Fig. 1, the enormous increase in the machine and blacksmith shops will provide for additional needed facilities in the manufacture of trucks and steel channel bottoms. The additions to the mill and erecting shops will provide for a substantial increase in the car-building part of the business. It was thought at the time the new shops were built that they would provide for the growth of many years, but already they are badly crowded to take care of the work.

An automatic sprinkler system for fire-extinguishing has been put in over the whole plant, and elaborate precautions are taken to prevent fire from gaining headway. Employees living near the shops are organized into a fire department for quick work at night when the shops are shut down, although at the present time the shops are in operation night and day. In the mill and machine shops a signal system is provided whereby the line shafting can be stopped on short notice in case of accident.

Compressed air is made extensive use of in all parts of the shop for operating portable drills and riveters for all of the erecting work which cannot be easily performed by hand.

However, probably the most interesting thing in connection with this great factory is the organization of the work so that the general manager keeps constantly informed as to the progress of every part of every job which is in the company's shops. It is to this, no doubt, that much of the company's success is due. General Manager H. F. Vogel runs the establishment with a remarkably small amount of red tape, while at the same time keeping thoroughly informed as to what is being done in all departments. In order to do this, semi-weekly meetings are held, the time selected being immediately after the noon lunch, at which time the heads of departments get together for the purpose of reporting as to the progress of work under their charge. This meeting takes usually about thirty minutes. From forty to forty-five men are present. The attendance at this meeting includes the superintendents, department heads, foremen, and, in fact, all who have charge of work for which they are held responsible. At this meeting the general manager asks as to the progress of each job, and if any foreman is being delayed by the lack of particular parts it is reported, and the foreman supposed to be furnishing the parts causing the delay must report as to the reasons for the delay, in order that difficulties of this kind can be located quickly. Every one goes to these meetings fully posted as to the progress and condition of every job under his charge. A stenographer is present to take notes of the reports made by the different foremen. No formal report in writing is made, but each man simply answer questions as to the progress of his work, and since record is kept of answers made, every man is, of course, watchful that there is no delinquency on his part. All work is so sub-divided that some one is responsible for the progress of every part of every job and is keeping close track of it. At these works L. Rubenbauer is superintendent, assisted by G. J. Smith, who looks more especially after the truck manufacture. Mr. Smith was formerly master mechanic on the St. Louis & Suburban Railway. William A. Sutton, formerly president of the American Car Company, is supervisor, looking after and advising regarding new work generally. The work is divided as follows among foremen: Erecting shop, paint shop, blacksmith shop, machine shop, mill, cabinet shop, car rigging, car finishing, brass foundry, lumber yards, receiving clerk, drafting room and shipping clerk.

Besides the semi-weekly meetings, for business purposes held after lunch, there is a monthly dinner and meeting of the superintendents, foremen and employees in responsible charge of work, which is familiarly known around the works as "Mr. Vogel's good time." These meetings are held the first Saturday of each month. Dinner is served in the company's lunch rooms, and after dinner a general discussion follows which is taken part in by all employees. At these meetings matters of improvement in shop methods or shop equipment are discussed. Any proposition brought up is open for discussion by every one, and debate is encouraged. At these meetings every one stands on the same footing, without regard to the position he may occupy in the company organization. Many valuable suggestions as to improvements in shops, machinery and methods have resulted from these meetings. If an employee has a suggestion to make it is welcomed at these times, and its good and bad points are sure to be brought out by the discussion of it which follows.

To the street railway man, in fact, a visit to these works is a liberal education in all matters relating to car construction.

CAR FENDER TEST

On May 22 the Eclipse car fender was tested in the presence of several officers of the Brooklyn Heights Railroad Company. Benjamin Lev, the inventor of the fender, stood in the center of the track and was struck by the fender when the car was running about 6 miles an hour. The fender immediately picked him up, and Mr. Lev jumped out without even a scratch. The second time the car was speeded up to nearly 21 miles an hour and struck Mr. Lev. Again the fender caught him, and the inventor scrambled out still smoking his cigar.

To show that the fender could also pick up small objects, a bag about 3 ft. high, filled with sand and shavings, weighing about 25 lbs., was placed on the track. The car ran against it at different speeds, but in every case the fender picked up the bag.

The front of the fender is usually inclined about 45 degs., but on striking an object over a foot high it becomes horizontal. The device is made entirely of iron, with the exception that the front grid is fitted with a heavy rubber hose. This hose, when striking an object, acts like a pneumatic cushion. To prevent the hose from being injured a thin rod runs through its length.

This fender is manufactured by the Eclipse Car Fender Company, of Cleveland, Ohio.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED MAY 19, 1903

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

728,238. Car Seat; Louis Janson, Brooklyn, N. Y. App. filed Oct. 6, 1902. Details of construction of a reversible car seat.

728,313. Trolley; George E. Smith, Exeter, N. H. App. filed April 5, 1902. A supplemental wheel is mounted in a spring-actuated frame and is adapted to remain in engagement with the conductor after the main wheel ceases to contact therewith. Widely diverging arms first direct the wire to the supplemental wheel, after which the spring on the trolley arm forces the main wheel into place.

728,324. Third-Rail Electric Railway; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed July 5, 1902. The rail is provided with a roof plate and a rod beneath it, the latter mounted in the insulators to serve as a foot guard.

728,428. Elevated Electric Railway; Wassily Varzar, St. Petersburg, Russia. App. field Oct. 27, 1899. A truck runs upon an overhead structure and has a car suspended from each side.

728,540. Motor Control System; Frank E. Case, Schenectady, N. Y. App. filed Jan. 6, 1902. Apparatus rendering it impossible to operate the motor controlling switch improperly in a multiple unit system.

728,590. Lock for Controller Handles; John B. Linn, Schenectady, N. Y. App. filed Jan. 29, 1901. At boundary points between city and suburban districts an inspector boards the car and adjusts the limit of movement of the controller handle so that the motorman cannot run faster than the law permits in each district.

728,636. Automatic Life Guard or Fender for Tram Cars; William T. Watson, Victoria, Canada. Relates to an automatic trip for dropping the fender in case it strikes a person.

728,637. Automatic Wheel Guard for Tram Cars; William T. Watson, Victoria, Canada. App. filed Dec. 12, 1902. Consists of a pilot board, a guard, a locking device therefor, a horizontal trip bar rearwardly and upwardly curved arms pivoted to the pilot board and connections between the pivoted arms and the locking device to release the latter and allow the guard to drop by gravity.

728,659. Collector for Use on Electrically Propelled or Lighted Vehicles. Benjamin H. Bedell, London, England. App. filed May 16, 1902. A magnet mounted on the car has pole pieces carrying spring supported fingers which are normally withdrawn from the roadway, but when presented to an iron button in the roadway are pulled downward into contact to establish electrical connection between the button and car.

728,736. Adjustable Housing for Cars; Joaquin A. De Macedo, Leventhorpe Hall, County of York, England. App. filed Oct. 30, 1902. An adjustable framework and curtains for the upper portion of a double-decked car.

728,792. Car Truck; John A. Brill, Philadelphia, Pa. App. filed Aug. 18, 1902. Vertical movements of the truck frame at either end are resisted by suitably arranged springs.

728,822. Means for Operating the Points on Tramway or Like Tracks; Stanislas Zylberlast, Manchester, England. App. filed Nov. 3, 1902. Relates to improved means for moving a switch point from the car; also the points in connection with overhead electrical equipment.

PERSONAL MENTION

MR. WILLIAM S. BLIGHT, president of the Ridge Avenue Traction Company, of Philadelphia, Pa., is dead. Mr. Blight was seventy-eight years old, and had retired from active business life several years ago.

MR. T. C. PENINGTON, secretary and treasurer of the American Street Railway Association, and treasurer of the Chicago City Railway Company, suffered a sad bereavement last month by the death of his wife. Mrs. Penington's death was not unexpected, as she had been seriously ill for a long time. The interment occurred at Princeton, Ill., where Mrs. Penington formerly resided. She possessed an exceptional number of very attractive qualities, and Mr. Penington has the sympathy of all his friends in his loss.

MR. F. L. FULLER, general manager of the Queens County & Suburban Railway Company, was elected last week a director of the company. Mr. Fuller has been connected with the company about two months, entering upon his duties immediately after his resignation as general manager of the United Power & Transportation Company, of Philadelphia. He is planning a number of improvements to the system and his well-known ability in street railway organization and development should have most beneficial effect on the future of this important road.

MR. C. E. COLLINS has resigned as superintendent of construction of the Cincinnati Traction Company, of Cincinnati, Ohio, to become general manager of the Topeka Railway Company, of Topeka, Kan., where a consolidation of local companies has just been effected. Mr. Collins has been with the Cincinnati Company for about seven months. Before his connection with the Cincinnati Company he was superintendent of the North American Railway Construction Company, of Chicago. Mr. Collins, in all, has been connected with railways and railroad building for the past fifteen years.

MR. R. T. CRANE, president of the Crane Company, of Chicago, about a year ago published a booklet giving the results of an investigation made by him regarding "The Utility of an Academic or Classical Education for Young Men who have to Earn Their Own Living and Expect to Pursue a Commercial Life." The treatise attracted much attention, and the author afterwards decided to go into the subject somewhat further. He has now issued a revised edition, which is not only a unique publication, but a very valuable contribution to the literature of a field that has been sadly neglected by most men in Mr. Crane's position. His facilities for obtaining data and his wide experience and observation have enabled him to present the subject in a very attractive form.

MR. W. W. WHEATLY, formerly superintendent of the Brooklyn Rapid Transit Company, has just accepted the position of superintendent of the railway department of the Public Service Corporation, of Newark, N. J. This company, as announced in a recent issue of this paper, has been formed to operate all of the electric railway, lighting and gas properties in Newark, Jersey City, Hoboken, Paterson, Elizabeth, the Oranges and neighboring towns, and will control in the neighborhood of 300 miles of track.

W. W. WHEATLY

Mr. Wheatly has been engaged in railway work since 1875, and before going to Brooklyn was chief train despatcher and afterward assistant superintendent of the Buffalo division of the West Shore Railroad. He started with the Brooklyn Rapid Transit Company as division superintendent, but was soon made assistant general superintendent, and upon the retirement of Mr. Ira A. McCormack was made superintendent of all the surface lines. Mr. Wheatly resigned from the Brooklyn system on Oct. 1 last, and has since that date contributed several important articles to the columns of this paper, notably one on the Passenger Traffic Problem of Greater New York, which appeared in the issues of Jan. 10, Jan. 17 and Feb. 7, and one on the Philadelphia Rapid Transit system, which was printed in the issues of March 28, April 4, April 11 and April 18. Mr. Wheatly is first vice-president of the New York Railroad Club, and for a number of years acted as secretary of the club.