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Of this issue of the Street Railway Journal 8200 copies are printed. Total circulation for 1905, to date, 253,550 copies, an average of 8179 copies per week.

The Table of Street Railway Statistics

Following our usual custom, we have tabulated the statistics given in the Red Book, showing the mileage, cars and capitalization of the street and elevated railways in the United States and Canada, and are publishing the table in this issue. As explained in the article accompanying this table, some slight modifications have been made in the method of compiling these statistics followed in former years, and the cable, steam and horse railways have been grouped in one column instead of in two as last year, or in three as in previous years. The maintenance of this column is due almost entirely to the retention of horses on a few of the downtown lines in New York, of the cable in a few other cities like Chicago, Kansas City and San Francisco, and to a few steam dummy lines which are still in operation in the Southern and far Western States. Certain of these cable lines may never be changed to electricity, owing to steep grades to be negotiated in Kansas City, San Francisco and a few other cities on the Pacific Coast, but these roads should be considered more in the nature of inclined planes than of normal street railways. The horse is, of course, an anachronism at present, and no one realizes this better than the companies which have them in use, but as yet circumstances in New York, where they are most in evidence, have prevented a change to a better power.

The Era of Interurban Consolidation

We appear to be now on the eve of an era of extensive consolidation of interurban roads. That such consolidation must come inevitably as a development of the business has been evident for some time. While consolidations in a small way have been taking place continuously since interurban building began, the present developments along the New York Central in New York State and the efforts of the Widener-Elkins syndicate in Southwestern Ohio and Eastern Indiana are probably forerunners of large movements of this kind wherever interurban networks exist. It is as natural that such consolidation should take place on electric interurban lines as on steam railroad, and the same reasons exist which make consolidations desirable. So far there seems to be no effort on the part of steam railroads in the Middle West to follow the example set by the New York Central in getting control of parallel electric lines and using them to take care of and develop a local traffic.

Observation Cars for Sightseers

For several years in a number of our cities which are popular objective points for tourists, the street railway companies have maintained a regular service for the benefit of sightseers and tourists. One of the first of these was the service given by the "Seeing Denver" cars in Denver. That city is yearly visited by many thousands of tourists, who are glad to be able to obtain a car which will take them all over the city without the trouble of transferring and with a guide to point out the places of interest. These "Seeing Denver" cars make several trips a day, leaving the downtown hotels at stated times. Similar service has been given in some other cities, among which Washington, Detroit, Montreal, Cleveland and San Francisco are probably the most prominent examples. In Montreal, as described elsewhere in this issue, a special car has been built for this purpose, and as it is along the lines of a tally-ho, it fulfils admirably the purposes for which it has been designed. While a service of this kind cannot be a very great source of revenue, it is a good thing for the city and indirectly a benefit to the company, as it raises the company in the esti-

mation of the public, both at home and abroad, to have a first-class service of this kind maintained. There are many cities so situated that a service of this kind would hardly pay, but it would seem that a more extensive trial of this scheme would be worth while.

The Automobile in Street Railway Work

To many operating officials the thought of using the automobile in street railway work comes as something of a surprise. In large city systems, however, there is no doubt that a great deal of time can be saved by the employment of the runabout or even the touring car in certain departments. Officials like the superintendent of transportation, chief engineer of power stations, supervisor of rolling stock and others whose duties call them almost daily to all the car houses and mechanical headquarters in the system are seldom able to use surface cars with anything like economy of time. Realizing this, some companies have furnished certain officers with a horse and carriage in times past with excellent results. The automobile is now coming into service in this way, and the ease and flexibility with which such machines can be navigated through streets crowded with heavy traffic, or directed through short cuts not traversed by the company's regular cars, contribute largely to their economy of official time. It is really surprising to find how much inspection can be done in this manner in a day, the point being that the amount of unproductive time lost in traveling from place to place is greatly reduced.

Manifestly it is impracticable for a company to provide all of its higher officials with automobiles, but even one machine can be made to do pretty substantial duty as a starter. Equipped with a suitable tonneau, light supplies can be transferred readily from place to place, and when one official is not using the machine there is little likelihood of its standing idle. Supposing that a company buys a machine costing $2,000 and that it is run 50 miles a day, operating expenses and all fixed charges ought not to exceed $600 per annum—a sum readily saved in the time of the class of officials by which it is used. The matter is well worth thinking about, at all events.

The Testing of Supplies

The purchase of the supplies which are used in the operation and maintenance of equipment upon electric railways is one of the most important essentials in economic operation. In no other line of work are the requirements made upon the materials and supplies used more severe and exacting than here, and variations in quality of materials for certain specific uses may mark the difference between success and failure. It stands to reason that careful study and an intelligent understanding of the situation are necessary in the proper management of the purchasing department, and that this is being recognized is evident from the greater amount of engineering skill that is being employed in the purchasing departments of most of the larger roads, particularly in reference to supplies subject to variations in quality.

It is also obvious that increasing care in the purchase of all classes of supplies is necessary to obtain the best results, on account of the more strenuous operating conditions of modern railway practice. In many lines this has come to signify the laboratory testing of certain classes of supplies. The important part that laboratory testing plays in civil and mechanical engineering lines is well known. In all work of any magnitude, testing is resorted to, and, in many cases, even the manufacturers have elaborate facilities for testing their product. In electrical apparatus the only method to predetermine probable qualities is by test. Not only must quality tests be made, but tests to develop faults in design and construction, to check up theoretical calculations, and finally to predetermine the practical limitations. Elaborate testing facilities are as essentially responsible for the high standard of excellence of electrical materials and machinery put on the market by the larger manufacturer as is the design.

If it is a source of economy for manufacturers, both large and small, to subject their products to thorough tests, it would seem that the purchaser may make use of testing to equal advantage. Large quantities of materials and supplies are purchased by the majority of electric railways without any knowledge of the actual qualities in individual cases. That almost all materials vary in quality is well known; accordingly it is inevitable that some purchasers will receive better grades of materials than others. Furthermore, it is unfortunate but true that in some lines of supplies there are salesmen who are willing to foist inferior grades of goods upon unsuspecting purchasers; this regrettable fact will be only too readily admitted by all purchasing agents.

All this can be remedied by inserting in the specifications or order, when purchasing, clauses referring to strict compliance with specifications, which shall cover all points where inferiority may enter. Public laboratories are now available to purchasers wherein all necessary tests of materials and of any desired accuracy may be made, and the records and reports may be kept confined as strictly in the possession of the purchaser as desired. This relieves the purchasing agent of responsibility in the technical side of the question, with which he may not be familiar, and enables him to secure for his company supplies and materials of the best grades obtainable.

As an instance of the effect of a very slight variation in quality, may be cited the case of copper wire, which, when bought from reliable makers, may be expected to be of uniformly good quality and show but slight variation in quality. On the other hand, it is well known that a variation of 2 per cent in conductivity of the copper wire is equivalent, electrically, to a variation of 2 per cent in the amount of wire that must be obtained for a certain definite carrying capacity, or, in effect, a variation of 2 per cent in the price paid. In one instance recently, a purchaser of copper wire in large quantities had four samples submitted for test, all of which looked very much alike, and variations in quality or conductivity would not have been suspected from the outside appearance; yet under test the conductivity of these four samples were found to be: (1) 57.7 per cent; (2) 65.6 per cent; (3) 80.2 per cent; (4) 99.1 per cent. The moral is evident. Three of the samples were so influenced as to electrical conductivity by very slight variations of chemical composition that their actual value for electrical purposes was seriously impaired. If it is desirable to go to no end of trouble in the power plant, or in a car equipment, to minimize the wastes in operation, it would seem to be fully as important to arrange for tests upon the conductivity of samples of wire before purchasing.

In other lines of supplies exact values cannot be assigned to variations in quality, but nevertheless such variations may be of great importance. The insulators used in construction work upon high-tension distribution lines may vary considerably in strength and resistance, and in view of the serious consequences which may attend the break-down of a single insulator, it is very important to get only the best. The only method of determining the variations in quality in such a case

is by inspection and test. While it is the general practice of all larger companies to buy high-tension insulators subject to inspection and test, still a great many use insufficient care in this direction and are obviously liable to get poor insulators. The cost of testing in this case is, as in many others, well repaid by the greater reliability in subsequent operation which results from it.

Results from the Valtellina Railway

We are glad to present to our readers a full account of the latest methods employed on this important line, together with a complete description of the new locomotive equipment there in use. It must be remembered that, considering the length of track and the character of the service, this is one of the most considerable electric roads in the world; in fact, one of the very few lines whereon electricity is used as a full substitute for steam in ordinary railway working. As the principal example of three-phase traction, its performance has been watched with great interest, and it has now been in operation long enough (three and one-half years) to allow something like a sound judgment concerning its practical performance. About a year ago three electric locomotives of new design and greatly increased power were added to its equipment, and the details of these form an important part of the present article. They possess many interesting features, but by all means the most novel are those relating to the design and support of the motors. As in the earlier passenger equipments, four motors are used, two of them fitted for use in cascade with the others, thus giving a powerful torque at half speed, while at full speed the main primary motors are adequate for all demands. The two normal speeds thus available are 40 m.p.h. and 20 m.p.h., while the rheostats supply the necessary gradations. In these new locomotives, twin motors, each consisting of a primary motor and motor for cascade connection, are united in a single structure, two such units being employed on each locomotive.

On its face, this seems a heavy and somewhat intricate arrangement, but it is more effective than would appear at first sight, since, after all, the total weight of the locomotive is not excessive, being but 62 tons, and the combination is, upon the whole, highly efficient. When connected for high speed, the motor efficiency is stated to be 95 per cent, while in cascade connection it falls to 88 per cent. These figures compare favorably under operative conditions with those obtained from d. c. equipments or a. c. series motors of similar size. The power factor on single connection is a little above 95 per cent, giving thus an apparent efficiency of fully 90 per cent, which should dispose of any fears about the carrying capacity of the line. On cascade connection the power factor falls to 79 per cent, giving an apparent efficiency of only a scant 70 per cent. This is the weak point of the cascade connection, which, however, is only intended for incidental use in the ordinary course of running, so that its total effect upon the efficiency of the system is not serious.

Even more unusual than the structure of the motors is their connection to the axles. There are three pairs of driving wheels on the locomotive, with the two motors spring supported in the spaces between the pairs, and each driving all three axles by means of cranks and connecting rods. The explanation given of this extraordinary design is not altogether illuminating. It is stated that for large units gearing is undesirable, in which we concur, and that the ideal drive for main line traction is by direct-coupled motors. But inasmuch as the flexible connection used on the earlier Valtellina equipment for the direct-coupled motors is stated to have worked satisfactorily in every respect, it is not quite clear why it was abandoned in favor of cranks and connecting rods. Of course, the new arrangement allows much easier access to the motors in case of necessary repairs, but since it is stated that it has not yet been necessary to change the bearings or to renew the bushings, although most of the motor cars have run over 100,000 miles, and that there has been no occasion to repair the motor windings for a year and a half past, the reasoning does not seem particularly cogent. It strikes us that the main function of the new drive is to compel the motors to pull together under all circumstances. However, this much may be said, that the drive does not seem to give any trouble and does not materially affect the efficiency, so that while certainly cumbersome it may be unobjectionable.

More important to engineers than the report on the new locomotives is the general information as to some of the operative features of the system. The current collector in use seems to have satisfactorily solved the problem of dealing with two trolley wires. It is a single flexibly supported bow carrying two long rollers borne by ball bearings on the same shaft. Current is taken from these by carbon brushes. The rollers are found to give fully 12,000 miles without repairs, and the copper exterior shell can then be easily renewed. Current up to 200 amps. can be taken off by this simple contrivance without the slightest difficulty, and the wear upon the trolley wires seems to be practically nothing. The experience of three and one-half years of operation appears also to have shown that the difficulty of operating with two trolley wires, especially at switches and in yards, has been greatly overestimated.

Meter tests on the system, to which we have recently referred, show a very moderate consumption of power, amounting on a year's average, including all the current generated for every purpose on the system, to but 71.6 watt-hours per ton-mile. The peak of the load, it should be added, is about three times the average load for the day. One interesting matter taken up is the effect of the normally constant speed of the motors upon train operation. It is generally understood that making up time on a three-phase road is decidedly troublesome. The necessary leeway is gained on the Valtellina system as follows: First the schedule is left, as it generally is, with a moderate reserve of time. Then in making up time the motorman does any or all of the following: Holds up speed in nearing stations instead of allowing himself a long coast; coasts down grade at increased speed; runs up grades at full speed instead of putting the motors in cascade. These devices have proved effective under the working conditions of the line, and the normally constant speed makes the trains somewhat less liable to lose time that must be made up. With a line having sufficient grades this scheme would seem to work out well enough, but on a nearly level line only the first mentioned recourse would be available, and some further means of getting back to schedule would have to be devised.

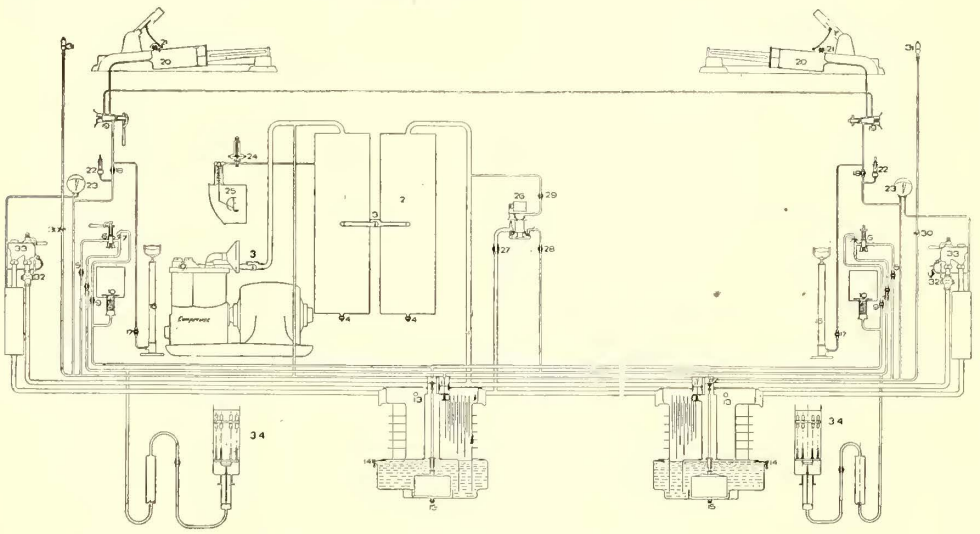
Altogether, Mr. Valatin's paper is most instructive, and we commend it to the earnest attention of our readers, particularly those who have been in the habit of thinking three-phase traction impracticable. Many of the details are worth careful study, for they seem to have been very thoroughly worked out. It must certainly be admitted that the Valtellina system has earned the right to an impartial hearing and need make no apologies, even though it has violated the most sacred canons of American electric railroading. It must, in view of its record, be judged strictly upon its merits.

NEW ELECTRIC LOCOMOTIVES FOR THE VALTELLINA RAILWAY

BY BELA VALATIN

An extended description of the Valtellina Railway in Northern Italy, was published in the issue for May 30, 1903, of the Street Railway Journal. Since that date the electrical equipment of the line has undergone several changes which will be the subject of discussion, but before considering them it will, perhaps, interest the readers of this paper if the general features of this important line are briefly described.

The Valtellina Railway is a part of the general railway system of the Società Italiana per le Strade Ferrate Meridionali, generally called the "Rete Adriatica" (the Adriatic Railway), which company owns more than 3600 miles of track. The Valtellina line proper is only 106 km, or about 66 miles, in length, the total length of track, including sidings, being about 85 miles.



1—Air reservoir for the electric apparatus
2—Main air reservoir for Westinghouse brake
3—Return valve
4—Discharge cock
5-8-9—Shut-off cocks for the starting cock
6—Starting cock
7—Throttling valve
10—Short circuits
11—Large valve of water rheostat
12—Small valve of water rheostat
13—Feed-pipe for the water rheostat
14—Trying cock of rheostat
15—Discharge cock of rheostat
16—Hand air pump
17—Shut-off cock for the hand pump
18—Shut-off cock for the trolley air pipes
19—Trolley valve
20—Air cylinder of trolley base
21—Trolley safety valve
22—Safety valve and whistle
23—Pressure gage
24—Switch governor for the air pump
25—Automatic switch for the air pump
26—Automatic brake
27—Shut-off cock between automatic brake and brake pipes
28—Shut-off cock between automatic brake and large valve
29—Shut-off cock between automatic brake and main tank
30—Whistle valve
31—Air whistle
32—Shut-off cock from the brake pipes
33—Westinghouse brake valve
34—Primary switch

FIG. 1.—AIR-PIPE DIAGRAM OF THE MOTOR CAR

Three-phase alternating current is generated at the power station at 20,000 volts and 15 periods direct, without step-up transformers, and is distributed by primary conductors along the line and transformed to 3000 volts by means of static transformers, which feed the overhead line at this pressure. There are in all nine transformer stations, each having a normal capacity of 300-kilovolt amperes, except that there is one of double that capacity, but all the substations can be overloaded five to six times their normal load for short periods without damage.

The first electrical equipment of the road included ten electric motor cars and two locomotives, the former for passenger trains, the latter for the freight trains. Each motor car has four motors which are designed for two normal speeds, viz.: 40 and 20 miles an hour. At 40 miles only two single motors are in operation; at 20 miles all four motors are used in cascade connection. Originally, the motor cars were designed for hauling trains of 85 (metric) tons, including their dead weight, the normal capacity of the motors having been guaranteed to be 150 b.hp each. As a matter of fact, they haul at present trains of 180 tons total weight, consisting of the motor car and ten to twelve ordinary railway cars as a maximum, at a speed of 40 miles an hour. Therefore the motors develop about double their normal capacity in ordinary working. In the motor cars compressed air is used not only for the brake signals, but also for controlling the current-collecting devices and for most of the rest of the apparatus. Fig. 1 gives the scheme of the air connections of the motor cars. The weight of the motor cars is 54 tons each.

The two electric locomotives used for freight traffic have four axles, each of them being directly driven by one motor. The weight of these locomotives is 46 tons. They have only one normal speed, i.e., 20 miles an hour; therefore all motors are high tension, although provisions are made to enable the use of only one part of the motors if the load is less. Each motor is designed for a normal capacity of 130 bhp and 128 r. p. m., the maximum tractive force of the locomotives being 8 tons at the above speed, measured on the periphery of the wheels.

Two peculiarities of the equipment should receive especial mention: the current-taking device and the water rheostat. Both were severely criticized when first proposed, but both have proved very satisfactory in actual practice.

THE CURRENT COLLECTORS

The current collectors consist of two long rollers mounted on the same wooden shaft and rotating in ball bearings. The current is taken from them by carbon brushes. They give a broad contact surface of 24¾ ins. for each phase, the distance of the two wires apart being 34¼ ins. It has been proved by three years' experience in actual service that the advantages claimed for this device really exist, viz.:

(1) They combine the advantages of the trolley wheel, the rolling friction, with that of the broad contact of a Siemens bow.

(2) They are perfectly safe and practically sparkless, even at currents of 200 amps. and speeds of 40 m.p.h. Trials were made with a speed of 60 m.p.h. and 100 amps, and the result was quite satisfactory, both for the current collectors and for the present overhead construction. These trials did not leave any doubt that with this device the problem of electric traction with considerably higher speeds and large capacities is easily to be solved.

(3) The maintenance and repairs are small, especially if one considers that for high-tension lines the ordinary trolley wheel cannot be used, owing to the difficulty in handling the same when jumping off the wire. Several electric railways running at high speed have tried to use the bow contact, but in all cases the result has been an extraordinarily quick wear and a high figure of maintenance. On the other hand, the cylinder contacts on the Valtellina line will run 12,000-locomotive or car-miles without repair. The latest form is a steel tube contact cylinder covered by a sheet of electrolytic copper. After running about 12,000 miles up to 25,000 miles this copper covering is renewed and the contact cylinders can be used again.

Not only is the maintenance of the current collector low, but that of the trolley wires is also considerably reduced by the use of these rollers. The Valtellina line has now been running

for about 3½ years (including the 1¼ years of the trial run), and it is not even possible as yet to measure any diminution of the section of the trolley wire. There is a small surface, about 1-32 in. broad, on the bottom part of the wire which is polished by the rollers, but there is no other sign of wear. This fact furnishes enough evidence of the advantages offered by this system of current collection.

WATER RHEOSTATS

The Valtellina line was the first to use water rheostats as starting devices for traction purposes. Compressed air moves the water to and from the plates of the rheostat, producing a contact of a more or less broad surface and thereby varying the resistance. In the early periods of the service the cooling of the water was not quite sufficient, owing to the fact that the rheostats were originally calculated and constructed for a smaller capacity. But after the necessary alterations were made, the water rheostats proved more suitable for railway service than metallic ones. Their weight is less; moreover, repairs which, in the case of metallic rheostats, are sometimes very troublesome are practically avoided, as water rheostats do not burn when overloaded, nor does solder melt out. The worst that can happen is that the water evaporates. Accordingly, the overload capacity of the rheostats is large. Starting can also be effected very smoothly, as there are no steps in going from one speed to another.

OTHER FEATURES

Another important result of the Valtellina installation is the proof furnished that the small air gap in three-phase traction motors does not interfere with the safety of the railway traffic in any way, supposing the bearings are properly designed. Most

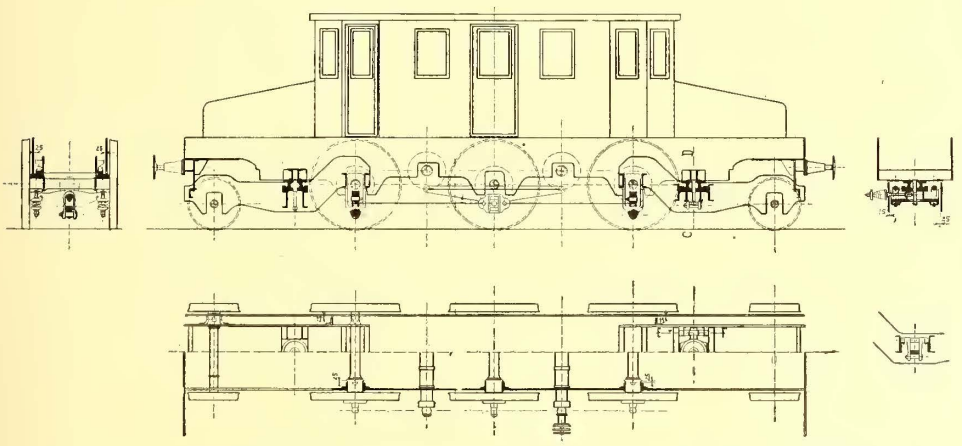


FIG. 3.—DIAGRAM SHOWING GENERAL ARRANGEMENT OF NEW LOCOMOTIVE

of the motor cars have run over 100,000 miles, and it has not yet been necessary to change the bearings or to renew the bushings. Only two or three break-downs have occurred which were due to the burning out of the bearings, and all these cases were caused through the carelessness of the attendant in forgetting to oil the bearings. A great deal has been said, also, in technical periodicals about the difficulty of using two overhead wires in switches and station yards. They are said to be complicated and to involve a constant danger to railway working. Exact notes were made by the exploiting company concerning expenses, and on going over them for the last year we see that the cost of maintenance and repairs of the air-switches was only a very small percentage of the whole cost of maintenance of the overhead line, and quite unimportant.

THE NEW LOCOMOTIVES

As has already been stated, the passenger trains on the Valtellina Railway are being operated by motor cars. In extending the service, however, the company decided, after a careful study of the question, to employ electric locomotives.

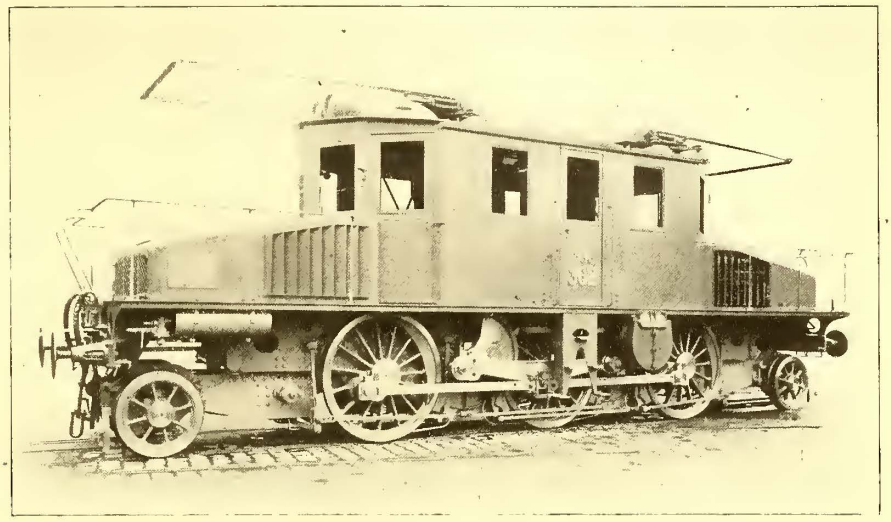


FIG. 2.—SIDE VIEW OF NEW LOCOMOTIVE

This decision was reached partly because the line connects with others, and the use of through cars was thought to be a convenience, and partly because it was thought that the cost of inspection and maintenance would be smaller.

Specifications for three locomotives were accordingly sent out by the railway company in October, 1902. The principal characteristics of the locomotives in question were to be the following: The locomotives should have two two-axle trucks, all axles being driven by gearless motors. The maximum pressure per axle should not be more than 16 tons. The motors should be fed by three-phase alternating current at 3000 volts and 15 periods, the locomotives to have two economical speeds, one about 40 m.p.h., the other about 20 m.p.h. The normal tractive force at constant working was to be 3.5 tons at the higher, and 6 tons at the lower speed, measured on the circumference of the driving wheels.

According to these specifications, Ganz & Company put in a tender on an eight-wheel locomotive, in which the four motors were direct coupled to the axles by the same type of flexible coupling used on the locomotives and motor cars of the original equipment.

The order of the railway company was placed with Ganz & Company in March, 1903, on the lines of their tender for these three locomotives, two locomotives being ordered exactly as tendered for; the third one was stipulated for as a special design.

At the same time, however, both Ganz & Company and the engineers of the railway company studied more carefully the question of driving the locomotive axles, and came to a solution which the railway company accepted finally for all three locomotives, i.e., using cranks and coupling rods, as shown in Fig. 2.

As already mentioned, in the specification of the railway company the solution with gearing was excluded. To use geared motors had for a long time been the general solution of electric driving. This is undoubtedly proper for small machines, but for outputs of several hundred horse-power, geared motors

would cause much trouble, both in their designing and in their operation. The gears themselves occupy valuable space, which would otherwise be available for the motor. The cost of repairs is increased, and so is also the watt consumption, owing to the losses in the gearing.

The ideal solution for main-line traction is direct-coupled motors. They have been used in several instances, but have become discredited, in some cases, owing to being rigidly connected to the axle and to their weight being spring-borne. For the motor cars and in the first locomotives of the Valtellina also, direct-coupled motors were used with a flexible coupling between axle and motor. A description of this coupling was given at the time, and it need only be stated in this connection that during two years of service it has proved to be quite practical and to work satisfactorily in every respect.

Direct coupling has, nevertheless, great drawbacks in the eyes of the railway engineer, especially in the case of induction motors. As the casing of the latter is not made of two pieces, it cannot be opened, and in case of any repairs on the windings, the wheels have to be pressed off the axles. For the new Valtellina locomotives, therefore, the following solution was adopted: The motors run with the same number of revolutions as the driving axles, but are mounted between the two axles and drive the axles with cranks and coupling rods.

Fig. 3 shows the general design of these locomotives. They have ten wheels (five axles), six of them being driving wheels. The total weight of the locomotive in working order is 62 tons, 42 tons being divided as adhesional weight on the three middle axles, and 20 tons as dead weight on the first and fifth axle.

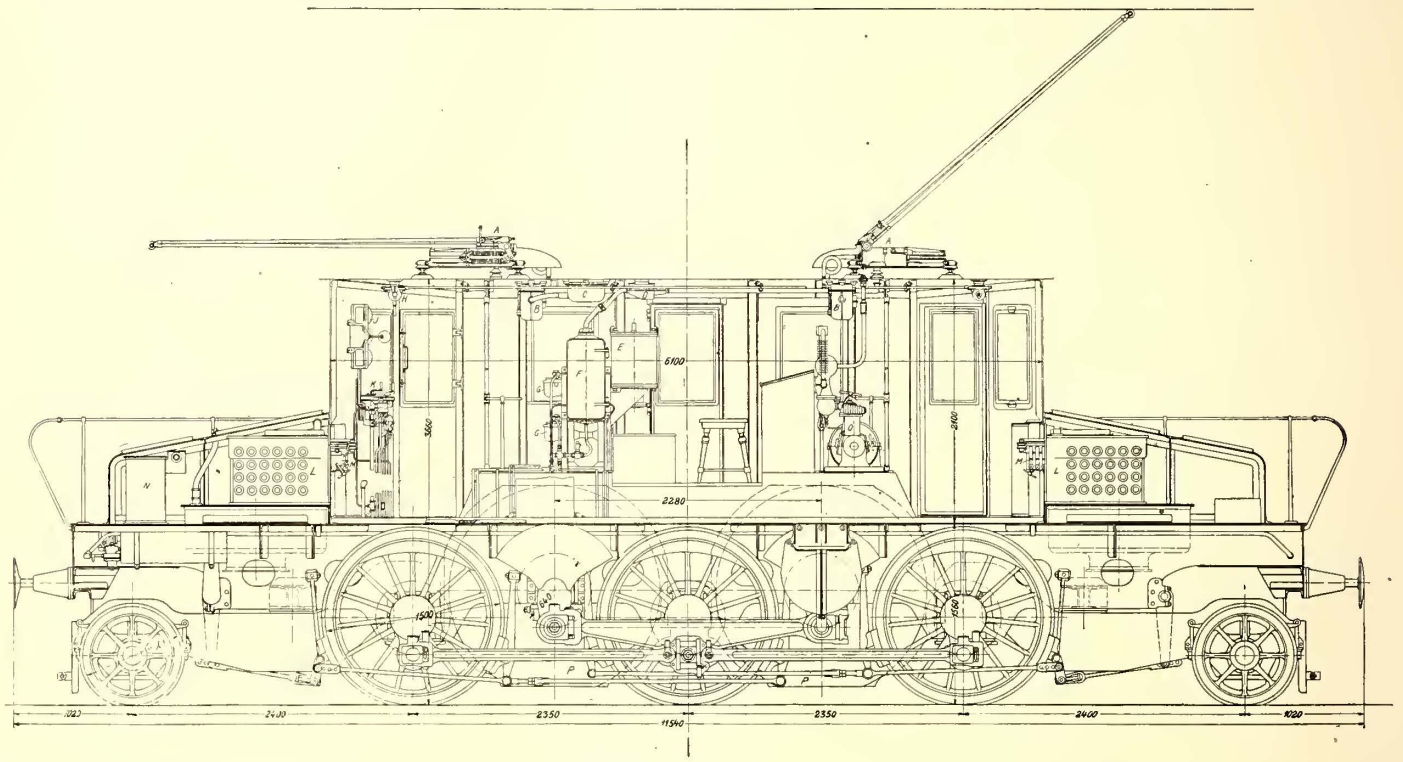
The main advantages to be claimed for this design are: The motors, being built in between two axles, may easily be taken out for repairs and can be replaced by other motors. The slip-rings and brushes of the motors are put outside of the locomotive frame, the use of such a design enabling ready access to those parts of the motors which require attendance and revision. As all driving axles are driven by all motors with the same mechanism, there is no danger that different loads are thrown upon the individual motors, or that one of the driving axles should slip. The mechanism has no dead point, the cranks on the two sides being keyed at a different angle of 90 degs. This mechanism has only rotating parts, which can be completely balanced by counter-weights, so that no disturbing oscillations can arise by unbalanced masses, as in the case of steam locomotives. The energy losses in the mechanism are small, whereas the piston rods and connecting rods cause the most friction in the mechanism of a steam locomotive. The weight of the motors has no hammering effects on the rails, as all parts are spring-supported.

THE MECHANICAL DESIGN

The locomotive is driven by two motors, one of which is placed between the second and third axles, and the other between the third and fourth axles. The locomotive has only one fixed axle, viz., the middle one. The other two driving axles have a range of movement sidewards of about 1 in. At both ends of the locomotive there is a pony axle (a leading and trailing axle, respectively), both having a radial movement, one of them also has a lateral movement. This portion of the design is not new, as it has been used with the best results with steam locomotives of the Adriatic Railway and was designed by the company's own engineers. The electric locomotive can be run equally well in both directions.

The fixed wheel base of the locomotive is the distance from the middle driving axle to the middle of the fixed truck. The design of this truck allows of a very smooth running in curves, and has over other designs the advantage of the weight being transmitted by the bolster and by the side frame of the truck to the axle boxes, and that the distribution of the weight is perfectly secured.

A general description of the driving mechanism has already been given. There is yet to be mentioned the special arrangement, which has been patented by Mr. de Kandó, by which, although the axles are not in the same horizontal line, there can be no vertical forces which will increase or decrease the



A—Trolley
B—Main fuses
C—Choking coil
D—Distributing box
E—Speed controller
F—Primary switch
G—Automatic relays
H—Trolley controller
I—Measuring apparatus
K—Master controller
L—Water rheostat
M—Head of the water rheostat
N—Transformer
O—Compressor
P—Twin motor

FIG. 4.—LONGITUDINAL SECTION OF LOCOMOTIVE

pressure on the rails. The cranks of the motors are connected by a coupling rod, which again is connected to the crank of the middle driving axle, but the bearing on this crank is permitted a free vertical movement in the rod. Both sides of that portion of the rod are linked in by bolts, the coupling rods being connected to the cranks of the next driving wheels of the locomotive.

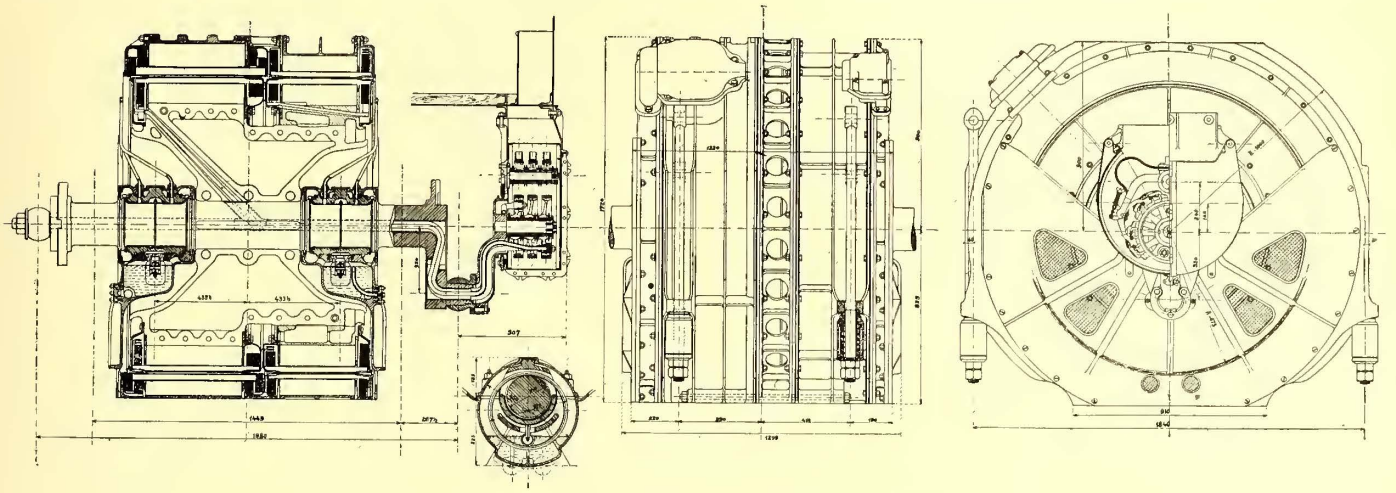


FIG. 5.—SECTION AND ELEVATIONS OF MOTOR

Fig. 4 is the side view of the whole locomotive, showing the general arrangement of both the mechanical and electric parts. The total length between the buffer ends is 11,540 mm (37 ft. 10¼ ins.), the diameter of the driving wheels 1500 mm (59 ins.); that of the idle wheels 850 mm (33½ ins.). In the middle of the locomotive is the motorman's cab. The front of the cab is so shaped as to reduce the air resistance when

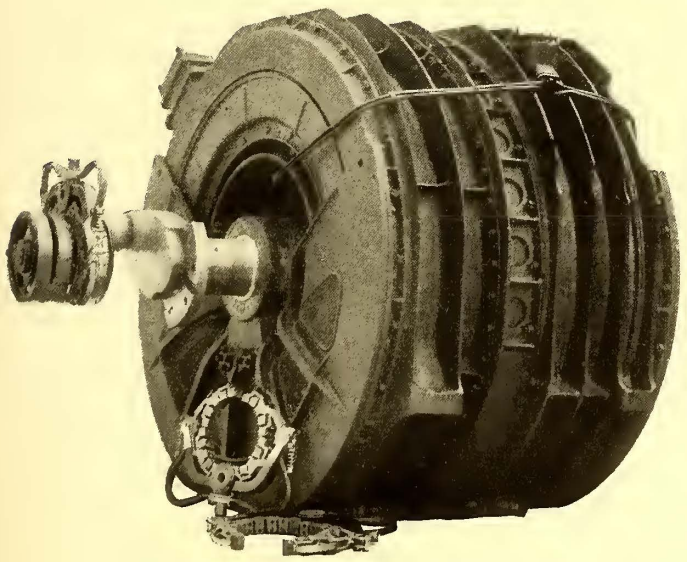


FIG. 6.—SIDE VIEW OF TWIN MOTOR

when running at high speed. At both ends it has a continuation of the casing with oblique surface, which covers the rheostats. The cab is provided with doors on both sides and also at both ends, enabling a communication with the next carriage along the outside of the locomotive.

The two main speeds of the locomotive correspond to the cascade and single connection of the motors. In cascade connection each pair of motors is combined in such a manner that the primary of the one (the high-tension motor) is connected to the line, whereas its secondary is connected to the primary of the other motor. The secondary of the second motor is either connected to the rheostat or short-circuited. In single connection each motor used is independently connected to the line.

MOTORS

The locomotive is equipped with two motors of the same type. (See Figs. 5 and 6). Both are double motors uniting a high-tension and a low-tension motor on the same axle and in the same casing. Both halves of these twin motors have eight poles, and accordingly the number of revolutions is 225 per minute, or when working in cascade 112.5 per minute. During the official tests they have repeatedly developed double their

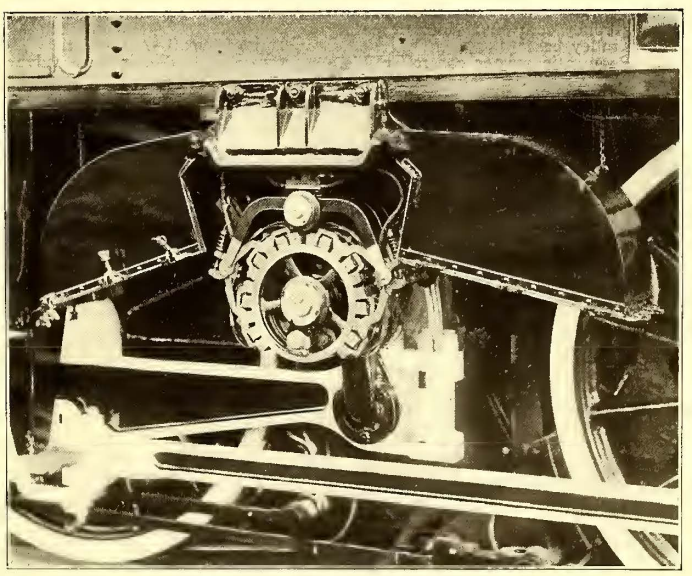
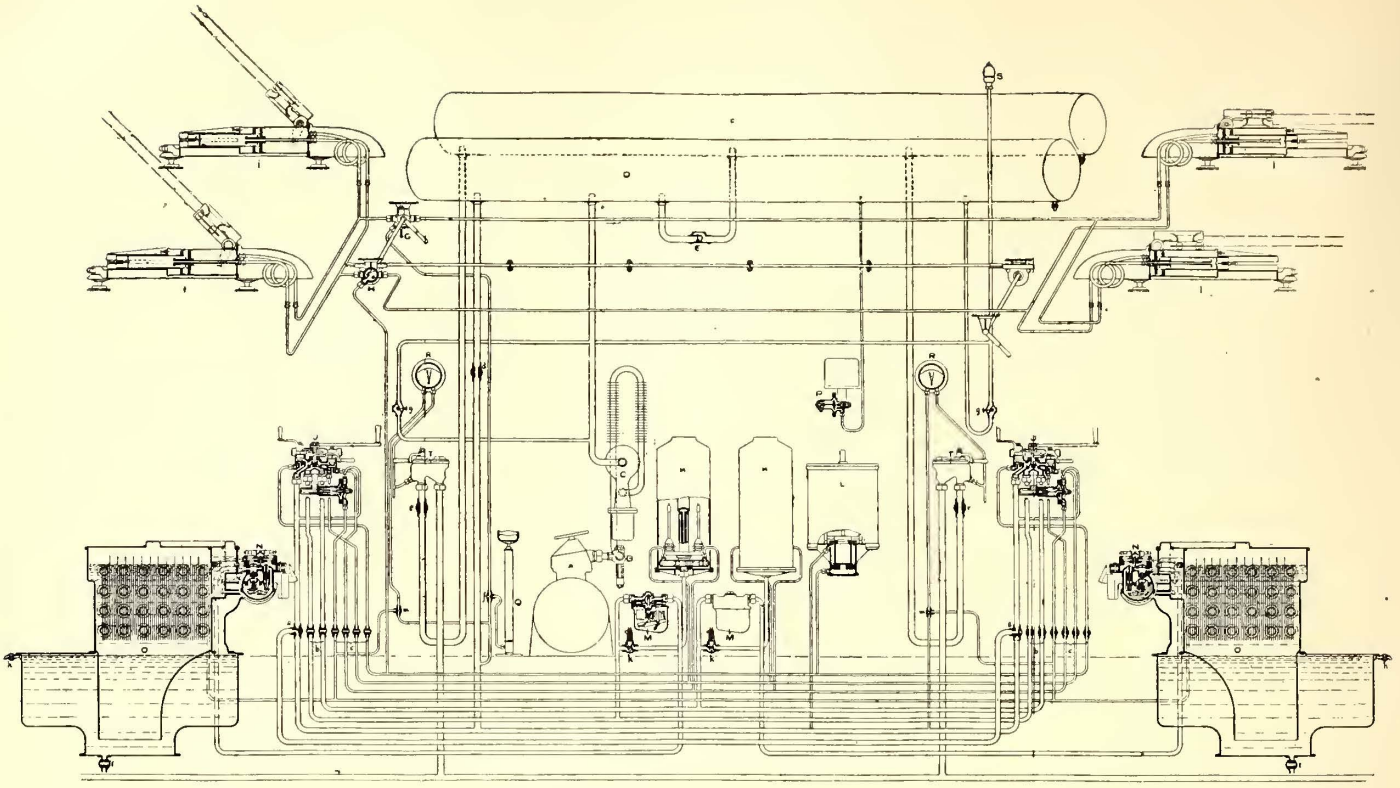


FIG. 7.—SLIP RINGS AND BRUSHES

normal tractive force, even when the voltage dropped about 25 to 30 per cent.

The two halves of the twin motor have common slip-rings. When the group works in single, only the high-tension motor is switched in, and then its rotor is short-circuited through the slip-rings. When the two motor halves work in cascade, the slip-rings are not used at all, since the two rotors are connected together and the stator of the second motor is short-circuited.

Fig. 11 represents the electrical wiring scheme of the locomotive. Fig. 8 gives a scheme of the air-pipe connections. All apparatus for taking off the current and for actuating and regulating the motors are controlled from one place by means of compressed air, viz., the current-collecting device by means of the so-called trolley valve, the driving apparatus by the pneumatic master-controller.



A—Compressor
B—Return valve with dash pot
C—Oil separator
D—Air tank for the electric apparatus
E—Return valve
F—Air tank for the air brake
G—Trolley controller (direct acting)
H—Trolley controller (indirect acting)
I—Trolley base
J—Pneumatic master controller
K—Primary switch
L—Speed controller
M—Automatic relays
N—Automatic governor of the rheostat
O—Water rheostat
P—Switch governor of the rheostat
Q—Hand air pump
R—Manometer
S—Air whistle
T—Air-brake valve
a—Shut-off and safety cock
b—Shut-off cocks for the two motor groups
c—Shut-off cocks
d—Principal shut-off cock
e—Shut-off cock of the air brake
f—Shut-off and commutating cock
g—Whistle valve
h—Trying cock.
i—Escape.
k—Commutating valve for the primary switch.
m—Commutating cock for the air reducer.

FIG. 8.—AIR-PIPE DIAGRAM OF THE MOTOR CAR

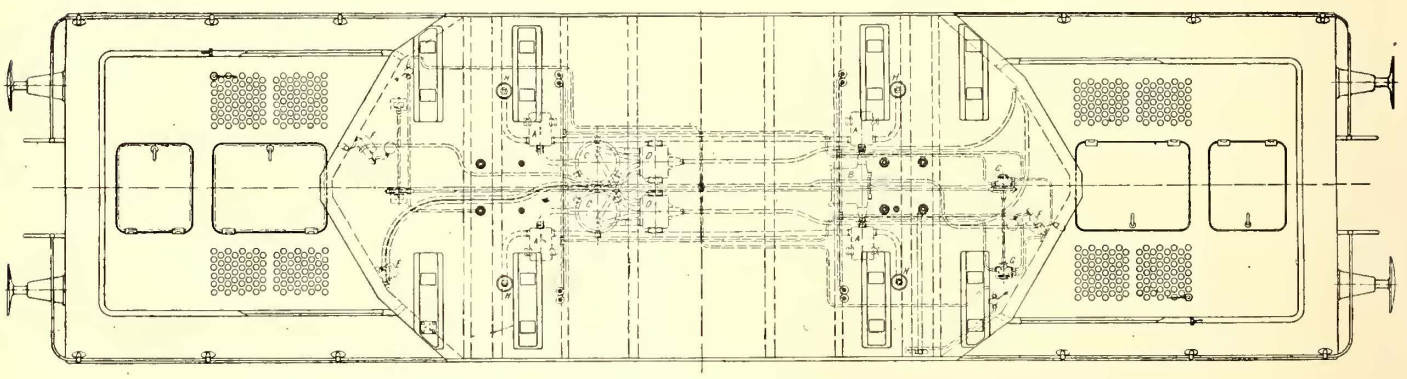
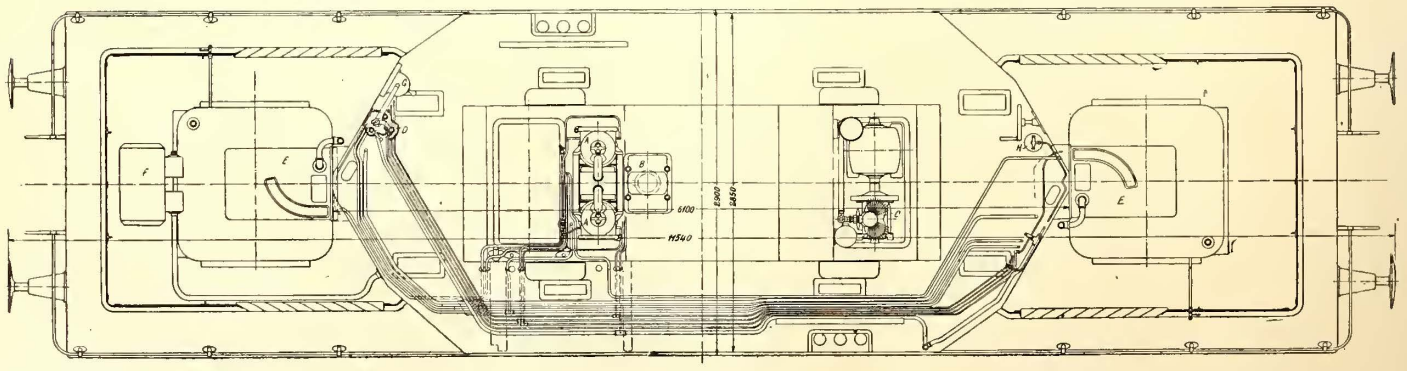


FIG. 9.—FLOOR PLAN OF LOCOMOTIVE, SHOWING ARRANGEMENT OF APPARATUS



A—Primary switch
B—Speed controller
C—Compressor
D—Master controller
E—Water rheostat
F—Transformer
G—Hand switch for compressor
H—Hand air pump

FIG. 10.—HORIZONTAL SECTION NEAR ROOF OF LOCOMOTIVE, SHOWING ARRANGEMENT OF APPARATUS

CURRENT COLLECTOR

The locomotive is provided with the same system of current collectors as has been used on the other vehicles of the Valtellina Railway. That is, two pairs of current-collecting rolls are used, working alternately, corresponding to the two directions of the run.

The under frame of the current collector differs in some features from the older construction, as will be seen in Fig. 15, which is from a photograph of the current collector or trolley base, and Fig. 12, which is a longitudinal section of the trolley base.

The current-collecting rollers are pressed against the overhead wires by compressed air, which is conducted into the cylinders of the under frame. In order to lessen the shocks in raising or lowering the current collector, a glycerine dash pot is used. Previous experience has shown that the current collectors give greatest satisfaction when pressed against the overhead wires with a pressure corresponding to the running speed. Accordingly, two degrees of pressure are provided, corresponding respectively to the two main speeds of 64 and 32 km per hour. When inserting the trolley valve, compressed air is admitted only to the surface of the main piston, corresponding to the lower speed. When regulating with the pneumatic master-controller up to the higher speed, compressed air passing through the bore of the piston rod is simultaneously admitted to the surface of the auxiliary piston, which further compresses the trolley spring and causes a greater pressure on the wires.

The pressure on the contact wires by the current collector at the lower speed is 6.6 kg (14.5 lbs.); at the higher speed, 8.5 kg (18.7 lbs.).

Another novelty of the current collectors of these locomotives consists in a switch, which is inserted in the current leads, and which is automatically opened (Fig. 11) when the current collectors are lowered. In this way all connection between the trolley wire and the inner part of the locomotive, as well as with the other current collector, is broken. Accordingly, the current collector, which is lower, is without current, while the other is raised. The switch is of the knife-blade type, and is arranged on the roof of the locomotive below the casing of the trolley base.

The trolley base (four for each locomotive), rests on four special high-tension insulators, which are cast-iron balls with wrought-iron fastening bolts. The bolt is separated from the ball by three layers of insulation, consisting of stabilit, porcelain and stabilit.

The regulating valve for the current collector is similar to that used on the other cars on the Valtellina Railway, and can be operated from either end of the car. The valve is so arranged that the trolley cannot be put on the wire unless the cases of all of the high-tension apparatus are closed.

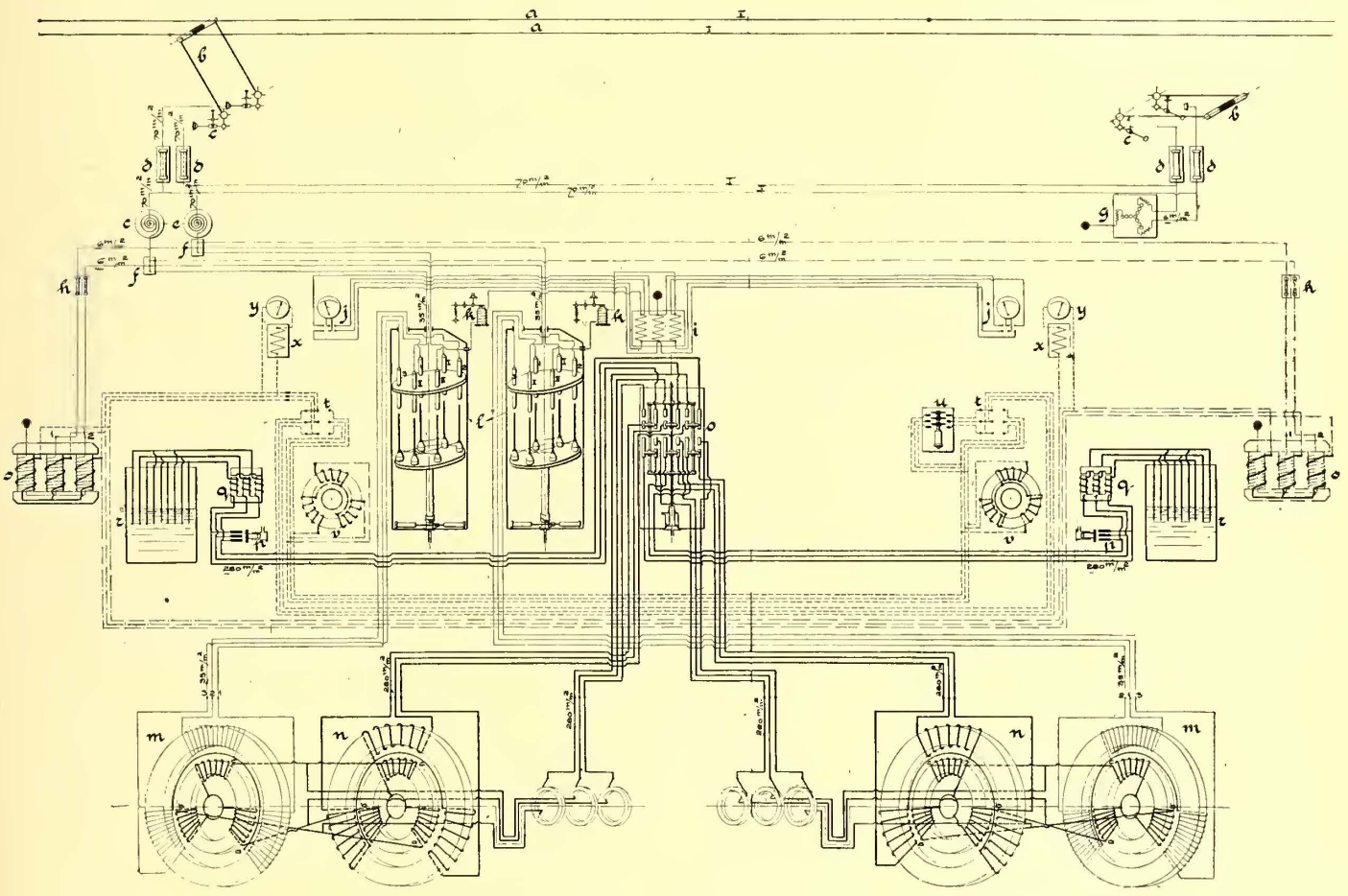


FIG. 11.—WIRING DIAGRAM OF THE LOCOMOTIVE

ELECTRICAL EQUIPMENT BETWEEN THE TROLLEY AND PRIMARY SWITCH

The high-tension cut-outs, lightning arresters, choking coils and fuse box are fitted on the lower side of the roof of the motorman's cab. The current from the current collector passing through high-tension leads is first carried to the high-tension main fuse box, on the inner side of the motorman's cab.

There are two such single-pole main fuses on each side of the locomotives. The boxes are enclosed, and the cut-outs are imbedded in porcelain.

After passing the cut-outs the conductors coming from the two current collectors are connected together, and connections are then branched off to the high-tension lightning arresters, Fig. 18. The latter consists of a series of zinc rollers arranged

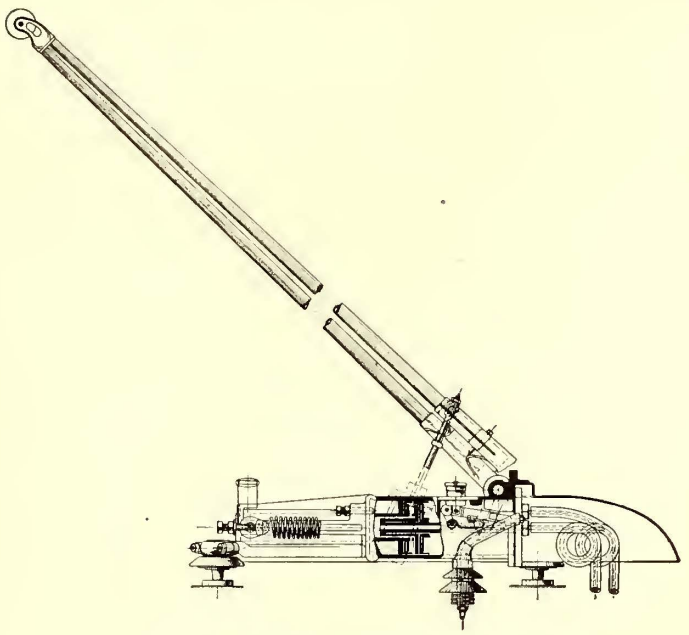


FIG. 12.—CURRENT COLLECTING DEVICE

in a locked box. The zinc rollers are connected in Y. The two end rollers are connected to the main conductors which join the current collectors. The third end roller is earthed by graphite resistance, and the whole apparatus is mounted in a piece of porcelain.

After passing the lightning arrester, the two main conductors are carried through one choking coil to the main distributing boxes, each of which has four branches, two for the primary switch and two leading to the lowering transformers, which supply the air compressor with current.

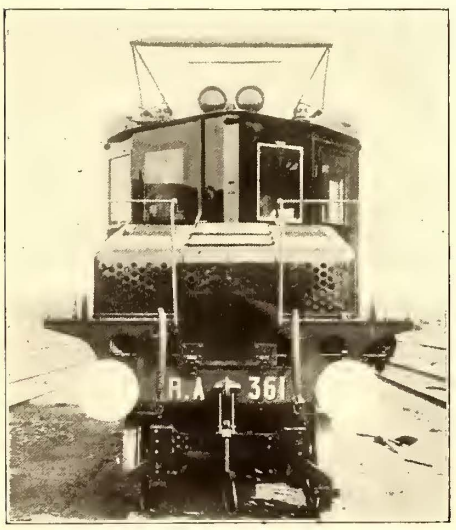


FIG. 13.—FRONT VIEW OF LOCOMOTIVE

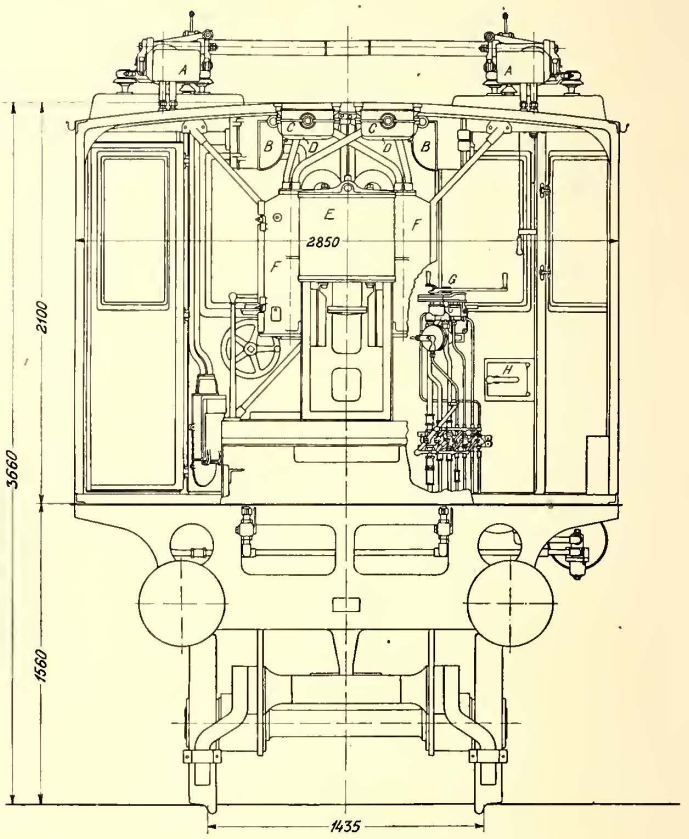
All high-tension conductors of this locomotive are placed in metal tubes, which are carefully grounded.

PNEUMATIC MASTER CONTROLLER

Through the two pneumatic master controllers fitted at both sides of the locomotive is operated the entire connecting and regulating apparatus of the motors, viz., the two primary switches, the speed controllers and the two water rheostats, including the short circuiter. In this respect only two of the locomotives are alike, because the third locomotive, for experimental purposes, was fitted with metallic instead of water resistances. A description of these resistances will be given later on.

The pneumatic master controller, Fig. 16, is a combination of valves. It has three levers performing various functions and being interlocked. The main lever, A, which is also a starting lever, serves for operating the starting and regulating valve. At standstill the starting lever stands vertically to the longitudinal axle of the locomotive. At starting, the locomotive driver pulls the starting lever towards himself, when it describes a certain angle and is brought into its first position at which it acts upon the starting lever, C, and thus admits compressed air to the primary switches and rheostat switchheads. By this means the primary switches are first thrown in, while the rheostat heads are brought into a position at which, while not yet in circuit, are ready to be acted upon by the regulating valve. When the lever is further turned, the regulating valve, D, begins to act and effects the insertion of the water rheostat.

The second, shorter lever, E, below the starting lever, is the



A—Trolley base
B—Main fuses
C—Distributing box
D—Choking coil
E—Speed controller
F—Primary switch
G—Master controller
H—Hand switch for compressor

FIG. 14.—ARRANGEMENT OF THE APPARATUS IN THE MOTORMAN'S CAB (TABLE)

reversing lever and acts upon the reversing valve. The outward position of this lever makes the locomotive run forward, whereas, if the lever is thrown towards the inside, the locomotive moves backward. The regulating valve has two openings, which are connected with the corresponding parts of the air pistons of the primary switch. According to the position of the regulating valve these openings are connected either with the air tank or with the open air. The third lever, F, at the left hand of the starting lever, is the speed lever, and connects the motors either in cascade or single.

The various levers are interlocked in such a manner as to allow of the reversing lever and speed-regulating lever being moved only when the starting lever is in its initial position, so that both the primary switch and the rheostat are disconnected. On the other hand, the starting lever can be moved only when the two other levers are in their end positions.

Since there are two pneumatic master controllers on the locomotive, care has been taken that these cannot be used simultaneously. As will be seen from Fig. 14, there are below the master controllers seven regulating cocks arranged in the

seven air pipes leading to the switch, which may be simultaneously operated with a single lever. Fig. 11 shows which pipe connections correspond to the two positions of this lever. Thus, the pneumatic master controller receives the compressed air from the air tank through the regulating cocks of the other driver's stand. If both groups of regulating cocks were placed in the position indicating "run," none of them could receive air from the reservoir. Thus the pneumatic master controller can be put to action only when the supply cocks of the other one are closed.

Two cocks are inserted in the air pipes which, leading from the starting valve to the primary switches and rheostats, are separately disconnectable, so as to allow of each pair of motors being perfectly cut out in case of breakdown.

PRIMARY SWITCH

Each group of motors has a separate primary switch, the two primary switches being placed on a common base in the middle of the motorman's cab, as shown in Figs. 4 and 9. They are constructed on the same principle as the primary switches of the other Valtellina vehicles, being of the dry-piston type. The switches are actuated throughout by compressed air for throwing in as well as for reversing. The switches are thrown in such a manner that a plate holding the contact plungers is lifted by the admission of compressed air through the starting valve of the master controllers whereby the contact plungers are pressed into the contact tubes. The contact is broken per phase at two points. The reversing can be done only with a primary cut-out switch. It is effected by the plate with the contact plunger being turned at an angle of 60 degs. For this purpose two pistons are provided connected with the reversing

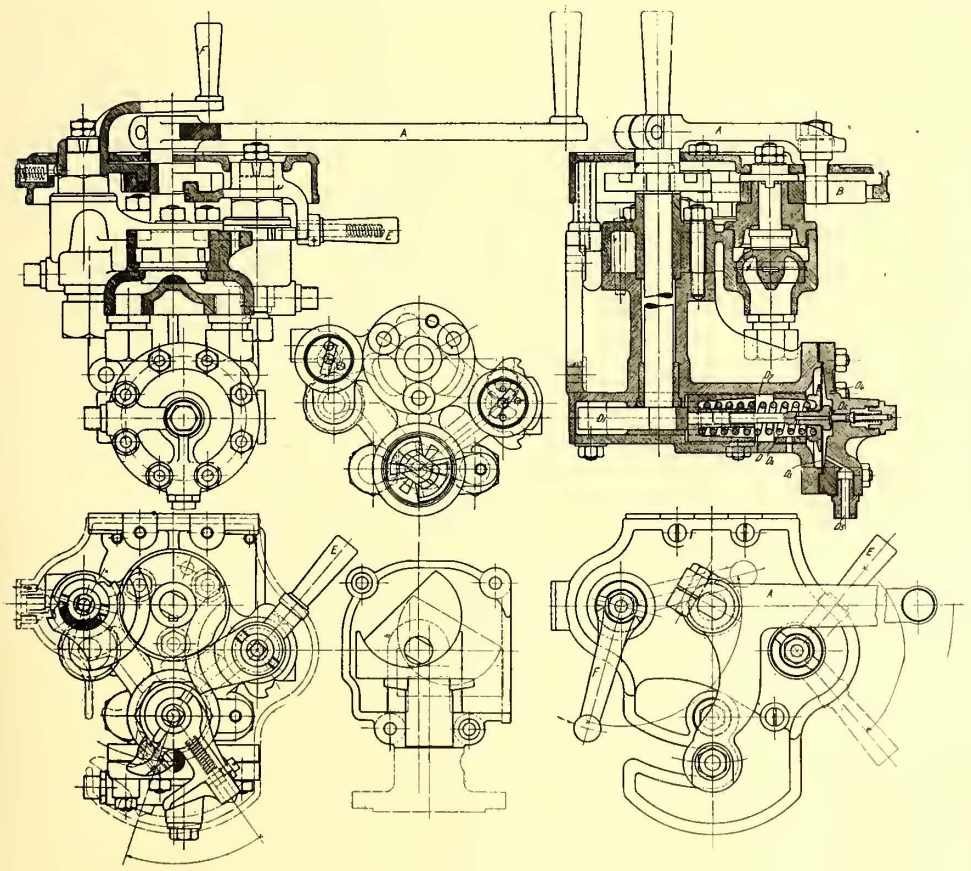


FIG. 16.—SECTIONS OF MASTER CONTROLLER

valve of the pneumatic master controller. According as the one piston or the other is connected with the reservoir or the open air, the plate assumes the corresponding position.

SPEED REGULATOR

The speed regulator serves for connecting the two twin motors in cascade or single. Figs. 5, 6 and 11 show the construction of this apparatus. On one axle are the contact brushes, which bring about the two different connections, and this axle can be shifted in a vertical direction. It terminates in the piston of an air cylinder whose smaller and upper surface is connected with the air reservoir, so that the air pressure ordinarily holds the apparatus in the lower position, which corresponds to the cascade connection. The larger surface on the bottom of

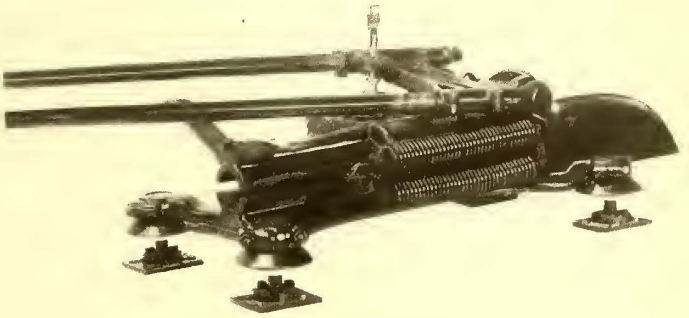


FIG. 15.—TROLLEY BASE

the piston is in connection with the atmosphere through the speed-regulating valve of the pneumatic master controller. Now, when the lever, F, of the master controller is in the position indicating high speed, compressed air flows through the speed-regulating valve into the lower part of the cylinder, and in consequence of the larger pressure surface the piston is pressed up and thus it effects the connection in single. Since the corresponding lever of the pneumatic master controller can be moved only when the starting lever is at zero, it is impossible to operate the speed regulator except when it is without current.

WATER RHEOSTAT

For every twin motor there is a water rheostat, which is built on a similar principle to that used for the other cars of the Valtellina Railway. Essentially, the rheostat consists of a vessel made of two parts. In one part three groups of sheet-iron plates are suspended. When not in circuit the water does not touch the sheet-iron plates. When the rheostat is thrown into circuit compressed air is admitted into the other part, forcing the water upward around the plates. The more air is admitted to the rheostat, the greater will be the surface of the plates in contact with the water until the resistance becomes a minimum. The connections from the three secondary motor ends are then short-circuited by a shorter circuiter. Fig. 17 shows this water rheostat.

ELECTRICAL EQUIPMENT OF THE THIRD LOCOMOTIVE

Two of the locomotives supplied are of identical construction; the third one differs from the two inasmuch as instead of water rheostats metallic resistances have been used to gain experience with this type. Accordingly, also, the master controllers and the apparatus for operating the resistances are of another design. In other respects the equipment of this locomotive is perfectly identical to that of the other two locomotives,

The resistance switches represented in Fig. 22 consist of six rings of contacts insulated from one another, being on the one

hand connected to the terminals of the secondary motor, and on the other hand with the various steps of the resistances. On a vertical shaft operated from below by a chain pulley from the motorman's stand, contact knives are arranged, which, by

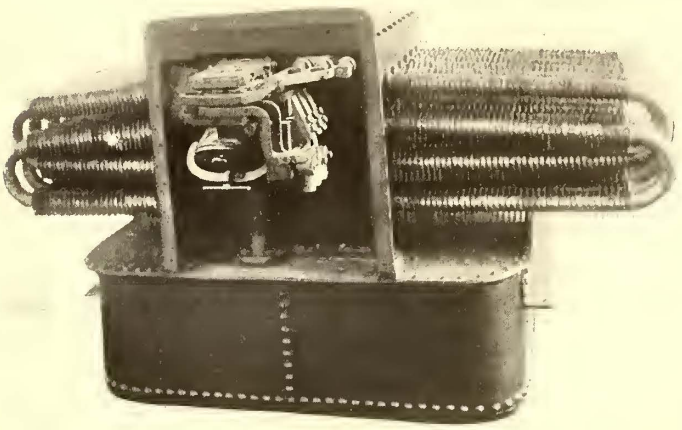


FIG. 17.—WATER RHEOSTAT

turning the shaft further, disconnect, step by step, the resistances until in the last position the secondary terminals of the motor are short-circuited.

TESTS ON THE NEW LOCOMOTIVES

Of the new locomotives the first was delivered in May, 1904, and put in regular operation in June. The two others were delivered somewhat later, but all three new locomotives have been in regular service since September. Before commencing regular operation they were tested thoroughly by the Government authorities, as well as by the railway company, to determine whether they fulfilled all the guarantees. It is characteristic of these locomotives that when the first one was put in operation it came up to the requirements of the service at once, and continued to do so until, after a month's time, it was taken out of the service for a day for inspection. The locomotives haul passenger trains up to 250 tons in weight and freight trains up to 400 tons. Fig. 23 shows a freight train at Colico station.

During the tests with these locomotives a dynamometer car was put between the locomotive and the other part of the train, which permitted a measure of the draw-bar pull and speed of the locomotive as a function of the time and of the distance. One test made with these locomotives covered thirty successive startings with a train of 400 tons to a speed of 30 km at time intervals of 120 seconds. During these tests a tractive force was observed several times with the dynamometer car, which, reduced to the circumference of the wheels, was about 12 tons, thus being about double the normal in cascade connection. It should also be mentioned that on such occasions a very great drop of the voltage was observed; the tension generally amounted to not more than 2200 volts to 2300 volts. This fact proves the great overload capacity of properly designed three-phase traction motors, even if the drop should be about 25 per cent.

The efficiency of the motors is about 95 per cent in single connection, and 88 per cent when connected in cascade. The power factor is 95.6 per cent in single and 79 per cent in cascade connection.

Another series of tests made with these locomotives was to measure their own resistance. The locomotive was accelerated to its highest speed, and then, with its current cut off, the locomotive coasted on a line with known grades. By measuring the distance and time it was possible to fix the resistance of the locomotive itself. At a speed of about 60 km this resistance amounted to 5.5 kg (12 lbs.) per ton, whereas, at a speed of 30 km the resistance was only 2.8 kgs (6 lbs.) per ton. This shows that the coupling rods do not increase the resistance of the locomotive considerably, and that the resistance of the locomotive is not much more than that of an ordinary car.

Fig. 24 shows two interesting run-diagrams with the new locomotives. The first of the two shows the run with a train of 286 tons from Cosio to Ardenno, the second run with a train of 280 tons from Ardenno to Cosio. The diagrams also show the grades of the line. The portions of the run made in cascade connection are distinctly marked.

From this diagram it will be clearly seen that the motors recuperate energy on down grades. The diagram is also very interesting from the point of view of showing that the train runs at a speed of 60 km (36 miles) per hour on a grade of 1.7 per cent.

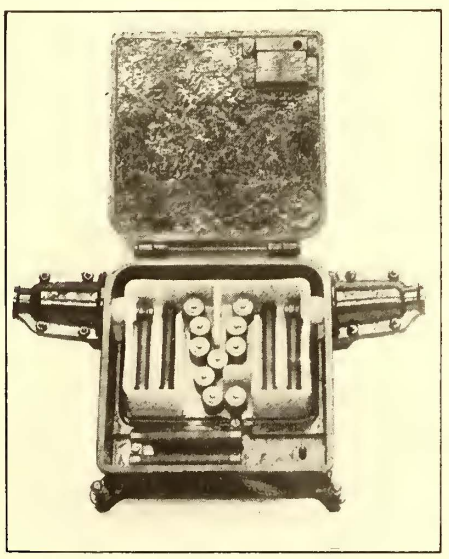


FIG. 18.—LIGHTNING ARRESTER

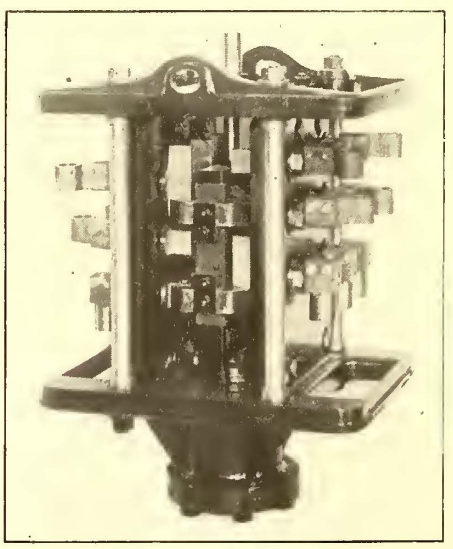


FIG. 19.—CONTROLLER

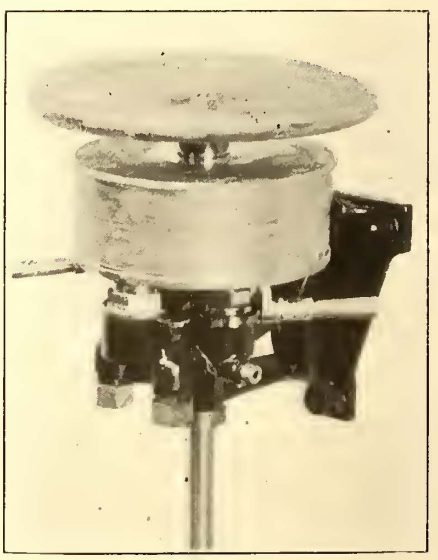


FIG. 20.—MASTER CONTROLLER OF THIRD LOCOMOTIVE

WATT-CONSUMPTION OF THE VALTELLINA LINE

The watt-consumption was measured by meters in the Morbegno station ever since the beginning of the electrical service. It must be borne in mind that these meters not only measure the watt-consumption of the trains, but all the current supplied by the central station, *i. e.*, the losses in the primary and secondary conductors, the losses in the transformers, the consumption of the lighting installation in stations, also that of the motor-dynamos for charging the accumulators used for the lighting of the motor cars and that of several motors driving the repair shops.

The total watt-consumption during a year (from July 1, 1903, to June 30, 1904,) was 3,402,502 kw-hours; the total number of ton-kilometers made during that time by electric trains was 75,845,265 (including the ton-kilometers of motor cars and locomotives), or 47,759,642 ton-miles, thus the average watt-consumption during this period has been 44.51 watt-hours per ton-kilometer, or 71.62 watt-hours per ton-mile, in which figures the above-mentioned losses are all included, as is also the watt-consumption when shunting the trains in stations.

To have a uniform basis of comparison for lines with different grades it is often customary to employ the virtual instead of the real ton-kilometers. The virtual ton-kilometers are obtained by multiplying the weight of the train in tons with the virtual length of the line—i. e., the length which a horizontal imaginary line would have, the energy consumption of which is the same as that of the actual line with existing grades. The number of virtual ton-kilometers on the Valtellina line during the above period was 92,541,511 ton-kilometers, or 57,514,923 virtual ton-miles, and therefore the average watt consumption was 36.77 watt-hours per virtual ton-kilometer, or 59.16 watt-hours per virtual ton-mile.

Several series of tests were made on the Valtellina line in order to ascertain the watt consumption of trains measured on the trolley wires—i. e., without the above-mentioned losses. One of the most complete tests was made April 20, 1904, with a train of 116 tons total weight, with a motor car at the head, on the Lecco-Colico line. This test was made during the night when there were no other trains on the line, all transformer

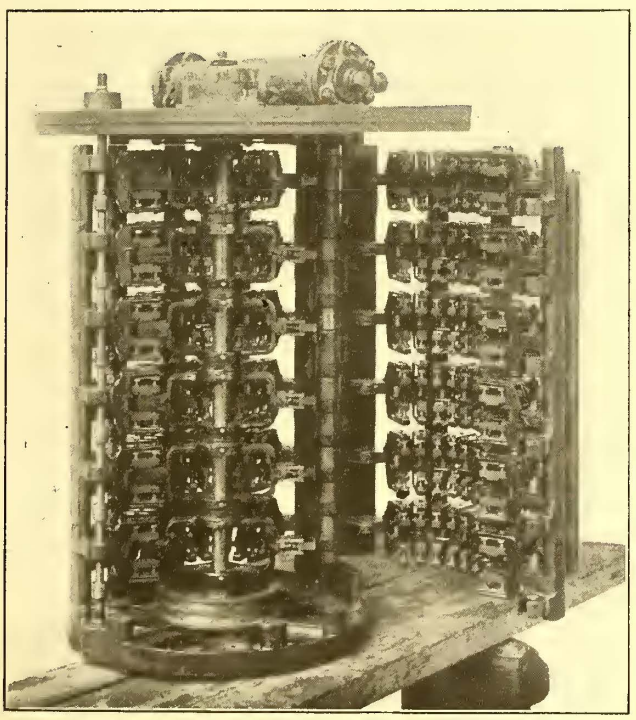


FIG. 22.—CONTROLLER FOR METAL RHEOSTAT

stations excepting one having been disconnected, so that the wattmeters in the central station were able to indicate the watt consumption of the train, with the deduction of easily calculable losses in the one transformer and in the line.

A total run was made from Lecco to Bellano, and vice versa. The average watt consumption of the train measured on the trolley line was 30.2 watt-hours per ton-kilometer.

The number of trains simultaneously on the line is very limited, and normally there are not more than five to six during the busiest hour of the service. In the morning and in the evening there are even less. It is not to be wondered therefore that the maximum load peak in the central station is about three times as much as the average load for the whole day.

THE ELECTRIC SERVICE ON THE VALTELLINA LINE

During the last periods of steam traction the daily number of train-kilometers on the whole system were 1104, or 686 train-miles; with electric traction they amount to 1998 train-kilometers, or 1242 train-miles. For the fiscal year ending June 30, 1904, the entire mileage made by the twelve electric vehicles (ten motor cars and two freight locomotives) was 678,109 km, or 421,447 miles. Therefore one electric vehicle performed

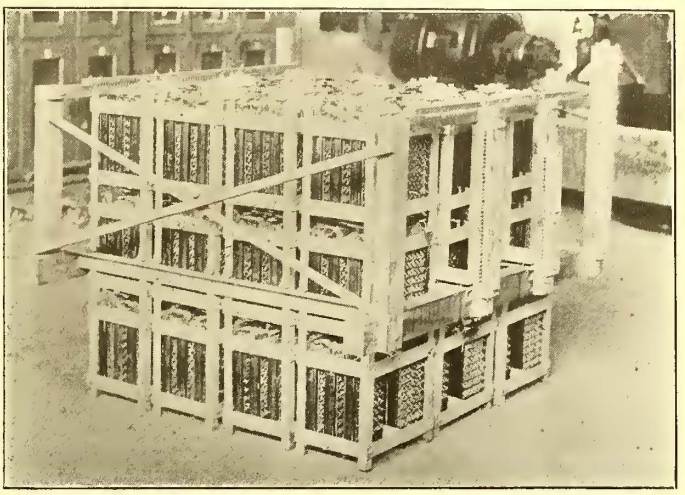


FIG. 21.—METAL RHEOSTAT

on the average 56,509 km. or 35,120 miles. That is a very large amount compared with the normal performances of steam locomotives, especially if one takes into consideration that during this period the motor cars were taken out of the service for changing the car bearings, two of them having been withdrawn from the service for repairs for several months on account of a collision. The ordinary performance of a steam locomotive on the lines of the Adriatic Railway is not more than 27,720 km, or 17,213 miles, per annum.

The first years of the electric service proved that also with three-phase traction it is possible to make up time in cases of retardation. For that purpose several means are available:

(1) The time-table is not worked out for the quickest possible run, a small reserve of time being left between two stations which can be utilized.

(2) The motorman does not brake from the highest speed, but the train coasts when approaching the station. By shortening the coast it is possible to make up time.

(3) On down grades the motorman can coast out the train to a higher speed.

(4) Some parts of the line, especially those with higher grades, are run with motors in cascade—i. e., at lower speed—to avoid great load peaks in the generating station. When making up time, cascade working is extended to a higher grade, thus allowing a larger maximum watt consumption per train and giving a longer run at a higher speed.

We have therefore practically the same means at disposal to make up time with three-phase motors as with a motor of the series-motor characteristics. The great advantage of three-phase motors, however, is that in ordinary operation the speed is quite independent of the grades and of the weight of trains. In the operation of tramways or suburban railways this peculiarity is insignificant, owing to the short distances between stations. In that case, although the maximum speed is lower, the same schedule speed can be made through quicker acceleration and shorter coasting. On a main line, however, where the greater part of the line is to be run at the normal speed, it is very difficult, with heavy trains, to make up speed. But even if this were possible, it is an advantage to the motorman that he need not think about the weight of his train when running, since the speed with three-phase motors is the same in any

case. There are, therefore, no objections to the constant speed of three-phase motors in railway work; it is rather an advantage for this class of service.

SAFETY

The experience on the Valtellina line shows that safety, in connection with high-tension current for electric traction, is only a question of good engineering, as Prof. Sylvanus P. Thompson said some years ago. During the entire period of three and a half years of the trial runs and normal service no man was killed by the high voltage used on the railway. The only accident that occurred was the death of the constructor of the exploiting company, in Colico sub-station, but this had nothing to do with the adoption of the high tension for the operation of the railway, and would have happened for the same reasons in any high-tension transformer station.

But the service on the Valtellina line has shown that in railway operation any security desired can be attained with the high-tension three-phase equipment, supposing that it is designed properly. After the first period of difficulties the present service is quite satisfactory. In the first year of the regular service considerable trouble was caused by the oil getting to the windings of the motor, but after repairing the damaged insulation and providing for a hermetical closing, no further repairs were necessary; in fact, there has been no occasion during the subsequent period of the last one year and a half to repair the motor windings. This is the best proof for the reliability of three-phase traction motors.

EFFECT ON THE TELEPHONE AND TELEGRAPH

Some years ago a great deal was said in periodicals about troubles which alternating current with earth return may cause in telegraph and telephone circuits. At the opening of the Valtellina line, although the periodicity was not more than fifteen, the railway company was obliged to erect separate insulated return wires for all telegraph and telephone lines running parallel with or near the railway line. Later on different methods were adopted to permit the operation without return wires, and as a matter of fact the telegraph lines along the Valtellina Railway are now working on earth return with entire satisfaction.

FIG. 23.—LOCOMOTIVE WITH FREIGHT TRAIN

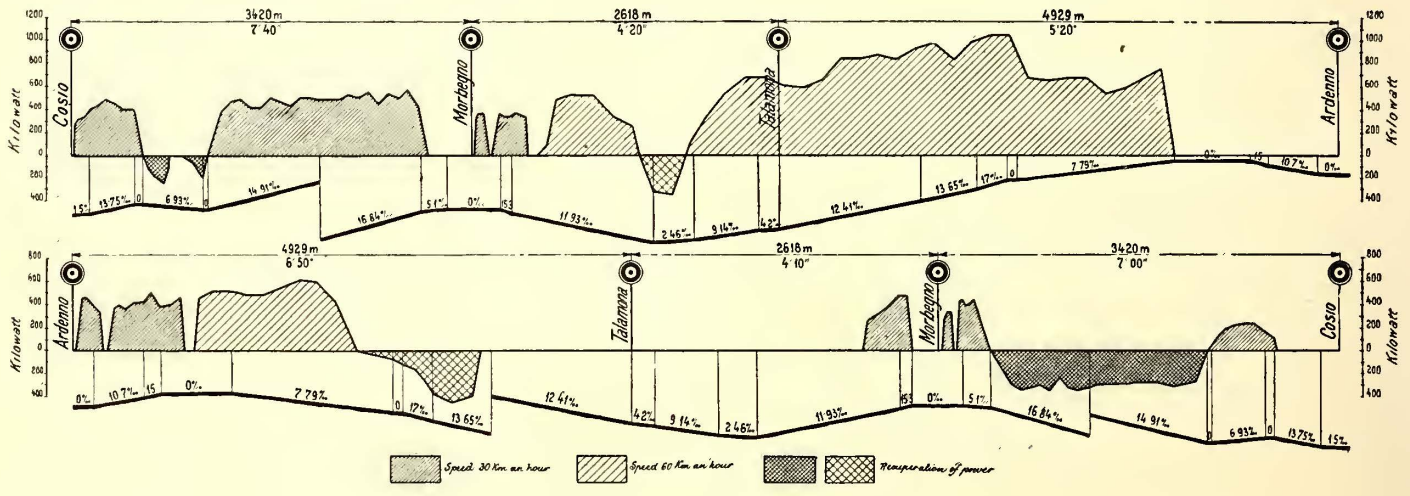


FIG. 24.—RUN SHEET BETWEEN ARDENNO AND COSIO

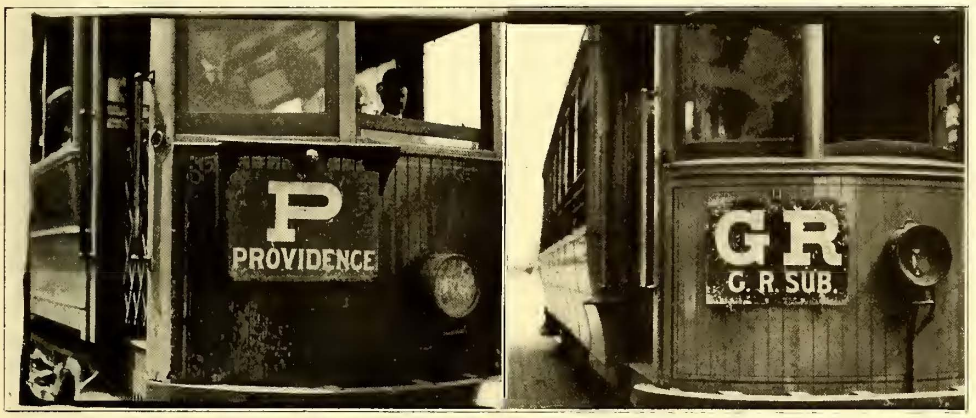
OPERATING COSTS

As regards the operating costs of the Valtellina line, only those are of interest which show a difference from steam service. Such an item is the cost of power. To this belong all the costs in connection with the electric equipment in the central station, sub-stations and overhead wires, as well as with the rolling stock, including the wages of the motormen.

These costs for the year from July 1, 1903, to June 30, 1904, were the following:

1.	Power station: Labor and material for the operation and maintenance	$4,138.36
2.	Primary and secondary line and transformers: Labor and material for the operation and maintenance	6,700.42
3.	Electrical equipment of the rolling stock: Labor and material for operation and maintenance	6,382.28
4.	Maintenance of the mechanical equipment of motor cars and locomotives	1,152.00
5.	Wages for the staff on the motor cars and locomotives	5.040.00
	Total	$23,413.06

During the same period the performance of the electric trains was 61,934,569, or 38,492,585 ton-miles, excluding the mileage of the motor cars and locomotives, and therefore the above costs per 1000 ton-kilometers are 37.8 cents, or 60.6 cents per 1000 ton-miles. The electric train-kilometers during the same period were 678, or 421,447 train-miles, and accordingly the cost per train-kilometer was 3.86 cents, or 5.56 cents per train-mile.



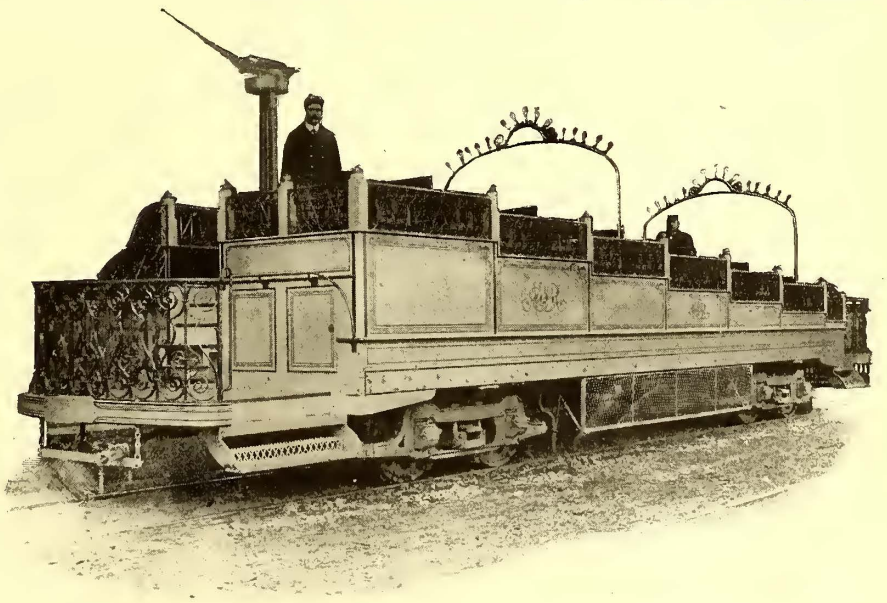
SCRANTON CAR SIGNS, ILLUSTRATING THE USE OF LARGE INITIAL LETTERS

It must be borne in mind that the Valtellina line works under somewhat unfavorable conditions, inasmuch as the traffic is not very dense, the total number of ton-miles being 584,288 per mile of length, and that with the same central station and sub-stations a considerably larger traffic could be dealt with.

OBSERVATION CAR IN MONTREAL

The increasing demand from observation parties for a car which would be as satisfactory as a coach or tally-ho has lead to the construction by the Montreal Street Railway Company of a car for this especial purpose. The objection to the ordinary car for this service is that the roof of the car obscures observation to any height above the shop windows. The Montreal car avoids this by dispensing entirely with the roof. As shown, the seats are arranged in seven tiers, with the entrance from the back of the car. Two arches, made up of ornamental scroll work, carry fifteen lamps each for illumination at night. In the rear of the car are lockers, in which any supplies may be carried if the car is chartered by a private party.

The design of the car has been registered and a patent for it has been applied for.



THE NEW ROOFLESS OBSERVATION CAR USED IN MONTREAL

The Singapore Electric Tramways, Limited, with $2,000,000 capital, will electrically equip the Singapore Tramways, and a side company, the East India Construction Syndicate, is formed to take over and re-equip all the other tramways in Singapore and in other ports of the Straits Settlements.

A NEW FORM OF DESTINATION SIGN

The difficulty of obtaining a destination sign for use upon street cars which shall be easily read from a distance, both by day and night, has been a serious problem. Many styles of signs which are in use are effective in daytime, but the trouble with most of the illuminated signs has been the difficulty of even and thorough illumination at night, so that they are easily deciphered when a car is approaching rapidly.

A new form of sign has recently been applied to all cars of the Scranton Railway Company, Scranton, Pa., which is an innovation in this respect. Each line throughout the city is designated by an initial or group of initials, and these initials are lettered in extremely large size on dash signs, so as to be readable at a distance of several blocks. Representative signs of this kind are illustrated in the accompanying views. As may be noted, the letters are about a foot high and are painted in white upon a dark background so as to stand out very strong in all classes of weather and at night, if properly illuminated. A difficulty that might otherwise be encountered in understanding the symbols is obviated by the introduction of the name of the line in small leters (4 ins. high) below the main initials.

The company is at present experimenting as to methods of properly illuminating the sign for night use. While the sign is sufficiently large to be easily readable at night if the street is fairly well lighted, yet in outlying portions of the city and in suburban districts some difficulty is experienced by passengers not being able to see the signs at a distance. Various arrangements of lamps have been made for illuminating the sign, one of which is shown in the first of the accompanying illustrations.

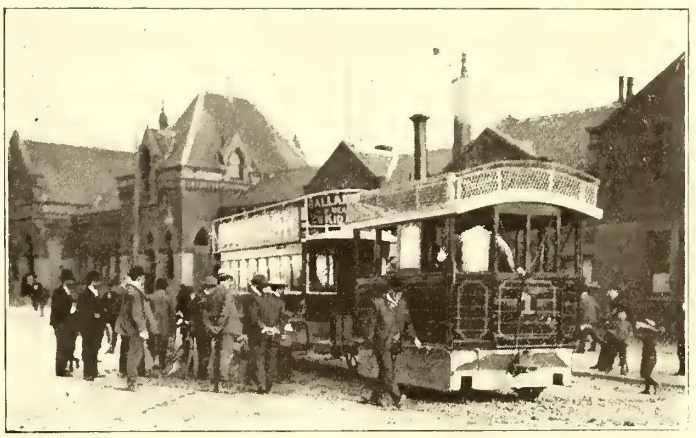
A more successful arrangement, however, is that in which the lamp, while fully illuminating the sign, shall not be visible to the passenger waiting for the car, so as to partially blind his view of the sign. Such a method of sign illumination is in use upon some of the cars and has proven very satisfactory—so much so that its use will probably be extended to the entire system.

THE INSTALLATION OF ELECTRIC TRAMWAYS IN CHRISTCHURCH, NEW ZEALAND

BY JAMES DRUMMOND

On June 5 the city of Christchurch, New Zealand, celebrated the installation of a municipal electric railway system, built under the auspices of the municipality.

In a way, Christchurch, which is the center of Canterbury,

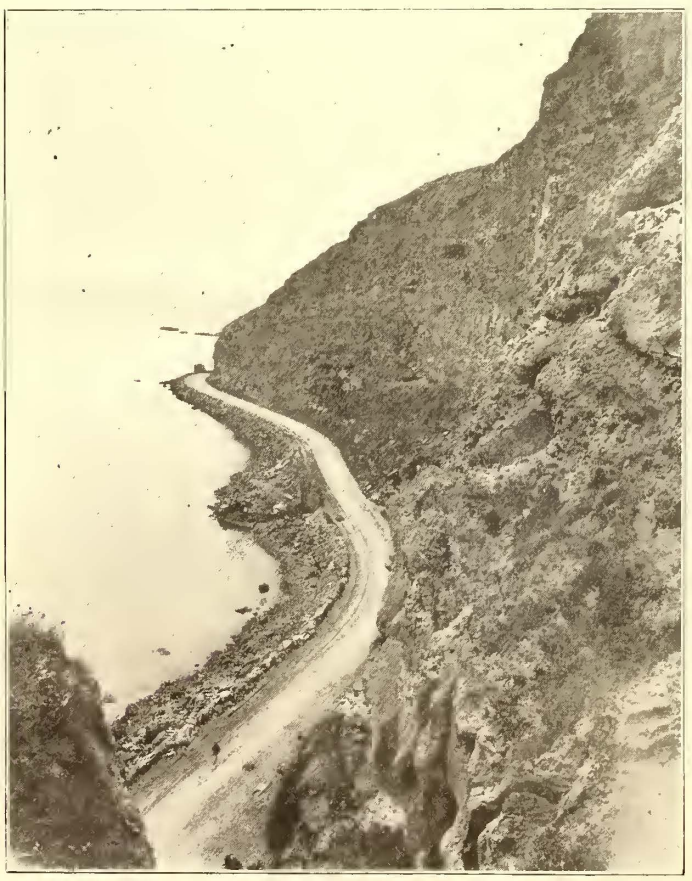


ONE OF THE OLD-TIME STEAM DUMMY TRAINS

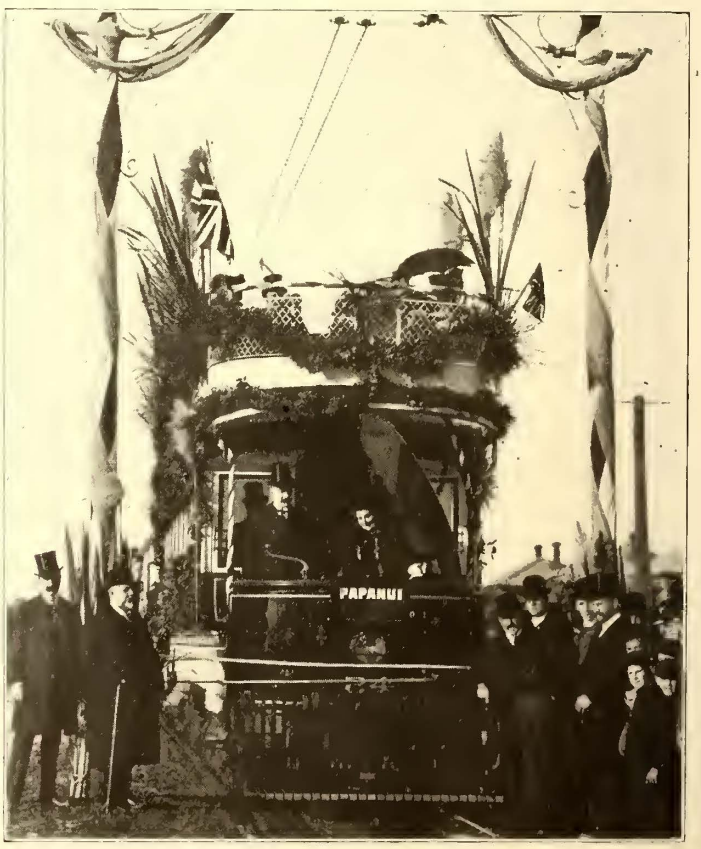
the wealthiest province of the colony, is admirably situated for electrical traction. It is as flat as a pancake, the main streets are 66 ft. wide, and many of the populated districts lie near the center. The absence of heavy grades has helped largely to solve the problem of the distribution of current, and it will be a factor in operating the system economically. On the other hand, a very large portion of the city is sparsely settled, and this feature will be carefully considered when extensions are made. The bicycle traffic in Christchurch is probably larger than in any other city of the same size in the world, but it is thought that a frequent and

LAYING PERMANENT WAY AT CATHEDRAL SQUARE, CHRISTCHURCH

up-to-date tram service will have a material effect on the use of bicycles. The city itself has a population of about 60,000 persons, but the tramway district includes two seaside boroughs, one 6 miles distant and the other 8 miles, and portions of three road districts, so that the area which will be served is a large one. It may be mentioned, by the way, that



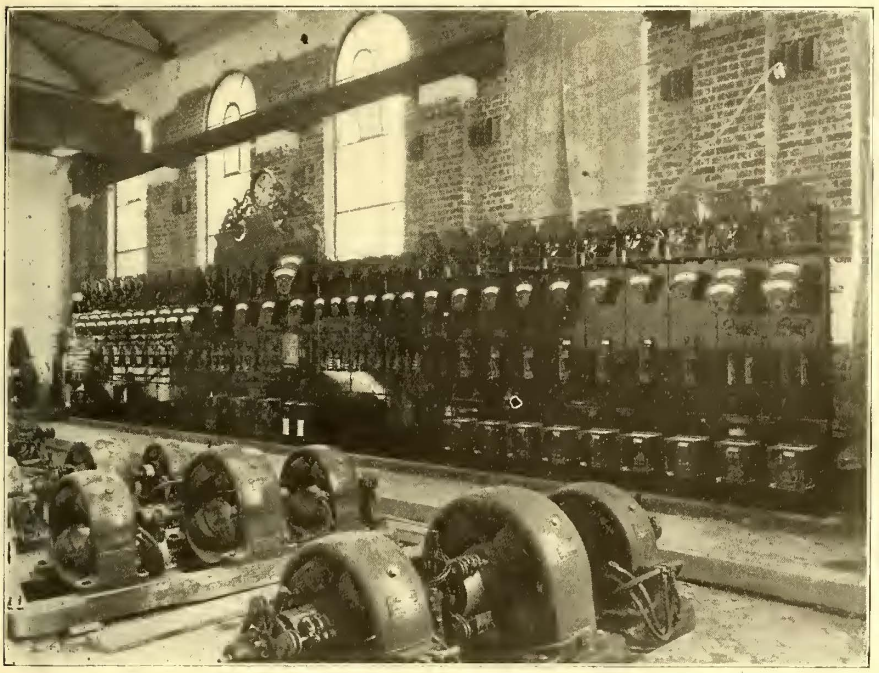
ON THE ROAD TO SUMNER, CHRISTCHURCH'S SEASIDE RESORT



AN INTERESTING MOMENT IN THE OPENING OF THE CHRISTCHURCH TRAMWAYS—MRS. REECE, WIFE OF THE CHAIRMAN, TURNING ON THE CURRENT

Christchurch is not much more than 50 years old, and it is an excellent illustration of the manner in which towns and cities spring up in the colonies and rapidly attain a position of importance and affluence.

In fixing upon a site for the power house, due consideration was given to securing the most economical power distribution without sacrificing good coal and water facilities. The section of land taken was chosen because it is almost halfway between the extreme ends of the system. It is an ideal site from the point of view of distribution, and as it adjoins the railway line, it affords the cheapest means of obtaining coal.



SWITCHBOARD IN POWER STATION OF THE CHRISTCHURCH TRAMWAYS

The tramways have been constructed by a Tramway Board, which is constituted by an act of Parliament, and is elected by popular vote in the district interested in the use of tramways. The citizens, seeing that they had entered upon a large and important scheme, selected their best men to carry on the operations and control the system. The board was elected in January, 1903, and it lost no time in getting to work. It was fortunate in securing the services of an exceptionally able and experienced electrical engineer, F. Hubert Chamberlain, who was in Australia at the time and was just about to leave for America, his native country.

The act that constitutes the board empowers it to borrow £250,000 in the first instance, and also an additional £100,000 after the first sum has been expended. It easily obtained the sanction of the voters to raise the first loan, and with that sum it has carried on the work, which has been pushed on so expeditiously that the first section of the line was opened on June 5, as stated before. The board has taken over the old horse and steam-motor system from private companies which ran the trams for many years, and it has converted the old system into an electrified one. To the principal company it paid £23,910 for the plant and concessions.

THE POWER HOUSE

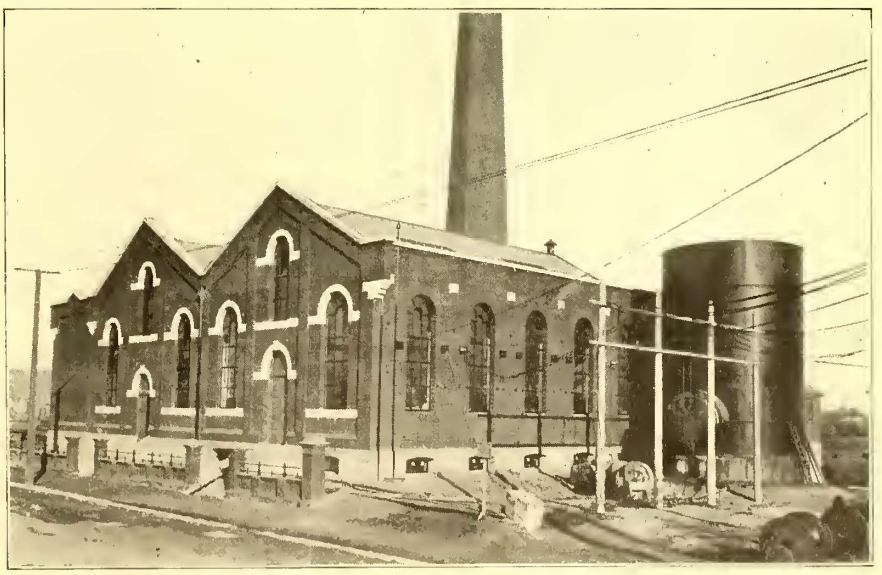
The power house is thoroughly up to date in every respect, and its equipment reflects great credit on the authorities, the consulting engineer and contractor, the latter being the General Electric Company, which supplied the Curtis turbines used, as well as all of the electrical apparatus for the system. The presence of a steam turbine in the power house places Christchurch in the proud position of having the only complete turbine-driven tramway power system in the Southern Hemisphere. Lately the Government of Victoria has installed two small steam turbines for lighting purposes, and the Railway Commissioners of New South Wales have installed a turbine in their power station in Sydney, but those installations do not affect the premier position occupied by Christchurch.

The board called for tenders for both reciprocating engines and steam turbines. By accepting tenders for the latter, it has reduced the cost of the building of the power house by over £2,000, due to the smaller space required by the turbines; and it is expected that there will also be a large reduction in the operating expenses and the charges for attendance and in other directions.

Only one of the board's turbines has been erected, but its power is sufficient to generate current for the whole system. Even when the two ordered are available, one will be held as a reserve unit.

The switchboard is the largest in New Zealand, and measures 47 ft. in length, with a height of 6 ft. It is made of black marble panels, with a subbase of similar material. Just below a handsome clock are the names of the present Christchurch Tramway Board.

The boiler room contains three Babcock & Wilcox boilers, each capable of evaporating 6000 lbs. of water an hour and of working at a pressure of 150 lbs. to the square inch. Combined with them are superheaters. The waste gases from the boilers are passed through a Green's economizer, which heats the feed-water before it enters the boilers. Mechanical stokers of the chain-grate type are placed under each boiler.



FRONT VIEW OF THE POWER HOUSE, SHOWING COOLING TOWER AT RIGHT

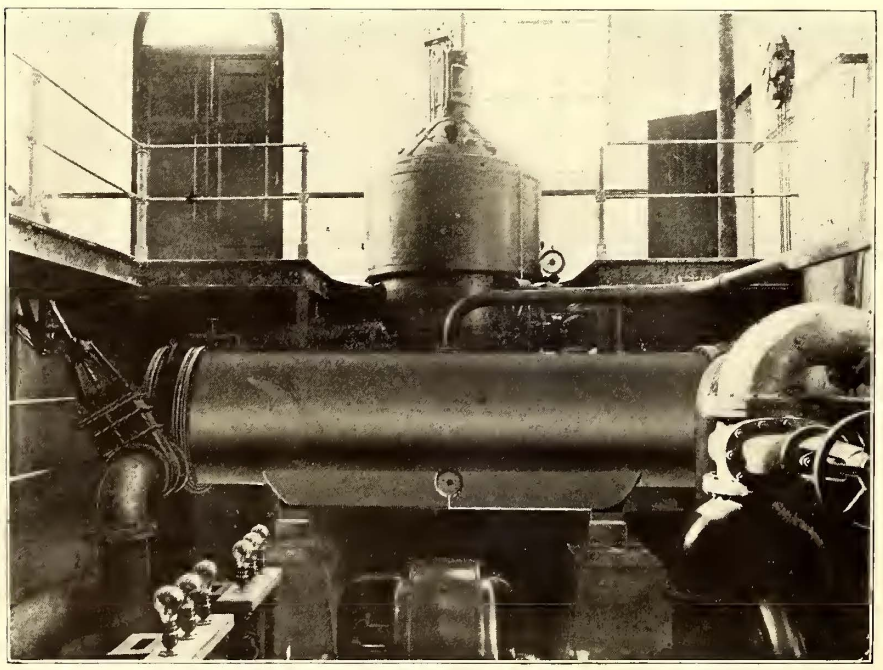
The coal bunkers have a capacity of 400 tons, and are filled direct from the railway trucks, which are hauled up an inclined way by an electric winch. This allows a minimum of handling of the coal; and when the bunkers have to be filled

it is necessary merely to haul up the trucks, open the truck doors and shoot the coal into the bunkers. Sidings have been provided at the railway side for conveniently handling the full and empty trucks. A 35-hp compound engine, directly connected to a dynamo, has been installed for supplying light to the power house, car shed and offices. Condensation is obtained by a cooling tower 35 ft. high and about 25 ft. in diameter, which is operated by two electrically-driven fans, each 8 ft. in diameter. Water is obtained from a 4-in. artesian well, which has been sunk to a depth of 425 ft. From the well the water passes into a concrete tank, which will hold 4000 gals. A connection has been made to this tank for the convenience of the fire brigade in case of an outbreak of fire in the vicinity of the power house.

The chimney is 149 ft. high, and rests on a concrete foundation 32 ft. square and 14 ft. deep. It has a clear internal diameter, inside the fire-brick lining, of 8 ft., and is built of brick, the base being of panel design.

THE OVERHEAD CONSTRUCTION

Both iron and wooden poles are used to support the overhead structure. The iron poles are painted a whitish gray, picked out with black bases and bands, wrought-iron arms and ornamental caps, rings and collars, and present a neat appearance. They are designed to stand a lateral strain of 1000 lbs. applied at the top of the pole, with a lateral deflection of not more than 6 ins., and a similar strain of 1500 lbs. with a permanent deflection of not more than ½ in. The wooden poles are Australian ironbark. Wooden side-bracket poles are to be used in the New Brighton, Sumner and Riccarton portions of the suburban lines.



ONE OF THE STEAM TURBINES AND ITS CONNECTIONS INSTALLED IN THE CHRISTCHURCH POWER STATION

No sooner had the decision been announced to use the single overhead trolley system than the Royal Society of Great Britain sent a long letter to the government, drawing attention to the important work which was then being done at the Magnetic Observatory in Christchurch, and the undesirability of any interference in that direction. The board virtually decided that it would be easier and more convenient to remove the observatory than the tramway system, and that the observatory ought not to have been erected near the city.

The overhead line is divided into ½-mile sections, in accordance with the Board of Trade regulations, with section insulators and switches, so that any ½-mile can be isolated without interfering with any other part of the line. No joints have been allowed in the trolley wire, except in splicing ears, and there is not more than one joint between each pair of section insulators. In the original specifications, guard wires were provided for the trolley or feeder wires where telegraph or telephone wires pass over them. After the contract had been let, however, the board agreed with the Public Works Department to have the guard wires obviated, and instead special arrangements were made for insulating all telephone and telegraph wires where they pass over either the trolley wire or the feeder cable. There is double insulation throughout the system for all steel poles, and single insulation for the wooden-pole construction.

MAKING EXCAVATIONS FOR THE TRACKWORK IN CATHEDRAL SQUARE, CHRISTCHURCH

THE TRACK CONSTRUCTION

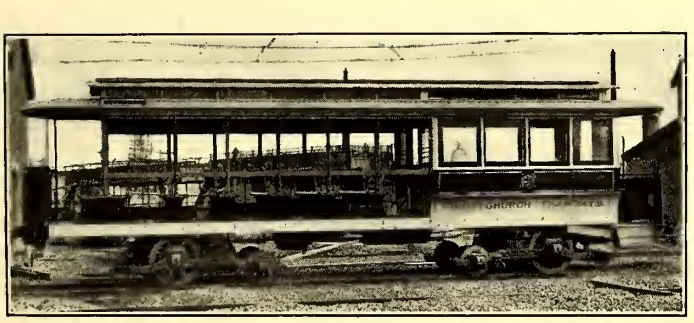
Up to the present time about 12¼ miles of standard gage track have been laid, and when the whole system has been completed there will be nearly 29½ miles of single track and 2½ miles of double track, the latter being used within the city limits. Ninety-two-lb. grooved rails will be used on the straight tracks over the whole system, with the exception of about 4 miles on the Sumner line, which runs down to one of the seaside resorts, where 72-lb. T-rails are employed. All rails are double-bonded with General Electric ribbon bonds.

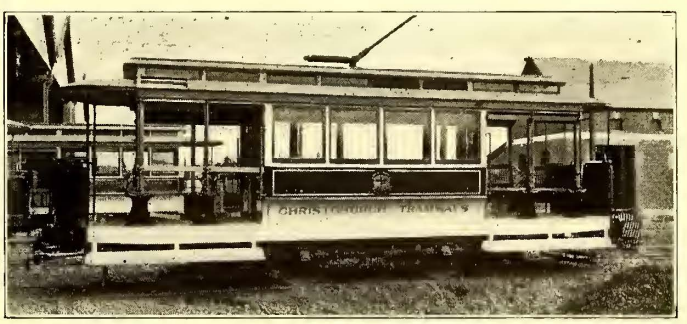
The flexibility of the sub-soil in the district required that special consideration be given to the sub-construction. The soil was first removed for 4 ft. on each side of the center line of the track to a depth of 17 ins., where the 92-lb. or 95-lb. rail were laid, and to a depth of 15 ins. for the T-rails. After the excavation was made and thoroughly rolled, it was filled to within 11 ins. of the finished surface with 2½-in. broken stone. The surface was then rolled with a roller weighing

more than 5 tons, and the rails were placed on the ties. The ties are of Australian hardwood, hewn from large trees.

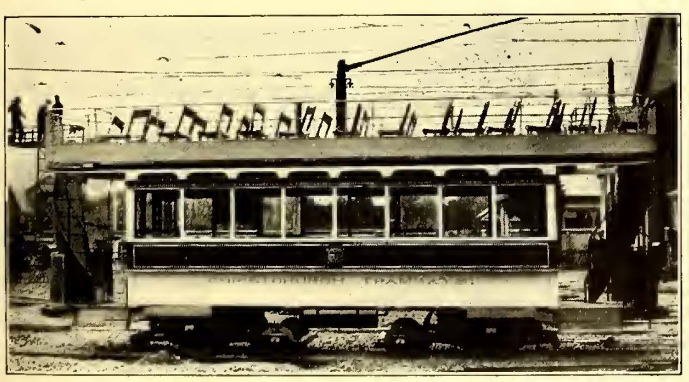
It was deemed advisable to cut off one of the bays of the estuary on the Sumner line. This deviation has caused a great deal of filling to be done, and also the construction of a special

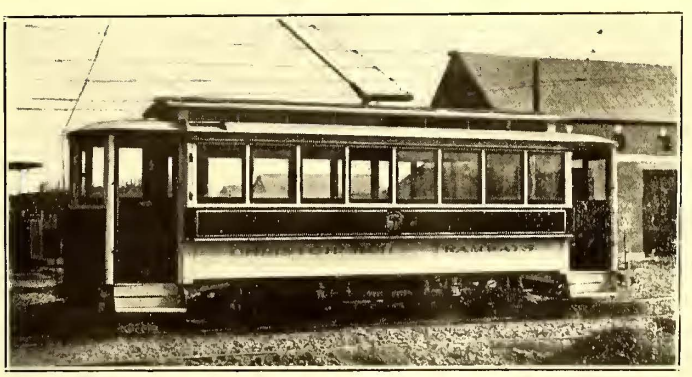
CAR SHEDS OF THE CHRISTCHURCH TRAMWAYS, WITH OFFICES OF THE TRAMWAY BOARD ON THE LEFT





TWO TYPES OF COMBINATION CARS USED BY THE CHRISTCHURCH TRAMWAYS





TYPES OF THE DOUBLE-DECK CAR AND DOUBLE-VESTIBULE CLOSED CAR USED ON THE CHRISTCHURCH TRAMWAYS

embankment, 15 ft. wide and 4290 ft. long. It has three bridges, each 20 ft. long, so as to allow for the flow of the tidal water.

THE CAR SHED

The car shed covers an area of 170 ft. x 170 ft. Of this, 170 ft. x 130 ft. is devoted to the use of the cars exclusively. The floor of the shed has been excavated for pits. The shed can receive fifty cars, which is a much larger number than the board will be called upon to deal with in the shed at present. In view of the future development of Christchurch, however, provision has been made for extending the shed so that it may double its present capacity at a comparatively small expense. The roof is wood, covered with glass and iron. Ample provision has been made for dealing with possible outbreaks of fire. Hydrants with hose and nozzles have been provided in different places around the building. A tank, which stands at an elevation of 30 ft., has a reserve store of 2000 gals. It is connected with the fire mains, and is kept filled automatically by an electrically-driven pump. The water supply is obtained

from a 3-in. artesian well, which flows into a large supply sump under the tank.

The repair shop is part of the same building. The plant is up to date; it includes a hydraulic wheel press, 12-in., 8-in. and 4-in. lathes, a radial drill, a large vertical drill and a small drill, a shaping machine and blacksmiths' forges. The armature room and woodworking shop contain a Lipe winding lathe, a band saw, a wood lathe and a drying oven for field coils, armatures and other parts of the electrical equipment that require to be dried by heat. The machines are driven by an electric motor, and a complete overhead traveling crane has been installed, which communicates with the repair shop pits at both ends, so that heavy parts of cars may be handled with perfect ease. A complete telephone system has been installed throughout the buildings, and also an intercommunication system between the offices, the machine and repair shops and the stables.

THE ROLLING STOCK

The cars, which were specially designed by the board's staff, are the only ones in Australasia provided with front fenders or life guards in addition to the wheel guards. The board has taken the precaution of fitting the cars in this respect on account of the extraordinary number of bicycles in Christchurch. Both the wheel guards and fenders were made by the Consolidated Fender Company, of the United States.

Each car is equipped with a motor-driven air compressor, Hale & Kilburn seats and electric heaters.

The rolling stock comprises seven steam locomotives, twenty-seven electric cars and forty-two trailers. The latter are the old cars taken over from the Christchurch Tramway Company. Most of the electric cars are made by the John Stephenson Company, of New York. Ten are of the single-truck combination type, ten of the double-truck combination type, three of the single-truck closed-vestibule type, three of the double-truck double-deck type, one of the closed-vestibule type, 30 ft. long, with a baggage compartment, and one single-truck electrically-driven water sprinkler.

All of the cars have been mounted on Peckham trucks. The wheels were made by John Baker & Company, of England, and are steel-tired.

THE MANAGEMENT

Wm. Reece, the chairman of the board, was born in Christchurch, and has always taken a prominent part in the city's public affairs, having been Mayor and a member of special committees appointed to deal with such events as the sending forth of contingents to the South African War.

F. H. Chamberlain, the engineer, served his apprenticeship with the old Daft Electric Company, and later was connected with the Metropolitan Railway Company in Washington. Before being appointed engineer to the Christchurch Board, he was engaged by the Railway Commissioners of New South Wales to superintend the construction of a three-phase power house and sub-station system in Sydney.

The whole system has been constructed by the New Zealand Electrical Construction Company, of Christchurch. The company was organized locally by T. E. Taylor, member of the House of Representatives, who is treasurer and secretary, while another Christchurch gentleman, J. L. Scott, is superintendent.

The First National Bank of Ypsilanti, Mich., has done the unusual thing of shipping $35,000 in specie, mostly silver dollars, by an electric car to the First National Bank of Detroit. The money filled thirty-one bags, and was loaded into the early morning limited car of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway, and was in charge of four officials. The regular express charge on this shipment would have been $1 per thousand. By sending it by electric car the bank paid four fares to Detroit and return.

STREET AND ELEVATED RAILWAY MILEAGE, CARS AND CAPITALIZANION OF THE UNITED STATES OF AMERICA

The accompanying table shows the mileage, number of cars and capitalization of the street and elevated railway companies in the United States and its insular possessions (Porto Rico, Hawaii and the Philippines), Canada (including Newfoundland) and Cuba, for 1903-1904, and has been compiled from the last two editions of "American Street Railway Investments." In compiling these figures, a slightly different method was followed than in previous years, in regard to the leased roads. It is very difficult, in view of the number of leased lines reporting in the Red Book, to determine absolutely to what extent the property of an operating company reporting covers that of its leased companies. This is particularly true in the case of recent consolidations. In preparing this table, especial effort was made to collect and compile this information, not only for 1904, but also for the previous year, and revised figures for 1903 are given with those of 1904, in the accompanying table. Another change has been made in the division of motor powers. Last year three separate columns were published for motive powers, viz., electric, cable and steam, and horse. This year, owing to the rapid disappearance of cable, steam and horse railways, their statistics have been combined. As will be noticed, about 80 per cent of the cars in these columns are in New York, Illinois, Missouri and California. This is owing principally to the retention of the cable or horse systems in New York City, Chicago, St. Louis and San Francisco.

The dates of the reports for the several railways as indicated by the reports in "American Street Railway Investments" vary, but practically all of them are within the limits of June 30, 1904, and May 1, 1905. The average we believe to be not far from Dec. 30, 1904, so that for this reason the 1904 figures may be considered as fairly representing the condition of the industry at the close of that year. In a few cases, where reliable reports could not be obtained of the capital stock and the funded debt of the companies, estimates have been made upon the known physical property of the separate companies. As the roads so not reporting were very small, however, both in number and importance, the estimates do not vitally affect the accuracy of the table. More important estimates had to be made of the outstanding capital stock and funded debt in cases where holding or leased companies owned a portion of the outstanding obligations or capital of sub-operating companies. These estimates were required, as many of the holding companies do not report the proportion of the capitalization of subcompanies controlled by them.

A number of slight inconsistencies in the reports of individual companies for the two succeeding years were discovered, particularly in the division of rolling stock between motor cars, trail cars and service cars. This is owing in most cases undoubtedly to the personal equation introduced through the preparation of the original report by a different officer each year. Under the belief, however, that such discrepancies as furnished by individual companies were slight, that they would naturally tend to balance each other, and that consequently they would not vitally affect the total result, the returns were compiled in the form they were presented.

As will be noticed, the total capital liabilities of the street railway companies in the United States show an increase of $134,839,324, or 44 per cent. Those of the insular possessions of the United States, $1,497,500, or 41 per cent, and those of Canada, $10,055,554, or 17 per cent.

Chicago has granted the Aurora, Elgin & Chicago Railway the right to carry freight and express in the cars it operates over the Metropolitan downtown loop for ten years.

STREET AND ELEVATED RAILWAY MILEAGE, CARS AND CAPITALIZATION IN UNITED STATES AND CANADA.

COMPILED FROM THE STATISTICS OF THE VARIOUS PROPERTIES CONTAINED IN "AMERICAN STREET RAILWAY INVESTMENTS," EDITION OF 1905.

STATES.	No. of Roads.	ELECTRIC RAILWAYS.								CABLE, STEAM AND HORSE RAILWAYS.						TOTAL RAILWAYS.				CAPITAL STOCK.			FUNDED DEBT.			CAPITAL LIABILITIES.			STATES.
		Track Mileage.		Motor Cars		Trail Cars.		Service Cars.		Track Mileage.		Grip Cars or Locomotives.		Trail Cars or Horse Cars.		Track Mileage.		Cars.		Total.		Increase for Year.	Total.		Increase for Year.	Total.		Increase for Year.	
	1904	1903	1904	1903	1904	1903	1904	1903	1904	1903	1904	1903	1904	1903	1904	1903	1904	1903	1904	1903	1904		1903	1904		1903	1904		
New England States.																													**New England States.**
Maine	18	353	378	409	432	57	71	132	166	3	3	....	....	6	6	356	381	604	675	$5,081,813	$5,933,013	$851,200	$5,961,000	$6,772,732	$811,732	$11,042,813	$12,705,745	$1,662,932	Maine
New Hampshire	14	272	292	324	338	6	1	40	57	....	....	....	....	....	....	272	292	370	396	6,904,900	6,904,900	.....	11,350,500	11,363,000	12,500	18,255,400	18,267,900	12,500	New Hampshire
Vermont	9	112	112	116	121	2	2	2	2	....	....	....	....	....	....	112	112	120	125	2,061,500	2,191,100	129,600	1,472,600	1,533,000	60,400	3,534,100	3,724,100	190,000	Vermont
Massachusetts	73	2,621	2,734	7,203	7,305	146	59	1,094	1,151	....	....	....	....	25	25	2,621	2,734	8,468	8,540	88,708,718	90,339,065	1,630,347	43,744,000	44,061,000	317,000	132,452,718	134,400,065	1,947,347	Massachusetts
Rhode Island	9	384	403	872	894	6	6	32	32	....	....	....	....	....	....	384	403	910	932	15,725,000	16,557,700	832,700	18,360,200	19,221,031	860,831	34,085,200	35,778,731	1,693,531	Rhode Island
Connecticut	26	668	687	1,264	1,405	20	24	178	191	....	....	....	....	....	....	668	687	1,462	1,620	27,887,890	28,847,240	959,350	20,222,000	20,999,642	777,642	48,109,890	49,846,882	1,736,992	Connecticut
TOTAL	149	4,410	4,606	10,188	10,495	237	163	1,478	1,599	3	3	....	....	31	31	4,413	4,609	11,954	12,288	146,369,821	150,773,018	4,403,197	101,110,300	103,950,405	2,840,105	247,480,121	254,723,423	7,243,302	TOTAL
Eastern States.																													**Eastern States.**
New York	106	3,175	3,192	11,788	12 013	2,114	2,276	987	1,100	159	137	122	31	1,473	519	3,334	3,329	16,484	15,942	324,496,117	336,032,395	11,536,278	298,226,060	299,637,590	1,411,530	62.,722,177	635,669,935	12,947,808	New York
New Jersey	35	1,025	1,108	1,939	2,012	112	103	11	12	8	8	28	2	8	29	1,033	1,116	2,098	2,158	86,089,160	87,828,290	1,739,130	74,836,090	78,477,600	3,641,510	160.925,250	166,305,890	5,380,640	New Jersey
Pennsylvania	124	3,142	3,319	7,298	7,024	232	407	656	711	....	....	....	....	....	....	3,142	3,319	8,186	8,142	224,518,826	231,355,495	6,836,669	153,177,559	163,117,714	9,940,155	377,696,385	394,473,209	16,776,824	Pennsylvania
Delaware	6	136	137	238	253	3	2	....	3	....	....	....	....	....	....	136	137	241	258	4,900,000	4,900,000	.....	6,974,000	7,074,000	100,000	11,874,000	11,974,000	100,000	Delaware
District of Columbia	8	294	308	828	978	243	292	13	17	....	....	....	....	....	....	294	308	1,084	1,287	29,605,000	30,605,000	1,000,000	20,267,450	20,460,000	192,550	49,872,450	51,065,000	1,192,550	District of Columbia
Maryland	9	452	454	1,658	1,669	10	10	45	45	....	....	....	....	....	....	452	454	1,713	1,724	16,908,306	17,779,006	870,700	52,351,695	52,401,000	49,305	69,260,001	70,180,006	920,005	Maryland
Virginia	19	402	414	571	578	14	38	84	51	2	....	....	....	2	....	404	414	671	667	26,469,500	27,025,100	555,600	28,529,814	29,146,500	616,086	54,999,314	56,171,600	1,172,286	Virginia
West Virginia	11	214	224	313	324	...	....	3	3	....	....	....	....	..	....	214	224	316	327	6,530,500	8,043,000	1,512,500	6,429,100	7,461,000	1,031,900	12,959,600	15,504,000	2,544,400	West Virginia
TOTAL	318	8,840	9,156	24,633	24,851	2,728	3,128	1,799	1,942	169	145	150	36	1,483	548	9,009	9,301	30,793	30,605	719,517,409	743,568,286	24,050,877	640,791 768	657,775,404	16,983,636	1,360,309,177	1,401,343,690	41,034,513	TOTAL
Central States.																													**Central States.**
Michigan	30	1,199	1 203	1,796	1,832	71	98	145	160	....	.. .	....	....	....	....	1,199	1.203	2,012	2,090	39,920,000	39,987,000	67,000	42,474,000	44,139,500	1,665,500	82,394,000	84,126,500	1,732,500	Michigan
Ohio	98	3,181	3.437	4,499	4,544	261	267	135	313	6	2	4	....	....	6	3,187	3,439	4,899	5,130	174,910,550	178,050,000	4,048,450	95,182,100	106,434,500	11,252,400	270,092,650	285,393,500	15,300,850	Ohio
Indiana	45	1,197	1,360	1,246	1,389	112	161	21	62	7	7	....	....	15	13	1,204	1,367	1,394	1,625	48,605,900	54,532,500	5,926,500	42,189,000	50,182,500	7,993,500	90,794,900	104,715,000	13,920,100	Indiana
Kentucky	12	276	292	564	577	242	241	5	42	....	....	....	....	....	....	276	292	811	860	9,781,900	10,890,900	1,109,000	9,766,300	10,491,000	724,700	19,548,200	21,381,900	1,833,700	Kentucky
Wisconsin	18	525	540	783	813	70	57	....	3	....	....	....	....	2	....	525	540	855	873	17,791,500	20,618,500	2,827,000	17,032,256	18,823,850	1,791,594	34,823,758	39,442,350	4,618,594	Wisconsin
Illinois	55	1,986	2,080	4,378	4,571	863	1,352	222	809	117	97	467	470	2,439	1,155	2,103	2,177	8,369	8,358	168,807,910	174,059,650	5,251,740	107,724,000	112,639,500	4,915,500	276,531,910	286,699,150	10,167,240	Illinois
Minnesota	7	352	360	813	813	306	303	....	....	....	....	....	....	....	....	352	360	1,119	1,116	25,591,495	25,591,495	.....	15,895,000	17,794,000	1,899,000	41,486,495	43,385,495	1,899,000	Minnesota
Iowa	27	478	554	729	738	85	91	....	2	2	2	....	....	2	2	480	556	816	833	16,536,000	16,860,000	324,000	9,313,500	10,159,000	845,500	25,849,500	27,019,000	1,169,500	Iowa
Missouri	21	866	902	2,407	2,388	174	64	16	12	36	36	187	187	203	202	902	938	2,987	2,853	69,125,100	74,116,500	4,991,400	86,379,000	86,710,000	331,000	155,504,100	160,826,500	5,322,400	Missouri
TOTAL	313	10,060	10,728	17,215	17,665	2,184	2 634	544	1.403	168	144	658	657	2,651	1,379	10,228	10,872	23,262	23,738	571,070,355	595,815,545	24,545,190	425,955,156	457,373,850	31,418,694	997,025,511	1,052,989,395	55,963,884	TOTAL
Southern States.																													**Southern States**
North Carolina	10	61	73	113	138	2	2	8	...	2	2	....	....	3	3	63	75	125	143	2,348,100	2,465,600	117,500	2,732,500	2,736,000	3,500	5,080,600	5,201,600	121,000	North Carolina
South Carolina	7	80	89	128	120	16	18	....	....	3	5	....	....	3	10	83	94	147	146	2,718,000	2,784,000	66,000	3,450,000	3,916,000	466,000	6,168,000	6,700,000	532 000	South Carolina
Georgia	13	338	356	459	468	22	37	1	26	6	7	....	....	6	11	344	363	488	542	19,441,000	19,588,000	147,000	16,793,000	16,988,000	195,000	36,234,000	36,576,000	342,000	Georgia
Florida	9	81	85	57	109	8	11	18	9	15	13	3	3	4	14	96	98	100	146	2,266,000	2,316,000	50,000	1,869,000	1,919,000	50,000	4,135,000	4,235,000	100,000	Florida
Alabama	12	234	246	287	287	90	97	19	29	10	9	2	3	10	10	244	255	388	426	10,075,900	10,240,900	165,000	9,109,000	10,850,000	1,741,000	19,184,900	21,090,900	1,906,000	Alabama
Mississippi	8	41	48	73	82	....	2	1	....	8	....	....	....	....	....	49	48	74	81	1,925,000	1,963,200	38,200	1,408,000	1,661,000	253,000	3,333,000	3,624,200	291,200	Mississippi
Tennessee	10	285	292	456	198	103	119	1	1	7	7	13	14	4	....	292	299	577	632	9,674,500	9,778,500	104,000	9,708,625	10,460,500	751,875	19,388,125	20,239,000	855,875	Tennessee
Louisiana	6	213	214	678	679	5	4	...	....	5	5	....	...	14	11	218	219	697	694	36,692,800	36,767,800	75,000	30,880,000	30,880,000	....	67,572,800	67,647,800	75,000	Louisiana
Arkansas	8	75	92	141	175	28	28	....	....	....	....	....	....	....	....	75	92	169	203	2,970,000	4,389,500	1,419,500	2,070,000	2,355,000	285 000	5,040,000	6,744,500	1,704,500	Arkansas
TOTAL	83	1,408	1,495	2,382	2,556	274	316	48	65	55	48	18	20	44	59	1,464	1,543	2,766	3,016	88,111,300	90,293,500	2,182,200	78,020,125	81,765,500	3,745,375	166,131,425	172,059,000	5,927,575	TOTAL
Western States.																													**Western States.**
North Dakota	2	12	12	11	15	....	....	....	....	....	....	....	....	...	....	12	12	11	15	250,000	300,000	40,000	210,000	250,000	50,000	470,000	560,000	90,000	North Dakota
South Dakota	1	....	4	...	3	....	2	...	....	....	....	....	....	....	....	....	4	....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	South Dakota
Nebraska	7	166	198	347	347	86	86	...	...	19	13	....	....	23	17	185	211	456	450	10,587,500	10,587,500	.....	7,875,000	7,875,000	.....	18,462,500	18,462,500	.....	Nebraska
Nevada	1	....	5	....	5	....	....	....	....	....	....	....	....	....	....	....	5	....	5	.....	100,000	100,000	.....	.....	75 000	75,000	.....	175,000	175,000	Nevada
Kansas	12	115	120	118	118	35	47	5	15	17	17	....	....	26	26	133	137	182	206	2,665,000	2,990,000	325,000	1,885,000	2,266,000	381,000	4,550,000	5,256,000	706,000	Kansas
Indian Territory	2	9	27	9	18	....	....	....	....	....	....	....	....	....	....	9	27	9	18	212,500	312,500	100,000	191,000	266,000	75,000	403,500	578,500	175,000	Indian Territory
Oklahoma	2	11	22	10	27	2	2	....	....	....	....	....	....	....	....	11	22	12	29	220,000	1,200,000	980,000	220,000	550,000	330,000	440,000	1,750,000	1,310,000	Oklahoma
Texas	19	349	400	562	656	41	58	.	5	9	11	..	....	10	12	358	411	613	732	15,807,500	15,884,500	77,000	11,979,000	14,693,000	2,714,000	27,786,500	30,577,500	2,791,000	Texas
Colorado	11	320	334	377	375	57	148	29	30	21	19	15	15	64	62	341	353	542	830	17,650,000	18,900,000	1,250,000	15,802,000	17,759,000	1,957,000	33,452,000	36,659,000	3,207,000	Colorado
Montana	5	62	64	77	81	16	25	12	....	....	....	....	....	....	....	82	64	105	106	1,695,613	1,695,613	.....	1,200,000	1,240,000	40,000	2,895,613	2,935,613	40,000	Montana
New Mexico	2	....	15	....	12	...	...	....	....	....	....	....	....	....	....	....	15	....	12	250,000	350,000	100,000	225,000	300,000	75,000	475,000	650,000	175,000	New Mexico
Idaho	2	18	23	9	13	7	7	....	...	19	21	2	2	....	....	37	44	18	22	404,000	538,400	134,400	300,000	440,000	140,000	704,000	978,400	274,400	Idaho
Utah	3	96	96	143	143	7	7	....	....	8	8	....	3	....	....	104	104	150	153	5,150,000	6 150,000	.....	2,870,000	5,458,000	2,588,000	9,020,000	11,608,000	2,588,000	Utah
Washington	12	347	355	360	383	71	67	102	201	34	33	94	94	....	....	381	388	627	745	20,091,100	22,549,100	2,458,000	12,690,000	13,877,000	1,187,000	32,781,100	36,426,100	3,645,000	Washington
Oregon	8	198	208	203	307	47	56	127	132	18	16	11	3	4	4	216	224	452	592	4,888,000	6,665,000	1,777,000	9,978,000	9,978,000	.....	14,866,000	16,643,000	1,777,000	Oregon
California	38	1,321	1,668	1,429	1,545	59	147	70	82	150	151	595	527	175	299	1,435	1,928	2,338	2,600	86,560,400	92,761,750	6,201,350	78,042,000	79,498,000	1,456,000	164,602,400	172,259,750	7,657,350	California
Arizona	3	11	12	10	10	7	7	....	....	11	10	4	....	7	10	22	22	28	27	277,800	337,100	59,300	120,000	120,000	.....	397,800	457,100	59,300	Arizona
TOTAL	130	3,038	3,563	3,723	4 058	445	659	345	466	306	299	721	644	309	430	3,342	3,862	5,543	6,257	167,719,413	181,321,463	13,802,050	143,587,000	154,655,000	11,068,000	311,306,413	335,976,463	24,670,050	TOTAL
United States	993	27,754	29,548	58,141	59,625	5,868	6,900	4,214	5,475	702	639	1,547	1,357	4,528	2,447	28,456	30,187	74,298	75,904	1,692,788,298	1,761,571,812	68,181,514	1,389 464,349	1,455,520,159	66,055,810	3,082,252,847	3,217,091,971	134,839,824	United States
Insular Possessions of U. S.—Hawaii, Porto Rico and Philippines	6	50	78	86	166	10	8	....	...	4	3	....	....	12	14	54	81	88	188	2,504,000	3,181,500	677,500	1,110,000	1,980,000	820,000	3,514,000	5,111,500	1,497,500	Insular Possessions of U. S.—Hawaii, Porto Rico and Philippines
Canada, including Newfoundland	42	860	861	2,305	2,424	71	42	40	111	60	39	12	12	76	50	920	900	2,504	2,639	34 201,080	40,833,142	8,632,062	25,147,558	28,571,050	3,423,492	59,348,638	69,404,192	10,055,554	Canada, including Newfoundland
Cuba	2	52	55	160	160	....	...	....	...	....	....	....	....	....	...	52	55	180	160	13,500,000	13,500,000	.....	8,550,000	8,550,000	.....	22,050,000	22,050,000	.....	Cuba

CORRESPONDENCE

TOOL STEEL

Chicago, Ill., July 14, 1905.

Editors Street Railway Journal:

In your issue of July 8 you publish an article, signed by Mr. Osmer, master mechanic of the Northwestern Elevated Railway, relative to a new process for tempering high-speed steel. Will you kindly let me know, through the columns of your publication, the kind of steel that Mr. Osmer is getting these phenomenal results from through this process of tempering?

George L. Nelson.

[Mr. Osmer reports to us that the steel for high-speed cutting that he is using and tempering by the process described is the Allen steel. We judge from what Mr. Osmer says that the best results can only be secured with this steel when the tempering is done almost at the fusing point, and this is what the apparatus he describes makes possible.—Editors.]

RAPID TRANSIT IN CITIES

In an address on this subject delivered last month by William Barclay Parsons at Purdue University, the speaker presented some interesting figures on the cost of the New York Subway. He stated that certain portions of the subway with four tracks, but exclusive of the equipment, cost at the rate of $5,000,000 per mile. The average cost, according to Mr. Parsons, including the elevated portion, which was, of course, much less expensive than the underground portions, was $2,000,000 per mile. The equipment cost about $750,000 per mile in addition. These figures are based upon a total length for the system of 24.7 miles, of which 5.7 miles are elevated, 1.4 miles are in iron-lined tubes, 3.4 miles are in deep tunnels, 1.2 miles are in arched construction and 13.0 miles are of the typical shallow subway construction, with concrete walls and flat steel roof. These variations in construction were adopted for topographical reasons. The average cost of the London tubular railways for two tracks, including stations and equipment, was given as $4,000,000 per mile.

In discussing general traffic conditions, Mr. Parsons said:

"In studying the problem for the building of a new line or the reconstruction or extension of an old one, the engineer should be sure he understands all phases of the question. While it is his business to supply the public with the facilities that the public desire, and not what he thinks they should desire, nevertheless he must be sure that there is sound and permanent logic in public demand. The traffic routes should be analyzed to determine the trend of travel and reasons for it. Frequently arguments are advanced that railroads should not be built along congested streets, because they tend to increase congestion, but instead they should be built along other and less frequented streets so as to draw travel away from the congested routes. Travel is usually concentrated along certain routes for well-established reasons, and frequently in spite of lack of transportation facilities. In this case it is idle to talk of drawing travel away. People that have become set in certain ways are hard to change, and a line built off a line of travel is of little public benefit and is doomed to failure or to a long wait for business to originate before attaining success.

"People also wish to be carried quickly. As our cities grow and distances increase, this question of speed becomes more and more important, as people measure the distance by minutes occupied in travel. Railroads for rapid transit should therefore, so far as possible, be on straight lines, and if one straight line cannot reach all the desired points, then other railroads must be built as soon as business warrants. The mistake should not be made of sacrificing the best individual results in the attempt to partially satisfy many. These were the errors in the location of the first underground railroads in London, where the attempt was made to avoid congested routes and give a circuitous location.

"In laying out rapid transit lines, it is found that people will not walk far to reach even a superior means of transportation, but are inclined to take the first at hand. For this reason one such road will not serve a very wide belt of territory, and the danger of disadvantageous parallel competition does not exist in anything like the same degree as with ordinary railroads operating in the same territory. New facilities of this character create their own traffic. The chief question arising is whether any particular route possesses in itself sufficient possibilities to justify the expensive construction. As parallel competition is not to be much feared, so new lines, even of an opposition corporation, should always be so constructed as to be capable of physical connection to permit through running. The whole tendency of American experience is toward consolidation of a city's transit lines. Our friends, the newspaper editors, and some of our other friends engaged in political strife, at times write and talk bitterly of local transportation monopoly. As a matter of fact, the public are better served when all lines are thus gathered together as a monopoly, and thus give the people the benefit of through running or of transfer.

"In judging of the value of traffic routes, two chief considerations must be kept in mind. First, mere density of population does not of itself signify great traffic returns. A certain portion of the population of great cities, and usually that which is densest, is not migratory, but being clustered around its work has little cause to go to other parts of the city. On the other hand, there are neighborhoods where the population is much more sparse, but where the residents leave their homes for business, shopping, visiting, school and entertainment. One must differentiate therefore between traveling and stationary population. This is well illustrated in New York, where one of the elevated lines traverses the celebrated tenement house district, where more people live per acre than in any other city of the world. The traffic returns are very low. Other portions of the line traversing districts where the population is not one-tenth of the former show receipts several-fold greater. Second, special points of occasional crowding are not so productive of traffic as they would seem to be. Recreation grounds and parks used occasionally or on certain days or seasons are illustrations, and even terminal stations of great railroads. To again quote from New York experience, when it is remembered that the Manhattan Elevated and Subway systems alone, on but a little over 50 miles of road, carry two-thirds as many passengers as do the steam railroads of the United States on over 200,000 miles, it needs no demonstration to show that the number of passengers interchanged with the Grand Central Station, the terminus not only of the New York Central system, but of the New England railroads as well, does not constitute a large percentage. Even in London, where the facilities are inferior to an American city, the Board of Engineers in their report advising the Royal Commission on London Traffic, show that one trolley terminus where the lines, through opposition, are compelled to stop short of ultimate destination, discharges and receives more passengers than are similarly handled at six large railroad passenger stations combined. A street passing through a commercial or shopping district, with places of entertainment in the neighborhood, is a much more desirable district to reach from the point of financial return, and more necessary from the point of view of public convenience, than the greatest railroad terminus or most popular ball ground."

ADVERTISING THE CONNECTICUT VALLEY ELECTRIC TRANSIT ROUTE

Several colored folders, published by the Public Service Corporation of New Jersey, the Detroit United Railway Company, the International Traction Company, of Buffalo, and others, have been illustrated in these pages, but it is comparatively rarely that several roads combine to issue a circular of this description. This course has been followed, however, in the case of the Connecticut Valley roads.

The plan was originated by Thomas C. Perkins, of the Hartford & Springfield Street Railway Company. Upon looking up the matter of an individual folder, it was found that the cost of getting out a map and lithographing, printing, etc., would entail an expense of $1,000 or more, no matter how small an edition was to be published. The plan was then suggested that the managers of all the street railways of the Connecticut Valley combine to issue a universal folder, showing all the trolley connections throughout the valley, both east and west, and by dividing the expense among all the roads make the proportion very small indeed for each road.

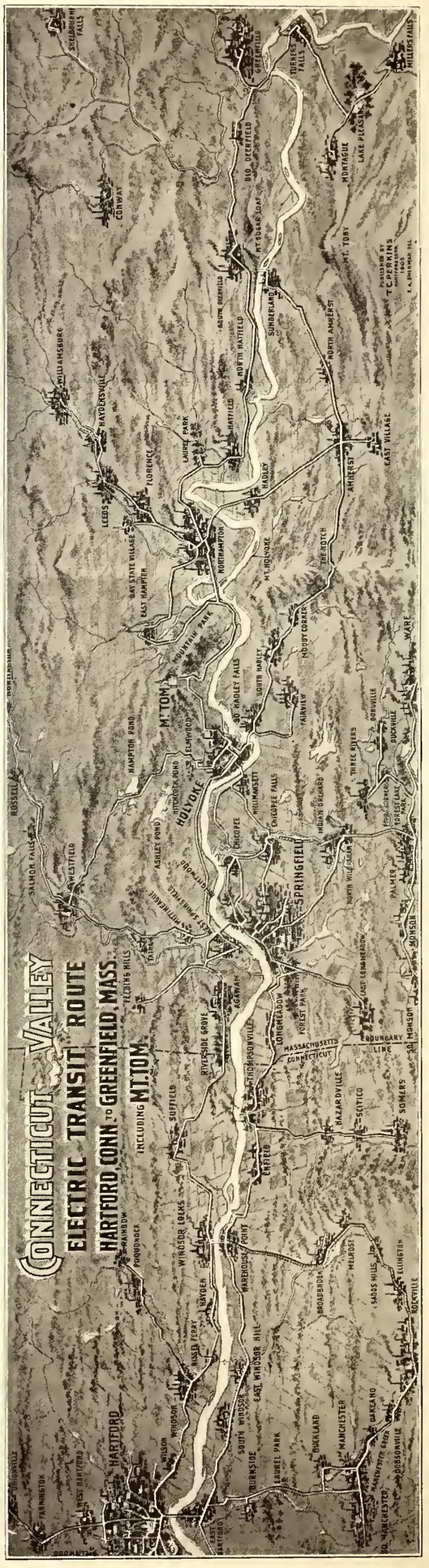
COVER DESIGN OF CONNECTICUT VALLEY TROLLEY GUIDE

This matter was then taken up with the various companies, every one of whom was found anxious to have the plan put through. The original colored map cost about $250, as it required considerable labor to get it out and have the lettering and the locations of the towns made properly. About 220,000 of these folders were issued, divided among the various street railway companies, as per the accompanying table, substantially in proportion to the mileage of the different roads, although one of the roads took a little less than its proportion.

CONNECTICUT VALLEY ELECTRIC TRANSIT ROUTE

	Number of Folders Taken	Cost
Hartford Street Railway Company	55,000	$550.00
Farmington Street Railway Company	5,000	50.00
Hartford, Manchester & Rockville Tramway Company	10,000	100.00
Hartford & Springfield Street Railway Company	20,000	200.00
Springfield Street Railway Company	55,000	550.00
Woronoco & Western Street Railway Company	20,000	200.00
Springfield & Eastern Street Railway Company	16,500	165.00
Holyoke Street Railway Company	20,000	200.00
Northampton Street Railway Company	7,500	75.00
Connecticut Valley Street Railway Company	20,000	200.00
	229,000	

The cost of getting out this issue, including the cost of the map and expenses of various sorts, together with 500 black japanned tin holders, which were furnished to the various street railway companies, was 1 cent each per folder. This



MAP USED IN CONNECTION WITH THE DESCRIPTION OF THE CONNECTICUT VALLEY ELECTRIC TRANSIT ROUTE, HARTFORD, CONN., TO GREENFIELD, MASS.

allowed enough for the originator of the folder to pay his expenses of traveling around and looking after the matter. In getting prices on the lithographing and printing, it was found that the minimum price per 1000 could be secured only by publishing at least 100,000 folders. How this plan worked out may be noted from the preceding table.

It is plain that the scheme is a very good one where connecting roads will join in such an undertaking, for the cost to the Hartford & Springfield Street Railway Company alone was only $200, for which it was furnished 20,000 folders. Besides this it reaped the advantage of having over 200,000 of these folders distributed for nothing by the other street railway companies, all of which could not help but stimulate travel. This same advantage, of course, was gained individually by every road joining in this distribution.

To construct a map that would be satisfactory to the managers of all the different roads, the Government topographical maps were used as a basis, each manager marking in on the map his various lines. By putting all the numbers together it became possible directly to represent the complete system.

As to distribution, each street railway is supposed to appoint one man in the car house whose business it is to see that the tin boxes in each car are kept filled with folders, and also that a supply of folders is kept on hand in all the hotels, cigar stores, drug stores and other public places in the various towns represented by the company's particular system.

When the matter of bringing out the folders was first taken up, there was some difference of opinion among the managers of the various roads as to whether the folders would not be thrown away, and to prevent this the plan was adopted to have the cover of the folder contain a very attractive design which would catch the eye and be so novel that every one who got hold of a folder would take it home. Of course, nothing would fill the bill better than a pretty girl, hence the design on the cover. The idea of the design of the trolley car under the lady's arm is not original, being taken from a poster prepared for the Brockton & Plymouth Street Railway Company, one of Stone & Webster's roads. The actual design of the cover for the folder was made by Mrs. Anna Westermann, of the L. A. Westermann Company, of New York City, at a cost of $50. There has been a great demand for these folders in Hartford and on all the other roads, and few, if any, have thrown them away or have not been interested in the excellent descriptions of the attractive features of the Connecticut Valley.

There are many cases throughout the country where connecting railways could get together and issue a folder of this kind which would result in increasing business on all the lines. One very common fault of street railway managers is that, being so familiar themselves with their own lines and the connections, they think everybody else in the community knows as much about them as they do, so do not make an effort to educate the public along these lines. In the city of Hartford, for instance, up to the present time there probably was not one person in a hundred who knew anything about the connections up the Connecticut Valley beyond Springfield or Holyoke, and on the other hand, the people in Holyoke and Northampton and in Springfield knew almost nothing about the connections to Hartford and to the south and west—consequently carrying out such a plan as issuing a general folder will be of considerable value in the way of stimulating traffic. A street railway company has goods to sell just as well as a department store, and if the management will keep its road before the public and use as much judgment in jollying along the newspaper people and doing a little advertising, as an up-to-date storekeeper does, it will reap the benefit of much increased riding.

Another scheme which Mr. Perkins originated in Hartford to stimulate traffic was the running of special limited cars from Hartford to Mount Tom on Sundays, charging a little more than the regular fare, and having the seats put on sale a week beforehand at a corner drug store, in the center of the city of Hartford. This service has proved very profitable and has been a good advertisement for the railway.

WHY ACCIDENTS HAPPEN

BY DR. H. B. ROCKWELL

In considering the subject of accidents in their relation to electric railways, perhaps the first question that presents itself is, "Why are accidents so named?" Why should the unfortunate casualties that occur every day on street railways be called accidents? An accident may be defined as an unforeseen and injurious occurrence not attributable to mistake, neglect or misconduct, and how frequently we hear the expression, "It was nobody's fault, it was purely an accident."

Now, as a matter of fact and experience, accidents thus defined rarely, if ever, happen on street railways. But because some one has blundered, some one has disobeyed an order or undertaken to reverse a law of nature, an accident with its long train of consequences is the result.

By whatever name we may choose to call these dire events, on this point we are all agreed: that their prevention is to be most earnestly desired and a means to that end most eagerly sought. So long as there are railroads and because men are fallible, accidents are bound to happen, and their entire prevention is impossible; but something can be done, that is not done, to that end. As President Roosevelt said in addressing the graduating class of Williams College last month, and while talking upon Government control and the adjustment of railway rates: "We do not believe that it will produce the millennium or anything approaching it, but it will work a measurable betterment." In discussing the subject, "Why accidents happen," we must necessarily consider the correlative proposition, "Why accidents should not happen."

It is somewhat difficult to formulate a classification of accidents, for each one is in a class by itself. There are almost as many classes as there are accidents; each one presents some different phase, and this fact becomes most strikingly apparent when an attempt is made to adjust it, and as the physician in treating his patients must take into consideration the idiosyncrasies of each and not undertake to prescribe for them all by an inflexible rule of practice, so the adjuster must study the peculiarities of his case if he would secure the best result. We can, however, classify the causes of accidents, and such a classification will be of service to the adjuster by enabling him to systemize his work.

CLASSIFICATION OF THE CAUSES OF ACCIDENTS

1. Accidents that arise through the negligence of the corporation or its servants.

2. Accidents that occur as the result of contributory negligence on the part of the injured.

The latter class is by far the larger, but the former is in some respects the more important, because it involves and includes the principle of "a priori" liability.

While, as regards the amount of damages, it makes little difference whether an accident occurs through the negligence of the corporation itself or its servants, in order to discover the cause and find the remedy, it will facilitate the subject to consider them separately.

First, then, let us take up accidents resulting from the company's negligence and how they can be prevented. In searching for the causes of accidents that result from a company's negligence, it is necessary to begin at the beginning of a railroad, the construction. For various reasons, but principally

from a mistaken idea of economy, things are done or left undone in building a railroad that contribute later on to the occurrence of accidents.

I do not presume to dictate all the measures that should be adopted in construction for safety, for the scope of this article would not permit it. Neither do I make any claim to omniscience, but I should like to call attention to some defects in construction that I have learned from experience have been the cause of accidents, and some very bad accidents.

CURVES

When engineers learn that not only the shortest but the safest distance between two points is a straight line they will have accomplished much toward the prevention of accidents. I know that it takes money to buy the right of way through a man's farm, and that frequently a considerable initial expense is saved by going around it, but in order to go around it requires curves, and curves are a most fruitful cause of accidents, and in two ways: cars are more frequently derailed at curves and the view is obstructed and collisions result.

It is true that the right of eminent domain is not granted to electric roads as it is to steam railroads, and it is therefore impossible for engineers always to have their way on this point, but money will accomplish almost anything, and it is better to pay a man several times what his land is worth than to depart from practically straight lines in building a road. But granted that curves are in some instances unavoidable, it is possible to make them comparatively safe by removing obstructions to the view. I have in mind an accident that cost in the neighborhood of $100,000 that could have been wholly prevented by the removal of a few trees and some underbrush that grew on the inside of the curve. The steam roads are spending millions of money in straightening their roadbeds, and it is not done altogether to save time either. Why should not electric roads follow their example?

GRADE CROSSINGS

Is there any reason why street railways should delay the abolishment of grade crossings until compelled by legislative action to do so? Why is it they cannot see that by so doing they save not only enormous expense from accidents but valuable time as well. I am free to admit that accidents do not often occur at grade crossings because of the extra precautions that are taken, and I know, too, that it has come to be almost a truism that accidents do not as a rule occur at danger points; but they do sometimes happen, and when they do they are fraught with awful results that stamp a lasting impression upon the minds of the public.

OPEN CARS AND RUNNING BOARDS

It is becoming to be freely expressed in railway circles that this "abomination of transportation" must go. It is entirely within the confines of conservatism to state that 50 per cent of all accidents result from persons alighting from or boarding open cars.

It cannot be denied that this type of car offers a strong incentive to travel, especially upon those roads that depend for their business largely on pleasure riding, and they will undoubtedly continue to be used, but they should be built with aisles and the exit and entrance should be by the rear platform while en route and from both platforms at terminals, and roads will act wisely if they will go one step further and adopt the system so successfully in vogue on some roads, of placing gates on the rear platform, operated by the motorman.

There is no question at all that the use of the running board for the purposes of transportation is a most iniquitous practice. It was never designed for this purpose, and it is an unfortunate device from an economic standpoint, to say nothing of its dangerous character. The number of fares missed on account of a crowded running board will probably overbalance the extra number of passengers carried upon it. Accidents to passengers riding on running boards are a daily occurrence, and although the rules of the company may prohibit the practice and a notice to that effect may be posted in a car, the courts are holding the companies rigidly to account, arguing that the very presence of the running board is a tacit invitation to ride thereon. In the name, then, of economy, humanity and decency, banish the running board and the summer car so equipped!

CAR INSPECTION

Every car before making its daily trip should be run over the wheel pit and thoroughly inspected by a competent man, and after it has run not over 3000 car-miles it should be taken off its run and subjected to a minute inspection as to its concealed parts that cannot practically be examined at the daily inspection. Car inspection on many roads is performed in a perfunctory and inadequate manner, and from the accident point of view too much stress cannot be laid on this important duty.

CULTIVATION OF FRIENDLY RELATIONS WITH EMPLOYEES

The cultivation of at least a speaking acquaintance with the employees on the part of the high officials of the road is very important. There exists in the bosoms of men, even the lowliest of men, a spirit of pride in their occupation. They like to speak of our road and our company, and this spirit should be fostered. Let men believe that they are not mere machines, that they are sentient beings, capable of feeling, and that the success of the road depends largely upon their personal effort, as it does. Instead of constantly disciplining men for breach of rules, occasionally reward them for service well performed, and if the presidents of roads would occasionally unbend their dignity and at stated intervals meet their employees in friendly concourse, be present now and then at their social gatherings, and give them a speech to show that, although they may stand on a higher rung of the social ladder, they are made of the same clay, it will redound to the advancement and betterment of the road, and the public will benefit proportionately.

ACCIDENTS DUE TO THE NEGLIGENCE OF EMPLOYEES

In seeking a motive (if one can call it a motive) that actuates a man in deliberately disobeying a rule, designed for the safety and welfare of not only those in his care, but himself as well, we meet with a problem in psychology difficult of solution.

Several years ago a car was making its customary run between two small cities in the central part of New York. It was in charge of a motorman who had been in the employ of the company continuously for seven years, and always on this particular run. Just midway between the two cities, the road crosses the tracks of a steam railway. It was the rule of the company and the invariable custom of the men to stop before crossing the track, and the conductor's duty was to go ahead and signal the crossing. On this occasion the conductor, as the car approached the crossing, walked to the rear of the car and stood upon the step, prepared to execute his usual duty. The possibility of the motorman failing to stop never for a moment entered his mind. He always stopped. He had been stopping for seven years, and had never failed to stop, but this time he didn't stop. He ran directly in front of a train running at a high rate of speed, the car was struck just back of the forward trucks and every passenger instantly killed. The motorman was picked up 50 ft. from the wreck, badly injured, and taken to a hospital, and when I saw him a few days after and asked him why he did not stop, his reply was, "I do not know; I cannot state," and I was unable to obtain any other explanation from him. Now, why was it? This man had not been drinking. His reputation in that respect was exceptional. He was not asleep. The conductor testified that he had stopped a few moments before to let off passengers. He was not a new employee and unacquainted with the road, and he was perfectly

familiar with the rules requiring him to stop at that particular point. He had stopped there thousands of times and had never failed before. It would almost seem as though the very habit of stopping would have unconsciously caused him to set his brakes, but his mind at that particular moment was a blank. There was an appreciable time when, to all intents and purposes, that man was dead, and his mind or spirit was as completely inoperative as though it had left the body for its eternal flight.

Occasionally a man undertakes to operate a car while more or less under the influence of liquor. His mind is clouded from drink and the machinery of his brain becomes clogged when it ought to be exceptionally active, for crises cannot be anticipated, and it behooves a man who holds in his hands the lives of the people to be ready for emergencies. Owing to the strict enforcement of the rule against drinking, whether on or off duty, accidents from this cause rarely, nowadays, occur, but they formerly were not uncommon, and furnished a theme for the exponents of total abstinence of which they were quick to take advantage.

Men do make mistakes at crucial moments, and for various reasons, some plausible, some ill-defined and some unaccountable. A man occasionally is overworked and is kept out all night on a snow plow. If then assigned to his regular run in the morning he may fall asleep at his post and make some mistake of memory or judgment which is due to sheer physical exhaustion. The negligence in such case is chargeable to the superintendent in permitting a man to work who is in any way or from any cause incompetent or incapable.

I think I am warranted in saying that 75 per cent of all accidents, for which a corporation is legally liable, arise from the employee's inattention to his duties, and the other 25 per cent to his disobedience of orders.

I have mentioned one or two instances where inattention to duties resulted in accident, and have tried to specialize, as it were, the different forms this inattention takes. The most common form of inattention, and the one most fruitful in the matter of accidents, is characterized by a frivolous "don't care" sort of a spirit, a lack of dignity and a lack of seriousness. Men indulge too much while on duty, in jocularity, not only between themselves, but occasionally with the passengers. They try to be funny and smart, and there is a considerable tendency to flirt with women both on and off the car, a practice to be condemned, both for reasons of morality and expediency. They should be reminded by the management frequently, every day if necessary, of the seriousness of their employment. "There is a time to dance and a time to refrain from dancing," and this is one of the times to refrain. Boys, or what is worse, men with boyish proclivities, are out of place as railroad employees. The steam roads are a long distance ahead of the trolley roads in this respect. It is quite the exception to meet a garrulous employee on a steam road.

During the early part of last fall, on a dark and rainy night, a summer car was running along at a moderate rate of speed between two towns in Rhode Island. The motorman was carrying on a conversation with a young woman who was seated directly behind him, when suddenly she called his attention to some object lying on the track a few feet ahead of the car. The motorman reversed and made a frantic effort to stop, but the front truck passed over a man and crushed out his life. The coroner's jury handed in a verdict of "drunk; lying on the track; contributory negligence; company exonerated." The verdict might have been different if the jury had the same opportunity that I had for obtaining the facts.

DISOBEDIENCE OF ORDERS

I presume there are some men so degenerate and morally perverted that for spite or revenge they will deliberately disobey orders, but these cases are so rare that they hardly come within the scope of this article. Yet, disobedience of orders is the common cause of accidents, and is usually due to carelessness or forgetfulness. In the great army of employees occasionally one is found who receives a verbal order very much as a ship takes on a miscellaneous cargo. Things are piled together without any relation, one to the other, and so in his mind, while it is a storehouse of information, the sequence of events and the correlation of ideas are sadly mixed and indistinguishable. Since the system of written orders has become a common practice on street railways, this excuse for accidents has in a measure been eliminated, and yet so long as men are employed with untrained and therefore unbalanced minds, accidents from carelessness are sure to occur.

ACCIDENTS DUE TO CONTRIBUTORY NEGLIGENCE ON THE PART OF THE INJURED

If corporations could obtain from the courts and jury the justice to which they are entitled, it would only be necessary to touch upon this particular phase of the subject. It is a melancholy fact, however, that this class of accidents furnishes the bulk of the work in the claim department of every street railway. It is the experience of nearly every road, some time during its history, to be called upon to defend cases where a deliberate effort is made to defraud the company. I do not propose at this time to enlarge upon this subject, not because it is unimportant, but because the occurrences are comparatively few and do not constitute a menace to the financial success of the road, and because they are, strictly speaking, not accidents.

The great majority of accidents due to the negligence of the public happen in one of three ways—through indecision, preoccupation, or the pernicious practice of "taking a chance."

If it were not so often attended by serious consequences it would be ludicrous to watch the exhibitions of indecision given by women. It is noticeable particularly in alighting from cars and in crossing tracks. There is probably no class of employees more abused and maligned than motorman and conductors, yet they are frequently entitled to sympathy and praise for their acts of heroism, both physical and moral. A woman signals a conductor to stop, or perhaps she doesn't signal and walks to the rear of the car. By her act she conveys the impression that she desires to alight and discontinue her journey. The conductor rings the bell, the car stops, she places her foot on the step and is about to alight, perhaps she actually does leave the car, when suddenly she changes her mind (woman's prerogative). It is the wrong corner, or she has left her pocketbook, or she has forgotten to bid her friend good-bye, or she didn't want to get off at all. Our courts are full of cases where accidents happen in just this way, and her friends are sure to swear that the car had come to a full stop; that she had one foot on the step and the other on the ground, when suddenly the car started off with a jerk and threw her. And it is astonishing how many friends a woman can command at this opportune moment. And so in crossing the track in front of the car. It hardly seems credible that the mind can act rapidly enough to keep up with the changes that a woman will make in her plans and purposes. It is utterly impossible for a motorman to anticipate what her intentions are. This same indecision is seen in the drivers of vehicles. They first stop and then whip up the horse, and then they stop again right on the track and the car hits them. The judge says it is a question of "due care and the jury must decide," and the jury does decide, and the company can usually forecast what that decision will be.

A great many people (and this statement is not confined to women) are so engrossed with their own thoughts that they become perfectly oblivious to the presence or existence of others, and while in this state of suspended animation undertake to perform the acts that call for conscious guidance. In so doing they are sometimes hit by a trolley car and the com-

pany has to pay. It becomes a question of veracity, and no one is willing to confess to being a somnambulist, so he simply lies about it.

There is a spirit born in each one of us and made manifest at the age of seven that prompts us in the early winter to "try the ice" on the mill pond. It bends and cracks beneath our weight, but we cross in safety, and then instead of congratulating ourselves on our preservation, we try it again just to see it bend, and continue the operation till we are "spilled in the drink." And probably because we are all "children still" when we arrive at mature years, we are constantly taking chances.

If it were not for the danger of running into vehicles, it would hardly be necessary to stop the cars on Broadway, for it is a rare exception that a man waits until the car stops before either boarding it or alighting. He calculates or miscalculates the speed and says to himself: "I'll just take a chance," and what a common occurence it is for a man to race after a car as though his life depended upon boarding that particular one, and the cars running on a half-minute schedule!

This head-long rush is not seen in other countries; people abroad are content to live out their allotted lives in some degree of quietness and leisure, but this rush and crush is characteristic of our Americanism, and I would be considered lacking in patriotism to advocate a change.

In concluding this subject I want to emphasize this thought: That accidents, most of them, are preventable. It may be necessary in many cases to discount and anticipate the folly and carelessness of people, but if claim departments would devote some of the energy and zeal which they exhibit in settling accidents to means and methods and appliances for their prevention they would accomplish not such brilliant results perhaps, but they would gain the approbation of street railway men in general and the gratitude of a much-abused and sometimes outraged public.

VIEWS IN THE LONDON TRAMWAY EXHIBITION

THE TRAMWAY EXHIBITION IN LONDON

The most important street railway event in London last month was the opening of the third International Tramway Exhibition, which was held at the Agricultural Hall, Islington, London, on July 3-14. The accompanying illustrations give a good idea of the appearance of the hall and the nature of the exhibition. It is three years since the last exhibition, but with a few exceptions the character of the exhibits is much the same as in previous years.

Perhaps the chief new feature which stands out boldest is the introduction of the motor car, or more correctly, the motor omnibus, to this exhibition, as represented by Wolseley, of Birmingham, and the Peebles steam car. Three years ago no motor omnibuses were in evidence. Secondly, there were this year three distinct surface-contact systems with elaborate exhibits, namely, the Kingsland, the Lorain and the Dolter, and while one or two of these were shown three years ago, they did not receive the same attention as at present.

Among the other exhibitors, the two most striking exhibits were undoubtedly those of the Brush Electrical Engineering Company, of London, and Bruce Peebles & Company, of Edin-

burgh, the former showing chiefly cars and equipments, while the latter exhibited a locomotive for high-tension three-phase work, and trucks equipped with motors for three-phase work on tramways and light railways. Among the other well-known manufacturers of electric traction apparatus were the following: The Stirling Boiler Company, Ltd., which showed models of boilers; Babcock & Wilcox, Ltd., gravity bucket conveyor, chain stokers and models of boilers; W. S. Laycock, Ltd., car fittings; Mountain & Gibson, Ltd., trucks, trolleys and fenders; Callender's Cable & Construction Company, Ltd., cables and appliances; Vacuum Oil Company, Ltd., oils and lubricators; ment, etc.; Miller & Company, Ltd., chilled-iron car wheels and a 150-ton wheel press; Aiton & Company, wrought-steel piping, grease separator and pump; Ed. Bennis & Company, Ltd., conveyors, stokers and furnaces; the Lorain Steel Company, special work and the surface-contact system used in Wolverhampton; Glasgow Numerical Ticket & Check Book Printing Company, specimen tickets; Lancashire Dynamo & Motor Company, Ltd., boosters; Electrical Power Storage Company, Ltd., storage batteries; G. D. Peters & Company, walk-over and turn-over seats, shades, millboard and other interior car fittings; Edgar Allen & Company, Ltd., special work;

VIEW FROM EAST GALLERY, LONDON TRAMWAY EXHIBITION

the Continuous Rail-Joint Company of Great Britain, Ltd., rail-joints; Kelvin & James White, Ltd., portable and recording instruments; Standard Varnish Works, insulating compounds, varnishes and motor coils; Nalder Brothers & Thompson, Ltd., electrical instruments; Electric Tramway Equipment Company, overhead material, gear wheels and pinions; Elliott Brothers, switchboard and portable instruments; E. Green & Son, Ltd., models of economizers; the Forest City Electric Company, rail-joints and commutator segments; Hadfield's Steel Foundry Company, Ltd., crossings, switches, car wheels, photographs of special work; British Johns-Manville Company, Ltd., fuses, overhead line material, insulation and pipe coverings; Robert W. Blackwell & Company, Ltd., motor-driven tower wagon, line material, tools, trolleys, gears and pinions, air-brake equipment; John Baker & Company, Ltd., steel-tired wheels and axles; Joseph Dixon Crucible Company, graphite; S. Dixon & Son, Ltd., automatic switches and overhead line material; Robert Young & Company, sacarbolate for cleaning cars; Glacier Anti-Friction Metal Company, Ltd., anti-friction metal for bearings; Thermit, Ltd., thermit welded rail-joints, including daily demonstration of the method of casting; Haste Pump Company, Ltd., pumps.

While some of the largest electrical manufacturing companies did not find it to their interests to exhibit this year, yet the exhibits of the smaller companies, especially those handling the auxiliary apparatus, were better than usual, and the exhibition, while it lasted, was well attended throughout and proved entirely successful.

THE WILLANS-PARSONS STEAM TURBINE

About two years ago Willans & Robinson, Ltd., of Rugby, England, manufacturers of the well-known high-speed engine, decided to take up the manufacture of steam turbines. After a careful survey of the work being done in the direction of building turbines of different types, they decided that the parallel-flow turbine, on the system proposed and developed by C. A. Parsons, had stood the test of time and was in a position for manufacture on a large scale. Negotiations were entered into with Mr. Parsons and a license to manufacture under his patents was taken. Consequently the Willans-Parsons turbine is identical in principle and in its main features with the Parsons standard type, and it is only in details of design and manufacture that there are any differences. As, however, these alterations have been introduced with a view to lending greater flexibility to the turbine when in use and facilitating manufacture on the interchangeable system, a few remarks on the subject may be of interest.

Special attention has been given to the arrangement of necessary details, such as governor gear, oil pump, steam and water piping, etc., as it has been found that ability to inspect the working portion of a turbine without dismantling any attendant gear is a convenience appreciated by those who have to take charge of the running and maintenance of machinery. To enable this to be attained, all the gearing and fittings named above are mounted on the bottom half of the bearing pedestals, and the top cover of the turbine, as well as the bearing caps of the three main bearings, are left free for instant removal.

To facilitate further the opening of the turbine, the top half of the casing has been arranged with two hinges, thus avoiding the use of guide studs and placing the turbine cover in a suitable position for examination. In the case of the 1000-kw Willans-Parsons turbine, it is possible for two men to remove the main bearing caps and to open up the turbine for inspection in less than an hour. A view of a turbine opened up in this manner will be found in Fig. 1.

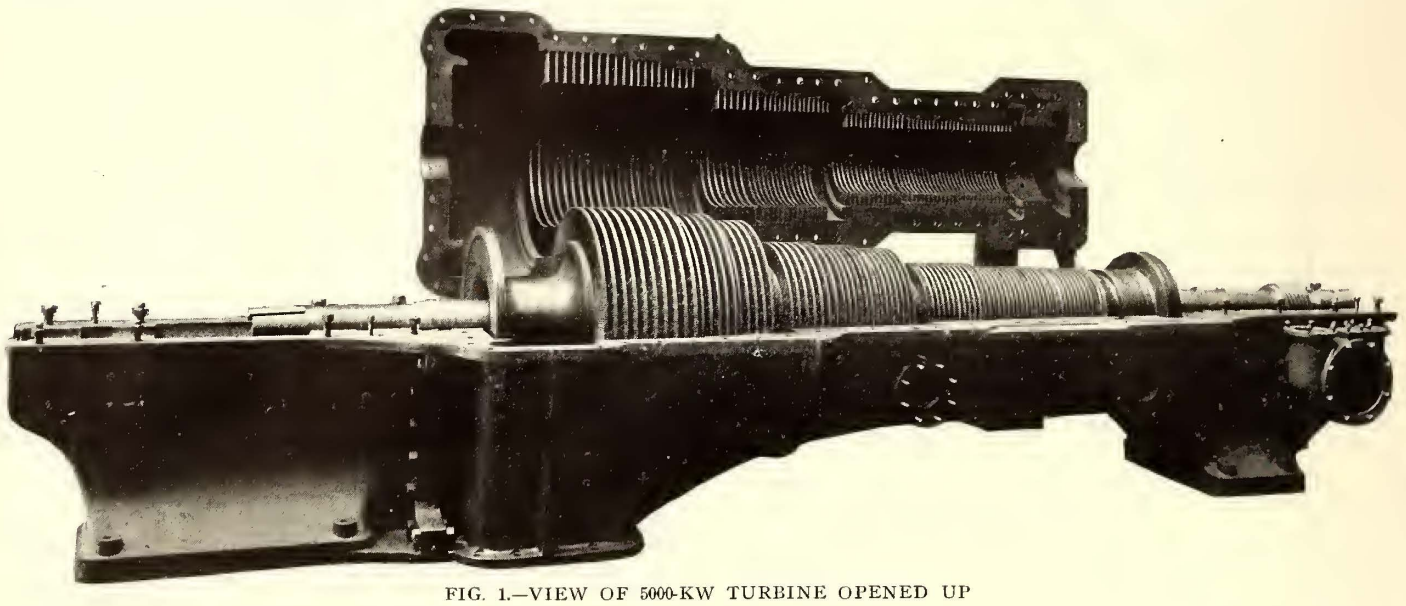


FIG. 1.—VIEW OF 5000-KW TURBINE OPENED UP

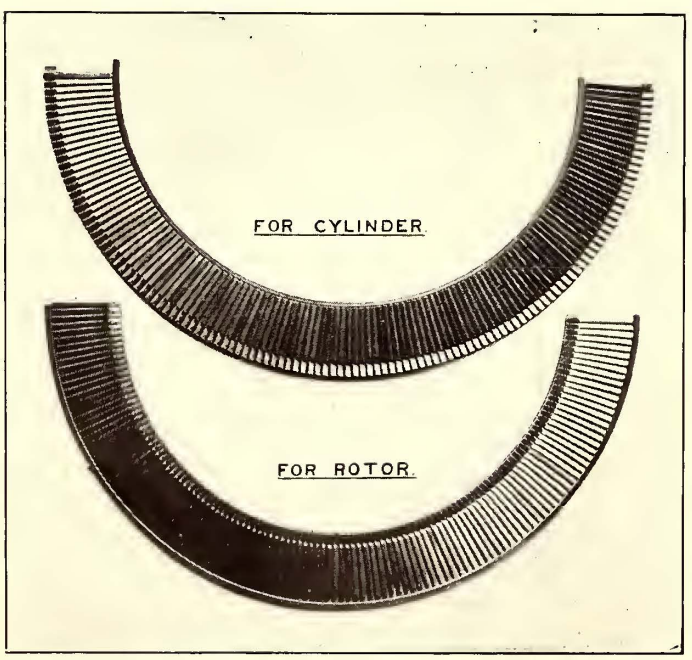


FIG. 2.—TWO HALF RINGS OF BLADES READY FOR ASSEMBLING

By a rearrangement of the balancing passages it has been found possible to shorten somewhat the length of the ordinary parallel-flow turbine, and, further, due to Fullagar's system of balancing, it has been found possible to dispense with the large balance piston at the high-pressure end of the turbine and to substitute in its place one of considerably smaller dimensions at the low-pressure end. It has been found in practice that this method of arranging the balancing pistons has the advantage of enabling castings of a more symmetrical form to be adopted, and in this way many of the troubles brought about by unequal expansion of the different parts are avoided.

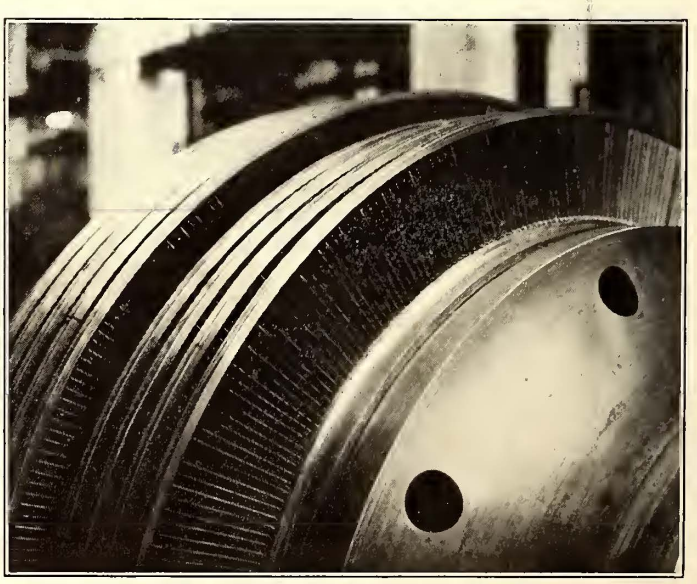


FIG. 3.—VIEW OF TURBINE BLADES, SHOWING SHROUDING

An improved method of attaching the blades to the rotor and casing has been adopted in this turbine. Extraordinary stiffness and rigidity is given to the blade rings when they have been fitted into their respective body or shaft grooves. In the ordinary turbine of this type, each blade is fixed separately into the rotor and casing by means of its own caulking piece. In the Willans-Parsons steam turbine, as will be seen from Fig. 2, the blades for one complete ring are built up on two half rings, which rings have had the necessary grooves for receiving the blades cut in them by means of automatic machinery. These complete half rings of blades are then caulked into the shaft or the casing. Attention might be drawn to the fact that the cutting and assembling of the blading by means of specially designed automatic machinery insures that the whole of the blade angles and openings on which the efficiency depends are mathematically correct. Fig. 2 shows two of these half rings complete for assembling on the shaft and in the casing.

Another feature of the Willans-Parsons turbine consists in the special channel shrouding encircling the blades which this manufacturer has the right to use under the patent of H. F. Fullagar. This shrouding is fixed on the half ring of blades before assembly on the shaft or in the casing, and has several points of merit. It adds materially to the mechanical strength of the blades themselves and removes any danger of the blades stripping should the rotor come into contact with the casing, or the blading on the casing come into contact with the revolving shaft. Further, the action of the channel shrouding when under working conditions minimizes the loss due to leakage over the revolving or fixed rows of blades, and by this means a considerable gain in the steam economy is effected. A view of the shrouding around the blades is shown on the right-hand side of Fig. 3.

Special attention has been paid to the question of governor gear with a view of making it as simple and as reliable as possible. By dispensing with some of the intermediate gears hitherto used on governors controlling steam turbines, it has been found possible to eliminate many of the undesirable features and to obtain results in the direction of close governing which it is believed surpass anything hitherto obtainable. All the turbines are fitted with by-pass valves, which automatically open when the maximum economical output of the turbine is exceeded, and by means of these by-pass valves any required overload can be obtained up to the full capacity of the generator, the steam economy of the turbine being, of course, reduced.

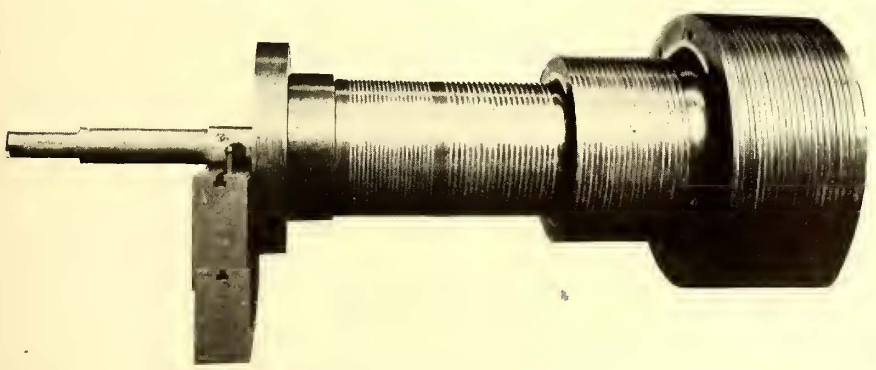
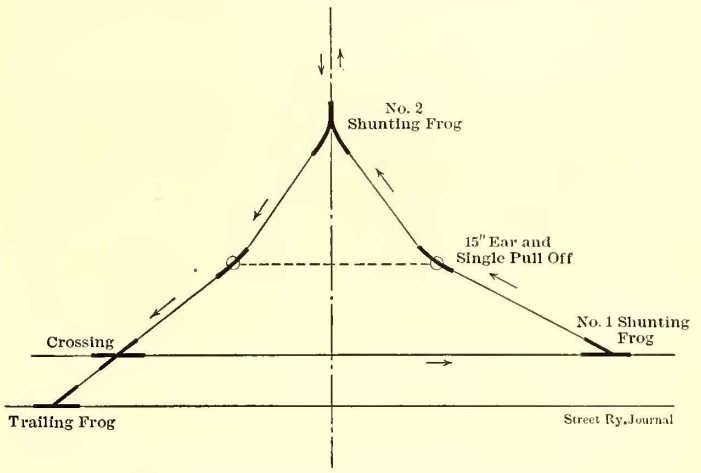


FIG. 4.—VIEW OF TURBINE SHAFT READY FOR BLADING

At the present time this company has 24,250 kw of this type of turbine at work or nearing completion, the smallest at the present time being of 750 kw normal capacity and the largest of 5000 kw normal capacity. Among others might be mentioned the following: Two 3000-kw and one 1500-kw for the Glasgow Corporation; two 1000-kw for the Bristol Corporation; one 3000-kw for the Metropolitan E. S. Company, London; two 1000-kw for Bruce Peebles & Company, Ltd., and one 1000-kw for Messrs. Watsons, of Linwood; also three 750-kw for the English McKenna Steel Process Company, Ltd., Birkenhead.

TROLLEY REVERSER USED IN BRISTOL, ENG.

The Bristol Tramways & Carriage Company, Ltd., has been using for some time Ward's trolley reverser. This is made in the form of a triangle, consisting of two switching points, one trailer and one crossing. This should be fixed in a suitable position at the terminus, so that the trolley head, when the car has stopped, has passed the switching or shunting point called No. 1 on the sketch. As the car starts on the return journey, the trolley, instead of taking the through wire, is lead off by the aforementioned shunting point on to one side of the triangle,



TROLLEY REVERSER USED IN BRISTOL

at the apex of which is fixed another shunting point in such a position that the trolley head, when at a right angle to the car, has just run past it. The car proceeding brings the trolley head with it along the other side of the triangle and trails through on to the main line wire.

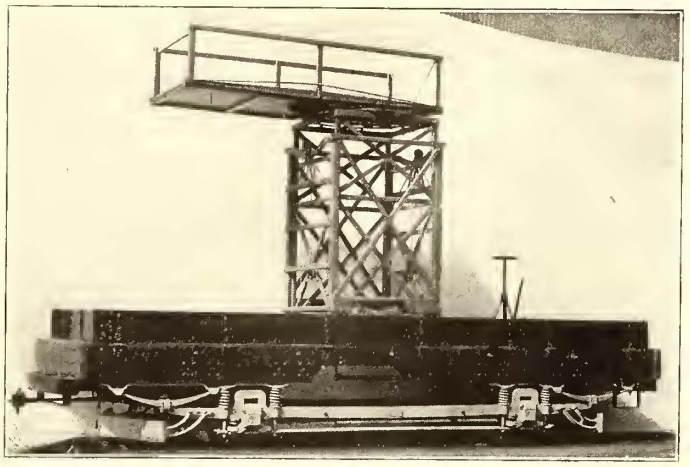
In fixing this to work with the 12-ft. boom, with the wire at a height of 20 ft. 6 ins., the most suitable measurements on the Bristol line for the position of the shunting points have been: No. 1 to be fixed as near as possible over the center of the track; No. 2 at the apex at a distance of 9 ft. from the center of the track to give a good lead in and out of the frogs. The other measurements are from center of the base of the triangle. No. 1 frog should be set at a distance of about 10 ft., the trailing point at about the same distance on the other side of this center line. An additional straining wire between the two sides of the triangle will be found advantageous for this purpose. Care must be taken that all wires are pulled up taut, in order to prevent the frogs tilting when the trolley is running under them. It is well to fix these reversers as near the end of the journey as possible, so that the outgoing car will not interfere in any way with the car standing to come into the siding.

The Spokane & Cœur d'Alene Railway has established a tent city this year in the woods bordering on Lake Cœur d'Alene and the Spokane River, which is meeting with a fair degree of success. It was established in May, and now has twenty tents occupied. Adjoining the tent city is a dancing pavilion, where the company maintains a dancing master and gives open air dances two or three times a week. This pavilion is now becoming popular with the people of Spokane.

TOWER CAR FOR LA PAZ, BOLIVIA

The J. G. Brill Company has recently delivered the type of tower car illustrated, ordered through W. R. Grace & Company, to the Ferro Carril Guaqui a La Paz, Bolivia. La Paz is a city of 80,000 inhabitants, located in the western part of Bolivia, in a deep valley, and yet 12,000 ft. above the sea level.

The car illustrated is 21 ft. over the sills and 5 ft. 9 ins. wide over the outside sills. The extension tower has a revolving platform and is completely equipped with hoisting rigging. The motive power will be furnished by a steam engine and vertical boiler arranged to drive on one axle by means of a sprocket wheel and chain, the sprocket wheel being placed on the axle between the outside of the wheel hub and the journal box. The No. 21-E type of truck, which has an unusually long wheel base, is used. This truck is particularly noted for its great strength and steady riding qualities, being almost universally used under double-deck cars. The length over the bumpers is 22 ft. 8 ins. The side sills are 4½ ins. x 7 ins., and the end sills are 3½ ins. x 13 ins. The weight of the car and truck without equipment is 9180 lbs. The No. 21-E truck has a wheel base of 10 ft. and 30-in. wheels. The builder's angle-iron bumpers and radial draw-bars are used.

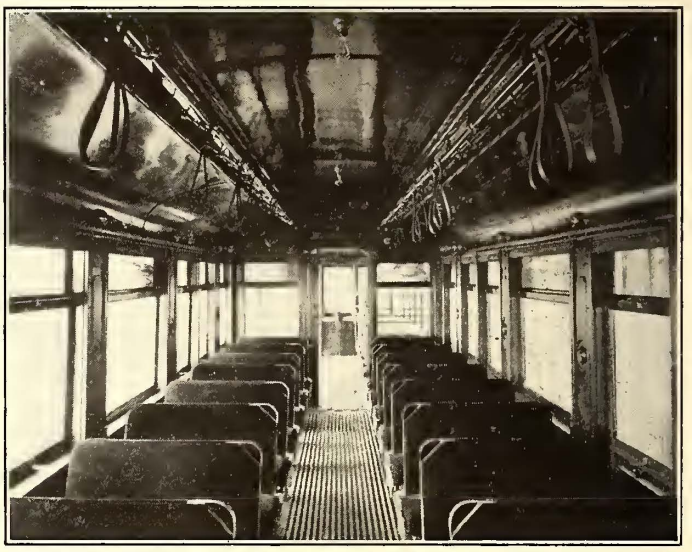


THE NEW LA PAZ TOWER CAR

HANDSOME COMBINATION CARS FOR CALIFORNIA

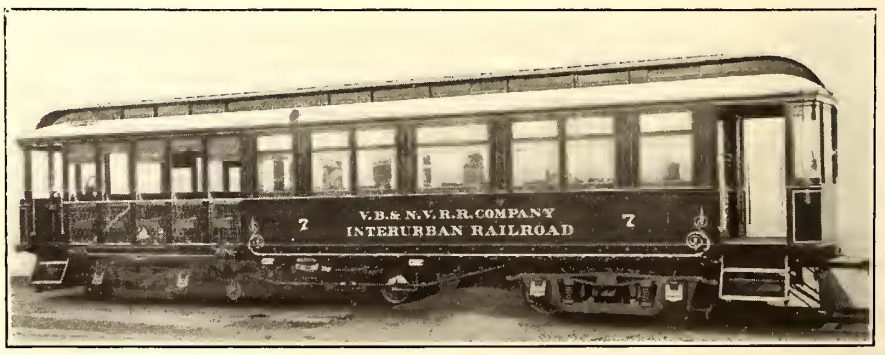
Three handsome combination open and closed cars, built by the American Car Company, have been placed in operation on the interurban line of the Vallejo, Benicia & Napa Valley Railroad Company, California. This road is located in the central western part of the State, and connects Vallejo, Napa Junction and Napa. Due to the favorable climate, combination open and closed cars are largely used on the Pacific Coast, being suitable for all-year service. In plan and general construction, the cars embody features that combine comfort and convenience with strength and durability. While not detracting from the comfort of passengers, the arrangement of different sized windows adds considerably to the appearance of the cars. The total seating capacity is sixty. In the closed compartment the seats are upholstered in red plush, and in the open compartment slat seats are used. The small upper sashes are stationary and the lower are arranged to drop into pockets, over which are hinged covers. The vestibule sashes also drop into pockets. Heavy curtains are provided for the open compartment. Wire net guards are fixed permanently on the outside of the posts from the vestibule posts to the closed compartments. The interiors present an elegant appearance, being finished throughout in mahogany, with the ceilings tastefully decorated. The cars are mounted on the American Car Company's No. 23-B type of M. C. B. trucks, with Westinghouse single-phase motors of 75 hp each.

The cars measure 48 ft. over all, and the length of the closed compartment is 25 ft. The length of the open compartment is 12 ft. 11½ ins. The width over the sills, including the plates, is 8 ft. 10 ins. The centers of the posts are 2 ft. 3⅜ ins. in the open and 1 ft. 5⅔ ins. in the closed compartment. The side sills are 5½ ins. x 7¾ ins., and the end sills are 5½ ins. x 7¾ ins. The sill plates are 8 ins. x ⅝ in. The thickness of the corner posts is 3¾ ins. in the closed compartment and 3½ ins. in the open compartment. The thickness of the side posts is 2¼ ins. in the closed and 3½ ins. in the open compartment. The seats are 35¼ ins. long and the aisles are 25 ins. wide. The height of the steps is 17½ ins., and of the risers, 13½ ins. The patented specialties include Brill angle-iron bumpers, "Dedenda" gongs and channel-iron draw-bars, and American Car Company's pilots and brake staffs. The trucks have a 6 ft. 4-in. wheel base and 33-in. diameter wheels.



INTERIOR OF CALIFORNIA COMBINATION CAR

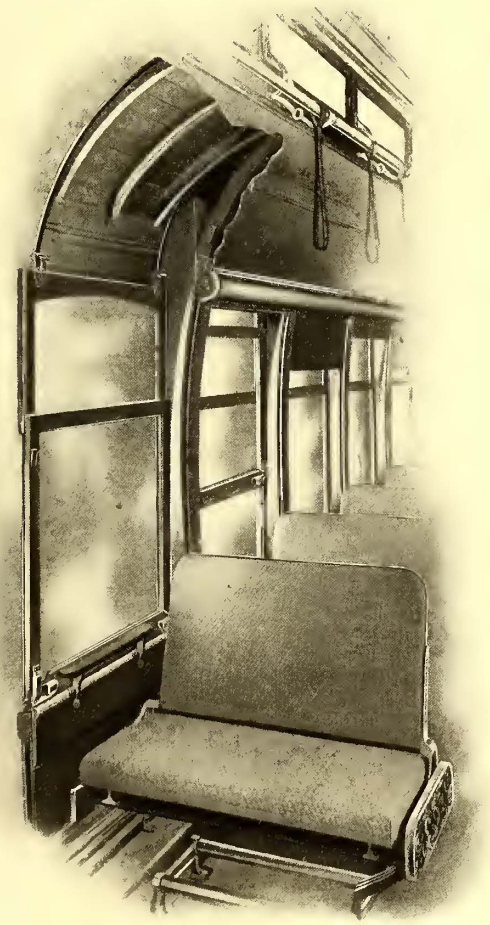
The Boston & Worcester Street Railway has inaugurated this year a series of excursions from Worcester and intermediate points to the beaches in the vicinity of Boston. Arrangements are made with other companies to make the trips without change of cars, and they have been very generally enjoyed. The company provides comfortable cars, so that a ride of 50 miles or 60 miles each way is not objectionable, as the trips are made in comparatively quick time.



INTERURBAN COMBINATION CAR FOR THE VALLEJO, BENICIA & NAPA VALLEY RAILROAD COMPANY

THE NEW "GROOVELESS POST" SEMI-CONVERTIBLE CAR

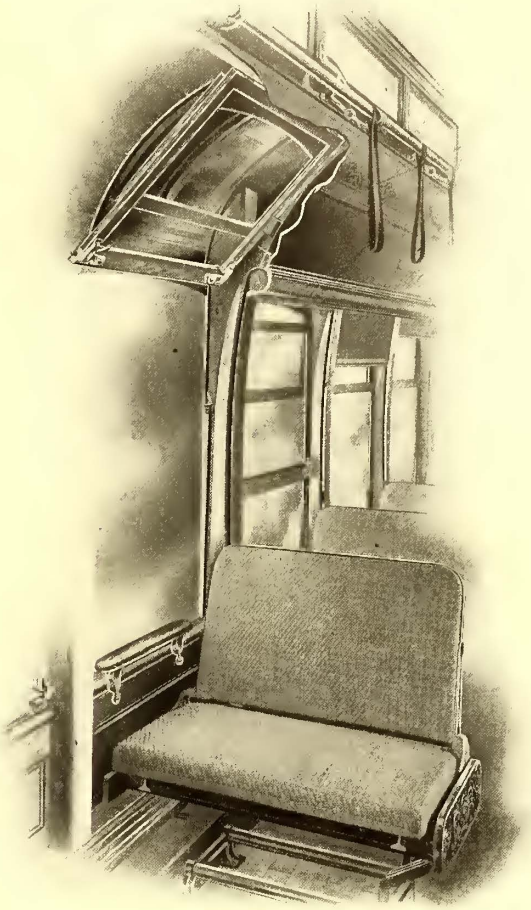
The "grooveless post" semi-convertible window system which has been referred to in this paper's recent articles on semi-convertible cars built by the J. G. Brill Company, is an improvement upon this well-known system, which the company has adopted as its standard construction, and which it believes to be the final step in the development of the type. When the car was introduced in 1899, a pair of sashes on being raised was automatically secured together by a button-and-eye method, the buttons and eyes being of metal and attached to the tops of the sashes. The sashes were guided into the pockets in the side roofs by means of trunnions at the sash corners sliding in grooves or runways in the posts. About two years ago the details were simplified by using metal hooks on the upper sash, in which the upper trunnions of the lower sash engaged when the sashes were raised. A few months ago this method was superseded by what has come to be known as the "grooveless



NEW GROOVELESS POST, SASH LOWERED

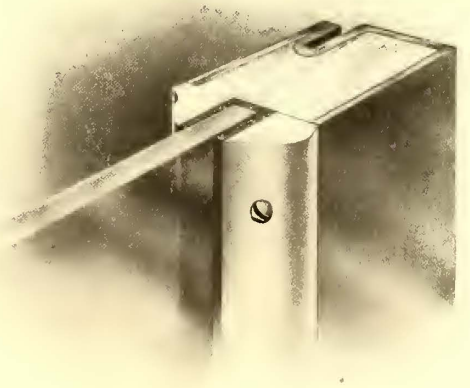
post" system, with which the company has experimented for more than a year. The chief object of the new arrangement is in that it dispenses with grooves, thereby increasing the strength of the posts. It also simplifies the mechanical details, perfects the operation and reduces the width and depth of the roof pockets.

The general plan of the "grooveless post" semi-convertible system consists of a pair of sashes, the lower attached to the upper by a sliding connection, and both conducted into the roof pocket by means of guides. Both the upper and lower sashes have brass stiles. The stiles of the lower sash have grooves in which slide tongues extending from the stiles of the upper sash. The tongues are composed of spring brass, inclined outwardly from bottom to top, so that the lower sash in being raised is moved slightly away from the surface of the upper sash to prevent friction. Small inclined metal plates upon the stiles bear against corresponding plates attached to the posts and press the frames of both sashes together in their lowered



NEW GROOVELESS POST, SASH RAISED

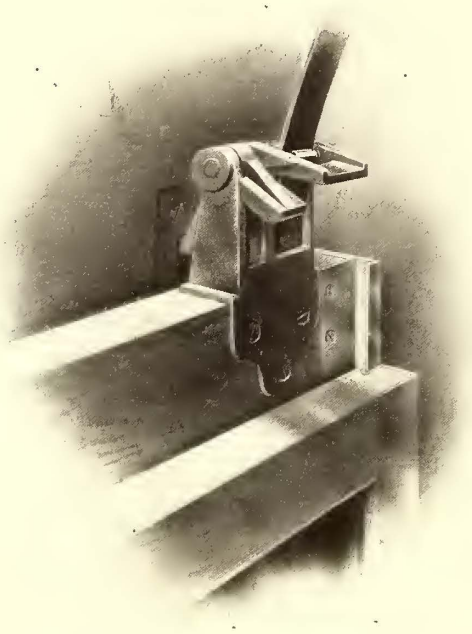
position, forming a waterproof connection. When the lower sash is raised, the top of its frame comes in contact with triggers in the roller brackets which are secured to the top of the upper sash. These triggers operate catches which spring into



BRASS SASH WITH WOODEN FILLER AND GLASS SET IN FELT, WITH WOODEN BEADING

metal stops in the letter panel, while the upper sash is drawn down to prevent dislodgement. After the sash presses the triggers up it contacts with the extensions or toes, also on the roller brackets, and by them the upper sash is raised. An open space through the back part of the toe in each bracket contains

two rollers, mounted on a stout spring, and between them passes a bow-shaped guide. The guides are composed of flat steel spaced about 20 ins. apart, and which extend from the letter panel to the lower ventilator rail. Any settling of the deck cannot affect the movement of the sashes, because it is not essential for the guides to retain a fixed configuration. The



ROLLER BRACKET AND AUTOMATIC SPRING CATCH

window locks were especially designed for this system, and are equal to all the strain that may be brought upon them, even if the car should collide heavily with another. The brass bolt of the lock has a steel core which prevents its bending if the sash is dropped from one stop to another. Besides the stops which hold the lock bolts when the sashes are in the pocket, there are three or more stops to each runway, so that the bolts cannot fail to catch if the sashes are carelessly dropped. Safety stops are provided to prevent the sashes from falling more than a few inches if it should happen at any time that a passenger should not push the sashes high enough into the pocket to engage the locks in the uppermost stops.

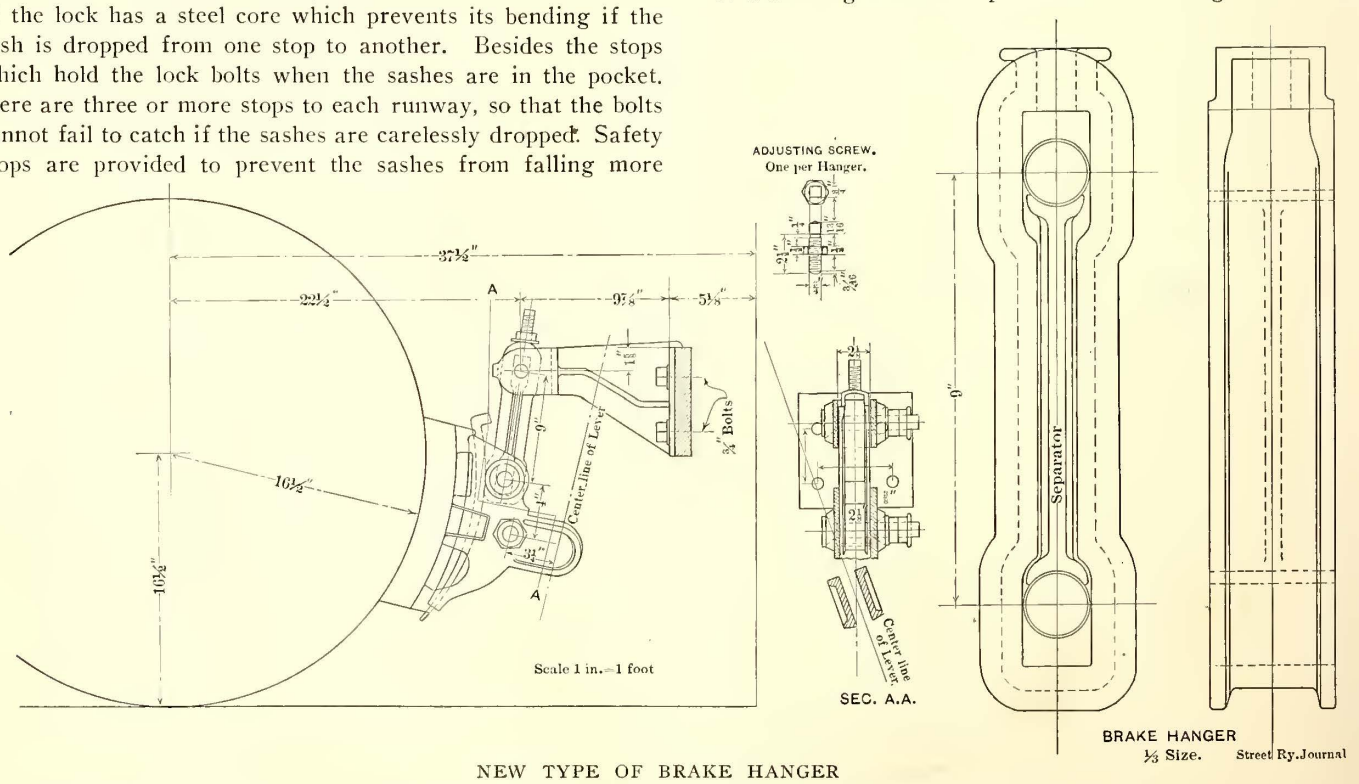
Formerly the use of metal sash stiles was objectionable on account of the difficulty in removing and replacing the glass. This objection has been obviated by a patented method of construction which consists of combining a metal casing with a wooden filler, allowing the usual wooden beading to be used, as is shown in the illustration.

The builders claim that having the sashes slide into the roof pockets gains certain important advantages, namely, interior width, on account of absence of pockets in the side walls and the introduction of the ends of the seats between the posts and against the side linings; easier operation because one motion only is necessary, and that in a direction which permits the operator to use his strength to the best advantage. The sashes may be held at any desired height; the position of the window pockets prevents passengers from stuffing rubbish into them, and therefore they do not get foul, nor is the glass of the sashes liable to be broken.

The type has come into large favor for city service. At present the company is building forty for Baltimore, thirty-five for Memphis, twenty-three for Nashville, 107 for Philadelphia, and completing a number of smaller orders for various parts of the country.

THE OLDS BRAKE HANGER

E. W. Olds, superintendent of rolling stock of the Milwaukee Electric Railway & Light Company, is the inventor of a brake hanger which is used on all the new cars of the Milwaukee Electric Railway & Light Company. The patent is now the property of the St. Louis Car Company. This brake hanger is so designed that wear can be easily taken up so as to avoid the lost motion in the brake rigging which causes rattling and chattering. The adjustment is made by means of a single adjusting nut at the top of the hanger. By means of this adjusting nut, the pin on the brake beam and the pin on the truck frame can be brought firmly against the separator which forms the central part of the hanger. This separator is free to move up or down in the hanger. The tightening of the adjusting nut draws together the top half of the bearing on the truck-



NEW TYPE OF BRAKE HANGER

frame pin and the bottom half of the bearing under the brake-beam pin, holding the truck-frame and brake-beam pins firmly against the separator and preventing lost motion. Thus both the pin bearings can be kept tight by adjusting a single nut which is easily accessible at the upper end of the brake hanger. There can be no such thing as having these bearings loose and the other tight, as one adjustment equalizes against the other.

RECENT PROGRESS IN ALTERNATING CURRENT TRACTION IN FRANCE AND GERMANY

In a recent test made by the French Thomson-Houston Company on a Paris line, two 4-pole, single-phase, 25-cycle, 300-volt, 37-kw motors of the Latour-Gratzmuller were used. The increase in temperature of the commutator was 75 degs. C. after one hour's run, while the other parts did not increase by more than 60 degs. The efficiency was 84 per cent. The air-gap was 2 mm and the speed reduction 4.6 to 1. The tests showed that the air-gap may be enlarged without inconvenience and that the motors can be started easily at three times the normal torque.

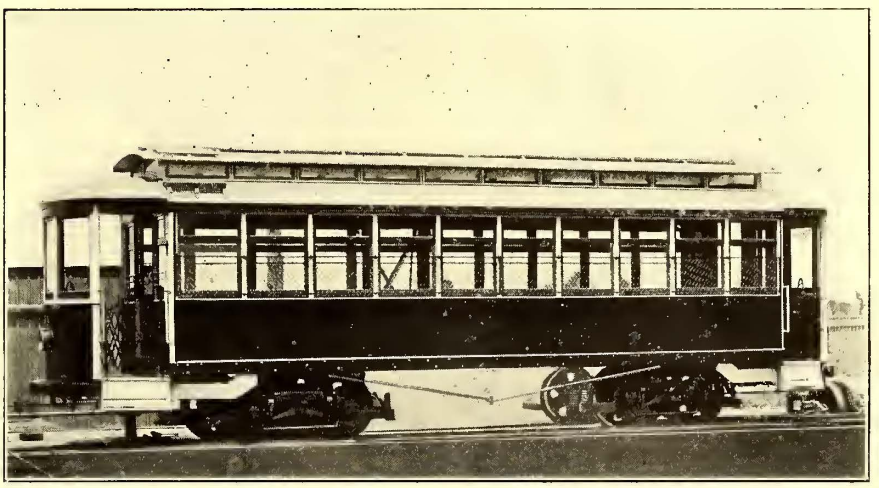
In a paper read by Mr. Schimpff before the annual meeting of the German Association of Electrical Engineers, the author reviewed the co-operation of the German Government with electric manufacturers in the development of heavy electric traction. He then sketched the equipment of the Hamburg road, from Blankenese to Olsdorf, which is now in course of erection. The single-phase system will be used and steam turbines of the Brown-Boveri-Parsons type will be installed in the power station. There will be five turbines, each of 1250 kw normal capacity and of 1700 kw maximum capacity; also two turbines, each of 600 kw for lighting. The 1250-kw turbines drive each a 2-pole dynamo, giving single-phase, alternating current of 6600 volts at a frequency of 25, the power being 1250 kw to 1700 kw at a power factor of 0.75. The lighting dynamos give a current of 6600 volts. The road, which has a length of about 14 km, with some considerable grades, will be supplied with current at 6600 volts. There are four feeding points. To one distant part of the line the current is transmitted at 20,000 volts and then reduced to 6600 volts. The construction of the trolley wire is the same as on the Spindlersfelde road. The rails are used for the return current. Double cars, each car having three axles, will be employed, each of the two cars having one truck and one driving axle. The trucks are placed at the beginning and end of the double car. One truck is provided with two motors, the other truck with one 125-hp motor. Such a double car will have seating capacity for 118 passengers, and will have a total weight, including passengers, of 180 tons. Finally some data were given comparing the cost of this single-phase system with a direct-current system with three-phase transmission and converter sub-stations. The total cost of conductors, transformers and converters for the latter system would be more than double that of the single-phase system ($729,000 against $316,000). On the other hand, the weight of the alternating-current cars is higher than that of the direct-current cars, by about 7.5 per cent, so that the consumption of power is correspondingly greater. Nevertheless, it is claimed that the combined three-phase and direct-current system, in comparison with the simple alternating-current system, would require annually an expense of about $29,000 greater, which is 23 per cent of the annual cost of power generation and distribution (about $125,000).

General Manager F. D. Carpenter, of the Western Ohio, announces that a traffic arrangement will be entered into between the Mandelbaum-Pomeroy syndicates and the Widener-Elkins people, thus making possible, with the completion of the Western Ohio's link now building between Lima and Findlay, complete through service from river to lake by trolley.

CLOSED CARS FOR BILOXI, MISS.

The John Stephenson Company has lately delivered to the Biloxi Electric Railway & Power Company two cars of the type illustrated. Biloxi is located in the extreme central southern part of Mississippi, on the Gulf of Mexico.

The new cars measure 28 ft. over the end panels and are 8 ft. 4 ins. wide over all. The window system is of the double-sash arrangement, the top sash being stationary and the lower drops into pockets which are provided with hinged covers. The vestibule sashes are of single lights, and also drop into pockets. Detachable wire window screens are included in the equipment. The seats are of spring cane and are transversely placed, with the exception of the four longitudinal seats at the corners of the car. The seating capacity is forty. Cherry, with decorated birch ceilings, constitutes the interior finish of the cars. The trucks are of the Brill No. 27-G type, with 4-ft. wheel base and 33-in. wheels, and have solid forged side frames. The motors are of 40 hp each. Among the specialties are Brill angle-iron bumpers, radial draw-bars, "Dedenda" gongs, "Retriever" bells, vertical brake wheels and folding gates.



CLOSED CAR FOR BILOXI

The length of the car over the vestibule sheathing is 37 ft. The height from the under side of the side sills to the top of the roof is 9 ft. 4 ins. The platforms are 4 ft. 6 ins. The thickness of the corner posts is 3¾ ins., and of the side posts, 2¾ ins.

An electric express train on the Lancashire & Yorkshire Railroad, bound from Liverpool for Southport, came into collision Thursday evening, July 27, with an empty stationary train at the Hall Road station, 6½ miles from Liverpool, causing the death of twenty-three persons and the injury of many others. The first car of the express, which was crowded, was smashed to pieces, and only six of the occupants escaped. The collision lifted the roof of the first car of the express completely off the steel frame and crashed it down again on the unfortunate passengers, twenty of whom were killed outright. Almost immediately after the crash, so the cable reports say, the wreckage burst into flames. Fortunately the badly injured number comparatively few.

The Aurora, Elgin & Chicago Railway has issued an "Outing" folder, one side of which is given up to a large, colored bird's-eye view map of the road. Half-tone views of attractive places on the road and some short descriptions occupy half of the remainder of the folder. The balance is taken up with the map of the downtown district of Chicago, showing the location of the new terminal station of the company and information about the service, including rates of fare.

INTERVIEW WITH MR. DALRYMPLE

While James Dalrymple, general manager of the Glasgow Municipal Tramway System, was in this country he expressed himself as adverse to newspaper interviews until his report should have been transmitted to Mayor Dunne. His report was sent to Chicago soon after his arrival in Great Britain, and in a recent interview in the "Tramway and Railway World," Mr. Dalrymple referred to his recent American visit as follows:

"I had an extremely pleasant tour, and I am glad to take this opportunity of publicly expressing my thanks and indebtedness to the municipal officials, the tramway administrators and representatives of the street railway companies with whom I came in close contact for the kind and generous way in which they received me. Any information I desired was readily placed at my disposal, and I cannot speak too highly of the courtesy I experienced on every hand. I visited Chicago, Minneapolis, St. Paul, Cleveland, Buffalo, Washington, Philalelphia, Montreal, Boston and New York, where everything that was possible was done to make me comfortable."

"Your immediate object, I believe, was to help Mayor Dunne and the Chicago people to solve their pressing tramway problem?"

"The object of my visit to Chicago was to explain to Mayor Dunne and the citizens of that great and important American city the tramway work that we have carried out in Glasgow, and to see if possibly the lessons we have learnt in Glasgow could in any way be applied to the benefit of that city. But I ought to explain that the local government system, the social and physical conditions, the climate and circumstances generally there are so entirely different from what obtains in this country, that great care has to be exercised in instituting comparisons. In fact, in many respects, accurate comparison is impossible, because everything is so different—law, habit and ideas, but of course the actual problem of locomotion, the giving of mobility to the people, is in principle the same."

THE CHICAGO TRAMWAY SYSTEM

"What did you find in Chicago as regards the tramway system?"

"The present tramway system of Chicago is, comparatively speaking, altogether out of date, and it has been rapidly going down hill of recent years from various causes. There is no wonder that the inhabitants are intensely dissatisfied with their transit facilities. One of the principal reasons for the decay has been the disputes between the municipality and the tramway or street railway companies in regard to franchise and other matters. The American franchise system corresponds somewhat to our system of Parliamentary concession, except that the franchise given to many companies in America is perpetual or for very long periods; the franchise means the original concession to work the tramways and construct the system. Of course the companies could not be expected to spend capital in improving or altering their system in any way until some definite agreement had been arrived at, and so matters have drifted. The position is complicated, not only among the owning and operating companies themselves, but also as between the companies and the municipality. The companies on the one hand contend that they still have 50 years' franchise on many of their important lines still to run, and the municipality disputes that view. The service has become so bad that the citizens, in my opinion, are quite justified in demanding a change of some kind. In the light of the experience of other cities, they not unnaturally look to a municipalized system as providing the best way out of the difficulty. In fact, Mayor Dunne was elected by a large majority last April on the distinct understanding that he would immediately take steps to municipalize or reform the whole tramway system in Chicago, so that you can see that public opinion in the city is ripe for the development."

"Would you mind explaining the features of the present system?"

"A very large portion of the present tramways is worked by cable, and in fact this was one of the first cable systems constructed in America In all there are about 700 miles of single track in the city, but the whole system is out of date, and the property has become much depreciated. There are two operating companies, with a number of underlying companies. The company that operates the north and west sides of the city is in a bad way financially, due, I fancy, to over-capitalization, whereas the company on the south side of the river is in a much better position. This company, I believe, has recently changed hands, and probably the whole system is now practically under one control. The southern company is not over-capitalized, and changed hands at about $36,000,000 as a going concern, the shares being bought at about $200 for every $100."

"Do you think Chicago offers a good field for modern tramway enterprise?"

"Indeed, I do. There are no gradients; the city is perfectly flat. There is an enormous population, immense trade, and an almost feverish activity. The streets are wide and straight, and there will be no need to spend money on widenings. But against that must be set the bad condition of the roads; the road surfaces are very inferior, and a considerable sum of money will have to be spent to have them made up; and of course the whole of the track must be reconstructed. You see, in respect of street formation, Chicago differs from English cities in having been designed and built in comparatively recent times. There is no congestion of the population as there is in most of our big towns. No doubt this is partly due to the fact that the tramways of even an inferior type have been operating for some years, and partly also to the methods of living, and the habits of the people themselves. They do not crowd together; they prefer to spread out and have plenty of room. An idea of this condition can be gathered from the significant fact that while Glasgow embraces about 19 square miles, Chicago embraces about 194 square miles. You see in America they have more land. Taking all these factors into consideration, I believe, in fact I am convinced, that Chicago provides a really magnificent opportunity for cheap and profitable tramway working. Looked at altogether, it really has the making of the finest tramway system in the world, provided it is all electrified and brought thoroughly up to date. I should propose to do away with the cable system and substitute the overhead system throughout the whole city. The City Council has hitherto objected to the adoption of the overhead system in the central parts, the consequence being that in the more central parts they have the trolley, the cable and the horse system. The whole system has gradually gone from bad to worse. This, in a modern enterprising city like Chicago, is emarkable."

THE AMERICAN MUNICIPAL SYSTEM

"Considering that the local government system in American cities is so different from the English method, do you think it will be practicable to effect the improvement you indicate by municipalization?"

"Well, the problem will be an exceedingly difficult one to solve. But I do not think that solution will be altogether impossible, because public opinion will be at the back of the movement, and public opinion must win in the long run. There exists a right to buy up the franchise or concession, and the municipality is thought to have powers under the Mueller law to issue certificates on the security of the undertaking for the equipment of the municipal system. But it is not plain sailing, for I should explain that although this law exists it has never yet been tested in practice. They have the law, but whether it is constitutional has yet to be proved. Doubtless there will be a long and hard fight in order to test this law, but I would be much astonished if the city could afford to purchase the undertaking including the value of the unexpired portion of the franchise. If the contention of the companies is upheld, that they have this period of 50 years still to run, it will be a very difficult matter indeed for the municipality to purchase the undertaking at a figure that will allow them to work profitably. Although ultimately the city will be able to obtain possession of the lines, it will take a number of years, because I do not suppose that the companies are going to give away their rights without fighting for them."

"How did this uncertainty about the franchise arise?"

"The city people say that the franchise is inoperative because it was obtained by corruption; but I cannot, of course, speak as to that, and the facts are in dispute."

"What have you advised them to do?"

"Well, that is in my letter sent to Mayor Dunne, and before speaking definitely as to that I would rather wait until it has been made public by him. I have not given my recommendations to anyone, and there will be no difficulty about getting the text when it is published."

"As to the provision of current, how will they get over that difficulty?"

"There is an electric lighting station for lighting the streets, but they do not sell any power, so there would very likely need to be a separate tramway power station if they were to municipalize the whole of the tramways. They propose to municipalize one of the lines of the city that falls in, and have actually asked for offers for the equipment of this first expired line; the offers were to be in at the end of last week. It is not a long section, just a few miles."

"In regard to the general condition of municipal affairs in Chicago, do you think under present circumstances it would be feasible and wise to introduce a system of municipal management under the control of the city council?"

"I believe the city council is a very able and intelligent body, but if they went in for municipalizing such a huge undertaking as this, there is no doubt they would require to eliminate the political element."

"If a manager were appointed would you be in favor of giving him an absolute tenure of his office?"

"Yes, certainly, he must have a fixed tenure and for a fairly long period, too. It would not do to leave him to the chances of a changing administration. Of course, I should let him be under the direction of the city council in matters of policy, but when it came to management he must be entirely free. They must make his position absolutely secure, as otherwise he would not have any chance of success, and no competent manager would undertake the work. You see things are so peculiarly managed there. Even with the companies to-day, a great many of the employees, possibly the bulk of the men, are nominees of the city councillors—I mean even the tramway companies' own servants. In the municipal departments they are absolutely the nominees of the parties in power, and you must remember they have votes which must not be lost sight of."

"Then it would be entirely new in American experience to have a fixity of tenure for a municipal tramways manager?"

"I think so. You see things are so different there. The mass of the people govern public affairs there, but I think they have a less sense of responsibility to the community than, say, the people of Glasgow. Every man above a certain age is a voter, and they consider all these questions of party largely from the personal standpoint, certainly a great deal more than the people do over here."

AMERICAN TRAMWAY METHODS

"Turning to the general condition of American tramways, we should be glad to have your experience and opinions. Take fares, for instance, have we anything to learn in that respect?"

"Not much, I fancy. They have the universal 5-cent fare with transfers, and I think that is as low as they can go. It is about 2½d. in English money. They could not work at a lower fare than that. I consider that a 5-cent fare with transfers carrying passengers the long distances they travel in America, has very much the same result to the company as a graded fare without transfers here. Of course, we do not want transfers here, and I do not believe there is a street railway man in America who would not do away with transfers if he could, and lower and grade his fares. The objection to this politic course is that American citizens are accustomed to pay the nickel and nothing else, traveling any distance they like, so that I do not think it would be popular to attempt to introduce the graded fare system."

"But what would be your alternative?"

"Well, I should say they might have a minimum fare of 2 cents, and a maximum fare of 5 cents, because they would then get very many more short-distance riders, and they would make a bigger revenue than they are getting now. In fact, for short distances, I do not consider that the American companies are carrying anything like the number of persons that they ought to be carrying, considering their magnificent opportunities. Of course, there are many advantages in the low fares for long distances."

"Did you get any figures as to working cost?"

"Yes, the working cost is pretty high, considerably over 60 per cent of the revenue. This is accounted for by the higher wages that are paid, although in my opinion they are not higher than they ought to be, considering all the circumstances. Wages are about right there. As to cost of construction, I got some figures in New York, where they are extending the conduit system. This system costs $90,000 per single mile of track, as against $35,000 for the overhead. That is the sort of proportion between the two systems, say, £18,000 against £7,000. The relative cost of working with the conduit is greater than with the overhead, and there is no doubt it is more expensive in the winter time, because it is then much more troublesome. In Minneapolis and Cleveland they have splendid systems, also a good system in Philadelphia, and a complete conduit system in Washington. That system appeared to work very well. In Boston and Montreal they have also very complete systems."

RELATION OF SPEED TO ACCIDENTS

"As to speed, do you think the American methods are dangerous or objectionable?"

"No, I think the American speed, at least in the outlying districts, is good and safe, and I do not see any objection to it at all. Of course, the great difficulty in some American cities is the abominable state of the roads and streets. In very many cases the sides of the carriage ways, where heavy traffic has to go, are so bad, the drivers are compelled to use the rail track, and in that way the tramcars are very much hindered by the slow-moving traffic. As to our own speed in this country, judging from American experience, I certainly think that some of the restrictions, necessary perhaps at one time, might now be relaxed considerably. With growing reliability of our systems and increase in the skill and experience of our men, there is a rapidly forming opinion that our speed might be accelerated. I have not the slightest objection to American speed as a whole. Modifications might usefully be made in Board of Trade regulations as to width of rail, special curves, and so forth."

"But what about accidents?"

"I think that possibly the Americans are a little more reckless than we are, but their men are not less skilled than ours. They are prepared to take greater risks, that is all. I believe they have a higher percentage of accidents proportionate to length of line and number of passengers carried, and they certainly have a higher percentage of bogus claims for alleged accidents. There they have a large number of people who are really professional accident makers, who live by their claims for accidents. These are assisted by a class of pettifogging attorneys, who do a thriving business, because a street railway company can never get justice from an American jury. The traffic is, of course, heavier, and the bad state of the roads contributes to the accidents quite as much as the tramways. In fact, the municipalities have to pay away each year large sums for accidents on account of bad streets. On the whole, I do not believe that the adoption of American speeds here would in the least increase the percentage of accidents."

"Did you see any attempts to experiment with other methods of mechanical traction than electricity?"

"No, not for public vehicles. They seemed to be convinced that electric traction is the only practicable method of tramway traction, and further that for this there is nothing like the trolley. They are quite indifferent to the advent of the motor-bus, and I did not see any electric motor-bus for ordinary purposes."

AMERICAN AND BRITISH COMPARISONS

"Speaking generally, do you think that American tramway administrators have more to learn from us than we have to learn from them?"

"Well, you see, conditions there are so different that it is difficult to answer precisely a general question like that. There is no doubt that in regard to maintenance of plant, cleanliness, and general attractiveness, they have a very great deal to learn from us. So far as methods of management go, there is nothing very much to find fault with. But I do not know that the discipline of the men is quite so good as it is here. The men in most American cities are more thoroughly organized, they are a bit more independent, and I believe on the whole have got more power than they ought to have. The men there are well treated. I spoke very strongly to the Chicago people of our own staff in Glasgow, of their discipline and behavior. I explained how they were satisfied with the conditions and service, and believed it best to work under a municipality, whose service was a guarantee that they would be well looked after, and be fairly and even generously treated. But I do not know that there is anything wrong with wages and hours in America. They get a big wage, and the fact that the condition of working men under a municipality in America would not be very much, if anything, better than it is now under a company, removes one reason for the municipalization of the tramways that has had great weight in this country, although I would like to qualify that remark in this way. I impressed upon my American friends that wages under a municipality here are very little different from the wages now given by a company. But there is a difference in this way. In Glasgow, when we took over the tramways, we paid a better wage, but we did not pay that wage to the same men, it was paid to other men; we got superior men. The tramway employee is now a better man all round. In fact, the electrification of tramways has not only educated and brightened the riders, but has sensibly improved and elevated the tramway men. We have all been brightened up by the advent of the clean and swift electric car. But I was careful to say that I did not believe wages paid by a municipality ought to be higher than the man can command. This clearly is economically sound."

TENDENCY TOWARDS MUNICIPALISM

"Do you think a tendency towards municipal methods will be likely to prevail in America?"

"Of course, municipalization is accepted here now as a principle—that the tramways should be in the hands of the local authority, and if the municipal conditions in America were the same I see nothing to hinder the eventual adoption of a similar view over there, if there were any just reasons why they should do so. There are no municipal systems there at present, but I believe the change will gradually take place. Yes, the municipal idea there is regarded as rank socialism; they think immediately anything is municipalized that their country is going to the dogs. This is with us an exploded idea. But as knowledge increases and sounder principles of communal effort obtain, I believe there will be a strong and a successful effort to municipalize American street railways, but at present they have a long way to go, and it will take a long time to graft the new idea to the municipal stock, to remove prejudice and substitute new ideas."

"Can you suggest any methods by which this important educational process can be expedited?"

"I can recommend them to study and examine English methods and English public conditions. If they could eliminate their present method of political influence, I do not see why they should not quickly make a considerable advance and improvement in municipal matters. But the system by which every municipal official becomes a little center in himself of political influence sacrifices efficiency to expediency. That is to say, it is the old idea of the spoils to the victors. If a man works to get a councillor in he expects to be paid for it. How can you expect satisfactory municipalization under such conditions as those?"

"Could you suggest any improvement in our own Parliamentary procedure for obtaining tramway powers in order to obviate the present great expense and delay?"

"No, I do not know that I can recommend any step like that, even for municipalities. I think there must be an arbitrator in these matters. After all, our own procedure is not so expensive as the American method, by which every person who has any interest at all has to be purchased. Practically there the facility for obtaining a concession or right does not exist. We have a better, a freer and a purer method after all."

"Did you notice any tendency or desire to adopt English methods?"

"Although the Americans did not just frankly express their opinion that this country was superior to them in many ways, especially municipally, I could plainly see there was among many of them a very great regard indeed for British institutions."

IMPROVEMENTS IN EQUIPMENT

"With regard to equipment, were there any noticeable features?"

"They are paying great attention now to their cars and striving to get the most perfect style of car. They are discarding the old practice of having winter and summer cars, and are adopting a very large combination car, open at the sides, which will answer for both seasons, notwithstanding the great variations in temperature. There is no doubt they are advancing very fast in that direction, and they are making a great number of very useful improvements in connection with their plant. The price of cars is much higher there than here, the cars being heavier, there is more material in them, and they have to be made suitable for fast traffic and long-distance journeys. I do not think there is any better workmanship. I do not think their style of car would be more adaptable for this country than our own. But they are paying great attention to devices for preventing accidents, through being subject to so many bogus claims, as I have already explained. They have perfect freedom as to these improvements, the principle being that each improvement must stand or fall on its own merits. They try many things for improving their plant, and there is no Board of Trade to step in the way, though in some States the tramways are under supervision. That system works well and facilitates the adoption of improvements for the service, track or plant. The control boards and the companies appear to work together well, and while I would not advocate absolute free trade in traction, yet I should like to see a practical body of men controlling our industry, so that if they saw an improvement they would at once let it be tried. The railroad companies are entirely distinct; they regard the tramways as keen competitors, and are buying up interurban lines. I do not think the railroads in any sense regard the tramways as feeders of their systems, but I think they see that the traffic within a given radius of the center of a city is not theirs, and so they have to give in to tramways and cater more for the long-distance passenger."

"Have you any idea of the cost of wear and tear?"

"Yes, I should say it is slightly higher than ours for plant and equipment, but the road-bed is not so expensive. Their construction approximates to ours, and they are now using a good deal of T-rail, with a chip off the granite, to form the groove instead of the groove rail. Their rail also approximates to ours, 100 lb. to the yard. The T-rail has proved advantageous, for the whole weight is on the head of the rail.

"I saw many more things in connection with the street railways of America that were very interesting and instructive, but I have not time at present to go into these."

"What about the financial side of the question?"

"Well, I should not care to say much in this connection. I am afraid the street railways of America have not been financed on our prudent, conservative lines. I believe, however, that the street railway men now see that they must alter their policy in this respect."

"Have you anything further that you would care to say?"

"I have a great deal that I could say, but I think I have given you quite sufficient, more perhaps than your readers will find of interest," said Mr. Dalrymple, and the interview terminated.

LONDON LETTER

(*From Our Own Correspondent.*)

The third International Tramway Exhibition was duly inaugurated on July 3, at the Agricultural Hall, Islington, London, by the Earl of Derby, who declared the exhibition open at the formal luncheon given on the occasion. The ceremony was well attended by those gentlemen who have come to be closely associated with the tramway enterprise of this country. After tracing the history of tramway development, Earl Derby made a special point of the growth, he would like to see the carriage of merchandise by tramways, and thought that a good deal of development might be done along that line. Robert Millar, general manager of the Caledonian Railway, proposed the toast of "The Industry of Transport," and said that while railway managers could not look complacently at their reduced receipts owing to tramway competition, yet they recognized that electric traction had come to stay, and that the problem of railway managers was how to utilize electric power for the benefit of the railways either by direct application or as a feeder for their traffic. H. Alexander, of Glasgow, proposed "The Tramway Associations," and was ably seconded by the Hon. Arthur Stanley, M. P., who is president of the Tramways and Light Railways Asociation. Mr. Stanley made an eloquent appeal for the amalgamation of the various tramway associations. Speeches were afterwards made by Alfred Baker, of Birmingham; Fred Smith, of Liverpool; Sir Guilford Molesworth and C. R. Bellamy, of Liverpool, who proposed the health of the chairman of the occasion, Jas. W. Courtenay, who, in replying, stated that he would like to induce the Colonies to come over occasionally for a conference on transport problems in connection with a gigantic exhibition of apparatus facilitating transportation.

A commencement has now been made with the new electrified trains of the Metropolitan & District Railway Company, and also of the Metropolitan Railway Company in the old underground railway tunnels. For some time past both companies have been running electric trains on portions of their lines outside the tunnel, but on the first of this month a number of electric trains were put in service by the District Company from Ealing to Whitechapel, which go through most of the tunnel on the south side of the famous Inner Circle, and a number of electric trains were also put in service by the Metropolitan Company from Aldgate to South Kensington. The Inner Circle, however, is not equipped, owing to slight differences in the collector attachment of the trains of the two companies, which do not fit each other's lines. This difficulty will soon be overcome, however, and it should not be long now before practically all the underground trains are electrically operated. Meantime the District Company is operating its Ealing-Whitechapel trains every fifteen minutes, and the Metropolitan Company is operating its trains about on the same schedule, so that one can judge of the improvement. As, however, many steam trains are still in operation, the whole benefit to be derived is not apparent, the tunnels being still full of smoke and sulphurous fumes. The quicker acceleration of the electric trains, moreover, for the present is all lost, as it simply means waiting longer at the platforms for signal to go ahead, the steam train taking much longer to get out of the way. Enough has been seen, however, to show what an immense improvement the new service will be when it gets fairly into swing. The electric trains consists of seven cars, three being motor cars and four trailers. All the cars are connecting cars from end to end, with a passage in the middle, and passengers enter at the ends and go out by doors in the middle of the car, which are opened by the attendant from the end of the car by compressed air. There is no second class in these trains, but each train has a "special" car which is reserved for first class passengers.

The tenth annual convention of the Incorporated Municipal Electrical Association was held in Edinburgh and Glasgow, with a further trip to Aberdeen for those who had time from June 27 to July 1. The meeting was convened on Tuesday at the North British Station Hotel, Edinburgh, where the Lord Provost, Sir Robert Cranston, welcomed the association in the name of the citizens of Edinburgh. F. A. Newington then read his presidential address, after which the two following papers were presented and discussed: (1) "Load Factor,—its Effect Upon an Electricity Station," by Councillor Sinclair, chairman of the electricity committee, Swansea, and (2) "Street Lighting," by E. E. Hoadley, chief electrical engineer, Maidstone. In the afternoon brakes were placed at the disposal of the members and visitors for the purpose of visiting the various electricity stations, while in the evening a reception was tendered at the City Chambers by the Lord Provost, Magistrate and Council of Clyde, Hawthornden and Roslin, all of which were well patronized. The association dinner was held in the evening and proved to be a most successful and enjoyable function. The annual general business meeting of the as-

sociation was held on Friday, at which J. E. Edgecombe was elected president for the ensuing year. In the afternoon those who desired left for Aberdeen, where on Saturday forenoon visits were made to the Electricity Works, under the guidance of J. A. Bell, the city electrical engineer. Luncheon by the Aberdeen Corporation was served at the Town Hall, after which the visitors left for Ballater and Balmoral, completing in this way one of the most successful and enjoyable meetings which the association has ever held. In closing, it might be said that one of the most interesting and certainly most enjoyable features of the convention, was the visit paid by the delegates to the new works of Bruce Peebles & Company at East Pilton. Here the most cordial Scotch hospitality was extended, a regimental band and Scotch pipers alternately vieing with each other to add to the gay scene on one of the lawns hard by a marquee containing much that was refreshing after the more serious work of inspecting the works. On Wednesday a special train conveyed the delegates and friends to Glasgow, where the Lord Provost of Glasgow, Sir John Ure Primrose, Bart., welcomed the association at the hall of the Institute of Engineers and Shipbuilders in Scotland. The following papers were then read and discussed: "Notes on Costs and Tariffs for Electric Supply," by Hamilton Kilgour, chief electrical engineer, Cheltenham, and "The Supply of Electricity in Industrial Areas, from a Municipal Point of View," by Councillor Hodgson, deputy chairman electricity committee, Salford.

In Glasgow's usual lavish manner, a most sumptuous luncheon was provided for the delegates by the Glasgow Corporation at the City Chambers, after which visits were made to the electricity stations in the city and suburbs. On Thursday the meeting was again held in Edinburgh, when the following papers were read and discussed: "Extensions to Outlying Areas," by A. B. Mountain, chief electrical engineer, Huddersfield, and "Free Wiring and Supply on the Prepayment System," by A. R. Sillar, chief electrical engineer, Colchester. In the afternoon the visitors devoted themselves to the many points of interest in and around Edinburgh, while special arrangements had been made for trips to the Forth Bridge and the Falls.

The fourth annual conference of the Municipal Tramways Association was held in the Agricultural Hall, London, on July 4 to 6, the selection of the place being due to the fact that the tramways exhibition, referred to elsewhere in this issue, was being held in this hall during the first fortnight in July. A. Baker, general manager of the Birmingham Corporation Tramways, presided and delivered an interesting address, after which the following paper was read and discussed: "Charges for Supply from Combined Lighting and Traction Stations," by J. H. Rider, chief electrical engineer, London County Council Tramways.

It was evident from the paper and the discussion that Mr. Rider was strongly in favor of a combined station wherever the lighting and the tramways were in the same hands. On the following day the two following papers were presented and discussed: "Rules and Regulations for Tramway Employees," by H. E. Blain, manager, West Ham Corporation Tramways. "Motor Omnibuses vs. Electric Tramcars," by W. A. Luntley, manager, Wolverhampton Corporation Tramways.

In the evening there was a reception and conversazione. The next day was devoted entirely to pleasure, the delegates leaving Paddington Station for Reading at 11 o'clock. Here they were received by the Mayor and entertained to luncheon at the Town Hall. At 2 p. m. they embarked on a steam launch (kindly provided by Mr. Bull, chairman of the Reading Tramways committee) at Caversham Lock for a trip down the Thames to witness the boat races at Henley, where a most enjoyable afternoon was spent. At the business meeting on the following day, J. B. Hamilton, general manager of the Leeds Corporation Tramways, was elected president for the ensuing year. Before concluding these notes it might be mentioned that an effort was made to make an amalgamation of the Municipal Tramways Association with the two other existing tramway associations, but as these are more or less associations in the interest of company management, the municipal managers took the narrow view than an amalgamation would be detrimental to their interests.

By forty votes the House of Commons has passed the second reading of the Administrative County of London and District Electric Power Company Bill, a measure which confers upon its promoters powers to supply electricity to users of machinery in and around London; the powers asked being under conditions which are far more favorable than any granted to other electricity providers in the same area, municipal or private. For once the County Council in its opposition to this bill speaks for the whole of London, for the City and Borough Corporations are also strongly opposed to it. The bill has been referred to a special committee for full consideration.

The House of Commons Committee and counsel for the County Council and the City Corporation have effected a satisfactory compromise in regard to the scheme of tramways over Westminister Bridge, along the Embankment and across Blackfriars Bridge. The committee decided last month that the bill could only proceed if an undertaking were given that Blackfriars Bridge should be widened, and this the Corporation has now agreed to do.

The Mayor and Corporation of Bournemouth have formally taken possession of the tramways running from the borough boundary to Poole railway station, which they have, by arrangement with the borough of Poole and the urban district of Branksome, districts traversed, acquired from the Poole & District Electric Traction Company. Starting from the generating station in Southcote Road, Bournemouth, in four gaily decorated cars, the Mayor and his colleagues journeyed right through to the Poole terminus, a distance of about seven miles, picking up the Branksome Urban District Council at the County Gates. On the return, the party alighted at the east gates of Poole Park, where they were entertained by the Mayor of Poole at a garden party arranged to celebrate the occasion.

The acquisition by the Electric Railway & Tramway Carriage Works, Ltd., of Preston, of the Castle Car works (late G. F. Milnes & Company, Ltd.), of Hadley, Salop, and the British Electric Car Works, of Old Trafford, has now been completed. The share capital of the first-named company has been increased from £150,000 in ordinary shares, to £300,000, by the creation of 150,000 £1 six per cent cumulative preferred shares, and the name changed to the United Electric Car Company; the present £5 ordinary shares to be split into scrip of £1 each. The debentures (£50,000 in 5 per cent stock) remain as they were.

It may be recalled that the Castle Car and the British Electric Car Works were active competitors of the Preston Company, but recently went into liquidation. Their works were offered for sale, and were purchased by a syndicate which has now sold them to the United Electric Car Company for £85,000.

In order to provide this sum, and £15,000 for additional working capital, the directors are now making an issue of 100,000 of the above-mentioned preferred shares, of which 75,000 are offered to existing share and debenture holders at par.

A committee of the House of Commons, presided over by Mr. Ashton, has passed the bill to authorize the construction of a new electric railway from Gracechurch Street to Hackney, in tube, and thence by Walthamstow to Waltham Cross in the open.

At the invitation of the chairman and directors of Raworth's Traction Patents, Ltd., a number of gentlemen this month journeyed down from London in a special saloon carriage to Birmingham to witness the practical working of the Raworth automatic regenerative system, which has been applied to forty-one cars of the City of Birmingham Tramways Company, Ltd., and which, for the past few months have been in daily operation between the Midland Railway Station, Birmingham, and the suburb of Yardley, a distance of four miles. In the line are many gradients, the most severe being 1 in 16, and there are ten right-angle curves on the round trip, which takes 63 minutes, including all stops. Since the inauguration of the regenerative control, the current consumption has averaged .97 Board of Trade units per car-mile, and as the system implies a perfect control, no new brake blocks have been fitted since the cars started. Two cars were placed at the disposal of the visitors, one equipped with the usual Raworth controller, and the other with a new controller which has just been designed by Mr. Raworth's son, and which, from the outside looks precisely like any other tramway controller, and is operated in the same way as other controllers. The old Raworth controller was operated with two levers with a "fore and aft" motion, but it has been thought advisable to construct all new controllers with a rotating motion to the handle, now so familiar to all tramway engineers. The trip to Yardley was quite successful, and the visitors were much interested in the operation, wattmeters having been attached so that the regenerative action could be observed. At Yardley a visit was made to the power house, which presents an entirely novel and interesting appearance. It is the first tramway power house in this country to be equipped with Diesel engines, and it naturally excited great interest among the visitors. There are four of these engines of 150-B. H. P. each, coupled to generators by the Brush Electrical Engineering Company. An opportunity was also afforded at Yardley to inspect the Brush radial truck, with which the cars are equipped, and which are the invention of Mr. Connaty. Without going into further details at present, though we hope to present a detailed article later, it might be said that everything connected with the trip passed off with the utmost smoothness, the regenerative system braking the cars in the hills or for stops among the traffic with the utmost ease without touching the hand-brake. After the completion of the trip, lunch was served at the Midland Hotel, and speeches were made by Mr. Raworth and Mr. Lycett, manager of the Tramway Company.

PARIS LETTER

[*From Our Regular Correspondent.*]

Work on the Mont Blanc Railway, full details of which have been published in your columns, has now been commenced. The railway will not be completed until 1911, when a four hours' journey in electric car from Chamonix will take the tourist within a four hours' walk of the summit.

The movement towards single-phase methods of traction has had its echo in France. Both the Westinghouse Company, at its Havre works, and the French Thomson-Houston Company have passed the experimental stage in this respect, and the latter company has made an installation on a short stretch of line belonging to the Tramway Sud, of Paris, and connecting two existing 500-volt lines of this company. The series compensated motor is employed, operated on the Latour system. The tension employed is 300 volts, and is transformed from 500 volts by a transformer carried under the car. The reason of the low voltage is found in the fact that existing regulations will not allow a higher alternating current voltage than this to be used on tramway circuits in the neighborhood. The motors have an output of 37 hp at 500 volts, 25 cycles. The length of line is about a mile, and of course has been equipped only to test the feasibility of the system.

The Westinghouse Company is building at its Havre works the single-phase equipments destined for the Rome-Civita-Castellana line, and just recently has obtained the contract for the equipment of a line from Bergamo to Valle Brembana. This is an interurban tramway of 30 km length, and the trolley line will be fed at 6000 volts. Five 30-ton locomotives, each equipped with 4 55-hp motors, and train-control system will be used. The generating station will include 3 units of 500 kw.

A mixed system of alternating and continuous current for railways has been arranged by way of experiment by the A. E. G. Berlin on the line between Niederschöneweide and Köpenick. The section is 6 km in length, and is, as a rule, worked by continuous currents at 500 volts. Part of the line, 2.2 km long, has been insulated from the remainder, and the overhead conductor is fed from a transformer station with alternating current. The pressure is 440 to 640 volts at 25 to 40 periods. The section can be connected temporarily to the continuous current line. The experimental car has two Winter-Eichberg motors, controlled by a slightly modified d. c. controller.

The Orleans Railway will shortly place in service another lot of locomotives and motor cars to run on the line from Paris-Juvisky.

THE ELECTRIC BOND & SHARE COMPANY

The purpose of the Electric Bond & Share Company, whose organization caused considerable speculation as to the scope of its operations, is fully set forth in an announcement made by Harvey Fisk & Sons, of New York. The company is organized under the laws of the State of New York, with power to purchase bonds, stock or other forms of securities resulting from electrical developments, such as electric street railways and electric light and power plants. The corporation has issued $2,000,000 of preferred stock and $2,000,000 of common stock. It begins business with this capital stock fully paid up, and with a surplus estimated by its officers, after careful appraisal by a special committee appointed for the purpose, to be of the value of $440,000. All of the common stock is owned by the General Electric Company.

The preferred stock has a 5 per cent cumulative preference as to dividends, is also preferred in any distribution of assets, and is further protected by a provision in the certificate of incorporation that no dividends shall be paid upon the common stock unless there shall remain, after payment of such dividends, a surplus equal to at least 15 per cent of the par value of the then outstanding preferred stock. The preferred stock can never be increased to such an amount as to exceed the amount of the then outstanding common stock, and may be retired upon any dividend date, upon ninety days' notice, at 110 per cent of par.

The corporation is forbidden by its certificate of incorporation to mortgage, pledge or in any way hypothecate any of its assets without the assent of three-fourths of the preferred stock. It is also forbidden by Article VII. of its by-laws (which article cannot be amended except by a nine-tenths vote of all stock then outstanding) to buy or contract to buy any securities unless the corporation at the time of making such contracts has cash in bank sufficient to pay for such securities or has made provision by which it will have cash to pay for the same at the time the same may be delivered. It is the intention of the company to keep out of debt, and these restrictions are designed to carry out this intention and thus preserve the present position of the preferred stock as the senior security of the company.

DISCRIMINATION IN RAILROAD RATES

One of the important questions now before the Indiana Railroad Commission is a charge of discrimination in passenger rates that the steam companies are making along their lines paralleled by the electric interurban railways. The electric railway managers charge that in order to meet the local interurban competition, many of the railroads paralleled by the electric lines have made special rates, some of which are considerably under the regular three-cent-a-mile charge. One case complained of shows the grounds for the complaint. The Big Four Railroad, in order to meet the traction competition between Indianapolis and Lafayette, has made a special rate between the two cities, so that residents of Lafayette can come by the steam roads as cheaply as by electric railway. The two roads are not parallel all the way to Indianapolis, however, the steam road coming to Lebanon, thence to Indianapolis, and the traction going first to Frankfort, thence to Lebanon, and thence to Indianapolis. Hence there is no competition. The result is that, although the steam road grants a very cheap rate from Lafayette to Indianapolis, it charges the regular rate to Indianapolis from points between Lafayette and Lebanon. As a matter of fact, residents between these two cities buy a ticket to Lebanon, where the roads are again parallel, at the regular three-cent rate, get off at Lebanon and buy a reduced ticket from that city to Indianapolis. This causes them considerable trouble, of course, and they are complaining of unjust discrimination. Situations similar to this are to be found all over the State. For instance, from Muncie, Anderson, Elwood, Kokomo, Shelbyville, Rushville and other cities the steam roads have made a rate under three cents a mile, while people not so fortunate as to enjoy the results of this competition for local business are still paying the old rate. The reduction of fare by the steam companies to meet the competition of the interurbans has also raised the question of a sweeping passenger rate reduction to 2 cents a mile.

CAR CONSOLIDATION EFFECTED—NINETEEN COMPANIES INCLUDED

The consolidation of street car building companies and allied concerns, about which rumors have been revived periodically for several years, is again under consideration. The financial management of the proposed consolidation is in the hands of Kean, Van Cortlandt & Company, of New York, who, last Saturday, made public the following plan: Nineteen companies will be taken over and capitalized under a new company at $43,000,000. The name of the new company has not been selected, but present indications seem to point to G. Martin Brill, president of the J. G. Brill Company, of Philadelphia, as president of the new company. Mr. Brill is recognized as one of the foremost car builders in this country, and if he will accept he seems the logical president of the new corporation. The preliminary negotiations for the purchase of the different properties were conducted mainly by W. T. Van Brunt, president of the St. Joseph & Grand Island Railway, president of the Furnaceville Iron Company and associate of E. H. Harriman. The companies to be taken over are: J. G. Brill Company, John Stephenson Company, Laclede Car Company, St. Louis Malleable Casting Company, American Car Company, G. C. Kuhlman Company, Cincinnati Car Company, St. Louis Car Company, Wason Manufacturing Company, Osgood, Bradley & Sons, John J. Cummings Car Company, Jewett Car Company, J. M. Jones' Sons, agents; Laconia Car Company, McGuire-Cummings Manufacturing Company, Peckham Manufacturing Company, Niles Car Manufacturing Company, Journal Bearing Company, Easy Access Door Company.

The circular issued by Kean, Van Cortland & Company descriptive of the plan does not state the terms at which the companies are to be taken over. The capital of $43,000,000 will consist of $15,500,000 6 per cent cumulative preferred stock and $27,500,000 common stock. A $13,000,000 issue of first mortgage and collateral trust sinking fund 5 per cent, thirty-year bonds is proposed, $11,000,000 to be issued upon the formation of the company and $2,000,000 to be reserved for future requirements.

The annual average of net earnings of the constituent companies is put at $1,263,391, and the estimated earnings of the first year of the consolidated company will amount to $2,400,000, the promoters say.

The company will be organized and the properties transferred to it under the supervision of the attorneys, Davis, Stone & Auerbach and Guthrie, Cravath & Henderson. It is estimated that the consolidated company will acquire quick assets of $6,400,000, consisting of cash, raw materials, cars and accounts receivable, also many valuable patents and patent rights, by the control of which considerable patent litigation will be avoided.

THE CANADIAN WHITE COMPANY

An announcement has just been made as to the purpose of the Canadian White Company, for which letters patent were issued in Canada the latter part of May. The company is incorporated to carry on a general contracting and engineering business, on similar lines to J. G. White & Company, of New York; J. G. White & Company, Ltd., London, Eng., and the Waring-White Building Company, London, Eng. The company will undertake civil, mechanical, electrical, hydraulic and building work. It will be fully equipped to handle large construction contracts for steam and electric railways, and will be prepared to design, build, equip and operate electric lighting plants and power installations, gas works, water supply, sewage systems, piers, docks, harbor works, office buildings, apartment houses, hotels, etc. The company will not engage in manufacture. The contracting and engineering departments of J. G. White & Company, of New York, will at all times be at the services of the Canadian Company, which will further have the benefit of the experience of J. G. White & Company, Ltd., London, Eng., and the Waring-White Building Company, London, Eng. The Canadian White Company, Ltd., will have upon its board and as stockholders, representative business men well known throughout Canada. The general manager will be a prominent civil engineer with large experience in railway construction, etc., who has held executive positions. H. P. Douglas, formerly vice-president and general manager of the Canadian Otis Elevator Company, Ltd., will be treasurer of the company. The superintendent of building construction will be H. C. Hitch, who has been for several years connected with the Thompson-Starrett Company, of New York, as superintendent. The company intends to make a feature of building construction and is now prepared to contract for the better class of building work; such as office buildings, apartment houses, hotels, industrial plants, warehouses, etc.

THE ST. LOUIS, ST. CHARLES & WESTERN SOLD

The St. Louis, St. Charles & Western Railway, running from Wellston to St. Charles, was sold at trustees sale July 24, to a syndicate of St. Louis capitalists, headed by Festus J. Wade and Thomas W. Crouch, for $495,000. It is reported in financial circles that the syndicate will turn over the line to the United Railways Company. The men in the deal would not confirm this, nor would they deny it. Another report was that the Suburban system had bought the line, but this also lacked confirmation. Mr. Wade bid the road in. He had for a competitor Capt. Robert McCulloch, general manager of the United Railways. The price was run up from $300,000. Capt. McCulloch said he was acting for the United Railways, but he did not know whether or not Mr. Wade was. The old owners of the road also took a hand in the bidding. The property was sold under mortgage foreclosure by the Commonwealth Trust Company as trustee for the bond holders of a $600,000 bond issue, which was financed through the old Colonial Trust Company three years ago. The transfer includes all the property, the franchise and privileges to operate over certain tracks of the United Railways and the St. Charles bridge. The receiver for the road was appointed by the United States Circuit Court on the application of the Illinois State Trust Company, of Chicago, which holds part of the bond issue. About three months ago the court ordered the receivership terminated as soon as the receiver completed his accounting to the court. Cross-claims against the receiver by former officers of the company were then filed, and the matter is still in court. J. B. C. Lucas is the president of the original company.

THE CAMBRIDGE SUBWAY

The Boston Elevated Railway Company's decision not to accept the Cambridge Subway Act passed by the last legislature unless it is amended to provide for a two-track subway, instead of a four-track layout, marks an interesting stage of rapid transit development between the Hub and its adjoining suburb across the Charles. The Cambridge situation is unique on account of its illustrating how a conservative and well-educated community can completely change its opinions after it has legally committed itself to a definite course of action, and attempt to retrace the path long since traversed.

Rapid transit between Boston and Cambridge is a recognized necessity. Under the most favorable conditions of traffic, from 20 to 25 minutes are required by surface cars to cover the route from Harvard Square to Park Street subway station in the heart of Boston, the distance being roughly 3 miles. An elevated or subway line between Scollay Square, Boston, and Harvard Square or its immediate vicinity in Cambridge, should easily cut the running time to 8 minutes. The company is anxious to provide the best possible service, and the citizens of Cambridge are practically united in the desire to enjoy the best facilities which can be placed at their disposal. The only difference of opinion is in the matter of ways and means.

By the law of 1897 the Boston Elevated Railway Company was committed to the building of an elevated line from Boston to Cambridge, with the full consent and desire of the public in the latter city. The company proceeded to build its trunk line route in Boston between Dudley Street and Sullivan Square, expecting to add the Cambridge line to the system in due season after the completion of the new West Boston Bridge. Gradually the desirability of a subway was realized by the people of Cambridge, and after a long series of conferences and discussions, estimates and surveys the Act of 1905 was passed, rescinding the Act of 1897, subject to the company's acceptance. The terms of this act were apparently advantageous to the company in the matter of rental, and to the city through the giving up of the elevated structure plan with its perpetual franchise. Singularly enough, however, the act required the building of a four-track subway—a piece of work that neither the present nor immediate future demands or Cambridge rapid transit seems to warrant. The company feels that such a subway cannot earn the interest and pay dividends on the investment; detailed estimates by its engineer, Geo. A. Kimball, W. B. Parsons, Geo. S. Rice, H. A. Carson, and City Engineer Hastings, of Cambridge, all indicate that the cost of construction would be at least $7,000,000, or $2,000,000 in excess of the preliminary figures. The road maintains that its expenses have been increasing faster than they should in the past five years, in proportion to gross earnings; that large fixed charges upon extensions are to be expected in the next three years, and that proper service for the public, fair treatment of employees, and reasonable returns to shareholders should not be jeopardized by the assumption of additional burdens not necessary for the safety and convenience of the whole service. The company stands ready to build an elevated line as provided in the Act of 1897, or to build a two-track subway, according to the desires of the people of Cambridge.

While the outcome is uncertain at this writing, it would seem that the wisest course for the people of Cambridge is to yield gracefully to the reasonable proposition of the company, which is necessitated by their own vacillating decisions, and to give up the four-track plan, which the ripened experience of transportation experts declares to be unfeasible. The company's attitude throughout the affair has been marked by openness and a desire to meet the wishes of the community in all reasonable ways.

SOUTHWEST MISSOURI IMPROVEMENTS

The principal stockholders of the Southeast Missouri Electric Railway Company have organized a subsidiary company under the title of the Webb City Northern Electric Railroad Company, which will build a branch line for the parent company from Webb City to Oronogo, Purcell and Alba, ten miles in all. The contract for the trestles and bridges for this line has recently been awarded the Reinforced Concrete Construction Company, of St. Louis, Mo. There will be 2250 ft. of this class of work, including two bridges, one over Center Creek and one over Spring River, and a viaduct over the Frisco Railroad tracks at Oronogo, Mo. The contracts for grading, track laying, etc., will be awarded during the present month, and it is expected to have this line in operation by Jan. 1, 1906.

The Southwest Missouri Company also will begin extensive improvements to its main line during the present summer. Two new water-tube boilers, 400 hp each, will be added to the main power plant in Webb City. A 400-kw rotary will be placed in the Webb City sub-station, and the 250-kw rotary now there will be removed to a new sub-station, to be located at Lakeside Park. In addition to this a 250-kw rotary will be located on the line of the Webb City Northern Electric Railroad. A double-track viaduct will be constructed over the railroad tracks between Webb City and Carterville, which will be about 2000 ft. long. About ten miles of double track will be constructed, and the old track relieved of curves at various points. An additional car house will be erected, and a series of general improvements inaugurated. The company is now building its own car bodies, six of which have recently been turned out of the shops. These cars are constructed with steel beam beds, and are equipped with four GE 70 motors and multiple system of control, and are handsomely finished. During the coming year the company expects to build in its own shop nine additional cars of the same type, to be used on the Webb City Northern branch and on the Southwest system.

A CLUB OF RAILWAY CAR INSPECTORS

A number of car inspectors of the Chicago City, Brooklyn Heights, Boston Elevated and other railway companies, who are at present stationed at the works of the J. G. Brill Company, at Philadelphia, have organized themselves into a club, which is called "The Knockers' Club." At a recent meeting of the club Myron Rounds, of Boston, was elected president and was presented with a small gavel to assist him in the exercise of the duties of his office, and to continue knocking at every opportunity.

It happened, recently, that the managers of a number of companies for whom cars are being built, visited the works to look over their cars on the same day. A number of cars, each representing a lot ordered, were placed together on tracks near the office building. After the managers had looked the cars over, the inspectors of course, all being present, and there was a general discussion on the comparative merits of the cars, one of the inspectors, an officer of "The Knockers' Club," slipped unnoticed into his car, and then, as if by magic, before the astonished and amused gaze of all the spectators, there floated from a very conspicuous part of the car a large bow of blue ribbon.

INTERURBAN ASSESSMENTS IN IOWA

The Executive Council of the State of Iowa completed the assessment of the interurban electric railways of the State of Iowa last week. The various interurban railways were assessed at the same rates as they were for the year 1904, except the Cedar Rapids & Marion City Railway. The rate of assessment of this road was increased $269 per mile. This company also reported a net increase in mileage of 2.15 miles, so the total increase of the assessment of this company amounted to $11,845. Two new companies, the Cedar Rapids & Iowa City Railway and the Iowa & Illinois Railway, were added to the list, with assessed values of $55,260 and $65,920, so the increase in the assessed values over the preceding year amounted to $133,025. The members of the council are required by law to base the assessment on gross earnings as largely as possible, and as the two new companies were only in operation for a short period of the year 1904, they are not assessed at anywhere near their actual value. The following table gives the names of the companies, mileage, net assessment per mile, total assessment, and the total actual value as determined by the council, which is four times the assessed value:

Names of Companies	Mileage	Net Assessment Per Mile	Total Assessment	Actual Value
Boone Suburban	4.70	$1,000	$4,700	$18,800
Cedar Rapids & Marion City	14.21	4,000	56,840	227,360
Interurban Railway	28.87	3,500	101,045	404,180
Mason City & Clear Lake Traction	14.62	900	13,158	52,632
Tama & Toledo Electric	2.75	1,818	4,999	19,996
Waterloo & Cedar Falls & Northern	*54.73	2,500	136,825	547,300
Cedar Rapids & Iowa City	27.63	2,000	55,260	221,040
Iowa & Illinois	32.96	2,000	65,920	263,680
Totals	180.47		$438,747	$1,754,988

* This company also leased 20 miles of track from Great Western.

ELECTRIC TRAINS IN REGULAR SERVICE ON THE LONG ISLAND RAILROAD

The electric train service on the Long Island Railroad, from Flatbush Avenue, Brooklyn, to Rockaway Beach, was put into regular operation Wednesday, July 26. Twelve round trips were made, and a total of nearly five thousand passengers carried. The first train left Rockaway Park at 7:55 a. m., arriving at Flatbush Avenue, a distance of sixteen miles, thirty-five minutes later, after making thirteen stops. This is about five minutes less than the running time under the steam schedule. As soon, however, as the work now in progress of removing the remaining grade crossings is completed, it will be possible to reduce the time of the trip still further. Three trains, of seven cars each, were in use the first day, each train making four round trips. This is to be the regular week day schedule, but on Sunday, two additional trips in each direction will be made. The old schedule provided only ten trains each way. Under the new arrangement the last train in the evening leaves Rockaway Park at 10:30 o'clock. The next section of the road to be operated by electricity will be the line from Woodhaven Junction to Jamaica and Springfield. This, it is expected, will be ready about Aug. 1.

HARTFORD & WORCESTER PLANS COMPLETED

Within 30 days construction work will be started on the air line electric route between Worcester, Mass., and Hartford, Conn., by James F. Shaw & Company, of Boston, controlling the Boston & Worcester Street Railway. At East Brimfield, Mass., a direct branch line will be run to Springfield. The original survey will be followed in general, the distance being about 60 miles, or 23 miles shorter than the steam railroad line between Worcester and Hartford. The cost of the line is estimated at $3,000,000, and the fare will probably be 85 cents, against $1.75 via the steam road, while the running time will be 3 hours, against the steam road's 2. The through rate from Boston to Hartford will probably be $1.30, with 5 hours running time, against $2.75 and 3 hours by steam. It is expected that the Worcester Consolidated Street Railway Company will take the cars of the Shaw interests between Lake Quinsigamond, Worcester, and the town of Spencer, Mass., where the private right of way of the Hartford air line begins. It is expected that operation will begin in the spring of 1907.

B. R. T. SUMMER EXCURSIONS

The Brooklyn Rapid Transit Employees' Association is holding during August its fourth annual series of Rockaway Beach excursions via elevated railroad lines, at Schillings pavillion. Excursions are run in three series—A. B. C. Series A. are on Aug. 1, 11 and 22, for employees from Crosstown, Maspeth, Ridgewood and Halsey Street depots. Series B. are on Aug. 4, 15 and 25, for employees from Fifty-Eighth Street, Twenty-Third Street and Ninth Avenue depots, Southern division elevated, East New York depot, Eastern Division elevated. Series C. are on Aug. 8, 18 and 29, for employees from Flatbush, Bergen Street, Canarsie depots, Brooklyn Bridge division. Employees from offices, power houses, line, track and building departments, shops, etc., may select any date desired. Tickets, (including transportation and dinner) are 60 cents. A special rate of 30 cents is made for children (under 12 years of age). In addition to this a special rate also is made to the excursionists for a number of attractions at the beach. There will be prize bowling for the Rockaway cup.

IMPROVEMENTS IN NEW ORLEANS

Extensive improvements have been decided upon by the reorganized company formerly known as the New Orleans Railways Company, now known, and hereafter to be known, as the New Orleans Railway & Light Company. The new board of directors is as follows: Elwin C. Foster, William Adler, J. J. Gannon, A. B. Wheeler, Hugh McCloskey, A. Brittan, W. R. Stauffer, S. P. Walmsley, T. H. McCarthy, W. E. Stauffer, A. M. Young, Geo. A. Hero, Harry Baldwin, Jr., Jos. H. DeGrange. Contracts for improvements involving the expenditure of $1,600,000 awarded by the old company was approved and ratified by the new board. The new track to the Jockey Club grounds has been completed and ready for operation. The line on Camp Street from Canal Street to Calliope is to be relaid, and the tracks repaved with Belgian block. A neutral ground is to be established on Tulane Avenue from Rampart to Galvez Streets, and the tracks of the Railway & Light Company will be rearranged to conform to this change.

THE TRACTION EQUIPMENT COMPANY

The Traction Equipment Company, of Brooklyn, has added a number of specialties to those which it has heretofore handled, and is now manufacturing quite an extensive line of electric railway supplies. It is prepared to supply the trade with ventilated spiral car starting resistance, the Weber electric illuminated signs, the Hammond sander, Flood's car holder and emergency brake, Flood's brake ratchet, the Wheeling automatic fender, the D. &. W. sidebar controller and automatic safety lock, and motor and journal bearings and car brasses. The Hammond sander is a new machine having a spiral conveyor which forces the sand out whether wet or dry. The Wheeling automatic fender is another device handled by the company that has thoroughly proved its worth. It is said to have made an excellent record in Pittsburg, where it has been on trial for some time.

STEAM ROAD TAKING OVER IOWA ELECTRICS

The statement which appeared in the columns of the STREET RAILWAY JOURNAL a few weeks ago, that the Mason City & Fort Dodge Railway, a part of the Great Western system, had increased its capital stock from $20,000,000 to $34,000,000 for the purpose of acquiring the properties of several interurban railways in Iowa, is substantiated by the fact that the Great Western has already absorbed the Waterloo, Cedar Falls & Northern Railway Company and the Mason City & Clear Lake Traction Company, and that both of these lines have been made a part of the Great Western system. It now develops that the consolidation of these two interurban lines, reported in the JOURNAL of May 26, 1905, was simply the first step in the programme, and as soon as this was accomplished the remainder of the programme was carried out easily. In acquiring control of the Waterloo, Cedar Falls & Northern interurban line, the Great Western has secured the largest interurban road in the State, and if the company carries out the original plans of constructing a connecting link between the two roads it has acquired, it will have one of the largest interurban lines west of Chicago. The combined properties will then have a mileage of about 140 miles. The acquisition of these roads by the Great Western, and the attitude of the Rock Island in bettering the service on its branch lines where possible interurban competition is threatened, show that the steam lines of the State are alarmed over the invasions of the interurban companies. Wherever an interurban line and a steam line parallel each other in Iowa, the interurban gets more than 90 per cent of the local traffic, and a large per cent of the traffic originating outside of its territory.

BOYCOTT AGAINST JIM CROW CARS

Reports from Tennessee indicate that a sympathetic movement has been started by the negroes of the State to defeat the Jim Crow law, which provides for the separation of negroes from white persons riding on street cars. Boycotts have been declared in Nashville and Chattanooga that are proving to be a source of considerable annoyance to the companies operating in those cities, and in Knoxville a boycott has been declared which has resulted in disorderly conduct. No negroes are riding on the Lonsdale cars in Knoxville, few are riding on the Highland Avenue cars, and it is seldom that a negro is seen on a Euclid Avenue car. None of the colored citizens of the northwestern part of the city, near Knoxville College, are said to be interested in the movement. It is chiefly iron moulders and other laborers. A few evenings ago there was a fracas on a car in Knoxville, in which the sheriff and his deputies took a hand. A car in which several negroes were riding was set upon by a mob, and the colored occupants were maltreated and compelled to leave the car. One negro was arrested and fined as a result of this disturbance, but his companions escaped.

PERSONAL MENTION

MR. WILLIAM B. PALMER, general claim agent of the United Railways Company, of St. Louis, resigned on July 18. No successor will be appointed at present. The claim department is now under the direct supervision of Capt. Robert McCulloch, the general manager of the company.

MR. G. A. BERRY has been appointed assistant to the principal assistant engineer of the electric zone of the New York Central & Hudson River Railroad, with headquarters at Grand Central Station. Mr. C. P. Marsh has been appointed bridge engineer, succeeding Mr. Berry.

MR. THOMAS E. MITTEN, who has been first vice-president of the Chicago City Railway Company for several months past, and its acting head, was elected president of the company at a meeting of the board of directors held July 24. Mr. Lawrence A. Young was elected first vice-president at the same meeting.

MR. GEO. R. FOLDS, assistant to Vice-President and General Manager Calderwood, of the Brooklyn Rapid Transit Company, has resigned from the company to become general manager of the South Chicago City Railway, and the Hammond, Whiting & East Chicago Railroad, and will assume his new duties on Sept. 1 next.

MR. ROBERT CRAWFORD, an associate of Mr. James Dalrymple in the management of the Glasgow Municipal Tramways, who was prevented by sickness from coming to this country with Mr. Dalrymple, is expected to arrive here soon, to study street railway and social conditions. Mr. Crawford, it is understood, will be the guest of Mayor Johnson while in Cleveland, and will be entertained in Chicago by Mayor Dunne.

MR. H. R. PARRISH, for ten years confidential secretary to Mr. T. N. Vail and American representative of La Capital Tramways Company, of Buenos-Aires, Argentina, and the Rosario Electric Lighting Company, died in Philadelphia, July 28, of rheumatism of the heart. Mr. Parrish formerly was with the Electric Storage Battery Company, of Philadelphia. He is survived by a widow and one child. Mr. Parrish was only 44 years old.

MR. E. M. VAN FRANK, superintendent of the Kentucky street division of the United Railroads, of San Francisco, on July 17 was presented with a handsome gold watch, suitably engraved, by the employees of his division, in token of the esteem in which he is held by all who served under him. The occasion was the taking up by Mr. Van Frank of his new duties as superintendent of the traffic bureau, a department newly inaugurated by the United Railroads, a promotion to which all feel him justly entitled.

MR. FRANK J. SPRAGUE'S admirable series of articles in the "Century" on "The Electric Railway," is closed in the August issue of that publication. Like the first part, this is full of personal reminiscence of a most interesting character and is profusely illustrated. The article, as a whole, constitutes a most valuable permanent addition to the history of the art, a record all the better because it is contemporaneous. Mr. Sprague closes with a glance at the future, and says: "There is not a railroad in the country which cannot be operated electrically if we are concerned only with the physical possibility of achievement." The financial factor is chiefly the determining one, related to relative density of traffic, load factor and line working potential.

MR. HINSDILL PARSONS has resigned as president of and a director in the Schenectady Railway, of Schenectady, N. Y., and with his wife has sailed for a short tour of Europe. Mr. Parsons has made his home in Schenectady since 1894, at which time he accepted his first office with the General Electric Company, that of resident attorney to look after the company's local legal interests. He was advanced from time to time, until, in 1901, he became the general counsel of the General Electric Company, and at the same time was honored with the fourth vice-presidency of the company, a position which he still holds. At that time also began his connection with the Schenectady Railway Company. Previous to his connection with the General Electric Company Mr. Parsons was a patent attorney, employed by the Wood Mowing & Reaping Machine Company, of Hoosick Falls. He is a graduate of Trinity College and the Albany Law School. He was born at Hoosick Falls, forty years ago, where he resided until he took up his residence in Schenectady. Mr. Parsons will in the future devote all of his time to the interests of the General Electric Company.

MR. W. M. PROBASCO has resigned as assistant to the president of the McGraw Publishing Company to accept the office of vice-president of the Search Light Publishing Company, an organization which promises to occupy an important field in the journalistic and publishing business of this country. The company owns a file of about 2,500,000 clippings, articles and pictures on all subjects, compiled from newspapers, magazines, engineering journals, books and reports of scientific societies, and has a carefully organized force by which this information is classified and kept up to date for the use of publishers and others who require prompt and up-to-date information on any subject. In addition the company publishes a weekly paper, called "The Search Light," which is a record of the most important events of the previous week, and which covers some sixty separate departments. As a nucleus for this paper the company purchased "The Great Round World" and "The Week's Progress," publications somewhat on the line of its own, but has improved on their plans, and especially in the completeness with which the information is compiled and indexed The company also handles the publishing and advertising accounts of important railroads, manufacturers and engineering firms, among them those of the Pennsylvania Railroad, the Long Island Railroad, the Power & Mining Machinery Company, and the Morse Chain Company. The fourth department of its business is the publication of books. Among those in hand is one on Cuba, while another perpetuates the exhibits of the Westinghouse Companies at the recent International Railway Congress. Mr. Probasco is well known in electrical circles, and his many friends will wish him success in this new departure. He was formerly assistant general manager of the Westinghouse Companies publishing, advertising and exhibition interests, and in this capacity was the designer and organizer of the Westinghouse exhibits at the St. Louis Exposition, which received the grand prize as an exhibit. He was also compiler and editor of the album recently issued for the Interborough Rapid Transit Company by the McGraw Publishing Company. Associated with Mr. Probasco in the Search Light Publishing Company are Mr. E. G. Handy, who with his brother had charge of the Bureau of Publicity and Promotion of the Chicago World's Fair, and has since been a prominent newspaper man and publisher; and Mr. W. G. Jordan, who was for six years editor of "Current Literature," was later managing editor of the "Ladies' Home Journal," and subsequently editor in chief of the "Saturday Evening Post," of Philadelphia.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Decrease due to strike.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.	1 m., June '05	85,163	45,841	39,322	23,017	16,305
Northern Ohio Tr. & Light Co	1 " " '04	80,504	43,274	37,230	23,167	14,064
	6 " " '05	425,478	236,918	188,561	137,602	50,960
	6 " " '04	397,086	228,261	168,824	135,702	33,123
AURORA, ILL.	1 m., May '05	39,660	21,492	18,167	9,226	8,942
Elgin, Aurora & Southern Tr. Co	1 " " '04	38,101	23,171	14,930	9,451	5,479
	11" " '05	413,975	236,701	177,275	101,998	75,277
	11" " '04	416,156	252,760	163,396	101,225	62,171
BINGHAMTON, N. Y.	1 m., June '05	26,226	11,961	14,265	------	------
Binghamton Ry. Co.	1 " " '04	24,665	11,374	13,291	------	------
	12" " '05	261,124	136,862	124,262	84,491	39,771
	12" " '04	241,789	130,887	110,902	77,872	33,030
BOSTON, MASS.	3 m., June '05	1,690,522	1,085,582	604,940	397,657	207,283
Massachusetts Elec. Cos.	3 " " '04	1,612,891	1,084,246	528,645	366,034	162,611
	12" " '05	4,420,753	3,225,778	1,194,955	1,165,270	29,685
	12" " '04	4,219,200	3,331,425	887,775	1,065,398	†177,623
CHICAGO, ILL.	1 m., May '05	52,071	28,474	23,597	------	------
Aurora, Elgin & Chicago Ry. Co	1 " " '04	41,778	25,033	16,745	------	------
	3 " " '05	131,441	79,001	52,440	------	------
	3 " " '04	94,746	64,625	30,120	------	------
Chicago & Milwaukee Elec. R. R. Co	1 m., June '05	53,218	22,266	30,952	------	------
	1 " " '04	40,838	15,136	25,702	------	------
	6 " " '05	211,973	104,017	107,957	------	------
	6 " " '04	163,250	72,587	90,663	------	------
CLEVELAND, O.	1 m., June '05	23,941	*13,200	10,741	6,733	4,007
Cleveland, Painesville & Eastern, R. R. Co.	1 " " '04	22,364	*13,045	9,319	6,830	2,489
	6 " " '05	99,416	*63,147	36,270	------	------
	6 " " '04	94,760	*60,465	34,296	------	------
Cleveland & Southwestern Traction Co	1 m., June '05	48,558	26,930	21,628	------	------
	1 " " '04	44,132	24,604	19,528	------	------
	6 " " '05	237,276	148,892	88,483	------	------
	6 " " '04	204,753	144,475	60,278	------	------
Lake Shore Electric	1 m., June '05	67,969	37,443	30,526	20,804	9 722
	1 " " '04	59,596	36,224	23,372	20,404	2,968
	6 " " '05	326,629	198,132	128,497	122,425	6,072
	6 " " '04	271,002	218,690	52,312	122,391	†70,079
DETROIT, MICH.	1 m., June '05	461,522	*266,530	194,992	93,364	101,628
Detroit United Ry	1 " " '04	411,347	*240,737	170,610	90,075	80,535
	6 " " '05	2,345,977	*1434023	911,954	553,924	358,030
	6 " " '04	2,085,319	*1345515	739,804	533,444	206,360
DULUTH, MINN.	1 m., June '05	55,456	28,276	27,081	16,826	10,255
Duluth St. Ry. Co	1 " " '04	53,377	26,258	27,119	16,517	10,602
	6 " " '05	304,742	167,465	137,277	100,579	36,698
	6 " " '04	292,745	168,953	123,792	98,878	24,914
FINDLAY, O.						
Toledo, Bowling Green & Southern Tr. Co	1 m., June '05	24,885	13,731	11,154	------	------
	1 " " '04	23,545	12,512	11,033	------	------
FORT WORTH, TEX.	1 m., June '05	57,849	30,042	27,807	11,576	16,230
Northern Texas Traction Co	1 " " 04	47,214	26,029	21,184	10,029	11,156
	6 " " '05	302,581	169,715	132,866	65,347	67,519
	6 " " '04	258,936	147,974	110,961	60,547	50,414
HANCOCK, MICH.	1 m., May '05	‡10,993	11,693	†699	3,627	†4,326
Houghton County St. Ry. Co	1 " " '04	16,441	11,531	4,909	3,455	1,455
	12" " '05	167,861	160,309	7,552	41,452	†33,900
	12" " '04	188,518	130,672	57,846	36,858	20,988
HOUSTON, TEX.	1 m., May '05	43,686	27,228	16,408	8,907	7,501
Houston Electric Co.	1 " " '04	35,137	23,685	11,453	7,941	3,513
	10" " '05	366,373	234,344	132,029	84,615	47,414
	10" " '04	327,376	227,559	99,818	76,862	22,956
LONDON, ONT.	1 m., May '05	15,730	11,274	4,456	2,137	2,320
London St. Ry. Co.	1 " " '04	14,454	9,920	4,534	2,162	2,372
	5 " " '05	68,250	54,966	13,284	10,371	2,913
	5 " " '04	59,256	49,689	9,567	------	------
MILWAUKEE, WIS.	1 m., June '05	280,856	133,318	147,538	79,041	68,497
Milwaukee El. Ry. & Lt. Co.	1 " " '04	265,906	128,433	137,474	75,236	62,238
	6 " " '05	1,551,692	782,435	769,256	450,749	318,508
	6 " " '04	1,538,674	801,383	737,291	443,505	293,786
Milwaukee Lt., Ht. & Tr. Co	1 m., June '05	55,164	22,525	32,638	21,568	11,070
	1 " " '04	41,282	18,854	22,428	17,225	5,204
	6 " " '05	256,825	122,366	134,459	117,909	16,549
	6 " " '04	195,786	106,882	88,904	94,302	† 5,398
MINNEAPOLIS, MINN.	1 m., May '05	389,425	172,504	216,921	97,208	119,713
Twin City R. T. Co	1 " " '04	363,646	170,772	192,873	90,279	102,594
	5 " " '05	1,778,942	861,674	917,268	486,508	430,760
	5 " " '04	1,689,121	812,237	876,885	448,049	428,836
MONTREAL, QUE.	1 m., June '05	248,200	137,594	110,607	29,514	81,093
Montreal St. Ry. Co	1 " " '04	232,610	131,589	101,022	26,295	74,727
	9 " " '05	1,923,992	1,258,520	665,471	199,168	466,303
	9 " " '04	1,761,917	1,149,936	611,981	175,371	436,610
OAKLAND, CAL.	1 m., May '05	45,556	20,051	25,505	13,425	12,080
San Francisco, Oakland & San Jose Ry	1 " " '04	33,418	14,389	19,029	8,648	10,381
	5 " " '05	216,223	87,705	128,519	65,863	62,656
	5 " " '04	155,973	70,867	85,106	39,003	46,102
PEEKSKILL, N. Y.	1 m., May '05	9,580	* 5,642	3,938	------	------
Peekskill Lighting & R.R. Co	1 " " '04	7,911	* 5,245	2,665	------	------
	11" " '05	106,262	* 61,949	44,313	------	------
	11" " '04	99,672	* 60,281	39,391	------	------
PHILADELPHIA, PA.	1 m., June '05	139,565	------	------	------	------
American Rys. Co	1 " " '04	126,934	------	-----	------	------
	12" " '05	1,471,991	------	------	------	------
	12" " '04	1 406,965	------	------	------	------
ROCHESTER, N. Y.	1 m., June '05	150,220	76,700	73,520	27,757	45,763
	1 " " '04	129,900	66,338	63,562	26,541	37,021
Rochester Ry. Co	6 " " '05	822,879	448,250	374,629	164,105	210,524
	6 " " '04	710,502	404,650	305,852	158,118	147,734
SAN FRANCISCO, CAL.	1 m., May '05	599,407	------	------	------	------
United Railroads of San Francisco	1 " " '04	574,970	------	------	------	------
	5 " " '05	2,830,982	------	------	------	------
	5 " " '04	2,687,936	------	------	------	------
SAVANNAH, GA.	1 m., May '05	50,569	27,936	22,633	10,554	12,079
Savannah Electric Co.	1 " " '04	45,481	25,895	19,586	10,878	8,708
	12" " '05	562,297	322,923	239,374	126,923	112,451
	12" " '04	530,608	305,502	225,105	123,130	101,975
SEATTLE, WASH.	1 m., May '05	208,608	132,775	75 834	24,955	50,879
Seattle Electric Co	1 " " '04	197,848	133,593	64,256	23,486	40,770
	12" " '05	2,378,040	1,632,848	745,192	301,416	443,776
	12" " '04	2,213,898	1,548,917	664,981	273,068	391,913
TAMPA, FLA.	1 m., May '05	34,953	20,697	14,256	1,885	12,371
Tampa Elec. Co	1 " " '04	32,573	19,877	12,696	2,112	10,584
	5 " " '05	163,921	99,067	64,854	9,494	55,360
	5 " " '04	144,557	85,290	59,267	10,464	48,803
TERRE HAUTE, IND.	1 m., May '05	51,749	36,143	15,606	10,854	4,752
Terre Haute Tr. & Lt. Co	1 " " '04	46,637	31,227	15,410	10,250	5,161
	12" " '05	588,558	379,145	209,413	113,654	95,760
	12" " '04	517,124	346,158	170,966	102,338	68,628
TOLEDO, O.	1 m., June '05	163,226	* 80,846	82,380	41,771	40,609
Toledo Rys. & Lt. Co.	1 " " '04	148,635	* 76,941	71,694	41,642	30,052
	6 " " '05	895,793	* 463,736	432,057	253,815	178,242
	6 " " '04	825,858	* 456,964	368,894	250,349	118,545
YOUNGSTOWN, O.	1 m., May '05	44,407	* 23,689	20,718	------	------
Youngstown-Sharon Ry. & Lt. Co	1 " " '04	38,693	* 22,881	15,812	------	------
	5 " " '05	213,954	* 119,176	94,778	------	------
	5 " " '04	186,925	* 115,123	71,802	------	------