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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 8000 *copies are printed. Total circulation for* 1905, *to date,* 277,550 *copies, an average of* 8163 *copies per week.*

The Ohio Coupon Book

The early bird catches the worm, and the Ohio Interurban Railway Association seems to have secured the honor of adopting the interurban interchangeable coupon book which will soon be the standard of the majority of interurban roads selling such books in the Central States. The Ohio book has been adopted by enough Indiana roads, as noted in our issue of Aug. 19, so that this, taken together with the fact that several Illinois roads have adopted practically the same form, makes it almost certain that this form of book is to be the standard. Probably when the roads in a number of States adopt the book, the name Ohio will be less prominent, but prices and form will doubtless remain much the same. Most of our readers interested in such matters are familiar with this interchangeable ticket book, but for the benefit of those who may not have followed the history of the matter, we may explain that the Ohio interchangeable coupon book is a book containing $12 worth of 5-cent coupons and selling for $10. These 5-cent coupons are good for 5 cents worth of transportation on any of the interurban roads signing the contract under which it is issued. It is a much more elastic arrangement than a mileage book could be, because of the different rates of fare prevalent on different roads. The Ohio Association canvassed the whole situation very thoroughly before it came to its conclusions in adopting this book. While it has its drawbaks, it seemed to come much nearer to suiting all the companies than anything else proposed. The Indiana Electric Railway Association devoted considerable attention to the same matter during the first six months of this year without arriving at any conclusions, but the signing of the Ohio contract by a number of Indiana companies seems to have settled the matter in favor of the Ohio form.

Steel Cars for Street Railways

The present tendency seems to be so strongly in favor of steel cars for underground and elevated roads that it seems almost certain that steel cars will make up an important proportion of the number of cars ordered for such service in the next few years, although it is not by any means to be expected that the wooden car will be entirely displaced in such service. For some time to come such a revolution in car building cannot be brought about in a day, and after all, the steel car building industry is in its infancy. Unless, however, several years' use should disclose some drawbacks to steel cars for elevated and underground service, their position in that service is practically assured. As to what place the steel car will take in surface street railway transportation is a matter for interesting speculation. The principal advantages of the steel car are, of course, its fireproof qualities and supposedly greater durability and strength than the wooden car. It is not feasible to make cars absolutely fireproof, even though most of the material going into them is fireproof. Much has been done the past two years in improving car house conditions and equipping with sprinklers, but the fact will always remain that as long as a large number of wooden cars are collected together in a car house the fire risk on cars will be considerable. It may be possible so to reduce the amount of combustible material in a car by adopting steel construction as almost to eliminate this risk, in which case it would be about as superfluous to carry fire insurance on cars as it is now to carry such insurance on absolutely fireproof power houses in isolated locations.

Handling Mail on Open Cars

Among the numerous trying details which enter into the operation of the modern street railway, the handling of mail on open cars is an exceptionally puzzling matter. At first thought it would appear simple enough to carry the bags either

on the floor between the front seat and the dasher or behind the last seat, but every street railway man who has tried either plan knows the difficulty of avoiding inconvenience to the passengers or the motorman by placing the bags within the car itself. Sometimes the Gordian knot is cut by carrying the bags upon the fender in front of the car, but this course can scarcely be recommended, considering the possibilities in the way of blocking the fender space and injuring the bags in case they fall beneath the car. On a closed car the front vestibule usually solves the problem without difficulty, for passengers need not be admitted to the motorman's compartment, but the open car is seldom built for anything but passenger work, and the trouble is consequently functional.

The interurban line which operates a combination smoker and baggage car need have little trouble with its mail handling, and the large system which can afford special mail cars is likewise well off in the matter. As for the ordinary open car, it should be a simple thing to design a stiff wire basket with a self-closing cover and padlock if necessary, which could be hung from the rear dasher without interfering with the trolley retriever or the tail lights. In case two or more cars should be run together, the mail basket could be transferred to the last car without the least trouble. The question is certainly worth thinking about in view of the damages in case of accident which might be collected by an injured party, through the obstruction of the fender, or by the Government in case of injury to the mails.

Practical Operation of Steam Turbines

The steam turbine as a prime mover in a power house is so new and its shortcomings are so religiously watched over by the turbine manufacturing companies that there is unfortunately at present a dearth of information on the practical points to be observed in the operation of large steam turbines in every-day work. When any device is new it is always the case that manufacturers, knowing that there will be numerous opportunities for improvement on the first designs, make strenuous efforts to see that but little leaks out regarding the practical drawbacks. This is probably wise, because it is human nature to criticise the shortcomings of new apparatus and to accept as a matter of course equally great shortcomings in standard apparatus. After a new invention has been able, first, to convince the world of possible customers as to its advantages, and second, to convince the manufacturing companies that users must be educated in its operation, more rapid progress is made.

To apply some of this generalizing to the steam turbine business, the steam turbine seems to be just now between the first and second stages of development mentioned. It has now secured a recognized place as a prime mover, and from now on, instead of hearing that these steam turbine units operate practically without attention, we will begin to learn something which is of much greater practical importance, namely, just what kind of attention they do need. For example, in the matter of starting up steam turbines, it seems to be pretty well established that they can be started much more quickly than corresponding sizes of reciprocating engines. The danger of knocking off cylinder heads because of condensation of water cannot exist in the turbine, and this is certainly a decided advantage over the reciprocating engine. There are, however, certain things to be guarded against in the turbine which need not be looked out for in the engine. Turbines are necessarily built with a very small clearance between stationary and moving blades. We have then the condition of a long shaft carrying moving blades and a long casing carrying stationary parts, with small clearances between the two. If either part contracts or expands more than the other, the clearance is reduced and rubbing may occur. The casing of the turbine in starting may not reach steam temperature as soon as the shaft. While it is easy to start a turbine quickly under light load, it is a very different thing to put full load upon it as soon as it is up to speed. The practice on one of the types of turbine in common use seems to have been to fix the governor so that the turbine can take only part load at first, gradually increasing the number of ports which can be opened by the governor as the turbine warms up. We have yet to hear of any large turbines with which it is possible to start up quickly and immediately take full load without rubbing. Since the first turbines were built it has been found unnecessary to have as small a clearance as was at first thought essential to economy, but the chances are that the danger of rubbing by careless starting will never be entirely done away with, and the sooner there is a free exchange of experiences on this point, the better.

Engine Efficiencies

Now and then, just as one is getting settled into a state of purring complacency over the virtues of our standard apparatus, there comes, generally from abroad, some disconcerting bit of news to convince one that the world is still moving. This time it is a set of engine tests that show very plainly the trend of modern improvements. Doubtless some of our readers are cognizant of them, but they are of a kind that demands solemn consideration. The substance of the tests as reported was as follows: A compound condensing mill engine of about 500 hp was tested with highly superheated steam. It was a marine type vertical machine with four valves per cylinder, and an independent superheater carried the temperature of the working steam up to between 720 degs. F. and 750 degs. F. The result was the most extraordinary yet reached anywhere, being per ihp-hour 9.2 lbs. at nearly full load and 8.6 lbs. at one-third load, the reduced load economy being regularly better than at full load. This remarkable feature, so pronounced that it must be dealt with as apart from any experimental errors, would apparently indicate merely that with great superheating the engine does best with rather extreme expansions, as indeed might be anticipated. Poor economy of engine at light loads has been so drummed into the ears of engineers that they seldom realize that a machine can be designed and rated so as to reverse this condition, just as in case of an electric motor. There is nothing inherently in the way of maximum efficiency at partial loads in either case.

Now let us see what this performance really means. Suppose this engine had been direct connected to a railway generator. Anywhere between one-third load and full load the indicated horse-power would have been given on an average of less than 9 lbs. of steam and the brake hp-hour on less than 10 lbs. At the ordinary generator efficiencies found in practice over this range of load, one would get the ehp-hour on, say, 10.7 lbs. of steam and the kw-hour on a little over 14 lbs., and this on a generating unit rating somewhere about 300 kw, while getting practically uniform economy over a wide range of load. It is enough to make one stop and think it over. It implies the possibility of getting an ehp-hour on 1 lb. of first-class steam coal and saving nearly, or quite, a pound of coal per kw-hour over anything reached in present practice. If this had been the first report of its kind, we should hesitate to take it so seriously, but several nearly as good have appeared before in England and Germany. The truth of the

matter is that our foreign brethren have been going in for high superheating, while people here have been denouncing it as "theoretical" or "impracticable," or some of the other things one calls a step which one dare not take. Now, as we remarked some time since, it is not yet clear how expensive the process of superheating really is, and evidently the coal economy cannot be quite so good as the steam economy, but since superheating is already advised and practiced in the use of steam turbines, the comparative situation has to be taken as it is. It means that the engines generally in use are being worked at a considerable disadvantage from a general hesitation to make good use of superheating.

Suppose one were dealing with a unit of 1000-kw output, giving, say, 15,000 kw-hours per day at the efficiency here considered. As above the present best practice, there would be a saving of something like 6 tons or 7 tons of coal per day, worth some $20 or $25. Now the real question for consideration is whether it is not advisable to try consistently for these higher economies, even at some added expense. We sometimes hear contemptuous insinuations that such figures as we have quoted are made under "test conditions" instead of "practical" ones. The actual meaning of this phrase is that the boilers are properly cleaned and fired and the engine kept in its finest running condition, instead of both being left to run themselves in care of men who can be hired at a figure pleasing to the executive committee. Test conditions are simply thoroughly good conditions which can be maintained perfectly well at a comparatively small extra expense if one is far-sighted enough to do so. Economy must be judged by the final results, not by individual items, and if a plant can cut down its fuel bill by $10,000 per year by spending $5,000 elsewhere in the running expense that is the policy to be followed. Superheating for engines is bound to come to an extent hitherto unheard of, and it is high time to stop mourning over hypothetical difficulties and to go ahead. It is the only step that can put the steam engine on anywhere nearly the same plane of efficiency as the gas engine, which is pushing so rapidly to the front. Efficiency is, after all, merely a question of working range of temperature, and whether it is reached by superheating or by other means, the end is the same. It is time for enterprising engine builders to busy themselves and to put upon the market engines fully up to the best machines tested abroad in thermal efficiency, as they certainly are now in mechanics.

The Weakest Link

The element of human fallibility in railway accidents is very forcibly brought to mind by the London papers which have just come to hand, giving an account of the terrible electric railway accident near Liverpool in which twenty people lost their lives. To recall the facts briefly, an electric express train, running about 40 m.p.h., from Liverpool to Southport, struck a train of empty cars which was standing on a siding, telescoped the two forward cars of the express and killed or injured nearly everybody in them. Fire broke out and added its horrors to those of the collision. At the inquest the facts as to the cause fortunately came out. The line was fully equipped with interlocking block signals, and the train had passed the distance signals in proper course, when the signalman, finding that the home signals would not clear, assumed that something was out of order and gave a hand signal to come on, thus turning the express into the fatal siding. Here was a case in which, apparently, every mechanical precaution that ingenuity could devise had been provided, and everything was in working order, yet all this foresight was made of no avail by the heedlessness of the operator. He had perhaps become, as men do, too much a part of his automatic machine, and when it behaved in a manner unexpected at that particular time, did the wrong thing. The driver of the express, too, took the hand signal at its face value and came on through the automatic danger signals at full speed.

Block signals, of course, sometimes fail, and it would be interesting to know whether in this case failure had been common enough to create any distrust on the part of the men. Presumably not, and in any event it would seem to be the most elementary precaution to enforce extreme care in running by an automatic danger signal, even when proceeding by direction of the signalman. Had the driver of the express kept his train under full control until he found a block signal set for clear ahead of him, the accident would have been averted or reduced to an insignificant shaking up. A good block signal system automatically going to danger in case of failure of the apparatus is the best safeguard against accident which has yet been devised, but neither it nor anything else can make up for lack of care or of prudence on the part of the human agents of control. More than all else, caution and good judgment are necessary on the part of signalmen and train drivers, and particularly in the matter of keeping the train in full control with respect to the signals. Danger signals are useless to a train which is running at a speed which cannot be checked until long after the signal has been passed. Every train bears before it a dangerous space equal in length to the braking distance at that particular speed. Unless danger signals are visible over a greater distance than this they are of relatively little use. In case of failure of the signals a danger warning may come down automatically, but it never should be disregarded to the extent of running by at speed, even in daylight, as in this latest catastrophe.

As we have many times intimated, the majority of accidents upon electric railways come from disregard of this elementary idea of the dangerous space. As a rule, modern electric cars are well provided with brakes, and are driven by well-trained and intelligent men. Many accidents are of a character quite unavoidable, as when a carriage suddenly turns upon the track in a clear road, or when, as last year, cars suddenly strike a grade made slippery by fallen leaves sodden with rain. But on the other hand, there are a good many cases in which single-track roads are worked at speeds which leave well-marked danger spots at curves and grades at which, if cars chance to meet, an accident is practically certain. At certain crossings, too, of roads and railways the conditions are such as to be a constant source of danger unless the cars are under full control. And a car under such circumstances is not under full control unless it can certainly be stopped at the appearance of danger before it reaches the crossing. Automobiles in reckless hands just now constitute a particular source of peril, which make a blind crossing a place to be feared, and impose an extra and undeserved burden of caution. But however or wherever danger arises, it cannot be wholly averted by any automatic means. It must depend in the last resort upon the skill and resourcefulness of the operators. The most that can be done with mechanical precautions is to adapt them to the requirements of the case in such wise as to simplify the work of the operators as much as possible. In so doing, it must not be forgotten that the signals and switching system may cease to be adequate when the original headway is halved and the speed is increased.

THE ST. GALL-SPEICHER-TROGEN ELECTRIC RAILWAY

BY HENRI SOMACH

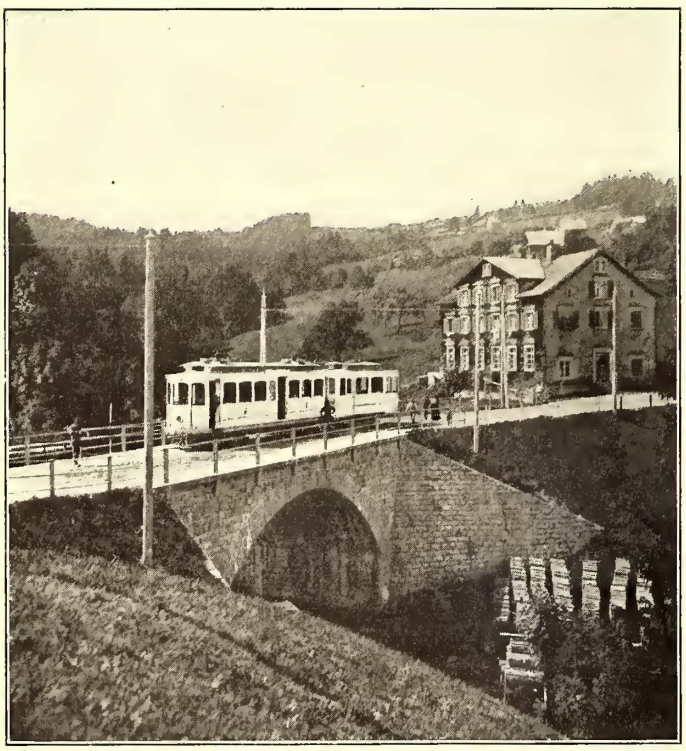
Switzerland possesses a number of important towns and smaller communities which are situated on plateaus with an altitude of 3000 ft. or so, and which are consequently cut off from all direct connection with the steam railroad system of the country. To provide access to these places by a railroad line of standard track and motive power would be too costly on account of the circuitous route which would have to be followed. On the other hand, a narrow-gage electric railway can often be built on existing highways without changing their grades, and forms a very satisfactory solution for this problem. This is especially the case in Switzerland, because all or the greater part of the electric power required for the road can nearly always be purchased cheaply from the numerous existing water-power plants which abound in the mountainous regions of the country. The service can be secured in an economical manner by means of motor cars of greater or less length, with sometimes the addition of a light trail car. In this way the dead weight of the locomotives is eliminated, the weight of the entire train is reduced and at least three-fourths of the weight required is available for traction. Under these conditions it is possible to mount grades as high as 8 per cent. The road which is the subject of this article is a typical example of a railway of this kind, and was put in operation July 10, 1903.

THE ST. GALL TERMINUS OF THE ST. GALL-SPEICHER-TROGEN ELECTRIC RAILWAY

It connects the city of St. Gall, having a population of 33,000 inhabitants, with Speicher, of 3000, and Trogen, of 2500 inhabitants. The altitude of St. Gall is 673 m; of Speicher, 926 m, and of Trogen, 919 m. The highest point on the line is at Vögelisegg, which has an altitude of 960 m. The entire length of the line is 10 km, of which one section, about 800 m in length, extending from the railroad station at St. Gall to the city limits, is used in common with the local system in that city. The minimum curve radius is 14 m.

PROFILE

As shown in the accompanying profile, the lowest point on the line has an altitude of 670.6 m, and the highest point 960 m, leaving a difference of 289.4 m in a distance of 5.5 km. This corresponds to an average in continual grade of 5.26 per cent. The actual maximum grade for a short distance is 7.5 per cent.



MOTOR CAR AND TRAILER CROSSING BRIDGE BETWEEN SPEICHER AND TROGEN

JUNCTION POINT OF THE 800 AND 500-VOLT TROLLEYS, SHOWING EXTRA OVERHEAD WIRE

TRACK

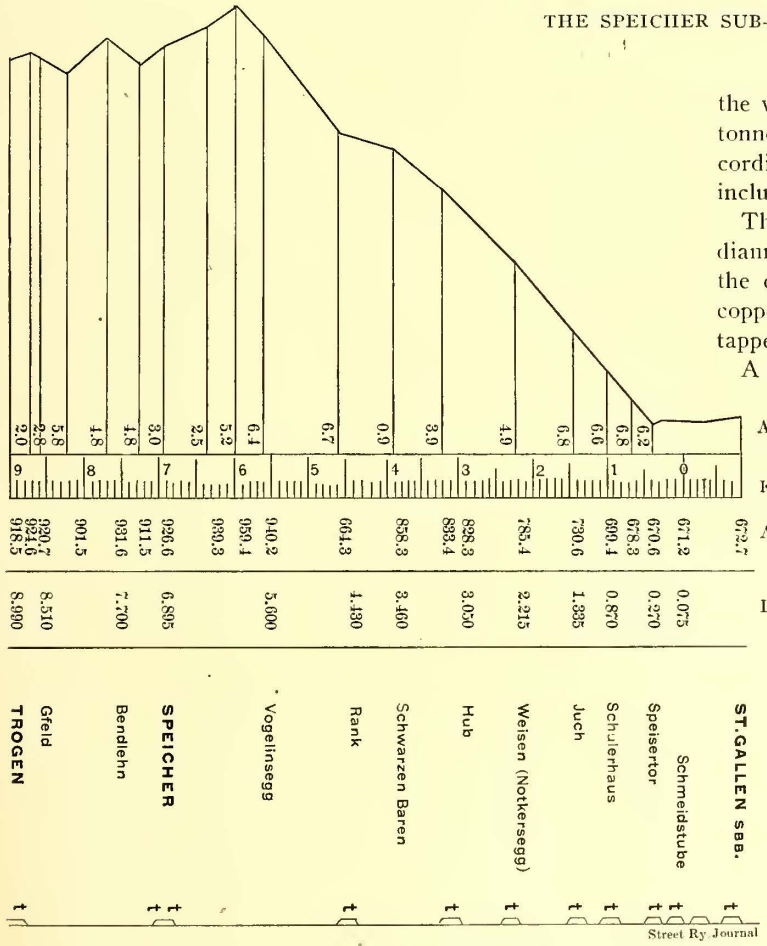
The line is single track with one meter gage, is laid on the public highway and is composed of grooved rails weighing 42.8 kg per meter, which are laid in lengths of 12 m. The weight per running meter of track is 98.35 kg. The substructure is

composed of broken stone 30 cm in depth and an upper bed of gravel 25 cm thick. It seems to the writer that it would have been better in the open country at least to have employed T-rails rather than those adopted. The T-rail has come into general use in Switzerland for light railways built on the side of highways, and grooved rails, as a rule, are employed only in towns and villages. The use of T-rails is especially desirable on lines reaching altitudes where the snow is abundant during the winter. If grooved rails are used, the groove becomes obstructed by snow, and the amount of power required to operate the cars is increased enormously.

THE SYSTEM OF DISTRIBUTION

On the division used in common with the local street railway in St. Gall the energy is supplied at 500 volts. Outside of the city, however, 800 volts are used on the trolley wire. This voltage is that which is generally used on the interurban electric railways in Switzerland. This difference in voltage requires no change in the motor equipment in passing from one section to the other, as the only effect is an increase in speed of the motors. It was necessary, however, to install some sort of automatic regulating device for the lamps. For this purpose an electromagnet is used with an armature which automatically inserts a resistance in series with the lamps when the car passes from 500 volts to 800 volts, and which cuts this resistance out when the car passes from 800 volts to 500 volts.

THE SPEICHER SUB-STATION OF THE ST. GALL-SPEICHER-TROGEN ELECTRIC RAILWAY



PROFILE OF ROAD

OPERATION

The company operates normally eleven trains each way between St. Gall and Trogen in summer, and ten trains each way in winter. Each train is composed of one double-truck motor car and one single-truck trail car, which can be used for either passengers or light freight. The company also has several single-truck freight cars. The weight of the train empty is 24.2 tonnes in the first case and 22.8 tonnes in the second case. The motor car alone weighs empty 18.7 tonnes. When loaded, the weights of the trains are respectively 29.5 tonnes and 33.3 tonnes. The speed varies from 12 km to 25 km per hour, according to grades, and the time of the trip is forty-two minutes, including intermediate stops.

The trolley line consists of two copper wires of 8 mm in diameter. Within the city steel poles are used, while outside the city impregnated wood poles have been installed. Bare copper feeders of 70 sq. mm section are employed, and are tapped into the trolley wire every 300 m.

A particularly interesting point in connection with the overhead system is the arrangement at the point where the voltage changes. At this point the company has installed in series two-section insulators of the same type as those employed for dividing the line into sections at other points. The cars pass over the insulated section, which is about 1 m in length, by momentum, although there is a grade here of 2.6 per cent. In case a train should become stalled at this point, a section of the 800-volt wire is carried parallel to the trolley wire as a precaution. To make use of it, it would be only necessary to transfer the trolley pole from the main wire to the reserve wire, but experience has shown that it is unnecessary, and that the cars drift over this point without trouble.

ROLLING STOCK

The standard motor cars of the company provide seats for thirty-six passengers, and are divided into smoking and non-smoking compartments. These compartments are separated by a small section of 4 sq. m for the transportation of baggage and mail.

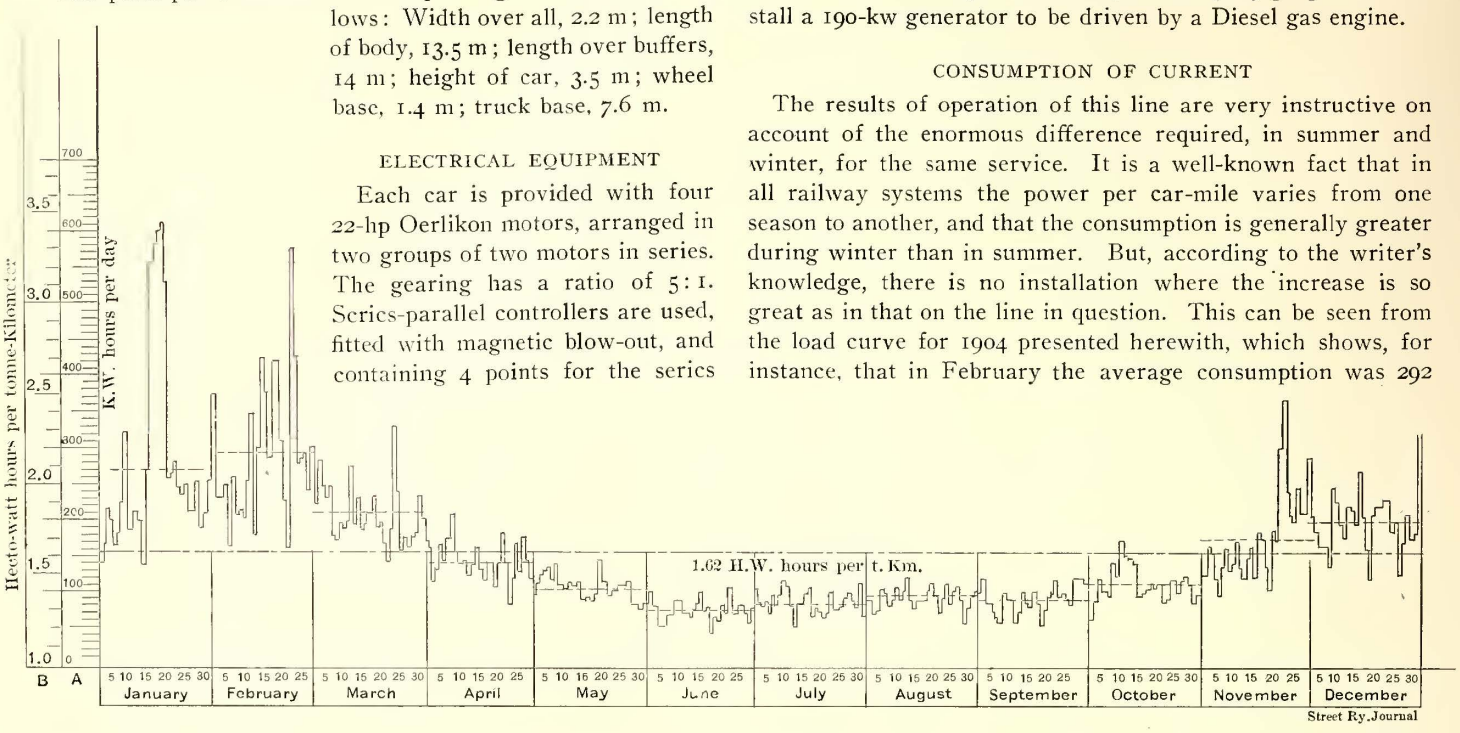
The cars are equipped with hand brakes and with Böker compressed air brakes. Air brakes are also fitted on the trail cars and can be operated from the motor car. In case of breakage of the coupling, the brakes are set automatically. The maximum effort in braking is from 75 per cent to 80 per cent

of the weight of the car. Axle-driven air compressors are used. The sand boxes are also operated by air, and are provided with electric heaters so that in damp weather the sand can be kept dry.

The principal dimensions of the passenger cars are as follows: Width over all, 2.2 m; length of body, 13.5 m; length over buffers, 14 m; height of car, 3.5 m; wheel base, 1.4 m; truck base, 7.6 m.

ELECTRICAL EQUIPMENT

Each car is provided with four 22-hp Oerlikon motors, arranged in two groups of two motors in series. The gearing has a ratio of 5:1. Series-parallel controllers are used, fitted with magnetic blow-out, and containing 4 points for the series connection, 3 points for the parallel connection and 6 points for electric braking. The cars are also equipped with eighteen electric heaters and two trolleys. The freight cars are designed for a carrying capacity of 7 tonnes, and are equipped with two motors of 40 hp each.



LOAD CURVE FOR 1904, SHOWING THE DIFFERENCE IN POWER REQUIREMENTS AT DIFFERENT SEASONS OF THE YEAR

SUB-STATION

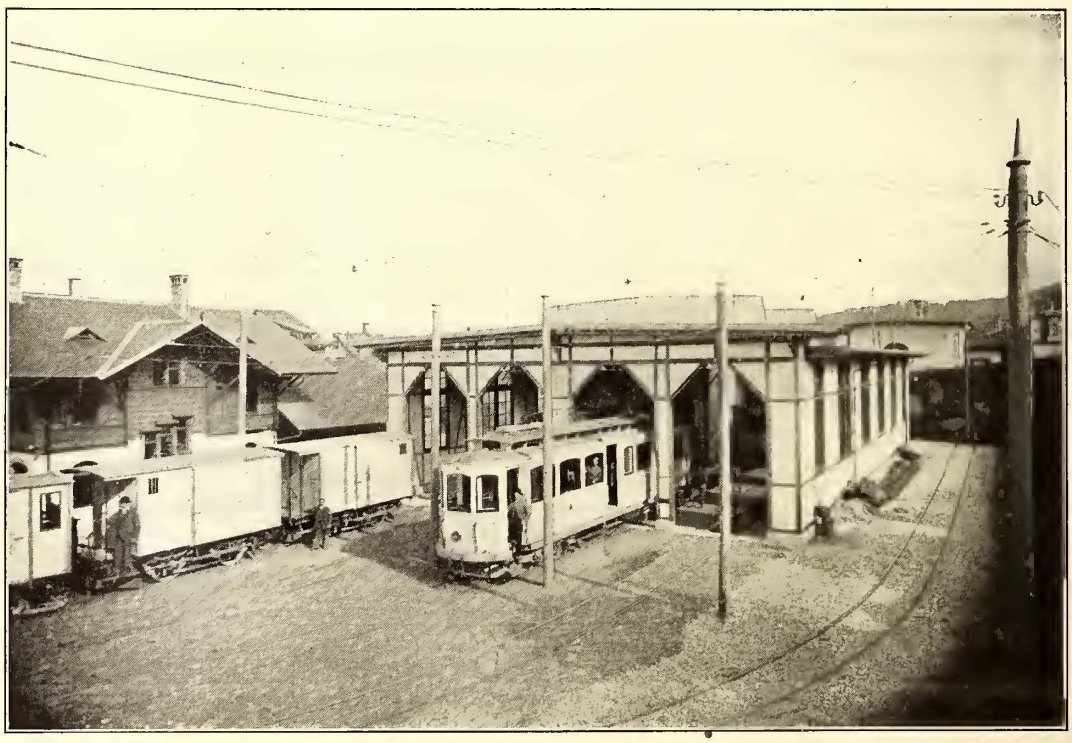
Electric energy is furnished from the Kubelwerk water-power plant in the form of three-phase current at 10,000 volts and 50 cycles. The railway sub-station is installed at Speicher, where the current is transformed to direct current at 800 volts. The apparatus includes three transformers of 150 kw each, from 10,000 volts to 2000 volts. Two of these transformers are used for railway service, and the other is for the lighting system of Speicher and Trogen. The direct current is supplied by two motor-generator groups, each consisting of a 150-hp induction motor direct coupled to a 105-kw, 800-volt, d. c. generator. These generators work in parallel with a storage battery composed of 400 cells with a capacity of 198 amp.-hours at the one-hour discharge rate. For charging these batteries the cells are arranged in two series of 200 cells each, and these two halves are connected in parallel. For discharge, the halves of the battery are connected in series.

The power station does not present any especially novel features.

In view of the fact that more power is required for the operation of the line, especially during the winter, than can be furnished from this power station, the company proposes to install a 190-kw generator to be driven by a Diesel gas engine.

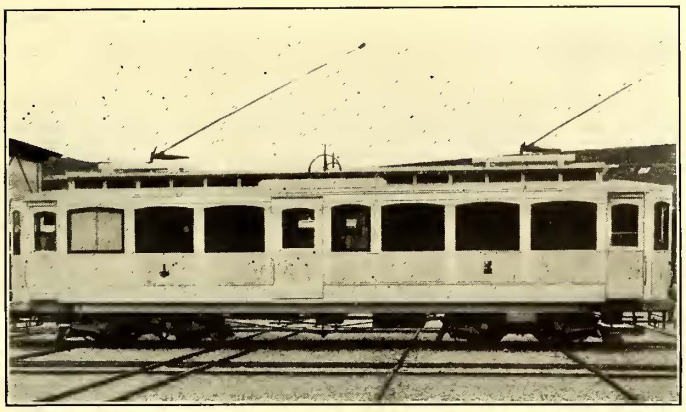
CONSUMPTION OF CURRENT

The results of operation of this line are very instructive on account of the enormous difference required, in summer and winter, for the same service. It is a well-known fact that in all railway systems the power per car-mile varies from one season to another, and that the consumption is generally greater during winter than in summer. But, according to the writer's knowledge, there is no installation where the increase is so great as in that on the line in question. This can be seen from the load curve for 1904 presented herewith, which shows, for instance, that in February the average consumption was 292 kw-hours per day, whereas in June it was only 70. The output per tonne-kilometer during 1904 averaged 162 watt-hours. During the summer months the output was less than this average, while during the winter months it was greater. The increase in consumption is largely due to the increase in rolling resistance in winter on account of the snow, and also to the operation of snow-plows. The results show how important it is in installations of this kind to design the power stations large enough.



SPEICHER CAR HOUSE OF THE ST. GALL-SPEICHER-TROGEN ELECTRIC RAILWAY, SHOWING ALSO TYPE OF FREIGHT AND PASSENGER CARS

All the electrical material of this line was furnished by the Oerlikon Machine Works. The cost of the complete line was Fcs. 1,420,000. The financial results of operation are very

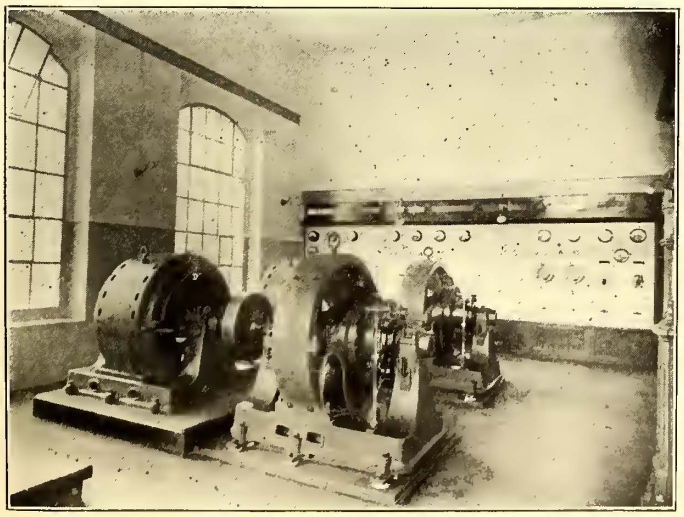


STANDARD DOUBLE-TRUCK MOTOR CAR USED ON THE ST. GALL-SPEICHER-TROGEN ELECTRIC RAILWAY

favorable, although the line traverses an agricultural region with a scant population.

HOLDING COMPANY FOR INTERNATIONAL TRACTION

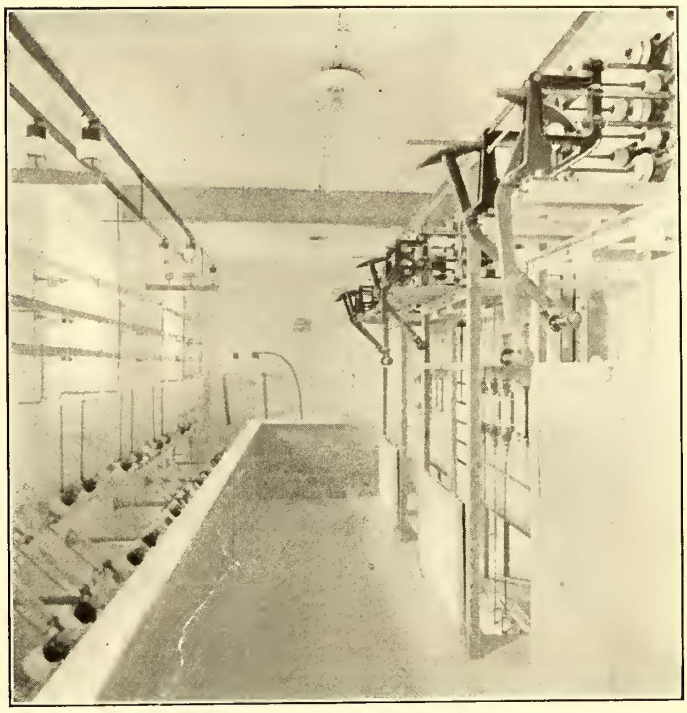
The organization was effected in New York on Tuesday of the Tractional Company, incorporated a few days ago under the laws of New Jersey. The capital stock of the company is $100,000, and interested in it are the owners of the International Traction Company, of Buffalo, for which it will act as the holding company. Although the authorized stock of the Tractional Company is $100,000, only $76,000 is to be issued at present. The holders of 76,000 shares of common stock of the International Traction Company, constituting a control of the common stock, have exchanged their stock for Tractional stock on the basis of 100 shares of International for one share of Tractional. A large amount of the preferred stock of the International is also held by the new company. According to the statement made by the bankers, three men control the



INTERIOR OF THE SPEICHER SUB-STATION OF THE ST. GALL-SPEICHER-TROGEN ELECTRIC RAILWAY

Tractional Company, G. Louis Boissevain, of Kean, Van Cortlandt & Company; Henry J. Pierce, of Buffalo, and Nelson Robinson. These three men, together with Grant B. Schley and T. DeWitt Cuyler, who is a prominent Philadelphia capitalist and a director of the Pennsylvania Railroad, are the directors of the new company. Mr. Pierce, who is president of the International Traction Company, was elected president of the new company. He is president of the Buffalo Chamber of Commerce, president of the Netherlands Tramways Corporation and a director in several other street railway companies. Nelson Robinson was elected vice-president of the new company, and Arthur Robinson, secretary and treasurer.

A statement current about the company that is not official is to the effect that its purpose extends considerably beyond the taking over of the International Company. The fact that Kean, Van Cortlandt & Company are interested in both the Detroit and the Buffalo companies, for instance, gives rise to the statement that eventually the Detroit United will be taken over. From one source comes the very bold conclusion that



REAR VIEW OF SUB-STATION SWITCHBOARD

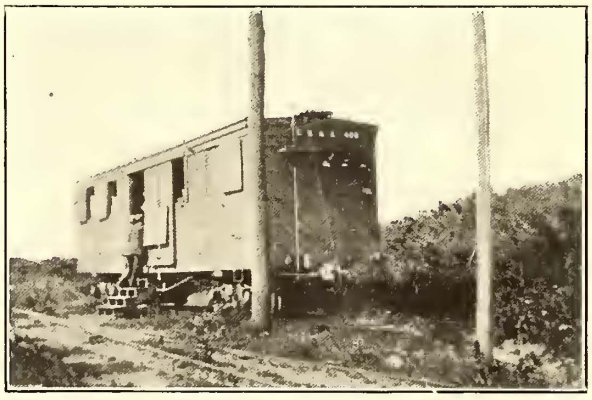
the Buffalo, Detroit and Toledo systems will all eventually be included in the scheme, and that these three cities will all be connected by a network of lines.

When the Toronto Railway Company asked the city of Toronto for the right to admit its radial lines, the city indicated its willingness to consent provided the Toronto Railway Company would forego its exclusive franchise and admit other radial roads upon terms to be decided by arbitration. The Toronto Railway Company has given valuable consideration to the city for an exclusive street car franchise until 1921. The company, notwithstanding this, offered to carry the cars of all radial lines, irrespective of their owners, upon terms to be decided by arbitration if the companies do not agree, from the city limits to the center of the city and return them, provided the city in 1921 would continue this practice. The question in dispute between the city and the company is not the one of "Upon what terms shall the present suburban lines radiating from Toronto be admitted," but the broad one of "Shall there be provision made for the entrance of all suburban roads?" The city desires the company to adopt a broad general policy during the tenure of its franchise, but frankly confesses that it is not willing to continue this policy should it assume the urban franchise in 1921.

THE NEW HAMPSHIRE TRACTION COMPANY'S PORTABLE SUB-STATION

An interesting portable sub-station, somewhat similar to those which have previously been described in this paper in connection with other roads, is in operation this summer at Seabrook Beach, N. H., on the lines of the New Hampshire Traction Company. The outfit is housed in an ordinary freight car, which stands on a short stub track at Salisbury Junction, where the lines of the New Hampshire Traction Company meet the trackage of the Haverhill, Amesbury & Merrimac Street Railway Company. Salisbury Junction is about 2.5 miles from Hampton Beach, and at this point cars moving northward from Black Rock and Salisbury Beach, and cars moving seaward toward Hampton Beach from Amesbury and the other cities and towns of the Merrimac Valley, come together for passenger transfer. Three different tracks meet at this place, which is consequently a strategic point in the distribution scheme of the New Hampshire Company's system.

The car is of the box type, weighs 29,200 lbs., and has a capacity of 60,000 lbs. It was built by the Laconia Car Company, and contains a 250-kw rotary converter and other equipment, which is supplied with current generated at the New Hampshire Traction Company's main power plant in Portsmouth. In the summer season the heavy traffic occurring along the famous beach resorts of Northern Massachusetts and New Hampshire requires additional power facilities in this district, and in the winter there is little or no need of such provision. For this reason the company installed a portable sub-station, which in the fall and winter is available for use at other points, notably in connection with the Rochester Fair.



PORTABLE SUB-STATION OF THE NEW HAMPSHIRE TRACTION COMPANY

A three-phase 13,200-volt circuit is brought to the car on overhead poles and dead ended on three high-tension porcelain insulators mounted on top of the car. The last pole of the line is equipped with double cross-arms to insure greater mechanical stability, and the pole is strongly guyed. Three taps are taken from the line between the last pole and the dead ends, and the wires carried to triple-petticoated porcelain insulators mounted on iron pins set in a horizontal iron strap secured in a recess in the end of the car. The bare transmission wires connect at the insulators with rubber-covered cables, which pass upward through porcelain bushings into the car. In one corner of the car, inside, are mounted banks of General Electric carbon pencil lightning arresters. From the arresters the three cables pass to the oil switches, which are set up on the opposite side of the car in the corresponding corner, and from the oil switches the circuit is carried to the stationary transformers and reactive coil, which occupy the center of the car on the side nearest the high-tension line. The reactive coil forms the nucleus of this arrangement, one transformer being set up on each side and one in front of the former. Opposite the center doors of the car is a motor-driven blower which cools the transformers and the reactive coil by forcing air to them through a 3-ft. x 2-ft. wooden duct; the latter branches at the reactive coil to the three transformers. The transformers are of the General Electric Company's air-blast type, each being rated at 100 kw. They reduce the 13,200-volt current to one of 356 volts for use on the a. c. side of the rotary. The blower is of the Buffalo Forge type, direct driven by a 6-pole, 1-hp, 350-volt, three-phase motor at 500 r. p. m.

The inside of the car is about 32 ft. long x 9 ft. wide, and practically the entire northern third is occupied by the 250-kw rotary, which has four poles and makes 750 r. p. m. when running on 25-cycle current. The rotary is set upon four iron plates by means of set screws, which may be used for raising or lowering it in order to give the proper alignment. The set screws pass through the bed-plate, and the supporting plates beneath are each about 6 ins. square and ¾ in. thick. Extra stiffening was provided in the channel beams beneath the car to take care of the rotary's weight. The low-tension rubber-covered cables running from the transformers to the rotary are carried through the upper part of the car in porcelain insulator clamps secured to the roof. As there is but one rotary in the sub-station, no synchronizing apparatus is required, but a Thomson alternating ammeter of 25 amps. capacity is installed on one of the car walls. The motor-driven blower is supplied with a blue Vermont marble starting panel mounted close by the outfit, and carrying a double-throw triple-pole switch for throwing about half voltage upon the motor in starting. The a. c. side of the rotary is controlled from a marble starting panel mounted on the floor in front of one of the transformers. This panel contains a triple-pole double-throw switch and the handle of the oil switch which connects the incoming high-tension line with the transformer primaries.

Against the west wall of the car are mounted the direct-current switches and instruments feeding the New Hampshire Traction Company's lines. There is no standard direct-current switchboard in the car, but the apparatus constitutes a combination generator and feeder group, consisting of a 1500-amp. Thomson indicating ammeter, a 750 Weston voltmeter, a Thomson recording wattmeter, a lightning arrester, a type M circuit breaker and a single-pole quick-break knife switch. Some of this equipment is mounted on wooden frame work, and the balance on small separate marble panels. A barrier of sheet asbestos about 18 ins. x 30 ins. is attached to the car roof about 4 ins. above the circuit breaker to prevent arcs blown up the chamber of the latter from causing fires. Power is also supplied to the line of the Haverhill, Amesbury & Merrimac Street Railway between Salisbury Junction and Black Rock through a frame switchboard on the opposite wall of the car. This carries a Thomson recording wattmeter and a single-pole feeder switch. The field rheostat of the rotary converter is mounted on angle irons set upon the floor near the center door on the east side of the car, and the car is lighted from the trolley by a series of five 16-cp lamps set in the roof. There is no section insulator in the trolley between Salisbury Junction and the New Hampshire Traction Company's permanent sub-station at the Amesbury car house, so that the portable sub-station at Salisbury Junction is not without light as long as the Amesbury rotaries are in operation, even though its own rotary is shut down. A lantern is, of course, available when all power is off the line.

Two men constitute the operating force at Salisbury Junction. The sub-station is in operation from 6:15 a. m. to 10:30 p. m. Mondays, Tuesdays, Thursdays and Fridays; from 6:15 a. m. to 11:30 p. m. Wednesdays and Saturdays, and from 7:15 a. m. to 10:30 p. m. Sundays. The day man works from 8 a. m. to 6 p. m., and the night man from 6 p. m. to 8 a. m. The latter is able to put in a night's rest, however, after the machine is shut down and the sub-station cleaned for another day's run. Readings of the wattmeters and the load are taken and recorded

hourly, and the sub-station is provided with a private telephone which connects it with the rest of the operating and power system. Acknowledgments are due to General Manager Franklin Woodman, of the New Hampshire Traction Company, for courtesies extended in the preparation of this description. J. T. Day is chief electrician of the company.

OPERATING RESULTS OF THE VALTELLINA RAILWAY—PECULIARITIES OF THE THREE-PHASE TRACTION

BY EUGEN CSERHATI

The "Valtellina line" has been opened for regular service since July 10, 1904, and on July 1 of this year was taken over by the Italian Government. As this line had previously been in operation for twenty-one months, the experience of two and one-half years allows a fairly reliable statement of the different items of operating expense, the working efficiency and other important features of three-phase railway operation. In the following will be given a brief summary of the results secured.

OPERATING COST

The expenses for labor and material in the Morbegno power plant from July 1, 1903, to June 31, 1904, amounted to Lire 21,553. During this period 3,420,502 kw-hours were generated.

The direct expenses for generating a kw-hour therefore amount to 0.63 centesimi, or about 0.118 cent.

The expenses for labor and material incurred for maintenance and inspection of working conductors, poles and transformer stations amounted to Lire 329 per kilometer of permanent line—that is, about $104 per mile.

The expenses for maintenance and repair of rolling stock, including electrical equipment and mechanical parts per locomotive or motor-car kilometer, amount to 4.36 centesimi—that is, about 1.38 cents per locomotive-mile or car-mile.

The total expenses for traction service, including lubricating and cleaning material, as well as labor, amounted on the average per year for the period with but partly electrically-driven freight trains to Lire 1.97 per 1000 ton-km, and for the period with trains conveyed exclusively electrically to Lire 1.71 per 1000 ton-km—that is, 0.62 cent and 0.54 cent per 1000 ton-miles, respectively.

The corresponding expenses on a steam line in Austria, selected for comparison on account of representing conditions similar to the Valtellina as regards curves and grades, although with a 30 per cent denser traffic, amounted to Lire 4.20 per 1000 ton-km. Hence the saving effected in operating expenses correspond in the first case to 3.98 per cent interest on the capital expenditure, and in the second case to 5.53 per cent, besides which the lighting of all stations and motor cars, as well as heating of the latter, is assured.

CURRENT CONSUMPTION TESTS

During the two years' operation of the Valtellina Railway thorough tests have been made as to current consumption and recuperation on levels and on grades, as well as the energy consumed at starting the trains. These tests have been undertaken by the engineers of the Rete Adriatica, Messrs. Novi and Donati, under the co-operation and superintendence of Mr. Celeri, engineer to the Italian General Inspection Service. The results of the same were published for the first time at the Congress of Italian Electricians, held at Bologna in 1904. The results stated below are taken from these reports.

As stated above, 3,402,502 kw-hours were generated at the Morbegno power plant during the year ending June 30, 1904. The number of ton-kilometers, weight of locomotives and the electrical equipment of the motor cars for the same period amounted to 76,845,265. Therefore the energy consumption per ton-kilometer amounted to 44.3 watt-hours, measured at the distributing board of the power station—that is, 71.3 watt-hours per ton-mile.

In these figures are included:

1. The energy required for traction by the trains.
2. All the losses between the switchboard of the power station and the wheel periphery of the rolling stock.
3. The current consumption for lighting all stations with 1254 incandescent lamps of 16 cp.
4. The current consumption for lighting and heating the motor cars and locomotives.
5. The consumption of energy for driving the machine tools at the Lecco repair shop.
6. The energy required for shunting and switching.
7. The energy consumed during various tests made for the purpose of inspecting the electrical apparatus and equipment.

The figure mentioned above, showing the energy consumption of 44.3 watt-hours per ton-km, was determined by the engineers of the Rete Adriatica, mentioned above, in thorough accordance with, but independently from, Ganz & Company for any period of the service. The net consumption per ton-kilometer was established by means of a motor car specially equipped for the purpose, being fitted out with ammeter and recording wattmeters for both overhead phases. The average of twenty tests showed a consumption of 31 watt-hours per ton-kilometer measured in the car. This figure quite agrees with the test results obtained by the staff of Ganz & Company.

These tests were extended with a view to establishing the net consumption in the power station, the train used for the purpose having run during the night after the termination of the regular service. The current consumption per ton-kilometer amounted to 34.9 watt-hours, and therefore the working efficiency of the system was 88.8 per cent.

In order duly to appreciate the importance of the figures quoted, it must be borne in mind that the profile of the Valtellina is a very unfavorable one, the average grade of the whole line as taken for both directions amounting to 2.5 per cent—that is, a train running through all sections in both directions, from one end to the other, and returning to the starting point, must be lifted about 527.5 m, which height corresponds to the mentioned average grade, the length of the run being $2 \times 106.5 = 213$ km.

The section between Lecco and Colico, on which the energy consumption tests were carried out, shows an average grade of 2.1 per cent, hence the 31 watt-hours must be regarded as the specific consumption per ton-kilometer at a speed of 60 km at a continual grade of 2.1, including starting.

For acceleration from rest to a speed of 60 km (37½ miles) per hour, 95 watt-hours are required per ton-weight, while the losses arising in the motor and rheostat amount to 6 watt-hours per ton-kilometer. Assuming an efficiency of 85 per cent for the motors, the motor losses amount to 4.6 watt-hours, so that there remain but 1.4 watt-hours for rheostat losses—that is, 4½ per cent of the total specific consumption.

A 120-ton train consumes 13 watt-hours per ton-kilometer at a speed of 60 km while continuously running on level track. A motor car running singly requires 48 watt-hours per ton-kilometer, including starting energy. The large difference as compared with the 31 watt-hours for a 120-ton train is due to air resistance, which is reduced in a much smaller ratio than the train weight.

It will be seen that in the light of economical considerations it does not appear to be advisable to replace heavy trains by numerous light trains or cars. Moreover, much importance should not attach to rheostat losses arising at starting, as often happens, as these losses are very small compared to the whole energy consumption.

RECUPERATION OF ENERGY

It is well known that a. c. induction motors have the pecu-

liarity of restoring energy to the line when running on down grades of a certain percentage, which varies according to traction resistance, while the speed is maintained practically constant. The practical value of this peculiarity has very often been doubted. However, the respective tests not only proved the possibility of recuperation, but settled at the same time the quantity of energy which could be gained. On a section with a down grade of 2 per cent, with a 120-ton train and a speed of about 30 km per hour, 28.2 watt-hours—that is, about 80 per cent of the energy—have been recovered which otherwise would have been lost in braking. The exceedingly favorable result in regard to energy consumption of the Valtellina is due chiefly to this circumstance.

The question as to how to utilize the energy thus gained has likewise often been discussed. The simplest solution would evidently be to equip with electric traction not only the steep grades of mountain lines, but also the adjoining level sections, in order to assure the utilization of the returned current of descending trains. Advantage may be taken not only of the energy regained when trains run on down grades, but also when being stopped on level sections, provided that the motors are designed for cascade working. In this case the speed will be reduced to a fraction of synchronous speed when switching over to cascade connection, and the energy which has been required for train acceleration from rest to full speed is partly given back by the deceleration. The energy recuperated in this way amounts to from 35 per cent to 40 per cent of that used in acceleration, and to about 10 per cent of the total consumption.

This advantage is of the utmost importance in suburban railway service where heavy trains have to be started and stopped within relatively short distances. It has, for instance, been proved, in a project worked out for the Vienna suburban lines, that with a four-step cascade connection, by means of one or two parallel working primary and two secondary motors connected in different combinations, more energy would be given back at stopping than the rheostat losses amounted to at starting.

The economical importance of this condition cannot be denied, either, in the case of main railways, inasmuch as both express and local trains must be stopped rather frequently from a high running speed. The acceleration of these trains represents an important part of the total energy required. With simple cascade working 35 per cent to 40 per cent of this energy, as above mentioned, may be saved; with four-step cascade connection even more.

In the case of hydro-electric power stations, the energy recuperation is so far of importance that it allows the operation of a longer line or heavier trains from the same plant than would be the case without recuperation. With steam plants the saving is shown in operating cost.

ENERGY CONSUMPTION AS A FUNCTION OF GRADES

For a certain speed the energy consumption may be represented very simply as a function of the grade. Assuming that the motors work with an efficiency of 100 per cent, the energy consumption per ton-kilometer expressed in watt-hours will be:

$$s = c\ (w \pm i)$$

c being a constant, w the resistance in level and i the grade represented in meters per kilometer. The plus sign is to be applied on up grades, the minus one on down grades. The equation represents two straight lines cutting the ordinate axis at the same point. By halving the sum of the ordinates, we get the average current consumption at a total period of running in both directions, with due regard to recuperation. The equation shows that, provided the motors would work with an efficiency of 100 per cent, the average current consumption would be the same on lines with grades as on level lines.

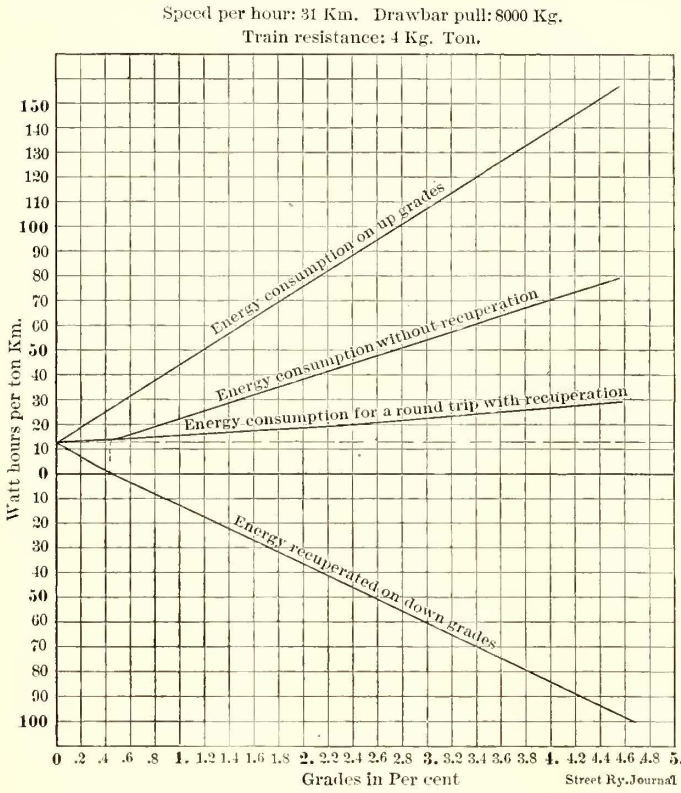
If we consider the motor efficiency, which, as is well known, increases with the load, the current consumption on up grades will be:

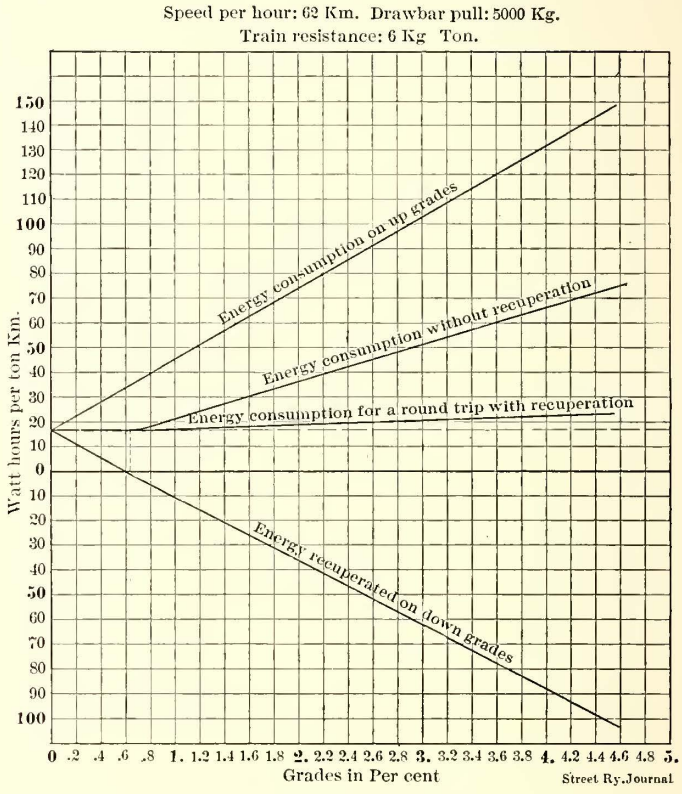
$$S_u = \frac{c}{\eta}\ (w + i)$$

and recuperation on down grades:

$$S_d = c\eta\ (w - i)$$

By means of these two equations and the curves showing





FIGS. 1 AND 2.—SHOWING THE CURRENT CONSUMPTION AND RECUPERATION ON DOWN GRADES, FROM 0 PER CENT TO 4.5 PER CENT, FOR SPEEDS FROM 30 KM TO 60 KM

motor efficiency at different loads, the curves represented by Figs. 1 and 2 have been drawn, showing the current consumption and recuperation on down grades from 0 per cent to 4.5 per cent and for speeds ranging from 30 km to 60 km. The half of the algebraic sum of ordinates represents, also in these cases, the actual consumption at a period up and down the grade. As will be seen, the consumption increases with increasing grades relatively slowly, especially at higher speeds, on account of the motor efficiency at single connection being higher than in cascade.

Where the curve meets the abscissæ—when running down grade—we get the down grade on which the train requires no energy for traction. Figs. 1 and 2 also show a curve, giving the energy consumption when the train descends without recuperation. We therefore get the average consumption for a cycle by halving the ordinates for the run up grades.

From the above it will be clearly seen how the economy increases with a system affording recuperation compared with one lacking that quality. The difference in favor of the three-phase system, allowing recuperation on down grades, is as follows:

With grades of per cent.	1.0	2.0	3.0	4.0	4.3
At a speed of 30 km.....	40	100	132	165	169
At a speed of 60 km.....	21	90	*150	*200	*250

* Speeds of 60 km per hour have not yet been employed on the grades represented by these figures.

FLY-WHEEL EFFECT

As will be seen by the load diagrams, Figs. 3 and 4, taken at the Morbegno power station, the load peaks caused by the starting of even the heaviest trains are not higher than about 70 per cent to 80 per cent of the energy requirements corresponding to the average consumption of the trains in operation. This favorable circumstance is due in the first place to the use of water rheostats, allowing a smooth starting effort, so that there can be no sudden rush of current. In the second place it is due to the peculiarity of induction motors in taking no current from the line as soon as the periodicity is reduced by about 1 per cent to 2 per cent. If the latter is further diminished, current is even given back to the line, consequently, when starting a heavy train, the speed of the generators and prime movers falls slightly and the periodicity diminishes; therefore the short-circuited motors of the running trains take no current until their speed drops to the value corresponding to the number of revolutions at the power plant. In this way the load on the latter is equalized. If the speed of the generators should be reduced suddenly by more than 2 per cent, current would be restored to the line by the motors of all moving trains, that is to say, the moving trains would act like a huge fly-wheel, having the effect of flattening out the momentary peaks, an exceedingly valuable peculiarity of the three-phase traction system which should be duly appreciated, as up to the present time very little or almost no attention has been paid to it.

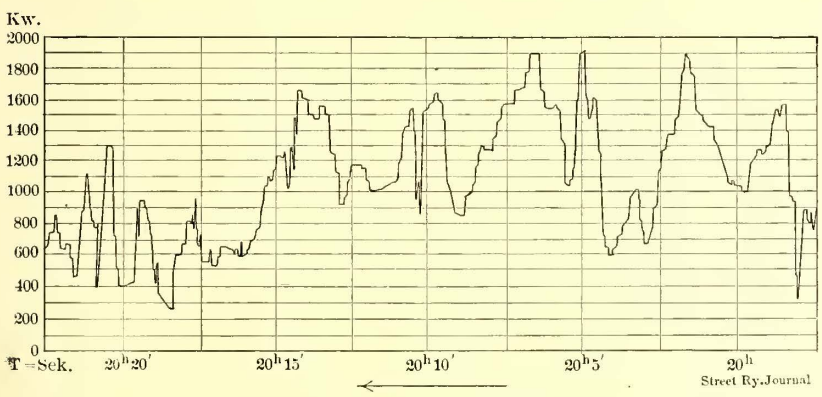


FIG. 4.—LOAD DIAGRAM, TAKEN AT THE MORBEGNO STATION

OUTWARDLY DISPOSED COLLECTOR RINGS

On the latest type of the Valtellina locomotives, as described in a recent article in this paper, the collector rings are not placed on the motor shaft between the locomotive frames, but outside of the latter. By this arrangement they are much more accessible for inspection and repair, and the entire space between the locomotive side frames is available for the motor frames and rotors. This is not a difficult task with a three-phase motor, as only three conductors are required. If, however, the collector of a continuous or single-phase alternating-current motor were arranged in this fashion, more than 100 conductors would necessarily have to be cared for in this way. Although this would not be impossible in a technical sense, it at all events presents a great many difficulties. The possibility of thus equipping the locomotive with very powerful motors should be appreciated, for the smaller the number of motors for a certain capacity, the less the weight and the simpler the mechanical features of the electric locomotive. The three-phase motor is the only one with which this arrangement is possible.

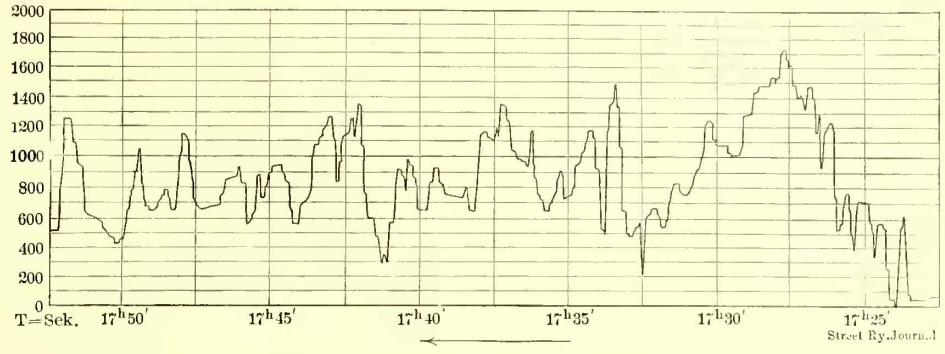


FIG. 3.—LOAD DIAGRAM, TAKEN AT THE MORBEGNO POWER STATION

ENERGY CONSUMPTION COMPARED WITH THAT OF OTHER SYSTEMS

The current consumption per ton-kilometer is influenced by a great many circumstances, such as speed, grades, curves, weight of train, length of train, distance between stations, etc. It is therefore difficult to compare the figures showing consumption of different railways equipped with different systems of traction. Moreover, very little information is to be found in the technical publications in regard to the energy required in main line work or on lines with heavy traffic. Even the data which have been published are usually the consumption measured in the car or on the trolley wire, and not that measured at the switchboard plant. The gross consumption of 44 watt-hours per ton-kilometer, which includes all losses on the Valtellina, must be regarded as very low, as most of the figures published concerning other lines and representing the consumption in the car are higher. Further, it must be considered that with direct-current lines the losses between the switchboard and the rotary sub-stations amount to about 20 per cent. Never has a net consumption as low as 31 watt-hours, measured in the car, been reached on any other system with a profile as irregular as that of the Valtellina Railway.

Figures relating to consumption on d. c. lines do not offer any particular interest, as nobody is likely to think nowadays of equipping a line of any length with this system, as it is more expensive, both as regards first cost and working ex-

penses. More attention should be paid to the corresponding figures from single-phase railways, which, on the whole, offer the same advantages in regard to transmission of energy on an extensive railway system as the three-phase traction system. The Street Railway Journal for Aug. 27, 1904, contains the interesting results of tests carried out by the General Electric Company on an experimental line equipped between Schenectady and Ballston. A test run has been made there with motors alternately with direct and single-phase alternating current.

The results show the following energy consumption: 53.5 watt-hours for direct current, and 78.1 watt-hours for single-phase alternating current. Hence, 46 per cent more current was consumed by the same motor under identical conditions for single-phase alternating current than for direct current. No further evidence need be furnished that three-phase motors may be built with at least as high an efficiency as that of direct-current motors, and therefore conclusions may be drawn from the above test results as to the respective behavior in regard to energy consumption of three-phase and single-phase traction motors. The latter will require about 40 per cent to 50 per cent more energy than three-phase motors, provided that conditions are the same as those prevailing at the tests mentioned.

According to Glaser's Annalen, 1904, No. 3, the Niederschöneweide-Spindlersfeld single-phase railway of 4.1 km length requires 45 watt-hours per ton-kilometer with a distance of 985 m between stations, a maximum speed of 34.4 km and a train weight of 170 tons. It should be remembered, however, that the line has no grades, except 2 per cent on a 500-m section.

In a project worked out by Ganz & Company for the Vienna Suburban Railway, the watt consumption of a train of the same weight at a maximum speed of 31 km and an average distance between stations of 906 m, as has been stated, was 30.7 watt-hours, and the manufacturers were prepared to guarantee that figure. In this case the difference amounted to 45 per cent in favor of the three-phase system, although on the Vienna line there are grades up to 2.9 per cent.

According to an article in the "Zeitschrift für Electrotechnik," issue No. 3, of 1905, the Stubaithal Railway requires 70 watt-hours per ton-kilometer. The corresponding energy consumption has been figured out on the basis of an exact profile of the above line for three-phase traction on the same speed as that given in the publication mentioned, and without using cascade connection. For a complete round trip an average consumption at the car of 29.4 watt-hours per ton-kilometer has been estimated, or about 31 watt-hours measured at the feeding point. This low figure is accounted for by the recuperation when trains run down the grades, and amounts to 27.6 watt-hours, whereas the consumption on the run up grade is 57 watt-hours per ton-kilometer.

The above figures relating to energy consumption on single-phase railways are taken from publications of the manufacturing firms. Those relating to the three-phase system have been ascertained by official tests of the Rete Adriatica, or at least represent conclusions drawn from the latter.

The peculiar advantages of the three-phase traction system as discussed in the foregoing article are then as follows:

1. The possibility of recuperating both the energy stored up in the moving trains when the speed is being reduced for stopping and the energy as represented by the train running on down grades; this energy reappears as electric current and is equivalent to the greater part of the original input. This circumstance results in a very low consumption of energy.

2. The possibility of reducing by "the fly-wheel effect" the load peaks caused by the starting of trains.

3. The possibility of removing the collectors from the motor axle and thus utilizing the entire space inside of the locomotive frames for the motors.

These advantages are obtained only by the use of induction motors, among which the three-phase motor alone has been found suitable for traction purposes. By choosing a motor other than of the induction type, all of these advantages are lost. On the other hand, it is not possible to have variable speed.

Steam locomotives, as is well known, may run at any desired speed within certain limits, which depend upon the capacity of the boiler and the security of service. The same range in speed is possessed by direct-current and single-phase series motors, whereas polyphase motors will run only at a few determined speeds, according to the frequency, number of poles and diameter of driving wheel.

This attribute of polyphase traction was at first regarded as a drawback. Now, however, especially since the results of the operation and the experience gained during a two years' service on the Valtellina Railway have become known, the peculiarity in question is recognized as an advantage by experienced railway men. The chief condition for regular traffic is exact observation of the time-table. All operating systems which permit their crews to regulate the running speed require a trained set of men, who, as it were, grow to be living tachometers. Even such experienced locomotive engineers can only perform safe service on lines with which they are well acquainted, and therefore their employment is limited.

The polyphase alternating-current traction system does not require such a thorough training of the personnel, as the speed remains automatically constant after having reached a value peculiar to the system. Indeed, even on lines with a very variable profile, the speed diagrams taken from actual service are almost horizontal lines. Thus individual skill of the staff is nearly eliminated, being restricted to correct starting and stopping.

ELECTRIC RAILWAY COURSE AT WORCESTER POLYTECHNIC

The Worcester Polytechnic Institute, at Worcester, Mass., has announced the establishment of a chair in electrical railroad engineering. To take charge of this branch of instruction, Albert Sutton Richey, chief engineer of the Indiana Union Traction Company, has been elected a member of the faculty, his title being assistant professor of railroad engineering. Cornell University and the Polytechnic Institute of Brooklyn are the only institutions that have previously offered a like course. Mr. Richey received a degree in electrical engineering at Purdue University in 1894. After having been associated with the Citizens' Street Railway Company, at Muncie, Ind., and the Marion (Ind.) Street Railway, he became, in September, 1899, chief electrician of the Union Traction Company of Indiana. He became electrical engineer of the Indiana Union Traction Company when it absorbed the other company in 1903, and remained as such until July 1, 1905, when he became chief engineer of the company's system of 400 miles of track. Mr. Richey was born in Muncie, Ind., April 10, 1874.

The Westinghouse Traction Brake Company, of Pittsburg, Pa., has secured an order for 160 equipments of the Westinghouse traction brake to be installed on the new cars of the United Railways & Electric Company, of Baltimore, Md. The contract was awarded after exhaustive tests conducted at Baltimore. The total number of equipments ordered was 200, of which 160 went to the Westinghouse Traction Brake Company and 40 to the National Electric Company.

DESPATCHING METHODS AND REPORTING TROUBLES ON THE WEST PENN RAILWAYS

BY J. W. BROWN,
Superintendent of Transportation, West Penn Railways

On the West Penn Railways the operation of cars is controlled by a double system of signal lights. At each passing point two controlling boxes are placed, one on the right and the other on the left. The one on the right controls the lights ahead and to the rear, the one on the left being for the control of the lights used by the car bound in the opposite direction.

FORM 331

CREW LIST P. McK. & C. RAILWAY.

DIVISION._____ DATE_____

CAR No.	ROUTE.	TIME OUT.	MOTORMAN.	CONDUCTOR	RELIEF.	MOTORMAN	CONDUCTOR

EXTRA LIST.

MOTORMAN. CONDUCTOR.

DISPATCHER.

FORM NO. 331, FOR POSTING THE RUNS OF VARIOUS CREWS

Form 307

Pittsburgh, McKeesport & Connellsville Railway Co.

DAILY REPORT OF TRANSPORTATION DEPARTMENT.

Division, _____ *190*

DELAYS

Car No.	Route	Time	Location	Caused By	Duration	Car No.	Route	Time	Location	Caused By	Duration
		M.						M.			
		M.						M.			
		M.						M.			
		M.						M.			
		M.						M.			
		M.						M.			

ACCIDENTS

Car No.	Route	Time	Location	Injuries to Persons or Property	Car No.	Route	Time	Location	Injuries to Persons or Property
		M.					M.		
		M.					M.		
		M.					M.		

CARS DISABLED

Car No.	Route	Time	Trouble	Disposition	Car No.	Route	Time	Trouble	Disposition
		M.					M.		
		M.					M.		
		M.					M.		

Sweepers and Plows Operated

Car No.	Route	Name	On	Off	Hours Worked	Road Opened	Remarks
							Mileage

Dispatchers and Inspectors

Name	On	Off	Hours Worked	Located at	WEATHER	Rail	Remarks
					0 A. M. to 12 M.		
					12 M. to 6 P. M.		
					6 P. M. to 12 P. M.		
					12 P. M. to 6 A. M.		

Men Employed, SANDING, GREASING and SALTING — Remarks:

Route	Name	On	Off	Hours Worked

Division Superintendent.

FORM NO. 307, DAILY REPORT OF TRANSPORTATION DEPARTMENT

All of the switches and switch boxes were made in the West Penn shops, and were designed with a view to durability. The contacts are very heavy, and as the major portion of the switch is made out of iron, there is little danger of trouble due to the rough handling that is generally accorded to a switch handle by a conductor who is in a hurry.

Owing to some portions of the road being used jointly by different routes, the headway at several places is as close as fifteen minutes, and even ten minutes at certain times of the day; this seemed to preclude a telephone system of despatching, but iron box telephones are installed at the switches,

Form 305

Pittsburgh, McKeesport & Connellsville Railway.

TRAIN REGISTER.

Station, *190*

Both Motormen and Conductor must compare watches with standard clock upon leaving terminal on initial trip. Except on initial trip Conductor will sign for Motormen and notify him of all delayed cars, signals carried, etc.

J. W. BROWN, Supt. Transportation.

CAR NO	ROUTE	DIRECTION	SIGNALS CARRIED	TIME ARR	TIME DEP	CONDUCTOR	MOTORMAN	CONDITION OF TRACK
				M.	M.			
				M.	M.			
				M.	M.			
				M.	M.			
				M.	M.			
				M.	M.			
				M.	M.			
				M.	M.			
				M.	M.			
				M.	M.			
				M.	M.			
				M.	M.			

UPPER PART OF TRAIN-REGISTER BLANK

400

BULLETIN NO. _____

_____ Route No. _____ Date _____

SUPT. OF TRANSPORTATION.

Signatures to Bulletin No. _____ Date _____

FORM NO. 400, SHOWING STYLE OF BULLETIN USED FOR POSTING SUPERINTENDENT'S ORDERS TO TRAINMEN

West Penn Railways Co. _____ **Division.**

TROUBLE SHEET. _____ 190

TROUBLE	Reported by	Time	Notified	Time	Reported O. K. by	Time

DISPATCHER.

FORM NO. 405, DESPATCHER'S TROUBLE SHEET

Contrary to the usual practice, the lights are not located in the signal box. The first one is mounted one pole ahead of the switch box, which makes it visible to the motorman as well as the conductor. The next three are placed on poles at curves or other important points along the line, while the fifth one is placed on a pole at the next passing point. The advantage of the intermediate lights is that the motorman can note that his protecting light is burning, or in case of any failure of the circuit the intermediate light apprises him of the fact. He must then proceed with caution, flagging all curves, and if by any means an opposing car should enter the block, the first light on the left hand would signify danger and a flag is sent out at once to protect the car.

and are a valuable adjunct to the block system, as car, line or track troubles are reported by telephone.

The telephone system is quite flexible, and as the railway telephone lines can be connected with the system of the Pennsylvania, Maryland & West Virginia Telephone Company, it is possible to talk over 1000 miles of lines from any of the railway telephones. The high-tension lines are also paralleled by telephone wires, which connect all sub-stations with the main power station. These lines also join the rest of the system.

Classification signals are carried by all cars. The normal signals carried by a regular scheduled car are two red flags by day and two red target lamps by night, the latter being oil-burning. When two cars are running together, the first one

carries green flags by day and green lamps by night, the authority for this being a carbon copy order, form No. 308, given by the conductor of the second section. The arrival and departure of all cars from the terminals is recorded on a train register, showing the car numbers, time, direction, names of the motorman and conductor and the color of the signals carried. From these registers a report to the general manager is made, showing percentage of cars on time on the different routes at the various terminals.

Form 239.

DELAY REPORT.

Pittsburgh, McKeesport & Connellsville Ry. Co.

Division,

Route No. Car No.

Date, Time.

Length of TIME Delayed,

Cause of Delay,

If caused by defect in track or car, to whom reported,

Conductor,

Motorman,

These reports must be made in all cases of delay, however slight, and forwarded to the General Manager immediately.

FORM NO. 239, CAR CREW'S DELAY REPORT

Delays are reported by crews on form No. 239, and from these a delay report is made to the general manager, showing number of delays, length of delays and cause. A duplicate copy is sent to the superintendent of each division and to the master mechanic, who in turn sends copies to the foremen of the division shops. In this manner the causes of

FORM 281

Reported by

Motorman No.

Brakes
Motors
Controllers
Wheels
Journals
Lights
Headlight
Register
Doors
Sash
Trolleys
Curtains
Seats
Remarks

Car No.

Report for

Repaired by

Date, 190

FORM NO. 281, MOTORMAN'S REPORT ON CAR DEFECTS, MADE TO MASTER MECHANIC.

delay are reached and the department causing the delay is notified of the fact.

Orders for motormen and conductors are posted at all divi-

PITTSBURG, McKEESPORT & CONNELLSVILLE RAILWAY CO.

DAILY STARTER'S REPORT.

PA. 190

Reg. No.	Car No.	MOTORMAN.	CONDUCTOR.	Register On.	Register Off.	Fares Registered.	Time On.	Time Off.	Hours Worked.	REMARKS.

FORM NO. 241, STARTER'S REPORT ON TRAINMEN AND REGISTER READINGS

sion headquarters. They are typewritten on a perforated bulletin blank, as per form No. 400. All bulletins must be signed by the men affected, the lower half with signatures being detached and sent to the transportation office, the bulletin proper being left in the crew room. This method of posting orders has been found very satisfactory, as it insures careful reading of the orders by the men, and in case of dispute at a later date the original signature can be produced.

The reports on the condition of the cars are made by motorman on "defective car" report, form No. 281. These reports are checked up daily by the master mechanic.

Each division reports delays, accidents, disabled cars and weather and track conditions daily on form No. 304, this report being sent to the office of the superintendent of transportation. The starters make their report on form No. 241, which gives the names of the crews, their times on and off, and the condition of the registers. The latter report is checked by the division superintendents and is then forwarded to the transportation office. Crews are listed up for their runs on form No. 331. Despatchers record the arrival and departure of all cars on form No. 305, which gives car number, route, direction, signals carried, arrival and departure, the names of crew and condition of track. Any track, line or car trouble is reported by them on trouble sheet, form No. 405.

Form 308

Car No. Carry Signals

to

for Car No.

M 190

Conductor.

FORM NO. 308, USED IN CONNECTION WITH THE SIGNAL SYSTEM

A MAGAZINE REVIEW OF THE CHARACTERISTICS OF SOME PROMINENT ELECTRIC RAILWAY MEN IN THEIR RELATIONS WITH PUBLIC LIFE

In "Ohio: A Tale of Two Cities," by Lincoln Steffens, which appeared in "McClure's Magazine" for July, there is a study of the methods of Mark Hanna and Tom L. Johnson, with an appreciation of Horace E. Andrews, of the Cleveland Electric Railway. As a brief review of the careers in public life in Cleveland of both Mr. Hanna and Mr. Johnson, the article is most complete. While little is told about either personage during his connection with the street railway business that is not well known to all connected with the industry, there is a wealth of other facts throwing considerable light upon the men themselves. This is particularly true of Mr. Johnson, and while many do not approve of some of the methods he has adopted to achieve his ends since entering public life, the fact remains that many laudable deeds stand to his credit. It is the spirit of equity shown by Mr. Andrews in furthering the public good by lending himself heartily to every project that at all presaged success that called forth the tribute from Mr. Steffens, and has endeared Mr. Andrews with the residents of Cleveland, who seem to be cognizant of his willingness to help them to solve problems with which the city is confronted.

NEW ELECTRIC SUBURBAN RAILWAY FOR EDINBURGH

A parliamentary commission, sitting in Edinburgh, has refused the application of a syndicate for the privilege of construction and operating an electric railway on the Queensferry Road from Edinburgh to South Queensferry. This commission has granted the application of a local syndicate (not yet incorporated), of which Peter Macnaughton, 20 York Place, is agent, to build and operate an electric tramway from Edinburgh to Dalkeith, with branches to certain other places. The total length of track will be about 7 miles. It will be a single line, along the side of the highway, with overhead wires.

THE QUESTION BOX

This issue of the Question Box contains a very interesting contribution on advertising methods from J. W. Brown, superintendent of transportation of the West Penn Railways Company; a number of opinions concerning the use of trailers, methods of fare collection, etc.; in the Master Mechanic's Department car fireproofing, brake-shoes, truck repairs are among the topics treated; while the Track Department contains several interesting replies relative to track work.

A.—GENERAL

A 1.—What means of advertising your road and its attractions have you found most effective?

This season we are doing some advertising on the West Penn system by means of single sheet and half-sheet posters. These are placed at prominent points, and attract attention on account of their bright colors and the wording. For instance, a large poster, showing an old farmer clinging tightly to his barn door which has blown off the hinges and is being carried through the air by a cyclone, serves as a vehicle for attracting attention, and the advice which is printed on the barn door to use the West Penn for business and pleasure is very often heeded. Several different semi-humorous posters of this nature have been used to good advantage.

Printed folders containing the summer schedule have also been very popular, giving, as they do, information as to the time of cars at various points along the line, connections, the time of steam railroad trains at the various points touched by the West Penn cars, the distance and stage connections, etc.

On hot evenings thousands of fans bearing the picture of an up-to-date young lady which is labeled the "West Penn Girl," and whose figure is surrounded by a map of the West Penn system, showing all the different towns served, and bearing on the reverse side the inscription "The finest cars, the smoothest roadbed, the most courteous employees, are found on the West Penn Railways," together with further information relative to points reached, and some facts about special car parties, have been distributed.

The company owns a large pleasure resort known as Olympia Park, and a large picnic held there lately was used to advertise the facilities of the West Penn for travel, by announcing before the date of the picinic, that a transfer hunt would be conducted at the park on the day of the picnic. Various colored cards were distributed by the thousand with a colored cord attached, bearing the inscription "Look out for 133,333," and giving the information on it that hundreds of transfers would be scattered throughout the picnic grounds, and that these transfers were numbered consecutively, and to the lucky finder of transfer 133,333 would be given a book of tickets good for one hundred rides through any 5-cent limit of the West Penn Railways. Five thousand people were in attendance at the picnic, and as they went backwards and forwards through the grounds hundreds of these transfers were picked up and examined to see if perchance it should be the lucky number. It was eventually found by a little girl, and the book of tickets was awarded to her. A great deal of interest was taken both before and after the contest, and the transfer hunt was written up in all of the daily papers on the line of the West Penn.

The publishing of "Trolley Talk," a little paper printed for the transportation department, has been very successful, and it is believed that a more friendly feeling has been established between the company and its patrons by this means.

J. W. Brown, Supt. Trans.,
West Penn Rys. Co.

A 17.—At one time the use of trail cars was quite general on electric railways throughout the country. Then came a period when the running of trailers was looked upon with more or less disfavor. There seems to be a decided tendency at the present time to go back to trailers. Please give your ideas and experience relative to trailers. Under what conditions do trail cars properly find a place in the operation of a modern electric railway? Do trail cars cause a greater number of accidents? If they do, what can be done to make them safer? What is the economy in running trailers?

Trail cars for interurban roads are not usually practicable on account of the conditions existing, particularly curves and grades in city street, but if conditions can be made proper for their safe use, I believe there would be a great economy in using them for handling excursion traffic.

Theodore Stebbins, Gen. Mgr. for Receivers,
Appleyard System, Columbus, Ohio.

We have used trailers for years and have had but few accidents caused by their use. One objection to them is it takes much longer for a motor car to make a trip when a trailer is attached. We have adopted the policy of buying new cars of a size to accommodate our regular year around business. When full equipment is purchased we will purchase double-truck motor cars for special days, and also a number of double-truck trail cars, and will dispose of all of our small cars. The use of small cars for extra occasions requires too many men to operate. We place a conductor on the trail car. Mobile Light & Railroad Co.

A 35a.—Can a fifteen-minute service be given successfully upon a single-track interurban road? If so, under what conditions?

A fifteen-minute service cannot be given safely on a single-track, high-speed interurban road.

Theodore Stebbins, Gen. Mgr. for Receivers,
Appleyard System, Columbus, Ohio.

A 36a.—What is a proper rate per mile for interurban passenger business, and to what extent should these rates be reduced by the sale of commutation tickets, monthly tickets, coupon books, etc.?

For interurban railway conditions prevailing in this section, I believe 2 cents per mile is a proper rate. Slight reductions only, if any, should be given for round trips, or other form of ticket for inlividual travelers, except for passengers riding daily, to whom I would allow a rate of 1.6 to 1.4 cents per mile.

Theodore Stebbins, Gen. Mgr. for Receivers,
Appleyard System, Columbus, Ohio.

A 36b.—How do you handle your half-fares?

At one time we sold half-fare tickets from the ticket offices for children from five to twelve years of age, but it involved keeping such a stock of tickets with so few sales, that we withdrew them and collect half fare on the cars only.

Theodore Stebbins, Gen. Mgr. for Receivers,
Appleyard System, Columbus, Ohio.

A 51.—What is the best method of destroying tickets and transfers? If a machine is used for this purpose, what is its maintenance expense, and what would be the power required for a machine capable of handling, say, 300,000 tickets and transfers per day and macerating unused transfer pads containing 100 transfers bound with wire staples?

We use a ticket destroyer which will destroy 300,000 tickets or transfers in six hours. This machine will not, however, macerate complete pads containing 100 transfers stapled, as the staple in the course of time will dull the knives. In destroying transfers in pads, we always remove the staples and scatter the transfers in the hopper of the machine. No skilled labor is required to do this work, only someone of ordinary intelligence. We always have the ticket receiver attend to the destroying of tickets and transfers personally, and he is responsible for any tickets that would be stolen and apt to be used over again. From 1½ to 2 hp is required to operate the machine to the best advantage. There is no additional expense for operating, except occasional oiling. After the tickets and transfers are macerated by the machine, we sell the waste to the paper mills and receive as much in return as what it costs for the operation of the machine.

D. A. Hegarty, Gen. Supt.,
Railways Company General, New York.

E.—MASTER MECHANIC'S DEPARTMENT

E 11.—What can the master mechanic of the average surface road do to render his cars more nearly fireproof?

Make all motor leads short. See that all cables are kept dry, as far as possible, and clear of water thrown from wheels. See that cables passing through platform do not come in contact with water from front windows or side doors. See that small wires are properly installed, and protected with good switches and enclosed fuses. The use of single lamps instead of clusters, reducing the difference of potential will keep down fire risk. Leaky roofs may be the cause of fires starting from fixtures and dirty or bad adjustment, or bad location of circuit breakers, overhead switches or controllers easily start fires. Asbestos between floor and rheostat, and between adjacent metal parts and rheostat reduce fire risk. H. V. S.

E 64a.—What are the more frequent causes of broken axles, and how can they be prevented?

Crystallization in the metal is the most frequent cause of broken axles. If a flaw develops in an axle that has been in service for some time, take the axle out, heat it to a red color and allow it to cool in the air. This will relieve any internal stresses and rectify the crystallization. Master Mechanic.

E 66a.—What has been your experience with different types of brake-shoes?

We find steel insert in face of shoe most satisfactory. Steel insert in back of shoe we find was of little value in preventing breaking of shoes. H. V. S.

E 70.—A road has had trouble with trolley rope leaking current when very wet; also with trolley rope becoming detached from the pole. How can some of these trolley rope troubles be remedied?

Have had no such trouble. Use a braided cotton rope.

J. Chas. Ross, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

E 82.—What can be done to prevent car windows from sticking or binding at the sides?

Use a little soap on edge of sash.

J. Chas. Ross, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

E 111.—When doing repair work on double-truck cars, which method is preferable; lifting the bodies from trucks and doing the work from the top, or doing the work from the pit? Please state what you consider the advantages and disadvantages of each method.

Lift the body from the trucks, pit or no pit. This operation allows free access to most all bolts on truck, also to electrical equipment or any parts attached under car body. Have a pit long enough to accommodate both trucks, also floor space back of pit to accommodate both trucks. Motors opening from the top can be worked on over the floor. Motors opening from the bottom should be worked on over the pit. The pit is desirable, as a good many truck and motor bolts can be tightened more readily from below.

J. L. Sullivan, Foreman Motor and Truck Dept.,
United Railways Co., St. Louis, Mo.

E 119.—Is there any satisfactory substitute for cotton tape as a covering for armature and field coils?

On a small road where tape is sometimes a scarce article, strips of canvas 2 ins. wide are a good substitute for cotton tape. If a good field compound is used, give the field a layer of canvas, apply compound with brush to avoid waste; before compound is dry give it another layer of the canvas, then another application of the compound after five or six hours. Field may be taped with black friction tape.

J. L. Sullivan, Foreman Motor and Truck Dept.,
United Railways Co., St. Louis, Mo.

E 127.—What is the best way of removing armatures and fields from cars, particularly on small and medium size roads?

Have portable armature lift in pit. J. Chas. Ross, Gen. Mgr.
Steubenville (Ohio) Tract. & Lt. Co.

E 131.—What is the best method of turning down a motor commutator?

We turn them in our lathe. J. Chas. Ross, Gen. Mgr.,
Steubenville (Ohio) Trac. & Lt. Co.

E 151.—How do you straighten a bent axle?

If axle is bent much it should first be straightened as much as possible by blacksmith. It is then put in a truing lathe arranged to turn the axle by hand, by means of a wheel at one end, lathe to have a presure-screw attachment. When high place is located, block under axle and apply pressure-screw at proper place. Repeat until axle is true.

J. L. Sullivan, Foreman Motor and Truck Dept.,
United Railways Co., St. Louis, Mo.

F.—STEAM ENGINEERING

F 17.—Have you discovered any schemes for simplifying the work of cleaning boilers? Please describe any of the little things which make the work easier. For instance, when necessary for a man to go inside the boiler, what kind of a light does he take with him?

For drilling boiler tubes where pump has no governor, we use a by-pass valve on drill when we wish to stop drill, and save wear and tear on pump. We use a torch and electric light, but great care must be taken to insulate cord so it will not ground when lighted from railway circuit.

E. G. Hindert, Chief Engineer,
Cleveland & Southwestern Tract. Co.

F 41.—Can superheating be applied to existing electric railway power houses? What changes in piping, valves, engines, etc., are necessary? What advantages will follow? Cite instances.

Yes. Superheaters as manufactured by several companies can be installed. Some will set in present settings, while others directly over. Present pipe from boiler must be tapped so that steam shall go through superheater. It would require three valves. No changes in engines will be necessary unless superheat is carried too high. Advantages are in dry steam with no more fuel and less condensation in engines. I have used 100 degs. superheat from one to two-thirds of the boilers, and the other third saturated steam, and noticed no bad effects from pumps and engines. The majority of the steam went direct to steam turbines, and do not know how much superheat reached the pumps. We have run in this manner a year with from 20 degs. to 100 degs. superheat.

E. G. Hindert, Chief Eng.,
Cleveland & Southwestern Trac. Co.

F 42.—What is the limit in size of station in which superheating can be used with economy?

I would put it in small-sized plants.

E. G. Hindert, Chief Eng.,
Cleveland & Southwestern Trac. Co.

I.—TRACK DEPARTMENT

I 15.—Have you had any experience with waves developing in the top surface of rails? What is the cause of this phenomenon, and how can it be remedied?

In a number of instances we have experienced the effect of what is known as "waves" developing in the surface of our tracks. Upon investigation it was learned that the ties had been improperly tamped, whether the foundation consisted of broken stone or concrete. Occasionally, however, these waves were caused really by the foundation under the tracks settling, and frequently occurred on fills. We have had very little trouble on streets where we made cuts. The only solution we have found for this trouble after it has once developed has been to shim up the rails on the ties where they were in concrete and to retamp the ties in rock ballast.

Cincinnati Tract. Co.

I 28.—What is a good method for testing rail-bonds?

We use millivoltmeter, put on a light frame with contacts 1 ft. apart, to be spaced across joint, and contacts 3 ft. apart to get drop in the given length of rail. A three-point switch gave readings across 3-ft. length of rail, then across bond with adjustable resistance in series, and then across bond straight. A portable resistance connected to trolley with fishing pole gave about 30 amps. when current was not flowing otherwise. H. V. S.

I 30.—What has been the experience with soldered bonds?

Our experience has been very discouraging, whether on account of the bond or on account of method of application we are not prepared to state. H. V. S.

I 32.—What is the best form of portable rheostat to use in connection with bond-testing instrument?

We used german silver coils with porcelain spools and wood-enclosing box. H. V. S.

THE BRAKE-SHOE PROBLEM

The development of power braking systems of recent years has done much toward the promotion of high-speed operation of heavy cars and trains, and extremely fast schedules are maintained in both steam and electric service with safety. But the result of modern conditions of operation has been that of placing the question of safe train control ultimately at the brake-shoes; these, for the best results in bringing trains to a stop without skidding wheels, should be effective in bringing the maximum of frictional resistance upon the periphery of the wheels, and maintaining it most effectively irregardless of heating and wear. The latter feature of the problem, namely, wear, has proved to be a serious item, and under modern conditions of weights and speeds of trains, it has grown to be alarming. The cost of brake-shoes per 1000 car-miles under present conditions is nearly double what it was five to ten years ago, and, moreover, gives promise of still further increase. While many attempts have been made to produce shoes of greater wearing capacity, without loss in braking efficiency, the results have not been satisfactory, and the question as to probable relief from the difficulty is now engrossing the minds of both street railway officials and leading manufacturers.

In steam railroad practice considerable investigation has been made of the brake-shoe problem, to determine the best compositions; constructional features and methods of using brake-shoes. Many attempts have also been made to produce shoes of special construction, intended to give greater wearing qualities without loss of efficiency in braking, and shoes of such composite construction have been and are being largely used at the present time. Active work of investigation along this line was begun by the Master Car Builders' Association soon after the introduction of the Congdon composite shoe—of cast-iron body with wrought iron inserts in its face to reduce the rate of wear, which was the first attempt to depart from the use of the original plain cast-iron shoe in the search for greater wearing qualities. A series of independent tests was also made by the Pennsylvania Railroad in 1892, and had an important effect upon present practice. All tests and investigations that have been made, however, tend to indicate that the plain cast-iron shoe is by far the most effective in producing high-frictional resistance or braking qualities, while the more durable shoes of composite construction obtain their greater wearing qualities at the expense of effective braking qualities. This fact is now well established, and practically universally accepted, and in present practice all brake gears are designed with reference to the efficiency of the cast-iron shoe as the standard.

The cast-iron shoe was, in fact, practically officially adopted by the Master Car Builders' Association for steam railroad service, when, in 1901, following upon a long series of laboratory tests, which had been conducted over a period of several years by a special brake-shoe committee, a specification was approved, giving the minimum frictional qualities desirable in brake-shoes, as follows:

FOR STEEL-TIRED WHEELS

Brake-shoes tested on chilled wheels moving at a speed of 40 m.p.h. must show a mean coefficient of friction of 22 per cent, acting under a load of 2808 lbs., a mean coefficient of friction of 20 per cent under a load of 4152 lbs., and a mean coefficient of friction of 16 per cent acting under a load of 6850 lbs.

FOR STEEL-TIRED WHEELS

Brake-shoes tested on steel-tired wheels moving at a speed of 65 m.p.h. must show a mean coefficient of friction of not less than 16 per cent acting under a load of 2808 lbs., a mean coefficient of friction of 14 per cent under a load of 4152 lbs., and a mean coefficient of friction of 12 per cent acting under a load of 6850 lbs.

The plain cast-iron shoe, although most effective and efficient of any of the various types of brake-shoes that has been tried, has unfortunately shown two very distinct objections and disadvantages for general use, namely, rapid wearing qualities and lack of inherent strength against breakage. It was these two disadvantages, as experienced in steam railroad service, which early induced the brake-shoe manufacturers to attempt to produce shoes possessing the advantages of the cast-iron shoe without its disadvantages, resulting in the introduction of the various types of shoes which have become so generally known during the past twenty years. The patents that have been issued for improvements in this direction are almost countless.

Under exhaustive tests, the various types of shoes were found to group themselves, especially in reference to use on chilled wheels at the heavier loads, into three distinct classes with respect to braking results. The first class covers the unchilled or soft cast-iron shoe, which is the most efficient, though least desirable, on account of rapid wear; the second class embraces the composite shoes with soft or hard inserts, which occupy an intermediate position in braking efficiency and durability, and the third class, the heavily chilled cast-iron shoes, which are the least effective in braking, although most durable.

While this classification will apply in general to both iron and steel wheels, there is, of course, a marked difference in their action upon the chilled iron and the steel-tired or rolled-steel wheels. The soft cast-iron shoes give a somewhat greater braking effect upon the chilled-iron wheel than upon the steel tire, although they hold the highest relative position on both. The composite shoes, with hard or soft body metal with harder inserts, show variable results, according to the character of the inserts, those having inserts with effective cutting edges producing by far the best results on the steel tires by virtue of the tire cutting or dressing effect, while those which do not cut are less efficient according to the relative hardness of the inserts. The very hard and heavily chilled cast-iron shoes have practically the same effect upon both steel and iron wheels, giving high standards of durability with correspondingly low efficiency in braking.

The action of these various classes of shoes upon steel and iron wheels has been explained on the theory that the surface of an unchilled cast-iron shoe is characterized by sharp projections of a crystalline structure, and that these crystals under wear become readily detached and break along the cleavage faces, continually furnishing angular crystalline particles, to grind between the shoe and wheel. The face of the chilled wheel is a series of minute elevations and depressions, and when pressed together, the two surfaces interlock and mesh with the particles ground off from the shoe, so that there is a continuous grinding and rolling action and consequent high friction. The steel tire is not so hard as the chilled wheel, and possesses an element of ductility, so that projections on its face tend to flow or bend away from the brake-shoe, to become compact and polished over, and affording less resistance and permitting a sliding rather than a grinding action between the two surfaces, and hence have less friction. The composite shoes of various grades of hard and soft iron are less effective on the steel tire, while those shoes with cutting inserts of hard metal give better results on the steel tire when they cut it. Shoes with wrought iron or mild steel inserts give poorer results on the steel tire as long as there is no cutting by reason of hard spots forming on the insert; when there is cutting action the friction is raised. The heavily-chilled shoes have practically the same relation to the steel tire as to the chilled wheel, because the very dense structure of the chilled areas prevent intimate contact with the wheel, and there are less ground-off particles to roll beneath the shoe, resulting mostly in a sliding action.

In the records of the above-noted M. C. B. tests it ap-

peared that the shoes doing the most work were also those most affected by heat. The soft and medium hard cast-iron shoe tends to lose its grip under conditions of high heating, while the very hard shoe tends to stand up better under such conditions. There even appears to be a certain point in the higher train speeds where the retarding effects of the various shoes tend to be equalized by this effect of abnormal heating, and at which the stopping distance for a train would be about the same with any type of shoe. This fact, of itself, favors the use of the hard shoes for heavy passenger service in connection with the high-speed brake, although the hard shoes are the least effective at low speeds.

A promising source of economy in braking appears to lie in the use of flanged brake-shoes in connection with steel or steel-tired wheels. The additional frictional area offered by covering the flange gives considerably more retarding power, and permits a much harder shoe to be used with braking effect equal to that of the unflanged shoe of softer metal. It is also observed that the wear upon the tire is much improved in general by the use of the flanged shoe.

In spite of all the attempts along other lines, the cast-iron shoe still has the preference, and is in use on many of the large systems, under the most trying conditions with success. Strength has been added for protection against breakage by the use of steel reinforcing backs in one form or another, which are very effective for the purpose. In the use of these shoes the practice is to operate them until worn down to the reinforcing backs, when they are removed, so that the shoe is handled and in effect resembles the cast-iron shoe, the reinforcing back permitting a much longer wear without danger of breakage of the shoe with accompanying dangers.

In the lighter classes of electric railway service, such as on street railway systems, braking conditions do not so closely resemble those of the steam roads, and less radical treatment will suffice. Here the narrow tread wheels predominate and flanged shoes are largely used. Because of the flanged shoe and of the slower speeds, the difficulty of heating is not encountered. The greater desideratum in light railway service has been durability in the brake-shoes, with consequent greater use of the harder and insert shoes. In fact, it is argued by many that the less efficient braking qualities of the insert shoes make them more desirable for the use of the average motorman in reducing the liability of flattening wheels. The question as to the proper shoe for general use is, however, largely unsettled, owing to the growing use of steel wheels.

One of the most important of the early accomplishments of the Master Car Builders' Association was the adoption of a standard brake head, which permits of keying the shoe upon the head with the utmost facility, and by which, furthermore, shoes will be interchangeable upon all cars operated on the lines associated. Such a practice has, however, never originated upon the street railways, for which reason there is an alarming lack of uniformity of practice in this respect. Many different designs of shoes have been introduced in connection with the use of light truck equipments, with undoubtedly the purpose of obtaining simplicity, but with the present multiplicity of designs that have come out, the result has become anything but simplicity. One large electric railway system in the East has a total of over thirty different styles of shoes, where the number should not be over three at the most, and could be reduced to a single one with great advantage. With the present rapid development of street railway service it is imperative that this subject should be investigated with standardization in view. A standard brake head of the Christie type was adopted by the American Street Railway Association at the Detroit convention in 1901, but nothing has as yet been done toward a general introduction of the new standard. The subject is an excellent one for discussion at the coming street railway conventions.

THE "AEROSTAT"

So many interesting devices for picnic parks have been brought out during the last three or four years to afford the amusement seeker all sorts of unusual sensations that it seems hardly possible there could be anything new in this field. Nevertheless, the Federal Construction Company, of Chicago, has come to the front with a novel contrivance called the "Aerostat," which is designed to give its patrons the delights of a voyage through space without the usual airship risk of broken bones.

The aerostat, as shown in the accompanying illustration, is a form of circle swing consisting of a six-leg steel tower of gusset plate bridge construction, over which is telescoped a solid steel cantilever crown truss with six or more radiating arms. The crown truss rests upon 153 1-in. steel balls, each having a special ball retainer, traveling in its own path between two case-hardened plates. The cars are suspended from the crown truss arms and the safety of the passengers is in no way dependent upon any part of the machinery. A thirty-six-passenger swing requires 6½ hp to operate. No brakes are used, but by the use of a controlling device the swing can be brought to a dead stop, without a jar, in thirty seconds. The structure has been designed as an ornament to any park, and when lighted presents a magnificent spectacle.

THE AEROSTAT IN USE

In addition to this interesting device, the company manufactures other popular specialties, such as the velvet coaster, Katzenjammer castles, mystic mills, water chutes, helter-skelters, etc.

The overcoat, it would seem, has practically ceased to be worn by the masses of the British people, and in consequence the winter trade of the clothing companies on this garment has been killed. "The Tailor and Cutter" says the trolley is responsible for all this. "The most important factor which has contributed to the decline of the overcoat is the great improvement in transit," says that journal. "The man who invented the electric tramways did a great deal to kill the heavy overcoat, and the issue of workmen's tickets has completed the thing. Tramway facilities are so many, and everybody rides nowadays." The article points out that the man who used to walk to work and needed an overcoat to protect him from the weather during six months of the year is now "whisked" the 4 or so miles to his work and back for a penny, and finds the heavy overcoat a nuisance while sitting in a comfortable car. The medical faculty also has aided the decline of the garment, by stating that the overcoat is unhealthy, because it is large and heavy, and does not permit of sufficient ventilation to the body, thereby inducing chills and colds.

Following an order from the Common Council, the Milwaukee Electric Railway & Light Company put into effect Tuesday, Aug. 15, for the first time, the rule that its cars should stop on the "near" crossing only.

NEW METROPOLITAN RAILWAY LOCOMOTIVES

The first of the ten electrical locomotives being supplied to the Metropolitan Railway by the British Westinghouse Company was delivered some few weeks back, and has recently been subjected to several tests under working conditions. On June 29 the locomotive was coupled to a freight train weighing 279 tons and made a number of most successful trips between Willesden Green and Uxbridge. It has also been tested on the Harrow line between Baker Street and Uxbridge on passenger traffic with equally good results. Fig. 1 is a dimensioned drawing of the locomotive, and Fig. 2 a general view.

The ten locomotives on order will be used for hauling the Great Western trains through the northern part of the Circle between Edgware Road and Aldgate, for conveying the main line passenger traffic from Pinner, Rickmansworth, Verney Junction, etc., between Harrow and Baker Street, and also for

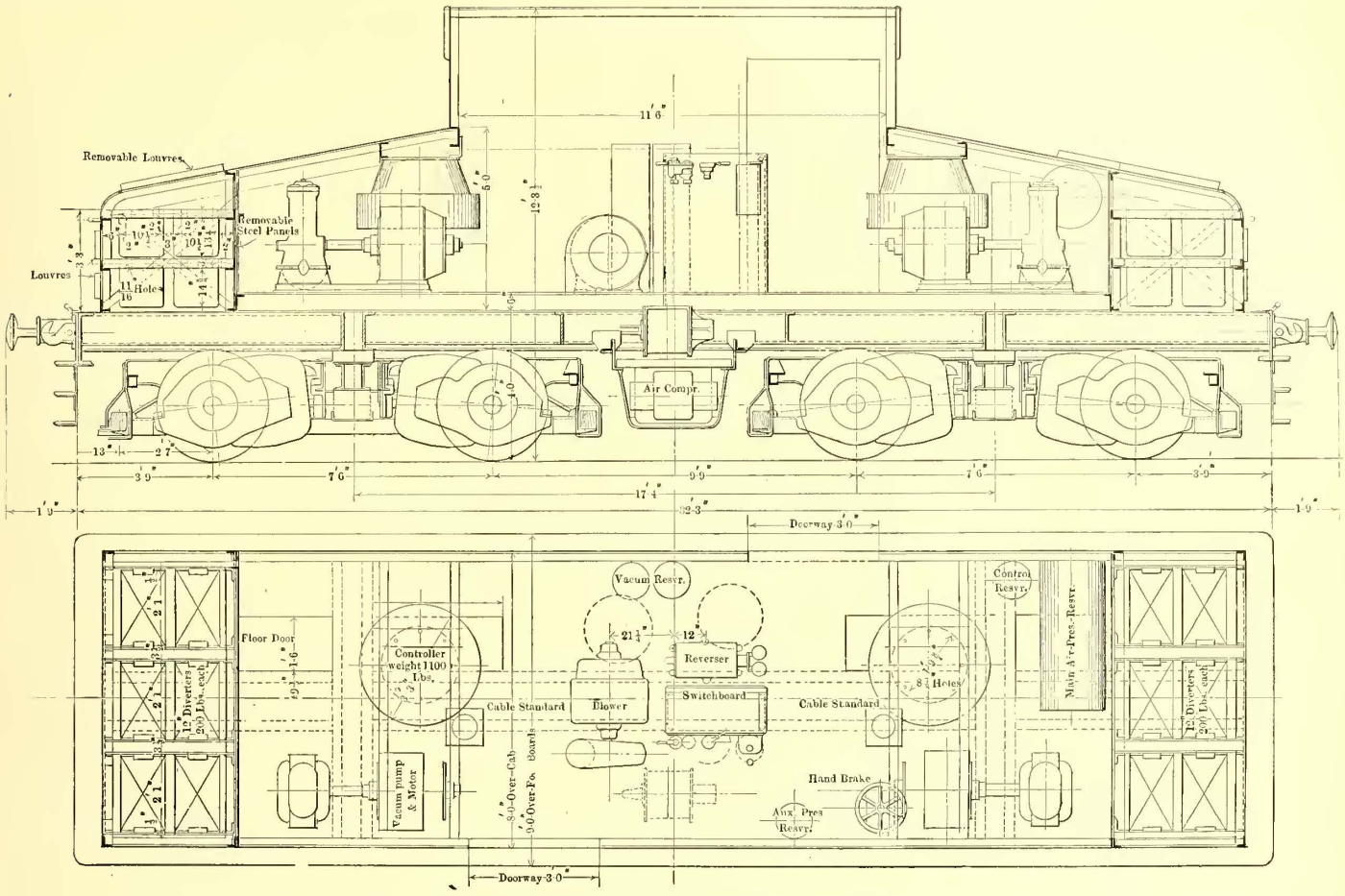
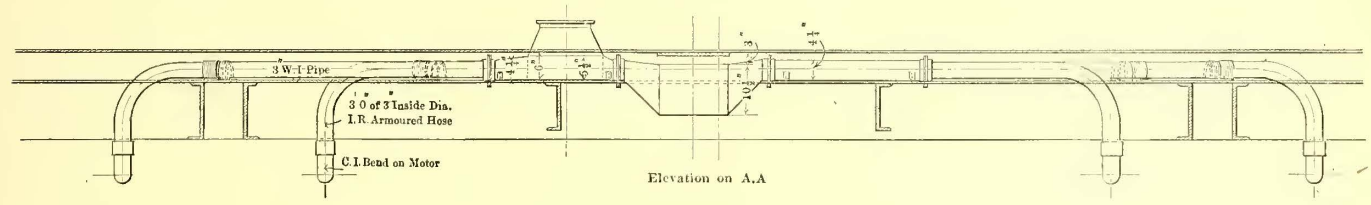


FIG. 1.—DIMENSIONED DRAWING OF METROPOLITAN ELECTRIC LOCOMOTIVE, SHOWING ALSO PLAN, ARRANGEMENT OF MACHINERY, ETC.



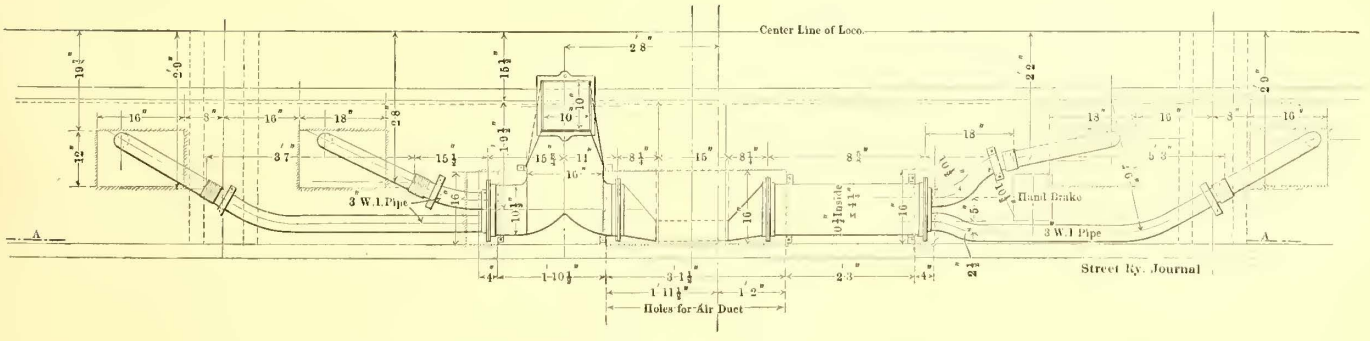


FIG. 3.—DETAILS OF THE VENTILATING AIR DUCTS

hauling freight trains over both the Circle and St. John's Wood Line. Owing to the length of the trains and the cramped conditions existing at the termini, it has been necessary to keep the length of the locomotives down to the lowest possible limit. This has been effected by using motors of a smaller size than usual and equipped with forced ventilation.

The locomotive equipment consists of four motors, the normal ratings of which are 200 hp each; but by aid of the forced ventilation, which is supplied by an air blowing set, the motors are rendered capable of developing 250 hp each with perfect safety. The locomotive is also equipped with both the Westinghouse automatic air brake and vacuum brake, and each is coupled to the foundation brake gear in such a way that either may be manipulated and caused to apply the brakes without making any changes whatsoever in the connections.

These locomotives are able to haul a train weighing 170 tons, exclusive of the locomotive, between Baker Street and Harrow

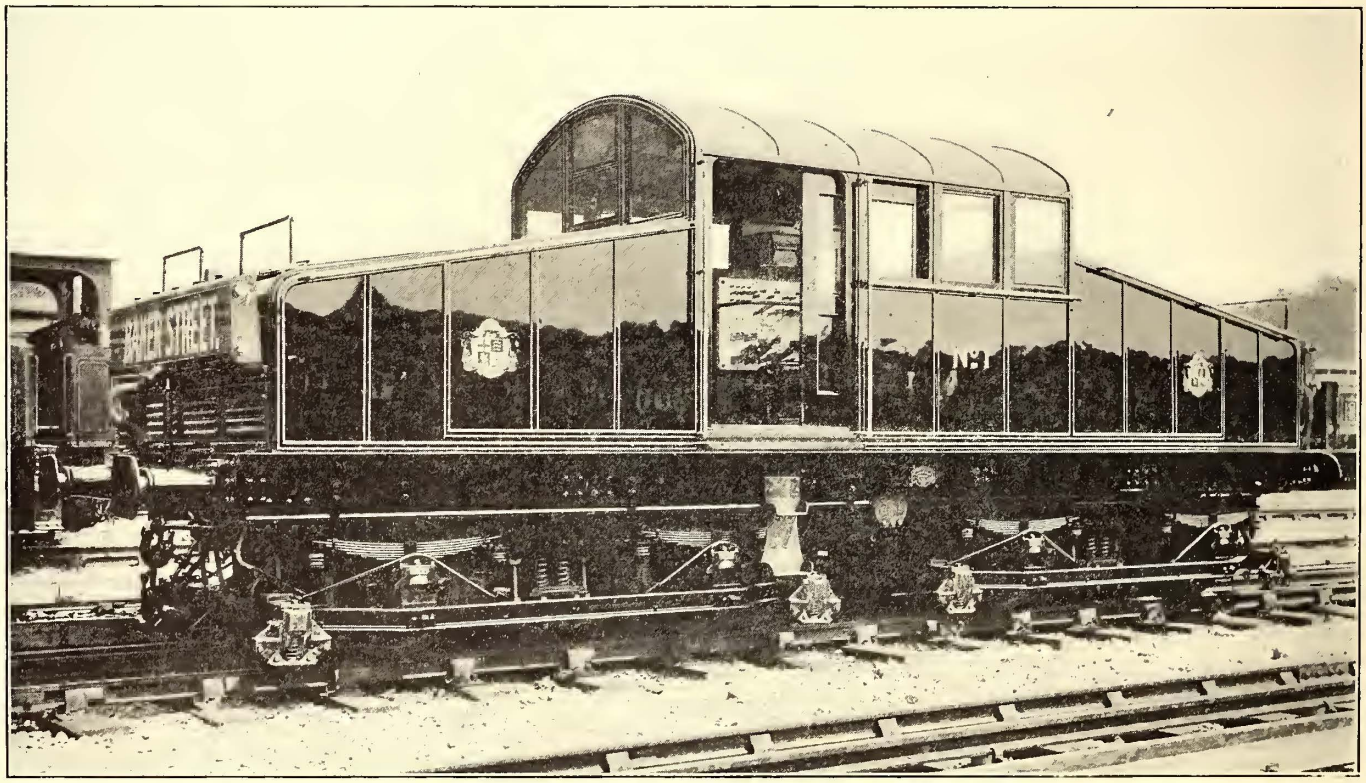


FIG. 2.—GENERAL VIEW OF METROPOLITAN ELECTRIC LOCOMOTIVE

at a maximum speed of 36 m.p.h.; and a freight train of 250 tons, exclusive of locomotive, over the Circle at a maximum speed of 27 m.p.h.

The motors of this locomotive are of the usual series-wound tramway type, and there is nothing novel in the winding. The drawing, Fig. 3, shows the details of the ventilating air ducts. The air is admitted to the motor at a pressure of 4 ozs. per square inch, and the mouth of the duct is so formed as to distribute the entering air over the entire end of the armature and field coils. The cover of the motor is of the ventilated type, so that this air, after it has absorbed the heat from the armature and field coils, passes into the atmosphere.

There are four motors with each locomotive, and these are arranged in pairs. Each pair of motors has a separate turret controller of the Westinghouse electro-pneumatic type. These controllers are manipulated by a single master switch and are not of the automatic type. The switches, however, are closed with the step by step method usual with tramway type controllers, this being necessary owing to the vast amount of shunting of freight and passenger trains in sidings.

The average weight on each wheel of the locomotive is 12,550 lbs. The blower is fitted with a resistance which can be switched in shunt connection with the field coils, so that the speed may be increased 25 per cent, and the pressure of the air thereby increased from 4 ozs. per square inch to 6 ozs. per square inch. This arrangement will be used when the motors are working under the most severe conditions of service.

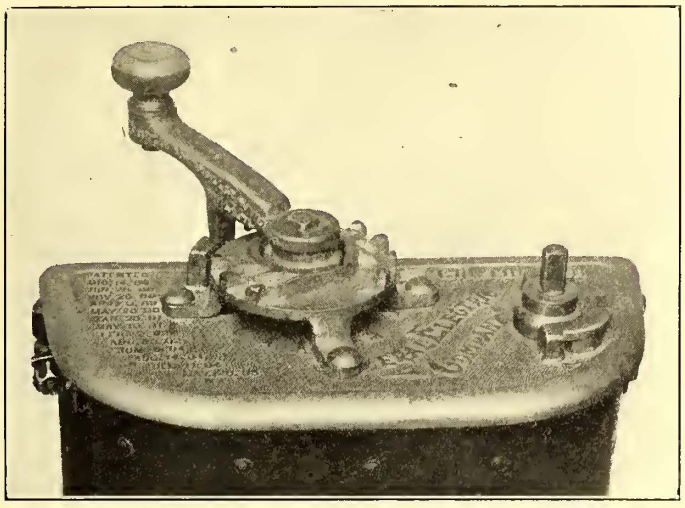
A SIMPLE GUARD AGAINST FAST FEEDING

The Durkin controller handle is a device for regulating the rate of controller feed on electric cars, which has recently been brought out by the Durkin Controller Handle Company, of Philadelphia. As shown in the accompanying illustrations, it consists of a rack, which is bolted to the top of the controller by means of three bolts, and a handle that is interchangeable with any rack made by the company. The rack is equipped with a series of teeth projecting outward, which engage a double-acting dog suspended under the handle, throwing the dog in contact with stops on the rack. The dog strikes each stop squarely, bringing the handle to a full stop; then at the slightest release of pressure,, the dog falls by gravity, striking the projecting tooth next in order, by which it is guided to the next stop.

This handle works automatically and compels the motorman to make a full stop at each position on the dial in turn, until the position is reached at which the full current is on. To move the Durkin handle from "off" to the last stop requires from five to seven seconds, a speed which feeds the current to the motors as rapidly as they can take it safely. A point of the utmost importance is that the current can be thrown off instantly from any point, the dog offering no resistance to the movement of the handle in returning to the "off" position.

This handle presents a strong claim to the consideration of railway managers in the simplicity of its parts and of the mechanical principles involved. To adjust the rack it is not necessary to remove either the star wheel or the pawl, or to dismantle the controller in any manner, and the device has no dash-pots, springs or complicated additions to the controller equipment. The handles and rack are of malleable iron

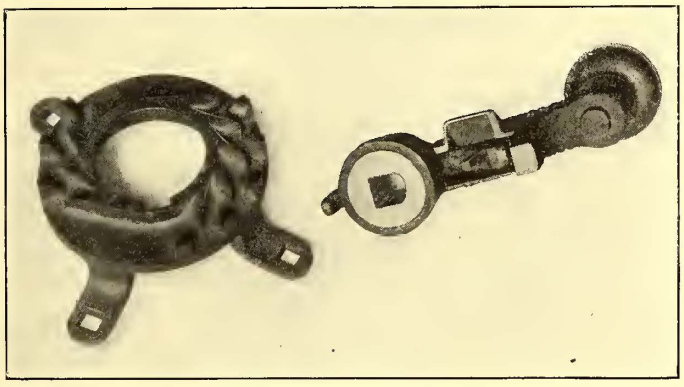
throughout, with the exception of the dog, which is of tool steel. In handles that have been in practical use on cars of the Philadelphia Rapid Transit Company and other lines, no



CONTROLLER HANDLE IN POSITION

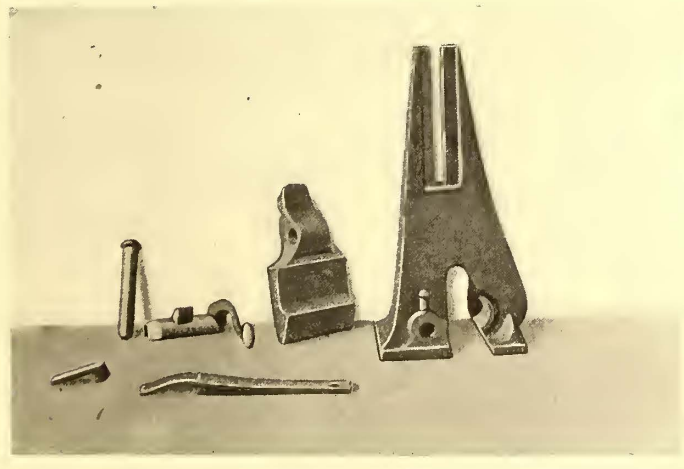
evidence of wear was shown in the dog—the only part of the device subjected to hard service.

While the chief value of this controller handle is in prevent-



RACK AND HANDLE

ing rapid, irregular feeding, with its attendant waste of power, injury of equipment and increase of power-house expense, it presents various incidental advantages. Among these may be



DETAIL PARTS OF CURRENT-CONTROLLING APPARATUS

named the fact that, as the handle makes a full stop squarely upon each point, the controller fingers are in exact contact, and are therefore not subjected to the uneven wear sometimes caused by carelessness of motormen in this matter.

In the operation of reversing, this handle serves to regulate the feed in exactly the same manner and degree as it does in the ordinary feeding, and with marked advantages. In an emergency reverse, when a motorman is especially tempted to swing on full current instantly, it compels him to feed the motor in the manner that will not only preserve the motor, but will stop the car in the shortest possible distance.

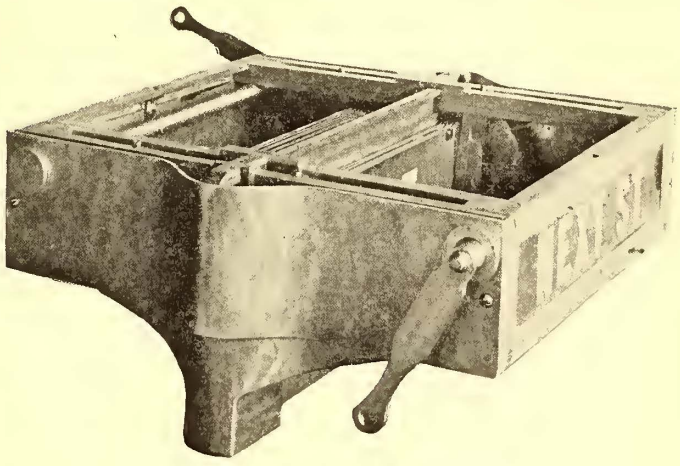
In practice this device is found to safeguard electric cars against the extraordinary wear and tear due to fast feeding and overfeeding. It also lightens the power house load, and on the smaller lines materially reduces fuel bills at the power house. It insures a regulated, even starting of each car, abolishing unpleasant jerking and avoiding the dangers arising from bad stops.

A NEW STATION INDICATOR

The indistinctness with which the names of stations on elevated railways are announced by the guards has long been the subject of humorous remarks in the joke columns of the daily

VIEW OF STATION INDICATOR IN SERVICE

and weekly papers. There is no doubt that there is considerable truth in the claim that passengers have difficulty in understanding the names as announced, and that visible station indicators would be of great convenience to many persons as well as passengers who are hard of hearing. A device for accomplishing this result has recently been patented by Edward



INTERIOR OF STATION INDICATOR

M. Skinner, and will soon be put on the market by Col. Giles S. Allison, of New York, who owns a half interest in the patents. It is illustrated in the accompanying cuts.

The indicator is a rectangular receptacle or box about 24 ins. wide and 8 ins. deep. Its length varies with the number of stops made, but 120 signs can be contained in an indicator about 14 ins. in length. The indicator, when in use, is mounted in the center of the car on the ceiling of the monitor. Each end bears the stationary sign "Next," or "Next Station," while

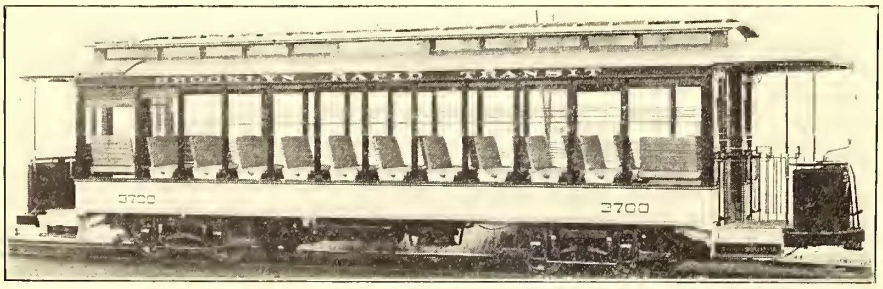
the name of the station itself is shown in a frame under the center, where it can be read from both sides.

The interior of the appliance is shown in the second illustration. The frame for holding the signs is divided in the middle by a floating plate, which is tilted slightly one way or the other by the operating mechanism, so that the signs can slide into or from the lower frame. The signs themselves are of metal, with white letters on a blue background, and slide on horizontal guides within the receptacle. When the operating handle is thrown, the sign nearest the central dividing plate is dropped down inside the lower frame, while the sign already there is thrown upward on the other side of the central plate. This process is continued after leaving every station until all the signs have been transferred from one side of the receptacle to the other. By operating the handle at the opposite end of the indicator, the process is reversed.

The operating handle can be thrown either by the guard or, if preferred, by an automatic device which would be set on the roof of the tunnel in the subway, or on the track in the case of an elevated structure. If this is done, the indicator would require no attention at all, being automatic in its operation. The device will be on exhibition at the Philadelphia convention in the space of the Security Register Company.

AN INTERESTING CAR FOR BROOKLYN

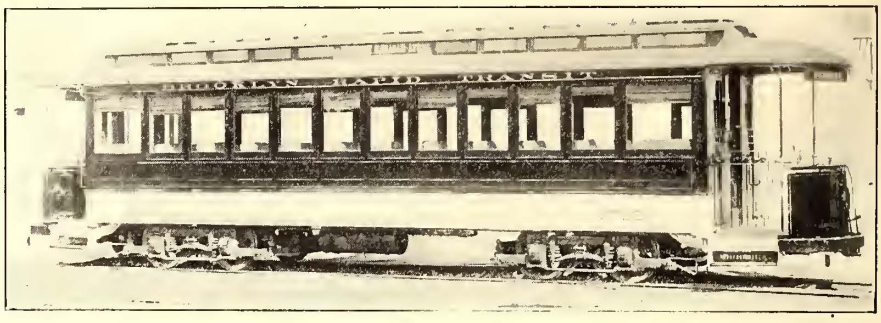
The J. G. Brill Company and the John Stephenson Company are delivering a lot of cars of the type shown in the accompanying illustrations to the Brooklyn Rapid Transit Company. The order being filled by the Brill Company is for 125, and that of the Stephenson Company for 50 cars. Although the type is not new, the design of these cars includes a number of features which have not been used heretofore. The style may be called semi-convertible, but not in the sense of the patented cars of the builders, as the windows are removable. In Baltimore and elsewhere cars of a similar type have been used, but the removable parts consisted of sashes with the panels separate, while in the Brooklyn car the space between each pair of posts when closed is filled with a sash and panel made in one section. In summer, when the sashes are removed, screens



BROOKLYN RAPID TRANSIT COMPANY'S NEW CAR READY FOR SUMMER SERVICE

consisting of two groups of round bars take their place. These screens serve not only to protect the passengers from passing vehicles, but also to brace the posts horizontally. Instead of the usual fixed lower panel of wood, a steel plate 17 ins. x 3/8 in. is employed, which serves the double purpose of panel and sill plate, and is considered to be an excellent mode of construction for cars of this length and style. The plates extend in one piece from end to end, and are bent around the corner posts and brought to the door posts; they are bolted to the sills, posts, cross timbers, bolsters, strainers and window rails, and, with the exception of the hexagonal heads of the tie-rod nuts at the cross members, the bolt heads are let into countersunk holes and smoothed flush with the plates. The window sashes are composed of cherry, and the frames include panels below the sash, the whole reaching from the window rail to the letter board. The sash panel is solid and is tenoned to the stiles.

The sashes are held in place by half-oval metal bar secured



THE BROOKLYN RAPID TRANSIT COMPANY'S CAR READY FOR COLD-WEATHER SERVICE

to the outer face of each post by four screws running through the posts and with the heads sunk in brass washers set flush with the inner face of the post. These bars are also used to retain the screens which take the place of the sashes in summer. Window pockets are provided for the sash at the ends of the car; inner sashes are also furnished, which are hinged to the corner posts.

The bottom framing consists of 4¾-in. x 7¾-in. side and end sills, 3¾-in. x 5¾-in. cross timbers and 3¾-in. x 2¾-in. diagonals, all of white oak, except the side sills, which are of long leaf yellow pine. The side posts are 2½ ins. thick, and the corner posts, 5¾ ins. Four steel knees support the platforms; these knees extend back to the bolsters, and at the outer end are capped by angle-iron bumpers of the builder's patented type. Steel carlines are furnished at each post, and are 1¼ ins. x 5-16 in. thick. The interior of the cars is finished in cherry, with birch veneer ceilings. Ratchet brake handles, "Dedenda" gongs and "Retriever" signal bells are included in the equipment, and are of Brill manufacture. The general dimensions of the cars are: Length over the corner posts, 31 ft. 5¼ ins.; length over the bumpers, 42 ft. 6 ins.; length of the platforms, 5 ft. 6⅜ ins.; distance from center to center of the bolster, 20 ft.; width over the sill plates and posts, 8 ft.; height from the bottom of the sill over the trolley board, 8 ft. 10 ins.

A car on the Trenton, Lawrenceville & Princeton Railroad (New Jersey & Pennsylvania Traction System) narrowly escaped being wrecked a few days ago. Three boys, the oldest 18, and each of the others 10 years of age, placed some stumps on the track between Trenton and Reed's Manor, where a 4-deg. curve is located on a 10-ft. embankment. The car was running at a speed of about 45 m.p.h. when the motorman saw the stumps on the track. He applied the air brakes so successfully, however, that the car did not leave the track, although the wheels were raised from the rails by the stumps. General Manager Honecker, who happened to be on the car, saw some boys running across the fields, and he gave chase, with such success as to capture the oldest, John Morollo, in a pond a mile from the scene of the attempt at wrecking the car. Morollo is now held in the county jail, without bail, to await the action of the next Mercer County Grand Jury. The company has announced its intention of prosecuting him to the limit.

FINANCIAL INTELLIGENCE

Wall Street, Aug. 23, 1905.

The Money Market

There was no material change in the money market this week. The tone was a shade firmer, but otherwise the market failed to reflect to any appreciable extent the fairly large shipments of funds to the West and South for crop-moving purposes, and a further reduction in bank reserves of nearly $3,500,000. Call money was under pressure during the greater part of the week, rates ranging from 1¾ to 2¼ per cent. The decided ease in this department was due in part to the offerings by stock commission houses of their unemployed balances in competition with the banks and trust companies. The time money market was practically at a standstill. During the early part of the week offerings were moderate at the recent low rates, but toward the close there was a disposition on the part of the banks to mark up the rates for all fixed periods. Sixty-day money was quoted at 3 per cent, and transactions in three months' funds were reported at 3½ per cent, as against 3¼ per cent a week ago. Four months' contracts ruled at 3¾, and five and six months' money was firmly held at 4 per cent. The volume of business, however, was extremely small, but at the same time there was no disposition on the part of lenders to press their funds, the opinion being quite general that higher rates will obtain in the near future. This belief is based upon the low bank reserves, and that the requirements at the interior for crop purposes will continue to grow larger from now on. In the meantime, borrowers are taking advantage of the easy rate for call money. Mercantile paper was unchanged, on the base of 4 to 4¼ per cent for the best names. Sterling exchange was weak, at 486½ for prime demand sterling. The foreign money markets continued easy at practically unchanged rates. The statement of the clearing house banks, published last Saturday, showed the surplus reserve to be only $9,355,675. This compares with a surplus of $12,846,800 in the preceding week, $58,613,075 in the corresponding week of last year, $21,058,300 in 1903, $9,743,350 in 1902, $18,148,150 in 1901, and $23,888,925 in 1901.

The Stock Market

An irregular movement characterized the stock market this week, but toward the close bullish sentiment was rather strongly stimulated by a sensational advance in Reading, due to active short covering in that stock, accompanied by rumors of a corner and a forced settlement on the part of some of the largest shorts. This movement was followed by aggressive buying of Erie at advancing prices and later by heavy buying of the Pennsylvania stocks and of Amalgamated Copper, the latter being influenced by the continued upward movement in the metal market. The peace situation has been a sentimental influence throughout the week, and at one time caused quite a little feeling of apprehension that the conference would be terminated without any agreement, but the intervention of President Roosevelt appeared to change the situation, and at the close of the week confidence in a final peace agreement had been restored. The feature of the market continues to be the buying of the high-priced investment issues, and the movement of these to new high levels. It is pretty generally recognized that developments of more than ordinary importance underlie this buying, which can only be for important interests, as the prices at which these stocks are ruling are prohibitive to the ordinary trader. The flattering crop outlook is the basis for the general confidence reflected in the stock market, and this feeling is encouraged by the activity and strength in the iron and steel industry and in the metal markets. Money is moving to the interior in fairly liberal volume, but thus far this has not had any appreciable effect upon the money market, although somewhat high rates for call and time money are generally expected. Public participation in the stock market is increasing, and the outlook continues favorable to the development of an active bull speculation in stocks, notwithstanding that prices for the general market are conceded to be high. Much attention is being paid to the railway situation in the Northwest, and intimation of something definite in the line of readjustment point to important developments in the near future. The iron and steel stocks and the copper shares attained some prominence in the latter part of the week, and all the conditions bearing upon these are regarded as favorable to higher prices for them.

There has been little activity and no movement of any importance in the local traction stocks, and these appear to be waiting developments in connection with the proposed new subway routes.

Philadelphia

There was a sharp falling off in the dealings in traction stocks during the past week, and although prices displayed some irregularity, the general tone was strong. Interest again centered to a great extent in Philadelphia common, which sold to the extent of about 5000 shares at prices ranging from 46½ to 45¾, while the preferred changed hands at from 47¾ to 48¼ for odd amounts. The recent strength in these issues was based upon the large gains in gross and net earnings, and it is said that the company will earn near 10 per cent on the common stock this year. Philadelphia Traction was in excellent demand, and the price rose in consequence to 101½, the highest point attained for a long time. Transactions amounted to about 500 shares. Philadelphia Rapid Transit was considerably less active, but very firm, upwards of 1000 shares selling at from 28½ to 29¼. In the lower priced issues American Railways sold at 54⅛ to 53½, but subsequently rallied to 54. Railways General was quite active, at prices ranging from 3⅞ to 4¼. Other transactions included Union Traction at 62 to 61⅞, Fairmount Park & Transportation at 10¾, Fort Wayne Traction preferred at 50, Consolidated Traction of New Jersey at 81¾ and 82, United Companies of New Jersey at 270, United Traction of Pittsburg preferred at 50.

Baltimore

The feature of the Baltimore market was the activity and strength in all of the Union Railway issues. The free stock rose from 14½ to 15¼ on the purchase of about 1000 shares, while the trust receipts moved up to 15¾ on the exchange of about 500 shares. The 4 per cent bonds were quiet but strong, about $15,000 selling at 94⅞ and 95. The incomes were in excellent demand, upwards of $350,000 changing hands at from 62¾ to 65¼ and back to 64¼, while the trust receipts brought prices ranging from 63⅛ to 63⅝ for about $220,000. Other transactions included Macon Street Railway 5s at 99, Charleston Consolidated Electric 5s at 98, Norfolk Railway & Light 5s at 93½ to 94, and Baltimore Traction 5s at 101⅝.

Other Traction Securities

Trading in the Boston market was extremely quiet, but apart from a decline in Boston & Worcester common from 27½ to 25, prices generally held firm. Boston Elevated was conspicuously strong, with sales of about 300 shares at from 154 to 155, an advance of a full point. West End common moved up from 97½ to 98 on light purchases. Massachusetts Electric opened at 19½, but later ran off to 18¼, but the preferred held firm, with sales of small amounts at 62 and 61¾. Boston & Worcester preferred sold at 74. The Chicago market was absolutely featureless. Trading was confined to a very few issues, and most of the transactions involved odd lots. Chicago & Oak Park Elevated common sold at 5¼, and the preferred at 18½ and 18. Metropolitan Elevated sold at 24 and 24¼, and the preferred changed hands at 64. South Side Elevated was strong, with sales of 125 shares at 95 and 95¼. In the New York curb market Interborough displayed moderate activity, but the price movement was very erratic. From 219⅜ at the opening the price slumped to 214, but later rallied to 215. Upwards of 5000 shares were traded in. New Orleans Railway issues developed strength, the common rising from 31¾ to 33 on the exchange of about 1500 shares, while the 4½ per cent bonds sold at 90⅛ to 90⅜ for $10,000. Washington Railway common advanced from 40 to 42½ on the purchase of about 600 shares, and the preferred advanced from 92½ to 93½ on the exchange of 450 shares.

It is reported that when the October quarterly dividend of the Syracuse Rapid Transit Railway Company is declared it will be on the basis of 5 per cent instead of 4 per cent per annum as hitherto, as this year's earnings will justify such an increase. A year ago the stock was selling around 75. Now the quotation is at least 87 bid and 90 asked. The issue amounts to $1,250,000, and there is $2,750,000 of common stock. The preferred stock is 6 per cent non-cumulative. A dividend of 6 per cent must be reached before anything is paid on the common stock.

Little activity in traction in Cincinnati. Cincinnati, Newport & Covington was practically the only active feature, the common ranging from 38 to 39½ on sales of 850 shares, while the preferred

moved up from 96¼ to 97. Cincinnati, Dayton & Toledo sold at 23. Unknown parties bought several blocks of Miami & Erie canal stock at 25 cents a $100 share. This was the first transaction this year and the stock was thought to be worthless. The sales are supposed to be based upon the whisperings that certain interests will make another move before the next legislature to secure canal concessions. C., D. & T. 5s sold at 96½, and Aurora, Elgin & Chicago at 95.

Last week was the heaviest in three years on the Cleveland exchange. A raid was started on Aurora, Elgin & Chicago and it effected almost everything on the board. Of Aurora common, nearly 7000 shares changed hands during the week, and the activity still continues. It started out at 20, and advanced rapidly to 25½, then a reaction took place and it declined a point, where it still stands. Some 300 shares of the preferred sold at 85 and 86. There is a general feeling that these stocks are selling too high, as the preferred is not yet earning a dividend, but the reports of improved earnings are most encouraging. Lake Shore Electric voting trust certificates came in for an upward movement. This property is also showing remarkable gains in earnings, and there is a report that it will take over the Lorain Railway. The common started at 10 and advanced to 13 on sales of about 3000 shares. The preferred sold at 50 for a small lot, but it is now hard to get at many points higher. Cleveland & Southwestern took a trend the other way. There are reports that the company will finance a heavy floating debt instead of paying the customary preferred dividend. The common started at 12½ and dropped to 9, while the preferred dropped from 54 to 50; sales 1500 shares. Northern Ohio Traction & Light was stationary at 23 and 23½; sales 1015 shares. Northern Texas advanced from 66½ to 68. Western Ohio sold at 15, and Cleveland Electric at 69. Aurora, Elgin & Chicago 5s sold to the amount of $137,000 at 95⅜ and 95½.

Security Quotations

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

	Aug. 16	Aug. 23
American Railways	53	53½
Boston Elevated	154½	154
Brooklyn Rapid Transit	70⅛	69
Chicago City	a196	185
Chicago Union Traction (common)	8½	8½
Chicago Union Traction (preferred)	36	35
Cleveland Electric	78	71
Consolidated Traction of New Jersey	82	82
Consolidated Traction of New Jersey 5s	108½	108½
Detroit United	92⅝	95½
Interborough Rapid Transit	218¼	215
International Traction (common)	31	32¾
International Traction (preferred) 4s	68½	70
Manhattan Railway	167	166¼
Massachusetts Electric Cos. (common)	18	18
Massachusetts Electric Cos. (preferred)	61	61
Metropolitan Elevated, Chicago (common)	24	23⅞
Metropolitan Elevated, Chicago (preferred)	64	64
Metropolitan Street	129¼	129
Metropolitan Securities	83⅜	83
New Orleans Railways (common), W. I.	30	31⅞
New Orleans Railways (preferred), W. I.	71½	75
New Orleans Railways 4½s	89½	90
North American	100¾	101
North Jersey Street Railway	—	—
Philadelphia Company (common)	46¼	45¾
Philadelphia Rapid Transit	28¼	28½
Philadelphia Traction	100	100
Public Service Corporation 5 per cent notes	—	—
Public Service Corporation certificates	68½	68½
South Side Elevated (Chicago)	95	95
Third Avenue	127¾	127
Twin City, Minneapolis (common)	117¾	117
Union Traction (Philadelphia)	61¼	61¼
West End (common)	97	98½
West End (preferred)	113	113

a Asked. W. I., when issued.

Iron and Steel

The "Iron Age" says, although the volume of business entered during the past week has not been as large as in some previous weeks, conditions continue sound, and mills are taxed to utmost capacity, especially on building material and rails. The most interesting development in the pig iron market was the conference by representatives of the Bessemer Association with United States Steel Corporation officers concerning the purchase of Bessemer iron for September delivery. The Corporation is now using its surplus iron at the rate of 20,000 tons a day, and it will be necessary soon to make a purchase. It is understood that there is a slight difference of opinion as to price, but it is not thought that there will be any serious difficulty in reaching an agreement. It is probable that the purchase of about 40,000 tons will be announced before September 1. The sales of steel rails during the week amounted to 135,000 tons.

THE LAKE SHORE ELECTRIC

It is understood that in the near future the bankers' syndicate, which has had supervision of the operation of the Lake Shore Electric Railway since it was refinanced after the Everett-Moore embarrassment, will be dissolved, and the pool on the stock released. The property has been making gains in net earnings of from $8,000 to $10,000 a month, and it is figured that this year it will not only be in a position to pay all fixed charges, but have a surplus for preferred stock, whereas last year it had a deficit of $70,000. If the deal is closed the Lorain Street Railway and the Avon Beach & Southern, now controlled by the syndicate mentioned, will be merged with the Lake Shore company.

A syndicate of Cleveland men is trying to secure an option on the majority of the preferred and common stock of the Lake Shore Electric, offering 60 for the preferred and 15 for the common; both are selling at much lower figures at present.

IMPORTANT TRANSFER OF ELECTRIC AND GAS PROPERTIES AT HELENA, MONT.

J. G. White & Company, of New York, and associates have acquired the street railway, electric lighting and gas properties at Helena, Mont., known as the Helena Light & Traction Company. The electric railway system consists of about 17 miles of line, the greater portion of which is single track. There is an attractive amusement park operated in conjunction with the road. Current for both the street railway and the electric lighting system is supplied by the Missouri River Power Company. The incandescent and alternating-power distribution is three-phase, sixty-cycle, 220-volt, and rotaries installed in the sub-station provide a direct-current power system of 550 volts.

Howard S. Reynolds, superintendent of the operating department of J. G. White & Company, has been appointed manager of the company, and will leave shortly for Helena to assume his duties.

FIRE PROTECTION IN CLEVELAND

The General Fire Extinguisher Company has secured a contract from the Cleveland Electric Railway for equipping six more of its car houses with Grinnell sprinkler fire extinguisher outfits, making a total of twelve car houses to be, or being, equipped with the device. The outfits are practically the same as those described and illustrated in the car house test at the Broadway car houses in the Street Railway Journal of June 3, 1905, with the exception that the sprinkler heads will be placed 7 ft. apart instead of 6 ft., a recommendation to this effect having been made by the fire underwriters as a result of that test. Otherwise the overhead and side sprinklers will be the same as in the installation described. Thirteen large wooden tanks and steel towers for these installations were furnished by the United States Wind Engine & Pump Company, of Batavia, Ill. The total investment to the Cleveland Electric Railway Company will be in the neighborhood of $150,000. The insurance will, of course, be reduced materially, and the company will be relieved of the fear of the disruption of the service through the destruction by fire of its rolling stock. The installations mentioned have been passed upon by the old line and the traction mutual insurance companies, and it remains to be seen which will get the insurance.

WIDENER-ELKINS NEGOTIATING FOR INDIANA PROPERTIES

While a deal is pending for the sale, by Tucker-Anthony & Company, of Boston, of the Columbus, Buckeye Lake & Newark, the Columbus, Newark & Zanesville, and the Indianapolis & Northwestern properties to the so-called Widener-Elkins syndicate, of Philadelphia, it had not been consummated previous to Wednesday, Aug. 23. These three lines embrace about 175 miles of road, and are among the best constructed and the most prosperous properties in the country. The Widener-Elkins syndicate evidently aims to control all the great through interurban roads in Ohio and Indiana. Already it has under control not far from a thousand miles of interurban lines in these States.

AN IMPORTANT GEORGIA INTERURBAN

Thomas B. Felder, of Atlanta, attorney for the Atlanta & Macon Interurban Railway Company, has secured a charter from the Secretary of State for the construction of an electric railway between Atlanta and Macon. The head offices of the company will be located in Atlanta. The capital stock of the company is placed at $1,000,000, divided into 1000 shares of a par value of $100 each. The application for the charter carried with it the names of Chas. J. Cranford, of Chicago; Geo. W. Sigart, W. H. Turnbull and C. C. Young, of Manistee, Mich.; Thomas B. Felder and Geo. W. Williamson, of Atlanta; J. Albert Johnson and Guyton Johnson, of Greenwood, Ind.; W. H. Wocher, of Indianapolis, and Jas. B. Nelson, of Greencourts, Ind. The line will, when constructed, be about 100 miles in length, running in a southeasterly direction from Atlanta through the counties of Fulton, Clayton, Henry, Spalding, Pike, Monroe and Bibb. Leaving Atlanta the road will pass through Jonesboro, Hampton, Griffin, Barnesville and Forsythe and thence to Macon, thus touching at all points of importance between the two cities. Mr. Felder says that all of the stock has been subscribed.

INTERBOROUGH REPORT

A statement of earnings of the Interborough Rapid Transit Company, of New York, covering its subway and elevated divisions, has been made public. The figures are for the quarter ended June 30, 1905, and for the six months ended June 30, 1905, for the entire system; for the quarter ended June 30 and the twelve months of the elevated division; and for the quarter ended June 30 and the period from the opening of the subway on Oct. 27 to June 30. In addition to these figures is the balance sheet as of June 30, 1905. Only in the case of the Manhattan, or elevated, division is it possible to give comparative figures. The several statements follow:

MANHATTAN AND SUBWAY DIVISIONS

Quarter ended June 30, 1905:	
Gross receipts	$4,548,843
Operating expenses	2,080,887
Net earnings	$2,467,956
Other income	156,553
Total income	$2,624,509
Fixed charges	1,922,566
Surplus	$701,943
Six months ended June 30, 1905:	
Gross receipts	$9,131,565
Operating expenses	4,140,204
Net earnings	$4,991,361
Other income	316,028
Total income	$5,307,389
Fixed charges	3,876,349
Surplus	$1,431,040

MANHATTAN DIVISION

	1905	1904
Quarter ended June 30:		
Gross receipts	$3,198,972	$3,746,101
Operating expenses	1,379,460	1,532,213
Net earnings	$1,819,512	$2,213,888
Other income	73,553	81,768
Total income	$1,893,065	$2,295,656
Fixed charges	1,694,328	1,537,222
Surplus	$198,737	$758,434
Twelve months ended June 30:		
Gross receipts	$14,010,381	$14,187,684
Operating expenses	6,006,190	5,846,052
Net earnings	$8,004,191	$8,341,632
Other income	324,066	341,504
Total income	$8,328,257	$8,683,136
Fixed charges	*7,046,668	*6,757,412
Surplus	$1,281,589	$1,925,724

* Includes dividends on Manhattan Railway.

SUBWAY DIVISION

Quarter ended June 30, 1905:	
Gross receipts	$1,349,871
Operating expenses	701,427
Net earnings	$648,444
Other income	83,000
Total income	$731,444
Fixed charges	228,236
Surplus	$503,208
From Oct. 27, 1904, to June 30, 1905:	
Gross receipts	$3,638,987
Operating expenses	1,850,358
Net earnings	$1,788,629
Other income	181,488
Total income	$1,970,117
Fixed charges	639,589
Surplus	$1,330,528

The general balance sheet as of June 30, 1905, compares as follows:

Assets:	1905	1904	1903
Cost lease and equipment of subway	$24,760,858	$15,330,167	$5,378,357
Stocks and bonds of other companies	17,565,682	15,555,113	13,527,266
Other permanent investment	1,781,928	1,150,216	1,738,341
Supplies on hand	534,413	859,847	550,291
Due by agents	3,196	258	164
Due by others	10,743	10,850	11,311
Open accounts	3,792,144	762,871	68,315
Cash	2,044,777	2,432,770	10,886,248
Loaned on collateral	492,500	143,000	1,015,000
Manhattan guarantee fund	4,107,190	4,018,812	4,018,812
Prepaid insurance	88,327	84,721	6,748
Sundries	15,781	9,225	.....
Total	$55,197,539	$40,393,852	$37,180,852
Liabilities:			
Capital stock	$35,000,000	$35,000,000	$35,000,000
4 per cent 3-year gold notes	10,000,000	.....	.....
Interest on funded debt due and accrued	555,081	295,209	288,497
Sundries	152,603	63,003	7,636
Manhattan Railway Company lease account	377,450	382,323	430,920
Due by agents	3,196	258	164
Due for supplies, taxes, etc.	554,235	473,722	267,614
Open accounts	4,602,911	9,486	10,085
Interest and premium on capital stock	*220,000	646,502	371,073
Taxes in litigation	1,848,405	918,665	163,000
Profit and loss, surplus	1,794,311	1,773,048	547,324
Dividends unpaid	.....	699,740	.....
Total	$55,197,539	$40,393,852	$37,180,852

* Premium only.

HASTENING SAN FRANCISCO MUNICIPAL LINE

The Supervisors of San Francisco have taken action to hasten plans for the reconstruction of the Geary Street Railway. By resolution heretofore adopted the City Engineer has been instructed and authorized to prepare plans and specifications on which bids might be asked for the work of reconstruction. That there might be no delay in this, on account of a possible scarcity of funds in the City Engineer's office, Chairman Braunhart, of the public utilities committee, introduced the following resolution, which received the unanimous support of the board:

"Resolved, That the sum of $3,500 be and the same is hereby set aside out of the appropriation of $350,000 made in the budget of the fiscal year 1905-1906 for the construction of the Geary Street Railroad, for the purpose of enabling the City Engineer to prepare and transmit to the Board of Supervisors specifications in detail of said road as ordered by resolution No. 6159 of said board, approved July 24, 1905, said sum to be expended under the joint direction of the committees on public utilities and finance of the board of supervisors and of the City Engineer."

A NEW LINE OUT OF TRENTON

The Trenton, Hamilton & Ewing Traction Company has been chartered in New Jersey to build extensions of the Trenton Street Railway from a point near Cadwalader Park to Trenton Junction, and from East State Street and Johnson Avenue to Mercerville and Hamilton Square, via the Interstate Fair Grounds. Karl G. Roebling, of the John A. Roebling Sons' Company, has been elected president of the company, and Louis C. Taylor secretary and treasurer. The board of directors includes William Anderson, B. C. Kuser and Duncan Anderson, as well as Messrs. Roebling and Taylor. Work upon the new lines will be started very shortly, the preliminary work having been under way for some weeks. It is expected that the construction of the extension from Stuyvesant Avenue, Trenton, to Trenton Junction, via the State Hospital for the Insane and the Trenton Country Club, will begin within a couple of weeks. This line will compete with the Reading Railway to Trenton Junction, and will open up a most desirable suburban section. The total length of the line from the City Hall, Trenton, to Trenton Junction will be about 5 miles, and the extension will cover about half of this. The Reading Railway has an excursion rate of 15 cents, and operates eighty passenger trains per day, but does not run to the business center of Trenton, nor into the residential section of Trenton Junction. The Hamilton Square extension will compete with the Trenton & New Brunswick Railroad as far as Mercerville, but will have advantage over the latter. The new line will go direct into the town of Hamilton Square, while the Trenton & New Brunswick Railroad goes a mile to the west and north, and the latter line charges an excursion rate of 25 cents for the 6¼ miles. The new line will be only 4½ miles to the intersection of the Trenton & New Brunswick Railroad, or 5½ miles to the center of Hamilton Square. Both the Trenton Junction and Hamilton Square lines will be operated by the Trenton Street Railway, entering the city over that company's tracks.

NO INDEPENDENT SYSTEM IN YORK

After eight months of consideration, the Common Council of York, Pa., has defeated ordinances permitting Philadelphia capitalists to build lines in that city, and has adopted ordinances giving to the York Street Railway Company and allied corporations franchises to construct new lines and extensions. The action of the Council was taken because the Philadelphia corporations stated in a communication from Attorney John F. Kell, of York, that they were unable to comply with the provision of the bills before Councils granting privileges to the several companies. The York Street Railway Company, on the other hand, had submitted a communication, with bonds to the amount of $75,000, agreeing to carry out provisions specified by the Councils. The bills granting the franchises to the York Street Railway Company came to a vote without material discussion. The ordinances demand of the York Street Railway Company that upon all new lines constructed there shall be paid to the city 5 per cent on gross receipts for the first five years, 6¼ per cent for the next five years, and 8 per cent thereafter, as well as taxation fees on all cars, poles and wiring, together with an assessment on all suburban cars entering the city.

'BUS LINE IN OHIO

The automobile bus line from Springfield to Cedarville, Clifton and Jamestown has commenced operations. Thus far but one gasoline car, seating twelve passengers, has been placed in service, and this has been insufficient to carry the people. Other cars will be added within a very short time. Eventually there will be a car each way every two hours. The road in Clark County has been leveled by the company, but the Commissioners of Greene County have refused to let the company do anything with its route in the way of improving it. Jamestown people are delighted with the service, and hope to induce the company to operate between Jamestown and Xenia. The Commercial Transit Company, which operates these cars, is headed by J. C. Harshman, of Sprinfigeld, who has been prominently identified with the building of a number of electric railways in the vicinity of Springfield. He has great faith in the new project. The company expects in the near future to start a similar service between Springfield, Catawba and Mechanicsburg. The prejudice which still exists against such cars among the country residents is shown by the refusal of Mr. Harshman's application for the right to operate several of his cars at a county fair.

NINTH ANNUAL CONVENTION OF STREET RAILWAY ACCOUNTANTS

Secretary Elmer M. White has announced that the ninth annual meeting of the Street Railway Accountants' Association of America will be held on the second floor of the South Building, Philadelphia Museum, Thirty-Fourth and South Streets, Philadelphia, Pa., Sept. 28, 29 and 30, 1905. The Mechanical & Electrical Association and the Claim Agents' Association will meet on Monday and Tuesday, Sept. 25 and 26, and the American Street Railway Association, Wednesday and Thursday, Sept. 27 and 28. The hall can be reached via Walnut Street cars to Thirty-Fourth Street, where stages will be in waiting to convey visitors to the hall without charge. A light lunch will be served at moderate cost.

The headquarters of the Accountants' Association will be at the Hotel Walton, Broad and Locust Streets. (The Bellevue-Stratford, the headquarters of the American Street Railway Association, is across the street.) Rates are as follows, European plan: Single rooms, without bath, $2.00 and up per day; single rooms, with bath, $2.50 and up per day; double rooms, without bath, $3.00 and $4.00 for two persons, and double rooms, with bath, $4.00, $5.00 and $6.00 two persons. The annual banquet will be held Thursday evening, Sept. 26, at the Bellevue-Stratford.

The passenger associations have granted rates of fare and one-third on the certificate plan. A certificate must be obtained from the ticket agent when purchasing a ticket, and it should be left with the clerk when registering.

The report of the reorganization committee will be presented, and the members will be called upon to vote on some amendments to the present constitution and by-laws. As this is a very important period in the history of this organization it is earnestly desired that a full attendance be present.

AFFAIRS IN CHICAGO

Chicago seems to have taken sadly to heart a decision rendered a few days ago at Indianapolis by Judge Francis E. Baker, of the United States Circuit Court, who, in handing down a decision in the Indianapolis gas case, which involved the city and the gas company, held that cities have no power to take over the property of public service corporations, even when the right is stipulated in the franchise. Judge Baker's opinion is based on the incompetency of the gas company, under its powers derived by statute, to make such a contract as was made with the city of Indianapolis. He does not go into the question of the city's right to make the contract. "The complainant asserts," says the opinion, "that the option is void by reason of the want of corporate capacity on the part of both the city and the gas company. It is obvious, however, that if either party was wanting in capacity the contract, which must be a valid engagement between competent persons, must be held void, unless the complainant is estopped from raising the question." After deciding that the gas company is a quasi-public corporation and, therefore, without power to exercise authority not granted to it by "the charter under which it exists or from some other act of the Legislature which granted that charter," Judge Baker says:

"As there is no pretense that the gas company was authorized by its charter to enter into an option to sell all of its property in gross, it is very clear, under the above authorities, that the act of the gas company in giving the city an option to purchase all of the gas company's property was beyond the scope of the corporate rights of the gas company."

It was pointed out in Chicago that if the decision applies to that city it guillotines the thirteen-year tentative ordinance, and that it brings up the question whether the city will have the right at the end of the time limit to take over the property of the Illinois Tunnel Company, as specified in the franchise. Corporation Counsel Jas. Hamilton Lewis, however, pointed out that the finding would not apply to the Illinois Tunnel Company, for the reason that it does not operate under a State charter, but under a city ordinance. Another deduction that caused vexation was one indicating that if a city has the right to enter the business of operating public utilities only by the method of starting independent systems to compete with the private ones already in the field the fact would tend to invalidate the Mueller law. This is the only enabling law Chicago has. It gives the city the right to "own, construct, acquire and operate" municipal systems. If it is illegal for the city to "acquire," it is pointed out, the presence of that word in the Mueller law perhaps would make the whole act invalid. Another interpretation of the act was that the ruling is not applicable to Chicago. One authority says the ruling is based on the fact that there is no statutory authority in Indiana for the city's taking over the property of the gas company. It is pointed out that this point is covered in Illinois by the Mueller law, through which the Legislature has given Chicago the right to buy the street railway properties.

SPECIAL FREIGHT RIGHTS FOR MASSACHUSETTS COMPANY

By securing an amended grant from the town of Attleboro, it looks as if the Taunton & Pawtucket Street Railway had removed the last obstacle to the experiment in Massachusetts of carrying freight and express by electric railway. The company's line runs through Rehoboth, Seekonk and Attleboro, connecting Taunton, Mass., and Pawtucket, R. I., and the Railroad Commission on July 13 issued the necessary certificate for beginning the experiment in freight carrying through Taunton, Rehoboth and Seekonk, all of which are in Massachusetts. Attleboro, however, instead of granting an unconditional permit for this kind of business, made the grant conditional on the erection by the company of a waiting room at a point designated by the town authorities. While the railway company made no open objection to this, the Railroad Commission ruled that this condition related in no way to freight service and was outside the intention of the statute of 1904, under which the company contemplated beginning the freight and express business. The commission therefore declined to grant a certificate as to that part of the line in Attleboro; and its objection was not met until the company secured an amended grant from the local authorities of that town similar in form to those in the other towns, and unrestricted by conditions. It is not expected that the Railroad Commission will require an additional hearing, since the whole matter was gone over carefully at the original session, and the certificate as to Attleboro will probably issue within a few days.

This undertaking of the Taunton & Pawtucket Company is the first under the statute of 1904, which authorized street railways to act as common carriers of freight and baggage after obtaining permission from local authorities and approval of the Railroad Commission in similar procedure to that required for locations. It is of particular interest for the reason that both the company and the commissioners regard the whole thing tentatively. The project is authorized merely as an experiment, to continue six months from Sept. 1. If it proves profitable and satisfactory, the authorization may be extended indefinitely; if not, the whole business may be discontinued. No similar experiment has been given a fair trial in Massachusetts up to the present time. A number of roads have received common carrier privileges under special charters, but so far as the eastern part of the State is concerned, at least, none of them has ever made a systematic effort to develop the business.

To meet the objection raised at the outset of negotiations, that the company might at some time refuse to carry certain classes of freight or express matter, if it found the carrying of such matter inconvenient or disagreeable, the commission had the company submit a schedule covering the kinds of matter which it desired to carry, and this puts a limitation on the whole business that seems likely to prove advantageous for both company and shippers, in keeping the business within reasonable bounds for street cars. By the terms of this schedule the company will undertake to carry general merchandise, groceries, furnishings, furniture, household commodities, stationery and printed matter, mill supplies, machinery, tools, implements, building materials, if no single piece exceeds 6 ft. x 4 ft. x 3 ft. in measurements, or 1500 lbs. in weight. It will carry liquids in cases, tanks and barrels not more than 6 ft. x 4 ft. x 3 ft. in size; perishable goods, when storage is at owner's risk; and hay and grain; but the schedule, as required by the Railroad Commissioners, specially excludes all explosives, as well as naphtha, gasoline, benzine and kerosene. The company may also carry coal for railway purposes.

The type of car allowed is the ordinary box baggage car, to be in charge of a motorman and a conductor, with possibly an express messenger, if the business requires it.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED AUG. 15, 1905

797,021. Railway Switch; Rudolph H. Scheibert, Middletown, Ohio. App. filed June 2, 1905. The usual switch at a turn-out or siding is equipped with operating levers which extend along the track. The engine of a through going express is equipped with an arm which strikes said lever and operates the switch if the latter should be open.

797,098. Brake Mechanism for Cars; Francis L. Clark, Pittsburg, Pa. App. filed Dec. 3, 1902. A usual form of magnetic brake is provided with links which connect to brake-shoes upon the wheels so that when the magnetic brake is operated the shoes are applied.

797,141. Block Signal System for Electric Railways; Frank R. McBerty, Evanston, Ill., and Malcolm E. Launbrauch, Chicago, Ill. App. filed Sept. 9, 1904. A pair of toothed wheels are stepped around whenever a car enters or leaves a block section. The semaphore is displayed as long as there is relative displacement between the two. The instrument at each end of the block is automatically cut out by the operation of the other, so that cars cannot simultaneously enter from both ends.

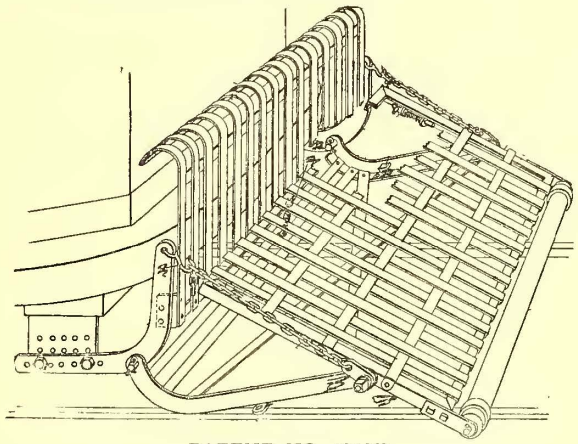
797,180. Electrical Apparatus for Signaling on Railways; Henri Cousin, Paris, France. App. filed April 3, 1905. When passing a danger signal certain contacts are made which absolutely stop the train, but a caution signal may be passed provided the engineer blows the whistle to show he is vigilant.

797,187. Car Signal; Frederic H. Ensign, Los Angeles, Cal. App. filed Sept. 20, 1904. A light is displayed at the rear of a train having a reflector which moves in accordance with the movement of the train so that the engineer of the following train may be informed of such movements and control his car accordingly.

797,191. Railroad Train Signal. Samuel E. Foreman, Paducah, Ky. App. filed March 28, 1905. A pair of conductors are laid along the track and a circuit is completed therefrom through each train. When two trains approach too closely together the resistance decreases and the increasing current indicates the danger.

797,229. Car Fender; William B. Rohmer, Bay St. Louis, Miss. App. filed Nov. 7, 1904. The fender carries in front of it a horizontal rod which acts as a sort of trigger or detent, and drops the fender whenever it encounters an obstruction.

797,252. Electric Switch; Milan V. Ayres, Newton, and Daniel E. Hennessy, Everett, Mass. App. filed Feb. 9, 1905. A U-shaped tube containing mercury is supported by the usual trolley wire. When a car passes the wire is inclined and the mercury breaks certain contacts which actuate the signals.



PATENT NO. 797,363

797,262. Switch Rod; William Kirkpatrick, Winnipeg, Can. App. filed Jan. 13, 1905. In order to prevent the breakage of a switch rod by the passage of a train when the switch is not properly set, the rod is extensible by means of a spring-pressed telescoping connection.

797,296. Metal Railway Tie; John A. Lippert, Buffalo, N. Y. App. filed April 10, 1905. An H-girder in which the lower base plate is formed with upwardly extending webs which increase the rigidity and facilitate tamping.

797,332. Car Door Operating Mechanism; John S. Stevenson, Detroit, Mich. App. filed March 10, 1905. The doors are opened by a system of levers and links having rollers at their pivots which are guided by a specially formed V-shaped rail.

797,336. Air Brake; Edwin B. Temple, Boston, Mass. App. filed Oct. 29, 1904. Each car door controls a valve in the train pipe, so that the brakes cannot be released until all the doors are closed.

797,363. Safety Device for Motor Cars; Benjamin Lev, Cleveland, Ohio. App. filed July 13, 1903. In order to prevent the rebound of a person from the spring back of a car fender, an attachment is provided for deflecting the fender upwardly after a person has fallen thereon.

797,398. Electrofluid Pressure Switching Mechanism; Walter J. Bell, Los Angeles, Cal. App. filed Aug. 25, 1904. The semaphore arm is operated from a branch of the same pneumatic pressure pipe that actuates the switch point. An ordinary D-valve is used for the operating cylinders, being moved into its alternate positions by a pair of electromagnets.

797,467. Switch-Operating Mechanism; Robert M. Stephens and James H. Holland, Carrollton, Ga. App. filed April 28, 1905. A pair of tappets in the roadbed are arranged to be actuated by arms upon the train manipulated by the engineer. The tappets are connected to move the switch point.

797,498. Block Signal System; Fred. B. Corey, Schenectady, N. Y. App. filed Jan. 21, 1905. A semaphore arm is actuated from an electric motor into three positions. The extreme positions correspond to safety and danger, respectively, and the intermediate position to caution. The circuits are arranged to actuate the motor to these positions.

12,381. Railway Passenger Car; George Gibbs, New York, N. Y. App. filed May 29, 1905. A construction of steel frame car having particular reference to the window frame. A complete steel plate construction is provided to form the sill and the guides for both of the sashes.

PERSONAL MENTION

MR. A. C. DENMAN, JR., has been elected general manager of the San Bernardino Valley Traction Company, of San Bernardino, Cal., to succeed Mr. John H. Fisher, resigned.

MR. F. L. MOWRY, of Boston, has been appointed general superintendent of the Stark Electric Railway, of Alliance, Ohio. He will have charge of the operating department. President C. R. Morley will thus be relieved of this portion of his duties.

MR. J. R. CURTISS, general superintendent of the Cleveland, Painesville & Ashtabula Railway, of Painesville, Ohio, has resigned to become superintendent of the Philadelphia, Lancaster & Christiana Electric Railway, which controls 80 miles of line. Mr. Curtiss will superintend the construction of an extension to Christiana, 24 miles.

MR. ALBERT A. COX, formerly superintendent of overhead lines of the Camden & Suburban Railway Company, and recently with the Schuylkill Traction Company, has started business as a contractor. His first contract is for the reconstruction of 28 miles of overhead line for the Schuylkill Traction Company, at Girardville, Pa.

MR HORACE C. STILLWELL'S resignation as general agent for the Indiana Union Traction Company, to take effect Sept. 1, has been accepted. With Mr. George F. McCulloch and others Mr. Stillwell is interested in the Muncie & Portland Traction Company, now building an electric railway to connect Muncie and Portland, and until that line is completed Mr. Stillwell will devote most of his attention to it.

MR. LINDEN P. WHITE, for a long time assistant superintendent and engineer for the Columbus Railway & Light Company, of Columbus, Ohio, will resign that position to become general manager of the Columbus Structural Steel Company, which has been organized in Columbus to build structural material and buildings. Mr. White will continue to act as one of the consulting engineers for the street railway company.

MR. R. P. WILLIAMS has resigned as inspector of special work for the Brooklyn Rapid Transit Company, to become roadmaster of the Northern Texas Traction Company, the duties of which office he has assumed under General Manager B. A. Mapledoram, of the company. Mr. Williams was with the Brooklyn company as inspector for two years. Previously he was with the Rochester Railway Company. At one time Mr. Williams was associated with Mr. Mapledoram in the management of the Lorain Company's plant at Johnstown.

MR. S. M. CLEMENT has been elected a director and Mr. Nelson Robinson vice-president of the International Railway Company, of Buffalo, to fill vacancies caused by the death of Col. Daniel S. Lamont. The present board is as follows: Arch M. Robinson, of Louisville, Ky.; Robert L. Fryer, Henry M. Watson, Pendennis White, Henry J. Pierce, S. M. Clement, of Buffalo, N. Y.; Thomas E. Mitten, of Chicago, Ill.; Col. Oliver H. Payne, Nelson Robinson, G. L. Boissevain, Daniel O'Day, Arthur Robinson, of New York; Thomas DeWitt Cuyler, of Philadelphia; Thomas Gibbs Blackstock and Edmund Boyd Osler, of Toronto.

MR. J. CLIFTON ROBINSON, managing director and engineer of the London United Tramways Company, Ltd., and of the Middlesborough, Stockton-on-Tees & Thornaby Electric Tramways, chief engineer of the Bristol Tramways & Carriage Company, Ltd., and director of the Metropolitan District Railway Company, which is now equipping its lines for electrical operation, was knighted June 30 on the occasion of the king's birthday. Mr. Robinson commenced his tramway work under the late Mr. George Francis Train, the pioneer of tramways in Great Britain, whom he subsequently accompanied to America. Mr. Robinson has been general manager of the Edinburgh Corporation Cable Tramways, and subsequently was responsible for the Highgate Hill tramways. He installed electricity on the Dublin, Southern, Bristol and Teesside systems.

MR. W. S. DORAN, on the occasion of his leaving England to return to the United States, was banqueted at the Hotel Cecil, London, by about one hundred of his associates in the British Westinghouse Company and other friends. Mr. Doran went to England in 1899 for the Worthington Pumping Engine Company, after an extended experience in the United States with this company, the Southwark Foundry & Machine Company and the United Gas & Improvement Company. In 1901 Mr. Doran joined the British Westinghouse Company, paying special attention to the organization of the branch offices, and also looking after important contracts with the railway companies and corporations. Mr. Doran has been appointed manager of the power department of the Allis-Chalmers Company, and will hereafter have his headquarters in Milwaukee.

MR. HOWARD S. REYNOLDS, superintendent of the operating department of J. G. White & Company, of New York, has resigned to assume the management of the electric light, street railway and gas properties in Helena, Mont., recently acquired by the White Company and allied interests. Mr. Reynolds graduated from the Massachusetts Institute of Technology in 1894, with the degree of B. S. The following year was spent with the Lowell, Lawrence & Haverhill Street Railway, after which he was with the Boston Elevated Railway and the Brockton Street Railway in various capacities. For six years Mr. Reynolds was with Stone & Webster, first as a draughtsman and street railway construction superintendent, and later as manager of their street railway, electric lighting and gas properties in Columbus, Ga. This position he resigned to become associated with J. G. White & Company.

PROF. HENRY H. NORRIS, who was in charge of the electric railway tests at the St. Louis Exposition, and who has recently done expert work for the American Street Railway Association in connection with its proposed plan of reorganization, has recently been appointed full professor of electrical engineering at Sibley College, Cornell University. In view of the importance with which the study of electric railway engineering is regarded at present, it is the purpose of the university authorities to allow those students who desire to specialize in this branch of electrical engineering an opportunity to do so, by a combined laboratory, recitation and lecture course. It is also the intention to increase the laboratory equipment at Sibley College in order to give special instruction in this department. Prof. Norris, who is now the head of the department of electrical engineering at Cornell University, is a graduate of Sibley College of 1896, and for the past five years has been assistant professor of electrical engineering at that school. He is a native of Philadelphia, where he was born in 1873. After graduating from the Manual Training High School in that city, he entered the employ of the Rhodes Manufacturing Company, a concern manufacturing dynamos, motors and other electrical machinery. Here he was assistant to the electrician, and was engaged in designing, constructing and testing electrical apparatus. In 1891 he took a position in Baltimore, where he attended the course in physics at Johns Hopkins University. After a short connection with the Arnold Electrical Manufacturing Company at Chester, manufacturers of dynamos, motors and storage batteries, Prof. Norris returned to Johns Hopkins University and took a special two years' course in electrical engineering, but in 1894, at the end of this period, went to Ithaca and finished his course there. In addition to his connection with the Electric Railway Test Commission at the St. Louis Exposition, Prof. Norris was a member of the official bureau of awards at St. Louis, being secretary of the group in electrical engineering. He has also acted as consulting engineer for a number of installations, and has been a frequent contributor to the technical and semi-technical press.

PROF. HENRY H. NORRIS