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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8200 copies are printed. Total circulation for 1906 to date, 310,500 copies, an average of 8171 copies per week.

Accidents at Steam Road Crossings

Some statistics concerning accidents on street railway systems would, without doubt, show that a large per cent of these casualties is caused by collisions with steam trains at steam road grade crossings. This condition of facts is rather surprising when it is considered how easily accidents of this nature can be avoided. All that is necessary is that the conductor should signal the car over the crossing and exercise average intelligence in looking out for steam trains. The trouble is that orders are not obeyed. This is the case especially in crossings that are used infrequently by the steam trains. When but two or three trains pass over a line in twenty-four hours, the running time of these trains is apt to be very well known, and this fact makes the electric crew careless. They look upon the duty of flagging their car as a useless precaution and loss of time, and as there is seemingly no chance of an accident, the management often pays little attention to violations of the rule. It is, in fact, the spurs to factories and the less frequently used steam road tracks that are the most productive of accidents. The chance of being caught by the train is so infinitely small that trainmen after a time run over crossings of this character at full speed. When a steam train passes over the spur, the chances are great that the motorman will not be prepared to do anything to avoid an accident. And collisions at such crossings are usually of the most serious nature, due to the fact that the electric car is usually going at full speed.

The writer remembers an incident that caused the management of a railway to regard all steam road crossings in their proper light. Two very serious accidents happened at close intervals at just such crossings. One of these crossings was used probably not more than a half dozen times a year. In one instance a death resulted, and in both the electric cars were badly wrecked. Immediately after the accidents orders were given to the conductors to flag over every steam road crossing, no matter what its character, and the accidents due to collisions at crossings suddenly ceased.

Spitting on the Floors of Cars

The city authorities in several of the larger cities have recently begun the enforcement of long existing ordinances prohibiting spitting on the sidewalk. If spitting on the pavement is detrimental to the health of all and obnoxious to the majority of people, to expectorate on the floor of a badly ventilated car is certainly much more so. In most States and cities ordinances are in existence prohibiting spitting in cars, and we believe it high time for the railway companies which have not already done so to take advantage of these ordinances and start a vigorous crusade against those who persist in violating this rule of health and decency. That the ordinances are violated in many cities may usually be proven by a glance at the floor of many a car. Should there be no evidences in the aisles, if the car be equipped with cross seats, an inspection along the sides of the car between the seats will usually furnish sufficient proof. Many companies think they have done enough in the matter when they put up conspicuous notices in their cars requesting that passengers abstain from using the car floors as cuspidors, and also mentioning the fact that the offense is punishable by a fine. But such notices, while they serve to remind the thoughtless ones, have no effect whatever on the willful violators. Conductors at times have instructions to make personal requests of violators and often to threaten them with arrest, but the effect

of such requests and threats is not much more effective than the posted notices. To stop the practice effectually, vigorous action must be taken by the arrest and fining of a few of the offenders. Such action on the part of the railway company would usually result in enough newspaper publicity to cause the company's attitude to become generally known, and afterwards there would be a decided change for the better in the condition of the cars. This at least has been the experience in cities where the ordinance against spitting on the sidewalks has been enforced. In one of the larger cities a comparatively small number of arrests of violators and fines of $1 and cost for each, put an effectual stop to the practice. In the work the city authorities were assisted greatly by the newspapers, who took up the city's side and let the determination of the company and the city authorities to stop the practice be generally known. Railway companies may urge as a reason against taking vigorous action that they would arouse the enmity of a certain class of people and thereby lose patronage. But we are inclined to believe that the reverse would be true. A greater number of people would appreciate the company's efforts to better conditions, and the general sentiment of the community toward the company would, without doubt, be better. People would further appreciate the cleaner condition of the cars, and it is safe to say that the increase of travel, due to the change of condition of car floors, would more than equal the lessened travel by those affected by the action of the company. However, the blame for the continuance of the practice of spitting on the floors does not always rest on the operating companies. Often when the companies do attempt to punish offenders, such action meets discouragement at the hands of the municipal authorities. At times these latter seem to consider spitting on the floor of a car too small an offense to deserve punishment, and accordingly refuse to punish those against whom the operating companies may prefer charges. Cars can only be kept clean when the municipal authorities and the railway company work in harmony.

The Lighting of Street Cars

Now that the short days of autumn draw near, the question of car lighting comes again to the front. Within the past two or three years there has been keen interest in improved methods of illumination, and they have gradually been put upon a scientific basis. We wish that the electric car would receive its fair share of attention—it needs it sadly. It is not that electric railways are at all parsimonious about their light; on the contrary, they sometimes err in the direction of too great liberality. Unquestionably a street car is from its shape and finish somewhat difficult to light satisfactorily, which is an excellent reason for making an especial effort to solve the problem. We shall therefore feel at liberty to discuss this subject again, and shall try to put a new phase upon it, although it has been considered several times before in these columns.

Speaking in general terms, illumination is effective in the proportion that it falls upon the objects which are to be lighted and keeps out of the eyes that are working by it, subject of course to the condition that there shall be no violent contrasts of bright and dark spaces within the field of view. For irremediable badness, the favorite method of reading a newspaper in the days of our great-grandfather easily takes the palm. The old gentleman would lean a bit forward on his desk, grasp the paper firmly in his right hand, and then with the left shove a lighted candle about midway between his nose and the type. By this means the light would shine fairly above his spectacles, which he would be obliged from time to time to readjust in the hope of seeing a little more through the glare.

Now, nine street cars out of ten are lighted very much after the same fashion, so far as results are concerned. The lights are commonly incandescents with clear bulbs arranged on a rather low ceiling or on the sides of the car in such positions that they shine full in the faces of those who attempt to read by them. Under this assault the iris contracts in self-defense and the light that actually falls upon the paper is proportionately ineffective. To get good results in car illumination, as elsewhere, one should endeavor to keep bright sources of light out of view while giving plenty of light for reading purposes. Plainly, this is hard to manage in a street car, since the occupants face in opposite directions and may fill the standing room, while the space to be lighted is directly in front of them. The ideal direction of lighting, slightly from the rear, cannot be followed out, since there is no rear with respect to all the passengers. The next best thing is to light nearly from above—a plan which can be carried out, but which is quite generally mismanaged. To get good results in so contracted a place as a car, the first requisite is the use of frosted lamps, or at least lamps behind diffusing screens, to cut down the intense brilliancy of the filaments. Second, these lamps should be so placed as to be screened from the side of the car opposite to that which they are directly intended to illuminate. Probably the best location is that just outside the monitor roof, in about the place now sometimes used, but so screened, or preferably recessed, as to be practically invisible from the opposite side of the car. Lamps so placed will give all the light necessary without being in the least obtrusive.

But how about standing passengers? The lights will be ordinarily out of their field of vision and still will throw out considerable useful light even for those who stand. There could be in case of necessity well-screened lights in the top of the monitor as auxiliaries. The chief requisite is to get well screened lamps throwing a rather narrow stream of light where it will do the most good. It is possible that the "line o' light" lamps used somewhat abroad might be made robust enough to stand up in railway service, in which case a particularly good distribution would be possible. Failing these, an effort should be made to get behind the ordinary bulbs reflectors that would disperse light mainly in a direction lengthwise the car. A symmetrical reflector of angle wide enough to cover the length of the car properly without very closely spaced lamps, will throw light directly into the faces of those on the opposite seat. The long and short of the matter is, that to do car lighting properly, requires appliances carefully designed for that purpose. It is high time for some enterprising person to get into the field and work it. Cars with cross seats are much easier to manage, since one can light them very effectively from the roof, but even in this case well placed reflectors are capable of considerably improving the illumination and saving energy as well. The current now used for car lighting is more than sufficient to give first-class results if properly utilized. If one compares the number of incandescent lamps in a car with the number

required to illuminate brilliantly a room of the same area, the usual waste of energy is painfully evident. The car, of course, loses in its dark finish and many windows, but gains in the comparatively low ceiling which brings the lamps nearer to the plane on which illumination is desired. The car builders are those to whom we must look for improvement in this matter, since illumination should be a feature considered in car design.

A Low-Voltage Shop Trolley Circuit and Some of Its Advantages

Often the power house of a large railway system is located in close proximity to the repair shops, and considerable trouble is experienced thereby through the opening of the circuit-breakers in the power house and often the throwing of rotary converters out of phase by reason of heavy loads on the shop feeders, caused by defective motors on cars or by accidental short circuits occurring in the shops. The ordinary voltage employed on the shop trolley wires, moreover, often causes the burning out of rheostats under the cars when attempting to move cars slowly. In addition, the high voltage does not permit of slow and steady pulling of cars in switching, and in fact introduces so many difficulties as to cause the question to arise as to the advisability of supplying the shop trolley circuits with a voltage considerably lower, say even about half, that ordinarily used on the line.

The advantage of a reduced voltage will be understood by every shop man. Those gained in moving cars and in switching would especially be appreciated. With the voltage ordinarily used, in order to make a car move slowly, the motorman must continually work the controller alternately, turning the power on and off. When a heavy load is being pulled, this jerking of the train is objectionable and usually the only means of avoiding it is to run on the first resistance point, if this point will give the low speed desired. But if care is not exercised, and frequently it is not, the rheostats are likely to suffer under this latter method of handling the car. With about 300 volts on the shop trolley the car, when starting under a heavy load, would accelerate more smoothly, and throwing the controller to the series position would not usually give too great a speed. But if it should be found necessary to run on the resistance points, there would be very little likelihood of the rheostats getting too hot under ordinary treatment, as the current would be cut down to half what it is at present.

In addition to the benefits gained in switching and in moving cars, there would be other decided advantages with a lower voltage on the shop trolley. There is very little danger of a pressure of 250 or 300 volts seriously injuring any one who gets across the circuit with his hands or with any portions of his body. In fact, unless the contact is a very good one, such as might be caused by wet hands, the shock from a 300-volt circuit is so mild that it does not inspire that feeling of fear which most have when working with a 600-volt circuit. With this lower voltage, therefore, there would be no occasion for many of the usual safeguards for protection when working with "live" apparatus. Much time would be saved by the omission of these precautions; and further, the freedom from fear with which the car apparatus would be handled would permit a great deal of the work to be done more rapidly.

With regard to the fire hazard, marked benefits would accrue from a reduced voltage on the shop trolleys. Many car-house fires, it is safe to presume, have their origin in electric heaters which are left on over night in cars stored in the shops. The reduced voltage would be an effectual means of preventing fires from overheated electric heaters, as with half the current it would be almost impossible for the heaters to get hot enough to ignite the car.

About the only objection from the shop standpoint which occurs to us to the plan of lowering the voltage on the shop trolley is the effect it would have on the lights in the cars. The car lights are frequently employed to light the interior when repair work is being done on the car while in the shops or while the car is being cleaned. With the lower voltage, these lights would be practically of no benefit, as with about 50 per cent of the normal voltage on an incandescent lamp, the filament has only a red glow and does not give off much light. Electrically driven air pumps would work slower with the low voltage, and some other minor disadvantages might appear.

We admit, on the other hand, that if it were decided to supply the shop trolleys with a lower voltage, there would usually be considerable difficulty in bringing it about. It would be necessary either to place a resistance of a few ohms in the feeder from the power house or to put the shop feeder on a separate machine. Reduced voltage might also be obtained from a storage battery. The plan of using a separate machine would be preferable, but the cost of this extra machine would be rather a drawback in the first place, and in addition, as the load factor on a shop circuit is under ordinary circumstances very low, the machine supplying the circuit would run at a rather low efficiency for the greater portion of the time.

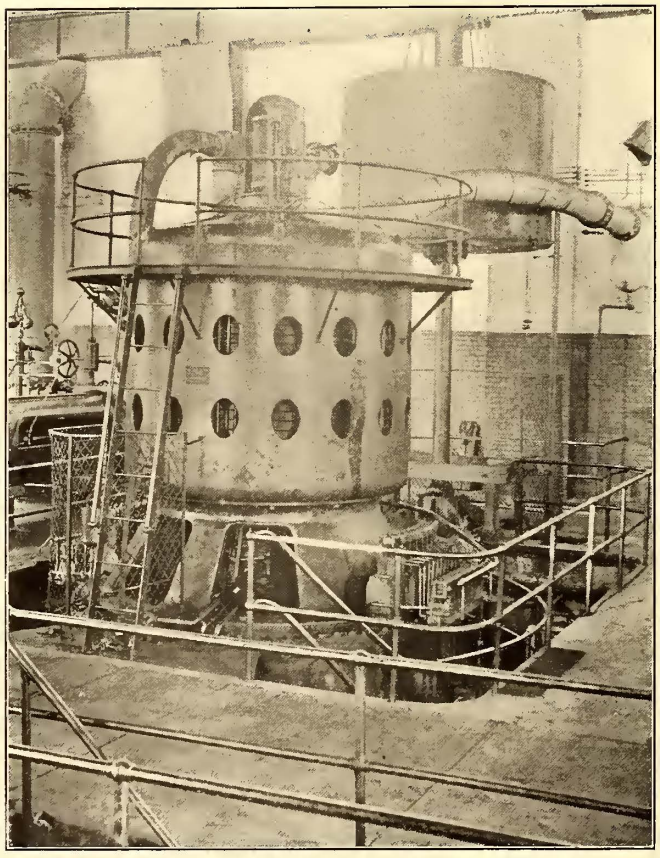
It would be very easy and very inexpensive to put a resistance in the feeder supplying the shop circuit, but this plan would not give all the benefits of a low voltage, as the voltage would fluctuate with the load. So far as pulling heavy loads and switching is concerned, the desired results would be obtained, but with no load on the circuit the voltage would be that of the generating machine, and the injury to a workman getting across the circuit would be the same as at the present time. And in addition the fire hazard would be about the same as at night. With only a load of a few heaters, these heaters would become about as hot as if there were no resistance in the feeder. A decided disadvantage would develop in that the men could not get accustomed to one voltage, and would consequently never know just how quickly a car was going to move when they turned the controller handle.

Wherever a storage battery is floated on the line and is available for connection, the desired voltage might be obtained by tapping in the shop feeder circuit, so that but half the total voltage of the line would be obtained. In such a case it would be necessary to connect the battery in two halves, and arrange switches and connections so that the two halves could be transposed to either the ground or the trolley side of the circuit. That half supplying current to the shop feeder would necessarily be connected on the ground side, and the fact that the shop circuit would have to be fed alternately from each half of the battery, in order to prevent over charging and over discharging of the battery, would necessitate the arrangements for transposition of the halves.

SOME IMPROVEMENTS ON THE CANTON-AKRON SYSTEM

The Canton-Akron Railway Company's property, which includes the interurban lines between Akron, Canton, Massillon, New Philadelphia and Uhrichsville, Ohio, and the city lines of Canton and Massillon, was quite fully described in the STREET RAILWAY JOURNAL of May 28, 1904, and constitutes one of the most important and progressive systems in Ohio. During the past six months the company has spent about $350,000 in improvements. They are in the way of refinements and additions to the equipment, which were not deemed essential when the road was new, but which became desirable after the property had been pretty well developed.

Important improvements were made in the power station, including the installation of machinery, which more than doubles the capacity of the station, and at the same time



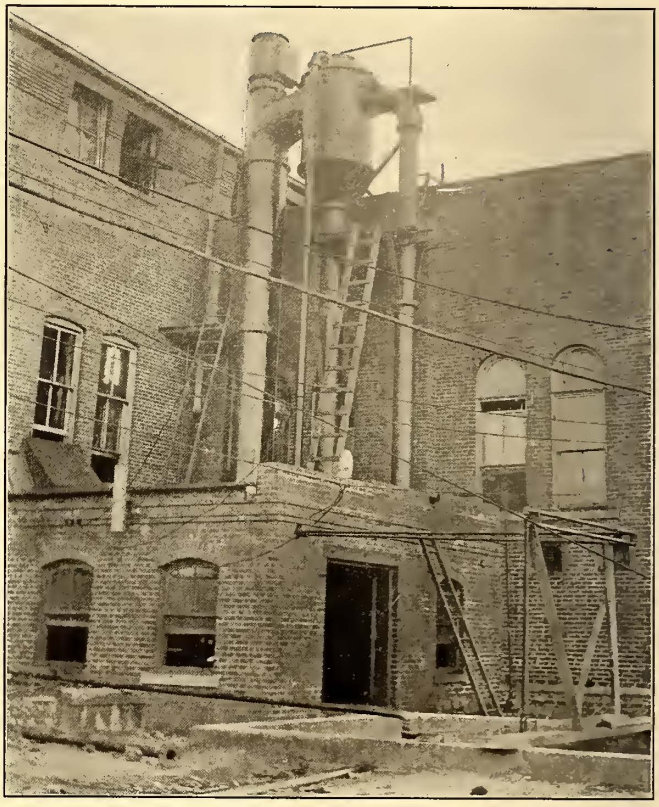
VERTICAL TURBINE INSTALLED FOR THE CANTON-AKRON RAILWAY

reduces the labor account. The new generating machinery was not absolutely necessary to maintain the operation of the road under normal conditions, but its installation provides a surplus of power which eases the work on all machinery and precludes the possibility of the system being tied up through the breaking down of one or even two units.

As outlined in the previous article, the system embraces about 70 miles of interurban road, equipped with heavy high-speed cars on hourly service, and about 22 miles of city lines, with double-truck city cars on 15-minute headway. The original generating equipment consisted of two 400-kw and one 800-kw General Electric three-phase, 13,200 volt, generators driven by Allis-Chalmers cross-compound engines. No space was provided in the station for additional units of similar type, and the installation of a 2000-kw Curtis turbo-generator and the increasing of the capacity of the station by 135 per cent without altering the buildings or moving any of the engines furnishes an interesting example of the space-saving qualities of this latest type of generating apparatus. The turbine occupies a space of 20 ft. x 30 ft. between the large engine and one of the smaller ones; considerably less space than is occupied by either one of the small units, although giving five times its capacity. The installation was made without disturbing any of the old equipment other than the shifting of some of the auxiliary pumps in the basement and the rearrangement of the piping. The turbine is of the four-stage type, with the electrically-controlled nozzles, and generates current at 13,200 volts, enabling it to operate in parallel with the other machine.

Back of the turbine is a Wood accumulator supplying 600-lb. pressure for the step bearing and maintaining its position for 15 minutes in case of accident to the step-bearing pumps. The turbine has been in operation for about six months and has given most satisfactory service. At one time it carried the entire load of the system for eight days without a shut-down, the other machines being out of commission.

The condenser outfit for the turbine consists of a 2000-hp



CONDENSER INSTALLATION FOR VERTICAL TURBINE

Alberger barometric condenser placed on the outside wall of the building. Water for this is supplied by a motor-driven centrifugal pump, and air by a two-stage motor-driven air compressor mounted separately in a small pump-house outside the main building. In this there is also a 20 in. x 10 in. x 15-in. outside plunger packed boiler feed pump of sufficient capacity for 5000 hp installed by the Canton Pump Company, of Canton.

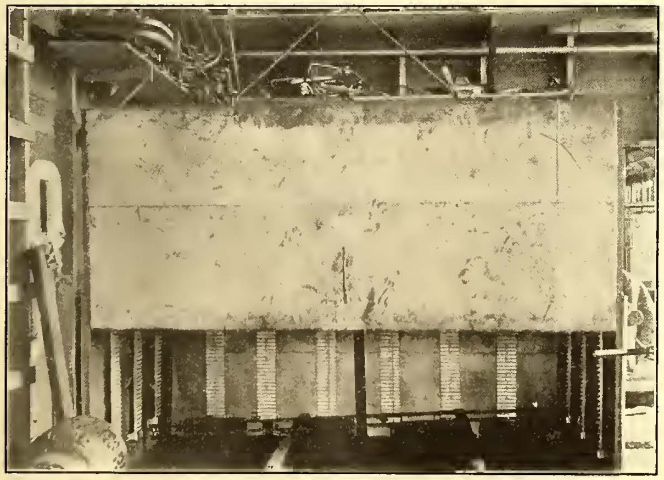
The original boilers consist of six 300-hp A. & T. boilers and two 300-hp Stirling boilers have recently been installed. These are equipped with the Model extension front grate and stoker, and the results with these have been so satisfactory that all of the other boilers are to be similarly equipped.

An interesting fueling outfit is being installed. At present there is a coal storage bin of 300 tons capacity alongside the boiler house. There is a trestle adjoining this, and fuel is discharged from side dump cars and handled by hand to the stokers. This bin is to be torn out and double tracks laid. A 300-ton storage bunker is to be erected on the boiler room

roof, and fuel from the cars is to be elevated by a locomotive crane provided with a 50-ft. boom and clam-shell grab bucket, which will travel on one of the tracks. The fuel will pass from the bunker down a chute into a crusher, and then into a hopper which will travel on a track over the stokers discharging into them. This hopper will be equipped with scales for weighing the fuel. The ash pits below the stoker will be equipped with sheet-iron baskets, and these will run forward to the outside of the building, and will be lifted out by the crane and dumped in the car. The locomotive crane will also be available for use in handling material about the yard and for wrecking purposes, thus making it a very valuable accessory.

The company is now mining its own coal, having bought 600 acres of coal lands, producing first-class steam coal at a point on its tracks near Midvale. It has a small direct-current power station at this point, and the fuel runs directly from the mine into the power station. The company employs its own miners, and the coal costs less than $1.00 delivered in its own cars at Canton, a haul of 37 miles. The fuel is hauled at night and a special combination locomotive, work car and coal car has been built for this purpose. The car is 50 ft. long, has a small cab in the center and is equipped with four 75-hp motors and G. E. type M. train control, the entire controlling apparatus being mounted in the cab. The car has removable sides and has the capacity for handling 35 tons of fuel. Two 45-ft. coal cars are being built, and these will be handled by the locomotive.

Several improvements have been made in the company's repair shops. A new building, 50 ft. x 100 ft., built of sheet iron, has been erected at the rear of the repair shops; this is divided in the center, and one room is used as a paint shop and the other as a woodworking shop, taking these classes of work out of the main shop. The woodworking shop is equipped with several valuable woodworking tools. A small portion of this room is divided off for a blacksmith shop, which is also equipped for making babbitt bearings. In the machine shop, which is in a separate room from the main repair shop, there has recently been installed a Putnam

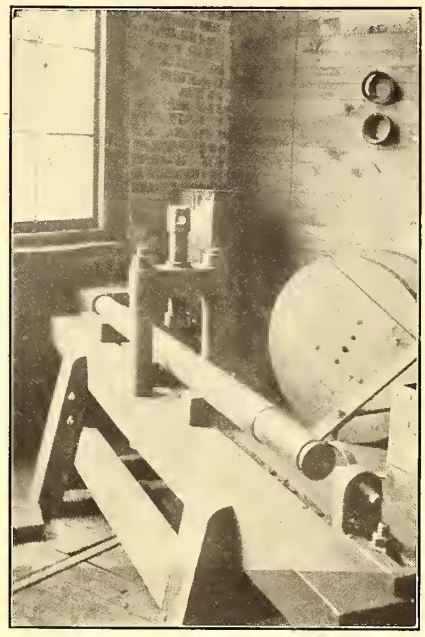


HOME-MADE COIL BAKING OVEN

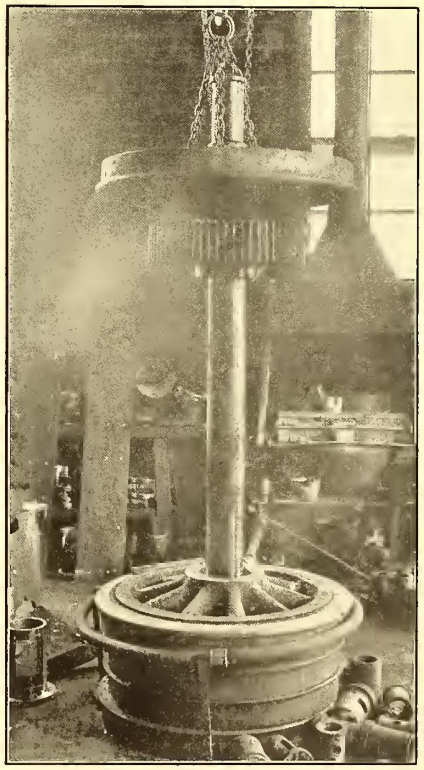
Machine Company's 42-in. boring mill, which is very valuable in wheel work.

A gasoline outfit for shrinking on steel-tire wheels shown in the accompanying illustration has recently been installed. The company does all its own armature and coil work, and a baking oven for baking varnish and insulation has been rigged up. It consists of a sheet metal box, the walls of which are double, with a heavy layer of asbestos between. The oven is heated by 12 rows of Simplex heaters. Another new device is an outfit for straightening axles and shafts. It consists of a heavy iron bed, with adjustable wedges and centering points and a powerful screw.

About $50,000 of improvements were made this season at Meyers Lake, which is owned and operated by the company. The resort is 2 miles from Canton, with a double-track spur line running to it, and embraces 160 acres of grounds bordering on a pretty lake about half a mile long by a quarter of a mile wide. The improvements include the erection of a fine theater building, an arcade for refreshments and penny amusement devices, a large roller rink, a boat house, a laughing gallery, electrical fountains and a pike, along which are a number of minor attractions such as a shooting gallery, cane racks, bowling alley, etc. The entrance has been improved by the erection of large shelter houses, and there is a covered walk leading from the entrance to the theater building protecting patrons in case of rainy weather. The park has a fine summer hotel, having 20 rooms and a large dining room. A number of steel row boats have been installed and two gasoline launches make trips across the lake to the Country Club, a beautifully situated resort, which is leased by the company to a private club.



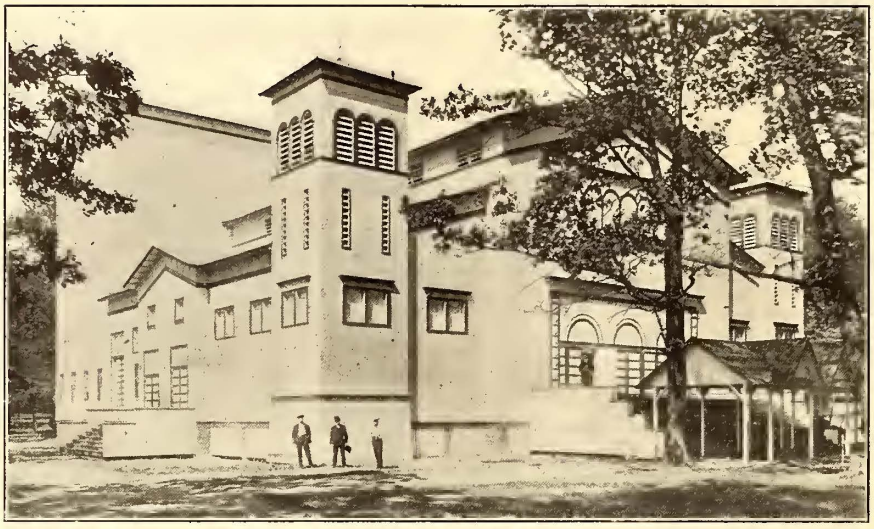
VISE FOR STRAIGHTENING AXLES



DEVICE FOR SHRINKING ON STEEL-TIRED WHEELS

The theater building is one of the finest summer theaters ever erected near a city the size of Canton. It cost $20,000, exclusive of scenery, which is most elaborate. It has opera seats for 1500 people, and a stage large enough to accommodate any of the large grand opera companies now on the road. It is provided with the latest electrical appliances and effects. The building is of the Colonial type of architecture, and entrance to the theater is through three large doors opening from a large porch. Over these doors and to the right and left are two columns decorated with scroll work representing

various figures prominent in the theatrical world. There is also a massive cornice over the entrance doors, and over this cornice there are five large windows with circle arch tops,



THE NEW THEATER AT MYERS LAKE

and another cornice. This breaks the view of the gable, which stands 50 ft. high and is surmounted by a flagpole. The theater is well supplied with exits, to enable everyone to get out of the building within less than two minutes. There are two large property rooms and eight dressing rooms, making the playhouse exceedingly attractive to theatrical people, whose comforts are seldom looked after in a summer theater. The stage is 35 ft. x 75 ft., and is set off by an arch 40 ft. wide and 30 ft. high. To the right and left of the stage are twelve large fluted columns, giving the stage an artistic and pleasing effect. The interior of the building is richly decorated.

The floor rises 6 ft. from the stage to the rear of the house, which is at sufficient elevation to give an unobstructed view of the stage from any seat in the house. The scenery, consisting of two fine interior scenes, two exterior scenes, a drop curtain, a street curtain, and an olio curtain, was painted by one of the best scene painters in the business at a cost of $2,000.

Two high-class vaudeville performances are given each afternoon and evening. The theater is on the Keith circuit, and many of the highest-priced attractions have been booked. The theater and park are under the management of L. B. Cool, a well-known theatrical man in that district. No liquor is sold on the grounds, as Mr. Cool aims to get the patronage of the best class of people in the vicinity. Thus far this season, in spite of unfavorable weather, the returns have been very satisfactory. Mr. Cool has quite a large force of assistants in maintaining and advertising the resort. There is an excursion agent who solicits excursions throughout the entire district within a radius of 75 miles of the park, a press agent and advertising agent who keeps the newspapers of the district supplied with reading notices and paid advertising, a bill poster, who covers a large district, and an assistant manager, who is in direct charge of the theater. In addition there are a chief of police, with five patrolmen; a bank, which is in constant attendance; theater employees, caretakers, etc. All of the amusements, except the theater, are let out on a percentage basis.

The park not only draws from Canton, being the only pleasure park in the vicinity of that city, but it derives good business from Massillon, and New Philadelphia to the south, Akron to the north, and Alliance to the west. The company caters to these towns in a systematic manner. On Wednesdays and Fridays there are special cars from Canal Dover and New Philadelphia running directly to the park and giving a 25 per cent reduction from regular rates, while on Tuesday and Thursday evenings there are similar excursions from Akron. From Massillon, six miles distant, there is a tripper running directly to the park every hour, afternoons and evenings, on which there is a round-trip rate of 15 cents. This is in addition to the regular hourly interurban cars which connect with city cars for the park. Two evenings a week the Stark Electric Railway gives an excursion from

ENTRANCE TO ROLLER COASTER AT MYERS LAKE

THE LAKEVIEW HOTEL, WITH DINING ROOM, GRILL ROOM AND BOWLING ALLEY

Alliance, the cars running directly to the park, and remaining until after the theater, giving a round-trip rate of 50 cents. There is a Canton city line running to the park on a 12-minute headway all day, and this is increased to 6 minutes in the evening and 3

minutes on Sundays and busy days. These cars run to the Public Square, where they connect with all city and interurban lines.

The park has a double system of illumination. There is one line running directly to the 500-volt direct-current busbar in the power station and a 13,000-volt high-tention line leading to a three-phase transformer, which reduces the current to 110 volts. The transformers and switching apparatus are contained in a small transformer station, and the lighting service is in charge of an electrician in constant attendance. The entrance to the park, several of the buildings, and the walks to the theater and along the lake have arches outlined

THE SHOOTING GALLERY

with incandescents. These, together with 10 arc lamps, are taken off from the d. c. circuits, as is also power for a number of motors operating pumps at the hotel and various amusement attractions. The theater is illuminated with the alternating-current service, as are also about 1000 incandescents in various buildings and about the grounds. By this double

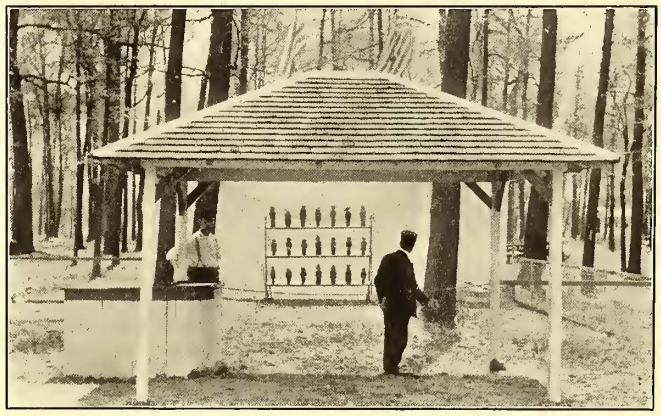
THE LAUGHING GALLERY

arrangement the park is never likely to be entirely dark unless the entire power station shuts down.

The Canton-Akron system is in charge of J. R. Harrigan, general manager, who was formerly general manager for the Columbus, Buckeye Lake & Newark Traction Company, while the mechanical end is in the hands of W. E. Rolston, chief engineer and master mechanic, who formerly occupied a similar position with the Dayton & Troy Electric Railway. These gentlemen came with the company the first of the year, and they are responsible for many of the innovations which have lately been introduced.

HOLDING POWER OF RAILROAD SPIKES

The Forest Service of the United States Government has completed a series of tests to determine the holding power of different forms of railroad spikes. The tests were made on ordinary commercial ties of loblolly pine, oak, chestnut, and other woods. The spikes used were of four kinds: common



PITCHING AT THE BABIES

driven spikes; a driven spike which has about the same form as the common spike with a lengthwise channel on the side away from the rail; screw spikes of the American type; and screw spikes similar to those in use on European railroads and differing from the American spike mainly in the manner of finishing the thread under the head.

The common and the channeled spikes were driven into the ties in the usual manner to a depth of 5 ins. A hole of the same diameter as the spike at the base of the thread was bored for the screw spikes, which were then screwed down to the same depth as the driven spikes. The ties were then placed in the testing machine and the force required to pull each spike was recorded.

The average force required to pull common spikes varies from 7000 lbs. in white oak to 3600 lbs. in loblolly pine, and 3000 lbs. in chestnut. The holding power of the channeled spike is somewhat greater. For example, about 11 per cent more force, or 4000 lbs., is required to pull it from the loblolly pine tree. The two forms of screw spike have about the same holding power, ranging from 13,000 lbs. in white oak to 9400 lbs. in chestnut, and 7700 lbs. in loblolly pine.

There is a marked difference between the behavior of driven and screwed spikes in knots and in clear wood. Knots are brittle and lack elasticity, so driven spikes do not hold as well in them as in clear wood. In the case of common spikes in loblolly pine the decrease of holding power in knots is as great as 25 per cent. On the other hand, screw spikes tend to pull out the whole knot which they penetrate. This increases the holding power in knots over that for clear wood.

OAKLAND TRACTION CLUB ROOMS IMPRESSED AS A HOSPITAL

Immediately after the earthquake and fire in San Francisco of April 18, all available halls and assembly rooms in that city, as well as in the neighboring cities about the bay, were converted into temporary hospitals for the injured and sick. In Oakland, through the generosity of the Oakland Traction Consolidated and the Oakland Traction Club, the club's handsome rooms were turned over to the relief committee and immediately arranged for hospital purposes. They were well adapted for such a use. With high ceilings, good ventilation, kitchen facilities and excellent lavatories, all the immediate necessities of a hospital were at hand. Here were taken old and young of both sexes, many of them injured in the stricken city, some of them overcome by shock and fatigue, and others confirmed invalids. Soon the rooms presented a far different aspect from that depicted in the description of the clubrooms in the Street Railway Journal of March 17, 1906. The accompanying views show the gymnasium used for the injured and the reception room devoted to the invalid women and children. The cardroom and reading room were similarly used for patients, while the billiard room served as a supply and commissary depot, the billiard and pool tables being utilized, one for towels and bandages, another for disinfectants, and a third for medicines.

CORNER IN RECEPTION ROOM OF OAKLAND TRACTION CLUB, USED FOR INVALID WOMEN AND CHILDREN

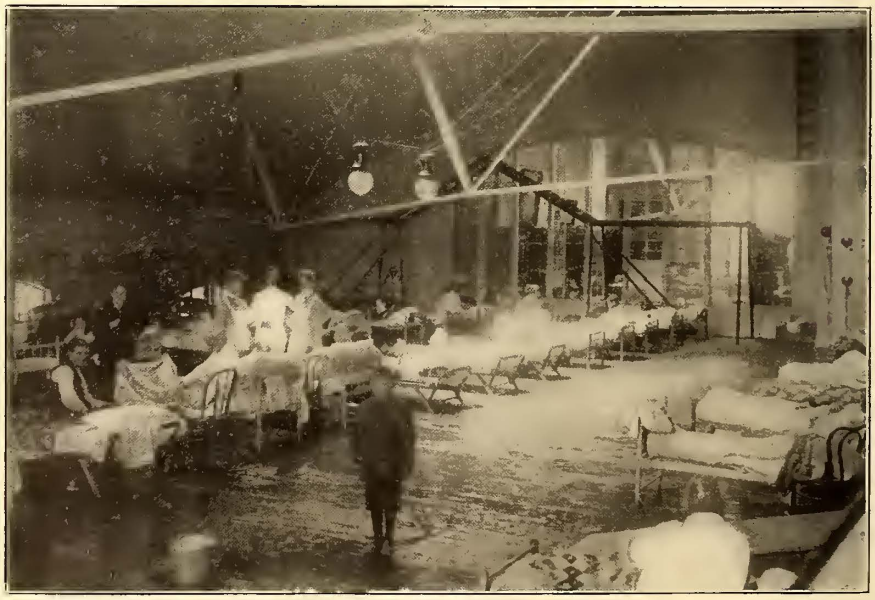
After having served for about two weeks as a general hospital, with as many as 150 cases at one time, it was changed to a maternity hospital on May 5. With a competent medical and nursing staff all cases were given the same attention as in a well-established hospital. A total of sixty-seven maternity cases were cared for, and over thirty babies were thus brought into the world under special obligation to the generosity of the Oakland Traction Consolidated.

On July 1 the few women who had not established homes of their own were transferred to other hospitals and the rooms were relinquished to the Oakland Traction Club.

During the period of over two months that the hospital was in possession the regular janitor service was maintained by the Traction Club, while the cost of supplies and the other running expenses were met by the Oakland relief committee and a committee of the Oakland Women's Club. The hospital was under the immediate direction of this committee, with Mrs. Wheeler as matron.

EFFECTIVE STREET RAILWAY ADVERTISING IN NEW ENGLAND

The Newton Street Railway Company, a description of whose advertising methods appeared in the Street Railway Journal of Sept. 1, found it necessary on Friday, Aug. 31, to place an order for 50,000 of its four-color maps, only 15,000 remaining of the 50,000 printed Aug. 15. The company gives these away and finds that they are appreciated not only as a street railway map but as a map giving the details of the country around Boston. The company has recently received permission from the Boston Elevated to place a box 14 ins. long, divided into three compartments, upon each of its elevated stations and in each of these boxes are put the maps, "Our Country Rides by Trolley," and the booklet, "Routes of the Minute Men. To keep the boxes full it takes about 1500 "Trolley Rides," 2500 maps, and 2000 of the "Route of the Minute Men" every day. Investigation shows the pamphlets are taken by adults and after careful reading are kept for future reference. This year has been the most successful one in the history of Norumbega Park, and the company has been selling the house out, which means 3000 seats every night, by 7:30 at the least. At times all the reserved seats have been sold or reserved at 6 o'clock.



THE OAKLAND TRACTION CLUB'S GYMNASIUM AS A HOSPITAL FOR THE INJURED

Connecticut's first high-speed electric line, the Norwich & Westerly (R. I.) Railway, was opened for service Sunday, Sept. 9, the cars running as far as the Rhode Island State line.

PAPERS AND REPORTS AT THE MILAN CONVENTION

The International Street & Interurban Railway Association, which is known in France as the "Union Internationale de Tramways et de Chemins de Fer d'Interet Local" and in Germany as the "Internationaler Strassenbahn und Kleinbahn-Verein," and which includes among its members the principal street and interurban railway companies on the Continent of Europe, has been holding a convention at Milan this week. The meetings of this association occur every two years, and previous conventions for the last twelve years have been held as follows: In 1904 at Vienna, in 1902 at London, in 1900 at Paris, in 1898 at Geneva, in 1896 at Stockholm, and in 1894 at Cologne.

The list of papers to be presented at the meeting was published in this paper for Nov. 4, 1905, and the program of the social side of the convention, with the excursions, entertainments, etc., will be found in the STREET RAILWAY JOURNAL for Aug. 18, 1906, page 279. The Milan meeting is the fifteenth in the history of the association, and at the business meeting three members of the executive committee are to be elected to take the place of Messrs. L. Janssen, H. Geron and E. Lavalard, whose terms of office have expired and who are eligible for re-election. The meetings of the association are to be held in the concert hall of "l'Institut des Aveugles" in Milan, and are conducted both in French and German.

In view of the fact that the members of the association came from every country in Europe, an outline of the methods adopted for overcoming linguistic difficulties may be of interest. All of the papers, proceedings, etc., of the association are printed in both French and German, as at least one of these languages is spoken by the majority of those belonging to the organization. Any member who wishes to discuss any paper speaks in the language which he prefers and afterward, if he so desires, repeats what he has to say in the other language. If he is not sufficiently familiar with the other official language of the association to translate his own remarks, this is done by one of the officers of the association who can speak readily in either.

It is the practice of the association to issue in advance of the meeting not only the papers to be presented at the convention, but also the replies of the different members of the association to the questions sent to them by the committees or gentlemen appointed to read papers. These appointments are made a year or nine months in advance of the meeting, and each author prepares a series of questions varying in number from ten to fifty, relating to the topic upon which he is expected to address the convention. These questions are sent to the member companies about nine months before the meeting, and the replies are printed, bound and issued to the members from four to six months previous to the meeting. This volume for the Milan meeting comprises 650 pages and includes all the replies of the companies to the eleven questions to be considered. As in this way the members have before them the information upon which the author bases his paper, the author does not have to describe the practice of the different members on the points discussed in his paper, but summarizes the replies in the way which he considers would be most helpful to the members, and then offers his conclusions upon the subject under debate. Where the character of the subject warrants such treatment, these conclusions are so definitely stated that they can be considered as motions before the body and as representing its conclusions on the topic considered. The acceptance or modification of the conclusions of the author then forms the real subject for debate of the association.

A very common practice of the association is to appoint two speakers on any topic which is of especial interest and upon which there is a diversity of opinion. These two speakers offer separate reports which naturally differ in conclusions, and it is then the province of the association as a whole to select which set of resolutions best embodies its ideas, or else to frame new resolutions to suit the case. Thus, at the present meeting there were two papers on the subject of braking, with two sets of conclusions which differ materially from each other. There were also two papers of track construction and two papers on the desirability of sectionalizing the overhead line.

A number of the papers to be presented at the Milan meeting have reached this country, and digests of several of them appear in this issue. Others will be in early issues of this paper, and it is also hoped later in the year to present a report of the meeting. Although electric railway practice differs considerably on the Continent of Europe and in America, it is thought that many of the points brought out in the digests of the papers printed below will be of interest and practical application in this country. Many of the papers abstracted below are quite long, and in every case considerable portions have been omitted.

BRAKE SYSTEMS FOR ELECTRIC RAILWAYS

BY M. SCHOLTES,
Manager of the Nuremburg-Furth Tramways

At the Vienna meeting it was decided to continue the study of braking systems and that a committee be appointed to report further on the subject, especially in regard to the expense of installation and maintenance of the different systems, that a report be rendered on the results of a similar investigation conducted by the German Street Railway Association, and that a second paper should be presented by a partisan of air brakes. The writer was one of the committee which investigated this subject for the German association, and with Mr. Bjorkegren presented a report at Frankfort meeting in September, 1905. The present report embodies not only information secured from members of the International Association, but also those obtained while making this investigation for the German association.

In choosing a system of brakes, the first consideration is safety, and the second is expense, although the latter factor has an importance which ought not to be neglected. All railway companies recognize that the hand brake is not sufficient and that the equipment of a tramcar should include with the hand brake a power brake, that is, an electric or air brake, but opinions differ as to which of these two brakes is more desirable. The solution of this question has not, up to this time, been easy, because complete data on expense of maintenance have not been available. To-day, however, this condition no longer exists.

One hundred and forty-two companies, operating 14,563 cars, replied to the inquiries of this committee. In only twenty-nine of these cases had the installation of power brakes been required by the authorities, and then principally where trail cars were used. The following table shows the number and weight of cars and the braking systems employed by these 142 companies:

System of Braking.	Number and Weights of Cars.*									Number of Cars.		No. of Companies	
	From 5 to 6 Tons.	From 6 to 7 Tons.	From 7 to 8 Tons.	From 8 to 9 Tons.	From 9 to 10 Tons.	From 10 to 11 Tons.	From 11 to 12 Tons.	From 12 to 13 Tons.	From 13 to 16 Tons.	Total.	In Per Cent.	Total.	In Per Cent.
Hand brakes..	238	508	1639	1335	1095	14	22	154	7	5,012	34.4	71	50.0
Electric.....	16	436	924	2232	3086	100	204	234	34	7,266	50.0	60	42.2
Air brakes....	0	21	286	426	216	326	71	704	235	2,285	15.6	11	7.8
										14,563	100.	142	100.

* All weights are given in metric tons.

As will be seen, the hand brake leads in number of companies, then the electric brake, and finally the air brake. It should be stated, however, that the hand brake is used principally on small roads running light cars. These companies declare the hand brake is amply sufficient for their purposes. As will be seen, many companies still use the hand brake for cars weighing more than twelve tons. Many of these companies even haul trail cars and have grades as high as 10 per cent. While the hand brake may be suitable for light traffic, its employment under conditions of the kind mentioned seems dangerous, because the physical strength required from the motorman to stop a heavy car with a hand brake under these conditions, is so great that it cannot fail to have an effect on the safety of the service.

About twenty-six companies complain that the electric brake is hard on the motors, that the gearing depreciates rapidly and that the controllers are injured. These complaints would indicate one thing only, that the electrical equipment of these cars is not suitable for electric braking. Many other companies speak very favorably of electric brakes, which tends to prove that when the electrical equipment is properly designed and selected for this service troubles of this kind disappear. Complaint is also made of the jerking character of electric braking, but this in turn is due to the fact that the resistances have not been properly selected.

Only twenty-six companies have made any tests on braking. This small number is undoubtedly due to the fact that tests on braking, to have any value, should be very carefully carried out. The results of the tests reported this year accord very closely with those obtained in 1900 by Mr. Poetz, manager of the Hamburg Railways, and confirm his conclusions that the electric brake is not surpassed by any other braking system in the rapidity of braking. On the other hand, the air brake is higher in first cost and maintenance and it wears out brake-shoes. All of these points confirm the opinion that the air brake is undesirable as a service brake. So far as energy is concerned, the results of tests at Berlin, Leipzig, Nuremberg, Hamburg and Paris indicate a consumption of 38 watt-hours per motor car kilometer for air brakes.

The accompanying table presents some figures on the amount of power and cost required to compress air for the use of air brakes:

Companies.	Car-Kilometers Run in 1904.	Annual Expenditure for Compression of Air.	
		In Kw-Hours.	In Marks.
Berlin	55,110,000	2,094,180	209,418
Leipzig	12,622,000	1479,636	47,964
Hanover	9,045,000	343,710	34,371
Munich	8,330,000	316,540	31,654
Nuremberg-Furth	5,094,000	193,572	19,357
Crefeld	2,265,000	86,070	8,607

The following table gives an average of all of the figures received from the different companies replying to the list of questions relating to the initial cost and maintenance of the three braking systems:

Braking System.	Cost of First Installation.		Annual Maintenance Charges.	
	Per Motor Car.	Per Trail Car.	Per Motor Car.	Per Car Kilometer.
	Marks.	Marks.	Marks.	Marks.
Hand brakes	Are included in cost of car.		87.00	0.20
Electric brakes	285.00	400.00	57.00	0.15
Air brakes	1164.00	212.00	188.00	0.30

To the maintenance of the air brakes should also be chargeable the expense of compressing the air and the extra expense due to the wear of brake-shoes and wheels.

When the electric brake is used as a service brake and not simply as an emergency brake, the equipment of the motor cars requires as the only additional expense the braking control cylinder. This cost, quoting again the average figures mentioned in the replies, is Mk. 285 ($71) per motor car. The installation of the electric brake on the trail cars costs an average of Mk. 400 ($100) per car. The replies indicate that some time ago trail cars were generally equipped with disc brakes, but recently the preference has been toward the solenoid brakes.

The figure, Mk. 1164 ($291), given as the cost of installation of the air brake, represents the average price demanded for old types and new types with different systems. For the old types the price was Mk. 1570 ($392); to-day it is about Mk. 1000 ($250) per car. The data on the price quoted for equipping the trail car with air brakes, Mk. 212 ($53), do not indicate whether this is for an automatic or straight air brake. In conclusion, the writer suggests that the association adopt the same conclusions which have already been presented to the German association, viz:

1. In the choice of a braking system all operating conditions should be taken into consideration. The retardation should be smooth. The equipment of the car should include two systems of brakes, each completely independent of the other. The service brakes should not tax the physical strength of the motorman.

2. When on account of the weight of the car, the operation of trail cars or the existence of very steep grades, the hand brake cannot desirably be employed as a service brake, a mechanical brake should be used, preferably an electric brake.

3. If the employment of an electric brake as a service brake should present inconveniences resulting, for example, from the use of too small a motor or unsuitable resistances or controllers, it is desirable to employ an air brake. The latter brake is indispensable when the cars are relatively heavy, and operate at high speeds or when the trains consist of three or more trail cars.

BRAKE SYSTEMS FOR ELECTRIC RAILWAYS

BY L. PETIT,
Division Engineer Societe Nationale des Chemins de fer Vicinaux, Brussels

The subject of braking systems was very fully discussed at the Vienna meeting of this association in 1904, as well as at the Frankfort meeting in 1905 of the German Street Railway Association. At the latter meeting two papers were presented on the subject, one by Mr. Scholtes of the Nuremberg Tramways and the other by Mr. Bjorkegren of the Berlin Tramways. A committee of two members was appointed by this association to report further upon the topic at this meeting, but they have reached different conclusions. One mem-

ber of the committee prefers electric brakes and the other air brakes.

One hundred and twenty-eight companies replied to the list of questions sent out by the committee. Many of these described their practice very carefully, but the conditions and opinions varied so greatly that the two members of the committee having this subject in charge have been unable to arrive at definite conclusions upon all points at issue. There is one point, however, upon which complete accord exists,—that it is indispensable to have an emergency brake when a hand brake is used. Ability to reverse the motors can be considered as supplying the requirement for the emergency brake, but reversing cannot take the place of a service brake. The committee is also agreed that any service brake ought not to require the expenditure of so much strength as to fatigue the motorman. Consequently on high-speed roads or where heavy cars are used, the ordinary hand brake is insufficient and air or electric brakes ought to be used. From this point the opinions of the members of the committee and of the member companies are divergent. We have not considered such special brakes as would be used on very steep grades, as they cannot be considered service brakes.

Electric brakes include short-circuiting brakes, reverse-current brakes, electro-magnetic, using either the disc or track shoe, and solenoid brakes. Air brakes can be divided into classes according to the method of compressing the air and whether they are automatic or use straight air. Thus, there are numerous kinds of each type of brake, and it is difficult on account of the varying first cost to establish an exact comparison. As, however, the electric brakes are as a class cheaper than the air brakes, the burden of proof as regards advantages is upon the latter.

It has been equally impossible to obtain any exact figures as to maintenance on account of the large number of elements involved. Thus, with the electric brakes it has been a question whether expense of maintenance of the motors, controllers and resistances should be included. Nevertheless, in general the advantage of maintenance is in favor of the electric brake with the reservation that while the maintenance of the air brake can be absolutely determined the same is not exactly true of the electric brake.

Twenty companies gave information as to the energy required in operating the air brake. The average is from 30 to 40 watt-hours per train-kilometer (50-65 watt-hours per train mile). On the other hand, it is estimated that 22 watt-hours (35 watt-hours per train-mile) is the energy required for the electro-magnetic brake. Munich, however, reports a total consumption of energy about the same when using hand brakes and air brakes, in fact a slightly lower consumption with air brakes. The line runs through crowded streets and has many grades, and the explanation is that with the slow-acting hand brake a motorman would apply his brake often, but that with the car under better control with air brakes he would not apply his brakes so frequently, and so would reduce the total current consumption. This experience, which will probably be the same on other lines, indicates that a braking system which would be undesirable for certain lines might on others possess great advantages. Even if the short-circuiting brake does not consume energy, it does require motors of larger power than would be employed with air brakes, hence the motors are less efficient in ordinary service and the consumption of energy is higher. It is a question whether this additional consumption of energy is not equivalent to that required to compress the air. No experiments have been made on this point.

The air brake has the advantage of being independent of the contact of the trolley wheel with the overhead wire, and moreover is more rapid in its action. It does not have to be supplemented by the hand brake to make a complete stop, like the electric brake. It requires less skill to make a good stop than the electric brake. The actual distance required to make a stop is practically the same with the two. Defects in the air brake are practically confined to leakages of air which are immediately manifest to the motorman by his air gage. Troubles with the electric brake can occur from a poor connection, which is not so easily detected. Automatic air brakes can be applied to trail cars and are of great advantage in case the coupling breaks on heavy grades. On the other hand, the electric brake is liable to burn-outs in case of overload. For this reason the air brake is more reliable than the electric, especially on systems with heavy grades. The writer agrees, therefore, with the conclusions of Mr. Bjorkegren expressed at the Frankfurt meeting of the German Street Railway Association, in which he preferred the air brake for lines with heavy grades where the trains consist of one or two train cars, also for all systems where heavy cars and high speeds are the rule.

There should be a more careful consideration of the advantages and disadvantages of the different types of air brakes and electric brakes, which the present author has not attempted in this paper. Moreover, there are a number of new mechanical brakes, particularly air brakes, which have not been in operation for a sufficient length of time to permit of a satisfactory verdict as to their value. For this reason the author recommends that the association should adopt the following conclusions:

1. In selecting a braking system, all operating conditions should be taken into consideration. The retardation should be smooth and the operation of the service brake should not tax the physical strength of the motorman. The service brake ought to be also suitable for employment as an emergency brake, and as such its action should be certain and rapid. The equipment of every car ought to include not only a service brake but an auxiliary brake.

2. When on account of the weight of the car, the operation of trail cars or the existence of very steep grades the hand brake cannot desirably be employed as a service brake, a mechanical brake should be used, either an electric brake or an air brake.

INTERURBAN TRACK CONSTRUCTION

BY C. DE BURLET,
General Manager Société Nationale des Chemins de fer Vicinaux, Bruxelles

This report is confined to a discussion of the proper length of rail, the use of welded joints, the maintenance of joints and methods for preventing the loosening of bolts. The reports from 138 companies show that—

Thirty-two companies use rails varying in length from 6 meters to 9 meters (19 ft. 8 ins. to 29 ft. 6 ins.).

Sixty-three companies use rails from 9½ meters to 12½ meters (31 ft. 2 ins. to 41 ft.).

Thirty-seven companies use rails varying in length from 14 meters to 15 meters (45 ft. 10 ins. to 49 ft. 2 ins.).

Six companies use rails 18 meters (59 ft. 3 ins.) in length.

One company, the Paris Eastern, is using rails 24 meters (78 ft. 9 ins.) long. The advantages of long rails are that they can be laid more rapidly, the number of joints is reduced and the riding is more easy. The principal difficulty seems to be inconvenience in handling in some cases. The company with which the author is connected owns 128 lines, having a total length of 2800 km (1736 miles) and including seven

electric lines with a total length of 140 km (87 miles). The standard rail has a length of 9 meters (29 ft. 6 ins.), but some rails 18 meters (59 ft. 3 ins.) in length have been used.

Welded joints will naturally be considered in a paper on city railway track construction which has been assigned to another committee, but the author has collected some particulars upon them. Three interurban companies seem to have used welded joints, two the Falk and one the Goldschmidt. A fourth has been using a substitute called the Ambert joint, in which the joints are held in place by a braced yoke which takes the place of angle plates and bolts. The companies using welded joints appear satisfied with them and consider that they add to the life of the track. Another type of welded joint was described by Mr. Catani before the Italian Electrotechnical Association in 1905, in which the rails are welded by the oxyacetylene blowpipe process, and which is claimed to be less expensive than and equally as durable as other welded joints. The cost of this joint on a 34.5-kg rail, 160 mm in height (79-lb. rail, 6 ins. in height), was 6 to 12 francs ($1.20 to $2.40).

Various types of lock washers are reported as in use, but none seems to have marked superiority compared with the others.

The conclusions of the writer are:

1. There is a tendency to increase the length of rails.

2. The experience with welded joints is not so positive as to warrant a definite conclusion.

3. General practice favors staggered joints on tangents and opposite joints in curves of short radius.

4. No one system of preventing the loosening of the bolts is so superior to the others as to warrant its exclusive endorsement.

TRACK CONSTRUCTION IN CITY STREETS

BY M. DUBS,
Manager of the Marseilles Tramways

The present tendency is to increase the speed of cars, not only because a better service is given passengers, but also because the platform expenses, fixed charges and many other items are relatively reduced. One of the great handicaps to high speeds is the attempt to run a frequent service upon a single track. Double tracks should be installed when the cars run on a headway as frequent as eight to ten minutes. Where the width of the street is not sufficient for a double track, a second track can be laid in a parallel street. Loops at the ends of lines are to be recommended, especially when trail cars are used. When the streets are narrow the tracks should be laid as near as possible to the middle of the street to avoid interference with vehicles standing at the curb. This has the objection that it makes access to the cars somewhat more difficult, but it can be overcome by placing "refuges" between the tracks. In Marseilles refuges are placed around the center double-bracket poles every 80 meters. The provisions in regard to clearances which form a part of every French tramway franchise, and which are fair and reasonable, are as follows:

Minimum distance between two vehicles passing each other at right angles .....50 cm or 20 ins.
Minimum distance between the outside of the car and the curb—
(a) When no standing traffic is to be provided for, 30 cm or 12 ins.
(b) When provision is made for standing vehicles, 260 cm or 8 ft. 5½ ins.
Which can be reduced under exceptional circumstances to.....240 cm or 7 ft. 10½ ins.
Minimum distance between car and abutting property, 140 cm or 4 ft. 7 ins.
Minimum distance between the car and any single obstacle, such as a tree, pole or bridge abutment.....75 cm or 29½ ins.

The desirability of widening the groove of rails in short-radius curves has been discussed to a considerable extent, and a paper on this subject has recently been published in the "Electrotechnische Zeitschrift." The author, Max Dietrich, of Stettin, recommends the dimensions given in the accompanying table upon the following basis:

Wheel base, 1.80 meters or 4 ft. 11 ins.
Diameter of wheels, 0.80 meters or 31½ ins.
Height of flange, 0.02 m or 0.8 ins.
Width of flange, 0.02 m or 0.8 ins.
Gage of wheels (inside) for a track of 1 m, 0.95 m or 37.6 ins.
Gage of wheels for standard gage of track, 1.385 m or 4 ft. 6½ ins.

Radius of Curve. (Interior Rail.)	One Meter Gage.			Normal Gage.		
	Gage.	Groove Interior.	Groove Exterior.	Gage.	Groove Interior.	Groove Exterior.
	mm.	mm.	mm.	mm.	mm.	mm.
15 m.....	1007	39	38	1441	39	38
20 m.....	1004	35	35	1439	35	35
25 m.....	1002	33	33	1437	33	33
30 m.....	1001	32	31	1436	32	31
40 m.....	1000	30	30	1435	30	30

A number of systems have adopted a width of groove of 35 mm (1.4 ins.) for curves having a radius of less than 40 m (121 ft.).

Concrete is usually employed as a foundation for track construction in England, Belgium and Germany, whereas most of the lines in France, Spain and Italy use ties on a broken stone ballast. Both methods give good results, but the writer is inclined to favor the more flexible construction on stone ballast, as he believes it will reduce the noise and vibration of the rails.

A number of new joints are being tried by different companies. Among these joints are Ambert, Arbel and Holzer. The Ambert joint consists of a yoke of cast or rolled steel

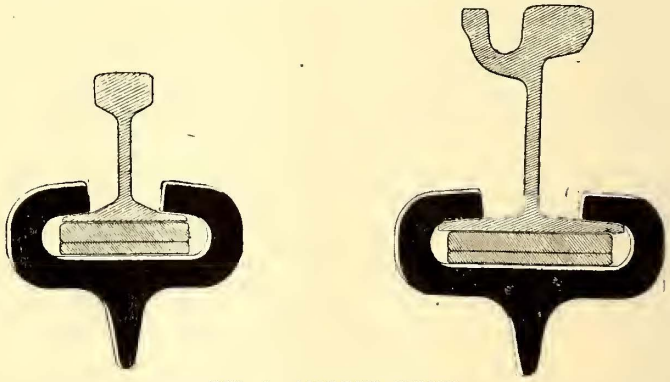


FIG. 1.—AMBERT JOINT

which has a thickness of 1 in. and is pressed around the base of the rail. Two base plates of the same size as the angle plates are used as shown in Fig. 1. No bolts are required. The Arbel joint (Fig. 2) also consists of a yoke, but the rail is held in the yoke by braces retained in position by four wedges. The Holzer joint (Fig. 3) is made by riveting on to the base of the rail a base plate which may consist of an old inverted rail. None of these joints has been in use long enough to determine its real value. The Falk joint has been used quite widely in France, and is considered one of the best, but has the drawback that it is expensive and requires a large equipment. The Goldschmidt joint has also been used to some extent and deserves the attention of railway com-

panies. Electrical welding by alternating or by direct current, the latter according to the system of the Accumulatoren Fabrik, has not been employed yet in France. A new system of welding by acetylene blowpipe has been used in Italy to some extent. The difficulty and expense of gaining access to the joint in paved streets makes a boltless joint extremely desirable.

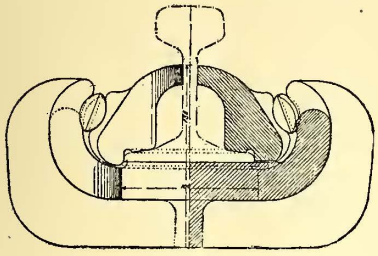


FIG. 2.—ARBEL JOINT

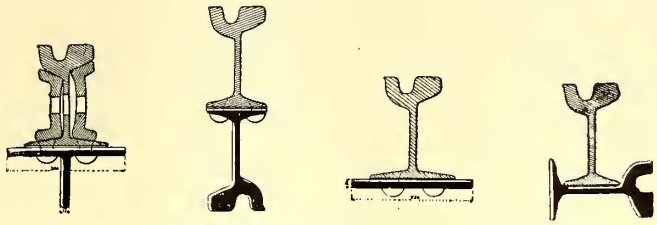


FIG. 3.—FORMS OF RIVETED JOINTS USED BY THE PARIS EASTERN

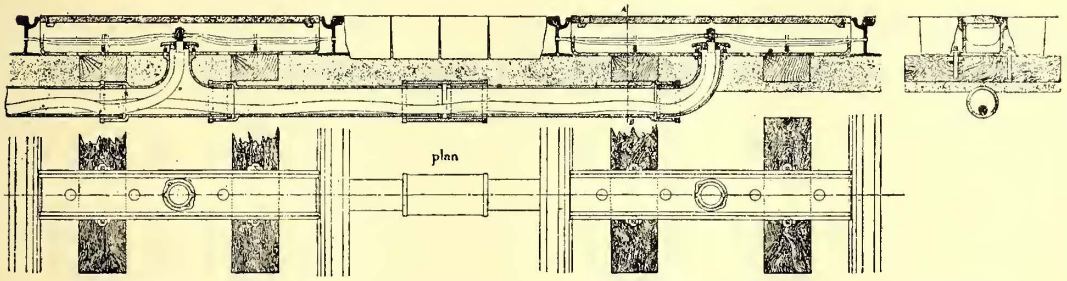


FIG. 4.—METHOD OF MAKING CONNECTIONS TO RETURN CONDUCTOR IN MARSEILLES

The general tendency in bonding is to use a short flexible copper bond with expanded terminals. In Marseilles especial attention is given to the connections between the cross-bonding and the return feeder. These return feeder taps are located in conduits passing under the rails, as shown in Fig.

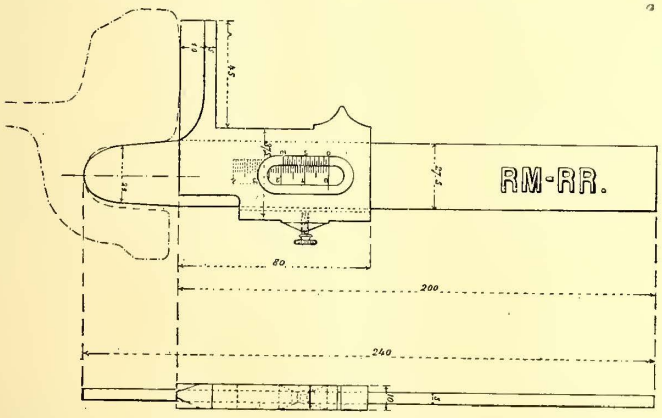


FIG. 5.—MICROMETER GAGE FOR MEASURING THE WEAR OF THE HEAD OF THE RAIL

4. Standard hardened steel manganese special work such as manufactured by the Lorain Steel Company, the Hadfield Steel Foundry and by the Cruesot and Krupp Steel Companies is in general use.

In most of the French franchises the railway company is obliged to keep in repair the portion of the street between the rails and tracks and on each side of the outer rails to a distance of 35 to 50 mm (14 to 20 ins.). While there is no legitimate reason for requiring the companies to maintain this pavement, it is an inheritance from the days of horse traction, and municipalities still insist upon this provision. The maintenance of this pavement is positively detrimental to the railway company outside of the expense entailed, because the result is that this portion of the street is always well paved and vehicles are attracted to it and obstruct the operation of the cars. The annual expense of maintaining this pavement varies from 2 francs to 2.5 francs per square meter (32 to 40 cents per square yard), and even more where the street traffic is large.

An ingenious form of micrometer gage for measuring the wear of the head of the rail is illustrated in Fig. 5.

There has been considerable speculation of late as to the cause of rail corrugation, and one of the questions sent out to the member-companies related to this phenomenon. In the opinion of the writer, rail corrugation is caused by vibration of the rail. If a car should run freely on the track there would be no tangential force between the periphery of the wheel and the rail, that is, there would be no tendency either to slip or skid. But it is otherwise as soon as any force is applied to the wheel, either positive in the direction in which the car is going, through the motor, or negative when the brake is applied. The adhesion between the wheels and the rails depends on the coefficient of friction and also on the weight upon the wheel. Assume now that the rail is vibrating rapidly. As the inertia of the car prevents it from following variations instantaneously, the pressure of the wheel on the rail and hence the adhesion of the wheel and rail at the point of contact undergo wide variations in proportion to the amplitude of the vibrations of the rail. As the tangential force at the point of contact, either positive or negative, remains constant, the result is a succession of slippings and in consequence a series of corrugations on the head of the rail. It has been shown that this kind of wear occurs rarely in tracks which are flexibly supported and consequently have less vibration.

WATTMETERS AND OTHER CURRENT RECORDERS FOR CARS

BY M. WATTMANN,
Manager of the Cologne Tramways

This subject was discussed by Mr. Klitzing, of Magdeburg, at the Vienna convention in 1904, but the tests at that time with devices other than wattmeters were so recent that it was difficult to formulate any definite conclusions. Since then a number of companies have adopted the current-time recorder instead of the wattmeter.

On a great many roads, especially those which have to purchase their current, the expense for power is an important item and in some cases is as high as 20 to 25 per cent of the entire cost of operation. It is generally admitted that the consumption of current depends in large part upon the skill of the motorman in manipulating the controller. It is a common sight to see careless motormen accelerate up to a certain point and then immediately apply the brakes, a condition which would soon be detected by the use of meters of some kind. The experience of different companies which have used meters show a reduction in current for the same service varying all the way from 4 to 20 per cent. In the

case of individual runs, in Cologne, the saving has been as high as 70 per cent. Magdeburg was the first company, so far as the writer knows, to install individual current meters on its cars. This was done in 1901, when a considerable number of the cars of that system were equipped. The results were so marked that a special bulletin of the International Association was issued on the subject.* The following table gives the names of the principal companies which have installed a considerable number of wattmeters or other recorders for measuring the current consumption on the cars. In addition a large number of other companies have installed meters on a few of their cars.

COMPANY.	Application of Meters Commenced in	Number of Motor Cars so Equipped.	Total Number of Motor Cars.
Berlin	1901	232	1664
Hamburg	1903	606	606
Barmen-Elberfeld	1903	66	66
Bremen	1905	131	131
Frankfurt	1905	241	241
Mulhausen	1905	19	19
Stuttgart	1905	23	133
Dusseldorf	1906	144	144
Hagen	1906	36	36
Dresden	(?)	99	162

Originally wattmeters were used for this purpose. Recently, however, many companies have adopted a time recorder, which consists of a simple clock movement which is stopped when the current is cut off. That is, it registers the hours during which the current is used. Several companies, among them those in Hamburg and Frankfurt, have experimented with a device which registers the revolutions of the wheels—that is, the distance run—with the current on; but this device did not give good results and is no longer in use.

The current-time recorder mentioned accomplishes only what its name implies, it registers simply the time the current is on, independently of the amount of current. Nevertheless it is much more rugged than the wattmeter, whose reliability seems to be affected by the vibration of the car. The result is that many companies have abandoned the wattmeter for this device. Berlin, which has been using for the last five years both Thomson-Houston wattmeters and Eibig current-time recorders, states that the latter after six months' operation maintain their accuracy within 1 to 2 per cent. Bremen has 131 of these recorders and Hamburg 600. Their great advantage lies in their simplicity, reduced maintenance and lower first cost. The average price of installing a car wattmeter varies from between 150 and 250 francs ($30 to $50), while the current recorder can be installed for about 50 francs ($10).

The advocates of the wattmeter claim, not without reason, that the object of measuring current is exclusively to secure economy in its use, and that the motorman will soon learn that with a current recorder the record is kept not in watt-hours but simply in hours during which the current is in use. The advocates of the current recorders, however, claim that there is practically a constant ratio between the time and the watts. Theoretically, it is evident that there is no such absolutely constant relation, because of the power required to accelerate after stops. On the other hand, a minimum consumption of current is also not the sole criterion. If it were, the proper way would be to pass over the notches of the controller rapidly and then coast as far as possible. This not only produces irregular acceleration but it is also bad for the motors. On the other hand, with the current-time recorder only, the motorman is tempted to throw the motors into parallel rapidly, although experience has not shown this to be the case. Under these circumstances we must recognize the fact already stated, that a minimum consumption of energy is not the sole criterion of skill in operation of the motorman. If, however, experience shows that the times during which the current is on are practically proportional to the consumption of the current, the use of the current-time recorder will undoubtedly result in an economy of energy equal to any system which directly measures the current. That this in fact is the case is shown in the three replies from the companies in Frankfurt, Dusseldorf and Hagen, which were able by the use of current-time recorders to obtain a notable decrease in the power consumption. It would be interesting if a car should be equipped with both devices and tested to see how closely the two registrations correspond. Some companies are opposed to any system of this kind, fearing that motormen who wish to make records will not comply with the schedule and that others also anxious to have a low current consumption will not pay sufficient attention to the security of pedestrians in the street.

The first cost of wattmeters has already been given. Their cost of maintenance per 100,000 car-kilometers (62,000 car-miles) varies between 3 marks (75 cents) in Dresden to 150 marks ($37.50) in Copenhagen. If we take only the companies which have had wattmeters in use for some time, the figures would be: Berlin, M. 17 ($4.25); Hamburg, M. 27.50 ($6.87); Magdeburg, M. 21.20 ($5.30). Wattmeters are calibrated twice a year in Dresden, every two months in Hamburg and every month in Magdeburg. The current recorders mentioned have not been in use long enough so that their maintenance cost can be accurately given. Frankfurt, which has had them in use for eight months, reports that they have been no expense and in any event the charge should be small.

The clerical work required in keeping readings given by the car meters varies among the different companies according to the extent to which these records are kept and applied, from M. 12 ($3) to M. 80 ($20) per 100,000 car-km (62,000 car-miles).

While the information obtained in the responses to the list of questions varies greatly, there is no doubt that the employment of meters of various kinds is increasing rapidly. The differences of opinion as to their actual and relative values, however, are so numerous that it would be desirable for those companies using meters of this kind to continue their trials and submit the statistical data thus secured to the association. In this way light may be thrown upon certain questions which at present are somewhat obscure.

CONTINUOUS VS. SECTIONALIZED OVERHEAD SYSTEMS

BY PROF. G. RASCH,
Of the Polytechnic Institute, Aix-la-Chapelle

As a preliminary to a study of this topic it would be well to consider certain conditions so as better to define the peculiarities of each of the different systems of feeding. Suppose Fig. 1 represents a part of a system. The feeding-in points are indicated by small black circles, the trolley wires by light lines, and the section insulators by breaks in the light lines. If these light lines were continuous and there were no section insulators the system would be a continuous one. Besides the trolley wires shown, the feeding-in points are cross-connected by feeders, represented by the heavy lines in the engraving. These feeders may also be connected with switches so that they also may be cut out of circuit if desired. The section insulators can also be bridged by switches so that the line can be connected up solid or remain sectionalized. Assume first

* See Street Railway Journal for May 2, 1903.

that these switches are closed. Then every portion of the system could receive current by many taps outside of the single feeder which supplies the section. This will reduce the loss on the system and the advantages of the closed system then consists in more or less economy of power. Another advantage is that there is a more uniform voltage in the closed than in the open system. This will give more uniform lighting and less current in the motors.

Figs. 2 and 3 show two other diagrams which illustrate clearly the economy of the closed system. In Fig. 2, suppose

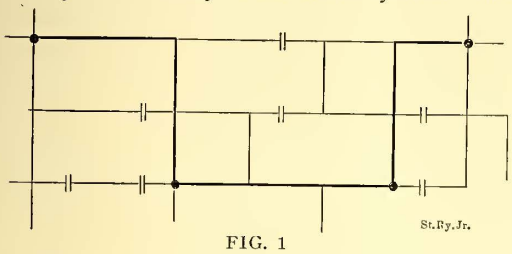


FIG. 1

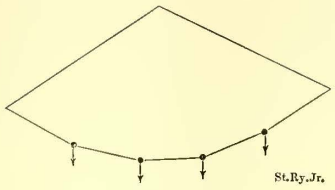


FIG. 2

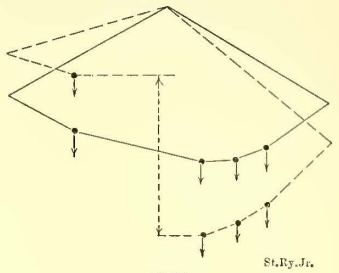


FIG. 3

there are four cars on the line, spaced equally along the line and each taking the same amount of current. In this case the drop in potential is indicated by the ordinates of the line and it is immaterial whether the closed or open system is used. Compare this, however, with Fig. 3, which shows the same system with the cars spaced unevenly. Here the distribution of voltage with the closed system is shown by the solid line and for the open system by the dotted line. It is hardly necessary to comment on this diagram. Let us now consider Fig. 4, in which the three points *a*, *b*, *c* are supplied with current and the trolley *A-D* is broken into sections which can be connected by the switches *B* and *C*. The feeders are supplied with circuit breakers F_1, F_2, F_3 and the generators by the circuit breaker *M*. Suppose first that *B* and *C* are open, making an open system, that the feeder breakers open with a current amounting to 60 and that the generator breaker opens with a current of 100. Assume then a short circuit amounting to 100 on the line feeding *b*. This will affect only feeder *b*, since the circuit breaker F_2 will open before circuit breaker *M*. If, however, *B* and *C* are closed, current 100 will divide

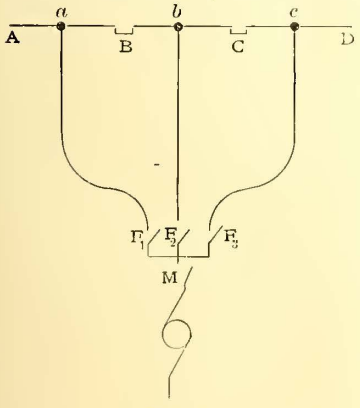


FIG. 4

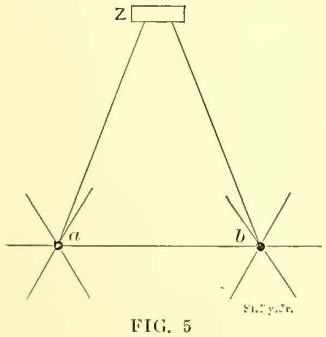


FIG. 5

those in which the section switches are operated by hand and those in which automatic breakers or fuses are used to bridge the sections. The former method is used principally on the shorter lines. Two only of the large systems use the hand switches, viz: the Amsterdam Tramways, which is now proposing to change part of its hand switches to automatics, and the Paris Eastern Tramway, which is very strongly in favor of hand switches. One company claims that automatic breakers at section insulators are not satisfactory because it is difficult to know whether they are open or not. The answer to this is that if the automatic breakers at section switches in a closed system are open, the company will be no worse off than if it were operating the open system.

To determine the value of the method of bridging feeding in points, already mentioned, let us take a theoretical case. Suppose section *a-b* in Fig. 5 is supplied with two feeders from power station *Z*, and that the resistance of each feeder is 2½ times that of the conductor between *a* and *b*. If the current furnished at each feeding-in point remains the same no advantage is gained by using two feeders. This condition, however, will rarely occur. An effort may be made to keep the voltage constant at all points of the system, but the size of the feeders has to be calculated from the average load,

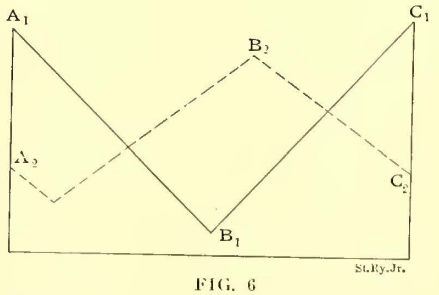


FIG. 6

itself between the three feeders, say in the proportion of 40 for feeder *b* and 30 for each of the feeders *a* and *c*. Then the main breaker will open and the entire system will be without current. For this reason advocates of the open system claim that an interruption of a single feeder will affect the entire line. On the other hand, the feeder breakers will open more frequently than in the closed system. Suppose for example that the short circuit has a value of 80 in place of 100. In this case none of the breakers will open, but if it were an open system the breakers on feeder *b* would open. According to one company, the advantage of localizing shorts is over-rated, for many lines are dependent upon each other for reasons outside the supply current. For instance, if there is an interruption of current on trolley section *b* and the cars stop, the cars on sections *a* and *c* will be blockaded, so that in many cases no great advantage is gained in localizing the faults. On the other hand, the open system does have the great advantage of enabling the management to tell promptly on which section the trouble lies.

Among the closed systems we can differentiate between

and under the conditions arising from the operation of cars the voltage must vary. The ordinates of the full line A_1 B_1 C_1 in Fig. 6 represent the amount of current fed in at the point *a* at different moments in an assumed case. Suppose the current at the point *b* during the same periods is shown by the dotted line A_2 B_2 C_2. The economy of energy in the closed circuit as compared with the open circuit would then be 10.3 per cent, the average current being the same at the two points. In Fig. 7 the position of A_2 B_2 C_2 has been preserved, all the ordinates of the line A_1 B_1 C_1 have been increased by the same amount. Here the average current at the point *a* would then be 40 per cent higher and the

economy would be increased in this case 11.1 per cent.

In the writer's opinion, an overhead system ought to be installed as follows: First, the greatest amount of copper should be put in the feeders and the least amount in the trolley wires. Then, sectionalize the trolley wires so as to limit the zone of distribution of each of the feeding-in points and render them possible of complete isolation from the

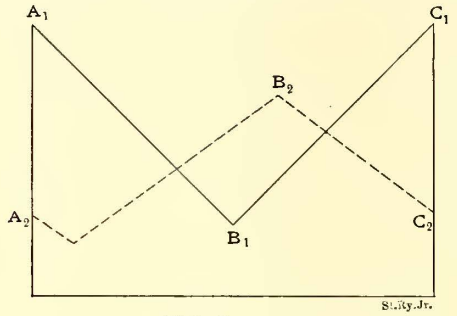


FIG. 7

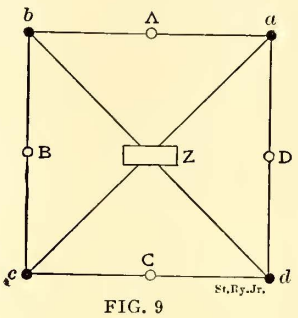


FIG. 9

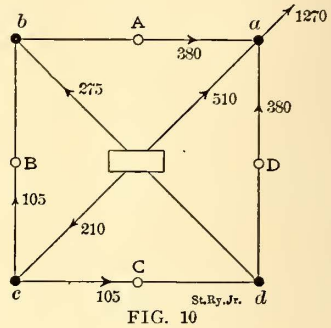


FIG. 10

neighboring sections. Finally, cross connect the different sections through automatic circuit breakers so as to join the termini of the feeders at from three to five neighboring points. If possible unite the ends of those feeders which will not be loaded at the same moment. This will give a system least subject to fluctuations. Thus, suppose Fig. 8 shows a portion of a tramway system. The feed-in points *a*, *b*, *c*, *d* are completely insulated from neighboring sections but are cross connected to each other by the heavy lines shown in the engraving, in which are the circuit breakers *A*, *B*, *C* and *D*. Fig. 9 shows schematically these same feed-in points, the conductors which connect them and the feeders which supply them with current. The other portions of the system have been left out in this diagram. Suppose the resistance of a trolley wire, for instance *a-b*, equals 0.29 ohms and that of the rails for the return of the current equals 0.06 ohms, that each of the feeders has a resistance of 0.5 ohms and that the average supply at each feeding-in point is 100 amps. Then in case of an accident to any one feeder each of the others would have to carry 137 amps. and each trolley wire forming the sides of the square ought to be calculated for a minimum of 50 amps.

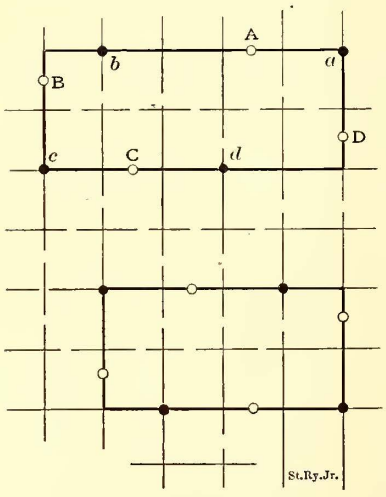


FIG. 8

The setting of the circuit breakers should depend on the amount of current resulting from a short circuit. If we suppose that in such case the voltage of the power station drops to 400 volts, say from a short circuit on line *a*, producing a short circuit of 1270 amps, Fig. 10, then the breakers of feeder *a* at the power station, and at *A* and *D* on the line, ought to open. That is, (1) the circuit breakers at the feeders ought to be able to carry 275 amps. but ought to open at 510 amps., and (2) the automatic circuit breakers *A*, *B*, *C* and *D* ought to carry 105 amps., but ought to open at 380 amps. As will be seen, these limits present variation sufficient to permit easy regulation.

It is possible to figure out other limits by a simple method. Suppose, for instance, we should insert just in front of each of the four line breakers *A*, *B*, *C* and *D* a resistance, equal to the resistance of the trolley wire, in this case 0.29 ohms. On account of these resistances the current from the short circuit on feeder *a* falls to 1080 amps. These 1080 amps. are distributed between the four feeding-in points as follows:

Point *a*	550 amps.
Point *b*	205 amps.
Point *c*	120 amps.
Point *d*	205 amps.

and between the four trolley wires as follows:

b-a	215 amps.
d-a	265 amps.
c-b	60 amps.
c-d	60 amps.

As will be seen, the limits 205 and 550 amps. for the feeder breakers and 50 and 265 amps. for the line breakers have just as wide a variation as in the preceding example. Moreover, the use of these resistances has an advantage from another point of view. Suppose that these resistances are not inserted and a short circuit occurs near the middle of the line *a-b*, or near the point *A*. Then the current would be divided nearly uniformly between the feeders *a* and *b* according to their size and resistance. If, however, the resistance was used the current would be largely confined to one feeder. That is, there would be an independence of the sections nearly equal to that obtained in an open system with the cöoperation between the feeders under normal load nearly equal to that in the closed system.

I might add that Prof. Blondel, of Paris, and the French Thomson-Houston Company recommend the connection of sections by means of automatic breakers, as outlined, though Prof. Blondel makes an exception of underground roads. The French Thomson-Houston Company recommends, in addition, the use in parallel with the breaker of five lamps which will indicate immediately by lighting up the opening of the breaker in case of a short circuit.

CONCLUSIONS OF MR. PIAZZOLI

Mr. Piazzoli, manager of the Silician Tramway Company, of Palermo, also brought in a report on this subject in which he gave preference to the sectional system. The saving in copper from the closed system does not, in his opinion, make up for its defects. Nevertheless he thinks that the breakers used for sectionalizing the line are by no means perfect, and suggests that experiments be conducted to determine their requirements and if possible to improve them.

STANDARDIZATION OF DIRECT-CURRENT TRACTION MOTORS

An important feature of the Milan meeting was a report presented on the standardization of direct-current traction motors by a committee consisting of Prof. G. Kapp, of the Birmingham University, ex-secretary of the Verband Deutscher Elektrotechniker; Prof. G. Rasch, of l'Ecole Polytechnique d'Aix-la-Chapelle; Prof. A. Blondel, of l'Ecole des Ponts et Chaussées, Paris; M. E. d'Hoop,

technical director of the "Les Tramways Bruxellois"; C. H. Macloskie, chief engineer of the Allgemeine Elektricitäts Gesellschaft; James Swinburne, ex-president of the British Institution of Electrical Engineers; and Prof. W. Wyssling, of the Polytechnicum, Zürich, and secretary of the Swiss Society of Electrical Engineers. Following is a translation of the report:

GENERAL

1. The following rules should be observed when machines are offered for sale, and when the sale is successfully completed, except where the seller and buyer, by mutual agreement, wish to modify them.

DEFINITIONS

2. Rating.—The mechanical power developed by a motor or simply the power of the motor, is that power which is developed at the motor axle, in accordance with conditions as given below.[1]

The continuous rating of a motor is that power which can be developed for ten consecutive hours without undue heating as prescribed in paragraph 6 on Heating; the current being supplied at normal voltage.

The normal rating of a motor is that power which would be developed for one hour without interruption and without undue heating, as prescribed in paragraph 6 on Heating; the current being supplied at normal voltage.

The maximum rating of a motor is that power which can be developed for five consecutive minutes without the least sparking at the brushes; the current being supplied at normal voltage.

3. Tractive Effort.—The tractive effort of a motor is the tangential force developed at the periphery of a wheel of specified diameter[2] for a given gear ratio. The conditions under which this force is developed are set forth in paragraphs on Acceptance.

4. Speed.—The speed of a motor is the peripheral speed of the car wheels produced when the chosen gear ratio is employed.

5. Efficiency.—The efficiency of a motor is the ratio between the mechanical power developed by the motor to the electrical power supplied to the motor terminals, the current being supplied at normal voltage.

6. Heating.—A motor is said to be overheated when, starting at an atmospheric temperature of 25 deg. C., it runs continuously for ten hours at its continuous rating or for one hour at its normal rating, and at the end of the specified period the temperature of the motor will have exceeded that of the surrounding air by the following amounts:

(a) Windings.
Cotton insulated, 70 deg. C.
Paper insulated, 80 deg. C.
Mica insulated or other substances having the same insulating and heat-resisting qualities, 100 deg. C.

(b) Commutator, 80 deg. C.

(c) The cores in which are imbedded the windings should have temperatures corresponding to those given for the windings, according to the nature of the insulation. When the windings are insulated with combinations of the above given materials, the lowest temperature limit is taken.

SPECIFICATIONS

7. The specifications should contain, in addition to the normal voltage, the following data, all referred to the normal voltage:

1. The continuous rating of the motor and the corresponding value of the current.

2. The normal rating of the motor and the corresponding value of the current.

3. The maximum rating of the motor and the corresponding value of the current.

4. The efficiency when running respectively at the continuous rating and at the normal rating, the temperature of the motor being taken at 75 deg. C.

5. The character of the insulating materials.

6. The over-all dimensions of the motor; the gear ratio for a given diameter of wheel, tractive effort and speed both at the continuous and normal ratings must be given. Performance curves showing the tractive effort, the speed and the efficiency of the motor plotted with current value must also be given.[3]

NAME PLATE

8. In addition to the above data, contained in the specifications, each motor shall bear a plate giving the normal voltage, the normal rating, the speed and the corresponding current value.

CONSTRUCTION

9. The frame should be so constructed as to avoid magnetic leakage; it must be dust proof and also proof against water which might be thrown against it when in service. The frame must be fitted with openings which permit the maintenance of the brushes; said openings being hermetically closed. Maintenance of the brushes does not mean merely the renewal of the brushes, but also the renewal of the brush holders.

10. The bearings should be so constructed as to completely avoid the introduction of oil or grease into the interior of the motor.

11. The motor, and notably the commutator and the brushes, should be so constructed that the motor will run equally well in either direction without changing the position of the brushes. The sparking should be practically nil for all loads below the maximum rating.

12. The insulation of the windings from the cores and frame should be such that, immediately after the motor has attained its maximum allowable temperature, it will be able to resist for five minutes an alternating voltage the value of which is four times that of the normal voltage.

13. All parts of the motor which are liable to be replaced, in particular the armatures, field coils, the armature coils, the commutators, etc., should be interchangeable, i. e., these parts should be replaced without incurring the least work outside of mere readjustment; the removal of the armature should take place without disturbing the brush holders.

ACCEPTANCE TESTS

14. The acceptance tests shall be made before the motors are mounted on the cars. These tests consist not only in an examination into the general conditions of good manufacture and good construction, but especially in the determination of the power, the tractive effort, the speed, the efficiency and the heating.

(A) DETERMINATION OF THE MECHANICAL POWER

15. The mechanical power of a motor can be determined with an absorption dynamometer, which may be in the form of an electric generator coupled directly to the motor axle. The efficiency of the generator must be known for each con-

[1] In certain special cases it may be desirable to know the power of the motor itself exclusive of the gearing axles, etc. In this case, the word "propre" is added to each of the above-described methods of rating.

[2] In the case of direct-connected motors, the tractive effort will be that developed at the end of an arm 50 cm long, supposed to be mounted on the motor axle.

[3] In certain cases it may be desirable to know the heating and cooling curves of the motor when working at its normal rating and subsequently at other outputs; also those of the field coils and the armature coils when the motor is closed and at rest.

dition of load. The generator cannot be replaced by a traction motor similar to the one under test.

(B) MEASUREMENT OF TEMPERATURE RISE IN THE POWER TESTS OF MOTORS

16. The rating of a motor is determined, according to definition, by the temperature rise.

17. It shall not be allowable to take away, open or modify the case, covers, etc., which should be left as they will be in actual operation. It shall also not be permitted to produce artificially the current of air which would be caused by the movement of the car.

18. The temperature of the surrounding air shall be measured in each existing current of air; if any predominant current does not make itself felt, the mean temperature of the air surrounding the motor should be measured at the height of the middle of that current, and in both cases at a distance of about one meter from the motor. The temperature of the surrounding air shall be taken at regular intervals during the last fifteen minutes of the test, and the mean of the readings shall be taken.

19. In case a thermometer is used to measure the temperature, an attempt must be made to get the best possible conduction of heat between the thermometer and the part of the motor the temperature of which is to be measured, for example, by the means of an envelope of paper or tin. To avoid the radiation of heat, the thermometer wells and the parts of which the temperature is to be measured should be covered with substances which are poor conductors of heat (waste or similar material). A thermometer shall not be read until the mercury has ceased to mount.

20. The temperature rise of all parts of the motor except the field coils shall be measured with thermometers. Where possible the temperature should be measured at those points where it is greatest.

21. The temperature of the field coils shall be determined by the resistance method. If the temperature coefficient of restivity of copper has not been determined it can be taken as 0.004.

(C) DETERMINATION OF THE EFFICIENCY OF MOTORS

22. In determining the efficiency of a motor alone or with its gears, the absorption dynamometer method can be employed; fastening the brake on the motor axle in the first case, and upon an auxiliary axle which will take the place of the car axle in the second case. It is also possible, by exercising proper care, to use methods purely electrical as outlined in the following paragraphs.

23. The combined efficiency of the motors and their gearing is to be determined by one of the two following methods[4]:

(A) Two motors to be tested are coupled together mechanically by an auxiliary axle carrying a gear similar to the one on the car axle and engaging with the pinions of the motors. One of the motors should have the normal voltage E impressed across its terminals and running as a motor will consume a power equal to E I corresponding to the normal rating of the motor; the other motor will act as a generator and will deliver a power equal to E I'. The power supplied and the power delivered being measured, the efficiency of one motor and its transmission will be

$$\eta = \sqrt{\frac{E\,I'}{E\,I}}$$

As a check it is advisable to measure the power E i absorbed by the system:

$$E\,i = E\,I - E\,I' = I - I'$$

(B) Two motors to be tested are coupled together mechanically by an auxiliary axle carrying a gear similar to the one on the car axle and engaging with the pinions of the motors. One of the motors should run as a motor and the other as a generator; they should be inter-connected electrically so that the only power (PP) taken from the external source will be that required to supply the losses. If the total power furnished to one motor is P, and the total power delivered by the other as generator is P_2, then $P = P_1 - P_2$, and the efficiency of one motor with its gearing is

$$\eta = \sqrt{\frac{P_2}{P_1}}$$

The quantities P_1 and P_2 should be measured directly and electrically. As a check it is advisable to measure the power P furnished the system to supply the losses.

24. In case it is desired to find the efficiency of motor intended to be coupled directly to the car axle, the above methods can be applied by coupling the motors directly together.

[4] The methods described above are not theoretically exact, because of the differences in the methods of connecting the two parts of the system; the error, however, remains within the permissible limits as long as the gear ratio is small.

NEW STREET ANNUNCIATOR

The Indianapolis Traction & Terminal Company, of Indianapolis, has equipped one of its cars with a sample of the Livergood automatic street register and advertising indicator. The device is being placed on the market by the American Advertising Indicator Company, of St. Joseph, Mo., the patents having recently been purchased by that company from G. R. Livergood, the inventor. The indicator is a device about the size of a cash register, and is placed over the front door of the car. It may be operated by electricity, compressed air or steam, and automatically announces streets, stops, stations, points of transfer, hotels or places of interest as they are approached. The device requires no change in the equipment of a car or line beyond the attachment of a spur on the trolley wire. The machine has a capacity of 250 plates which, in connection with or between street announcements, afford space for advertising. The advertising capacity of each machine is said to be ten times the present available space in cars, and has the advantage of being front-end advertising. It is claimed that the indicator is compact, accurate and unobjectionable in appearance and requires no manipulation or attention by employees. It is stated that several Ohio and Indiana roads are about to make experiments with the device. A test machine was used for nine months on a St. Joseph, Mo., car to demonstrate that it is an accurate and practical device and a great convenience to the public, besides being a source of revenue to the company from an advertising standpoint.

The new clubhouse of the employees of the Jacksonville Electric Company, of Jacksonville, Fla., on Riverside Avenue, that city, has been formally opened. It is roomy, with large piazza upstairs and down, on the front and sides. To the right of the entrance is a large sitting room, with comfortable chairs, a table of magazines, chess and a big phonograph with numerous records. To the left of the entrance is the pool room, and back of this a well-arranged meeting room. The large dining room is on the right side of the hallway at the back. A room, perhaps 35 ft. square, well lighted and ventilated, containing four large dining tables and with a seating capacity for forty-eight. Across from the dining room is a large lavatory. Back of this is a well-equipped and very busy kitchen, where the first meal for the day is cooked at 5 o'clock in the morning and the last served a little before midnight. Upstairs are ten good-sized bedrooms, each containing two iron beds and two chiffoniers, and each room the sole property of its occupants, each man having his own latch key and his name on the door. A bath room is fitted with tubs and shower baths.

BRIDGES FOR ELECTRIC RAILWAYS—II

By C. C. SCHNEIDER, Consulting Engineer

SPECIFICATIONS FOR STEEL SUPERSTRUCTURES

The specifications which form a part of this paper have been adopted by the author for his guidance in his own practice. They are divided into two principal parts: Part I. contains the information necessary for computation and designing, such as loads, unit strains and details of construction. Part II. covers the quality of material, the workmanship, the inspection and the erection. Part I. for the use in the office, by the designer, and Part II. for the use in the shop and field.

That the specifications may be better understood, the writer will explain why he adopted some of the important features on which opinions of engineers may differ and for which the reader may naturally want to know the reason.

Live Loads: In selecting the proper live load for which structures carrying electric railways should be designed, not only the immediate needs, but also the probable future developments should be considered. Most of the earlier electric railways have committed the same error as the steam railroads in making no provision in their structures for future increase of loading produced by the necessity of using larger and heavier cars to accommodate the increasing traffic or providing for passenger traffic only, when it is quite probable that in the near future it may be desired to haul freight over the line. The probable future increase in the weight of rolling stock, as well as the probability of change in the traffic, should be anticipated in designing bridges which are intended to carry any kind of railway traffic. As the different kinds of cars in operation on the many electric railways now in existence vary so much regarding size, weight and wheel spacing, from the light four-wheeled conveyance in use on strictly rural lines to the heaviest train of motor cars run over the elevated railroads in our great cities, or a train of coal cars, it is impossible to select a certain kind of car as a typical loading to represent the maximum effects produced by every one of the different cars which are likely to run over a structure, even on a line limited to a particular kind of traffic. The author has collected diagrams of almost every kind of electric cars, freight cars and motors, and has grouped them into three different classes. By drawing moment and shear diagrams he has been able to select typical loads which, while they do not exactly correspond to any particular car in use as regards loads and wheel spacing, will give results somewhat in excess of the effects produced by any or a combination of the heaviest cars in existence used for a certain line of traffic, and also provide for probable future contingencies. To facilitate the selection of the proper loading for which structures should be designed, the loads have been classified in the specifications under three different heads, viz:

Class "A" loading: This represents the heaviest loading to which an electric railway bridge will probably ever be subjected, and should be used for freight lines or interurban railways connecting with steam railroads, or other lines on which freight traffic may be expected in the future. Bridges designed for this loading, approaching that of a steam railroad, will be strong enough to carry the heaviest coal trains hauled by electric locomotives.

Class "B" loading: This loading is adapted for elevated railroad traffic in large cities, such as occurs on the lines of the Interborough Rapid Transit and elevated railroad lines in New York City. City and suburban bridges in thickly populated districts where heavy passenger but no freight traffic is expected should be designed for this loading.

Class "C" loading: This is the minimum loading which should be allowed on any structure carrying electric railways, even for the lightest traffic in rural or thinly populated districts. A bridge designed for this loading will carry an ordinary contractors' construction train, consisting of a small locomotive weighing 16 tons on two pairs of drivers, hauling a train of short dump cars. Any bridge is liable to be loaded with a train of this kind during the construction of the road.

Many suburban lines originally intended for light passenger traffic only are now also carrying light freight such as is usually carried by express companies. This kind of traffic should therefore be anticipated in all cases, as it is likely to come sooner or later, and is provided for in Class "C" loading.

Impact or dynamic effect of the live load: To provide for the dynamic effect of the live load, caused by the irregularity of the track, flat wheels, swaying motion of the cars, etc., the writer has adopted the impact formula which he has used for steam railroad bridges for the last fifteen years in a modified form, to suit the conditions existing on electric railways. While this formula has been amply verified on steam railroads and found to be invariably on the side of safety, we have no data for electric railways. We know that the dynamic effect produced by electric cars and electric locomotives is considerably less than that produced by a steam locomotive, as the rotating motion of the driving wheel of an electric motor does not produce the same pounding effect on the rails as the reciprocating motion of the connecting rod in connection with more or less unbalanced driving wheels. Owing to the absence of any data, the writer has assumed the dynamic effect of electric motors to be one-half of that produced by steam locomotives, to be verified or corrected by later experiments.

Lateral load: The lateral load is not considered as consisting of the wind force only, but the function of the lateral system, besides resisting the wind force, is to prevent excessive lateral vibrations. For this reason the lateral force on the loaded chord is increased with the train load; that is, a bridge built for a heavier class of loading should have a heavier lateral system of the loaded chord, and for the same reason, viz: to prevent excessive lateral vibrations, the lateral system of the unloaded chord is specified to have the same section throughout, corresponding to that required for the end panels.

Centrifugal force: The formula for the centrifugal force is based on a varying speed of the train, the speed decreasing as the degree of curvature increases. The speed of train, which corresponds to centrifugal force given by the formula, is the maximum speed considered to be safe for any degree of curvature. Thus the centrifugal force for a 1-deg. curve corresponds to a speed of 59 miles per hour, and for a 12-deg. curve to 25 miles an hour.

Unit strains: The permissible unit strain of 16,000 lbs. per sq. in. specified for direct tension or compression, and the unit strains for shearing, bearing, bending and compression on columns corresponding therewith are those recommended by the committee on steel structures of the American Railway Engineering and Maintenance of Way Association as being in accordance with the best modern practice for railroad bridges, and are endorsed by a large number of the most eminent bridge engineers in this country and abroad.

Material and workmanship: That portion of the specifications relating to material and workmanship is practically the same as adopted by the American Railway Engineering and Maintenance of Way Association, as far as applicable to electric railway bridges and consistent with the views of the writer. The grade of steel specified, known as "structural steel," is also endorsed by the American Society for Testing Materials as the most reliable material for structures on the

strength and safety of which human life depends. It is, moreover, a commercial article which can be purchased from any reputable manufacturer without extra cost.

GENERAL INFORMATION TO BIDDERS

1. The railway company will furnish all information required to determine the span and general characteristics of the structure.
2. Bidders shall submit sealed proposals containing a price per pound for the steel work delivered at a specified location, or a price per pound for the structure erected, according to the requirements in the letter of invitation.
3. Immediately after the award of the contract, if the railway company does not furnish strain sheets or general drawings, they shall be prepared by the contractor, and in addition a complete set of shop drawings; blue prints of all drawings to be submitted to the railway company for approval.
4. Strain sheets shall show skeleton diagrams of all trusses, the dead and live load assumed, the strains from dead, live load and impact, area required and make up to section for all members of the bridge. The plus + sign shall be used to denote tension, and the minus — to denote compression.
5. Shop plans shall consist of the detail drawings of all parts of the structure, and shall include an erection diagram showing the marking and position of each member of the bridge.
6. After approval of the plans the contractor may commence work on the structure, and shall furnish the railway company with a requisite number of blue print copies of drawings for use during construction.
7. The drawings shall all be of a uniform size, 24 ins. x 36 ins. for shop drawings, and 18 ins. x 24 ins. or 12 ins. x 18 ins. for strain sheets, made on linen tracing cloth. One complete set of blue prints shall be deposited with the railway company before the material is shipped.
8. The contractor shall be solely responsible for the correctness of shop drawings, with regard to errors in fittings and lengths.
9. After plans have been approved, alterations will be permitted only upon written instructions from the railway company.
10. The time of completion of the contract shall be specified in the proposal, and the contractor will be held responsible for any delay beyond that date. He shall not sublet any part of the work to a sub-contractor, without the consent of the engineer of the railway company.
11. The contractor shall furnish all material and do all work to the full extent, spirit and meaning of the following specifications:

GENERAL SPECIFICATIONS FOR ELECTRIC RAILWAY BRIDGES

PART FIRST—DESIGN

General Features

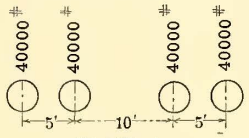
1. Classification—Bridges under these specifications are divided into three classes, viz.:
   Class A—For heavy electric railways carrying freight.
   Class B—For city traffic, including elevated railroads.
   Class C—For light suburban railways.
2. Kind of Material—The material in the superstructures, except as otherwise designated, shall be rolled steel.
3. Type of Bridges—The following types of bridges are recommended:
   For spans up to 20 ft.—Rolled beams or longitudinal trough floors.
   For spans from 20 to 100 ft.—Plate girders.
   For spans from 100 to 150 feet—Lattice girders.
   For spans over 150 ft.—Lattice girders or pin-connected trusses.
4. Clearance—In all through bridges the clear width from the center of track shall be not less than 7 ft. at a height exceeding 1 ft. 6 ins. above the top of rails where the tracks are straight. The width shall be increased to provide the same minimum clearance on curves, allowance being made for super-elevation of rails.
5. Head Room—The clear head room for all through bridges shall be not less than 15 ft. above the top of rail.
6. Spacing Trusses—The width center to center of trusses shall in no case be less than one-twentieth of the effective span.

Spacing of Stringers—Stringers shall be spaced generally not less than 6½-ft. centers, and in high viaducts not less than 8 ft.

7. Skew Bridges—Ends of deck plate girders and track stringers of skew bridges at abutments shall be square to the track.
8. Ties—Wooden tie floors, where used, shall be proportioned to carry the maximum wheel load, with 50 per cent impact distributed over three ties; fiber strain on ties not to exceed 2000 lbs. per square inch, and the length to be not less than the total distance over the outer edge of supports plus 12 ins. They shall be not less than 7 ins. wide and spaced with not more than 6-in. openings, and shall be notched to a tight fit over supporting girders, depth of notch to be not more than 1½ ins.
9. Guard Timbers—Guard timbers shall be not less than 5 ins. x 8 ins., laid with the 8-in. face down, notched over each tie and securely fastened.

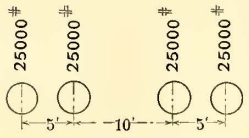
II. LOADS

10. Dead Load—The dead load shall consist of the estimated weight of the entire suspended structure, assuming timber to weigh 4½ lbs. per foot B. M., and the rails and fastenings 100 lbs. per linear foot of track.
11. Moving Load—The moving load shall consist of one of the following classes:



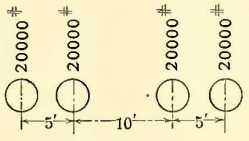
CLASS A

Class A—On each track a series of concentrations, as shown, or a uniform load of 6000 lbs. per linear foot for all spans up to 50 ft., reduced to 4500 lbs. per linear foot for spans of 200 ft. and over; proportionately for intermediate spans, as per table below.



CLASS B

Class B—On each track a series of concentrations, as shown, or a uniform load of 3500 lbs. per linear foot for all spans up to 50 ft., a load of 2000 lbs. for spans of 200 ft. and over; proportionately for intermediate spans, as per table below.



CLASS C

Class C—On each track a series of concentrations, as shown, or a uniform load of 2500 lbs. per linear foot for all spans up to 50 ft., a load of 1500 lbs. for spans of 200 ft. and over; proportionately for intermediate spans, as per table below.

TABLE OF UNIFORM LIVE LOADS

Class A		Class B		Class C	
Span in Feet	Pounds per Lineal Foot of Each Track	Span in Feet	Pounds per Lineal Foot of Each Track	Span in Feet	Pounds per Lineal Foot of Each Track
50....	6,000	50....	3,500	50 ...	2,500
55....	5,950	55....	3,400	55....	2,450
60....	5,900	60....	3,300	60	2,400
65....	5,850	65....	3,200	65....	2,350
70....	5,800	70....	3,100	70....	2,300
75	5,750	75....	3,000	75....	2,250
80....	5,700	80....	2,900	80 ...	2,200
85....	5,650	85 ...	2,800	85....	2,150
90....	5,600	90....	2,700	90....	2,100
95	5,550	95....	2,600	95 ...	2,050
100....	5,500	100....	2,500	100....	2,000
110....	5,400	110....	2,450	110....	1,950
120....	5,300	120....	2,400	120....	1,900
130....	5,200	130....	2,350	130...	1,850
140....	5,100	140....	2,300	140....	1,800
150....	5,000	150....	2,250	150....	1,750
160....	4,900	160....	2,200	160....	1,700
170....	4,800	170....	2,150	170....	1,650
180....	4,700	180...	2,100	180....	1,600
190....	4,600	190....	2,050	190....	1,550
200....	4 500	200....	2,000	200....	1,500

12. Impact—The dynamic increment of the live load shall be added to the maximum computed live load strains, and shall be determined by the following formula:

$$I = S \frac{150}{L + 300}$$

Where
I = impact to be added to the live load strains.
S = computed maximum live load strain.
L = loaded length of track in feet producing the maximum strain in the member. For bridges carrying more than one track the aggregate length of all tracks producing the strain shall be used.

Impact shall not be added to strains produced by longitudinal, centrifugal and lateral or wind forces.

13. Lateral Load—All spans shall be designed for a lateral force on the loaded chord of 200 lbs. per linear foot, plus 10 per cent of the specified train load on one track, and 200 lbs. per linear foot of the unloaded chord; these forces being considered as moving. The laterals throughout the unloaded chord shall be of the same section required for the end panels.
14. Wind Load—Viaduct towers shall be designed for a force of 50 lbs. per square foot on one and one-half times the vertical projection of the structure unloaded; or 30 lbs. per square foot on the same surface, plus 400 lbs. per linear foot of structure applied 7 ft. above the rail for assumed wind load on trains when the structure is either fully loaded or loaded on either track with empty cars, assumed to weigh 1200 lbs. per linear foot, whichever gives the larger strain.
15. Longtudinal Force—Longitudinal bracing for viaduct towers and similar structures shall be designed for a longitudinal force, applied at the rail, of 20 per cent of the live load.
16. Centrifugal Force of Train—Structures located on curves shall be designed for the centrifugal force of the live load acting at the top of the rail. The centrifugal force shall be calculated by the following formula:

$$C = (0.043 - 0.003\ D)\ W\ D$$

C = centrifugal force in pounds.
W = weight of train in pounds.
D = degree of curvature.

III. UNIT STRAINS AND PROPORTION OF PARTS

17. Unit Strains—All parts of structure shall be so proportioned that the sum of the maximum strains shall not exceed the following amounts in pounds per square inch, except as modified in paragraphs 25 to 27:
18. Tension—Axial tension on net section..... 16,000
19. Compression--Axial compress'n on gross section, $16{,}000 - \frac{70\,l}{r}$

where "l" is the length of the member in inches and "r" is the least radius of gyration in inches.

20. Bending—Bending, on extreme fibers of rolled shapes, built sections and girders, net section..... 16,000
On extreme fibers of pins..... 24,000
21. Shearing—Shearing, shop driven rivets..... 12,000
Field driven rivets and turned bolts..... 10,000
Plate girder webs, gross section..... 10,000
Pins 12,000
22. Bearing—Bearing, shop driven rivets..... 24,000
Field driven rivets and turned bolts..... 20,000
Pins 24,000
Expansion rollers, per linear inch, 600 d, where "d" is the diameter of roller in inches.
Masonry 500
23. Limiting Length of Compression Members—No compression member shall have a length exceeding 100 times its least radius of gyration, excepting those for wind bracing, which may have a length not exceeding 120 times the least radius of gyration.
24. Alternate Strains—Members subject to alternate strains of tension and compression shall be proportioned for the strains giving the largest section. If the alternate strains occur in immediate succession (as in stiff counters), such members shall be so proportioned that their total sectional area is equal to the sum of areas required for each strain. The connections in either case shall be proportioned for the sum of the strains.
25. Counters—Wherever the live and dead load strains are of opposite character, only 70 per cent of the dead load strain shall be considered as effective in counteracting the live load strain.
26. Combined Strains—Members subject to the action of both axial and bending strains shall be proportioned so that the combined fiber strains will not exceed the allowed axial strain.
27. Lateral and other Strains Combined—For strains produced by lateral and wind forces combined with those from live loads, dead loads and centrifugal forces, the unit strains may be increased 25 per cent over those given above; but the section shall not be less than required if lateral and wind forces be neglected.
26. Net Section at Rivets—In proportioning tension members the diameter of the rivet holes shall be taken ⅛ in. larger than the nominal diameter of the rivet.
29. Rivets—In proportioning rivets the nominal diameter of the rivet shall be used.
30. Net Section at Pins—Pin-connected riveted tension members shall have a net section through the pin-hole at least 25 per cent in excess of the net section of the body of the member, and the net section back of the pin-hole, parallel with the axis of the member, shall be not less than the net section of the body of the member.
31. Proportioning Plate Girders—Plate girders shall be proportioned either by the moment of inertia of their net section, or by assuming that the flanges are concentrated in their centers of gravity, in which case one-eighth of the gross section of the web, if properly spliced, may be used as flange section. Assumed distance between centers of gravity of flanges should not be greater than distance over flange angles.
32. Compression Flange—The gross section of the compression flange shall not be less than the gross section of the tension flange; nor shall the strain per square inch in the compression flange of any beam or girder exceed $16{,}000 - 200\ \frac{l}{c}$

where "l" = unsupported distance and "c" = width of flange.

33. Flange Rivets—The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer the total shear at any point in a distance equal to the depth of the girder at that point, combined with any load that is applied directly on the flange. The wheel loads where the ties rest on the flanges shall be assumed to be distributed over three ties.
34. Depth Ratios—Trusses shall preferably have a depth of not less than 1/10 of the span. Plate girders and rolled beams, used as girders, shall preferably have a depth of not less than 1/12 of the span. If shallower trusses, girders or beams are used, the section shall be increased so that the maximum deflection will not be greater than if the above limiting ratios had not been exceeded.

IV. DETAILS OF DESIGN

GENERAL REQUIREMENTS

35. Open Sections—Structures shall be so designed that all parts will be accessible for inspection, cleaning and painting.
36. Water Pockets—Pockets or depressions which would hold water shall have drain holes, or be filled with waterproof material.
37. Symmetrical Sections—Main members shall be so designed that the neutral axis will be as nearly as practicable in the center of section, and the neutral axis of intersecting main members of trusses shall meet at a common point.
38. Counters—Rigid counters are preferred; and where subject to reversal of strain shall preferably have riveted connection to the chord.
39. Strength of Connections—The strength of connections shall be sufficient to develop the full strength of the member, even though the computed strain is less, the kind of strain to which the member is subjected being considered.
40. Minimum Thickness—The minimum thickness of metal shall in main members be ⅜ in., in laterals, sway bracing and other unimportant members 5/16 in.
41. Pitch of Rivets—The minimum distance between centers of rivet holes shall be three diameters of the rivet; but the distance shall preferably be not less than 3 ins. for ⅞-in. rivets, and 2½ ins. for ¾-in. rivets. The maximum pitch in the line of strain for members composed of plates and shapes shall be 6 ins. For angles with two gage lines and rivets, staggered the maximum, shall be twice the above in each line. Where two or more plates are used in contact, rivets not more than 12 ins. apart in either direction shall be used to hold the plates well together. In tension members, composed of two angles in contact, a pitch of 12 ins. will be allowed for riveting the angles together.
42. Edge Distance—The minimum distance from the center of any rivet holes to a sheared edge shall be 1½ ins. for ⅞-in. rivets, and 1¼ ins. for ¾-in. rivets, and to a rolled edge 1¼ and 1⅛ ins., respectively. The maximum distance from any edge shall be eight times the thickness of the plate, but shall not exceed 6 ins.
43. Maximum Diameter—The diameter of the rivets in any angle carrying calculated strain shall not exceed one-quarter the width of the leg in which they are driven. In minor parts ⅞-in. rivets may be used in 3-in. angles, and ¾-in. rivets in 2½-in. angles.
44. Long Rivets—Rivets carrying calculated strain and whose grip

exceeds four diameters shall be increased in number at least 1 per cent for each additional 1/16 in. of grip.

45. Pitch at Ends—The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivets for a length equal to one and one-half times the maximum width of member.

46. Compression Members—In compression members the metal shall be concentrated as much as possible in webs and flanges. The thickness of each web shall be not less than one-thirtieth of the distance between its connections to the flanges. Cover plates shall have a thickness not less than one-fortieth of the distance between rivet lines.

47. Minimum Angles—Flanges of girders and built members without cover plates shall have a minimum thickness of one-twelfth the width of the outstanding leg.

48. Tie-Plates—The open sides of compression members shall be provided with lattice and shall have tie-plates as near each end as practicable. Tie-plates shall be provided at intermediate points where the lattice is interrupted. In main members the end tie-plates shall have a length not less than the distance between the lines of rivets connecting them to the flanges, and intermediate ones not less than one-half this distance. Their thickness shall not be less than one-fiftieth of the same distance.

49. Lattice—The minimum width of lattice bars shall be 2½ ins. for ⅞-in. rivets, 2¼ ins. for ¾-in. rivets, and 2 inches if ⅝-in. rivets are used. The thickness shall not be less than one-fortieth of the distance between end rivets for single lattice and one-sixtieth for double lattice. Shapes of equivalent strength may be used.

50. Rivets in Flanges—Five-eighths-inch rivets shall be used for latticing flanges less than 2½ ins. wide, and ¾-in. rivets for flanges from 2½ to 3½ ins. wide; ⅞-in. rivets shall be used in flanges 3½ ins. and over, and lattice bars with two rivets shall be used for flanges over 5 ins. wide.

51. Angle of Lattice—The inclination of lattice bars with the axis of the member shall be not less than 45 degs., and when the distance between rivet lines in the flanges is more than 15 ins., if single rivet bar is used, the lattice shall be double and riveted at the intersection.

52. Spacing of Lattice.—Lattice bars shall be so spaced that the portion of the flange included between their connection shall be as strong as the member as a whole.

53. Faced Joints—Abutting joints in compression members when faced for bearing shall be spliced on four sides sufficiently to hold the connecting members accurately in place. All other joints in riveted work, whether in tension or compression, shall be fully spliced.

54. Pin Plates—Pin holes shall be reinforced by plates where necessary, and at least one plate shall be as wide as the flanges will allow and be on the same side as the angles. They shall contain sufficient rivets to distribute their portion of the pin pressure to the full cross-section of the member.

55. Forked Ends—Forked ends on compression members will be permitted only where unavoidable; where used, a sufficient number of pin-plates shall be provided to make the jaws of twice the sectional area of the member. At least one of these plates shall extend to the far edge of the farthest tie-plate, and the balance not less than 6 ins. beyond the near edge of the same plate.

56. Pins—Pins shall be long enough to insure a full bearing of all the parts connected upon the turned body of the pin. They shall be secured by chambered nuts or be provided with washers if solid nuts are used. The screw ends shall be long enough to admit of burring the threads.

57. Filling Rings—Members packed on pins shall be held against lateral movement.

58. Bolts—Where members are connected by bolts the body of these bolts shall be long enough to extend through the metal. A washer at least ¼ in. thick shall be used under the nut. Bolts shall not be used in place of rivets except by special permission. Heads and nuts shall be hexagonal.

59. Indirect Splices—Where splice plates are not in direct contact with the parts which they connect, rivets shall be used on each side of the joint in excess of the number theoretically required, to the extent of one-third of the number for each intervening plate.

60. Fillers—Fillers between parts carrying strains shall be attached to the main member by independent rivets outside of the connection. The number of these rivets shall be at least 50 per cent of the number required in the connection.

61. Expansion—Provision for expansion to the extent of ⅛ in. for each 10 ft. shall be made for all bridge structures. Efficient means shall be provided to prevent excessive motion at any one point.

62. Expansion Bearings—Spans of 80 ft. and over resting on masonry shall have turned rollers or rockers at one end; and those of less length shall be arranged to slide on smooth surfaces.

63. Fixed Bearings—Movable bearings shall be designed to permit motion in one direction only. Fixed bearings shall be firmly anchored to the masonry.

64. Rollers—Expansion rollers shall be not less than 4 ins. in diameter. They shall be coupled with substantial side-bars, which shall be so arranged that the rollers can be readily cleaned.

65. Bolsters—Bolsters or shoes shall be so constructed that the load will be distributed over the entire bearing; spans of 80 ft. or over shall preferably have hinged bolsters at each end.

66. Wall Plates—Wall plates may be cast or built up, and shall be so designed as to distribute the load uniformly over the entire bearing. They shall be secured against displacement.

67. Anchorage—Anchor bolts for viaduct towers and similar structures shall be long enough to engage a mass of masonry the weight of which is at least one and one-half times the uplift.

68. Inclined Bearings—Bridges on an inclined grade without pin-shoes shall have the sole plate beveled so that the masonry and expansion surfaces may be level.

FLOOR SYSTEMS

69. Floor Beams—Floor beams shall preferably be square to the trusses or girders. They shall be riveted directly to the girders or trusses or may be placed on top of deck bridges.

70. Stringers—Stringers shall preferably be riveted to the webs of all intermediate floor beams by means of connection angles not less than ½ in. thick. Shelf angles or other supports provided to support the stringer during erection shall not be considered as carrying any of the reaction.

71. End Spacers for Stringers—Where end floor beams cannot be used, stringers resting on masonry shall have cross frames near their ends. These frames shall be riveted to girders or truss-shoe where practicable.

BRACING

72. Rigid Bracing—Lateral, longitudinal and transverse bracing in all structures shall be composed of rigid members.

73. Portals—Through truss spans shall have riveted portal braces rigidly connected to the end posts and top chords. They shall be as deep as the clearance will allow.

74. Transverse Bracing—Intermediate transverse frames shall be used at each panel of through spans, having vertical truss members where the clearance will permit.

75. End Bracing—Deck spans shall have transverse bracing at each end proportioned to carry the lateral load to the support.

76. Minimum Bracing—The minimum sized angle to be used in lateral bracing shall be 3 x 2½ x 5/16 ins. Not less than three rivets through the end of the angles shall be used at the connection.

77. Bracing to Clear Ties—Lateral bracing shall be far enough below the flange to clear the ties.

78 Tower Struts—The struts at the foot of viaduct towers shall be strong enough to slide the movable shoes when the track is unloaded.

PLATE GIRDERS

79. Top Flange Cover—Where flange plates are used, one cover plate of top flange shall extend the whole length of the girder.

80. Web Stiffeners—There shall be web stiffeners, generally in pairs, at ends and inner edges of bearing plates, and at all points of concentrated loading, and also at intermediate points wherever the unsupported depth of the web exceeds sixty times its thickness. They shall usually be spaced at intervals of about the depth of the girder, and in deck bridges shall not be more than 5 ft. apart. The stiffeners at ends and at points of concentrated loads shall be proportioned by the formula of paragraph 19, the effective length being assumed as one-half the depth of girders. End stiffeners and those under concentrated loads shall be on fillers and have their outstanding legs as wide as the flange angles will allow, and shall fit tightly against them. Intermediate stiffeners may be offset or on fillers, and their outstanding legs shall be not less than one-thirtieth of the depth of girder, plus 2 ins.

81. Stays for Top Flanges—Through plate girders shall have their top flanges stayed at each end of every floor beam, or in case of solid floors, at distances not exceeding 12 ft., by knee braces or gusset plates.

TRUSSES

82. Camber—Truss spans shall be given a camber by making the panel length of the top chords, or their horizontal projections, longer than the corresponding panels of the bottom chord in the proportion of ⅛ in. in 10 ft.

83. Rigid Members—The hip verticals and similar members, and generally the two end panels of bottom chords of single-track pin trusses up to 200 ft., shall be rigid.

84. Eye-Bars—The eye-bars composing a member shall be so arranged that adjacent bars shall not have their surfaces in contact; they shall be as nearly parallel to the axis of the truss as possible, the maximum inclination of any bar being limited to 1 in. in 16 ft.

85. Pony Trusses—Pony trusses shall be riveted structures, with double webbed chords, and shall have all web members latticed or otherwise effectually stiffened.

PART SECOND—MATERIALS AND WORKMANSHIP

V. MATERIAL

86. Process of Manufacture—Steel shall be made by the open-hearth process.

87. Schedule of Requirements—The chemical and physical properties shall conform to the following limits:

Elements Considered	Structural Steel	Rivet Steel	Steel Castings
Phosphorus, max. { Basic	0.04 per cent	0.04 per cent	0.05 per cent
Phosphorus, max. { Acid	0.08 "	0.04 "	0.08 "
Sulphur, maximum	0.05 "	0.04 "	0.05 "
Ultimate tensile strength Pounds per square inch	Desired 60,000 *1,500,000	Desired 50 000 1,500,000	Not less than 65,000
Elong. min. % in 8" Fig. 1. {	Ult. tens. stgth.	Ult. tens. stgth.	
" " " 2" Fig. 2	22	.....	18
Character of fracture	Silky	Silky	Silky or fine granular
Cold bends without fracture	†180° flat	‡ 180° flat	90° d=3t

* See paragraph 96. † See paragraphs 97, 98 and 99. ‡ See paragraph 100.

The yield point, as indicated by the drop of beam, shall be recorded in the test reports.

88. Allowable Variations—The ultimate strength, to be acceptable, shall be within 5000 lbs. of that desired.

89. Chemical Analysis—Chemical determinations of the percentages of carbon, phosphorus, sulphur and manganese shall be made by the manufacturer from a test ingot taken at the time of the pouring of each melt of steel, and a correct copy of such analysis shall be furnished to the engineer or his inspector. Check analyses shall be made from finished material, if called for by the purchaser, in which case an excess of 25 per cent above the required limits will be allowed.

90. Form of Specimens—Plates, Shapes and Bars: Specimens for tensile and bending tests for plates, shapes and bars shall be made by cutting coupons from the finished product, which shall have both faces rolled and both edges milled to the usual form of a standard test specimen, 1½ ins. wide on a gaged length of 9 ins., or with both edges parallel, or they may be turned to a diameter of ¾ in. for a length of at least 9 ins., with enlarged ends.

91. Rivets—Rivet rods shall be tested as rolled.

92. Pins and Rollers—Specimens shall be cut from the finished rolled or forged bar, in such manner that the center of the specimen shall be 1 in. from the surface of the bar. The standard turned test specimen, ½ in. diameter in 2 ins. gaged length, shall be used for tensile tests. The specimen for bending test shall be 1 in. x ½ in. in section.

93. Steel Castings—The number of tests will depend on the character and importance of the castings. Specimens shall be cut cold from coupons molded and cast on some portion of one or more castings from each melt or from the sink heads, if the heads are of sufficient size. The coupon or sink head, so used, shall be annealed with the casting before it is cut off. Test specimens to be of the form prescribed for pins and rollers.

94. Annealed Specimens—Material which is to be used without annealing or further treatment shall be tested in the condition in which it comes from the rolls. When material is to be annealed, or otherwise treated before use, the specimens for tensile tests representing such material shall be cut from properly annealed or similarly treated short lengths of the full section of thebar.

95. Number of Tests—At least one tensile and one bending test shall be made from each melt of steel as rolled. In case steel differing ⅜ in. and more in thickness is rolled from one melt, a test shall be made from the thickest and thinnest material rolled.

96. Modifications in Elongation—For material more than ¾ in. in thickness, the following modification will be allowed in the requirements for elongation:

For each ⅛ in. in thickness above ¾ in., a deduction of 1 will be allowed from the specified percentage.

97. Bending Tests—Bending tests may be made by pressure or by blows. Plates, shapes and bars less than 1 in. thick shall bend as called for in paragraph 86.

98. Thick material—Full-sized material for eye-bars and other steel, 1 in. thick and over, tested as rolled, shall bend cold 180 degs. around a pin, the diameter of which is equal to twice the thickness of the bar, without fracture on the outside of bend.

99. Bending Angles—Angles ¾ in. and less in thickness shall open flat, and angles ½ in. and less in thickness shall bend shut, cold, under blows of a hammer, without sign of fracture. This test will be made only when required by the inspector.

100. Nicked Bends—Rivet steel, when nicked and bent around a bar of the same diameter as the rivet rod, shall have a gradual break, and a fine, silky uniform fracture.

101. Finish—Finished material shall be free from injurious seams, flaws, cracks, defective edges or other defects, and have a smooth, uniform and workmanlike finish. Plates 36 ins. in width and under shall have rolled edges.

102. Stamping—Every finished piece of steel shall have the melt number stamped or rolled upon it. Steel for pins and rollers shall be stamped on the end. Rivet and lattice steel and other small parts may be bundled with the above marks on an attached metal tag.

103. Defective Material—Material which, subsequent to the above tests at the mills, and its acceptance there, develops weak spots, brittleness, cracks or other imperfections, or is found to have injurious defects, will be rejected at the shop and shall be replaced by the manufacturer at his own cost.

CAST IRON

104. Cast Iron—Except where chilled iron is specified, castings shall be made of tough gray iron, with sulphur not over 0.10 per cent. They shall be true to pattern, out of wind and free from flaws and excessive shrinkage. If tests are demanded, they shall be made on the "Arbitration Bar" of the American Society for Testing Materials, which is a round bar, 1¼ ins. diameter and 15 ins. long. The transverse test shall be made on a supported length of 12 ins. with load at middle. The minimum breaking load so applied shall be 2900 lbs., with a deflection of at least 1/10 in. before rupture.

TIMBER

105. Timber—The timber shall be strictly first-class white pine, Southern yellow pine or white oak bridge timber, sawed true and out of wind, full size, free from wind shakes, large or loose knots, decayed or sapwood, wormholes or other defects impairing its strength or durability.

VI. WORKMANSHIP

106. General—All parts forming a structure shall be built in accordance with approved drawings. The workmanship and finish shall be equal to the best practice in modern bridge works.

107. Straightening Material—Material shall be thoroughly straightened in the shop, by methods that will not injure it, before being laid off or worked in any way.

108. Finish—Shearing shall be neatly and accurately done and all portions of the work exposed to view neatly finished.

109. Size of Rivets—The size of rivets, called for on the plans, shall be understood to mean the actual size of the cold rivet before heating.

110. Punched Work—All riveted work shall be punched accurately. When pieces forming one built member are put together, the holes must be truly opposite. Drifting to enlarge unfair holes will not be allowed. If holes must be enlarged to admit the rivet they must be reamed. Poor matching of holes will be cause for rejection.

111. Rivet Holes—For all punched work, the diameter of the

punch shall not be more than 1/16 in. greater than the diameter of the rivet, nor the diameter of the die more than ⅛ in. greater than the diamcter of the punch.

112. Thick Material Requiring Reaming—Material in main members over 11/16 in. thick shall have all holes sub-punched and reamed with twist drills. Material over ⅞ in. thick shall be drilled from the solid.

113. Field Connections—Holes for floor beam and stringer field connections shall be sub-punched and reamed with twist drills to a steel or iron template 1 in. thick. All other field connections may be punched providing they are carefully checked to template.

114. Sub-Punching and Reaming—Where reaming is required the punch used shall have a diameter of not less than 3/16 in. smaller than the nominal diameter of the rivet. Holes shall be reamed to a diameter not more than 1/16 in. larger than the diameter of the rivet.

115. Burrs—The outside burrs on reamed holes shall be removed.

116. Assembling—Riveted members shall have all parts well pinned up and firmly drawn together with bolts before riveting is commenced. Contact surfaces to be painted. (See 142.)

117. Lattice Bars—Lattice bars shall have neatly rounded ends, unless otherwise called for.

118. Web Stiffeners—Stiffeners shall fit neatly between flanges of girders. Where tight fits are called for the ends of the stiffeners shall be faced and shall be brought to a true contact bearing with the flange angles.

119. Splice Plates and Fillers—Web splice plates and fillers under stiffeners shall be cut to fit within ⅛ in. of flange angles.

120. Web Plates—Web plates of girders, which have no cover plates, shall be flush with the backs of angles or project above the same not more than ⅛ in., unless otherwise called for. When web plates are spliced not more than ¼ in. clearance between ends of plates will be allowed.

121. Connection Angles—Connection angles for floor beams and stringers shall be flush with each other and correct as to position and length of girder. In case milling is needed after riveting the removal of more than 1/16 in. from their thickness will be cause for rejection.

122. Riveting—Rivets shall be driven by pressure tools wherever possible. Pneumatic hammers shall be used in preference to hand driving.

123. Rivets—Rivets shall look neat and finished, with heads of approved shape, full and of equal size. They shall be central on shank, and grip the assembled pieces firmly. Recupping and calking will not be allowed. Loose, burned or otherwise defective rivets shall be cut out and replaced. In cutting out rivets great care shall be taken not to injure the adjacent metal. If necessary, they shall be drilled out.

124. Bolts in Place of Rivets—Wherever bolts are used in place of rivets which transmit shear, the holes shall be reamed parallel, and the bolts must have a driving fit. A washer not less than ¼ in. thick shall be used under nut.

125. Members to be Straight—The several pieces forming one built member shall be straight and fit closely together, and finished members shall be free from twists, bends or open joints.

126. Finish of Joints—Abutting joints shall be cut or dressed true and straight and fitted close together, especially where open to view. In compression joints depending on contact bearing, the surfaces shall be truly faced, so as to have even bearings after they are riveted up completely and when perfectly aligned.

127. Eye-Bars—Eye-bars shall be straight and true to size, and shall be free from twists, folds in the neck or head, or any other defect. Heads shall be made by upsetting, rolling or forging. Welding will not be allowed. The form of heads will be determined by the dies in use at the works where the eye-bars are made, if satisfactory to the engineer, but the manufacturer shall guarantee the bars to break in the body when tested to rupture. The thickness of head and neck shall not vary more than 1/16 in. from the specified thickness. (See 153.)

128. Boring Eye-Bars—Before boring, each eye-bar shall be properly annealed and carefully straightened. Pin holes shall be in the center line of bars and in the center of heads. Bars of the same length shall be bored so accurately that, when placed together, pins 1/32 in. smaller in diameter than the pin holes, can be passed through the holes at both ends of the bars at the same time without forcing.

129. Pin Holes—Pin holes shall be bored true to gages, smooth and straight; at right angles to the axis of the member and parallel to each other, unless otherwise called for. The boring shall be done after the member is riveted up.

130. Variation in Pin Holes—The distance center to center of pin holes shall be correct within 1/32 in., and the diameter of the hole not more than 1/50 in. larger than that of the pin, for pins up to 5 ins. diameter, and 1/32 in. for larger pins.

131. Pins and Rollers—Pins and Rollers shall be accurately turned to gages and shall be straight and smooth and entirely free from flaws.

132. Screw Threads—Screw threads shall make tight fits in the nuts, and shall be United States standard, except above the diameter of 1⅜ ins., when they shall be made with six threads per inch.

133. Annealing—Steel, except in minor details, which has been partially heated, shall be properly annealed.

134. Steel Castings—All steel castings shall be annealed.

135. Welds—Welds in steel will not be allowed.

136. Bed Plates—Expansion bed plates shall be planed true and smooth. Cast wall plates shall be planed top and bottom. The cut of the planing tool shall correspond with the direction of expansion.

137. Pilot Nuts—Pilot and driving nuts shall be furnished for each size of pin, in such numbers as may be ordered.

138. Field Rivets—Field rivets shall be furnished to the amount of 15 per cent, plus ten rivets in excess of the nominal number required for each size.

139. Shipping Details—Pins, nuts, bolts, rivets and other small details shall be boxed or crated.

140. Finished Weight—Payment for pound price contract shall be by scale weight. No allowance over 2½ per cent of the total weight of the structure as completed from the plans will be allowed for excess weight.

VII. SHOP PAINTING

141. Cleaning—Steel work, before leaving the shop, shall be thoroughly cleaned and given one good coating of pure linseed oil, or such paint as may be called for, well worked into all joints and open spaces.

142. Contact Surfaces—In riveted work, the surfaces coming in contact shall each be painted before being riveted together.

143. Inaccessible Surfaces—Pieces and parts which are not accessible for painting after erection, including tops of stringers, eye-bar heads, ends of posts and chords, etc., shall have a good coat of paint before leaving the shop.

144. Condition of Surfaces—Painting shall be done only when the surface of the metal is perfectly dry. It shall not be done in wet or freezing weather, unless protected under cover.

145. Machine-Finished Surfaces—Machine-finished surfaces shall be coated with white lead and tallow before shipment, or before being put out into the open air.

VIII. INSPECTION AND TESTING

146. Facilities for Inspection—The manufacturer shall furnish all facilities for inspecting and testing the weight, quality of material and workmanship. He shall furnish a suitable testing machine for testing the specimens, as well as prepare the pieces for the machine, free of cost.

147. Access to Shop—When an inspector is furnished by the purchaser he shall have full access at all times to all parts of the works where material under his inspection is manufactured.

148. Copies of Mill Orders—The purchaser shall be furnished with complete copies of mill orders, and no material shall be rolled and no work done before he has been notified as to where the orders have been placed, so that he may arrange for the inspection.

149. Starting Work in Shop—The purchaser shall also be furnished with complete shop plans, and must be notified well in advance of the start of the work in the shop, in order that he may have an inspector on hand to inspect the material and workmanship.

150. Shipping Invoices—Complete copies of shipping invoices shall be furnished to the purchaser with each shipment.

151. Accepting Material or Work—If the inspector, through an oversight or otherwise, has accepted material or work which is defective or contrary to the specifications, this material, no matter in what stage of completion, may be rejected by the purchaser.

IX. FULL-SIZED TESTS

152. Test to Prove Workmanship—Full-sized tests on eye-bars and similar members, to prove the workmanship, shall be made at

the manufacturer's expense, and shall be paid for by the purchaser at contract price, if the tests are satisfactory. If the tests are not satisfactory, the members represented by them will be rejected.

153. Eye-Bar Tests—In eye-bar tests, the fracture shall be silky, the elongation in 10 ft., including the fracture, shall be not less than 15 per cent; and the ultimate strength and true elastic limit shall be recorded. (See 127.)

ERECTION

154. If the contractor erects the bridge he shall, unless otherwise specified, furnish all staging and falsework, erect and adjust all the metal work, and shall frame and put in place all floor timbers and guard rails, etc., complete, ready for the rails.

155. The contractor shall put in place all stone bolts and anchors for attaching the steel work to the masonry. He shall drill all the necessary holes in the masonry, and set all bolts in neat Portland cement.

156. The erection will also include the unloading of materials after delivery and their proper care until the erection is complete.

157. Whenever the new structures are to replace existing ones, the latter shall be carefully taken down and removed by the contractor to some place where it can conveniently be loaded on cars.

158. The contractor shall so conduct all his work as not to impede the operation of the road, interfere with the work of other contractors or close any thoroughfare on land or water.

159. The contractor shall assume all risks of accidents and damage to persons and properties prior to the final acceptance of the completed structure by the railway company.

160. The contractor must also remove all false work, piling and other obstructions or unsightly material produced by his operations.

PAINTING AFTER ERECTION

161. After the structure is erected the metal work shall be thoroughly cleansed from mud, greases or any other objectionable material that may be found thereon, then thoroughly and evenly painted with two coats of the kind the engineer may select, mixed with pure linseed oil. All recesses which will retain water, or through which water can enter, must be filled with thick paint or some waterproof cement before receiving the final painting. The different coats of paint must be of distinctly different shades or colors, and one coat must be allowed to dry thoroughly before the second coat is applied. No painting shall be done in wet or freezing weather.

ARRANGEMENTS FOR THE COLUMBUS CONVENTION

The various committees and secretaries which have charge of the work of preparing for the meeting of the street railway associations in Columbus have been very busy during the last few weeks. The committee on rules and the Engineering and American committees on standards have held several meetings in New York during the past few days to decide upon the final forms of their reports. Secretary Swenson, of the American Association, has mailed to each member a handsome illustrated pamphlet on Columbus, issued by the Board of Trade of that city and giving valuable information and statistics as to the city and interesting points to visit. In all between thirty and forty papers and reports will be presented at the different meetings. Of these a large proportion have already been received by the general secretary and are now in the printer's hands. The secretary is working on a bulletin which will be issued next week and which will cover the matter of railroad rates and special trains to the convention.

The American Street and Interurban Railway Engineering Association has announced the composition of its Columbus local committee. It will consist of the following gentlemen: E. O. Ackerman, chairman, Columbus Railway & Light Company, Columbus; L. C. Bradley, Scioto Valley Traction Company, Columbus, Ohio.; W. P. Jackson, Columbus, London & Springfield Company, Columbus; W. H. Evans, Indianapolis Traction & Terminal Company, Indianapolis; Burr S. Watters, assistant engineer of way, Columbus Railway & Light Company; E. H. Hitchcock, professor of experimental engineering at the Ohio State University.

The executive committee of the Manufacturers' Association held a meeting at Columbus on Sept. 19 and 20, going over the plans for accommodations, entertainments and exhibits. Owing to the tremendous demand for space this year, it has been decided to utilize the sixth building in the group of State Fair buildings, which will be devoted to the convention exhibit, and which it was first thought would not be required. The following is a list of the companies which have recently been assigned space at the convention buildings, and is supplemental to the list published in the STREET RAILWAY JOURNAL for Aug. 11:

Berry Bros., Ltd., Detroit, Mich.
Standard Motor Truck Company, Pittsburg, Pa.
Jno. A. Roeblings' Sons Company, Trenton, N. J.
Liberty Bell Company, Bristol Conn.
Elliott Bros. Electric Company, Cleveland, Ohio.
Watson Stillman Company, New York.
National Carbon Company, Cleveland, Ohio.
Grip Nut Company, Chicago.
Emil Calman & Company, New York.
"Electrical Review," New York.
Standard Brake Shoe Company, Aurora, Ill.
Climax Stock Guard Company, Chicago.
Baldwin Steel Company, New York.
Columbia Machine Works, Brooklyn, N. Y.
Magann Air Brake Company, Toronto, Canada.
The Electric Railway Improvement Company, Cleveland, Ohio.
New York Switch & Crossing Company, Hoboken, N. J.
Philip Carey Manufacturing Company, Cincinnati, Ohio.
Crouse-Hinds Company, Syracuse, N. Y.
Heany Fire Proof Wire Company, York, Pa.
The Jenkins Auto Fender Company, Toronto, Canada.
Novelty Incandescent Lamp Company, St. Mary's, Pa.
The Riverside Metal Company, Riverside, N. J.
W. N. Matthews & Bro., St. Louis, Mo.
American Advertising Indicator Company, St. Joseph, Mo.
Ramapo Iron Works, New York.
Pittsburg Steel Company, Pittsburg, Pa.
Chicago Pneumatic Tool Company, Chicago.
J. Frank Lanning & Company, Pittsburg, Pa.
Cary Automatic Coupler Company, Chicago.
U. S. Electric Signal Company, West Newton, Mass.
J. P. Sjoberg & Company, New York.
Semon Bache Company, New York.
S. W. Bird & Son, East Walpole, Mass.
J. A. Fay & Egan Company, Cincinnati, Ohio.

The new limited service between Cleveland and Canton over the lines of the Northern Ohio Traction & Light Company and the Canton-Akron Railroad Company started last week. There are three limiteds each way daily between Cleveland and Canton in addition to the three limiteds over the Northern Ohio line from Cleveland to Akron, thus making six limited cars each way daily between Cleveland and Akron. The new limiteds do not run to the Union Station in Akron, although they pass through the center of the town. They make the 62 miles in 2 hours and 40 minutes, an improvement of one hour over the present local service. By reason of the absorption of the Canton-Akron system by the Northern Ohio Traction and Light Company, which goes into effect Sept. 18, Canton will be made a division point and passengers for Massilon and New Philadelphia and other points south of Canton will change cars in Canton. In the past through cars have been run between Canton and New Philadelphia.

NEW ROLLING STOCK FOR NASHVILLE

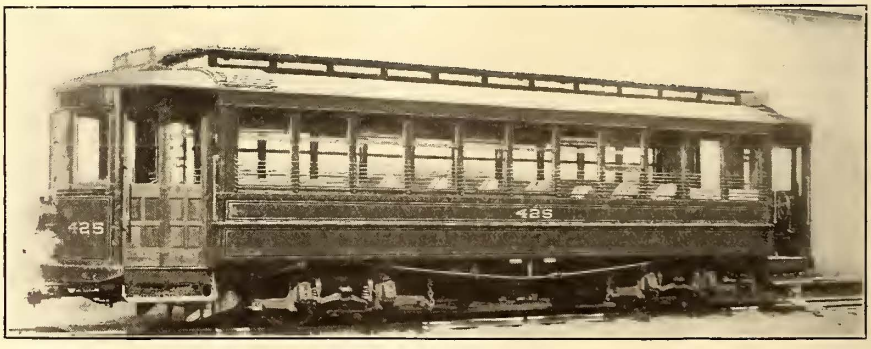
Ten cars of the Nashville Railway & Light Company which went forward last week from the J. B. Brill Company's works are built especially low, a slight decrease being made in the height of the roof, deck and body sash; the truck, too, is made 2½ ins. lower than the standard 27-G1 truck on which the cars are mounted. The height of car from the rail over

HEAD-ON VIEW OF NASHVILLE CAR

the trolley is 11 ft. 4⅝ ins.; from the track to the bottom of the sill, 32⅜ ins.; bottom of the sill over the roof, 8 ft. 6¾ ins. The vestibules are extra narrow at the end to take care of cars passing on curves. Both incandescent and arc headlights are carried, the former to be used on country roads where the maximum speed is attained and where it is essential that a bright light be thrown on the tracks and well distributed, which will enable the motorman to keep a sharp lookout for any obstructions. The car-builders' improved track scraper is installed at each end of the car and is utilized to insure a good contact with the rails. This device will be particularly effective in the country where roads cross the tracks at grade and where dirt and dust is most likely to accumulate. As very little snow falls in Nashville the track scraper will adequately perform the duty required of it at all seasons of the year.

The car interiors are furnished with an abundance of artificial light which is thrown from the continuous line of lights placed along the lower ventilator rails instead of the usual clusters in the ceilings. The low window sills which have done so much to make the grooveless post and semi-convertible car popular are amply protected by continuous safety guards, and such accessories as thermometers and fire extinguishers also have their place. It is an interesting fact that Brill semi-convertible cars constitute practically the entire equipment of the Nashville Railway, and the present consignment will make seventy of this type furnished this road by the same builders.

A natural finish of cherry forms the interiors; ceilings are of bird's-eye maple. The chief dimensions are: Length over the end panels, 30 ft. 6 ins., and over the vestibules, 40 ft. 6 ins.; width over the sills including the sheathing, 8 ft. 1½ ins.; size of the side sills, 4¾ ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, ⅜ ins. x 12 ins.; thickness of the corner posts, 4½ ins. x 6⅝ ins.; thickness of the side posts, 3¼ ins. The wheel base of the trucks is 4 ft. The wheel and axle diameters are standard, and four 50-hp motors are on each car.



DOUBLE-TRUCK VESTIBULED CAR FOR NASHVILLE

PASSENGERS ASKED TO HELP IMPROVE SERVICE

In the "Tri-State Tourist," which is the monthly traffic publication of the Boston & Northern and Old Colony Street Railways, the policy of the company, in regard to complaints, is explained to the public in the following words:

In the hustle and veritable swarm of details incident to operating hundreds of miles of electric railway, no matter how great care and attention is given to details, there will be little faults here and there. Some of these are discovered and promptly remedied. Others go on and on until some day there is an especially strong protest from the public and the managers learn of them for the first time.

When the managers have the knowledge of these little deficiencies there is a chance to correct them; when they are not called to their attention there is none. For this reason it is within the province of the public to do much for their own comfort and convenience by promptly reporting anything that they see is radically wrong to the division superintendents of the company. It is a duty passengers owe to themselves and the general welfare. Their complaints will be thankfully received, and they will not be looked upon as belonging in the category of "kickers." Many hesitate to make complaints fearing to be misunderstood. This is a wrong view.

When anything is wrong the company wants to know it, and will do what it can to make things right. That this may be better understood the Boston & Northern and Old Colony companies have prepared large signs to be placed in all of their cars asking the passengers to co-operate with the companies to improve the service.

This is supplemented by a card in the cars which reads as follows:

Report in writing to local office any discourtesy or inattention to duty on the part of employees, suggestions for improving service or matters of general interest to us. Such reports will be given our careful consideration.

To give still wider publicity to this notice, copies of it have been sent to local newspapers for publication.

RATE WAR IN INDIANA

The first step in a rate war on lines in the vicinity of Evansville, Ind., will be taken Oct. 1, when the new commutation tariff of the Southern Railway goes into effect on their Lincoln City-Evansville line with a fare 10 cents less between all points than now charged by the Evansville, Suburban & Newburg Electric Railway. The steam line proposes to run three trains each way daily, and has made three forms of books to be sold at the above named rates—a business man's, a family and a school children's rate. The interurban road will meet the cut rate.

WIRE GLASS FOR VESTIBULE SASH

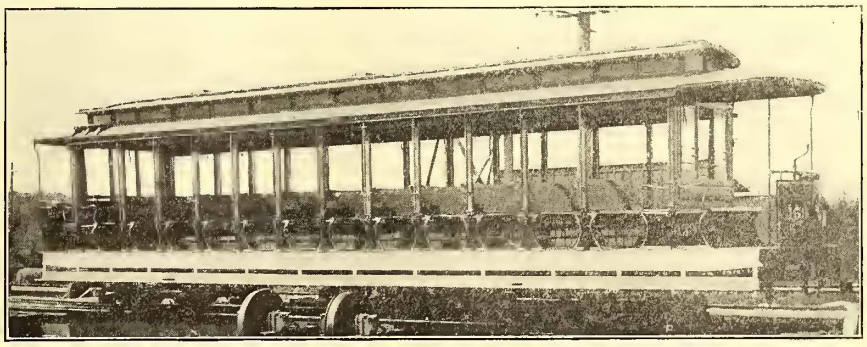
The use of wire glass for elevator shafts, skylights, windows and other places is growing rapidly, so that the suggestion to employ it for sash is interesting. The advantages in avoiding accident from flying glass are obvious. With the tenacity with which the various fragments of a sheet of wire glass are held together under the stress of impact breakage, it is difficult to conceive of personal damage being caused through its breakage even under severe conditions. There is, it is true, a slight loss in transparency, but whether this would militate against its use either for side sash or for vestibules is as yet a question.

To determine this point the St. Louis & Suburban Company equipped some time ago the vestibules of one of its cars with polished wire glass. The car was a private car, built some eight or ten years ago by the St. Louis Car Company, and fitted with open platforms. In 1903 the car was rebuilt at the company's shops, vestibules were added and the wire glass sash were inserted. Since that time several of these sash have been broken by people falling against them, but the glass remained intact and the person was not cut. At another time a motorman broke the glass while raising the sash during a heavy rain, but the wire held the glass together and no water leaked in. The car has not been in a collision. The only objection so far developed is that owing to the fine mesh used some motormen have objected to the car on account of the effect of the wire mesh on the vision during a fast or long run. Experience has shown, however, that consciousness of the mesh disappears after a few days, the eyes of the motorman seeming to focus beyond the glass.

CAR VESTIBULE AND DOOR WITH WIRE GLASS

OPEN CARS FOR THE ATLANTIC COAST ELECTRIC RAILWAY

There are numerous roads throughout the country whose chief source of revenue is derived from the handling of large crowds of excursionists during the summer months, and a line of this kind is the Atlantic Coast Electric Railway, with headquarters at Asbury Park. Starting from Asbury Park in either direction numerous popular watering places and amusement resorts are passed, and at the height of the season the capacity of the rolling stock is taxed to the utmost. The annual military operations at Sea Girt, the terminus, attract thousands of visitors, and Belmar, Avon-on-Sea and Spring Lake all get their share of patronage, and in the other direction from Asbury Park as far as Long Branch, the other terminal of the lines, traffic is equally brisk, Pleasure Bay with its fine park, as well as the famous New York resort mentioned, affording very pleasant stopping-off places. A variation in the trip to New York City may be had by taking the trolley to Pleasure Bay, thence direct to the metropolis by steamer. Many passengers board the cars merely for the sake of the exhilarating ride along the coast and to enjoy the scenery, which is most diversified and charming.



OPEN CAR FOR ATLANTIC COAST ELECTRIC RAILWAY

The big open cars of the present order which were built by the John Stephenson Company are duplicates of those ordered from the same builders a little over a year ago, which were in turn duplicated in 1903 and, needless to say, they have answered their purpose admirably on this line of heavy travel. Each car will seat seventy-five passengers, and the type of truck employed is the "Eureka" maximum traction with a wheel base of 4 ft. The chief dimensions of the cars are: Length over the end panels, 33 ft. 4 ins., and over the crown pieces, 42 ft.; width over the sills, 6 ft. 7⅞ ins., and over the posts at the belt, 7 ft. 3 ins.; height from the floor to the ceiling, 7 ft. 8½ ins. Other features of the car will be noted by consulting the illustration. The curtains may be pulled down to the floor, the round corner seat end panels which are used being so arranged in connection with the grooves in the posts as to permit the curtains coming down over the posts outside of the panels, a continuation of the grooves of the posts being formed in the exterior of the panel. Each car is furnished with two motors of 40-hp capacity each, together with a number of the manufacturer's specialties.

FINANCIAL INTELLIGENCE

Wall Street, Sept. 19, 1906.

The Money Market

Although the monetary situation has been greatly improved during the past week, there has been no marked relaxation in rates for money. The tone of the market has been firm throughout, due to the enormous volume of business being carried on in all branches of trade and to an active stock speculation, and which have been accompanied by a heavy demand for funds in all sections of the country. Money on call ranged between 10 and 2 per cent, the average for the week being about 6 per cent. In the time loan department, maturities extending from 90 days to six months inclusive, commanded 6 per cent, and a premium bringing the total charge up to 7½ and 8 per cent, altohugh in special instances transactions for the long period were made at 6 per cent and at 6½ per cent, the character of the collateral and the standing of the borrower being taken into consideration. By far the most important development of the week has been the very substantial gains in cash by the New York City banks resulting from the heavy importation of gold from Europe. Up to the present time the Treasury Department has advanced $21,628,000 to the national banks under the relief plan adopted by Secretary Shaw, and which went into effect on Sept. 10. In addition to this considerable amounts of gold have been engaged upon which no advances have yet been made, and it is expected that by the end of the current week the amount advanced to local banks will be close to $30,000,000. This does not include several million dollars engaged in the Australian market nor the $2,000,000 imported by a Boston institution last week. Gold amounting to $4,000,000 will also arrive from Europe during the week, against which no advances have been made, the engagement taking place before the Treasury plan went into effect. The result of these heavy importations of gold has been to strengthen materially the position of the local banks, notwithstanding the heavy transfers of currency to San Francisco, and to the heavy shipments of currency to the interior cities for crop-moving purposes. The outflow of money during the past week has been heavy, and all indications point to a continuation of the movement on a large scale. The foreign exchange market has ruled steady throughout the week, and, notwithstanding the advances in discount rates by the Bank of England and Imperial Bank of Germany, the engagements of gold for import have continued and are likely to continue for some time. The bank statement published on last Saturday, although not up to expectations, was nevertheless a very gratifying document. Loans showed a further contraction of $15,313,700 as a result of the shifting of loans to other institutions. The increase in cash amounted to $7,932,700, and as the reserve required was $2,181,625 less than in the previous week, the surplus reserve was increased by $10,114,325, which not only wiped out the deficit of $6,557,925 reported in the week ending Sept. 8, but established a surplus of $3,536,400. In the corresponding week of 1905, the surplus was $4,635,300; in 1904, $29,353,150; in 1903, $13,173,625; in 1902, a deficit of $1,642,050; in 1901 a surplus of $13,654,225 and in 1900, $20,836,175.

The Stock Market

Speculative activity in the stock market increased and during the week there was a broadening of interest which suggests even greater activity before any serious break in prices will occur. Sentiment is strongly bullish and the dominant interests are encouraging the development of this feeling with a view to a larger participation on the part of the public. Apart from the firmness in money, conditions are all favorable. The action of Secretary Shaw in advancing to national banks the full amount of the gold engaged for import has been followed by engagements of over $23,000,000, and the indications are that over $30,000,000 will be brought from Europe on this movement. The advance in the Bank of England discount rate has been followed by an increase in the Imperial Bank of Germany rate to 5 per cent, and it is likely that we will be able to draw additional supplies of the yellow metal from Europe. The important point is that we have been able to obtain abroad a considerable amount of money that the New York City banks will be called upon to send to the interior for crop-moving purposes, and to this extent the financial situation has been improved. If our imports of gold fall below requirements, the Federal Treasury is in a position to deposit funds in the country banks to an extent that will offset the drain upon the local institutions. The improvement in the stock market and the more bullish feeling are not entirely the result of the improvement in the monetary position. They have been influenced to a large extent by the increase in the Union Pacific dividend, the beginning of dividends on Southern Pacific and by the prospects of a more liberal dividend policy on the part of many other corporations. The re-instatement of Steel common to the dividend list has had a very favorable influence, as this stock is widely held, and intimations that it will be placed upon a 4 per cent basis are receiving consideration. The copper stocks have been features and both Amalgamated and Anaconda made large advances, the improvement having been based on rumors that the dividend on Anaconda will again be increased, and that Amalgamated will be placed on a higher dividend basis next month. The prosperous condition of the copper metal trade warrants such action and the market action of the stocks would justify the anticipated increase. Rumor has it that there is to be a radical change in the position of the coal-carrying properties, and it is intimated that the Union Pacific will have a large interest in Baltimore & Ohio as a result of the recent sale of the Pennsylvania holdings of that stock. It is expected that the dividend on Pennsylvania will be increased, and that Norfolk & Western and Chesapeake & Ohio will go on a higher dividend basis.

Prices are now on a high level, and many of the leading dividend payers return less on the investment than can be obtained by lending money at ruling rates. Such a situation usually precedes a change in the market position, and it is obvious that the bull-market cannot be carried much further, unless there is assurances of more liberal supplies of money. The prosperity of the country employs all available funds, and while the market holds strong and promises to go higher, it is time to adopt a cautious policy.

The local traction stocks have been held back, but the heavy earnings of these companies must tell in the long run. It has been demonstrated that the Brooklyn Rapid Transit Company can earn and pay dividends even though such payment may not be advisable just yet. If it can earn 5 per cent over and above all charges, the outlook is certainly very flattering.

Philadelphia

The overshadowing feature in the market for the local traction shares this week has been the enormous dealings in Philadelphia Rapid Transit which were accompanied by fractionally higher prices. In the early dealings the stock ran off from 29⅝ to 29, but later in the week a heavy demand developed for the stock, which carried the price up to 29¾. It was reported that a large block of the stock which had been hanging over the market has been taken up, and subsequently the announcement was made that a syndicate had taken over the holdings of J. J. Mack. From 29¾ the price reacted a fraction, but near the close it advanced to 30⅛ and closed near the highest. It is said that August Loeb, vice-president of a local bank, will succeed Mr. Mack as a director in the company. Upwards of 35,000 shares of the stock changed hands. Otherwise the market was dull and devoid of special feature. American Railways fell from 51 to 51¾, and Union Traction advanced from 63¾ to 64⅛, on purchase of odd lots. Other transactions included Philadelphia common 49¾ to 49½; preferred at 48½; Philadelphia Traction at 98½, United Companies of New Jersey at 255 to 254; United Traction of Pittsburg 50½ to 50; Fairmount Park Transportation at 16, Fort Worth & Wabash Valley Traction at 26½ and Consolidated Traction of New Jersey at 78⅝ to 78.

Baltimore

Trading in the traction issues at Baltimore was unusually quiet and featureless. United Railway issues were firm, the free stock selling at 14½, and the deposited stock changing hands at prices ranging from 15 to 15½. About $25,000 of the 4 per cent bonds sold from 89¼ to 89½, and about $50,000 of the deposited incomes brought prices ranging from 69¾ to 70½. A small lot of the new funding 5s sold at 88½. Washington City & Suburban 5s sold at 103.

Other Traction Securities

The Boston market was decidedly strong, but the dealings for the most part were confined to small amounts. Massachusetts Electric stocks were exceptions to the general rule, about 1000 shares of the common changing hands from 20 to 21, while about 600 shares of the preferred sold from 70½ to 73½. Boston & Suburban common advanced from 17 to 18½, and the preferred sold at 81¾. Boston Elevated sold at 153⅝ and 153½, and West End sold at 97. In the Chicago market a larger number of issues were traded in, but the individual totals were comparatively small. Chicago Union Traction advanced from 4¾ to 5⅛ and the preferred sold at 19 to 18¾. Metropolitan Elevated preferred brought 67½ and 67, and South Side Elevated sold at 96½ and 96. North Chicago changed hands at 36, and West Chicago declined from 35½ to 32.

The inactivity of traction securities in Cincinnati continues. Cincinnati Street Railway sold in several lots at 143, even with the former price. Cincinnati, Newport & Covington preferred sold at 97 and 97¼, also no change. Columbus Railway sold at 111, an advance of ½. Toledo Railways & Light at 32, a decline of ¼, and a block of Northern Ohio Traction 5s at 100, an advance of ¼.

There were but few traction sales in Cleveland. Cleveland & Southwestern sold at 14½, and Lake Shore Electric at 15¼, both fractional declines from last sale. Northern Ohio Traction advanced fractionally to 29, due to the absorption of the Canton-Akron system. Cleveland Electric and Forest City Electric, the two conspicuous tractions were inactive, a small lot of the former selling at 71, even with previous sales.

Security Quotations

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

	Sept. 12	Sept. 19
American Railways	51¾	51¾
Boston Elevated	153½	153¾
Brooklyn Rapid Transit	80¼	80⅛
Chicago City	160	160
Chicago Union Traction (common)	4¾	4¾
Chicago Union Traction (preferred)	18	18
Cleveland Electric	71	70
Consolidated Traction of New Jersey	—	77
Detroit United	93	94
Interborough-Metropolitan, W. I.	38¼	38⅝
Interborough-Metropolitan (preferred), W. I.	77¾	77½
International Traction (common)	54½	54½
International Traction (preferred), 4s	76	76
Manhattan Railway	147	144¼
Massachusetts Electric Cos. (common)	20	20
Massachusetts Electric Cos. (preferred)	72	72½
Metropolitan Elevated, Chicago (common)	26	26
Metropolitan Elevated, Chicago (preferred)	66½	66½
Metropolitan Street	106	107
North American	91	92⅞
North Jersey Street Railway	27	27
Philadelphia Company (common)	49½	—
Philadelphia Rapid Transit	29	29¾
Philadelphia Traction	*98	98½
Public Service Corporation certificates	69	69½
Public Service Corporation 5 per cent notes	94½	—
South Side Elevated (Chicago)	96	95
Third Avenue	124	126
Twin City, Minneapolis (common)	113	114½
Union Traction (Philadelphia)	63	64
West End (common)	—	—
West End (preferred)	—	—

* Ex-dividend.

Metals

According to the "Iron Age," there is no sign of a let-up in the demand for iron and steel. During the first two weeks of the current month, the United States Steel Corporation booked an average of 60,000 tons per day, which contrasts with a capacity of 33,000 per day. The principal merchant furnaces in the valleys are sold up tight into the second quarter of next year. One leading iron producer in the South has this week sold 40,000 tons of basic pig to Western steel makers, the bulk of it at $15.50 Birmingham.

Copper metal continues strong; prices for all grades making further advances during the week. Quotations are: Lake, 19⅞ to 19¾c; Electrolytic, 19 to 19⅞c, and castings, 18¾ to 19c.

ANNUAL REPORT OF THE NORTHWESTERN ELEVATED

The report of the Northwestern Elevated Railroad for the year ended June 30, 1906, has been issued under date of Sept. 14. The figures contained in the report follow substantially as given there:

INCOME ACCOUNT OF THE YEAR ENDING JUNE 30, 1906

Passenger earnings		$1,456,454.01
Other earnings (including loop net earnings)		492,273.27
Total earnings		$1,948,727.28
OPERATING EXPENSES		
Maintenance of way and structure	$65,092.09	
Maintenance of equipment	147,387.13	
Conducting transportation	415,555.80	
General expenses	7,537.76	
		705,572.78
Net earnings		$1,243,154.50
CHARGES		
†Taxes	$171,624.04	
Bond interest	783,466.53	
Other interest	7,565.92	
		962,656.49
Surplus for year		$280,498.01

The above figures include $71,700 set aside in monthly instalments as a reserve for future betterments and maintenance, $41,700 on main line, and $30,000 on loop division.

† Includes compensation to city on account of loop.

* GENERAL BALANCE SHEET—JUNE 30, 1906

Assets		
Cost of road and equipment		$30,133,939.63
Land and buildings		442,022.42
Stocks and bonds		82,515.14
Cash and bills receivable		746,529.58
Accounts receivable		121,443.50
Materials and supplies on hand		7,131.61
Unadjusted accounts		403,018.51
		$31,936,600.39
Liabilities		
Capital Stock—		
Preferred	$5,000,000	
Common	5,000,000	
		$10,000,000.00
Bonds	$19,624,000	
Less bonds owned	1,142,000	
		18,482,000 00
Mortgages		126,850.00
Reserved for taxes		241,839.50
Accrued interest on bonds		242,691.66
Reserved for maintenance		238,762.70
Accounts and notes payable		1,297,297.90
Unadjusted accounts		5,723.75
Profit and loss		1,301,434.88
		$31,936,600.39

* Includes loop division.

COMPARATIVE STATEMENT OF DAILY AVERAGE PASSENGER TRAFFIC PER MONTH DURING THE YEARS ENDING JUNE 30, 1901, 1902, 1903, 1904, 1905 AND 1906

Month	1903	1904	1905	1906
July	56,110	59,393	60,816	67,496
August	57,911	60,093	62,453	68,938
September	63,950	68,107	66,407	74,307
October	69,562	71,617	73,385	80,642
November	67,236	71,422	74,307	83,597
December	71,607	76,259	78,263	87,199
January	68,266	70,204	73,728	81,204
February	69,885	73,193	78,773	83,572
March	70,070	74,344	80,500	85,154
April	71,340	74,217	79,779	84,244
May	66,990	69,232	77,863	81,748
June	66,571	68,222	75,837	80,165
Daily average	66,591	69,664	73,460	79,816

Total number of passengers carried year ending June 30, 1901	18,950,167
Total number of passengers carried year ending June 30, 1902	21,769,079
Total number of passengers carried year ending June 30, 1903	24,305,704
Total number of passengers carried year ending June 30, 1904	25,497,079
Total number of passengers carried year ending June 30, 1905	26,812,825
Total number of passengers carried year ending June 30, 1906	29,132,871
Daily average passengers carried year ending June 30, 1906	79,816
Daily average passengers carried year ending June 30, 1905	73,460
Average daily increase	6,356
Equal to	8.65
Ratio of operating expenses, including maintenance reserve, to earnings	46.62 per cent
Ratio of operating expenses, maintenance, reserve, loop account and taxes to earnings	62.72 per cent

MUELLER LAW DECISION IN CHICAGO—VALUES OF INTANGIBLE PRORERTIES OF COMPANIES SUBMITTED TO THE CITY

Judge Thomas G. Windes, in the Circuit Court, on Saturday, Sept. 15, refused to enjoin the city authorities from issuing certificates under the Mueller law for the purchase of the local street railway companies in any sum not over $75,000,000. This was the first hearing in the case, and the matter will be taken to the Supreme Court of the State, from which an opinion is hoped some time next month.

The Mueller law was the act passed by the State Legislature under which the City of Chicago was authorized to issue certificates in amount not exceeding $75,000,000 for the purpose of acquiring and operating the street railways of the city. A committee of taxpayers opposed to municipal ownership attacked the constitutionality of the law, and at the same time the legality of certain ordinances passed by the City Council of the city of Chicago, also looking to the control by the city of the street car systems. The city filed a demurrer to the bill of complaint entered by the committee.

The decision of Judge Windes upheld the constitutionality of the law, approved every step that the city had taken in following the provisions of the law, and finally dismissed the bill of complaint for want of equity. The court declared that it was the evident purpose of the Legislature and of the City Council to give the city the right to own and operate the street railways. He declared that while there might be some doubt in some points regarding the intention of the Legislature, he believed the doubt should favor what appeared to be the intention of the enactment of the measure. The court held, in brief:

"That it is clear that the Legislature intended that no debts should be incurred by the city under the Mueller certificates, that the only purpose of the city was to acquire income from street railways, to be purchased by the issuance of bonds; that the city has the right under the Mueller law to condemn property for the extension of the street car system, which it proposes to acquire; that the law itself is constitutional; that all ordinances passed by the city with the purpose of furthering the working of the law are legal."

It was claimed by the complainants that the Mueller law was unconstitutional because it was a local or special act. The court held that it was not a local law, and applied to every other city in the State as much as it did to the city of Chicago.

The Chicago City Railway and the Chicago Union Traction Company have submitted to the local transportation committee of the Chicago City Council their estimates of the value of the intangible properties of each company. The Chicago City Railway reports that it values its unexpired franchises and other rights at $10,332,228, while the figures of the Union Traction Company for its rights and franchises are $13,825,040.

Figures as to the "tangible values" of each road were submitted several months ago. For the Chicago City Railway these were $20,103,906, and for the Union Traction Company $27,401,218. The total value of the tangible and intangible properties of both roads, as figured by the companies is $71,662,422. This is the sum the city is asked to consider the roads worth in the event that it make a settlement with the companies upon an indeterminate license plan.

Detailed statements of values were given by neither company, as it was considered that this would not be helpful to the companies. The value submitted by the Chicago City Railway was based on the following assumptions:

"1. That taking into account the existing situation a fair allowance to the company for its intangible rights would be the value of right of the company to operate its entire system for a term of seven years.

"2. That the gross receipts from the operation of the company's street railways would increase at the rate of 5 per cent in each year over the gross receipts for the preceding year.

"2. That the net profits from the operation of its street railways would amount to 30 per cent of its gross receipts, less interest on the value of the company's tangible property."

Seventy per cent of the gross receipts was taken as the cost of operation, and the present value of the intangible properties was considered as being the present worth of the net profits for seven years.

The figures submitted by the Chicago Union Traction Company do not include the value of the Chicago Consolidated Traction Company.

As with the City Railway so with the Union Traction Company. It bases its values on seven years operation. The gross receipts are assumed to increase 10 per cent the first year and 5 per cent each succeeding year, and the cost of operation is assumed to be 70 per cent of the gross receipts.

The figures submitted by both companies will be compared with the estimates now being made by the city's special commission on values. In regard to the values submitted, Mayor Dunne said: "The figures are excessive. The city experts and the committee will act in conjunction in deciding how much too high they are. I can duplicate the street car lines in the city, street for street, for less than $70,000,000, with absolutely new material."

Mayor Dunne announces that as a result of the Mueller traction decision the City Council will continue to negotiate with present companies for the reconstruction of the properties and for their operation until the city can purchase them.

SEATTLE'S MUNICIPAL OWNERSHIP PLAN DEFEATED AT POLLS

Municipal ownership of street railways, as represented in a proposal to bond the city of Seattle for $4,272,000, of which $1,172,000 was to be charged against the general funds of the city and the rest to be an indebtedness against 20 per cent of the gross receipts of the system when in operation, was defeated at a special election held Sept. 13. Out of a total of approximately 13,000 votes cast, municipal ownership lacked 935 of a plurality. Registration for the special election was 23,000. The weather was inclement, but the working classes voted heavily. It was proposed to build a municipal street railway system that would parallel and extend beyond the lines of the Seattle Electric Company.

Some little time before the election, Jacob Furth, president of the Seattle Electric Company, was asked for an expression of opinion as to the proposal. Despite his position Mr. Furth yielded to the demand, making some interesting comments. He is quoted as follows:

"I am somewhat embarrassed in expressing my views by the fact that I am the president of the Seattle Electric Company. However, those who know me are aware that I am able to speak for myself as a citizen and taxpayer, irrespective of the interests which I also represent. Without discussing the general question of municipal ownership, I do not think that the city can afford at this time to incur the indebtedness necessary to construct and operate the proposed system. The city has many urgent needs. We have not enough sewers, our water supply is inadequate, the municipal building must be completed, our fire protection in the business district is wholly insufficient. Besides these there are public improvements, such as grading and regrading streets, which must be carried forward without delay, and while it is true that the greater part of the most of these will fall upon the property affected, yet the immediate burdens on owners will be so great that the city should not add to them by unnecessary demands. This consideration, in my opinion, should be controlling upon the citizens of Seattle at this time.

"As for the Seattle Electric Company, it is waiting to see what the voters do at the special election. The company came into the field here when there were half a dozen or more independent and in many cases competing companies, most of which were in the hands of receivers. The service was poor. There was no transfer system. The equipments were run down. The company instituted a better service, replaced the worn equipment, built new lines, gave general transfers, and has done its utmost to keep pace with the growing demands of the city. In the outlying districts it has been a leader of population, not a follower. By reaching out to localities where land prices are low, often regardless of the fact that the new lines in the beginning were not profitable. it has made it possible for persons of moderate means to own their own homes in the suburbs and to get to their work conveniently, and has aided and made possible the development of large districts which otherwise would have remained unimproved. The company has prospered by this policy, and its policy in the future will be as it has been in the past.

"Some of the criticism of the company's service, in respect to overcrowding of cars, is justified. It has not been any more possible for the company to foresee all the extraordinary growth of the city than it has been for the city authorities, or men engaged in other enterprises. Orders for new cars and other equipment have to be given practically a year in advance, and often before the expiration of six months after the order has been given

it has become apparent that the provision was not sufficient. But this has been true in all departments of the city service. It has been true of the water department, of the sewer department, and in fact of all affected by the city's growth.

"Stone & Webster are the owners of about thirty properties in various cities. Their experience, resources, opportunities for purchase in large quantities on favorable terms, as well as their broad experience and liberal policy, have combined to render the Seattle service as nearly what it should be as the extraordinary conditions which I have mentioned would permit. The president and manager here have been accorded the most complete power in all matters of local concern—the business policy of the company is as much dictated by local conditions as if all of its stock were owned in Seattle."

SPECIAL CALL OF CENTRAL ASSOCIATION TO CONSIDER STANDARDIZATION

With a view of co-operating with the American Street and Interurban Railway Association in its work of standardizing equipment, the officials of the Central Electric Railway Association have called an informal meeting of the representatives of the mechanical departments of city and interurban companies, members of the association, to be held at the Aveline Hotel, Ft. Wayne, at 7 p. m., Sept. 26, the day preceding the next meeting of the association, for the purpose of making some definite recommendations to be presented at the national convention the week of Oct. 15, at Columbus, on the following subjects: Brake-shoes, journals and journal boxes, tread and flange of wheel, rails for interurban railways.

Members of the association are requested to come to this meeting prepared with data as called for by the standardization circulars which have been forwarded from time to time by the New York office of the American Street and Interurban Railway Association. E. W. Evans, superintendent of motive power of the Indianapolis Traction & Terminal Company, of Indianapolis, has been asked to preside at this meeting. Mr. Evans is a member of the engineering associations committee on standardization.

Secretary Merrill urges that every road represented in the Central Association have a representative of its mechanical department present at the Columbus meeting, prepared to take an active part in the discussion, and he also urges that as many as possible be present at the informal meeting at Ft. Wayne, which is called for the purpose of preliminary discussion and making of recommendations on the subjects mentioned.

POLICE REPORT ON CONEY ISLAND FARE TROUBLE SCORES PUBLIC OFFICIALS AND THE DAILY PRESS

Police Inspector Adam Cross's report to Commissioner Bingham on the recent fare disturbances along the Brooklyn Rapid Transit lines running to Coney Island has been made public. In it the Inspector blames an "inflammatory press" for "nearly all the trouble," and says, referring to Bird S. Coler, Sheriff Flaherty, Magistrate Higginbotham, and Highways Commissioner Van Vleck, that "the reprehensible attitude and unseemly interference" of these "gentlemen" who "butted in" was another reason for the trouble.

The Inspector reviews the occurrences along the Coney Island routes at length, beginning with the Gaynor decision on the five-cent fare question and relating, with detail, the happenings of Sunday, Aug. 12, the first day of the rioting. He says that the police were in a difficult position and that they arrested the railroad men wherever unnecessary force was used in ejecting a passenger. He tells of Coler, Flaherty and Van Vleck's visit to the scene; of the latter's using a wrench in an attempt to start a blocked car, and of his making a speech to the passengers advising them not to pay a second fare. Then he speaks of the Sheriff's appearance at King's Highway on the Tuesday, bent on seeing that the police protected passengers. He says that after Sheriff Flaherty had satisfied himself as to the manner in which the police were acting "he and his deputies absented themselves and disappeared from view." The Inspector's letter then says:

"It is no exaggeration to state that nearly all of the trouble that occurred can be attributed to an inflammatory press. The reports printed in some of the newspapers of assault and disorder were greatly exaggerated, misleading, and untrue."

As an instance, he says he and his men were charged with aiding and favoring the railroad. He emphatically denies that such was the case. The letter continues:

"To the reprehensible attitude and unseemly interference on the part of a number of gentlemen aforementioned, who tried to get into the limelight, who tried 'to butt in,' if I may be permitted to use the term; who endeavored to excite, by their inflammatory remarks and actions, the people to riot, presumably for the purpose of aggrandizing or gaining political prestige for themselves, is another reason why this controversy between the road company and its passengers reached such a serious aspect for a time."

TUNNEL AND "L" CONNECTIONS FOR NEW YORK BRIDGES

At the meeting of the plan and scope committee of the Rapid Transit Commission of New York last week, Chief Engineer George S. Rice laid before the committee his report on the proposed plan to build both an elevated loop and a subway loop. After the meeting Controller Metz declared that it now looked as if something finally would be done to relieve the intolerable congestion at the Manhattan end of the Brooklyn Bridge. He approved Mr. Rice's plan for a subway loop, but declared that the main thing was to give relief as soon as possible. If an elevated loop is built, he declared, it should be only a temporary arrangement, and a definite time should be set for its removal. The Controller declared that President Orr shared this view.

As contemplated in Mr. Rice's report the present elevated structure from the terminus at the Brooklyn Bridge as far north as Delancey Street would have to be constructed into a double-decker, with the main lines on the lower tier and the loop lines on the upper. A new station would be built at Delancey and Allen Streets and at Park Row and Duane Street. The total cost of the improvement, including damage to abutting property, is estimated at $3,500,000. The cost of the various loops and connections is estimated at $16,080,000.

The estimates for the various proposed subway connections are as follows:

BOROUGH OF MANHATTAN

A four-track subway from the Williamsburg Bridge terminal, which is now under construction, to the Brooklyn Bridge	$3,400,000
Changes of Brooklyn Bridge approach to connect with subway	750,000
A two-track subway from the Brooklyn Bridge through William Street to a point north of and near Wall Street	700,000
A two-track subway on Grand Street and Desbrosses Street from Centre Street to Washington Street	1,530,000
A two-track subway in Liberty Street and Washington Street from William Street to Desbrosses Street	2,100,000
A two-track subway in Washington Street from Desbrosses Street through Greenwich Street, Ninth Avenue, Fourteenth Street, University Place, Washington Square East, Wooster Street and Canal Street to Centre Street	5,600,000
Easements (estimated)	2,000,000
Total	$16,080,000

BOROUGH OF BROOKLYN

A two-track connection from the elevated tracks on the Williamsburg Bridge to the subway at the intersection of Bedford Avenue and Broadway	420,000
A four-track subway in Bedford Avenue and Bedford Avenue extension, from Broadway to Lafayette Avenue	2,520,000
A four-track subway in Lafayette Avenue from Bedford Avenue to Fulton Street	2,050,000
A four-track subway in Fulton Street from Lafayette avenue through Flatbush Avenue extension, Willoughby Street and Fulton Street to Myrtle Avenue	1,830,000
A two-track connection from the subway at Myrtle Avenue and Fulton Street to the elevated tracks on the Brooklyn Bridge	410,000
Easements (estimated)	200,000
Total	$7,430,000

CLEVELAND'S LOW FARE FIGHT

The Cleveland Electric Railway Company has filed a petition asking the Supreme Court to advance the Reynolds suit for an early hearing. The suit was brought in the Common Pleas Court originally. It attacked rights of the low-fare company on Dennison Avenue, the first street upon which the low-fare obtained a grant, on four grounds, viz.: that a small portion of the projected route was outside of the city, preventing free bidding; that the $10,000 cash deposit required was too heavy and hindered free bidding; that the successful bidders were required to give free transfers, thus placing an unequal burden upon the Cleveland Electric, and that the City Clerk neglected to advertise three weeks for bids.

The lower court held that there was some doubt as to the legality of the grant on two counts, but held for the Forest City Company in the main. The Circuit Court decided wholly for the low-fare company. The case, under ordinary conditions, would not come up for two years. If the Cleveland Electric should win this case, it would mean not only the loss of the Forest City Company's grant on Dennison Avenue, but on nearly all other streets where it has obtained grants, because the later grants have all been made as "extensions" of the original route in order to prevent competitive bidding.

The Central Avenue franchise for the Forest City Company was to have been passed Monday evening, but was not brought up. It appears evident that the old company is the victor for the time being, at least, in the battle for consents of owners of this street, which is one of its most important arteries; otherwise the ordinance would have been put through.

ANOTHER EFFORT AT INTERCHANGE OF TRAFFIC IN THE WEST

D. G. Edwards, traffic manager of the Schoepf properties in Ohio and Indiana, has for some time past been negotiating with leading steam road officials relative to an interchange of business between the lines in this important traction system and the steam roads of the Central Passenger Association. Heretofore the Central Passenger Association has declined to recognize the tractions or do business with them, although several of the roads have individually made alliances with electric roads, much to the displeasure of some of the other roads whose business was affected by the arrangements. Mr. Edwards is an old steam road man, having formerly been traffic manager of the Cincinnati, Hamilton & Dayton Railroad (steam), and he has strong influence among the steam traffic men. One of the chief objections of the steam people to doing business with the electrics in the past has been the excuse that some of the electrics were not financially responsible. This objection is, of course, removed in the strong system representing something like 1500 miles over which Mr. Edwards has charge of traffic. There has also been the objection that the rates of electrics were lower than those of steam, and that such an alliance would result in many conflicting rates between certain points. Since the adoption of the 2-cent fare law in Ohio this objection has been practically removed in that State, and the rates are now substantially the same. At the meeting of the Central Passenger Association, to be held in Chicago this week, the committee appointed to confer with Mr. Edwards will make its report and recommendations, and the outcome of this meeting will be watched with considerable interest by all steam and traction men of the district.

SECRETARY MERRILL AN EMERGENCY MAN

J. H. Merrill, secretary of the Central Electric Railway Association, is demonstrating that his office of salaried secretary can be of value to the various roads in the association in more ways than those contemplated when the office was created. Aside from his routine work of preparing tariff sheets for governing interline passenger business, and of compiling and promulgating information and statistics of different kinds, he has recently been of assistance to some of the roads where information and quick action were required. For instance, a road in Ohio needed a number of extra cars on short notice to handle a big excursion. They could not be secured nearby, and as a last resort the manager telephoned to Mr. Merrill to see if he knew of any Indiana lines that could help him out; a few minutes telephoning to various roads radiating from Indianapolis soon had the desired rolling stock on the way to the Ohio manager. Another Ohio road had an accident, in which several Indiana people were injured. The matter of making adjustments with these people was placed in the hands of Secretary Merrill and the claims were quickly settled on a basis satisfactory to the company. Frequent visits among the various roads, and his wide acquaintance with operating practice and conditions in all parts of the district, have enabled Mr. Merrill frequently to supply information along certain lines, which has been of great convenience and value to the manager making the inquiry.

OHIO INTERURBANS COME UNDER SUPERVISION OF THE RAILROAD COMMISSION

The Railroad Commission of Ohio, appointed a few weeks ago acting under the Wirtz law, passed by the last Legislature of that State, has extended its supervision over electric railways, and in the future will require them to make the same reports and to follow practically the same regulations that have been required of steam roads in the past. Representatives of the Commission have already made thorough investigations of two or three wrecks which have occurred on Ohio interurban roads within the past few weeks. The Commission has decided that it wlll not attempt this year to require the interurban roads to make the same detailed reports of equipment, earnings, operating expenses, employees, etc., that is required of the steam roads, because these reports are due within a few weeks, but it will shortly call a meeting of Ohio interurban operators to devise plans for more uniform regulations and schemes of operation. The Commission will take up the question of safety devices on traction lines, and will require the roads to make reports of all accidents immediately.

It is also understood that the Commission will investigate the passenger rates charged by some of the interurban lines. The Commission holds that its jurisdiction extends to the electric roads in the matter of rates as well as in other matters. It is known that in a few instances where interurban roads do not have the competition of steam roads, they have always charged more than the 2 cents a mile rate which was prescribed by the last Legislature. It has been claimed by these roads that the 2-cent law referred only to the steam roads and that therefore they do not come under the province of its rule and there may be some controversy on this point.

ANNUAL MEETING OF THE ALLIS-CHALMERS COMPANY

The annual meeting of the stockholders of the Allis-Chalmers Company held in Jersey City, Sept. 6, was marked by an unusually large attendance, more than 65 per cent of the entire capital stock being represented. The re-election of W. H. Whiteside to the presidency, and his election to the directory to fill the longest term in the gift of the company, assures a continuance of his aggressive policy. It is noticeable that the company has secured about $4,500,000 worth of orders for classes of machinery not hitherto manufactured by the company, and this amount would have been very largely augmented had the completion of the improvements and extensions of the West Allis plant not been delayed by the labor troubles to which the contractors erecting the new buildings have been subjected. Notwithstanding the fact that the volume of orders taken for Allis-Chalmers steam turbines has been beyond all expectation, the demand for Reynolds Corliss engines also shows an unprecedented increase over preceding years. In the electrical field the large orders received have hastened the occupancy of the new shops at West Allis provided for this branch of the business, which, in spite of their unfinished condition, are already in partial operation. Some of the largest corporations in the country have awarded the Allis-Chalmers Company contracts for their complete power and electrical equipments, thus endorsing President Whiteside's policy in providing the new departments established during the past year, which now enables the Allis-Chalmers Company to take orders for complete installations and thereby save purchasers the losses and annoyance incident to the division of responsibility in the erection and operation thereof. The acquisition by the company of the Christenson air brake and compressor patents rounds out the list of products required to enable the Allis-Chalmers Company to enter the electric railway field fully equipped for that service.

ILLINOIS TRACTION TO ENTER ST. LOUIS

The Illinois Traction System will bring its passenger and freight cars into St. Louis by transfer in sixty or ninety days, arrangements having been made with the Venice Terminal Company and the Madison County Ferry Company for the Illinois company's cars to cross the tracks of these two companies at Venice, and for the cars of the two companies to cross the Illinois company's tracks. The Illinois Traction System is now laying tracks at Venice, and proposes to have the road completed to the ferry landing in sixty or ninety days. The company has a frontage of 3600 ft. on the St. Louis levee in the vicinity of Salisbury Street, on land embracing 24½ acres, and it is enabled to enter St. Louis without operating its cars over the Merchants' Bridge. However, the plan of entering St. Louis on the Merchants' Bridge or the proposed new municipal bridge has not been abandoned. The company will finish its construction in East St. Louis by Jan. 1. It is now operating between Venice and Springfield, between Decatur and Bloomington, from Staunton to Litchfield and Hillsboro and between Danville and Champaign. Construction is under way between Champaign and Decatur, between Bloomington and Peoria and between Springfield and Lincoln, and all of these lines will probably be completed by Jan. 1. Work will be started early next year on the line, 30 miles long, between Springfield and Jacksonville.

SAN FRANCISCO SITUATION

After the eleven days' strike of the carmen of the United Railroads of San Francisco service was resumed as usual on Sept. 6, and has been continued since. The differences between the men and the company are to be settled by an arbitration board. As members of this board the United Railroads has selected Thornwell Mullally, assistant to the president, and the men, Richard Cornelius, president of their organization. The neutral arbiter has not been chosen yet, as some difficulty is being found in selecting a man who will be satisfactory to both sides. In all probability a judge of the local bench will be chosen. Meanwhile the United Railroads has declared itself for an open shop on its system, President Calhoun stating that he would discharge no efficient workman who wished to remain in his employ simply because he was not a member of a union. The men assume that this point will be arbitrated. A. L. Worthington, president of the Pacific Council of Electrical Workers, who has been foremost in the events of the last few days, has been chosen by the men as arbiter for all the workmen outside of the carmen. Track construction and reconstruction will be carried on as rapidly as possible. All building work of a permanent nature, however, will be postponed until the labor conditions reach a more stable and satisfactory basis. Among the improvements contemplated are new car houses, shops and sub-stations and a $1,000,000 central office building to house all the offices of the company.

INCREASE IN PAY FOR SURFACE CAR EMPLOYEES IN NEW YORK

The employees of the New York City Railway Company were voluntarily given an increase in pay, effective Sunday, Sept. 16. The new schedule provides that first-year motormen shall be increased from $2.10 a day to $2.25 a day; second year, $2.25 to $2.35; third, fourth and fifth years, $2.35 to $2.45, and after five years $2.50 to $2.60. The pay of conductors in their first year's service will be raised from $2.00 to $2.15; second year, $2.15 to $2.25; third, fourth and fifth years, $2.25 to $2.35, and after five years, $2.35 to $2.45. There are about 8000 men affected by the order. This includes every electric line in Manhattan, whether of the original Metropolitan Street Railway, a leased line or one operated by the company. The increases will aggregate from $700 to $800 a day, which will make the total increases in a year from $250,000 to $300,000.

Mr. Root, vice-president and general manager of the company, said:

"There are two reasons for this action. The first is that we wish to recognize the services of our men, and do recognize and appreciate them exceedingly. The second is that we wish to get the best men possible. And I think we have them. We are already paying higher wages than any other street railroad in this country, and by the new move will go still further. We wish to attract the best class of men, and the best wages will surely bring them."

TRIALS OF SPEED IN OHIO

As a rule, the managers of Ohio interurbans are adverse to high-speed contests or races with steam railroad trains, but occasionally there are exhibitions which demonstrate the astonishing speed powers of some of the interurban roads when cars have a clear track. There have been several demonstrations of this kind of late, which did not get into the daily print.

J. B. Foraker, Jr., of the Schoepf syndicate, tells of a little ride he recently took on the Ft. Wayne, Van Wert & Lima. The motorman on this line, which closely parallels the main line of the Pennsylvania, claim to have run away from or stayed alongside of every passenger train on the line, except the Pennsylvania special, the 18-hour train between New York and Chicago, which goes through very early in the morning. On this occasion they pulled onto straight track outside of Lima just as the flyer came along. For a few seconds it looked like an easy thing for the famous train, but after the big interurban got under way, she ran neck and neck with the special for more than 25 miles when a slow-down for a town allowed the flyer to get away. It was described as a wildly exciting burst of speed.

Superintendent Bradley, of the Scioto Valley, tells of a little trip on his road, which demonstrated the speed of his cars. A surgeon was wanted for a wealthy patient at Chillicothe, and the company was asked to get him there as quickly as possible. The car left Columbus station at 12:55 a. m. and didn't exactly observe the speed ordinance going out of town and arrived at Chillicothe at 1:59, 1 hour and 4 minutes for 49 miles, including 3 miles on city tracks and five stops for railroad crossings and passing points.

The Lake Shore Electric tested out one of its two-car limiteds with train operation one night recently and reached a speed of 71.1 miles an hour for a short distance.

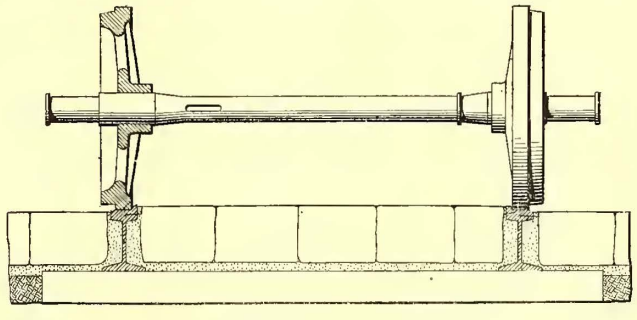
STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED SEPT. 11, 1906

830,568. Trolley Controlling Apparatus; Frank E. Case, Schenectady, N. Y. App. filed March 10, 1905. Pneumatic cylinders are provided for withdrawing the contractor shoe or the trolley from their operative positions as desired. The two cylinders are respectively under the control of the engineer's valve.

830,623. Rail; George B. Taylor and Constantine B. Voynow, Philadelphia, Pa. App. filed Feb. 17, 1904. Comprises a rail provided with a relatively broad and thick tread symmetrically disposed with relation to the plane of its vertical web and to the



PATENT NO. 830,623

cross-section of its base and having a lateral, retaining flange extending along one edge of the tread.

830,647. Vestibule Curtain for Cars; Samuel M. Dawson, Kansas City, Mo. App. filed March 6, 1906. In order to prevent the vestibule curtains from being torn when two cars separate, the patentee has a yielding catch which is tripped by a band connection whenever the cars separate to a predetermined amount.

830,686. Trolley Pole Controller; John J. Tartt, Los Angeles, Cal. App. filed Dec. 28, 1903. A solenoid magnet is connected to retrieve the trolley pole when energized by a special circuit completed by the movement of an upper pivoted section of the trolley pole whenever the latter leaves the wire.

830,733. Multiple Speed Railway; Leslie McHarg, New York, N. Y. App. filed June 18, 1904. A moving sidewalk platform has a number of rails on each side which have such a relative move-

ment and co-operate in such a way that straight rails are used when the platform is traveling in a direct line and curved rails when it is turning a corner.

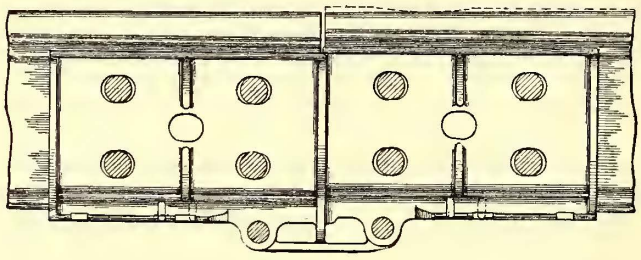
730,748. Fare Register Operating Device; Joseph A. Stone, Arlington, N. J. App. filed April 7, 1906. A shaft extends centrally in a longitudinal direction through the car and has lever arms on both sides for ringing up cash and transfer fares. Has slotted link connections with the respective registers.

830,791. Removable Handle for Fare Registers; William G. Kirchhoff, Chicago, Ill. App. filed June 16, 1905. Mechanical details of an adjustable handle applicable to a longitudinal shaft in a car. It is designed to be firmly positioned at any point on the shaft.

830,847. Rail-Joint; Arthur L. Plimpton, Boston, Mass. App. filed June 9, 1905. The process of repairing rail-joints, which consists in raising the worn rail, removably holding the same in raised position and cutting down its tread.

830,867. Extension Car Step; Benjamin Watson, Eden, N. Y. App. filed Dec. 29, 1905. The lower step is fixed to downwardly slidable rods, which are depressed by a foot pedal on the platform, and held in such relation by a detent against spring pressure.

830,922. Car Construction; Allen E. Ostrander, Paterson, N. J.



PATENT NO. 830,847

App. filed Jan. 10, 1906. Details of a steel frame car construction including the disposition of the vertical posts and diagonals with respect to the window openings.

830,940. Steam Motor Car; William G. Wagenhals, St. Louis, Mo. App. filed May 18, 1906. A steam engine for branch lines adapted to carry passengers and freight. Constructed like an ordinary dummy engine except the engine is on the bogie trucks and has swivel connections with the steam supply pipe.

831,025. Locomotive Engineer's Alarm; Edward McClintock, Merriam Park, Minn. App. filed May 16, 1904. Special conductors are laid adjacent the usual track rails and trolleys on the locomotive depend into continuous contact with the conductors. A special form of controller in the locomotive cab is effective to throw signal devices or telegraph instruments into circuit as desired.

PERSONAL MENTION

MR. GEO. W. PEIRCE has resigned as manager of the Stamford & Port Chester division of the Consolidated Railway of Connecticut, because of ill health.

MR. F. W. HAMLIN has been appointed master mechanic of the Eastern Ohio Traction Company. Mr. Hamlin was formerly train master with the Columbus, Delaware & Marion Railway.

MR. EZRA E. SAVAGE, for a number of years superintendent of the Dedham & Franklin Street Railway, has resigned from the company to take up residence in Union, Me. Mr. William E. Gardner, who has been connected with the company in a clerical capacity at Westwood, has been appointed to succeed Mr. Savage.

MR. FRED. S. BERRY has been appointed superintendent of the Orange County Traction Company, Newburgh, N. Y. Mr. Berry was connected with the Staten Island Midland Railroad Company for fourteen years, and during the latter part of this time he was assistant superintendent. For the past three years he has held the position of train despatcher on the road of which he is now superintendent.

MR. DANIEL O'DAY, prominent in Standard Oil affairs for many years and a figure in financial circles, died Thursday, Sept. 13, at Royan, in the South of France. Mr. Day was in one way or another connected with the following electrical corporations: Niagara Falls Power Company, International Railway of Buffalo, Buffalo General Electric Company, Cataract Power & Conduit Company, Venanga Power & Traction Company.

MR. CARL J. KIEFER has resigned as chief engineer of the Cincinnati, Milford & Loveland Traction Company, and has become associated with the Reliance Engineering Company, consulting and contracting engineers, of Cincinnati, Ohio, which makes a specialty of power and lighting plants and interurban electric railways. Mr. Kiefer had charge of the designing and building of the power station, sub-stations and road of the Cincinnati, Milford & Loveland Traction Company.

MR. ARTHUR W. FIELD, who formerly represented the Peckham Manufacturing Company at Boston, has been appointed general sales agent of the Standard Motor Truck Company, of Pittsburg, Pa. This company has been manufacturing double and single electric car trucks during the past three years under the name of the Standard Steel Car Company, of Pittsburg, Pa. The car company is said to have the largest plant for the manufacture of steel cars in the world, and is controlled by the same interests identified with the Standard Motor Truck Company.

MR. EDWIN JOWETT, for eight years chief engineer of the South Chicago City Railway Company, has recently accepted the position of assistant chief engineer at the Fisk Street plant of the Commonwealth Electric Company, Chicago. Mr. Jowett, whose record as a steam and electrical engineer is very enviable, is actively in charge of the operation of the plant, which is said to be the largest of its kind in the world. The generating units are Curtis-General Electric turbo machines, one of these which has just been installed having a capacity of 8000 kw, probably the largest single unit now in use. Mr. Lawrence W. Robinson, who was one of Mr. Jowett's assistants for more than seven years at the South Chicago plant, has been promoted to engineer in charge at the latter place.

MR. JOHN J. GETTINGS, division superintendent of the Springfield Avenue, Kinney Street and Plank Road lines of the Public Service Corporation, has been appointed superintendent of division No. 3, in which position he has charge of all lines in the section embracing Elizabeth, Westfield, Plainfield, Rahway, Perth Amboy and New Brunswick. Mr. Getting's old place has been halved, and Mr. John McCarthy, for the last nine years chief inspector at Market and Broad Streets, is now division superintendent in charge of the Plank Road line, while Mr. Joseph Sturm, who has been conductor and starter and more recently day depot master at the Plank Road car houses, has been promoted to division superintendent in charge of the Springfield Avenue and Kinney Street lines. Mr. McCarthy has been succeeded by Mr. William Dowling, who was his assistant. The Central Avenue line, hitherto operated in combination with the Orange Street line, is now a division by itself, with Mr. H. Valentine, for seventeen years a conductor and more recently depot master at the Central Avenue car house, in charge, with the title of division superintendent.

MR. RICHARD S. BUCK, M. Am. Soc. C. E., consulting engineer to the Department of Bridges of New York City, had recently become a member of the firm of Sanderson & Porter, of New York, the partners now being Messrs. Edwin Sanderson, H. Hobart Porter, Francis Blossom, Richard Talbot and Richard S. Buck. The firm's operations embrace all lines of civil, mechanical and electrical engineering, and it has designed, constructed and operated steam and hydro-electric power plants, railways and lighting properties in various parts of the country. Among its works now in hand may be mentioned 50,000 hp of hydro-electric work in two developments on the Pacific Coast; the power-house equipment and transmission system of the McCall Ferry Power Company on the Susquehanna River; extensive additions to the New Orleans street railway and lighting properties, and to those of the Mahoning & Shenango Railway & Light Company, of Youngstown, Ohio, and New Castle, Pa. Mr. Buck, the new member of the firm, was graduated from the Rensselaer Polytechnic Institute in 1887, and served on river and harbor works under officers of the Corps of Engineers, U. S. A., for some years. He then became general manager and engineer of a company engaged in mining phosphate rock in Florida, but left this work in 1893 to enter the field of structural steel design, fabrication and erection. His work in this specialty is too well known to need extended review here, for he has been identified in very responsible positions with several of the great bridges over the Niagara River and the East River and has also been the chief engineer of the Dominion Bridge Company.