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The Car Ahead

We do not know if scientists have yet agreed upon the point as to whether there is one of the seasons of the year which might be called the pugnacious season. Human nature is so constituted that most people kick vigorously and pretty continuously at all features of the public service where they consider that their individual rights or comforts are concerned, but it seems as if examples of unreasonable criticism have been more numerous recently than usual. Most of these complaints are made absolutely without regard as to whether a practice which at times occasions a slight inconvenience to an individual may not be, when viewed broadly, much the most satisfactory to the general community. It is needless to say that street railway companies come in for a large amount of this gratuitous abuse from persons who are unacquainted with the practical needs of street railroading, and their complaints often gain the sympathy and support of others who would be the first to raise a protest if the only remedy for the practice of which complaint is made was applied.

One of the most frequent causes of popular clamor against railway companies is the requirement occasionally for those riding in a short-route car and who wish to travel farther, to change to the next through car. There has been a number of conspicuous examples of this in New York and vicinity recently, when passengers on a short-route car have remained in the car even after it was run into the car house, and have stayed there for hours, upon a mistaken assumption that in some way the railway company was obliged to haul them to the more distant point where they wished to go. Others to whom a siesta in the car house has seemed tiresome have assailed the railway company in public print or the employees of the company in fistic encounters, on the theory that the trouble of changing from one car to another was too onerous to be endured.

The situation is not confined to New York, or even to large cities. There is hardly a street railway company in the country which runs through a town of 25,000 inhabitants which does not find it necessary to run short-route and long-route cars, and while passengers in some of the smaller cities usually take regulations of this kind more gracefully, or are perhaps better acquainted with the schedule and the needs for it, there is probably no part of the country where the cantankerous individual does not exist to raise a protest against a change to the car ahead.

Now, it would seem to be a self-evident fact that to give a proper service a shorter headway should be run on some sections of a line than on others, so that we can take it for granted that the short-route car is perfectly legitimate. But the question arises more frequently whether a company is ever warranted in operating short-route cars when the through cars are crowded, as in the rush hours. We certainly believe that it is, for a number of reasons. In the first place the schedule has to be made out for the average conditions, and to change it so as to make a car which was intended to stop at one place go through to another would disorganize the entire time-table. Even if the through cars are crowded at certain hours there may still be good reasons for operating short-route cars at these times. If all cars ran over the entire route the passengers who boarded the cars near the terminals might possibly have a better service, but those entering or leaving the cars at other points would probably have difficulty in securing seats. These people are just as much entitled to good service as those who live a long distance away, and this can only be secured by starting some of the cars at a point between the two termini, depending on the amount of traffic along the line. In any case, the idea that through service is an inherent right of the passenger and that it can be secured by remaining in the car after it has been run into the car house is ridiculous. The requirement to transfer from one car to another is not unreasonable and should not be regarded as such.

Railway Profits

At every discussion on the subject of street railway franchises or taxation, it is part of the recognized procedure for some individual to arise and formally declare that such and such a company is making a prodigious amount of money out of the use of the streets, and hence that this sum is being taken in some fraudulent manner from the citizens. We do not ever remember having heard any of these orators offer their sympathy to the stockholders of those street railway companies in other cities where the conditions are not quite so favorable, and where there is nothing at the end of the year as a return for the capital invested except a deficit. Nor do we remember ever having met one of these self-constituted re-

formers who would admit that the risks run in business enterprises of this kind warranted any greater gain, if one was secured, than if the investment was made in government bonds.

The application of this principle has come up recently in New York city as the result of a statement by Edward F. Shepard, that the contract for the construction and operation of the rapid transit system in New York was worth between $30,000,00 and $50,000,000 more than was paid for it. The remark has been repeated broadcast, and has been taken up by Senator Ford and others, who refer to it as another instance of the giving away of valuable franchises which originally belonged to the city. We do not understand how Mr. Shepard can yet predicate the value of this franchise, as the road has not yet been built and no cars are in operation or will be for a considerable time to come. We believe that with careful management the property can be made financially profitable, but whatever returns are secured by the stockholders the advantage to the city will be tenfold. Nevertheless, the actual value to the stockholders is still problematical, and that the history of the entire rapid transit undertaking in New York indicates that the citizens have been deprived in any way of their just rights in the matter is entirely far from the truth. Like most of the other franchises which have been heralded as Eldorados, the question at the time of the award was not who would get the franchise but who would take it. During the ten or more years in which the Rapid Transit Commission vainly endeavored to secure a bidder for the plan, neither ex-Senator Ford or any of his friends came forward with any great enthusiasm with an offer to put up a bond and build the road. The present owners took the franchise when it had been rejected as unprofitable by every one of the existing transportation lines in the city, including the Metropolitan, Manhattan, New York Central and New York, New Haven & Hartford. If a profit is made by them they richly deserve it.

It is certainly pretty late now to raise the complaint that the franchise is worth more than was paid for it.

Chicago Franchises

The time is ripe for action on the question of the Chicago traction franchises, and, as President Hamilton, of the City Railway, says, in his letter to the aldermanic committee, published last week in these columns, "Not only the personal comfort and convenience of the individual citizen are involved, but very many business interests, other than those of the railway company, are dependent upon the speedy settlement of this matter." There is now no excuse for postponing action; the city has been granted the enabling legislation it sought at Springfield, the people are clamoring for better facilities, and the transportation companies are equally anxious for a settlement, as they realize more than any one else the magnitude and importance of the work involved in providing satisfactory transportation facilities for the city of Chicago, and the necessity for immediate action. There is, in fact, every reason for expedition—not haste, necessarily, but serious effort toward effecting a settlement.

In considering the terms upon which the present franchises are to be renewed, one of the most important factors will doubtless be the disposition to be made of the ninety-nine-year franchise extension. In the preliminary negotiations the city refused to recognize this claim, and insisted that the companies should waive all rights under it without any guarantee that it would be considered when the final adjustment was made. Naturally, the companies objected, and the proceedings were dropped temporarily. Now, however, the same question is brought into prominence again, and it is quite probable that it will prove the key to the situation, as the receivers for the Union Traction will doubtless insist upon recognition of these rights and adequate concessions for their abandonment. They have received explicit instructions from Judge Grosscup on this point, in which he declares that the act is law, and, as such, must be recognized and respected. There can be no doubt as to the position of the court in this matter after reading the following declaration in Judge Grosscup's letter, the full text of which is presented elsewhere:

"The act stands in the official statutes unrepealed and unannulled. To the eye of the law it is an existing law of the land—as much so as the laws creating the offices of Mayor and Aldermen. Nor—laying aside for the moment the eye of the law—do I believe that an informed public insists upon subjecting, nearly forty years after the event, innocent investors to 'revenge and retribution,' such possibly as ought to have overtaken the men who passed those measures through the General Assembly of 1865."

A note of warning is also sounded in the letter which plainly intimates that the court will not tolerate the bulldozing tactics which Mayor Harrison declared to be his purpose in securing the enactment of the Mueller bill. The letter reminds the receivers, that as representatives of the court, they are bound to protect the interests of the property entrusted to them, and assures them that they will have the support of the Federal Government in doing this. It is evident that Judge Grosscup appreciates the gravity of the situation and the responsibility of the position in which the receivers have been placed, and it is likewise apparent that it is not his purpose to allow anything to interfere with the proper discharge of these duties. While recognizing the claims of the public depending upon the companies for transportation facilities and the authority of the city over the granting of franchises and employment of these privileges, the receivers are instructed to bear in mind that the rights of the investors who have contributed so much to the general advancement by the development of the transportation system are also entitled to consideration. In view of the avowed hostility of the city administration, it is very fortunate that the affairs of the company are being safe-guarded by the Federal Courts.

The negotiations that have been in progress during the last two weeks have been almost entirely in relation to the South Side system alone, and without any reference to the other parts of the city. It should be borne in mind in this connection that any satisfactory solution of the traction problem that will be acceptable to the people of Chicago will have to embrace the entire system of transportation for the entire city, and in order to make terms with the South Side Company, which is ready and free to act, the city must be prepared to effect a settlement with the North and West Divisions. Consequently, Judge Grosscup's instructions to the receivers of the Union Traction Company will affect the entire problem.

There are other considerations that will have to be recognized and adjusted, including the compensation to be exacted for the privileges bestowed and the form it is to take. Upon this subject public sentiment is divided, and it is believed that the members of the transportation committee of the City Council are not entirely united. The Mayor is known to be very radical in his views, but it is hoped that the conservative element in the Council will prevail, and that an equitable arrange-

ment will be made. President Hamilton, in his communication, expresses a willingness to abide by the decision of the Council as to what form this compensation is to take, but he points out that this question cannot be intelligently determined without taking into consideration, among other things, the companies' liability under the proposed ordinance for license fees, taxes, street paving, street cleaning, sweeping and sprinkling, and the disposition to be made of the railway at the expiration of the grant. It is only fair at this time to bear in mind the fact that the requirements which the city will demand of the companies in the way of improved service mean the expenditure of a large sum of money, and that in making the improvements the system will be badly crippled temporarily. The transformation cannot be completed quickly; power houses must be built, machinery installed, rails laid and new cars put on. It is a great undertaking, and the time when better service can be furnished depends very largely on the promptness with which authority is given to begin work. The interests of all concerned require that there be no greater delay than is absolutely necessary in bringing about a settlement of this important problem.

Conduit Railway Construction in London

The month of May has been signalized, as described elsewhere in this issue, by the opening of the first modern street railway in the city of London proper. It is true that an overhead trolley line enters the outskirts of the city and that electric underground railways, or "tubes," as they are called, have been carrying passengers through the subterranean depths of the city for a number of years. But for surface transportation London has been dependent on horse cars or omnibuses, especially the latter, as even the horse railways have not been allowed to penetrate into the region where the greatest amount of traffic exists. The opening of the London County Council Tramways is, therefore, a momentous event in more ways than one, and if these lines should prove to be the entering wedge for a modern system of transportation within the world's metropolis, they will effect changes the extent of which it is difficult to foretell.

As yet the new electric lines have been practically limited to the region south of the Thames, although a vigorous effort was made last year to secure rights along the Victoria Embankment. The latter is one of the broadest streets in London, and connecting, as it does the West End with the "City," could relieve enormously the overcrowded Strand and Fleet Street if provided with a modern surface transportation system. The bill authorizing this extension was defeated, but further efforts to secure transportation rights on the Embankment will probably be made in the early future and will undoubtedly receive assistance through the practical demonstration of the advantages of electric traction on the Surrey side.

In some respects it may seem strange that the three largest cities of the world should have been the last to adopt modern methods of traction. It has taken a long time to convince the city authorities of New York, London and Paris that improved transportation facilities, the value of which was self-evident to the authorities of smaller cities, were desirable or even necessary to their city's welfare. Even now horse cars are common spectacles in these three cities, and, so far as Paris is concerned, will probably remain in use for some time to come. The backwardness of the large cities in surface transportation improvements has been due in part to the slowness with which large bodies move, and in part to the insularity of the inhabitants who, strange as it may seem, do not appreciate the value of improvements introduced elsewhere until long after others have reaped the benefit of them. This characteristic is peculiar to no nation or race, but is the same the world over.

The technical features of the new electric conduit line in London are as interesting as are those of a traffic standpoint. The power station is equipped with 1500-kw units, a size which seems somewhat small for modern stations of the extent of the London system. Nevertheless, they are among the largest in traction work in Great Britain, and the station marks an interesting departure from the 800-kw size which was for a long time popular there.

The conduit differs radically from that used in either New York, Washington or on the Continent. The center slot has been adopted, and in this respect the system follows American practice, but the track rails are supported on concrete instead of on extensions from the yokes, as in American practice. There can be no doubt but that the American type of conduit is more capable of resisting transverse strains, but it is also considerably more expensive. The absence of great extremes of temperature in the London climate undoubtedly was the reason for the adoption of the separate yoke, and as experience with similar conduits in cable work in Great Britain, and also with the side conduit on the Continent, indicates that its transverse strength is amply sufficient, the builders were warranted in its adoption. Inside of the conduit the equipment bears a striking resemblance to the New York pattern with its vertical Z-slot rail, its suspended porcelain insulators and its T-conductor bars. The method of construction followed, that is from above down, is the one generally employed in modern conduit work, and is, of course, much cheaper than that of building up from below. The London authorities are to be congratulated for having adopted the conduit construction instead of experimenting with a surface contact system, in which case the unfortunate results just experienced in Wolverhampton would have been repeated, through on a larger scale.

Novel Storage Battery Installation

An interesting application of the storage battery to central station practice is described this week, and while the plan followed in this instance is a departure from recognized practice it undoubtedly possesses some advantages that may commend it to managers of other stations where the conditions are somewhat similar. The situation in Milwaukee is unusual, as all the railway and electric lighting and power service is furnished by one company, and for this reason a battery was installed which could be used in common by the lighting and railway departments. It is consequently of greater capacity than would ordinarily be used for a railway company of that size, and not as large as the combined capacity of two independent plants might be for the service performed. The flexibility of the system as a whole has been greatly increased by this innovation, and the only complication introduced has been in the matter of switching arrangements, but this has not been considered a drawback. On several occasions, it is explained, the batteries have been invaluable to the railway department in caring for unusually heavy loads when the excessive demand could not be anticipated, and when, under ordinary conditions, it would probably overtax the facilities at hand. It is in just such emergencies that the storage battery steps in and endears itself to the station manager, but it is in the no less important work of caring for the peak of the load, day after day, and in the matter of regulation that its great value as an auxiliary is felt.

FIFTY-SECOND AVENUE TERMINAL IN CHICAGO

At the time the Aurora, Elgin & Chicago Railway was completed the Metropolitan West Side Elevated Railway Company built an elaborate terminal station at West Fifty-Second Avenue to provide for the transfer of passengers from the cars of the Aurora, Elgin & Chicago Railway, and also from the suburban railroad, to the Metropolitan Elevated. This terminal station is now practically completed. It forms not only a means of convenient transfer but a terminal yard for the Metropolitan cars operating over the Garfield Park line, which terminates at West Fifty-Second Avenue.

Fig. 1 shows the general arrangement at this terminal. The plans were made by W. S. Menden, chief engineer for the elevated company. The terminal yards and transfer station are on the surface. The elevated road and the surface line are connected by an incline, having a grade of 1.5 per cent. The arrangement is such that if ever found desirable the cars of the Aurora, Elgin & Chicago Railway can proceed straight through the transfer station, ascend to the elevated structure, and proceed into the city. At present, however, it is being used as a transfer station, and the Aurora, Elgin & Chicago cars turn back at this point. Referring to Fig. 1 the elevated cars come in from the east and operate around a loop. The Aurora, Elgin & Chicago cars come in from the west and cross this loop at grade. On the north side of the Aurora, Elgin & Chicago tracks is a transfer station where the elevated trains discharge passengers, who can then go out through turnstiles to Fifty-Second Avenue, or can go directly through the station and pass a ticket-seller's booth to the platform where the Aurora, Elgin & Chicago cars load. A similar transfer depot is provided on the south side of the Aurora, Elgin & Chicago tracks for passengers leaving the Aurora, Elgin & Chicago to take the elevated.

North of the terminal loop is an inspection

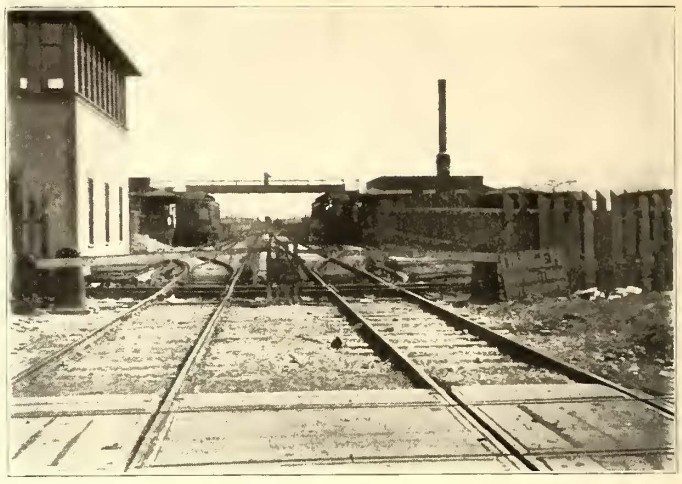


FIG. 2.—ENTRANCE TO TERMINAL FROM THE WEST

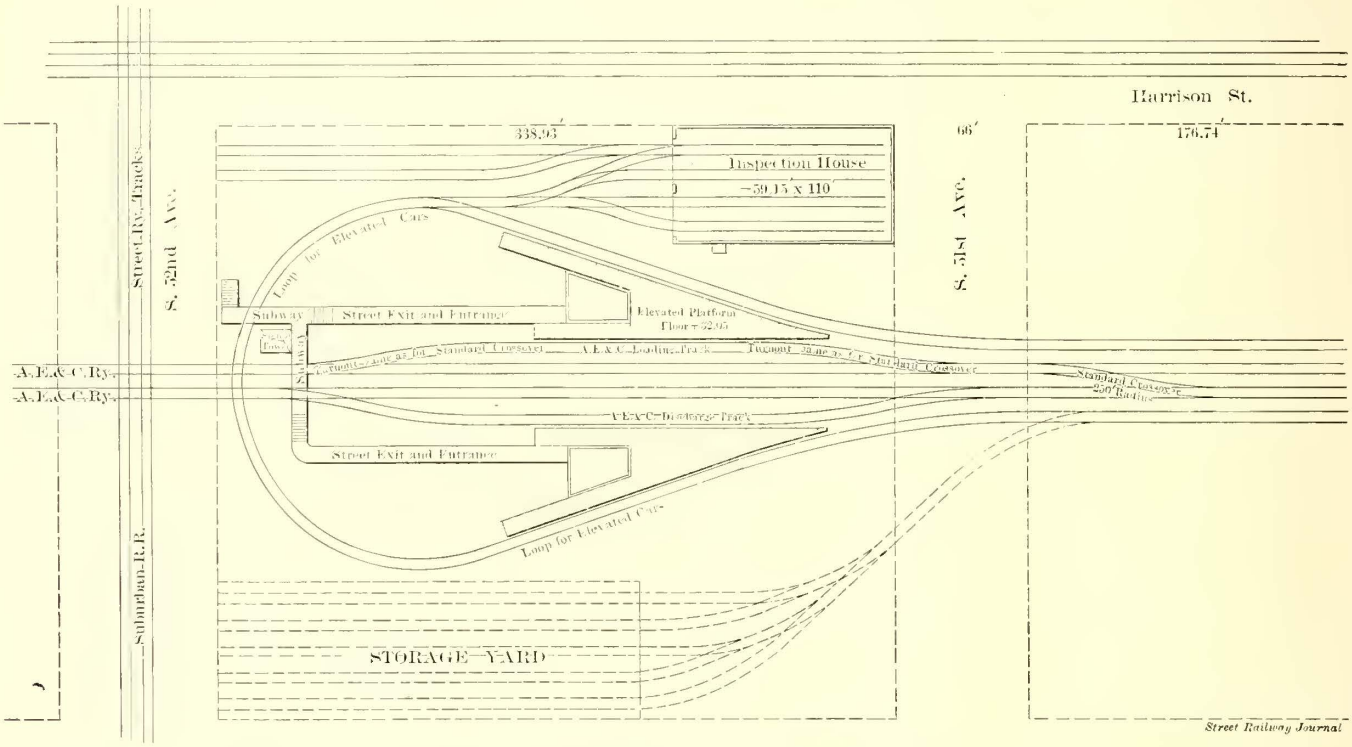
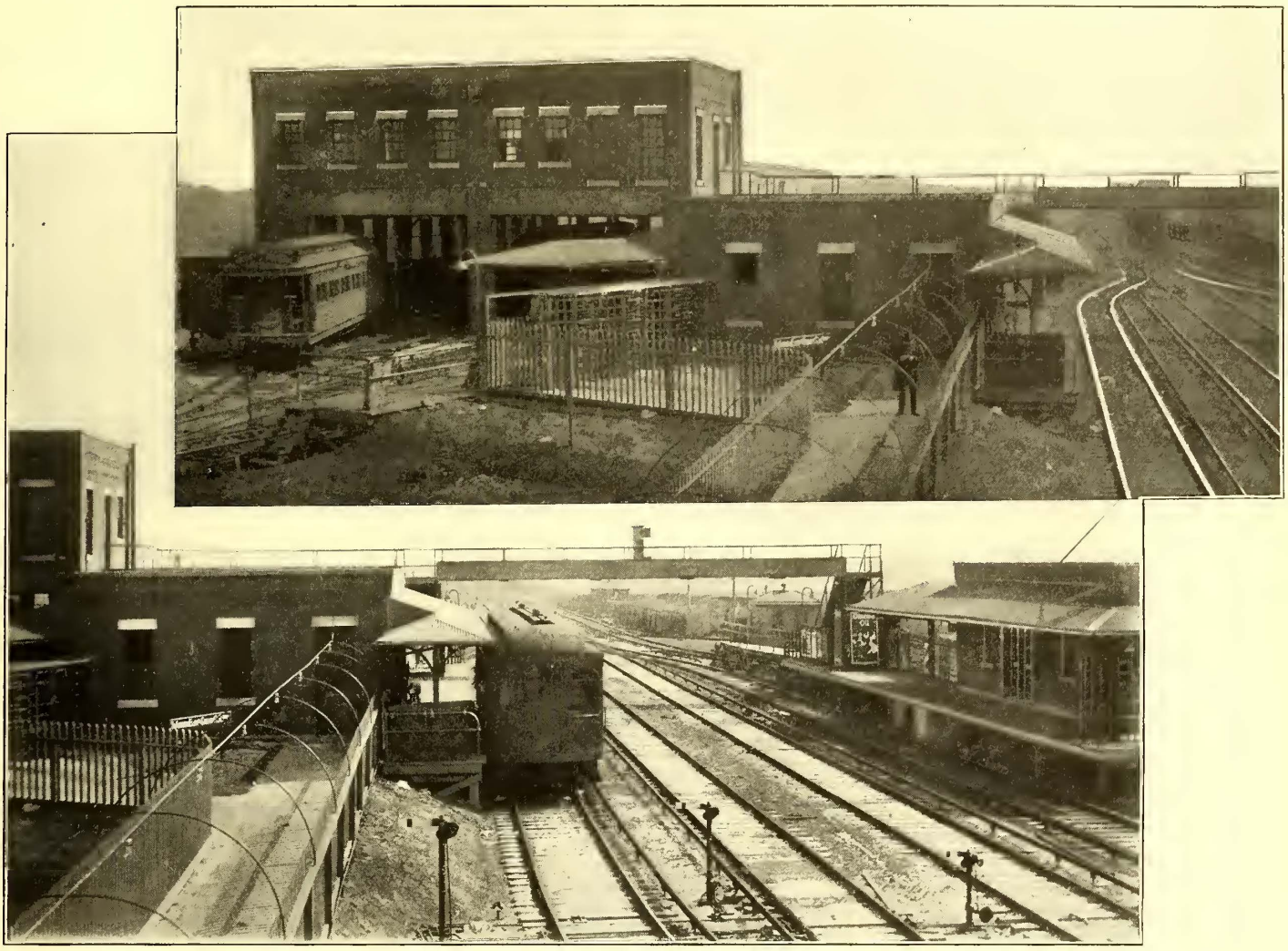


FIG. 1.—PLAN OF TERMINAL USED BY METROPOLITAN WEST SIDE ELEVATED RAILWAY AND AURORA, ELGIN & CHICAGO RAILWAY AT FIFTY-SECOND AVENUE, CHICAGO

FIG. 3.—VIEW FROM BRIDGE, LOOKING WEST, SHOWING INTERLOCKING TOWER

house for the elevated motor cars. The tracks in this house have pits. The floors are all concrete. Over one end of this inspection house is a second floor, where there is a lounging room and lockers for the elevated employees and an office for the man in charge of this division of the elevated. South of the transfer depot is the storage yard for the elevated cars. The switching for the entire terminal is done at an interlocking tower, equipped by the Union Switch & Signal Company.



FIGS. 4 AND 5.—TRANSFER DEPOTS AND INSPECTION HOUSE AT TERMINAL

Fig. 2 is a view looking toward the terminal yard from Fifty-Second Avenue, showing two Aurora, Elgin & Chicago cars, one discharging passengers into the transfer station at the right, and another car of the same line receiving passengers from the transfer station at the left.

As seen in Fig. 2 a bridge over the Aurora, Elgin & Chicago tracks is provided so that conductors and motormen, in going from one side of the terminal to the other, need not cross the yards in which there is a live third rail. If they were obliged to cross on the surface there would also be the liability that cars would be standing in the way. Fig. 3 is a view taken from this bridge looking west. The interlocking tower is seen and also the tracks of the Aurora, Elgin & Chicago Railway leaving the yards. The elevated loop crosses these tracks just beyond the signal tower. Except when Aurora, Elgin & Chicago cars are passing a crossing gate is kept closed at the entrance to the yards, to warn people against entering from the highway as well as a signal to Aurora, Elgin & Chicago cars.

Fig. 4 is a view from the interlocking tower, showing both transfer depots. The exit to the street from the north depot is seen in Fig. 5. A subway is provided under the elevated loop track, so that no tracks need be crossed by passengers entering or leaving the terminal. Fig. 5 also shows the inspection house, the interior of which is shown in Fig. 6.

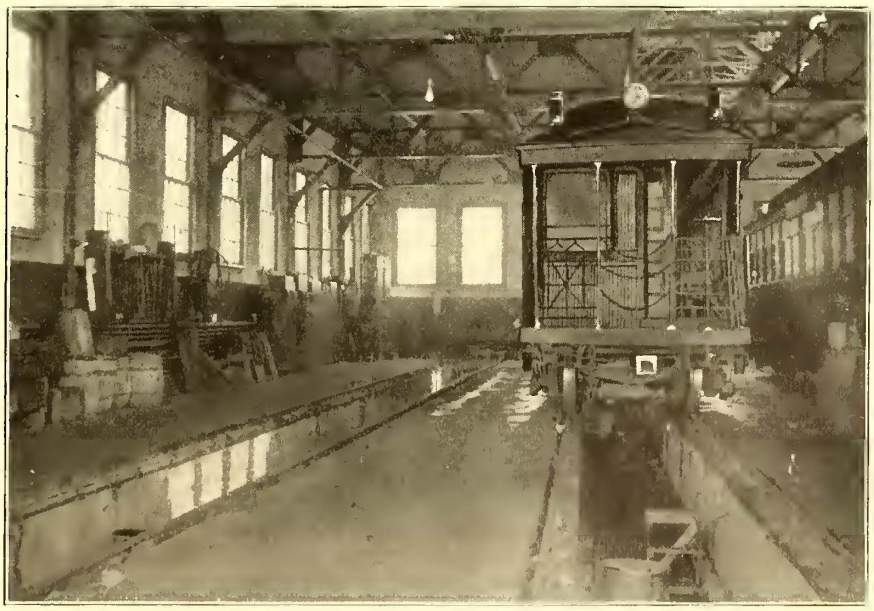


FIG. 6.—INSPECTION HOUSE

Fig. 7 is taken from the bridge, looking east up the elevated incline. The service tracks of the elevated are at the extreme right and left. The middle tracks are used by the Aurora, Elgin & Chicago. The inspection pit, over which the cars of that

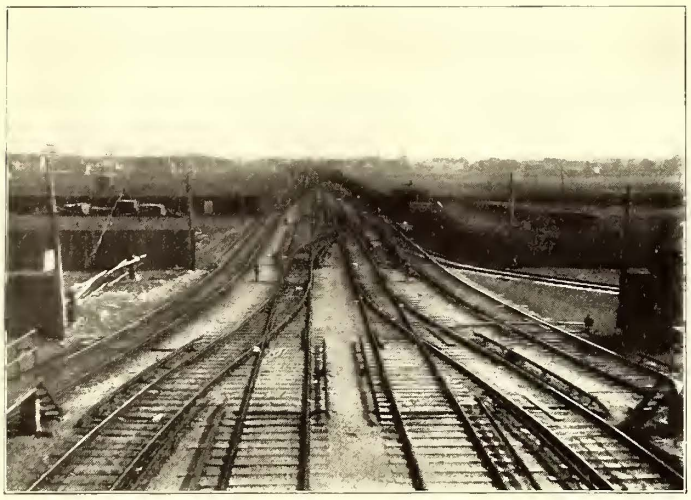


FIG. 7.—LOOKING UP THE INCLINE

company are run between trips, can also be seen. An extra car is kept in service on this road so that every interurban car that comes into Fifty-Second Avenue terminal can lie over one trip before being sent out again. This gives each car thirty

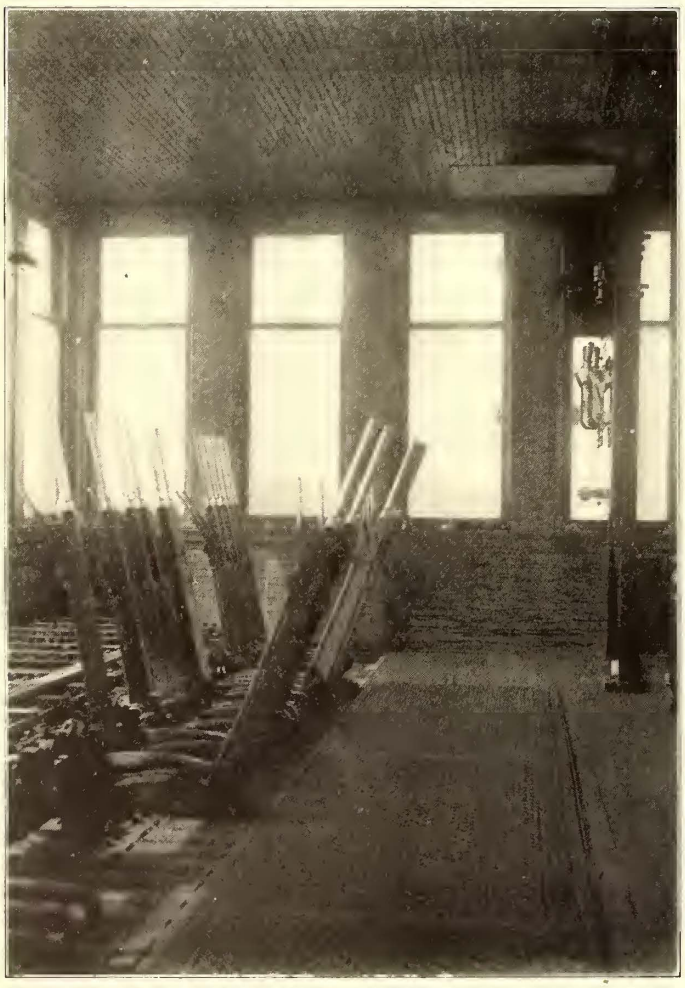


FIG. 8.—SWITCH TOWER

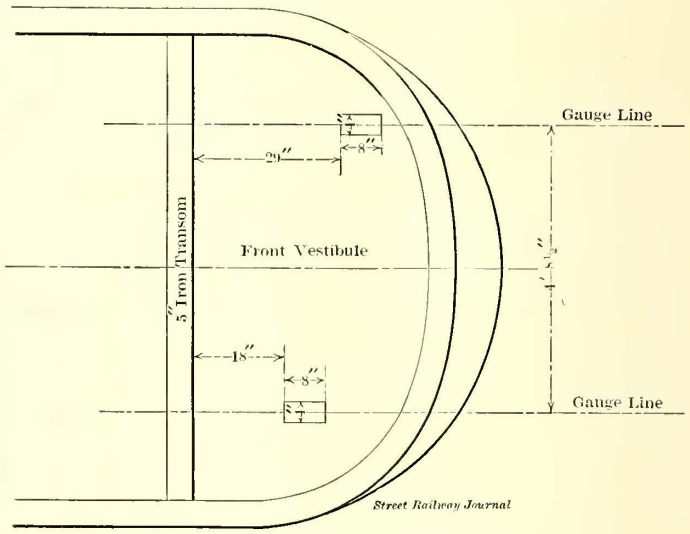
minutes for inspection and cooling of motors at the end of each round trip of 68 miles.

Fig. 8 shows the interior of the interlocking tower controlling all the switches and signals in the terminal and its approaches. This tower also controls the signals on the street railway tracks at Fifty-Second Avenue. All the crossing signals are interlocked with derails. In the signal tower are feeder switches, by which different portions of the yard can be cut out.

A little study of the drawings and engravings given here will show how completely all the details have been thought out in connection with this terminal.

TRAP-DOORS FOR SWITCHING

The Twin City Rapid Transit Company is using an arrangement for switching that will doubtless prove of interest to other managers who are operating under similar conditions. All of the Twin City lines terminate in a loop, which is especially favorable under the circumstances, as this makes it unnecessary to have controlling apparatus at both ends of the car. In the motorman's cab on the front platform two small trap-doors have been placed in the flooring, in the position shown



MOTORMAN'S CAB WITH SWITCHING TRAP DOORS

in the accompanying cut. When the car approaches a switch, the motorman can make a stop so that the trap will be directly over the switching point, and when the door is opened it will enable the motorman to introduce the turning bar and throw the tongue of the switch. The motormen have no difficulty in stopping the car within reaching distance of the switch, and this arrangement saves them much trouble and time which would be devoted to leaving their cab or leaning out of the vestibule window and using a long bar, as is now generally done. Of course, even where both platforms have controlling apparatus trap doors could be put in, especially in cars operating over lines where many switches have to be passed.

IMPROVEMENTS AND EXTENSIONS AT SACRAMENTO

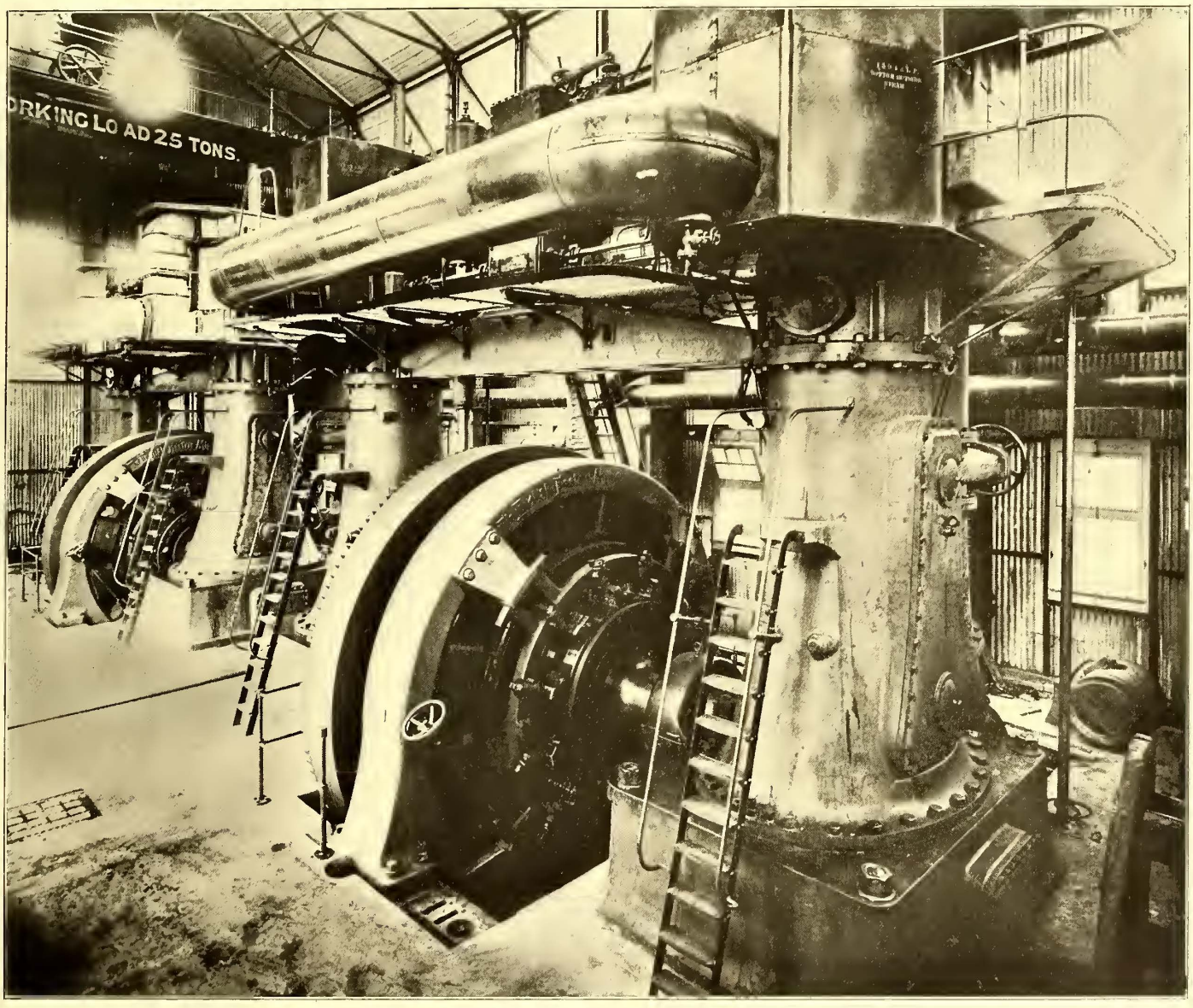
The Sacramento Electric, Gas & Railway Company, of Sacramento, Cal., is now completing a number of improvements to its railway system. All the main lines throughout the city and leading to the suburbs are being double tracked and laid with new rails, and the suburban lines are being rock ballasted. Twenty-five new double-truck cars are being added to the equipment, and all of the old cars are being thoroughly overhauled and refitted. A new car barn, 80 ft. x 160 ft., is being built, and a repair shop, 50 ft. x 80 ft., also is in course of construction.

The Toledo, Bowling Green & Southern Traction Company has purchased several flat cars, dump cars and freight cars for freight business, as much material is hauled for the oil wells along the line.

CONDUIT SYSTEM OF THE LONDON COUNTY COUNCIL

The successful opening by the Prince of Wales, on May 15, of the first section of the tramways of the London County Council, which have been converted from horse to electric traction during the last year, furnishes an appropriate occasion for presenting details and illustrations of the electrical equipment which has been successfully put into operation. The London County Council has secured control of about 99 miles of the total of 115 miles of tramways in the County of London, and for the last few years the Council has been operating the lines on the south side of the river, while those on the north side have been leased to the North Metropolitan Tramways Company. Though somewhat late in providing a modern system for London, it became quite evident a few days ago that electrification was necessary, the Council being stimulated by the progress which the provincial cities and towns were making in this direction and also by the electrification of the London United Tramways Company in the western suburbs of London. Powers were therefore secured for the electrification of a portion of the tramways on the south side, and as the overhead system met with considerable opposition and was declared unsuitable for a city of the magnitude and importance of London, it was at last decided that the conduit central slot system should be adopted.

The first section of the tramways to be converted commences on the extreme southwest boundary at Tooting, the route proceeding by Clapham Common along Kennington Park Road to a point at the "Horns," where the route divided, one branch going directly by Kennington Road to Westminster Bridge, and the other continuing eastward to the "Elephant and Castle," where again it was divided, this time one route leading to Waterloo Station and the other to Blackfriars Bridge. This section comprises about 8 miles of double track, and is now complete, and is the road put into operation by the Prince of Wales on May 15. All the track work for the first section was done by Messrs. J. G. White & Company, of London, under specifications of Dr. Alexander B. W. Kennedy, of Kennedy & Jenkins, which was somewhat modified to suit the circumstances. The special work was provided by the Lorain Steel Company, though all the castings for the conduit were made in Scotland by the Anderson Foundry Company, of Glasgow.

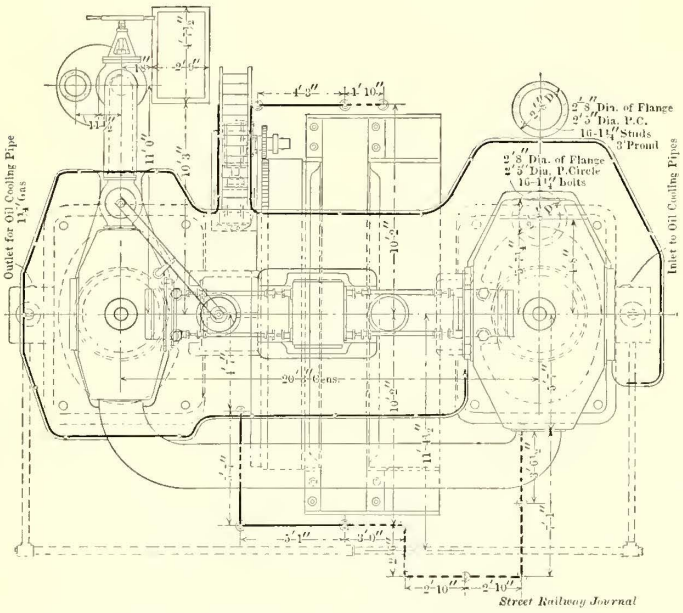


ENGINE ROOM IN TEMPORARY POWER PLANT AT LOUGHBOROUGH JUNCTION

The second section of about 19¼ miles was let some months ago, and extends from the Elephant and Castle to Greenwich by two different routes, one-half of this track being let to J. G. White & Company, Ltd., and the other half to Dick, Kerr & Company, Ltd., of London. The special work for this portion of the road, which has been let to J. G. White & Company, will all be made in Sheffield, England, by the Hadfields, who, in recent years, have established a magnificent plant for this class of work. In addition 7 miles in other localities will soon be let, for the completion of connecting links of the southern part of London.

At the time that the contract for the first section was entered

into, the London County Council was in possession of a power house at Camberwell, but when John H. Rider took over the responsibility it was decided by the London County Council, under his advice, to abandon this power house and to build a complete, up-to-date power house in the vicinity of Greenwich,



PLAN OF 1500-KW GENERATING SET FOR MAIN POWER HOUSE

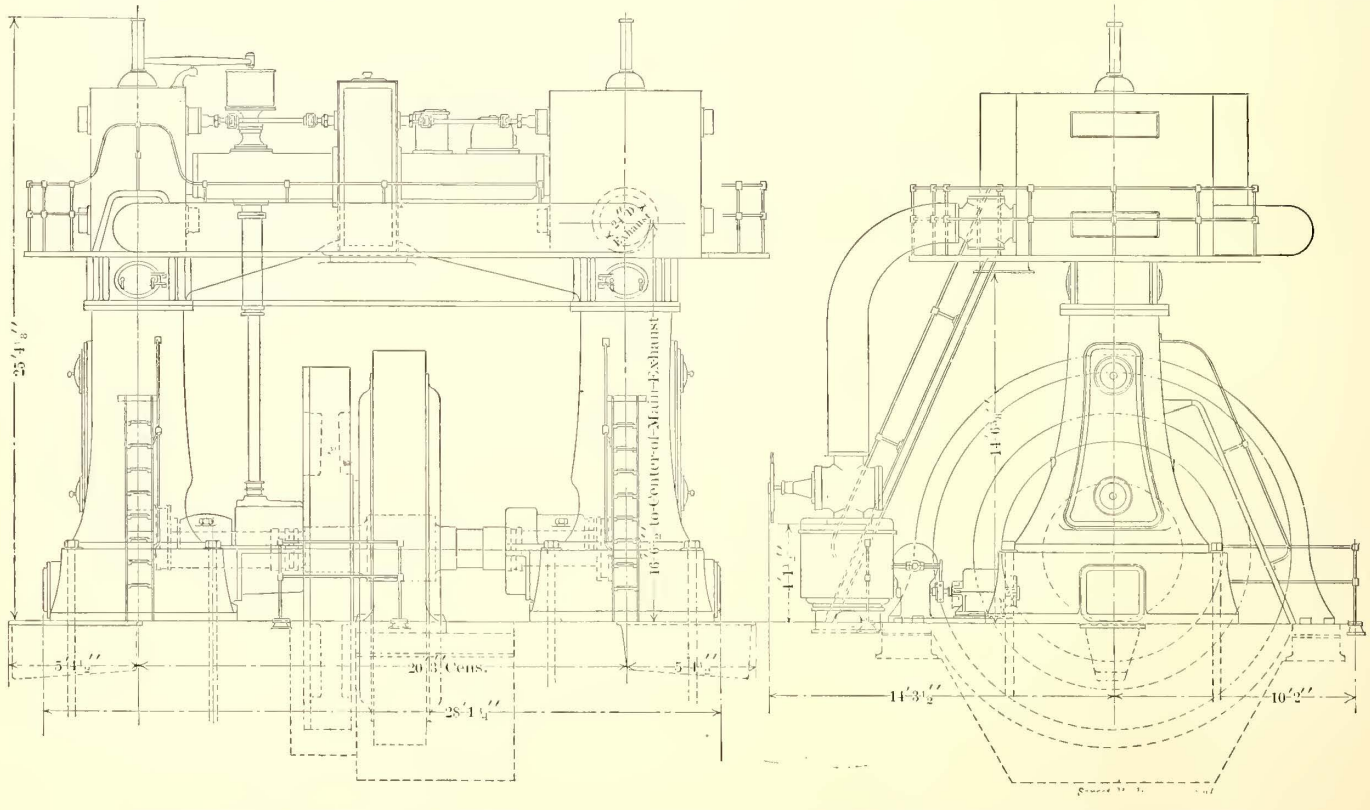
on the water side, where condensing water could be procured and where a station, built on modern lines, having a capacity for the whole of the southern system, could be installed. The contracts for the supply of apparatus for the station were let to Dick, Kerr & Company, Ltd., who are at present manufacturing the apparatus necessary. The Stirling Boiler Company, of Edinburgh, will furnish sixteen boilers for this plant, having a heating surface of 3230 sq. ft. and developing 10,000 hp. They will be fired by chain grate stokers. This station will be thoroughly equipped with a high-tension system, using sub-stations. In the meantime a temporary station has been installed at Loughborough Junction, from which all the power supply will be derived until the Greenwich power station is ready. This contract was also let to Dick, Kerr & Company, who have supplied the whole apparatus in conjunction with Ferranti engines. It should also be said that the complete equipment of 200 cars for the first section of the route, now ready for service, was entrusted to Dick, Kerr & Company, Ltd., these cars being built by the Electric Railway & Tramway Carriage Works, at Preston, and equipped with Dick-Kerr motors and controllers. The London County Council Tramways are managed by Alfred Baker, general manager. John H. Rider, under whose specification all of the Greenwich power house and the succeeding section of the route will be completed, is the electrical engineer to the Council and has entire charge of the work of conversion and operation. James W. Benn is the chairman of the tramways committee, while Maurice Fitz Maurice is engineer to the London County Council and attends to all matters of civil engineering connected therewith.

POWER HOUSE EQUIPMENT

Although the electrical machinery at present in position serves only that portion of the line which extends from Westminster Bridge to Tooting, the order already placed for generating plant includes two 1500-kw direct-current machines and three-phase machinery consisting of two 1500-kw alternating generators and eleven 300-kw motor-generator sets, and other small auxiliary sets, including small motor-generator sets and steam-driven exciters. Two 1500-kw direct-current machines are coupled direct to Ferranti vertical engines. They are 12-pole compound-wound generators, and when running at a speed of 150 r. p. m. develop at full load 2400 amps. at 625 volts.

The Ferranti engines have 31-in. and 62-in. cylinders, with 30-in. stroke. The main bearings are 18 ins. in diameter and 36 ins. long. The guaranteed consumption per indicated horse-power-hour is as follows, with 190 lbs. steam:

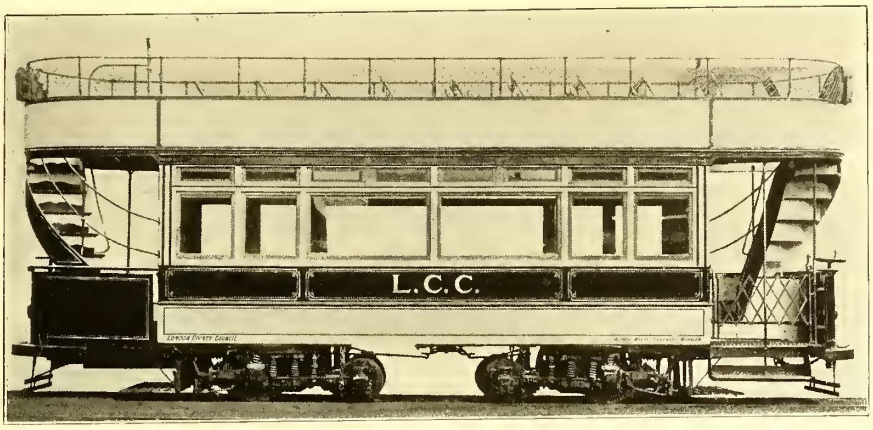
At full load, condensing, 13½ lbs.; non-condensing, 16½ lbs.; at three-quarters load, condensing, 13¼ lbs.; non-condensing, 16 lbs.; at one-half load, condensing, 14½ lbs.; non-condensing,



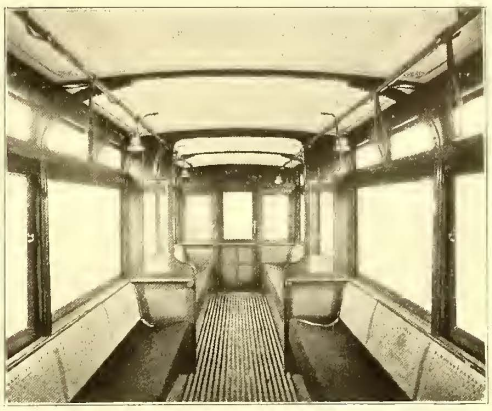
SIDE AND END ELEVATION OF 1500-KW COMPOUND ENGINE AND ALTERNATING-CURRENT GENERATOR

17½ lbs.; at 20 per cent overload, condensing, 14¼ lbs.; non-condensing, 19 lbs.

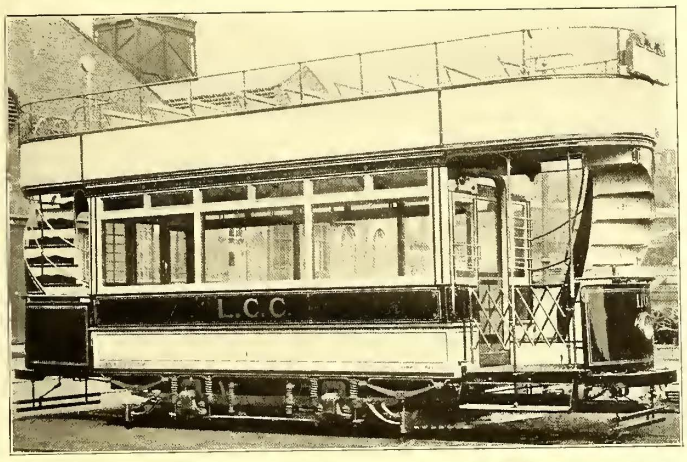
The fly-wheel, which weighs 48 tons, is bolted to the armature spider, whereby the torsional strains are transmitted directly from one to the other instead of passing through the crankshaft. The engines have an automatic governor of the relay type, and an emergency governor fitted to work on the throttle valve. The expansion gear is fitted with hand-gear for alternating the cut-off, should the automatic governor fail, and the engine may be shut down instantaneously from the starting platform by means of a knock-off lever closing the throttle. The valve gear is of the Ferranti type, in which separate steam and exhaust valves of grid form are positively driven by cams.



BOGIE CAR



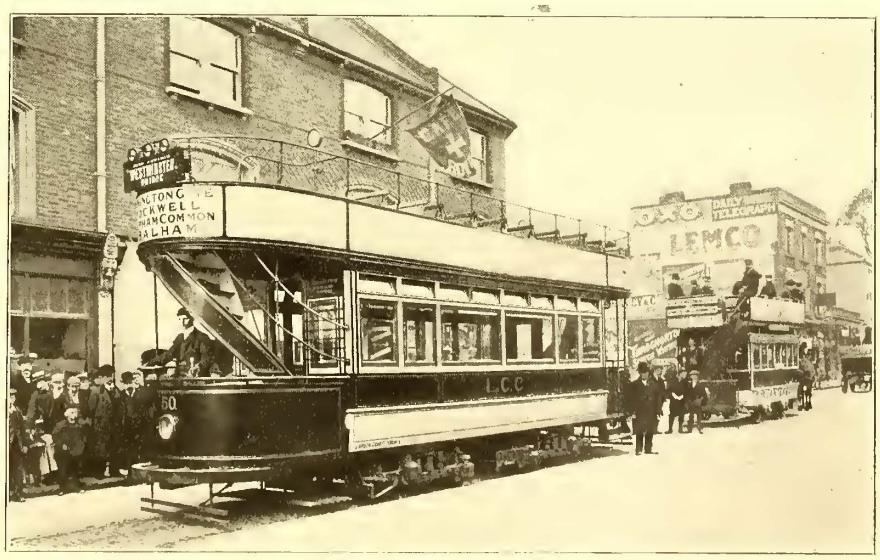
INTERIOR BOGIE CAR



SINGLE-TRUCK CAR

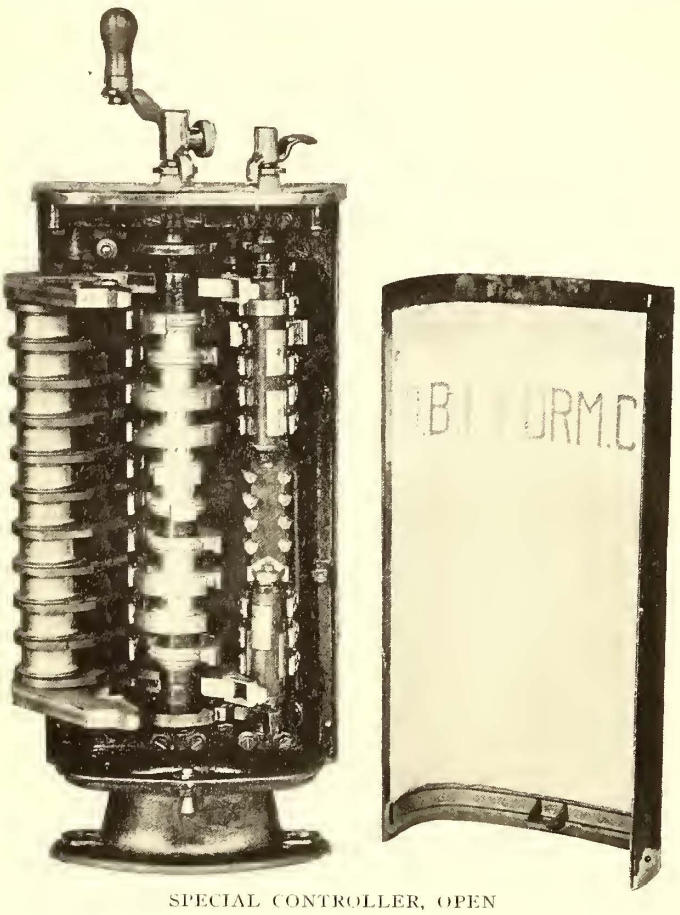
It will afford some indication of the massive proportions of the units in these stations when it is mentioned that the complete magnet frame, with its field magnet spools, weighs 30 tons. The frame is divided horizontally, but in order to provide easy access to the armature and to the lower field coils it is possible to slide the whole of the field frame sideways along the shaft of the engine and thus disclose either the armature or the lower half field spools. The pole pieces are cast into the magnet frame with a cast-welded joint. They are made of laminated steel, and are dove-tailed at each end. The laminations are held together by steel end pieces bolted securely together. Before being assembled into the form of a pole piece the laminations are punched by means of special machines. The field spools in the County Council generators are held in position by means of detachable pole-shoes, specially shaped to give an efficient distribution of the magnetic flux. The arrangement of the spools provides for series winding at one end and shunt winding occupying the remainder, making it unnecessary to disturb one winding should the other develop trouble at any time.

Both the series and shunt windings are insulated with special material of high quality. The armature is built up of laminations, which are carried on a special form of spider. The hub has a very large bearing surface on the shaft, is key seated and is extended to carry the commutator spider. The armature is made up of laminated punchings of high-class steel, which are thoroughly annealed and are then placed in position on the arms of the armature spider in a series of dove-tails. At intervals of 4 ins. spacing discs are inserted between the laminations, to give an air duct passing from the center of the machine to the periphery of the armature. The coils are, of course, form wound, and are entirely interchangeable, thus rendering it easy to wind the armature and to replace injured coils. The commutator bars are of hard-drawn copper, and are finished accurately to gage. The complete commutator is carried on the extended armature hub already referred to, and is securely keyed to it, any relative movement between the commutator segments and the armature conductors being thus prevented. The whole of the commutator is insulated from the hub by means of specially built-up mica end rings, which are moulded into form without joints. The commutator bars are held together by means of steel clamping rings, which prevent displacement by expansion or contraction. Balancing rings are provided, which are carried on one of the armature end plates nearest to the commutator, the number of rings and connections



THE FIRST RUN

of the commutator segments varying according to the number of poles. The commutator leads are of laminated copper, securely riveted and soldered in slots at the back of the commutator bars. These leads extend radially from the bars to the



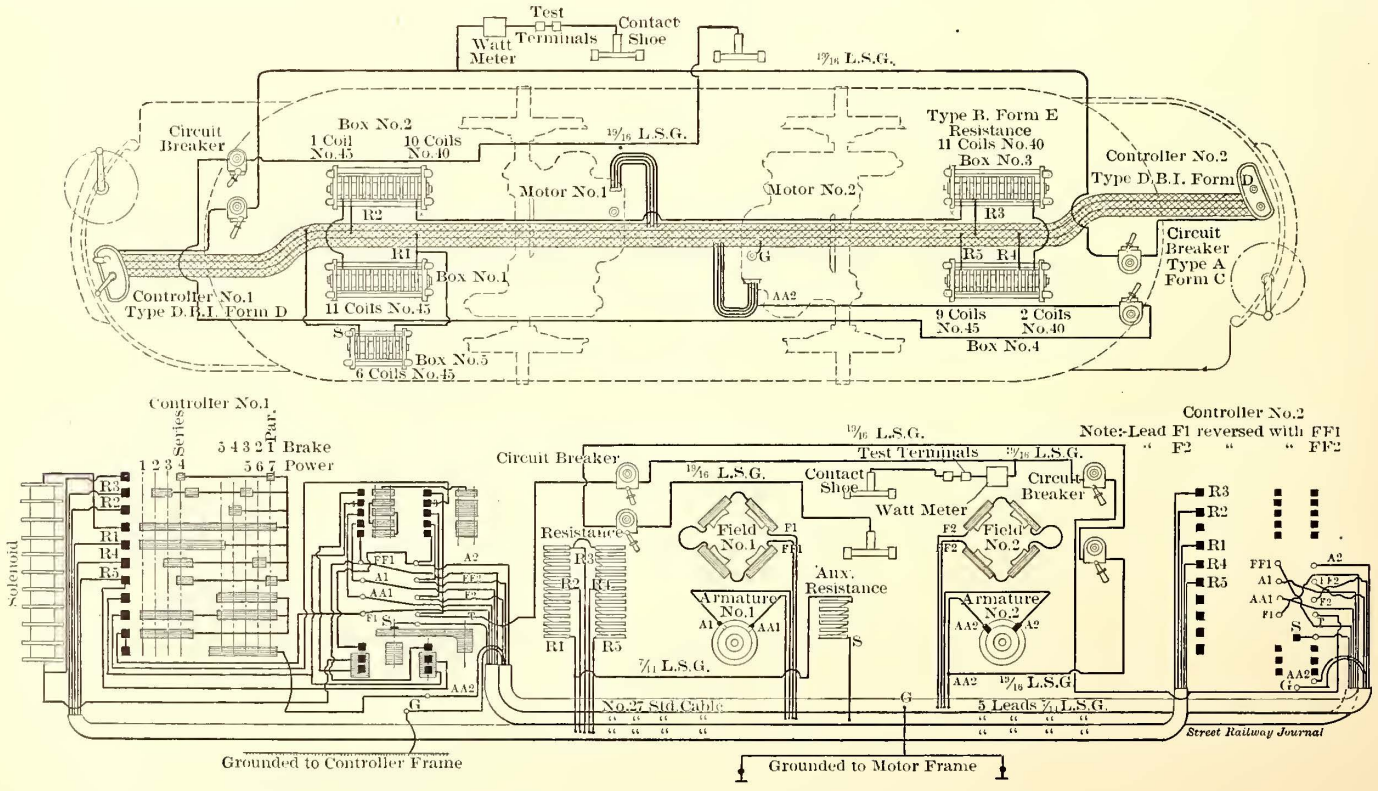
SPECIAL CONTROLLER, OPEN

armature windings, to which they are securely soldered. The brush holders are so designed that the current does not pass through any moving joints or tension springs. The tension can be applied to the brushes without lifting, and any brush can be removed without disturbance of the others.

The remainder of the machinery in course of construction comprises two 1500-kw three-phase alternators, directly coupled to Ferranti engines, and these develop current at 6000 volts when operating at a speed of 150 r. p. m. These sets are being erected in the works of the London Electric Supply Corporation at Deptford, and will supply current to sub-stations along the line.

ROLLING STOCK

It is proposed to operate 100 cars of the bogie type, ordered on the specifications of Dr. Kennedy. Since this order was placed a further order for 100 single-truck cars, on the specifications of J. H. Rider, electrical engineer to the London County Council, has been placed with Dick, Kerr & Company, Ltd., and these are now being delivered. The bogie cars are carried on Brill maximum traction trucks, the bodies being the standard construction adopted at the works of the Electric Railway & Tramway Carriage Company, Ltd. They are of the reversed stairway type, and are designed to carry sixty-six passengers. The overall dimensions of the cars are 31 ft. 6 ins. over the buffers, the extreme width being 7 ft. 1 in. The under frame of the car follows the usual Preston practice, and is constructed of teak, strengthened at the side sills by angle irons, which run the whole length of the car. The main structural work in the body of the car is of ash, the main body panels being of mahogany and the remaining panels of canary white wood. The roof is of double type, the inner boarding of pine, being covered with millboard. Considerable head room is obtained by the arrangement of the roof, which is of flat construction from side to side of the car. The ventilator framing is carried immediately under the roof, which provides effective ventilation, but does not cause draught. The interior of the car varies from standard practice, in that two large central windows and four small windows are used at each side of the car, the smaller windows being arranged with a movable sash, to give increased ventilation during hot weather. The interior is divided in the middle by a partition, the idea being that the conductor has better control over the seating of passengers by such an arrangement. The inside finish is of quartered oak, and the seats are covered with carpet. One plough is carried on each car, the carrier being on an extension of one of the



CAR-WIRING DIAGRAM, SHOWING CONTROLLER CONNECTIONS

trucks, and consisting of a strong rectangular frame, having a central rail on which the plough is free to move in a lateral direction.

The electrical equipment on the cars consists of two 3-A-4-type of motors, which give nominally 37-brake horse-power. This motor, while being extremely efficient, has high acceleration properties, and has been designed to meet the special conditions of London service. They follow the standard construction adopted by Dick, Kerr & Company, Ltd.

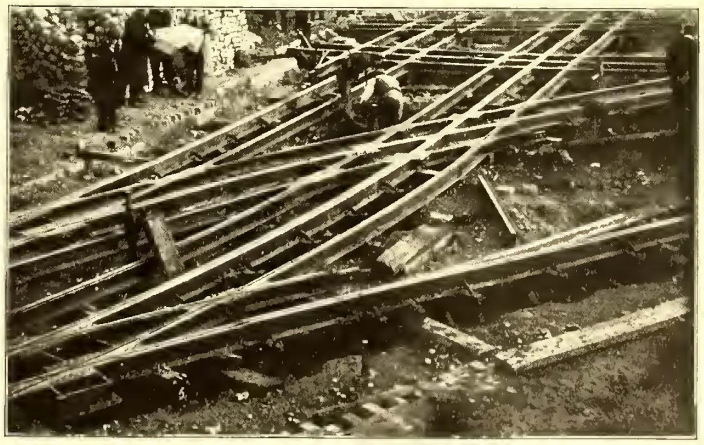
BALHAM CAR HOUSE

On account of there being no earth return on the London County Council system it has been necessary to adopt double canopy switches and automatic circuit breakers on the cars. These are of the standard Preston construction.

A new form of controller has been adopted which possesses some special features of interest, including the form of arc-disrupting device and the arrangements for rheostatic braking. The controller itself has been reduced in size without crowding the parts together. The arc-disrupting device consists of a solid iron core extending from the top to the bottom of the controller. This core is suitably wound throughout its entire length, but the windings are not all in the same direction. They are so arranged that the magnetic flux shall have proper relation to the direction of current flowing in the arc. Where a change in the direction of the winding becomes necessary a flange is cast on the core. The windings are then covered with suitable insulation, around which is placed a series of cylindrical thin copper rings, so arranged that each ring subtends a finger and contact. The blow-out windings are in series with the main current, and the effect upon an arc created between a finger and contact is that the arc becomes so attenuated that disruption takes place almost instantaneously.

The whole blow-out device is placed so that the copper rings are in close proximity to the source of arc, but for convenience sake is mounted on pivotal hinges, so that it may be swung back for inspection of the fingers, or it may be lifted right away from the controller, if required, without unscrewing any nuts or bolts whatever. The electrical connections for the blow-out windings are made automatically when the blow-out is in position. The blow-out is short circuited when on either the full series or parallel notches, but comes again into operation prior to any break in the circuit being made on the movement of the controlling handle.

In rheostatic braking sufficient power notches for easy acceleration are provided without reducing to an inconvenient minimum the distance between each notch, by arranging that the three notches used for power working in parallel should also do duty for the braking when approached in the opposite direction, i. e., from the brake side. In addition, two further brake notches are provided, which, on the power side, are merely transition notches. The controller under consideration has seven power and five brake notches, and the spacing between them, together with a positive and easy action of the notching gear, renders it almost impossible for the most careless of motormen to rest between the proper notches. The driving and reversing handles are interlocked in the usual manner, and neither handle can be removed from the controller unless it is at the "off" position. There are three sec-



SPECIAL TRACK WORK

tions in the power cylinder, the top seven rows of contacts engaging with seven fingers, to control the resistance in circuit and the operation of the blow-out, the next of three contacts

SLOT RAILS AND YOKE

and fingers to control in conjunction with the bottom section of one contact and finger the connections of the motors for series or parallel running.

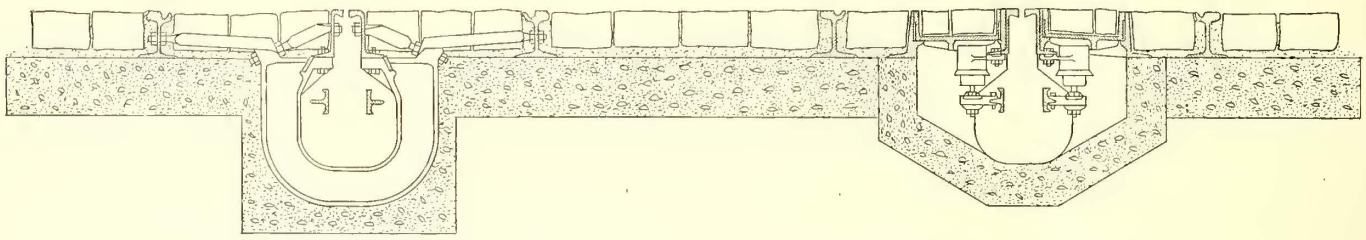
The wiring diagram given herewith gives a clear idea of the arrangement in connection with this form of controller. It should be explained, however, that this involves some alteration from standard wiring, these modifications being necessary in this system on account of the completely insulated return.

CONDUIT CONSTRUCTION

The construction of this conduit system presented some novel features, owing to the fact that the former horse-car track was laid in concrete. It was found that the old method of breaking out the old construction with road spikes and sledges was not only slow but costly, and some other quicker method had to be adopted. The procedure which up to now has proved most satisfactory is as follows:

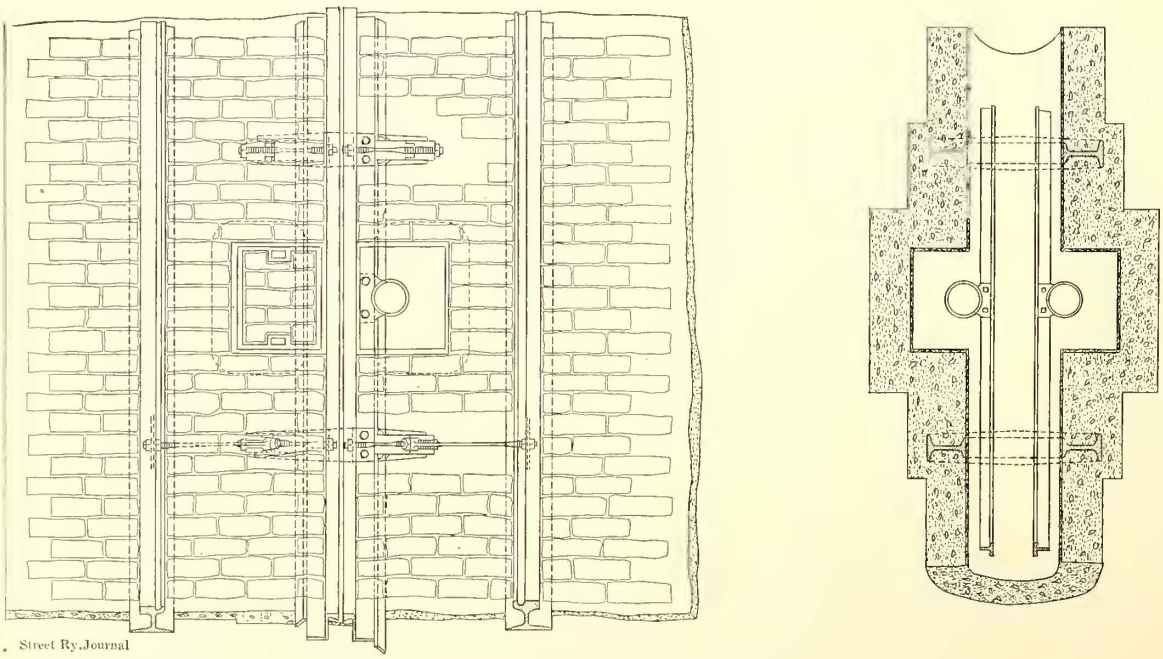
The margin of the old track on the outside was broken out just enough to permit the insertion under the concrete bed of special lever jacks. A distance of some 50 ft. to 60 ft. was dealt with at a time, and the jacks are spaced at about 4 ft. to 6 ft. centers, as the lifting resistance of the bed may require. The entire existing concrete bed and track was then lifted bodily, when it could readily be broken with spikes and sledges in the ordinary way from the top and removed.

The method then followed was similar to that employed in Brussels, and described in the Street Railway Journal for May 2, and also in New York. Spaces were first cut in the trench for the cast-iron yokes, which are at 3-ft. 9-in. centers throughout the whole length of the conduit, after which the rails were put in place and aligned, and the conduit was built up by wooden moulds. With the yokes as closely placed together as this a lighter form can be used, and in some ways it strengthens the construction, especially preserving the position of the slot rail and preventing it at all times from closing by outside pressure. The slot rail is of the Z-type, having a vertical web, and is constructed so that any surface water drops easily to the bottom of the conduit from which it is drained by special sewer connections. The service rails are 7 ins. high



Cross Section at Yoke Cross Section at Insulator Box

SECTION OF ROADWAY, SHOWING TRACK AND CONDUIT

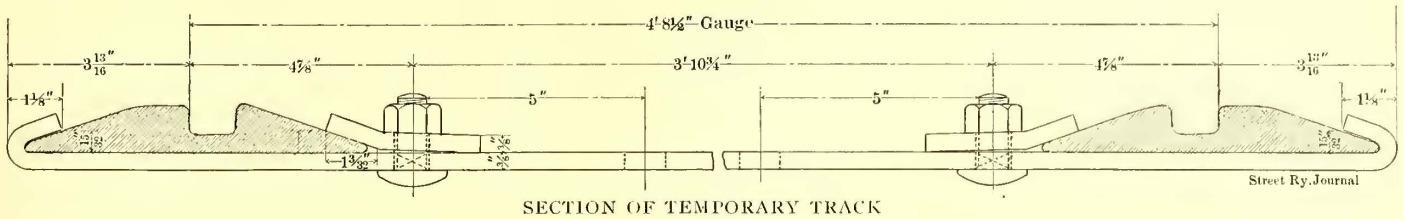


Street Ry. Journal

PLAN AND SECTION

with 7 ins. width of base, having a groove 1 1-16 ins. wide for straight track and 1 3-16 ins. on the curves. The tie-bars are attached not only to the slot rail and the yoke, but by extension pieces they are attached to the rail so as to preserve a perfect gage. The wooden moulds used for building up the conduit are in two parts.

The conductors used are similar to those employed in New York, and are supported by insulators every 15 ft. As provision has to be made for inserting or removing the conductor bars special gaps are left in the conduit, except where, as in most cases, the sump holes for draining the conduit to the sewers afford this facility. The conductor bars are fed into the conduit at the manholes, and are suspended by means of special tools to small carriages running on the tops of the slot rails, and in this way are carried to the point where they are required and secured to each insulator; the necessary bonds for connecting electrically the adjacent T-rails are fixed in position by a special hydraulic press, which can be used through the insulator box opening.

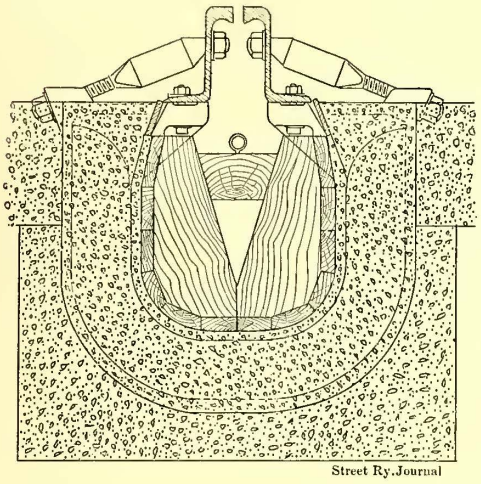


SECTION OF TEMPORARY TRACK

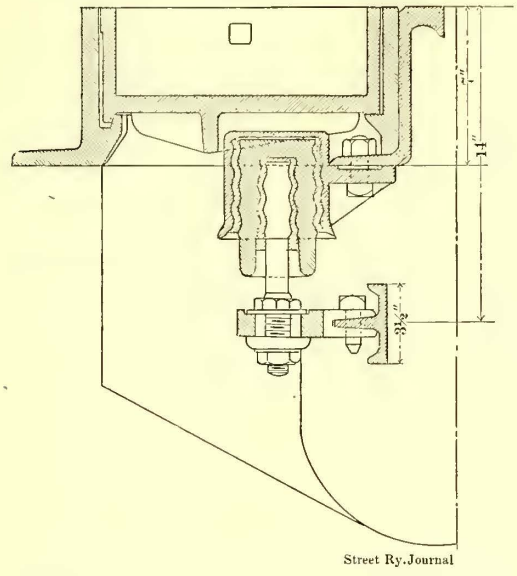
Drainage sumps of ample size are provided at intervals of about 50 yds, as the grade of the road may require, and these sumps are trapped and connected to the nearest sewer.

Another point of interest in connection with the equipment of the lines was the fact that the present horse traffic was kept going during the reconstruction. Moreover, the vehicle traffic on the streets under reconstruction was considerable, so that provision and maintenance of a temporary track became an important factor, and necessitated a special flat section rail which would be surmounted without injury to springs of the passing vehicles. The special section now in use for this purpose was expressly rolled by Dick, Kerr & Company, Ltd., for the London County Council P. W. contract, and the special work was supplied by the Lorain Steel Company and Hadfields Steel Foundry Company, of Sheffield.

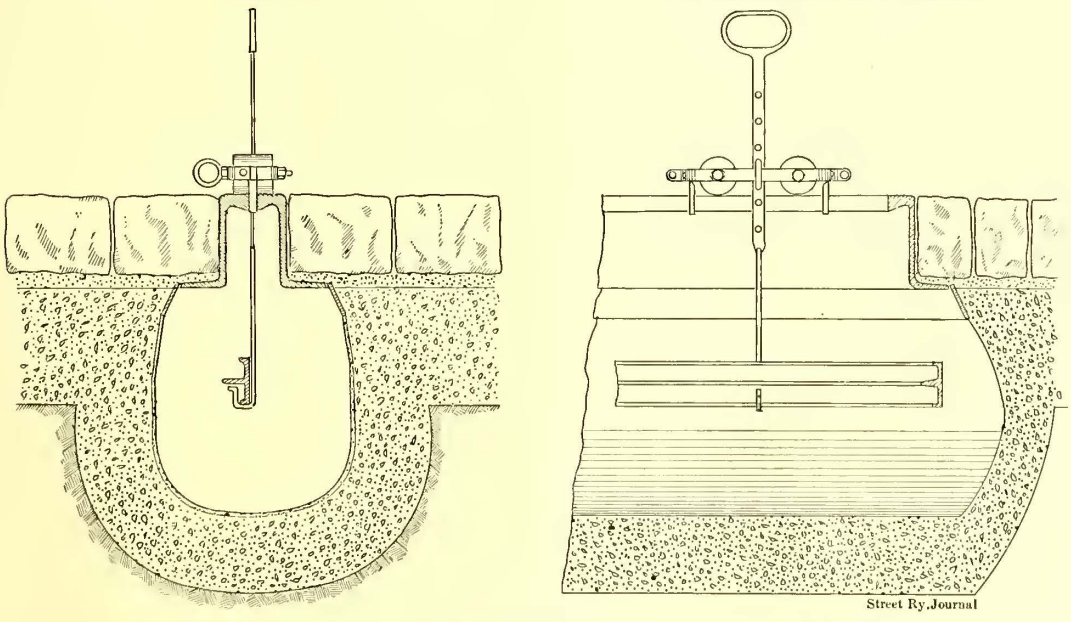
As stated there were two contractors for the work, J. G. White & Company, of London, built the first section, and Dick, Kerr & Company that between Old Kent Road and Greenwich.



SECTION SHOWING WOODEN MOULD FOR CONDUIT



SECTIONAL VIEW OF INSULATOR BOX, SHOWING INSULATOR IN POSITION



SECTION AND ELEVATION, SHOWING CONDUCTOR RAIL CARRIER

GRADE CROSSINGS

It is announced that important changes are to be made in the State's regulations for grade crossings of steam railroad tracks by electric railways in Massachusetts. It is known that the Railroad Commissioners believe the daily operating conditions at some of these crossings, particularly those in and near Boston, are considerably more dangerous than they would be under different regulations; and the logical conclusion is that some kind of an order will, without doubt, shortly be issued from the Commission's office to deal with the matter, as there has been considerable discussion of late bearing upon the subject, and the Board has been at work investigating the causes of the accidents reported.

RAILWAY AND LIGHTING STORAGE BATTERY AT MILWAUKEE

The Milwaukee Electric Railway & Lighting Company has just completed the installation of a large storage battery plant at its central power station, which is notable as being the first large storage battery installation in this country, installed for use on either lighting or railway circuits. The Milwaukee Electric Railway & Light Company operates the street railways in Milwaukee and furnishes the electric light service. It has an Edison 3-wire direct-current network for the downtown district.

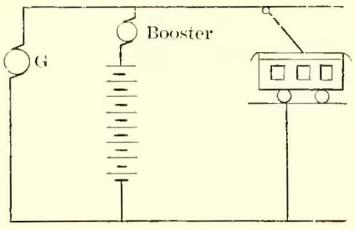


FIG. 1.—RAILWAY BATTERY

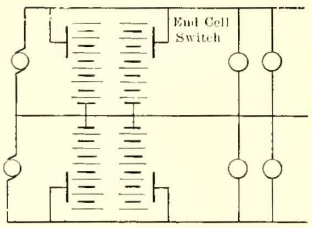


FIG. 2.—LIGHTING BATTERY

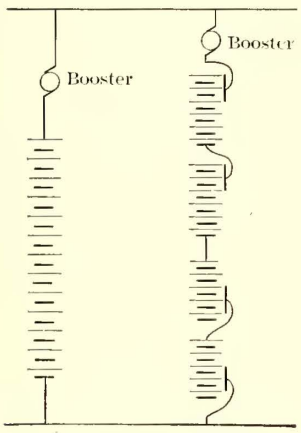


FIG. 3.—BOTH BATTERIES ON RAILWAY SYSTEM

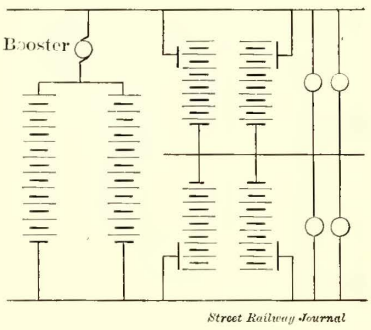


FIG. 4.—BOTH BATTERIES ON LIGHTING SYSTEM

The use of the same batteries for railway or lighting involves a little more complication in switching but affords a reserve for either railway or lighting plants. These advantages have already been demonstrated at Milwaukee, as there have been times when the ability to work the entire battery on the railway load has helped the transportation department out of a very tight place.

The battery is installed on the upper floor of the company's station on East Water Street, located on the east bank of the Milwaukee River, which was built several years ago, and provision was made for the storage battery at that time, but only recently the battery was installed. John I. Beggs, president and general manager of the Milwaukee Electric Railway & Light Company, foresaw the advantage and flexibility of a battery so connected as to be used on either railway or lighting circuits, and although this has not been the standard practice he insisted that this battery plant should be so arranged that it would be a reserve at all times, to be connected to either the railway or lighting loads. As said before, the wisdom of this decision has already been demonstrated.

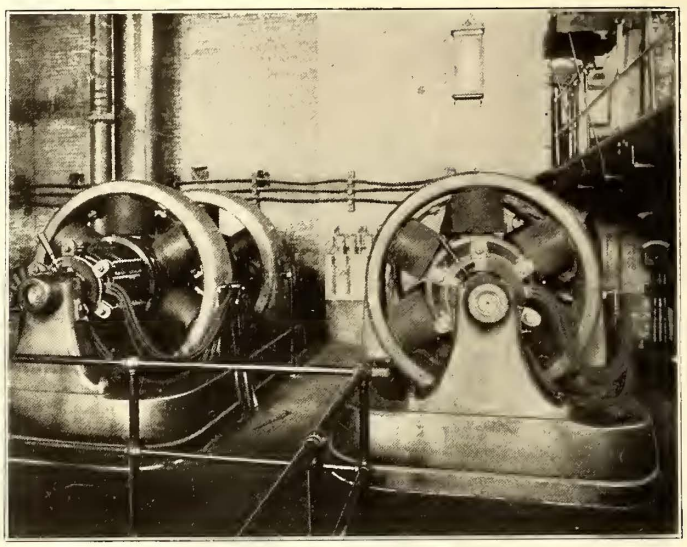


FIG. 8.—BOOSTERS

This battery, which was furnished and installed by the Electric Storage Battery Company, consists in all of 608 cells. These are grouped in various combinations, according to the uses to which they are being put. What will be designated as the railway battery in this article, because it is usually operated on the railway load, consists of 288 cells connected across the railway bus-bars in series with a special booster, as seen in Fig. 1.

The battery ordinarily placed on the lighting load has its connections indicated in Fig. 2. In this battery there are 320 cells, divided into two series of 160 cells each. They are connected across the direct-current 3-wire incandescent lighting bus-bars. An end cell switch, by which some of the end cells can be thrown in or out, is placed in each series of cells.

In case it is desired to connect both batteries to the railway load, switches are provided by which the arrangement shown in Fig. 3 can be obtained. Here the railway battery is connected between the railway bus-bars just as in Fig. 1. The cells comprising the lighting battery have all been placed in series, and are connected through a second booster across the railway bus-bars. The voltage of the lighting battery is raised or lowered to correspond to that of the railway bus-bars by cutting in or out end cells with the end cell switches.

In case both railway and light batteries are to be connected on the lighting circuit the ar-

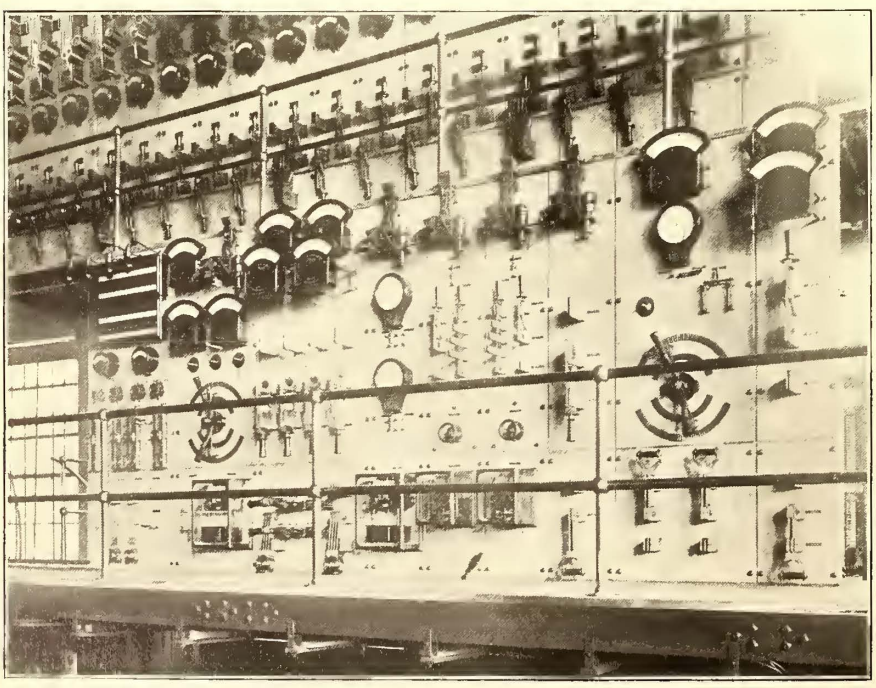


FIG. 7.—SWITCHBOARD FOR BATTERIES

rangement shown in Fig. 4 is adopted. Here the lighting battery is connected, as in Fig. 2, and the railway battery has been divided into two sets, which are put in multiple with each other. These two sets charge or discharge on the lighting bars through the booster.

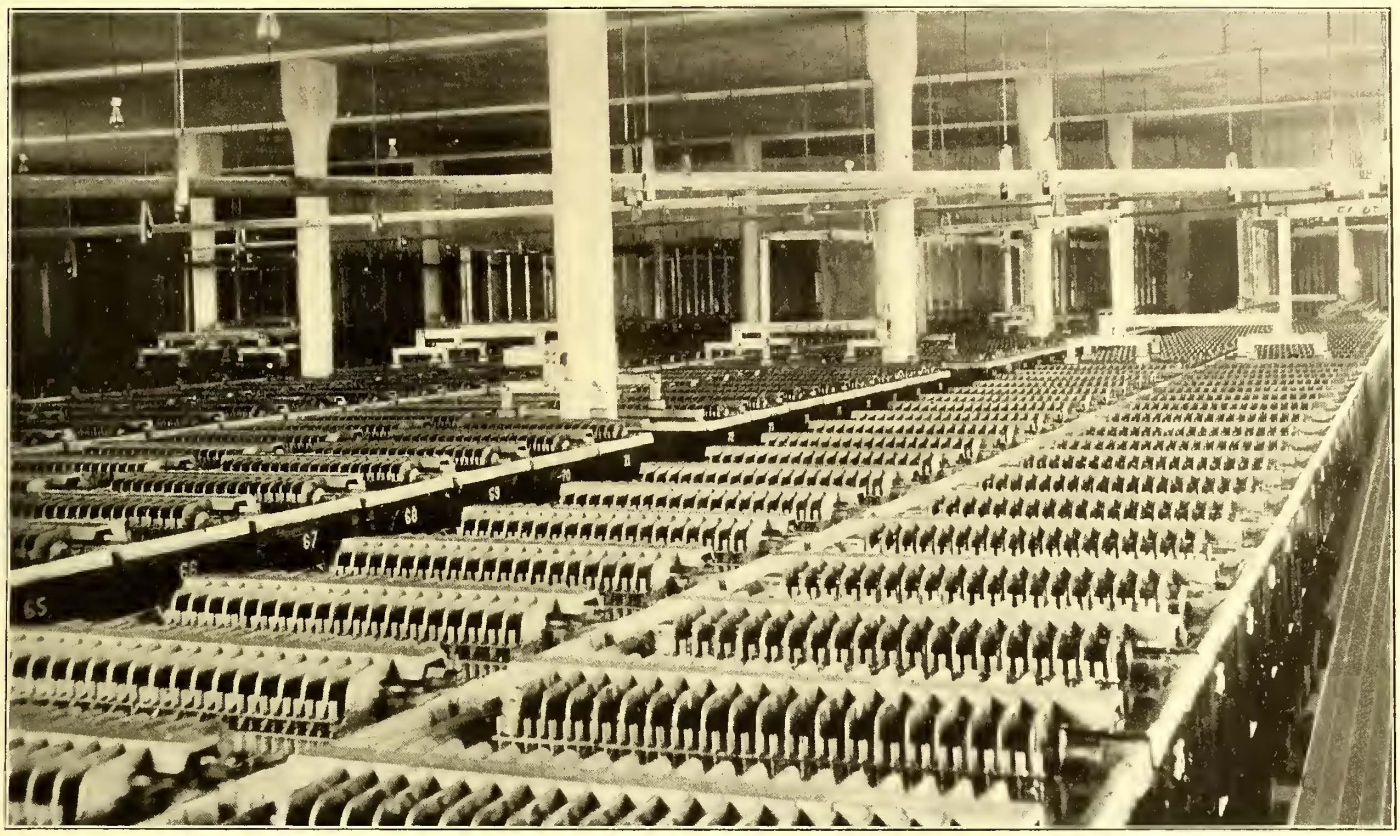


FIG. 5.—BATTERY ROOM, SHOWING END CELLS

The arrangement is thus very flexible. The railway battery can be charged on the lighting bus-bars when the lighting generators would be otherwise idle, and can be put on to the railway load to help in summer traffic. In other words, the lighting generators can be made to help the railway generators without interfering with their usefulness on the lighting load. On the other hand, the railway generators might be made to help out the lighting load by charging batteries for use on the lighting circuits. The batteries act as a reserve, to tide over emergencies in either railway or lighting departments.

The cells of both batteries are known as the G-39 type, consisting of thirty-nine plates in lead-lined tanks. The tanks are 41¼ ins. wide, 20¾ ins. long, and 24½ ins. high. The plates are 15½ ins. x 15½ ins. These cells have a capacity of 1500 amps. for one hour, or 750 amps. for three hours. Since the railway battery consists of a single series, its capacity is 1500 amps. for one hour, and that of the lighting battery, consisting of two series, is double this. The normal charging rate for the lighting battery is 750 amps., or 375 amps. per series. The end-cell regulating switches have twenty-one points, thereby permitting the cutting in or out of twenty-one cells. These switches are of 2000-amp. capacity. The copper bus-bars from the end cells have a cross section of ¾ sq. in. At the points where the bus-bars are taken off, at the end of each series of cells, and also at each end cell, the capacity of the lead plate connectors on the cell is reinforced by a lead-covered copper bus-bar, which is connected to two points of the lead connector to which the battery plates are burned.

Figs. 5 and 6, which give an idea of the extent of the battery room, show this arrangement of bus-bars well. They also show the flexible suspension of the lead-covered bus-bars from the ceiling. This battery room is peculiar in being located over

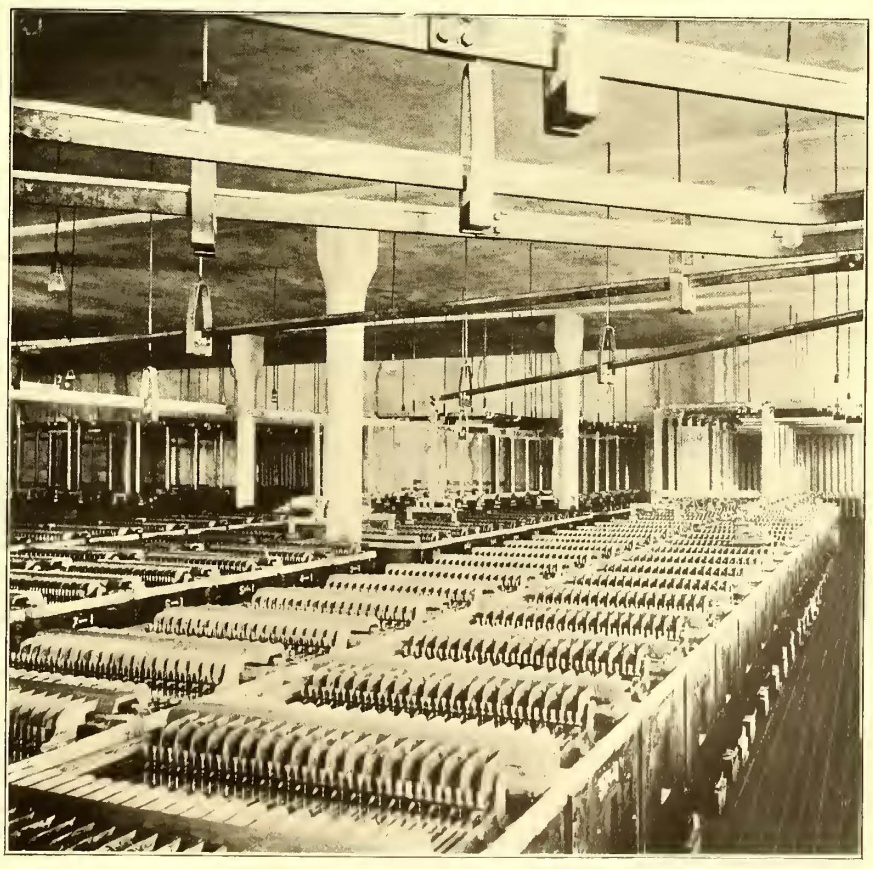


FIG. 6.—FLEXIBLE SUSPENSION OF LEAD-COVERED BUS-BARS

the generating room, the actual weight of the batteries, with bus-bars, is something over 1,000,000 lbs., as the weight of one cell alone is 1626 lbs. The room is 71 ft. x 98 ft.

The switchboard by which the various combinations of railway and lighting batteries can be made, is shown in Fig. 7. It is located directly under the gallery containing the regular feeder board of the Edison 3-wire network. At the left is a panel containing the apparatus for controlling the four end cell switches. Circuit breakers are all of the I. T. E. laminated edgewise type. There is a circuit breaker in the motor circuit of each booster, and this circuit breaker is made interlocking with the circuit breaker in the circuit of the booster armature. In case the motor-circuit breaker opens the interlocking device causes the booster circuit to be opened also. This is to prevent the booster from running away and tearing itself to pieces, as it might if its circuit were kept closed with the motive power from the booster motor cut off. The circuit breaker in the booster circuit does not, however, disturb the circuit breaker of the motor driving the booster by its opening, as there is no reason why the booster should be stopped every time its circuit breaker opens.

The boosters are shown in Fig. 8. They can be controlled so as to cause a battery to charge or discharge at any predetermined point, by varying the strength of the shunt field, or, if necessary, changing its direction.

By using railway generators with very little compounding effect of the battery, and with the air of the booster, the fluctuation above or below a certain amount is taken care of, and this amount is determined by the adjustment of the shunt field of the booster.

The battery room was fitted up with great care to prevent any possible leakage of acids through the floor onto the iron work, or onto the generating machinery below. On top of a layer of concrete tar paper and pitch were spread, and over this a tile, burned extremely hard, was laid, with spaces between of ¼ in. Into the opening pitch was poured even with the top of the tile. Sheet lead was laid around the edges of the room; to prevent acid getting through at the place where the floor joins the wall. This lead was carried up like a base-board for a short distance above the floor. The same precautions were taken at the pillars. The whole interior of the room was coated with acid-proof cement.

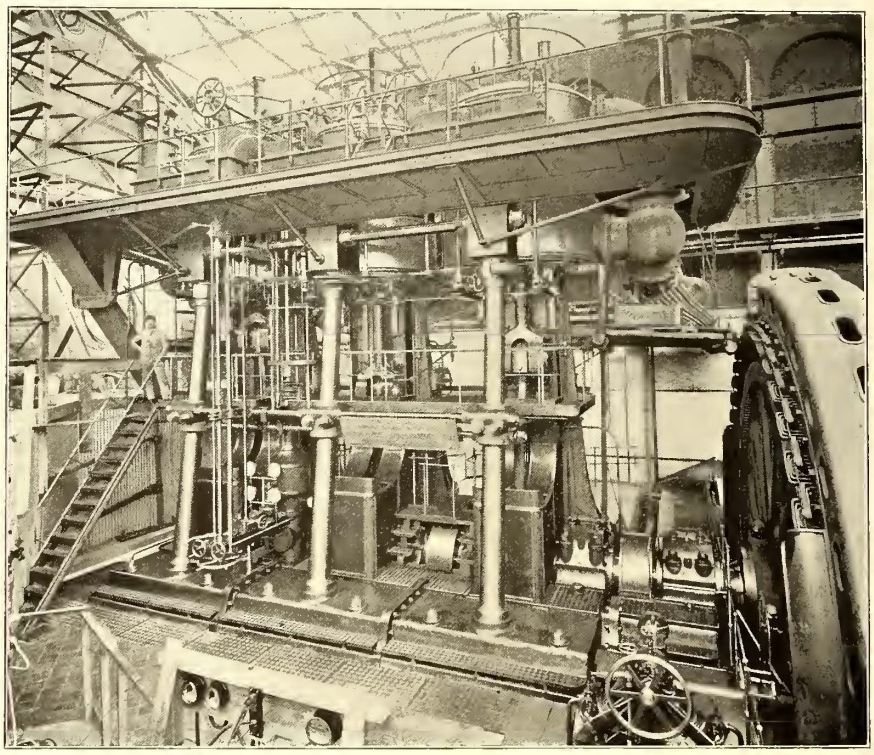
BROOKLYN ELEVATED EXTENSIONS

The Brooklyn Rapid Transit Company plans soon to establish through elevated train service between the Brooklyn Bridge and Jamaica, thus entering into direct competition with the Long Island Railroad for suburban traffic. The company has constructed an incline at Cypress Hills, the terminus of the elevated lines, and will run the trains of the elevated from the bridge to Cypress Hills, from which point the trains will run over the surface of the Jamaica Plank Road and Fulton Street to Grand Street, Jamaica.

The bridges of the Long Island Railroad on the Rockaway Division and the Montauk Division, where they cross Jamaica Avenue, had to be raised 2 ft. or 3 ft. to permit the passage of the elevated trains beneath them, and the distance between the tracks at the curves and switches had to be considerably widened also. All this has been done. The running time between Jamaica and the bridge, a distance of about 12 miles, will be about 45 minutes.

MODERN ENGLISH POWER PLANT

The extensions to the generating station of the Metropolitan Electric Supply Company at Willesden, London, include two 3000-kw two-phase direct-connected generators, each machine designed to operate at a speed of 75 r. p. m., and a frequency of 60 cycles. They are noteworthy as being the largest that have yet been operated in Europe, and on account of the conditions under which they have to work. These generators operate in parallel with the existing 1500-kw Westinghouse generators, which are of the revolving armature type, designed for 500 volts, the current being raised to the bus-bar pressure of 10,500 volts, or thereabouts, by means of 8000 kw of step-up transformers. The contractors for the additional equipment are Witting Bros., of London, while the makers of the two



MAIN PLATFORM OF 5000-HP ENGINE IN WILLESDEN STATION

engines are Sulzer Bros., of Winterthur, Switzerland, and the makers of the generators are Kolben & Company, of Prague, Austria.

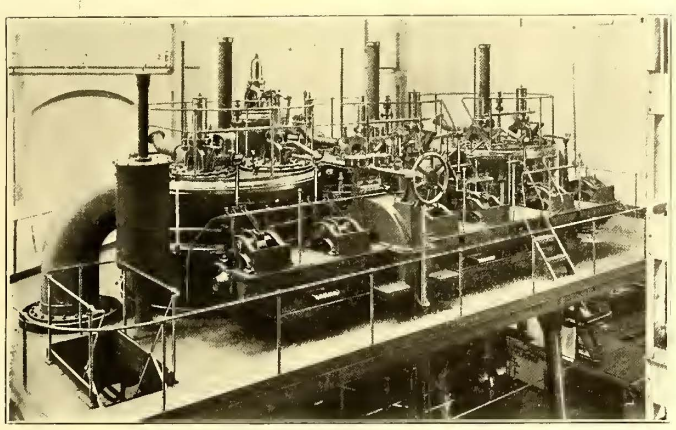
Each of the 5000-hp engines is of a vertical three-cylinder compound type, the high-pressure cylinder being in the center. The crankshaft is extended at one end, in order to carry the revolving field of the generator, and the shaft projects beyond the outboard bearing, in order to allow the exciter armature to be mounted directly upon it.

The high-pressure cylinder of each engine has a diameter of 50 ins., and each of the low-pressure cylinders 71 ins. The length of stroke is 51¼ ins. The engines are designed to work with a normal steam pressure of 150 lbs. per square inch at the stop valve, with a normal vacuum of 28 ins., and without any superheating whatever.

The valves and valve gearing of the engines are of the Sulzer type. The admission and exhaust valves are four-seated drop valves, combining a very large port area with small clearances. They are placed in the upper and lower cylinder heads, to insure the shortest possible steam passages and the least clearances. The valves are operated from a horizontal shaft carried in an oil trough with the necessary bearings. This shaft is driven from a vertical shaft by means of a pair of machine-cut spiral gears (bronze and steel) running in oil, and the vertical shaft itself is driven by means of a similar

pair of gears from the crankshaft. All the valves, with the exception of the two admission valves of the high-pressure cylinder, are actuated by eccentrics in connection with rocking levers, the latter being arranged with long strokes on the ends opposite the valve rods in order to be able to obtain large curves. These levers give very favorable leverage at the moment of opening, fast motion afterwards and very soft closing motion again. The two admission valves of the high-pressure cylinder are operated by a releasing gear, which is varied by the governor from 0 per cent to 55 per cent cut off. The governor is mounted directly upon the vertical shaft before mentioned, in order to do away with an indirect drive. It can be altered by hand, while the engine is running, to give speed variation of 5 per cent. There is also an automatic emergency governor provided, which comes into operation when a certain prearranged speed is attained and the vacuum destroyed, thus effectually providing against racing.

The main engine bed-plate consists of three separate parts, which are fitted and bolted together by means of turned surfaces concentric with the shaft. The crank races are arranged



UPPER GALLERY AND VALVE GEAR OF 5000-HP ENGINE

to catch all the drip oil from the cranks, there being a separate race for each crank, connected by a channel terminating in an oil filter. Circulating pumps raise this oil after filtration into an oil tank at the top of the engine, from which it is distributed by means of oil pipes, fitted with special regulators to the crankshaft and other principal bearings to be lubricated.

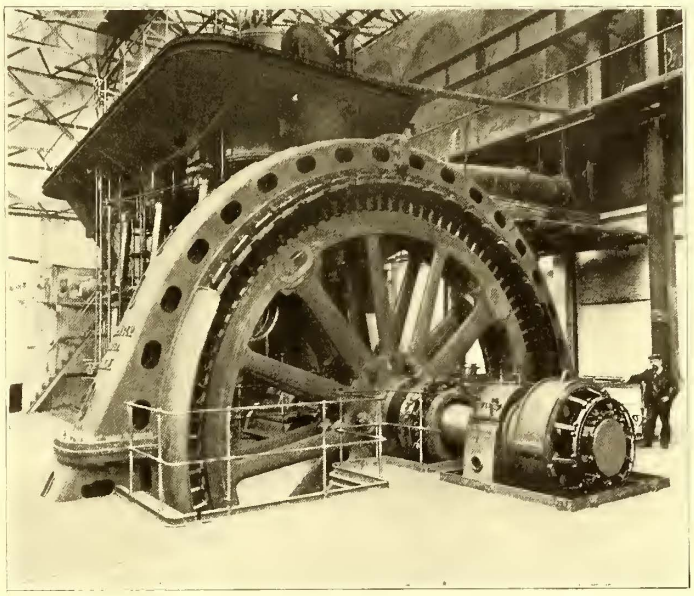
The massive cast-iron cylinder standards are bolted directly to the bed-plates, the cross-head guides (which are provided with water jackets) being screwed to them. The cylinders are supported on the opposite side of the standards, in the front of the engine, by means of heavy steel pillars, the lower bosses of which are let into the bed-plate to the extent of 5 ft. On account of this and also because the pillars are stiffened by special tie-rods about half-way up, the engine operates at all loads without the slightest vibration, and without any movement whatever of the stationary parts.

The crankshaft proper consists of three sections, each containing a crank and each working in its own pair of bearings (none of the cranks being overhung). These sections are each in one piece, the coupling flanges being forged with them. The generator shaft, comprising the fourth section of the whole shaft, has a flange forged upon it, by means of which it is bolted to the crankshaft proper. Its other end is carried by the outboard bearing, and projects beyond this to carry the armature of the exciter. The object of making the crankshaft in four sections is to insure sound forgings and easy removal of any one part. The whole shaft is of Krupp's best open hearth Siemens-Martin steel, having a tensile strength not less than 28.5 tons per square inch, and at least 20 per cent elongation. Under the most exceptional circumstances the combined bending and torsional stresses on this shaft will be less than 8500 lbs. per square inch in any part. To ensure absolute safety and soundness of forgings, the whole shaft and the crank pins have been provided with a 4-in. internal hole, allowing the most careful inspection inside.

The pedestal casting of the inside generator bearing, next to the engine, really forms part of the main bed-plate, as it is fitted and bolted to the adjoining section of the main bed-plate in the same manner as the three sections of the bed-plate already referred to. The pedestal of the out-board bearing stands upon a separate plate, and is adjustable in height. The bearing itself is self-aligning.

One main stop valve is provided so that the engines can be handled either from the floor level or from the main platform, which is about 21.5 ft. above the floor level.

The pistons are constructed as light as possible, and provided



3000-KW GENERATOR IN METROPOLITAN STATION

with self-expanding cast-iron rings, which exert an even circumferential pressure of 3 lbs. to 4 lbs. per square inch. The pistons are provided with tail rods, having a diameter of 7 ins. These tail rods are made separately, and they can be easily dismounted when it is necessary to remove the pistons. The piston rods themselves have a diameter of 9 ins., and are forged in one piece with the cross-head.

The crankshaft, connecting rods, cross-head, piston rods and valve rods, together with most of the valve gear parts, and all the studs and pins, are of the best forged steel, hardened in the wearing parts, all nuts being case hardened. Screws and nuts are Whitworth standard, except in the larger sizes, where a special semi-circular thread is used for increased strength.

Messrs. Sulzer have guaranteed that at the stop-valve pressure of 150 lbs. per square inch, and with a vacuum of 25 ins. the consumption of dry saturated steam will not exceed the figures given below, and that the efficiencies will be greater than the values given in the third column:

	Steam consumption per ihp-hour, lbs.	Mechanical efficiency excluding air pump friction, etc.
Full load	15	92.5 Per cent
Three-quarters load	14	90 " "
One-half load	14	86 " "

It is claimed that should these engines ever be operated with steam superheated to, say, 117 degs. F. (65 degs. C.) above the temperature of saturated steam at 150 lbs. per square inch, the steam consumption figures will be as under:

Full load	13¼ lbs. per ihp-hour
Three-quarters load	12½ " " "
One-half load	12½ " " "

Each engine, previous to shipment, was erected complete,

and the whole of the valve gear tested mechanically at different speeds, driven by motor and under steam.

Each two-phase generator is of the revolving field type, with stationary external armature and direct-coupled overhung exciter. The maker's rating of each generator is 3500 kw, at a pressure of 10,500 volts per phase at 60 cycles, when driven at a speed of 75 r. p. m. But each generator has to be capable of giving an output of 3000 kw at any pressure between 10,000 volts and 11,500 volts per phase. Actually, each generator was guaranteed to give a continuous output of 3000 kw upon a non-inductive load at a pressure of 11,000 volts per phase, for a period of twenty-four hours, with a temperature rise in any part of the generator or exciter of less than 70 degs. F. above that of the surrounding atmosphere. The trials of the first machine have shown that the actual temperature rise, under these exact conditions, is only 45 degs. F.

Each generator was, moreover, guaranteed to carry a non-inductive overload of 25 per cent, or 3750 kw, for a period of four hours without undue heating or undue pressure drop. Trials on the first set (working non-condensing with high-pressure steam in low-pressure cylinders) have further shown that this overload can be carried with a pressure drop of only 8 per cent from no load to full load at constant speed and excitation. The efficiency of the generators when working upon non-inductive loads including the excitation and ventilation losses as at full load, is 96 per cent; three-fourths, 95 per cent; one-half, 93 per cent.

The insulation of the armature windings withstood for a period of 20 minutes 30,000 volts, alternating, applied between the two phases, and 20,000 volts, alternating, applied between the windings of either phase and the (earthed) armature core.

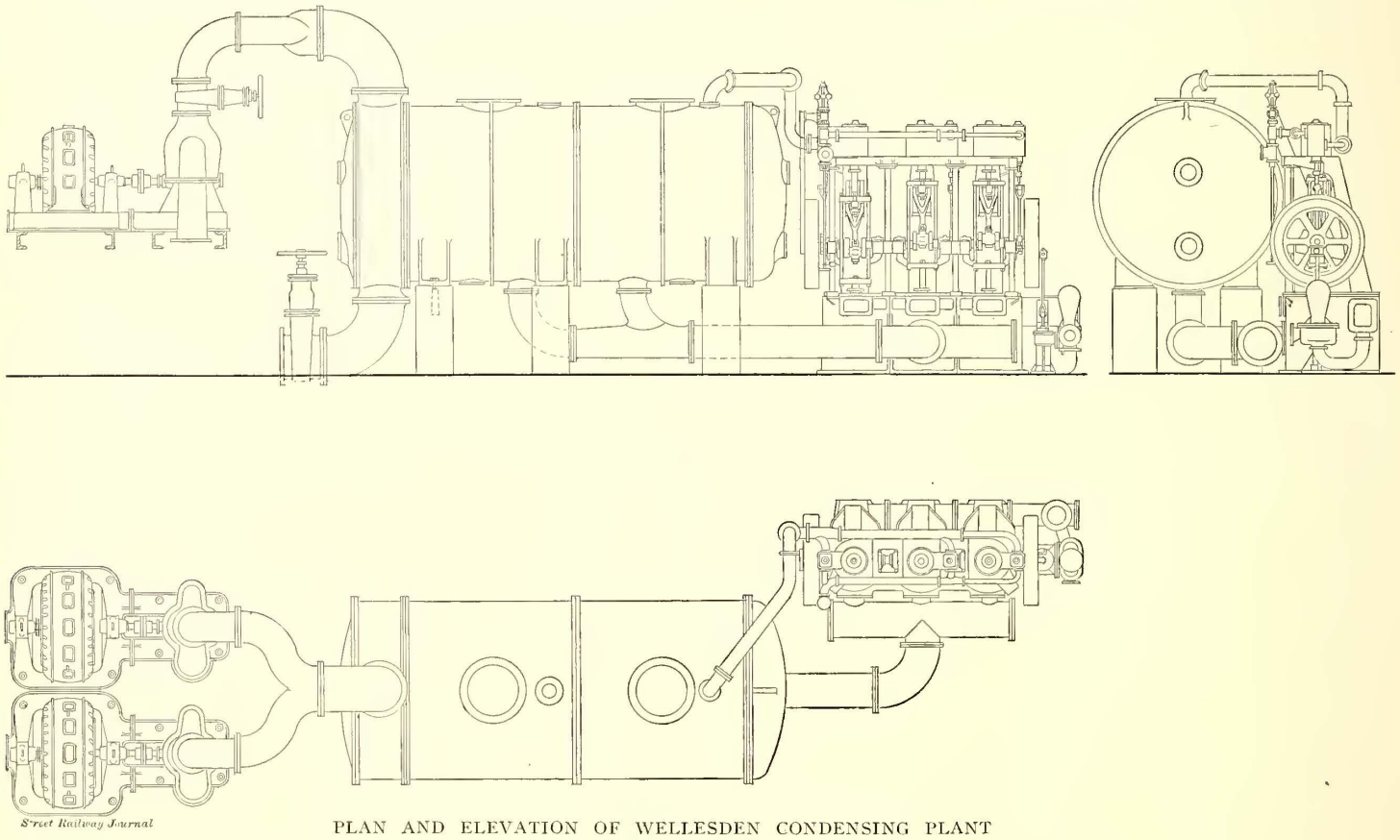
The cast-iron armature case is in four pieces, secured by means of bolts and eight shrinking rings. The lower half of the casing, which is subjected to the greatest stresses, is supported below in the pit. In order to render the armature coils readily accessible at any time for cleaning or inspection the whole armature is capable of being moved in a direction parallel to the shaft, and suitable screw gear is provided for effecting this movement.

The armature core discs are built up inside the casing, and are secured to the latter by means of dove-tails. The armature coils are first former-wound in the micanite tubes, and then carefully taped and varnished.

The revolving field of each generator has a steel rim having a stiff U section, and being united to the center boss by means of twelve pairs of radial arms. This wheel is constructed in four sections, which are united by means of bolts and heavy shrinking rings. The center boss or hub, which is carefuly keyed to the extended crankshaft, is also secured by means of bolts and shrinking rings, the latter having a section of 36 sq. ins. The 96-pole cores are of the softest cast-steel, of oval section, with the laminated pole-shoes cast in with them.

The magnet windings consist of copper, strip-wound on edge, the adjacent layers of this strip being insulated by means of special parchment paper insulation, having a thickness of about 1-50 in.

The slip rings which serve to lead the exciting current into the field winding are of phosphor bronze and are carried on a cast-iron spider. The brushes for these rings are of block carbon, the current density at the bearing surfaces being about 30 amps. per square inch.



PLAN AND ELEVATION OF WELLESDEN CONDENSING PLANT

Each exciter consists of a multipolar generator with cast-steel field system and a slotted, former-wound, drum armature of the series parallel type. This is rated at 250 amps. and 150 volts. The brushes are of block carbon, and press upon the commutator, which is constructed of hard-drawn segments insulated by mica.

In the steam plant ten boilers have been installed for supplying steam, six being of the dry-back economic type, by John Fraser & Son, of London, and four Babcock & Wilcox, with superheaters and motor-driven chain-grate stokers. Each of these boilers is guaranteed to evaporate 10,000 lbs. of water per hour. Fully 15,000 lbs. per hour have been evaporated for considerable periods by the chain-grate stokers with double-screened nutty coal.

W. H. Allen, Son & Company, of Bedford, is supplying condensers for both engines, each set consisting of one surface condenser with 11,000 sq. ft. of cooling surface and capable of

dealing with 90,000 lbs. of steam per hour at a temperature not exceeding 212 degs. F., with circulating water at 80 degs. F. or under, the vacuum to be within 4-in. absolute under these conditions. The outer casings are of cast-iron, fitted with rolled brass tube plates, 1⅜ ins. thick, and solid-drawn brass tubes, 1 in. external diameter. The tubes are fixed into the plates by means of screwed ferrules at one end, the ferrules being provided with lips to prevent the tubes from slipping out of place, and at the other end they are expanded into the plate. One of the water-heads of the condenser is divided by a diaphragm so that the water will first pass through the lower half of the tubes and thence through the upper half to the discharge outlet at the top of the condenser. There is also one three-throw, single-acting, steam-driven Edwards air pump, with an auxiliary pump attached to deliver air-pump discharge water to hot well in boiler house, and two 15-in. centrifugal circulating pumps, each driven by a two-phase motor. Oil separators with grease extractors are fitted on each exhaust pipe, and an automatic valve is also fixed on each pipe to open to atmosphere in the event of vacuum failing.

The circulating pipes are 30 ins. diameter for the greater part of the distance to cooling towers, and are carried through a tunnel under the boiler house foundations.

Two cooling towers, each capable of dealing with the full load of one 5000-hp engine, and able continuously to cool 236,250 gals. of water per hour, reducing the temperature from 150 degs. F. down to 80 degs. F., are provided. Each tower consists of two bays 75 ft. high, the whole being 123 ft. long by 31 ft. wide, made entirely of wood, fastened together by wooden dowels and copper nails. Three 14-in. pipes deliver the water to the tower at a height of 26 ft. above ground level.

Ferranti & Company supplied the switchboard, and it consists of three sections, one for each machine, and the third for the outgoing cables and forming an interconnector panel, enabling either of the machine panels to be made dead for cleaning purposes or for killing either pair of outgoing mains whilst under repair. The board is built for 11,000 volts and to control two 3000-kw two-phase alternators, and is complete with exciter gear, synchronizing arrangements and all necessary switches, fuses and instruments. The main frame is formed of horizontal enamelled slate slabs, 3 ins. thick, built into the engine room walls and divided into cells by vertical partitions. The bus-bars are rectangular, 0.5 sq. in. in section, and totally enclosed in an insulated chamber, provided with plug sockets to enable any particular panel to be isolated. Oil-break fuses are provided for each phase, capable of safely breaking 200 amps. at 11,000 volts, the fuse is three-fourths of an inch long and drops into 24 ins. of oil. Oil-break switches are used, one in each phase, capable of breaking 1500 kw at 11,000 volts. The interconnector panel is supplied with oil-break switches also, but not for breaking full load, and also carries the cable receivers. All transformers are dry insulated. The wattmeters are recording and indicating, and are connected through the outer or earth side of the circuit. These meters, it is hoped, will not be affected by the power factor or change in periodicity. Single-pole shunt and main field switches are included.

Altogether the present extension forms an interesting installation, and affords abundant evidence of the rapid development of the electrical interests in Great Britain.

The electric cars that run between Redlands and San Bernardino are to be equipped with telephones. The new switchboard has arrived and will be installed at once in the power station. The line will provide for twenty instruments. Ten will be installed on the cars, and there will be five stations between the two cities and one at each end of the line. It will be possible to communicate between stations or cars, or talk from the cars to any of the stations while enroute.

RECENT ADDITIONS TO THE GENERATING PLANT OF TEH MONTREAL STREET RAILWAY

BY RALPH D. MERSHON

The Montreal Street Railway Company has recently completed the installation of an addition to its generating plant which is interesting in a number of respects and in some regards unique. This addition comprises the machinery and switchboard apparatus required for receiving, from the Montreal Light, Heat & Power Company, power transmitted from the hydraulic generating plant of the latter company at Chambly, 17 miles from Montreal.

The maximum power generated by the street railway company in its present station, at greatest peak load, is about 13,000 hp. For this supply of power the company has a steam plant, with a maximum capacity of approximately 17,000 hp. The additional power mentioned above has been installed because of the fact that the power company can supply power to the street railway company at a price which makes it worth the while of the latter company to put in apparatus for utilizing the power and allow a corresponding amount of steam-driven apparatus and machinery to lie idle. The capacity of the new apparatus installed is such as to enable the delivery, continuously, to the bus-bars of the street railway company of 5000 hp in direct current, with a relay capacity of about 15 per cent. This means, therefore, that 5000 hp of steam-driven machinery is put out of commission except in so far as may be necessary for the proper care of it and for having it ready, without too much preparation, in case of emergency.

The power is supplied to the railway company as alternating current at 66 cycles, 2200 volts quarter phase. There are seven quarter-phase circuits supplying this power, one for each of the seven-motor generator units receiving it. The circuits are brought overhead from the sub-station of the power company to the power house of the street railway company, though ultimately they will go underground.

The machinery for receiving and converting the power consists of seven direct-connected motor generator units, each having a rated capacity at the direct-current end of 500 kw, with a continuous overload capacity of 25 per cent, and an overload capacity of 50 per cent for one hour. The motor of one of these units is a synchronous machine, the other six motors are of the induction type. The synchronous unit was installed some time before the induction units, and really forms an installation separate and distinct from that comprising the six-induction motor generator sets. This unit and its switchboard were supplied by the Canadian General Electric Company.

The complete diagram of connections and circuits in the case of the six induction motor generator sets is shown on page 834. As will be seen by inspection of the diagram the units are started from the direct-current side only. They are brought up to speed, using the direct-current generator as a motor, and, when at approximately normal speed, as indicated by the position of the field rheostat, the induction motor is connected to the alternating-current circuit. By a change of connections and an adjustment of the generator field the unit is then made to take its share of the load.

The engraving of the station from the switchboard gallery shows the six motor generator units. Two of them were built by the Westinghouse Electric & Manufacturing Company and four by the Canadian General Electric Company. Some of these units were built and guaranteed under specifications calling for a power factor of the induction motor at full load of not less than 92 per cent; the remainder under a power factor guarantee of not less than 93 per cent. The guarantee for full-load efficiency of the direct-current generators was 94.5 per cent, and of the induction motors 94 per cent.

The induction motors have rotating secondaries of the

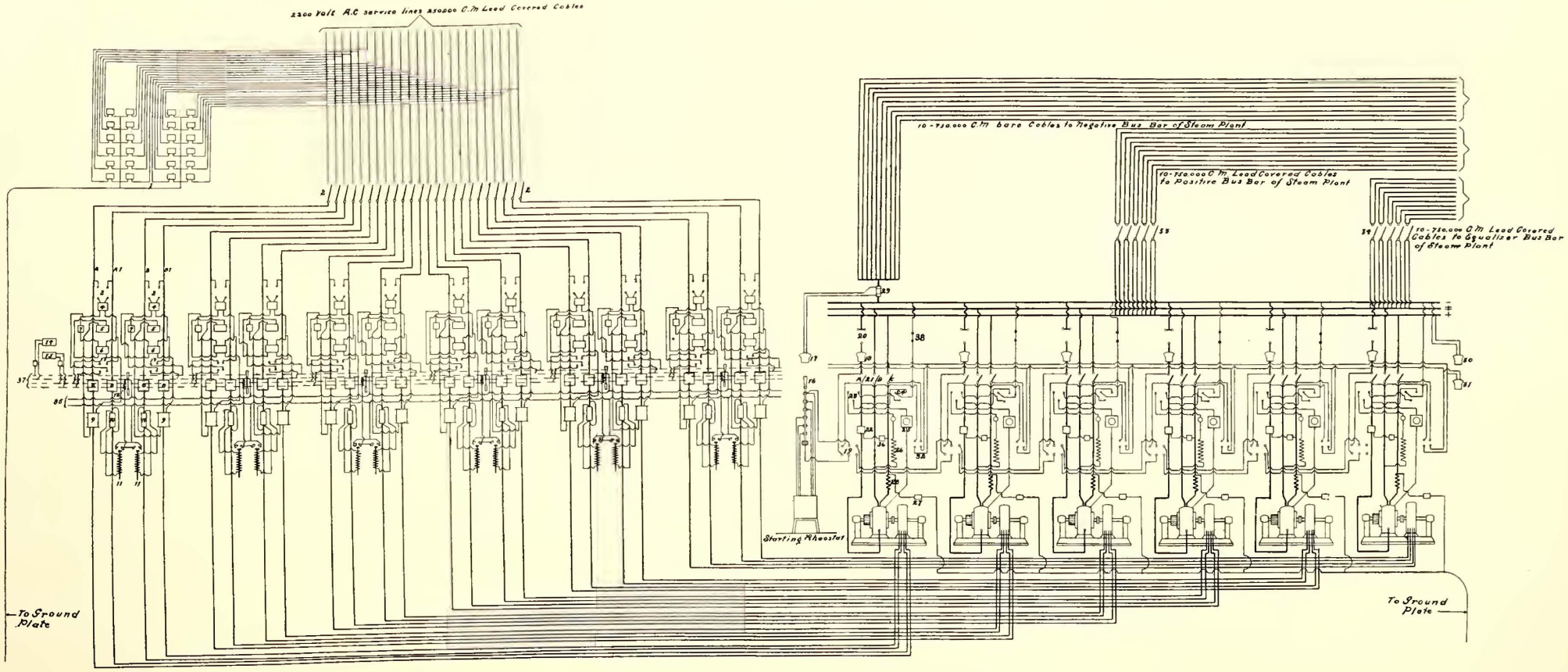
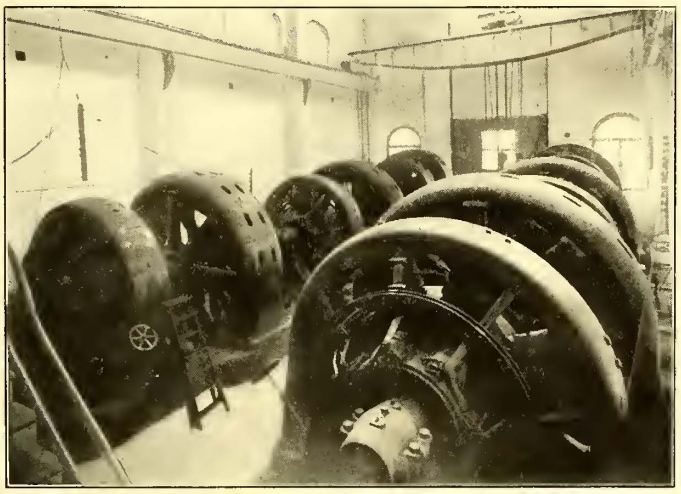


DIAGRAM OF CONNECTIONS, INDUCTION MOTOR GENERATOR SETS

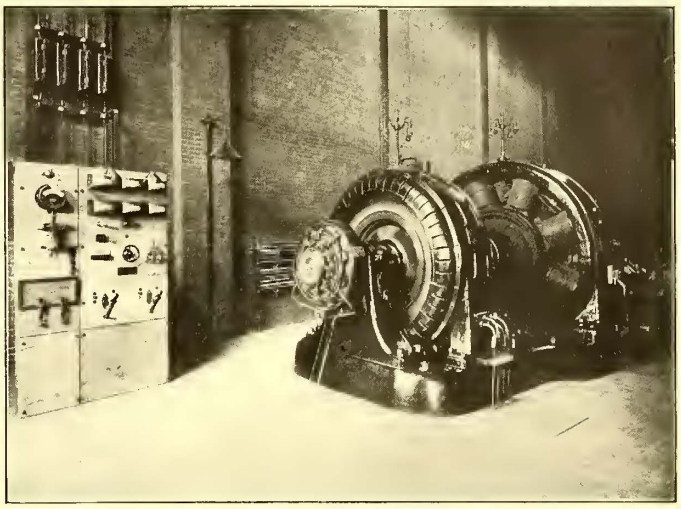
(1) Alternating-current lightning arresters. (2) Alternating-current single-pole knife switches. (3) Voltmeter transformer fuses. (4) Potential transformers. (5) Alternating-current ammeters. (6) Alternating-current indicating wattmeters. (7) Potential resistance. (8) Oil switches. (9) Current transformer for wattmeters and ammeters. (10) Current transformer for overload relay. (11) Overload relay. (12) Tripping coil. (13) Alternating-current voltmeter plugs. (14) Voltmeter, phase "A." (15) Voltmeter, phase "B." (16) Series starting switch. (17) Totalizing ammeter. (18) Machine ammeter. (19) Switch for transferring starting rheostat from panel to panel. (20) Direct-current circuit breaker. (21) Machine switches "A," "B," "C." (22) Recording wattmeter. (23) Field switch. (24) Switch for changing from self to bus-bar excitation. (25) Shunt field rheostat. (26) Discharge resistance and lamp for shunt field. (27) Lightning arrester. (28) Lightning arrester choke coil. (29) Main ammeter shunt. (30) Direct-current line voltmeter. (31) Machine voltmeter. (32) Direct-current voltmeter plugs. (33) Postive switches in leads to steam plant bus-bars. (34) Equalizer switches in leads to steam plant bus-bars. (35) Direct-current mains for tripping coils. (36) Shunt resistance for recording wattmeters. (37) Alternating-current potential mains. (38) Fuse for protection of 24.

METHOD OF STARTING.—All switches open. Cut all resistance out of 25. Throw 19 to left. Set 24 for bus-bar excitation. Close 23. Close 21B. Close 20. Close 16 slowly, cutting out all series resistance. Close 21A. Open 19 and throw it to right. Open 16. Bring direct-current machine to proper speed by cutting in rheostat 25. Close 8. Open 21A. Close 21C and bring machine to bus-bar voltage. Close 21A direct-current machine now running as compound-wound generator.

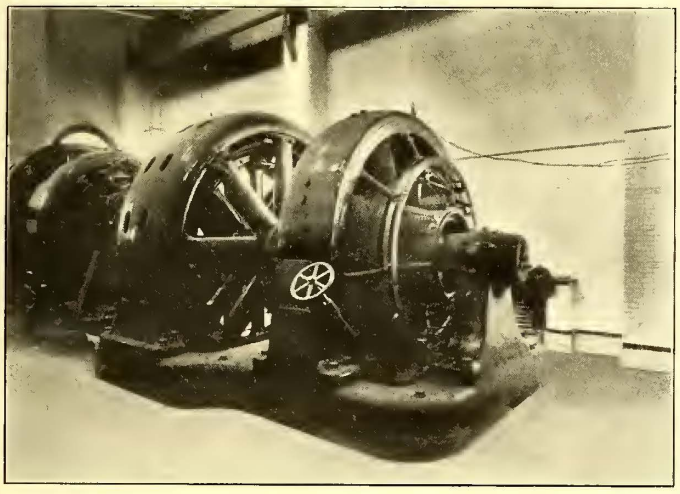
"squirrel cage" type. As the sets are not started from the alternating-current end, the secondaries are built in such a way as to keep their resistances as low as possible, resulting in low secondary loss and good speed regulation. The air gap called for by the sepcifications was for one make of motor 3-32 in. and for the other make .0825 in.



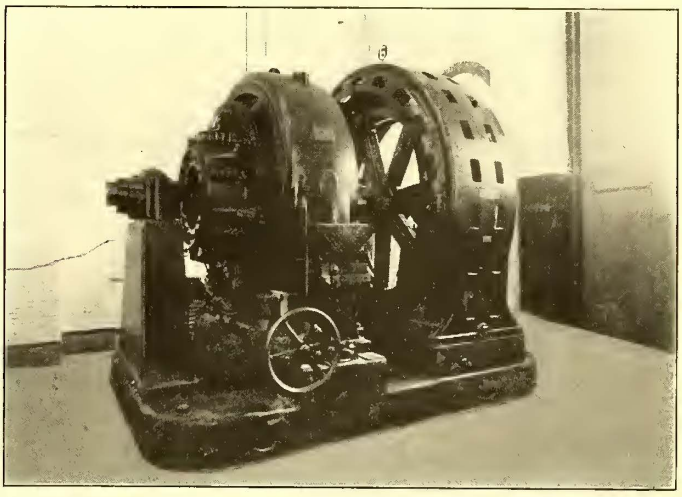
GENERAL VIEW—INTERIOR OF STATION



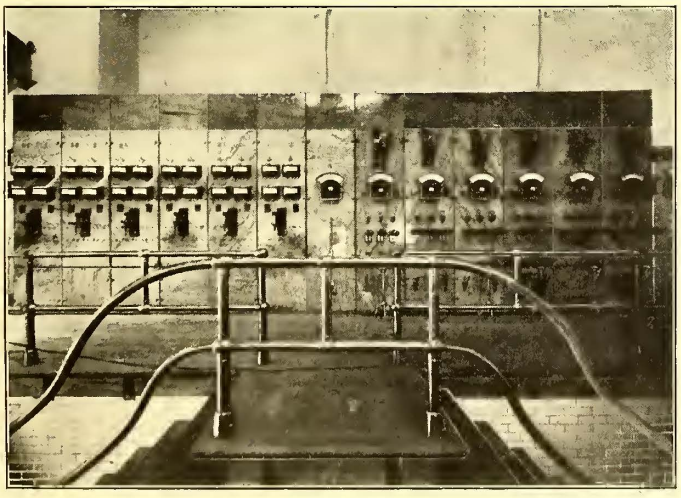
SYNCHRONOUS MOTOR



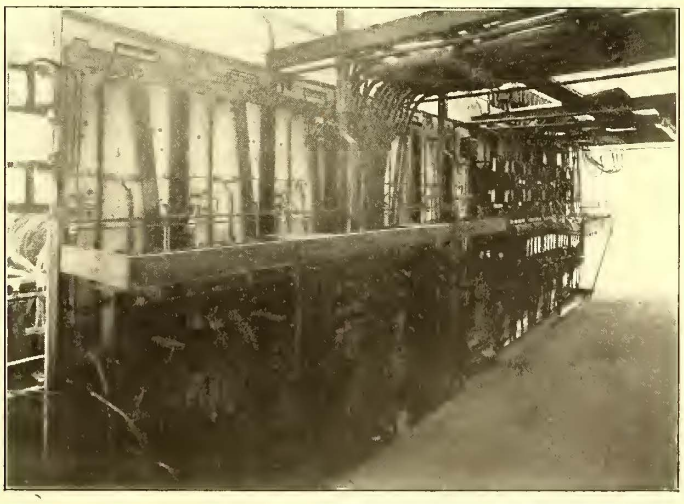
GENERATOR—CANADIAN GENERAL ELECTRIC COMPANY



GENERATOR—WESTINGHOUSE COMPANY



FRONT OF SWITCHBOARD



BACK OF SWITCHBOARD

The switchboard for the control of these units was supplied by the General Incandescent Arc Light Company. The views of the front and back of this board show its general make-up and construction. Before coming to the oil switches on each of the motor panels the power circuits pass through four single-pole knife switches, so that any given panel may be made absolutely dead.

In its operation the plant clearly demonstrates the advantage of induction over synchronous motors for the service rendered. The superiority of the induction type is shown not only in the less care, attention and skill required in operation but also in the less disturbance to the system of the power company.

This induction motor generator installation constitutes rather a compact plant. Located in a room whose floor plan is 40 ft. x 85 ft. we have six machines with a total continuous output of 3750 kw, and with a one-hour capacity of 4500 kw. The actual machine capacity is, of course, somewhat in excess of double these values. The installation is of interest also as containing induction motors which are amongst the largest (though not the

largest) that have ever been built. It is probably the largest aggregation of large induction motors in the world to-day.

In case of emergency these induction motor generator units are used to supply power to the power company. In this case the direct-current generator is operated as a direct-current motor, the induction motor being driven as an induction generator for the supply of power. It has long been known that an induction motor could be so used, but it is believed that this is the first case on record where such a motor has been so employed in commercial service.

REINFORCED SILLS

BY A. O. CARPENTER

Electric car construction is in an extremely interesting transition. It is passing from an under-frame of wood to one of steel, a fact which is, perhaps, most plainly seen in the changes which are taking place in car sills. The first application of steel or iron to give strength to the car was in the form of a truss-rod, which was early applied to cars of all description. One of the first steam car builders went a step further and put a broad plate of iron in the side of the car. This was a forerunner of some of our modern electric methods, although long since forgotten. With the introduction of electricity builders were no longer satisfied with the truss-rod for the longer and heavier cars. Then steel plating began, marking the first modern step toward an iron or steel under-frame. To men accustomed only to woodwork, and without metal working facilities, this was as far as it was considered desirable to go. Now the blacksmith shop is becoming a necessary feature of every car shop, and, in consequence, steel is being more generally employed.

Fig. 1 shows one of the most common methods of applying the steel plate. The metal varies from ½ in. to ¾ in. in thickness, and extends the whole depth of the sill. Occasionally, where increased strength is required another plate is put on the inside. A few builders have introduced a ¾-in. plate, as shown in Fig. 2, placing it in the middle of the sill. This is the well-known "flitch plate," and has the advantage of using plank instead of timber.

Lack of thought, or ignorance, produces some queer results in sill plating. One of these is shown in Fig. 3, where we have a 7-in. sill faced with two ½-in. plates. One was not considered sufficiently strong. Two plates are twice as heavy as one and only two times as strong. Together they represent 7 sq. ins. of steel section. Had the original plate been extended, as shown by the dotted lines in Fig. 3, more strength would have

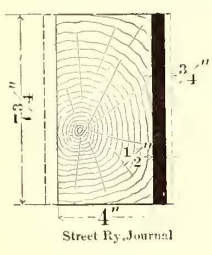


FIG. 1

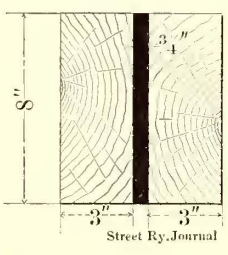


FIG. 2

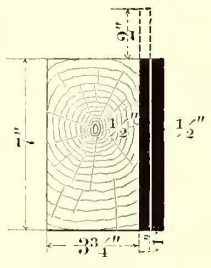


FIG. 3

been obtained with only 5 sq. ins. of section instead of seven. This idea of increased depth, of course, is a good one, but sometimes it is carried to extreme, as shown in Fig. 4, where a plate only ⅜ in. thick and 12 ins. wide is used. Here the upper and lower edges have hardly sufficient area to withstand the strain which its depth would indicate might be placed upon it.

Fig. 5 shows a case where the designer was either limited or ignorant. He used a channel iron to strengthen his sill and then put a filling piece into the channel to hold his cross timbers. The sill is nearly heavy enough to do the work, and with the filler might be considered strong enough. The structure is bad for two reasons, there is more wood than is necessary, and the joints are made in wood where they might have been in metal. By putting in a channel like that shown in Fig. 6

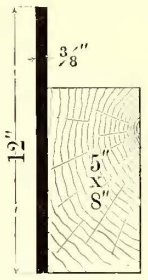


FIG. 4

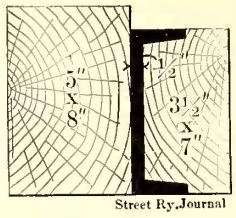


FIG. 5

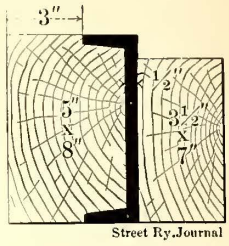


FIG. 6

FIG. 7

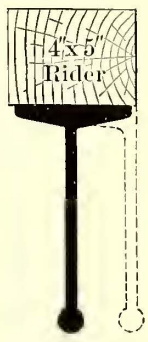


FIG. 10

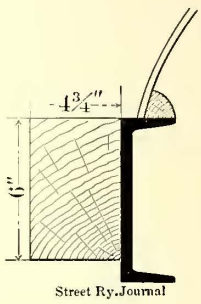


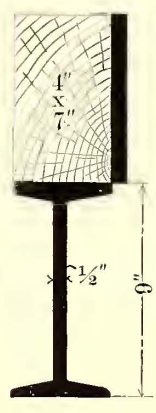
FIG. 8

the weight could have been reduced from 49 lbs. to 43 lbs. per yard, and the strength would have been increased in the ratio of 1 to 1.27. Practically the inside filler could be dispensed with if metal pockets had been used.

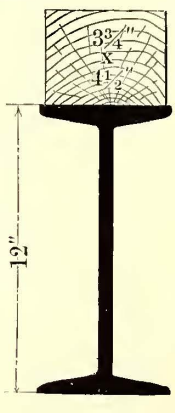
Fig. 7 is a very foolish waste of iron, although it is a design which has been often employed for intermediate sills. It is hard to say what the designer had in mind; the wood performs no part beyond that of a packing piece. The channel iron alone is ample for the purpose.

Fig. 8 shows a peculiar English construction; the sill in this case merely holds the tenons of the posts and the cross sills. The plan gives very much more strength than the plain plate; the projection of the channel iron and the molding at its top are fatal defects.

"A" in Fig. 9 represents a design adopted for some of the



A—FIG. 9



B—FIG. 9

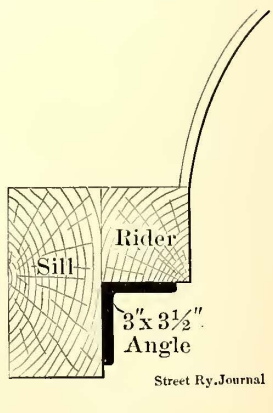


FIG. 11

latest high-speed electric cars. The ¾-in. plate on the outside of the sill is undoubtedly a concession to the prejudices of managers. The 9-in. I-beam is amply sufficient for the work without the ¾-in. plate, but if it is considered necessary to have an additional strength the same result may be much more economically obtained by using the metal in a different form, as shown in "B." Here a 12-in. I-beam carries a rider 3¾ ins. x 4½ ins. The use of the 12-in. instead of the 9-in. beam produces a saving of more than 11 lbs. per running yard. The strength, however, is somewhat greater than in the combination. The rider

becomes simply a strip into which the posts are mortised and to which the floor is nailed. This construction would necessitate a complete steel under-frame, carrying on its top the necessary nailing strips.

Fig. 10 is a form which has been employed in Europe. The strength is obtained by a bulb-iron or deck beam, an alternative form is shown in the dotted lines. For car work it is better than the I-beam, because there are no lower flanges. Properly proportioned it should give the same strength as an I-beam. It is said that this construction has been employed in some parts of the United States.

Fig. 11 shows one of the most peculiar designs in which wood and iron have been combined. It is from an English designer, who strengthens his sill with an angle iron and on the angle places a rider, which carries the posts and becomes practically a small sill.

A FEW OPERATING CRITICISMS

BY K. S. H.

Two boulevard lines, just outside the congested district of one of our large cities, meet in a Y junction. During the greater part of the day, say for sixteen hours, outward-bound cars arrive at the fork of the Y at intervals of three minutes to five minutes, sometimes singly, and often in groups of from two to four. The switch has to be repeatedly turned at a great loss of time by conductors, who stop their cars and run ahead to the switch; turn it for the proper route; run back to their cars; hand the switch stick to their motorman and give the starting bell. This process wastes nearly half a minute on each round trip, not a very serious item to the company, but certainly a constant annoyance to passengers. The company maintains switchmen at many of its other important junctions, and should place one at this point, or else permit the conductor to start the car from the switch by signal to the motorman on being advised by the latter that all is right to go ahead. Time is also sometimes lost on this route by the companies obliging a conductor to go back and reset another switch for the next car behind, which does not always appear in its proper order.

Conductors should always be required to remain at their posts on cars until the end of the route is reached. Not long ago a car running through a beautiful residential district was abandoned by its conductor about a mile from the terminus of the run, and a noisy crowd of bibulous rowdies reigned supreme until the journey's end. The company's good will assets were naturally not improved by this experience. Such a defection on the part of a conductor should be sufficient cause for prompt discharge, unless extraordinary reasons can be given to show that it was absolutely impossible for the conductor to remain on the car.

On another system with which we are acquainted it was not infrequently the custom of the crew of a certain late car to stop on their trip at a night lunch cart, and literally hold up the passengers as regards time while the aforesaid crew ate their lunch. Comments on this are superfluous. Still another road, operating a single car through a country district, stops its business from noon to 1 p. m., in order that the crew may eat in peace. The local conditions, however, are some justification for the latter course of inaction. It has not been announced, however, that interest and depreciation take a siesta on this road between the hours above specified.

A large square in a certain congested quarter is crossed by several lines of cars, a steam freight railroad, and a huge pedestrian and vehicle traffic. The operating street railway company maintains white-painted stopping poles throughout its entire system, but this particular square is woefully deficient in information as to where cars will stop. Proper signs or posts should at once be installed, as the inconvenience to both citizens and strangers is very trying.

Car signs are often turned at a considerable distance from the end of a route. While persons living in the locality affected may easily know where a car is going there is considerable perplexity in store for the stranger, and possible loss of fares for the company.

Car numbers should be kept painted in legible condition, and should be on both inside and outside of cars. The importance of being able to identify cars in cases of accident or other trouble is not easily over-estimated.

At night cars should never be run with the rear headlight turned on at the sacrifice of the front one, on excuse that the end of the route is near. The possibility of accident is vastly increased by such a course, and the conductor who operates a car in this manner should be called strictly to account. Especially is this practice dangerous in following another car under close headway, as both passengers and pedestrians are likely to overlook the following car in passing behind the first one.

On suburban lines, where transfers are given, cars standing at junction points, and operated at over five-minute headway, should not start directly upon the arrival of connecting cars before the passengers have time to transfer. There are few more aggravating experiences than to see such a car accelerate away from one's reach when one is within a rod or two of the goal, leaving the passenger to reflect on the policy of the management during a quarter or half-hour of subsequent enforced leisure.

Tools or projecting poles should never be carried at the side of an open car by employees or passengers. Their proper place is the platform, front or rear, preferably the latter. It is not pleasant to contemplate the condition of the occupants of the front seat on an approaching car which might happen to pass at the moment pole or tool slipped into a horizontal or oblique position in the carrier's hands. A practical example of the danger thereby incurred was shown by an actual occurrence in one of our large cities recently. A young man, returning in an open car from a sale of Spanish war relics, was taking home a Mauser rifle to which a bayonet was affixed. Through carelessness he allowed the end of the gun to project beyond the side of the car, and the bayonet gouged out the eye of a passenger in another open car, which was going in the opposite direction.

Giving the starting bell too quickly is a fault frequently met in street railway work. The danger to passengers is obvious. The motorman should rigidly adhere to the rule never to go ahead on one bell, even though the conductor makes the mistake of ringing once when he means twice.

The time-tables of electric cars should, as far as possible on depot routes, be arranged for the meeting of through trains, especially where the railroad station is one of the street car terminii. The reputation of both city and car service suffer if this is not done. Similarly, it is bad mismanagement to take off the cars until the last train has arrived or departed. A 2-mile walk at 12:30 a. m. in a city of 100,000 inhabitants is not always a joy to the traveler who expects to find an electric car at the station on his arrival.

Finally, construction work should always be kept as clear as possible from the rush hours if it interferes with the traffic. Modern methods of illumination provide ample facilities for pushing such work at night, and in many instances there is little reason for blocking the traffic of a whole division by tearing up track in the daytime. If it cannot be avoided every effort should be made to furnish unimpeded right of way and ample equipment for the hours when the welfare of thousands of people depends upon giving them safe, speedy and frequent transportation to their homes. Attention to these details pays high interest on their improvement, and each source of waste or danger eliminated adds one more element of strength to those which go to make up good service.

TICKET SYSTEM ON A NEW JERSEY INTERURBAN RAILWAY

BY S. C. STIVERS

The several concessions as to rate of fare between points on the Paterson & Hoboken line of the Jersey City, Hoboken & Paterson Street Railway Company have caused considerable difficulty in correctly checking conductors and ascertaining the number of passengers carried. Under these conditions it became necessary to create some system of checking which would accomplish its object in an advantageous and economical way. The ticket which is herein described has been the result of such endeavors.

This line extends from Hoboken to Paterson, a distance of 17.5 miles, passing through Hoboken, Homestead, Carlstadt, Rutherford, Wallington, Passaic and Paterson. The relative positions of these municipalities and the distance covered by the payment of a single 5-cent fare are shown on the sketch below. The through rate of fare from Hoboken to Paterson is 20 cents, divided into four collections:

	Cents
First collection Hoboken to Hackensack River	5
Second collection Hackensack River to Rutherford	5
Third collection Rutherford to Passaic River	5
Fourth collection Passaic River to Paterson	5

Passengers boarding cars at Homestead are entitled to ride to Bergen County Short Cut for 5 cents. Passengers boarding cars at Carlstadt are entitled to ride to city limits of Passaic for 5 cents. This rule applies in the opposite direction also.

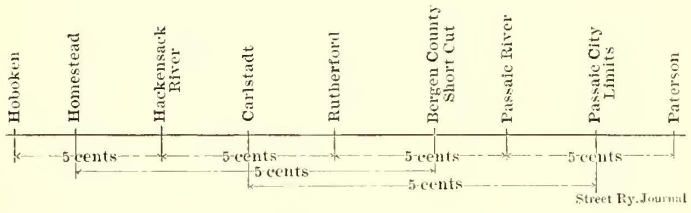


DIAGRAM SHOWING FARES CHARGED ON HOBOKEN-PATERSON RAILWAY

By comparing these privileges with the sketch given above it will be seen that it would be necessary to have at least twelve men (six day and six night), i. e., going west, one each at Hackensack River, Rutherford and Passaic city limits. Going east, one each at Passaic River, Carlstadt and Homestead beside the necessary tickets, etc., if the usual method of placing inspectors at the end of each 5-cent fare limit was adopted.

These conditions led to the designing and adoption of tickets shown in Fig. 1. Two tickets of this kind are used, one for each direction, and are differentiated by printing one on yellow the other on red paper.

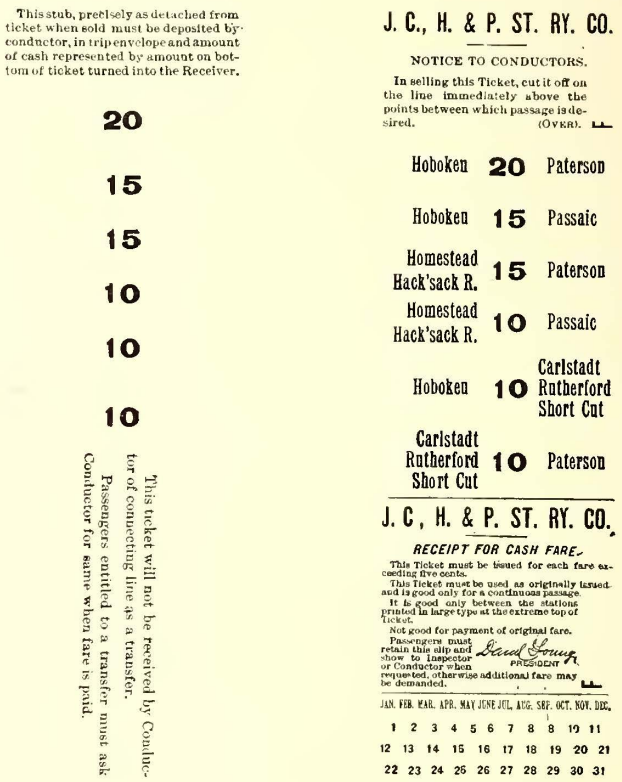
As is shown in the cut the ticket is composite, covering six different distances, for which fare is in excess of 5 cents as follows:

	Cents
Hoboken to Paterson	20
Hoboken to Passaic	15
Homestead or Hackensack River to Paterson	15
Homestead or Hackensack River to Passaic	10
Hoboken to Carlstadt, Rutherford or Short Cut	10
Carlstadt, Rutherford or Short Cut to Paterson	10

Attention is called to the back of the ticket, which is so arranged that it does not matter at which point the ticket is separated, the figures at the bottom on the back of the conductor's portion of the ticket represent the value of the portion detached. If the passengers see that they receive full value for amount paid, the conductor is unable to issue correct ticket to the passengers and to return a sum less than the value of the ticket issued to the office. The placing of the inspectors for the examination of tickets at the proper points impresses the passengers with the advisability of seeing that the figure on top of the face of the ticket represents the amount paid the conductor, as it will be seen that unless the passenger holds the correct ticket he cannot ride beyond the inspector without the payment of an additional fare.

The use of this ticket has necessitated the placing of inspectors at the Hackensack River and at the Passaic River only, making four men in all (two day and two night).

Conductors upon starting out are supplied with "F" tickets


This stub, precisely as detached from ticket when sold must be deposited by conductor, in trip envelope and amount of cash represented by amount on bottom of ticket turned into the Receiver.

20
15
15
10
10
10

This ticket will not be received by Conductor of connecting line as a transfer.
Passengers entitled to a transfer must ask Conductor for same when fare is paid.

J. C., H. & P. ST. RY. CO.

NOTICE TO CONDUCTORS.

In selling this Ticket, cut it off on the line immediately above the points between which passage is desired. (OVER).

Hoboken	20	Paterson
Hoboken	15	Passaic
Homestead Hack'sack R.	15	Paterson
Homestead Hack'sack R.	10	Passaic
Hoboken	10	Carlstadt Rutherford Short Cut
Carlstadt Rutherford Short Cut	10	Paterson

J. C, H. & P. ST. RY. CO.

RECEIPT FOR CASH FARE.

This Ticket must be issued for each fare exceeding five cents.
This Ticket must be used as originally issued, and is good only for a continuous passage.
It is good only between the stations printed in large type at the extreme top of ticket.
Not good for payment of original fare.
Passengers must retain this slip and show to Inspector or Conductor when requested, otherwise additional fare may be demanded.

David Young PRESIDENT

JAN. FEB. MAR. APR. MAY JUNE JUL. AUG. SEP. OCT. NOV. DEC.

1 2 3 4 5 6 7 8 9 10 11
12 13 14 15 16 17 18 19 20 21
22 23 24 25 26 27 28 29 30 31

FIG. 1.—BACK AND FRONT OF FORM F TICKET

(Fig. 1), to be used going west, and also a pad of "G" tickets, which, as stated, are similar to the "F" tickets, but to be used going east. Each conductor is also supplied with three forms of identification slips, similar to that shown in Fig. 2, but covering different portions of the route. These slips are also printed on paper of different colors, more easily to distinguish them.

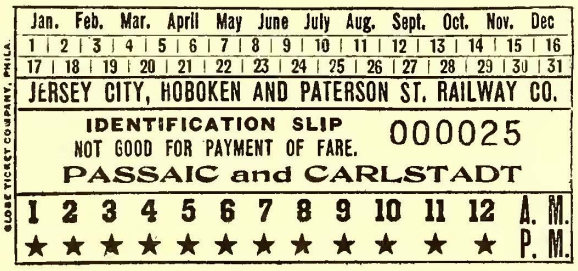
The tickets are used as follows: The conductor issues an "F" or "G," depending upon the direction going, ticket for each single fare in excess of 5 cents, punching out the date and the point to which passage is paid and makes one register for each fare regardless of amount paid. He tears the ticket off on the line immediately above the points between which passage is desired, and delivers the lower portion to the passenger as receipt for fare and evidence of point to which fare is paid, and retains the stub or upper portion, which is deposited in trip envelope, and the number of stubs enclosed is stated thereon and turned into the receiver at the terminus of the line.

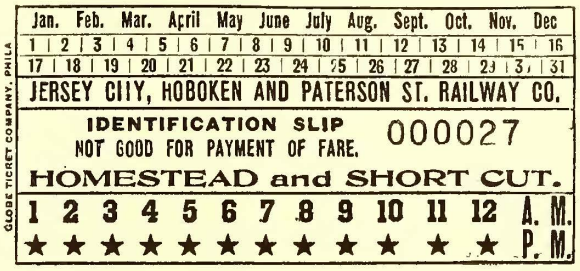
The conductor is required to account for all tickets issued to him, and at the end of day's work he returns to the superintendent's office all unused tickets. Tickets which are not so accounted for are charged the conductor as short at highest amount, viz., 20 cents.

In the case of tickets cut or punched in error the conductor returns both portions to the superintendent's office.

To cover the 5-cent fares only between the various intermediate places the identification slips, Fig. 2, were designed. The conductor registers the 5-cent fare collected and issues the slip by punching it to show the next approaching hour, the slip is then a receipt for fare and evidence of the destination to which fare has been paid in the same manner as the "F"

or "G" tickets. These slips cannot be received as fares by the conductor, nor will the company accept them to cover register. They have no value except to show the conductor evidence of the passenger's right to ride to the destination on the car on which it was issued, and the conductor's punch mark is conclusive evidence as to whether it was issued on the car and on the trip. If a passenger boards the car, and when approached by the conductor for fare, shows a slip of this kind, the conductor can readily see by examining the punch mark and time whether that fare has been paid to him. If it bears some other conductor's punch mark or if time punched indicates that it was issued on another trip by the same conductor it is valueless.





FIGS. 2 AND 3—IDENTIFICATION SLIPS USED WITH 5-CENT FARES

The appended diagram covering a trip west from Hoboken to Paterson will make the various issuings and collections for passengers boarding car at the various points clear.

At the Hackensack River, going west, an inspector boards the car and examines all tickets, collecting form "F" (Fig. 1) tickets, reading to Carlstadt, Rutherford or Short Cut; he also collects the white identification slips (Fig. 2), which is that covering the ride from Homestead to Short Cut, and registers a fare for each passenger who does not hold a ticket, calling the conductor's attention to the fact.

After leaving Rutherford Junction the conductor goes through the car collecting fares from all passengers not holding tickets. Passengers who then board the car and pay a 5-cent fare are entitled to ride to the city limits of Passaic,

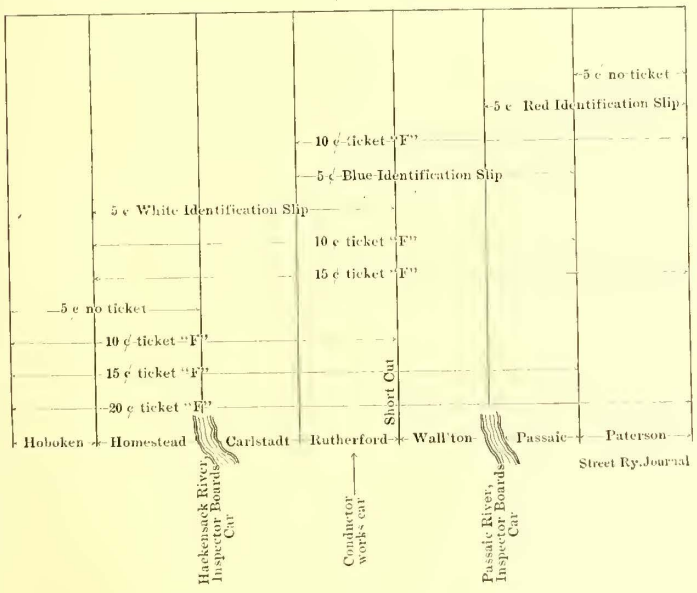


DIAGRAM SHOWING COLLECTING POINTS BETWEEN HOBOKEN AND PATERSON

and the conductor issues to such passengers a blue identification slip (Fig. 3).

At the Passaic River an inspector boards the car and takes up all tickets, issuing to those passengers entitled to a ride to Paterson a brown Paterson identification slip. Passengers who board cars in Passaic are entitled to a ride to Paterson and a city limit transfer on a payment of 5 cents, and for this purpose the conductor issues to those passengers a red identification slip.

At the city limits of Passaic the conductor collects all slips, which he turns in but does not register, and collects fares from those passengers not holding slips.

The same methods apply in the reverse direction with the exception that Homestead is substituted for Passaic and the Hackensack River for the Passaic River, at which point going east the inspector issues green identification slips instead of a brown ticket. Conductors do not issue tickets to points beyond their destination, that is, if a car is going from Paterson or Hoboken to Rutherford, he will not sell tickets for points beyond Rutherford, etc.

In case of an accident or for other reason where a conductor finds he has to turn back before reaching his destination he issues transfer tickets to all passengers. The conductor who receives these passengers collects the transfers, and treats the tickets which they may have the same as if he issued them.

For the number of Hoboken identification slips issued the inspector at the Hackensack River Bridge must return a corresponding total number of Paterson-Hoboken 20-cent form "G" tickets, Passaic-Hoboken 15-cent form "G" tickets, or a Short Cut, Rutherford or Carlstadt-Hoboken 10-cent form "G" tickets.

For the number of Paterson slips (brown) issued the inspector at the Passaic River returns a corresponding total number of Paterson-Hoboken 20-cent form "F" tickets (Fig. 1), a Paterson-Homestead 15-cent form "F" (Fig. 1) tickets, or a Paterson-Carlstadt, Rutherford or Short Cut 10-cent form "F" ticket.

The method of checking the conductors' returns is that generally used by all street railway companies. The envelopes, with their contents and cash received on trip, are turned into the receiver at the terminus of the line, who enters them on his sheet. At the close of the day the envelopes and their contents are forwarded to the auditor's office, where the tickets are counted and checked. Each conductor's returns for the day is then separated into piles of different values, and the total number of each value is entered on a check sheet under its respective column; a notation is also made of the commencing and closing numbers of the tickets received. These numbers should check with the report of tickets issued and returned which is made out by the superintendent of the division. The value of the tickets are then ascertained and checked with the day sheet of the conductor, which shows the total number of tickets of each value issued. The conductor should turn in 5 cents cash for each fare registered in excess of the total number of tickets returned, plus the value of such tickets.

This checking takes about four hours for the handling of one line using on an average of 1800 of these tickets daily.

Although some opposition was experienced upon the introduction of this ticket it is now freely endorsed by passengers, and after over four months' operation no serious defect has been discovered.

DAILY REPORTS

The practice of requiring daily reports from different employees is growing, especially on the smaller railways, and the advantages of it to the discipline of the road are considerable.

DAILY REPORT OF POWER HOUSE OF

The Dayton and Nortnern Traction Company.

BROOKVILLE, OHIO.

DATE .....

Time.	W. M. Reading.	K. W. Hr.		Car No.										
4:30 A. M.				Car Miles.										
12 M.				Car No.										
5 P. M.				Car Miles.										

Total K. W. Hr. per day .....
Total cost per day .....
Cost per K. W .....

Total Car Miles per day .....
K. W. per car mile .....

SERVICE REPORT.

	1	2	3	4	TOTAL.
Generators	Hrs	Hrs	Hrs	Hrs	Hrs.
Engines	Hrs	Hrs	Hrs	Hrs	Hrs.
Boilers	Hrs	Hrs	Hrs	Hrs	Hrs.
Condensers	Hrs	Hrs	Hrs	Hrs	Hrs.
Boiler Feed Pumps	Hrs	Hrs	Hrs	Hrs	Hrs.
Feed Water Heater	Hrs	Hrs	Hrs	Hrs	Hrs.
Amp. Meters	Hrs	Hrs	Hrs	Hrs	Hrs.
Volt Meters	Hrs	Hrs	Hrs	Hrs	Hrs
Feed Switches	Hrs	Hrs	Hrs	Hrs	Hrs.
Circuit Breakers	Hrs	Hrs	Hrs	Hrs	Hrs.
Lightning Arresters	Hrs	Hrs	Hrs	Hrs	Hrs.
Air Compressor	Hrs	Hrs	Hrs	Hrs	Hrs.
Transformers	Hrs	Hrs	Hrs	Hrs	Hrs.
Batteries	Hrs	Hrs	Hrs	Hrs	Hrs.

Power turned on at switch ..... M. Power turned off at switch ..... M.

Average coal per hour ..... Average coal per H. P ..... Tons coal on hand .....
..... tons coal consumed ..... pts Cyl. Oil ..... Pts Cyl. Oil .....
Eng. Oil ..... pts Eng. Oil ..... pts Boiler Comp ..... lbs Waste .....

Extra Labor .....

	NAME.	HOURS.	SIGNED.
1			
2			
3			

CONDITION OF PLANT.

	GENERATORS.	ENGINES.
No. 1		
No. 2		
Boosters. 1		
Boosters. 2		

	BOILERS.	CONDENSERS.	BOILER, FEED AND SER. PUMPS.
No. 1			
No. 2			
No. 3			
No. 4			

	FEED WATER HEATERS.	AMP. METERS.	VOLT METERS.
No. 1			
No. 2			
No. 3			
No. 4			

	AIR COMPRESSORS.	TRANSFORMERS.
1		
2		
3		

FEED SWITCHES.		CIRCUIT BREAKERS.	
1	4	1	4
2	5	2	5
3	6	3	6

TIME.

TIME ON.	TIME OFF.	TIME ON.	TIME OFF.
Chief Engineer		Day Fireman	
First Ass't Engineer		Night Fireman	
		Handy Man	

REMARKS .....

Approved:

Chief Engineer.

FORM 1.—POWER STATION ENGINEER'S REPORT

It not only gives the manager information as to any defects which there may be in all departments, but interests the men themselves in maintaining the system in a high state of efficiency. In this way it makes every man an inspector of the mechanical equipment of the line. Still, a third advantage is that it prevents any claim made in damage suits that certain parts of the apparatus were in defective condition, when that was not the case. If a car, for instance, has been reported by a

THE DAYTON & NORTHERN TRACTION CO.

Motorman's Daily Report.

CAR Nos .....
DATE ..... 190 ..... TIME ON ..... A. M. ..... P. M.
TIME OFF ..... A. M. ..... P. M.

NOTE—Motorman will fill out these reports daily and send to Dayton Office with remarks and explanations on reverse side.

	CHECK	NO	YES
1. Are your motors in good condition?			
2. Are your hand brakes in good condition?			
3. Is your controller working satisfactorily?			
4. Is your air brake working satisfactorily?			
5. Were there any defects to interior or exterior of your car?			
6. Are your trolley stand poles and wheels in good condition?			
7. Have you an extra pole on your car?			
8. Are your goog and signal bell in good condition?			
9. Are you supplied with the necessary tools?			
10. Are the heaters, lights and headlight in good condition?			
11. Are sand boxes working?			
12. Was car equipped with markers and lauterns?			
13. Have you repaired anything while on duty?			
14. What repairs have you had made on car and at what station?			
15. Did you pick up mail going south, where and what time?			
16. Did you pick up mail going north, where and what time?			
17. Was you current off, how long and when?			
18. Is there a switch iron on your car?			
19. Have you had an accident, where? **Be sure to make out report of same**			

MOTORMAN'S DAILY REPORT ON OVERHEAD LINE.

1. Note defects in trolley line, near what number? Report this at once .....
2. Trolley wire down or very slack, near what stop number? Report this at once .....
3. Hangers, pullovers or ears off, near what stop number? Report this at once .....
4. Brackets bent or broken, near what stop number? .....
5. Any particular place where trolley came off? .....
6. Poles out of place or broken? .....
7. Telephone wires broken or insulators off? .....
8. Feed wires broken or insulators off? .....
9. Report any defects to telephone booths, instruments or hoods .....
10. Did you notice any sparking joints, where? .....

MOTORMAN'S DAILY REPORT ON TRACK AND ROADWAY.

1. Report any defects to track, near what stop? .....
2. Report any special work out of order .....
3. Report any bad joints .....
4. Report any curves not having proper elevation .....
5. Report any R. R. crossings riding rough .....
6. Report any derailing devices not working .....
7. Have you killed any animals or fowls, where? .....
8. Report any dead animals or fowls you saw, where? .....
9. Report where a derailment occurred .....
10. Report any iron or brass you may have seen on or near road-bed .....

MOTORMAN

FORM 2.—MOTORMAN'S REPORT

ROAD MASTER'S DAILY REPORT.

The Dayton and Northern Traction Company,

DAYTON, OHIO.

Crew ..... *Working at* ..... *Date* .....
Time Starting ..... *A. M. Time Stopping* ..... *P. M. Weather* .....

NO.	NAME.	RATE.	HOURS.	AMOUNT.	KIND OF WORK DONE.

Remarks .....

Material Used .....

Approved .....

Received at Office.

FORM 3.—ROAD MASTER'S REPORT

motorman as in a good condition he cannot very well claim the following day that the brakes or some other part of the equipment were out of order if an accident occurs.

LINEMAN'S DAILY REPORT.

The Dayton and Northern Traction Company,
DAYTON, OHIO.

Working at ..... *Date* .....
Time Starting ..... *A. M. Time Stopping* ..... *P. M. Weather* .....

NO.	NAME.	RATE.	HOURS.	AMOUNT.	KIND OF WORK DONE

Remarks .....

Material Used .....

Received at Office. *Approved* .....

FORM 4.—LINEMAN'S REPORT

CAR BARN DAILY REPORT.

The Dayton and Northern Traction Company,
DAYTON, OHIO.

Date ..... *Weather* .....

NO.	NAME.	RATE.	HOURS	AMOUNT.	KIND OF WORK DONE.

Remarks .....

Material Used .....

Received at Office. *Approved* .....

FORM 5.—CAR HOUSE FOREMAN'S REPORT

THE DAYTON AND NORTHERN TRACTION COMPANY.

REQUISITION FOR SUPPLIES NEEDED.

The following supplies are needed:

QUANTITY.	ARTICLES.

Stock Keeper

FORM 7.—STOCK KEEPER'S REQUISITION

TheDayton & Northern Traction Co.

CONDUCTOR'S DAILY REPORT

Date ..... 190 *Car No.* .....
Time on ..... *Time off* .....
Condition of Car .....

Conductor

FORM 8.—CONDUCTOR'S REPORT

To illustrate the way in which these blanks are used in practice some reproductions are given herewith of a set of daily report blanks used by the Dayton & Northern Traction Company.

Form 1 shows the report made to the manager in regard to the power stations, and which is signed by the chief engineer. As will be seen, it shows the hours of service of all of the apparatus used, the consumption of coal and supplies, the hours of labor of the different men, with blanks for extra labor and the general condition of the plant.

The Dayton & Northern Traction Company.

REPORT OF MATERIAL RECEIVED.

..... 190

The following supplies have been received from .....
at ..... *and disposed of as follows:*

QUANTITY.	ARTICLES.	Condition Rec'd in.

Stock Keeper.

This report must be made daily and sent to the Superintendent. If nothing has been received write "nothing received," and send in on first car.

FORM 6.—REPORT OF MATERIAL RECEIVED

Form 2 shows a motorman's daily report, which is much more complete than that used on most lines. As will be seen, the motorman is not only required to state that his car is in good condition, but has to specify the working parts separately and also to report on the overhead line and track, so far as his observation goes.

Forms 3, 4 and 5 are those used by the road master, line men and car house foreman respectively, and are self explanatory. These three reports are all counterchecked by both the timekeeper and the stockkeeper, and give the number of men employed, material used, etc. The stockkeeper himself makes reports to the manager, which are included herewith for completeness in forms 6 and 7. One covers the material received, the other is a requisition for supplies. The conductor's daily report blank is shown in form 8.

All of these reports are sent to the main office every morning on the first car, ready for the inspection of the superintendent, R. E. De Weese, to whose courtesy this paper is indebted for the blanks thus given. As nearly as possible the company endeavors to have all requisitions for supplies received on the twenty-eighth of each month, and the requisitions are supposed to cover the amount of supplies needed for the following month.

The new branch line of the Chicago & Milwaukee Electric Railway, from Lake Bluff to Libertyville, will be put in operation this month. The new depot at Libertyville is completed and five cars are on hand to start the road. At Lake Bluff the cars will run under the Chicago & Northwestern Railroad tracks in a subway and connect with the present line between Waukegan and Evanston.

CONSTRUCTION AND OPERATION OF A FREIGHT-CAR DRIVEN BY INDUCTION MOTORS

BY A. B. WEEKS

The flat car for freight service in a factory is in many places indispensable. While there are belt and chain conveyors of many designs, none of them, after all, can fill all the requirements of the freight car.

The electric crane, operated by induction motors, has its several bare trolley wires for supplying current to its motors, and it is from this system that we borrow the idea for supplying the contemplated car with current.

The bare copper wires, No. 8, B. & S. gage, are of one span, and 150 ft. long. If the distance were greater several hangers would be necessary to support the trolley wires. These trolley wires should be insulated at each end of the runway with No. 2

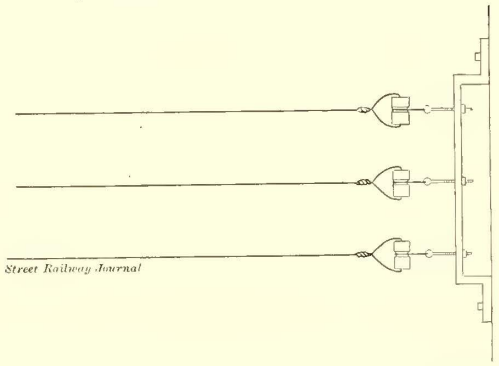


FIG. 1.—METHOD OF SUPPORTING TROLLEY WIRES

porcelain insulators, as shown in Fig. 1, and some method employed to take up the slack in the wires. This may be accomplished by means of ⅜-in. bolts, as shown in the cut, or turn buckles may be used for the purpose. The angle-iron is 2 ins. x ⅜ in. fastened to wooden posts by means of coach screws. The trolley wires are 4 ins. apart.

When making adjustments of these wires it is a good plan to open the service switch beforehand. Do not get the wires close enough to swing against the car rail when installing, nor too near the floor to admit of their trailing should the wires get slightly slack. Indeed, considerable slack is permissible, and in some cases necessary to secure a good contact in the sliding shoes, which are to take off current for the motor.

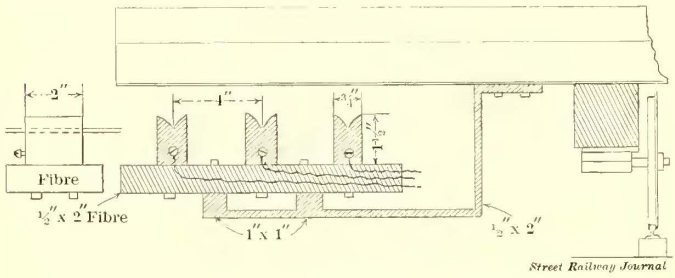


FIG. 2.—TRAILER UNDER CAR PLATFORM

The trailer, shown in Fig. 2, is secured below the car platform where nothing can strike it, and yet it is accessible for inspection. The angle-iron is ½ in. thick, 2 ins. wide, and is fastened to the car frame with ½-in. x 6-in. lag screws.

The sliding contacts are of hard brass. They are spaced 4 ins., center to center, and secured by means of two ⅜-in. x 1½-in. cap screws to the insulated base, which is preferably of ½-in. x 2-in. fiber. The fiber is secured to the angle support by means of ½-in. x 1¼-in. cap screws. The section of the angle-iron to which the fiber is secured is 1 in. x 1 in. One bolt each is sufficient to secure the part firmly.

The sliding brass contact is 2 ins. long, 1½ ins. high, ¾ in. wide, and a depth of groove of ⅝ in. Round the groove, from time to time, as the trolley wire wears its way into it. Make a tight fit on the cap screws, using iron washers under the head of each cap screw. Wires run from the screw heads on each brass slide up through the controller stand to the center connections on the controller switch.

While this is the cheapest and most easily constructed trailer, yet trolley wheels may be used if desired. They could be 2½ ins. in diameter, ¾ in. wide, and have a groove ⅝ in. deep, the width at trolley-pin hub being 1 in., and the bore ½ in. Good, hard brass composition should be provided for the wheel, and angle-irons for trolley pins should be either brass or wrought iron.

Those who were early engaged in electric railway construc-

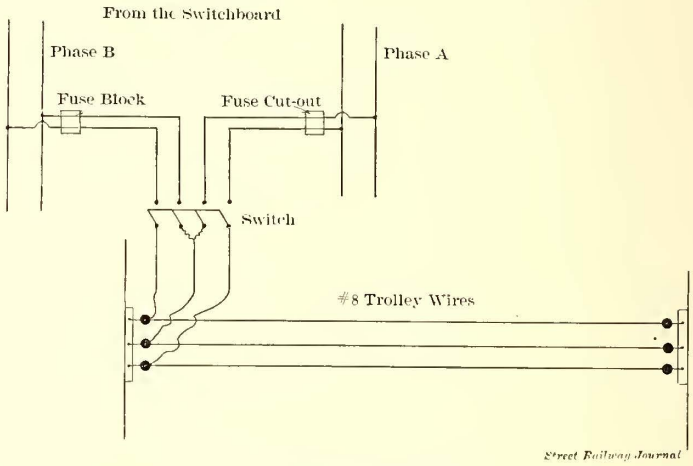


FIG. 3.—WIRING DIAGRAM

tion will remember that the trolley first used by the late Professor Sydney Short consisted of a renewable copper slipper, inserted at the end of the trolley pole in place of a trolley wheel, the patent for which was controlled by other corporations. The idea here used is but a modification of this early application of a current conveyor.

Having fully described the trolley wires we will next give a wiring diagram of the supply circuit. The induction motor here employed is of Westinghouse make, two-phase, size No. 0, 110 volts, 1200 r. p. m. The current can be taken from the alternating-current 110-volt lighting mains, one circuit from each phase. Two circuits from the same phase will not do to operate the motor, for well-established reasons.

The circuits are run as shown in Fig. 3. Two-phase four wires are changed to two-phase three wires. If the circuits

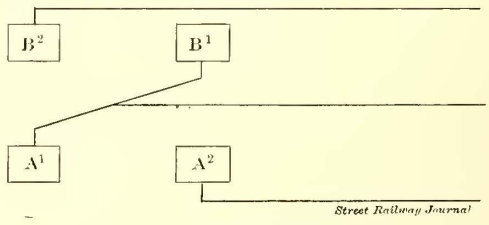


FIG. 4.—MOTOR TERMINALS

have to be run a considerable distance this means a great saving in wire. Double-pole branch cut-outs, fused for 25 amps., are used.

At the two-phase switch the two inside wires are joined, entirely eliminating one wire; and the three wires are continued to the bare trolley wires, to which they are soldered and so installed as to be free from injury.

The other motors of this type are operated on 440-volt circuits, most of which require a resistance known as an auto-starter, or a compensator in starting. This motor requires no such resistance, but is operated by closing its switches directly on the line.

Fig. 4 gives an idea of the motor connections: There are four terminals on the motor, marked A-1 and A-2, which repre-

sent one circuit for phase A, while B-1 and B-2 are the terminals for phase B. Run one wire to B-2 and one to A-2, and connect A-1 and B-1 together, using a common wire for both of these terminals. These connections can also be made the reverse of these just described. To get a change in direction of motor change places with wires B-2 and A-2.

We will next consider the controller shown in Fig. 5. Far from being an elaborate series parallel controller this one consists simply of a two-phase switch, four-pole, double-throw, mounted upon a 1½-in. pipe. It should be so connected that when thrown forward the car will run in that direction, and when thrown in the opposite direction the car will reverse its direction.

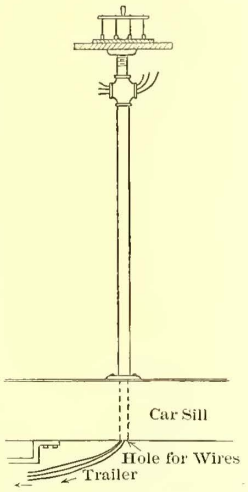


FIG. 5.—CONTROLLER

The wires from the trailer are connected to the center contacts on this switch. The other wires lead to the motor. The switch, with a marbleized base, is mounted upon a wooden base, which in turn is secured to a flange union at the upper extremity of the pipe.

The motor used for this purpose could have been a three-phase type, and three-pole switches and fuses might also be used; but for this particular purpose all the apparatus used is two-phase, hence the two-phase motor. The motor is suspended below the car platform. Since its speed is 1200 r. p. m., it must be reduced by intermediate gears to about 150 ft. per minute.

Make a trap-door in the car floor for convenience in oiling the motor. The bearings for the car axles and intermediate gear shafts can be of the plain split box type. Gain the boxes into the car timbers to prevent the shaft boxes from getting out of line. This defect will cause delays and expense. When a shaft shifts out of line a strain is thrown on the outer edges of the gears, and when the car is in motion the gears are extremely noisy. The outside edges frequently chip off, and the results are even worse if not at once remedied.

Do not use paper or cardboard to line up shaft boxes, for such material very soon cuts out and troubles follow. Wood chips are no better. Procure sheet iron and tin and make the job thoroughly up to date with perfect workmanship. Where it is possible to do so, when the load is carried one way only, build the runway with a down-grade. The reason is plainly apparent. Very little current is required for the return trip without load.

There will be sufficient space on the armature shaft beside the pinion for an iron pulley, which can be used for a friction brake by means of a friction band and the necessary levers. The main lever should be placed close to the controller stand, out of the way of trucks, etc. Pushing forward releases the brake; pulling toward the operator applies the brake. Very little movement is necessary to stop the car under full load and speed.

Since boxes and other material are liable to fall over the end of the car upon the trolley wires, especially when the brake is applied, a removable railing made of gas pipe should be made, to be inserted in holes in the car frame. The car rail may be a T-rail, 2¼ ins. high and 1⅛ ins. across the ball of the rail, the gage about 4 ft.; the car axle 2 ins., and wheel base 6 ft. The car wheels are 18 ins. in diameter, 2-in. to 3-in. tread, ⅝-in. flange. Should the rail wear a groove in the wheels, as will be the case if the wheels are not properly chilled, it is best to get a new one, for the increased friction interferes with the smooth running of the car, to say nothing of the waste of power. A good size for the car is 12 ft. long and 6 ft. wide. A truss rod on each side, of ½-in. round iron, might be necessary; but if so it can be put on at any time. A few inches clearance on either side of the car is necessary.

But little trouble will be experienced in the operation of the car, and these troubles are easily discovered and remedied. Since the voltage on the circuit is 110, an incandescent lamp with two free ends of the lamp cord extending from the socket can be used as a test lamp, to indicate closed or open circuit, and may be connected across the service switch blades to indicate whether the fuse is blown and on which phase.

If the fuses are all right next test at the center connections of the controller switch. If the lamp does not burn either one or more of the trolley wires are out of their proper place in the trailer contacts, or there is a very poor contact on the trolley wires. Yet again there might be a bad connection in the controller switch itself that would prevent the car from starting, although the lamps would light at the center connection of the switch.

If there is a flash at one phase of the switch, and the car does not start, it is also an indication that there is an open circuit somewhere. Any of the previously mentioned plans of procedure that fits the case may be followed.

When the car is in motion if sparks are seen or heard at the trailers there is a poor contact at this point, and it may be necessary to give a little slack to overcome this. Too much slack will allow the wires to swing together, which would also blow a fuse.

One very necessary thing is to line up the trolley wires with reference to the car track and the center line of the trailer contacts. Failure to give this the necessary attention will cause frequent delays, since it will be impossible to keep the trolley wires in place.

Should the car run off the track examine the motor connections to see if they are intact, for they are liable to injury since the motor will hang pretty low. A carpenter can make new ones if required. Cover the screw-heads below the wood block with insulating compound as originally found.

CONTRACT FOR POWER BRAKES IN ST. LOUIS

All the cars of the St. Louis Transit Company, of St. Louis, Mo., by a contract closed May 21, will be equipped with power brakes before the opening of the World's Fair. The contract was placed with the Westinghouse Air-Brake Company, and is for that company's air brake, deliveries to be made as fast as the brakes are completed. The first consignment is promised within sixty days. The work of equipping the cars will then begin, and it is expected that the majority of the rolling stock in use will be equipped within six or eight months; 1500 cars are to be equipped.

The brakes are similar to those in use on the new cars of the St. Louis & Suburban Railway. So far as their operation by the motorman is concerned, they are the same, but their further construction differs in details. The compressed air with which to work them will be supplied from forty compressor plants, to be erected in as many locations in the city. The compressors will be of the Ingersoll-Sergeant Westinghouse electric-driver type, and of special design for local requirements.

The letting of the contract is the climax of a year or more of bickering between the city and the Transit lines over the brake question. The time limit named in the ordinance requiring the cars to be equipped with power brakes expired with the cars still unequipped. The explanation by the officers of the Transit Company was that such a step could not be taken without a thorough investigation of the efficiency of the several devices submitted.

The Aurora, Elgin & Chicago Railway Company has opened its Elgin branch, running from Wheaton to Elgin, for regular commercial service. This branch is giving a half-hourly- service similar to the other branches, which have been in operation for some time.

A CALCULATION OF FEEDERS FOR INTERURBAN LINES

Boston, Mass., May 12, 1903.

Editors Street Railway Journal:

It is a well-known fact that most electric lines are lightly coppered. It must be manifest to anyone who thinks at all, that copper, which will be all right for the average winter load, is altogether too small for the maximum load even without snow-plows, and with them out as well, the chance of the entire line being stalled is great.

I should suggest the following as an outline for calculating the feeder system for a line having for its equipment four General Electric No. 58 motors per car or its equivalent. This equipment averages 75 amps. running on a level and 175 amps. accelerating, 85 amps. running on a 5 per cent grade, and 250 amps. accelerating. Running time on an average line 20 miles per hour, maximum speed 35 miles.

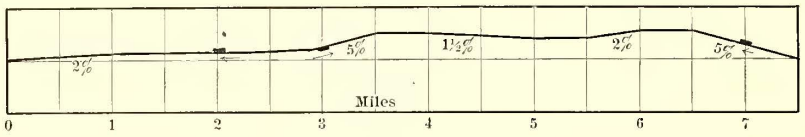


FIG. 1.—PROFILE OF ROAD

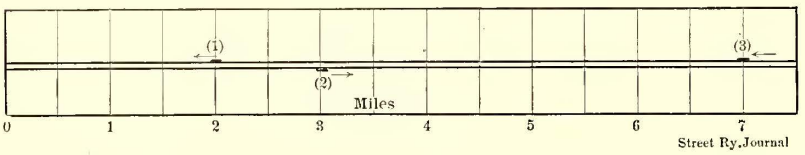


FIG. 2.—PLAN OF ROAD

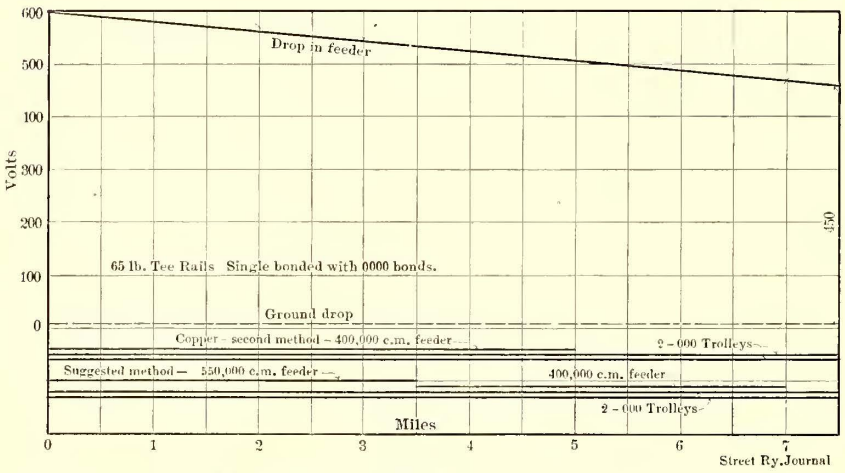


FIG. 3.—FEEDER DIAGRAM AND VOLTAGE DROP

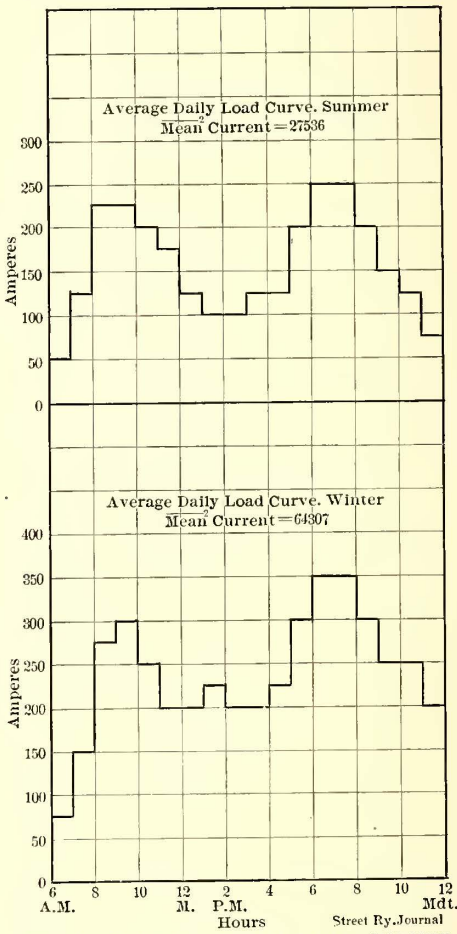


FIG. 4.—AVERAGE DAILY LOAD CURVES

The first step is to lay out an approximate profile of the road, then a plan of road giving the spacing of cars on their running time, Figs. 1 and 2. The cars are then shifted about on this plan until the worst possible condition is realized, as is shown in Fig. 2, where cars (2) and (3) are climbing grades; we will assume that car (3) is accelerating, which will give us as near as we are likely to get to our worst condition as regards voltage. Assuming a maximum drop that we will allow under these conditions, as given in Fig. 3 on a straight line plot, we can easily calculate what our copper should be.

This method gives, I frankly admit, a large amount of copper, but that it is justifiable and indeed is economy, is easily shown by comparison of costs during the year of the line losses of the two methods. If the interest on the additional amount of copper required by the suggested method is less than or equal to the amount saved in line losses by the added amount of copper, it is best to have it, for it adds to the ability to keep up the schedule speed, and allows of running extra cars under ordinary conditions and reduces to a large extent that item of expense, repairs to motors, due to their being over-heated from having to carry full-load current for long periods of time in order to make the schedule speed, much time being lost on grades due to low voltage, requiring that power be used more on the level and down grade.

For the purpose of discussion we will consider one end of a 40-mile line, having its generating station in the middle of the line and one sub-station 7.5 miles from each end. The line is double-tracked, and the rails 65 lbs., bonded with single 0000 bonds. Cars running on 15-minute schedule makes three cars on the line between the sub-station and the end of the line, spaced as shown in Fig. 2. Our load then from this data is: Car (1), 75 amps.; car (2), 85 amps.; car (3), 250 amps.; total of 410 amps. From our plot we find the drop between cars (2) and (3) is 79 volts, which requires an area of copper of 720,000 circ. mils; between car (1) and (2) we have 22 volts, which means 867,500 circ. mils; between station and car (1) we have 42 volts, which means 900,000 circ. mils. Taking our trolley out of this, which we will call 000, we have 564,400, use 550,000 circ. mils between station and car (1), 5,319,000, use 550,000 circ. mils; between (1) and (2), 384,400 use 400,000 circ. mils between (2) and (3) and trolley to end of line. The cost will then be as follows:

Cost of copper and installing same but exclusive of trolley	$11,635.76
*For extra cross-arms and insulators	500.00
Total	$12,135.76
Interest at 6 per cent, plus depreciation and maintenance at 3 per cent	$1,092.22
Line loss at .02 per kilowatt-hour	1,286.06
Line loss plus interest	$2,378.28

* The extra cross arms, etc., are those required over and above what are needed in the second method of figuring.

Figuring the same road in the usual manner from average load from data of General Electric 58 equipments we have 100 amps. per car, and figuring in the rough-and-ready way that the load is concentrated at the center point of feeding we have 400,000 circ. mils. to 5-mile point, and trolley to end of line. This is by no means unusual with a 000 trolley.

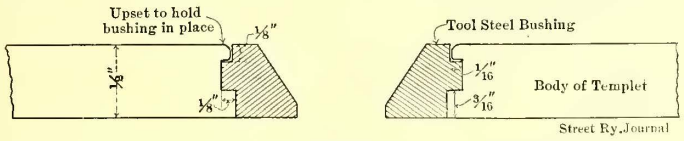
Cost of copper and installing same, but exclusive of trolley	$7,158.75
Interest, maintenance and depreciation at 9 per cent, as above	644.29
Line loss at .02 per kilowatt-hour	1,733.84
Line loss plus interest	$2,378.13

"Line loss" is figured from the curves shown in Fig. 4, which are daily average winter and summer load curves for an actual road very similar to that under discussion. The loss is figured by using the resistance of the copper and track to the center of distribution, i. e., 3.75 miles from the station, and multiplying that by the mean square value of the current from the two curves. This gives the hourly loss for winter and summer; considering that winter lasts 120 days and summer lasts 245 days, we can easily find the yearly line loss as given above. The schedule is the same in winter and summer, but the winter load includes the snow-plows. On this line three passenger cars were run from 7 a. m. to 9 a. m., and from 4 p. m. to 8 p. m. At other times two cars were run.

HENRY D. JACKSON.

TEMPLET FOR PUNCHING TRUCK FRAMES IN ST. LOUIS

The St. Louis Transit Company, of which W. O. Mundy is master mechanic, uses a templet for punching the bolt holes in truck frames, which has effected a great saving over the cost of drilling these holes, as would be necessary if this templet were not used in the manufacture of trucks. The company's present standard truck for double-truck cars is of the Du Pont type. This truck has a very simply constructed frame, made of two pieces of bar steel, bent to form the frame. The truck is too well known to need further description. The templet used differs from an ordinary templet in having the holes where the punch enters tapered, as shown in the accompanying sketch. The body of the templet is made of soft steel with guides and



SECTION THROUGH BODY OF TEMPLET AND BUSHING USED IN PUNCHING HOLES IN TRUCK FRAME, ST. LOUIS TRANSIT COMPANY

clamps for holding it to the piece of work to be punched. The holes are bushed with tool-steel. These bushings are put in counter-sunk holes and the edge of this hole is upset to hold the bushing in place, as shown. The object of the tapering hole in the tool-steel bushing, which guides the punch, is, of course, to allow the punch to easily enter the hole as it descends automatically to move the piece of work to its proper position. If the hole were not tapered, of course it would be a difficult, if not impossible, matter to use a punch in these templet holes, for it would be necessary to get the hole exactly under the punch, which could not be done without consuming a prohibitive amount of time. By the use of the tapered hole the punching can be done very rapidly, effecting a great saving of time over drilling. In this connection it may be noted that Mr. Mundy has made a study of labor-saving methods in manufacturing this particular type of truck, with the result that labor on such a truck has been reduced to the extremely low figure of about $12 a truck, which could only be done by a thorough study of the cheapest means of manufacture and provisions for rapid work such as this templet affords. For these Du Pont swivel trucks (900 of which are being made by the company in its own shops to go under 450 cars ordered for the World's Fair traffic) the truck frame is to be bent on a form in a bulldozer. This, together with the punching of the frames by templets, makes all the truck frames interchangeable, which is another very desirable feature in addition to the labor saved. The punch used with this templet must, of course, be a blunt-ended punch, without the centering point which is sometimes used in punches. If a centering point were on the punch there would be danger that it would be broken off by the sliding action caused by the tapering hole in the templet. Since the only useful function of the centering point is to enable holes to be punched accurately when the work has been marked previously with a hand punch it is obviously of no use when a templet is employed.

THE HUNTINGTON ELECTRIC RAILWAY SYSTEM IN SOUTHERN CALIFORNIA

Electric railway operations out of Los Angeles, Cal., are attracting wide attention, owing to the extensions proposed by the Pacific Electric Railway Company, of that city. This company's proposed improvements will require $30,000,000.

The Pacific Electric Railway Company now operates about 130 miles of track to country points, and has in contemplation for construction in the near future about 100 miles more. All its tracks are standard gage, of 60-lb. A. S. C. E. section rails, and the roadbed is heavily ballasted.

The Pacific Electric Railway Company is now working hundreds of men on the proposed road to Whittier, where 24.6 miles of track will be laid and the line opened by the middle of summer. From Dominquez to San Pedro—9 miles—a railway will soon be built, nearly a mile of track having already been laid at the San Pedro terminus. An extension from Monrovia to Azusa, and from San Gabriel to Covina, will probably be accomplished by fall.

Within the last month Mr. Huntington has secured control of the railway situation out of San Bernardino and purchased all of the railways of Fresno. These moves were made in the name of the Pacific Light & Power Company. From Los Angeles to San Bernardino is about 61 miles, through a rich orange country, well populated; from Fresno the distance is 273 miles.

Eventually Mr. Huntington feels that conditions will justify an electric road to San Francisco, approximately 500 miles, and in that direction he has purchased interests all along the coast. Fresno is in line. To connect Los Angeles with San Bernardino Mr. Huntington will extend his Monrovia line, which is 17.7 miles long.

The interurban system with the most extensive branch traffic out of Los Angeles is that of the Los Angeles-Pacific Railway Company. It owns about 150 miles of track and touches six or seven thriving beach resorts. This company has been the building of Santa Monica, Ocean Park and Playa del Rey, and now runs down the coast 8 miles to Redondo.

To Redondo also runs the Los Angeles & Redondo Railway Company, operating a little less than 50 miles of track. This corporation has recently doubled its capital stock to $1,000,000, to make many improvements and enlarge its wharf facilities.

North from Los Angeles, Leslie C. Brand, a wealthy citizen, proposes to build 10 miles of double track to Tropico and Glendale, at a cost of about $200,000. The right of way has been secured and grading gangs are at work.

Out of Santa Ana are also several projected electric roads to the coast. One will go to Newport Beach, another to Pacific

City—both distant about 15 miles from Santa Ana. The Pacific City project is backed by Mr. Huntington. On May 4 he agreed to buy all the holdings of the West Coast Land & Water Company in Pacific City for about $200,000.

A particularly interesting feature of the Los Angeles traction situation is the closeness with which the electric roads have paralleled the steam roads in all the territory surrounding Los Angeles for a radius of 20 miles. The purchase of the Los Angeles Traction Company by Senator W. A. Clark, president of the San Pedro, Los Angeles & Salt Lake Railroad Company, backed by President E. H. Harriman, of the Southern Pacific, is taken as an evidence of the fear that steam has suddenly evinced for electricity in this section. If Senator Clark carries out the work actually begun by the former owners of the Traction Company, there will soon be another electric line from Los Angeles to Santa Monica.

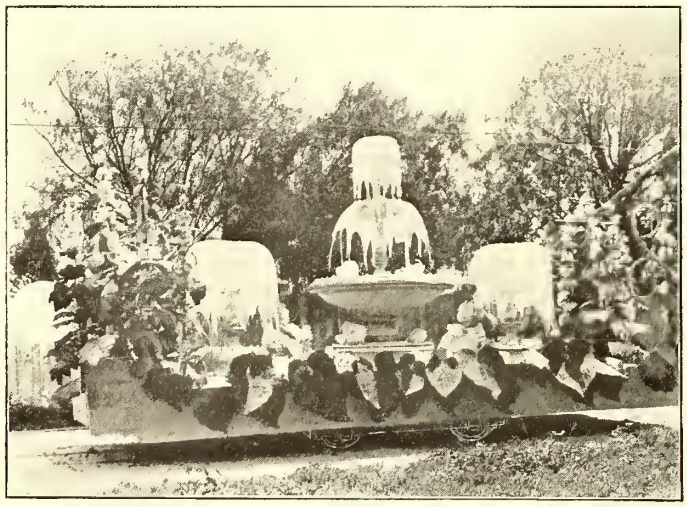
Perhaps the best equipped electric road out of Los Angeles is the Long Beach line of the Pacific Electric Railway Company, 20½ miles long, running a 5-minute service in 35-minute time. On May 3 this line transported 5000 passengers to the beach.

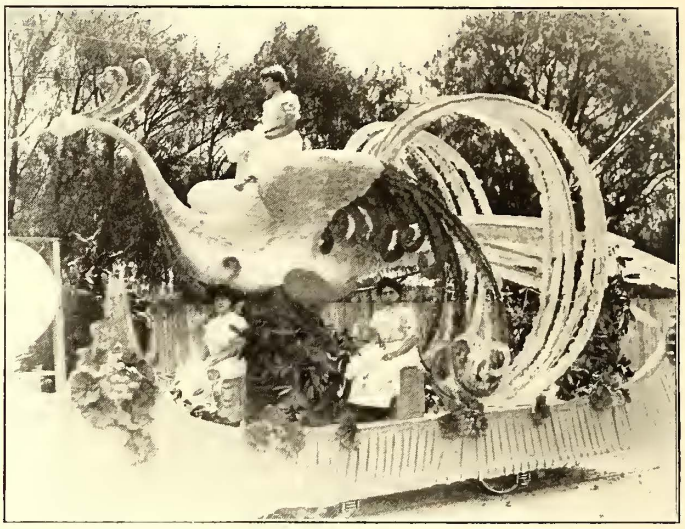
The daily papers and leading merchants of Canton, Ohio, are planning to form a Merchants' League for the purpose of running trade excursions into Canton. The plan is to have each of the interurban roads entering the city to give round-trip excursion rates on certain days during the week. If the interurban roads cannot be induced to make concessions for these days the League proposes to maintain a fund to help bear the burden of the reduced fares.

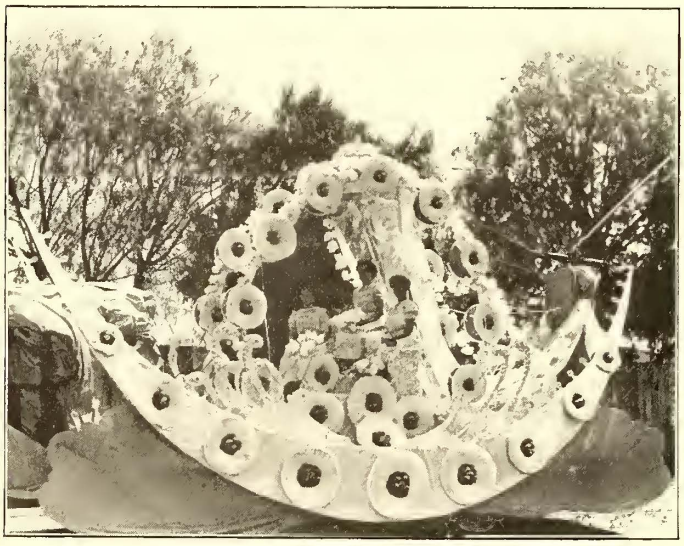
ELECTRIC RAILWAY FLOATS IN FIESTA

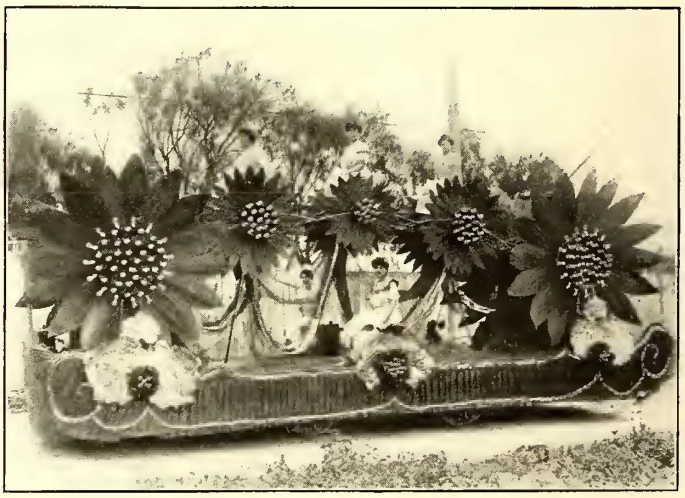
Car trucks of the Los Angeles Railway Company formed the basis of an exquisite electrical parade during the recent Fiesta de las Flores in Los Angeles, Cal., in which President Roosevelt participated. Both the trucks and the power necessary for the parade were furnished free of charge through the courtesy of John A. Muir, general manager of the company.

There were fifteen floats in the parade, requiring in their construction 5000 ft. of copper wire, 4500 incandescent bulbs, ten arc lamps and 1000 fuses.









FANCY FLOATS, MOUNTED ON ELECTRIC RAILWAY TRUCKS, USED IN FLOWER FESTIVAL AT LOS ANGELES

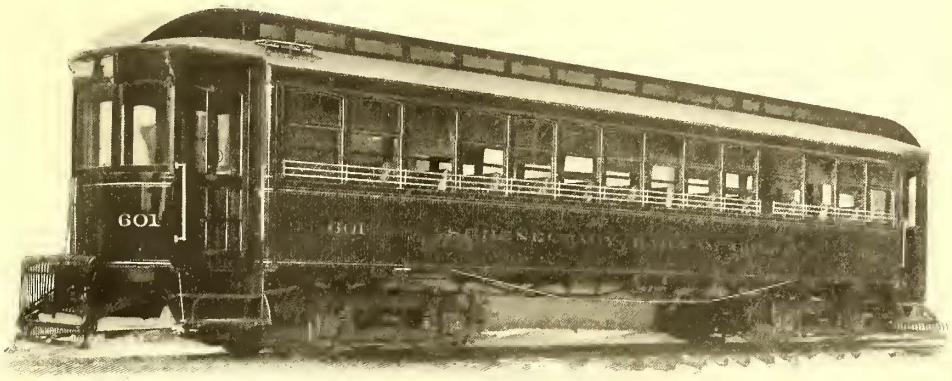
The floats were designed to tell a story characteristic of a land of flowers, wherefore the results of sunshine and irrigation in a seeming desert land were pictured in thirteen floral floats. Naturally, the float that headed the procession was Sunshine on Desert, followed by Irrigation. Then came Pond Lily, Chrysanthemum, Bridal Wreath, Camelia, Corn Flower, Calla Lily, Hybiscus, Carnation, Pansy, Wistaria, Red Rose, Moon Flower and Sunflower.

The accompanying pictures show four of the floats, and readily indicate the elaborate design of the others. On the float Irrigation, which is the first one shown, 340 incandescent and two open arc lights were used. The Camelia flower, which is second in the group herewith, was represented by an immense bird of paradise, aglow with fifty-five incandescent lights. The plumage of the bird fell at the back of the float, after circling high in the air, and was decorated with camelias interspersed with small electric lights. The wings of this immense bird

flapped up and down as the float moved along. In the float were used 165 electric lights, together with eighty miniature lamps in the tail. The illumination in the Moon Flower float, the third in the set shown, was furnished by 300 incandescent lamps. On the Sunflower float, which is the final view, was an arch of sunflowers over a rich disc of purple and gold, and at the sides of the float the sunflowers all revolved with the moving of the truck.

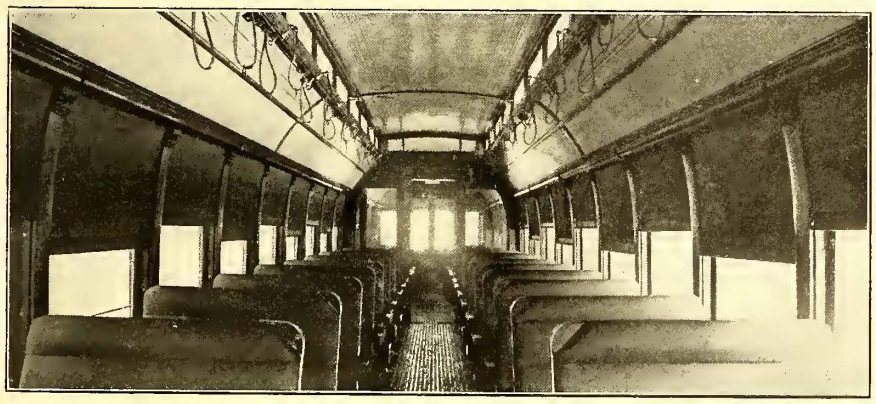
LARGE SEMI-CONVERTIBLES FOR THE SCHENECTADY RAILWAY

The Schenectady Railway Company has received six large semi-convertible cars from the J. G. Brill Company, of Philadelphia, and the cars are now in operation on the lines between Schenectady and Albany, a distance of about 15 miles. On this division the remarkable run was made which was chronicled in the issue of Feb. 28. A car mounted on the same style of trucks that carry the new semi-convertibles made 2 miles a minute for 10 miles of the run. The lines run over private right of way, and as the grades are slight and the curves long fast time can be made. As the cars enter the terminal cities over the street railway tracks, the wheel flanges are shallow and the treads narrow.



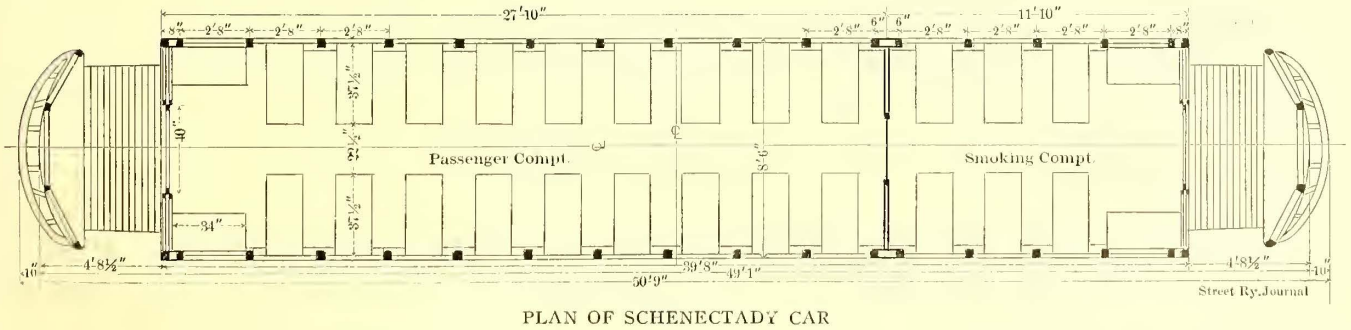
EXTERIOR OF SCHENECTADY CAR

The cars have much the appearance of steam coaches with their straight sides and steam railway roofs. Over the vestibules they are 49 ft. 1 in. long, and 39 ft. 8 ins. over the end panels. The width over the side sheathing is 8 ft. 6 ins., allowing the seats to be full steam-road length. The interiors are divided into two compartments, separated with hardwood partitions having single sliding doors. The smaller compartment is for smokers, and is 11 ft. 10 ins. long. Both compartments are finished in dull mahogany, handsomely carved and inlaid, and with ceilings of bird's-eye maple with gold stripings. The windows are of the builder's regular semi-convertible type, with roof storage when not in use. The slight curve of the upper parts of the posts, with the sweep continuing up to the lower ventilator rail, gives an exceedingly graceful appearance to the interiors. The illustration of the interior of one of the cars gives an idea of the simple but rich style of the whole, and one can imagine, with the windows raised into the roof pockets and the curtains up, how bright and airy it must be. Double steps are used at the platforms, as the time consumed in loading and unloading is not a consideration on an interurban road. The platforms are enclosed with round-end vestibules sheathed with steel. From the end panels over the crown pieces is 4 ft. 8½ ins. The corner posts have a thickness of 3¾ ins. and the side posts 3¼ ins. The side sills are of long-leaf yellow pine, 4 ins. x 8¾ ins., and are plated with ⅜-in. x 12-in. steel on the inside. These plates extend up the base of the posts and add much to the vertical strength. They are a regular feature of the semi-convertible type. The cars are arranged to run in either direction, and as it is not intended to run them in trains fenders are provided at both ends. Vertical hand wheels of solid bronze are furnished. The builders' patented bumpers, drawbars and alarm gongs are included in the equipment.



INTERIOR OF SCHENECTADY CAR

The trucks are 27-E, with spring-link suspended equalizing bars and solid forged frames. The wheels are 34 ins. diameter. These trucks are simply a larger type than the No. 27, which the road has been using for several years.



PLAN OF SCHENECTADY CAR

The president of the Montreal Street Railway Company announced on May 28 that while the company would not recognize any labor union of its employees, it would assist them in forming a benevolent union, if they desired to do so. All the former employees who apply as individuals will be taken back, provided they have not committed unlawful acts during the strike.

BRUSH DIRECT-CONNECTED GENERATING SETS

The opposite cut (Fig. 3) illustrates a 300-kw generating set, consisting of a 300-kw generator connected to a triple-expansion engine. This set was built by the Brush Electrical Engineering Company, of London, England. The engine cylinders are of hard, close-grained cast-iron, and made to register into the cross-head guide. The ports are straight and self-draining, and the cylinders are fitted with drain and relief valves of ample size. The exterior is lagged with non-conducting material and covered with steel sheets.

The steam distribution valves are cast-iron and of the balanced piston type, annealed after rough turning. The high-pressure pistons are of cast-iron, bored and faced, having recesses formed in the top flanges, into which the registers of the cylinders fit, thus insuring alignment of cylinders and guides. The cylinders are mounted on a cast-iron standard, to which are attached the cross-head guides. This standard encloses the whole of the working parts, and is fitted with large doors at the front and back, to give easy access to the interior. The bed-plate is of cast-iron, girder form, in one piece, with the supports for the main bearings. The crank chambers in the bed-plate form the reservoir into which the lubricant flows after being forced through all the bearing surfaces.

The fly-wheel is of cast-iron. On it is formed the engine-half of the coupling for connecting to the generator.

A powerful automatic governor controls the cut-off of the high-pressure piston valve. It is fitted with a simple speeder gear, capable of easy regulation, while the engine is running. A throttle governor can be fitted if desired. The engine is fitted with automatic-forced lubrication, two valveless oil pumps, driven from the crank shaft from the oil under a pressure of about 15 lbs. per square inch through a closed system of pipes and channels to all the working surfaces. Strainers are fitted, easily removed for cleaning, through which all the oil is filtered on its way from the pumps to the bearings.

On the electrical side of the unit the armature is of the hollow-drum multipolar type, consisting of a cast-iron spider carrying the core laminations. The spider and coupling are cast solid for direct connection to the engine, so that power is directly transmitted from the fly-wheel to the armature, and all torsional strains on the shaft are avoided. The stampings are of charcoal iron, .014 thick, insulated from each other by paper or varnish, and fixed rigidly to the spider by dove-tailed keys. The armature bars are firmly held in position by keys and binding wire.

The field magnets are made of cast-steel of high permeability. A rigid construction is adopted to prevent sagging during erec-

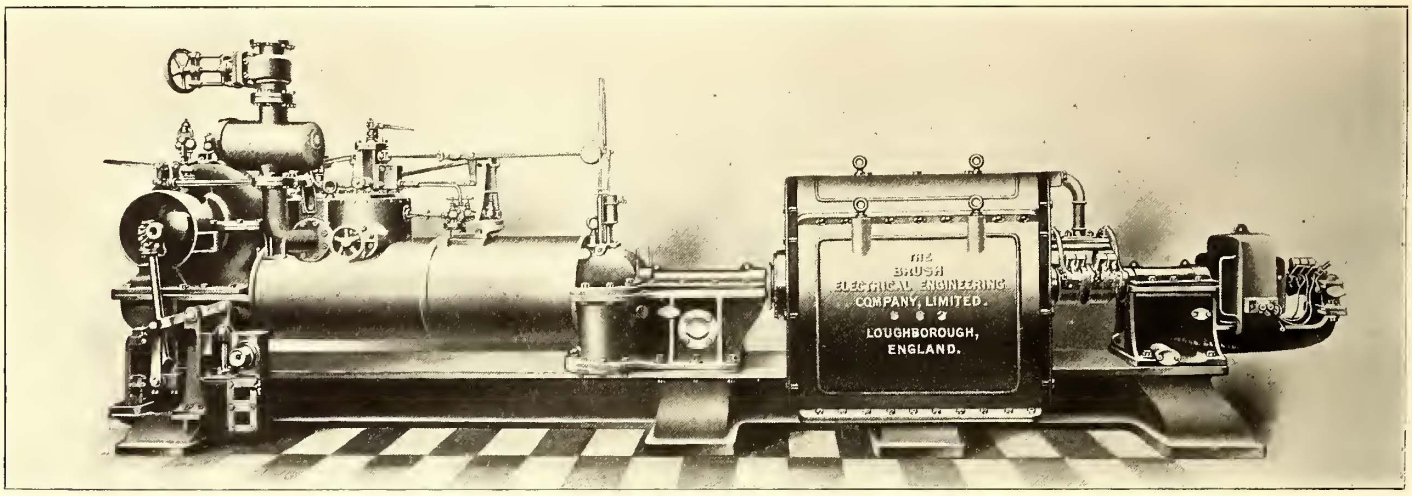


FIG. 1.—300-KW TURBO-ALTERNATOR AND EXCITER

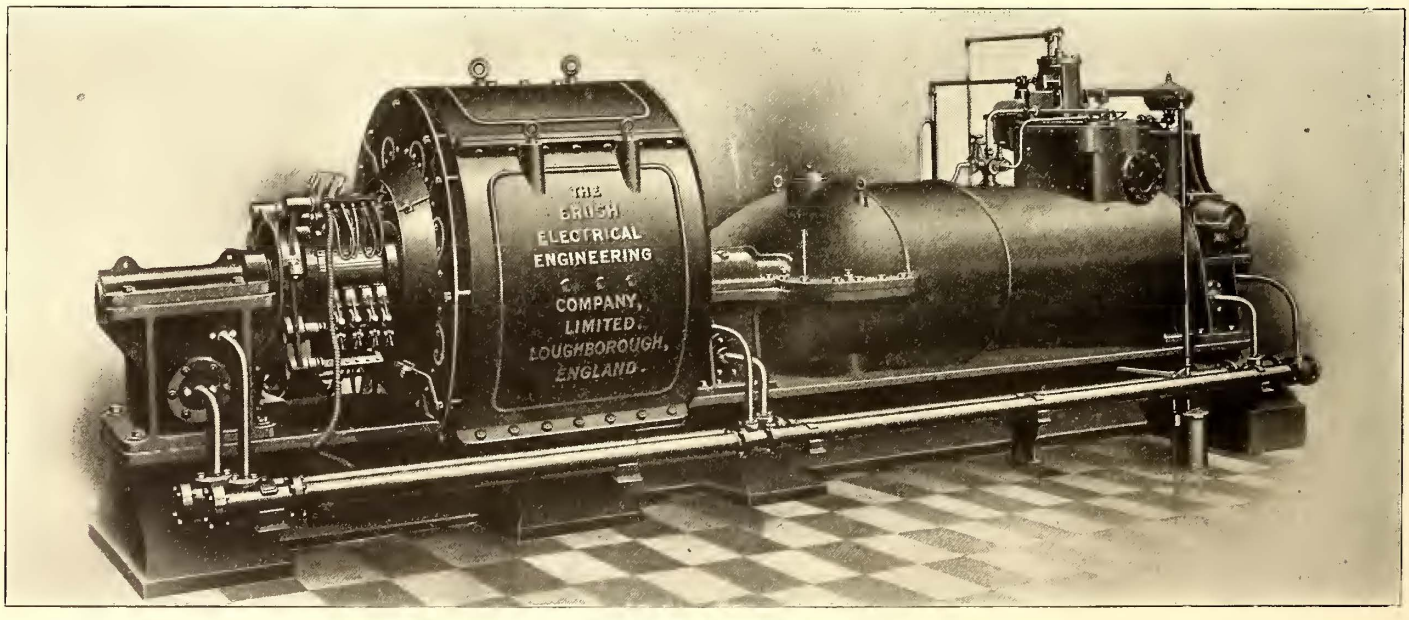


FIG. 2.—500-VOLT TURBO-GENERATOR

tion, and the poles are fitted with removable laminated faces.

The field coils are wound on formers, with ample clearance round the poles for ventilation and for easy removal and replacement of coils.

The rocker is fixed to the field magnet frame so that the end bearing can be removed without interfering with the brush gear. The latter is of substantial and rigid design, with the brush spindles supported at both ends.

The commutator is built up of copper bars insulated with mica. Ample brush surface is provided, and special carbon brushes are supplied.

The outside bearing is usually lubricated by means of two or more brass rings in contact with the top of the journal and revolved thereby; but, if desired, the system of forced lubrication can be extended from the engine.

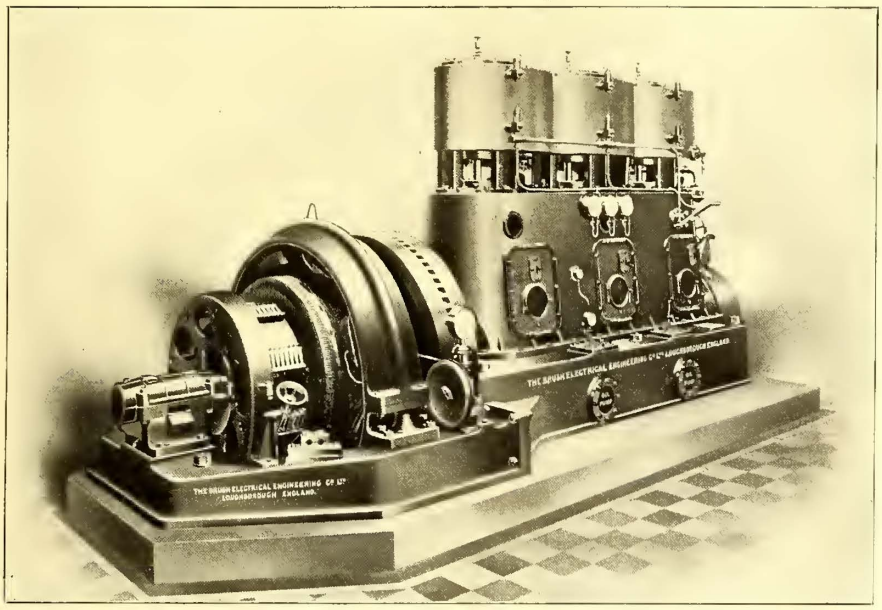


FIG. 3.—300-KW THREE-CYLINDER ENGINE AND GENERATOR

BRUSH-PARSONS TURBO—GENERATOR

The manufacturers of the Brush engines and generators have obtained full license from the inventor to build and sell the Parsons turbine, and have commenced their manufacture in all capacities up to 10,000 kw for direct-current or alternating-current generators.

Fig. 1, of the accompanying cuts, shows a Parsons turbine direct-connected to a 300 kw alternator, and Fig. 2 shows it used in connection with a direct-current generator.

The company has obtained a license under the Heyland patent to manufacture synchronous, single-phase and polyphase, inductor generators. These are especially suitable for connections to turbines, and have the advantage of being self-exciting, with a facility for paralleling unknown in other machines. The actual drop with any power factor is said to be only 3 per cent, and if desired the machine can be compounded or even over-compounded.

SEATS FOR BROOKLYN ELEVATED RAILWAY CONVERTIBLE CARS

The Heywood Brothers & Wakefield Company is delivering 3000 reversible seats for the 120 new convertible cars for the Brooklyn Elevated Railway. This seat, as shown in the accompanying cut, was designed especially to meet the requirements of this road.

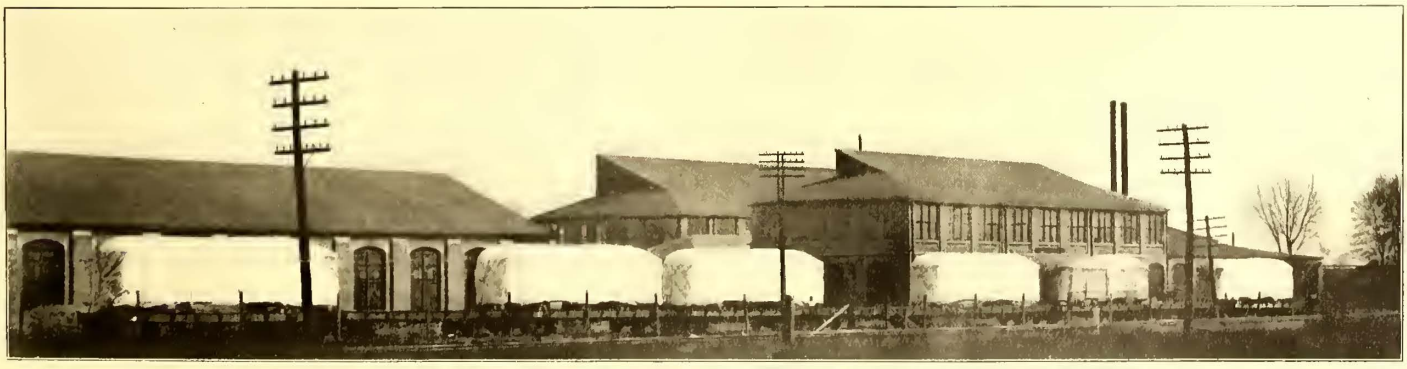
It has a pedestal base and foot rail hanger with single foot rail. The wall end is fastened to truss plank of car with six screws, and has two bosses, ½ in. round and ½ in. projection, to extend into the truss plank to relieve the screws of the weight. This arrangement gives a clear space from bottom of pedestal base to side of car, greatly facilitating the cleaning of the floor, there being no corners to retain the dirt, as where the ordinary seat leg is used.

SEATS FOR BROOKLYN ELEVATED CARS

The reversing mechanism is of the well-known Wheeler pattern, and designed to withstand the abuse this seat may be subjected to. Owing to a lifting movement in reversing it is unnecessary to put a catch or lock on his seat. The back will give a firm support to standing passenger without such catch, and is offset to gain aisle space above the seat line. The seat and back are made of maple slats. The castings are finished in gold and green and the whole seat presents a handsome appearance.

NEW CARS FOR TOLEDO

The G. C. Kuhlman Car Company has just completed an order of thirty cars for the Toledo Railways & Light Company, and the accompanying cut is a reproduction of a photograph of a part of the first shipment on this order, which was taken as

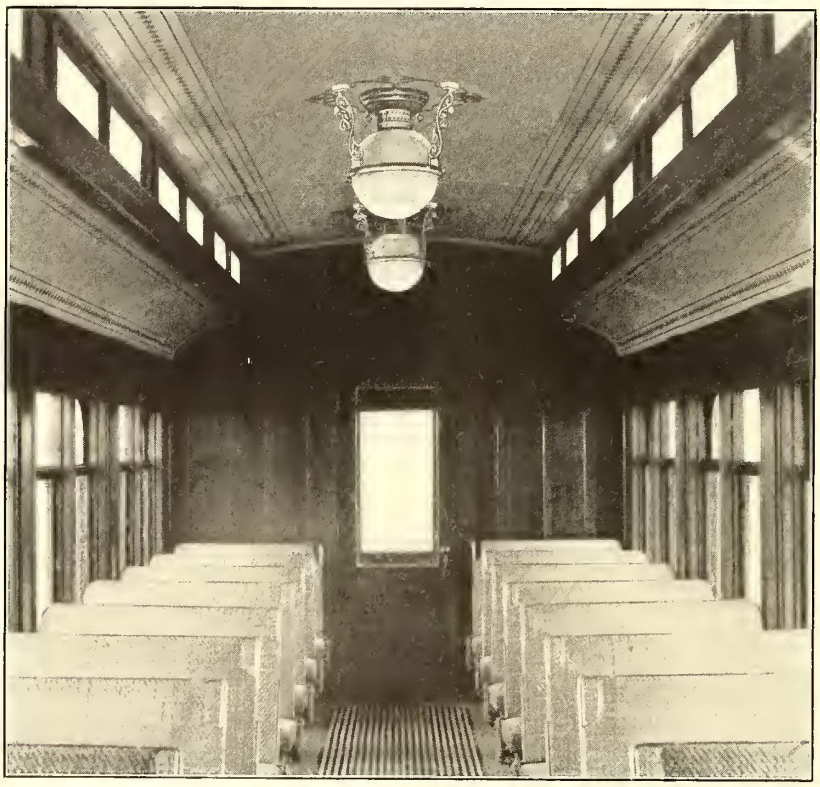


TRAIN OF CARS FOR TOLEDO

the cars were leaving the factory. At the left of the picture is shown a part of the erecting shop, and on the right the blacksmith shop and machine shop, the upper portion of the store room and the mill room. These cars are of the standard city type made by the Kuhlman Company, having a central aisle with rattan seats. The finish is in cherry rubbed to a dead gloss, with whitewood head linings tinted green and gold-leaf decorations. A feature of these cars is the Detroit platform, which has been adopted for this service.

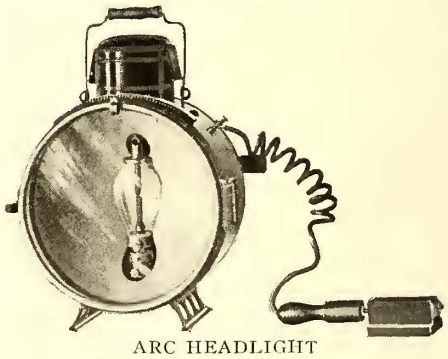
ARCS FOR INTERIOR CAR LIGHTING

The St. Louis Car Company has put out a number of cars recently equipped with its new enclosed arc lamp for interior car lighting as a substitute for the usual incandescent lights. These lamps are enclosed in holophane or other globes, which give such a diffusion of the light as to make the intensity of the arc unobjectionable. While it may appear that the lighting of a car interior with an arc lamp would be a precarious matter in view of the jolting to which these arcs are subjected and the possibility of carbons jarring together and putting out the arc, these possible objections do not hold with the arc lamp mechanism which the St. Louis Car Company now controls. This is the same mechanism that is used on its arc headlights, and which was developed after several years' experiment by Messrs. Anderson and Smith, of the Los Angeles & Pasadena interurban line, and later perfected by the St. Louis Car Company. The mechanism is very simple and consists of a single coil of wire in series with the arc which serves to start the arc, and also to feed the carbons as the arc burns along. The most remarkable thing about the lamp is the clutch, which acts directly on the carbon and is extremely simple, consisting of but two pieces. Its strong point is that it is practically impossible to make the carbon slip through the clutch by jarring the lamp. Just why the clutch is so perfect in this respect many good mechanics have puzzled themselves to discover. Nevertheless, the fact remains that the lamp can be subjected to all manner of abuse, in the way of jolting, without going out. These lamps take a current of 2⅛ amps., as do also the arc headlights, one of which is illustrated herewith. The number that it is advisable to place in series on a railway circuit, of course, depends on the voltage which is available at all times. On a road where there is considerable drop in potential at certain times, it would not be advisable to place as many lamps in series as on some road where the feeder load is less. With 500 volts maintained on the trolley, five of these lamps can be operated in series. There is, of course, a steadying resistance in series with the lamp circuit in addition to the resistance of the magnet coil of each lamp. This resistance is also the result of considerable experience and the weeding out of defective forms of construction. The latest type consists of Climax resistance wire, wound in spirals on porcelain tubes with grooves. These tubes are mounted on non-combustible galvanized iron holders. These arcs can be run in series with the arc headlight, if desired, although this arrangement might not be satisfactory in some cases if the arc headlight is to be changed from one end of the car to the other, as it would leave the car in darkness during the change. The accompanying engraving is of one of the cars recently sent to the North Shore Railroad, of California, equipped with these interior arc lights with holophane globes. A recent feature introduced in these lamps, which seems to be a very valuable one, is that the gas cap, instead of being of iron as is usual, is turned out of Catalina marble, obtained from the island of that name off the California coast. This marble seems to have the property of absorbing so as to prevent the accumulation of soot on the inner globe, which is common, practically, to all enclosed arc lamps.



INTERIOR ARC LAMPS ON NORTH SHORE CARS

ARC LAMP FOR INTERIOR OF CAR



ARC HEADLIGHT

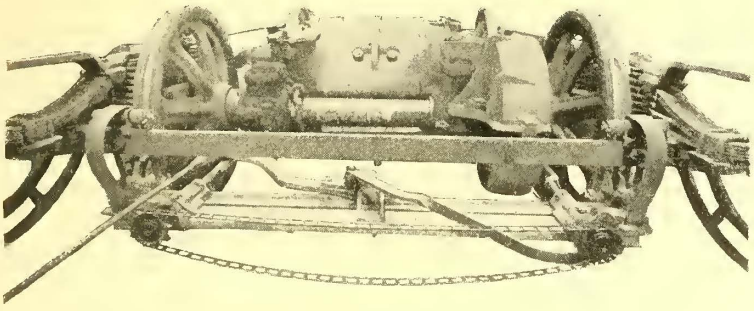
An enterprising clothier at Columbus, Ohio, has a plan for increasing suburban trade which works to the advantage of himself and likewise to that of the interurban roads radiating from the city. He buys special round-trip tickets containing his advertisement, and mails them to prospective customers in the surrounding country. The tickets are good for persons to whom addressed for thirty days; but in order to avail himself of the return trip privilege the holder must call at the clothing store and have the ticket countersigned. This gives the clothier the opportunity sought for.

AUTOMATIC BRAKE ADJUSTER

The accompanying illustration shows an application of an automatic brake adjuster on a Brill No. 21-E single truck. This device can be used for both steam and electric railway work, but special attention has been given to adapting it for electric street railways. The adjuster is designed to take up automatically the slack caused by the wearing away of the brake-shoes.

The operation of the device is as follows: When applying the brake a lever is pulled outward, which causes a connecting rod to move a sprocket casing. Should the lever, from the wear of the shoes, travel further than a given distance the sprocket casing is rotated far enough to allow a pawl to travel more than the length of a tooth in the ratchet wheel. When the brake is released the springs which draw the lever back will rotate the sprocket casing into its original position. Thus the pawl will rotate the ratchet wheel, tightening up a nut on the rod to the extent of the angular motion of one tooth. The result is that when the slack on the brake-shoes is greater than a certain amount it is automatically taken up; and as there is a similar arrangement at each end of the car, and as the motion on the nuts on the one brake-rod is transferred to the nuts on the other rod by the sprocket chain, the slack is taken up equally on both brake-rods. The adjuster is manufactured by the Delaware Street Railway Equipment Company, of Wilmington, Del.

Among the railways now using this device are the following: Wilmington City Railway Company and Wilmington & New Castle Railway Company; Elmira Water, Light & Railroad Company, Elmira, N. Y.; Harrisburg Traction Company, Harrisburg, Pa.; Johnstown Passenger Railway Company, Johnstown, Pa.; Lehigh Valley Traction Company, Allentown, Pa.; Waverly, Sayre & Athens Traction Company, Waverly, N. Y.



AUTOMATIC BRAKE-SHOE ADJUSTER

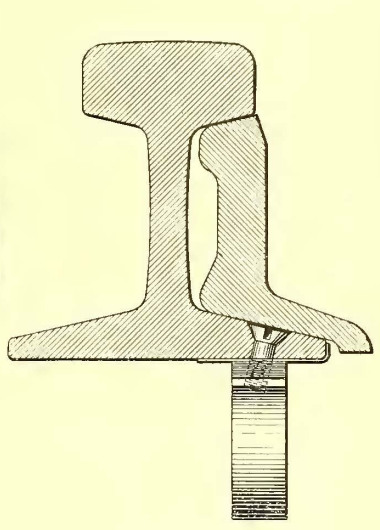
THE THOMAS RAIL-BOND

The accompanying cut shows the Thomas type-H rail-bond on 65-lb. rail. This is an unprotected bond and can be applied wherever the base of the rail is exposed. It is, therefore, available for use with fish-plates or angle bars, for third-rail work, and in other cases where exposed bonding is permissible. The bond is soldered and bolted to the rail. The bolt thus takes up any strains produced by the moving of the rail.

This bond is preferably applied after the rails have been put in place and spiked down, so that the bonding may be done at any time, allowing construction work to proceed without regard to it. The application of the bond requires only ordinary workmen, and the apparatus necessary is inexpensive, comprising a light bonding drill, a hand grinder and a large gasolene torch.

The manufacturer states that the type-H bond is particularly valuable for rebonding, or for adding to the capacity of present bonding. Where fish-plates are used the bond may be placed close to the edge of the rail to give room for the bolt outside the fish-plate. With angle-bars the bolt-hole may be drilled through both angle-bar and rail and countersunk to allow the use of a fillister head screw, seated in the foot of the rail to such a depth that the angle-bar can move freely over it as the rails move to and fro. This bond, therefore, can be applied to existing track without removing the joints.

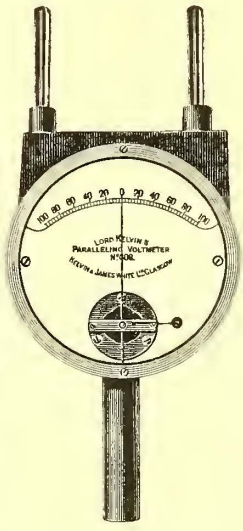
The Thomas type-A bond, which is attached to the web of the rail, was described in detail in the Street Railway Journal of Oct. 4, 1902. Both types are manufactured by Edward G. Thomas, Boston, Mass.



TYPE H RAIL-BOND

PORTABLE PARALLELING VOLTMETER

An improved form of paralleling voltmeter, manufactured by Kelvin & James White, Ltd., of Glasgow, is shown in the accompanying cut. This instrument is portable, and is designed for use in paralleling direct-current dynamos. The terminals are in the form of split springy prongs, arranged to plug into sockets permanently connected to the contacts of the main switch of the dynamo. The switch, or automatic circuit breaker, on the other pole of the dynamo being closed the instrument indicates the difference between the bus-bar volts and the dynamo volts. The indications will be to the right or left, depending on which of the two voltages is in excess. When they are exactly equal the indication will be zero.



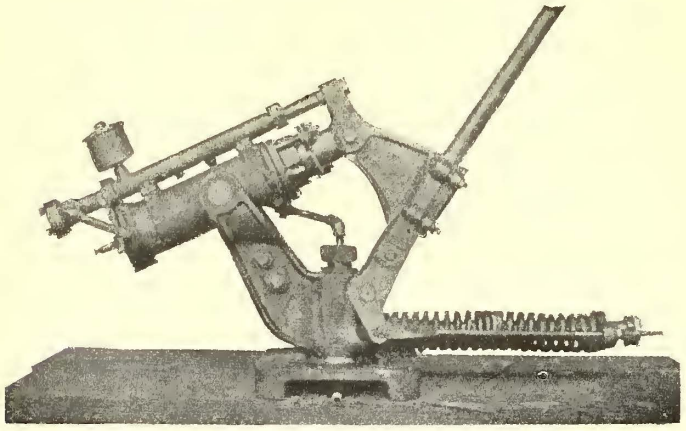
PORTABLE VOLTMETER

The instrument is available for use with any number of dynamos, provided a set of sockets is fitted for each. These should preferably be close to the switch which is closed last. The instrument is wound to withstand the maximum voltage, but it will not be damaged by a reversal of the dynamo, in which case it would be subjected to double voltage, provided this is not kept on for more than half a minute. The scale indicates only one-fifth of the maximum voltage it is designed to withstand, thus giving an open scale and greater sensibility at the part required. To attain still greater sensibility a spring-push switch is provided at the end of the handle, which, when the indication falls below 20 volts, may be depressed and the sensibility increased five times.

This method of paralleling has the great advantage that the instrument is close to the main switch, and consequently the paralleling can be done much quicker than when two voltmeters are used. This method also is independent of the calibration of the instrument itself, since one is always certain that the incoming dynamo is at the voltage of the bus-bars when the main switch is closed.

PNEUMATIC TROLLEY POLE CONTROLLER

The accompanying cut illustrates a pneumatic trolley pole controller, the invention of W. C. Greenamyer, of Los Angeles.



PNEUMATIC TROLLEY-POLE CONTROLLER

This device has been in successful operation on the high-speed interurban lines of the Pacific Electric Railway Company for several months, and as a result of extended tests it has been adopted for general use on the interurban cars operated by that company where high speed is required.

It is claimed for this controller that it prevents the trolley wheel from damaging the overhead work when it jumps the wire, and eliminates the annoyance and damage caused by a defective spring trolley base in similar service. Compressed air is employed for the operation of this controller and is supplied from the air-brake reservoir under the car. The consumption of air is very small in actual operation, and there is little waste, so that the additional cost from the operation is very slight. When the trolley wheel leaves the wire the pole is automatically brought to a horizontal position below the wire and a three-way valve, under control of the motorman, automatically restores the pole to contact with the wire under the guidance of the conductor. The spring shown in the cut simply balances the pole, and is not intended to be used in the same manner as on an ordinary spring trolley base. The invention is being exploited by W. H. Holabird, of Los Angeles.

The trolley base has been tested on the Long Beach division of the Pacific Electric Railway Company, and has taken as high as 800 amps. at starting and 350 amps. during continuous running at 69 m. p. h.

AUTOMATIC CAR FENDER AND WHEEL GUARD

The accompanying cut shows the construction details of a fender which has been designed to operate automatically, thus making it unnecessary to depend upon the motorman to avoid accidents. It is the invention of W. T. Watson, of Newark, N. J.

This fender is fitted with two automatic releasing devices besides the foot-drop commonly used. A pawl, which projects through the center of the car platform, is used for the foot-drop. When this pawl is pressed the bell crank beneath is released and permits the rock-shaft, to which rocker-arms are attached, to rotate. The rocker-arms are connected to levers, which in turn are connected by chains to other levers attached to the fender cushion. The operation of the foot pawl, therefore, releases the fender, permitting the cushion to swing forward and the cradle to drop downward by their own weight. One automatic releasing device consists of a front trip-bar, which on coming in contact with an obstruction is forced back. The motion caused is transmitted through a set of cranks and levers to the foot pawl, which acts as before.

As the trip-bar might prove inconvenient when snow obstructs the track, it may be turned up against the fender and the other automatic device used instead. This latter is operated by the weight of the person falling on the fender cradle, which causes the fender to drop to the roadbed. The dropping of the fender pulls forward rocker-arms connected to levers, which operate the foot pawl as if the motorman's foot were used. The complete fender may be easily attached to the car by two bolts connected to each outside sill of the car platform. The fender occupies very little space when folded, nor does it interfere with the coupling of cars or with car headlights. The front of the fender is made of rubber tubing with a steel cable passing through it. The fender is interchangeable to any style of car.

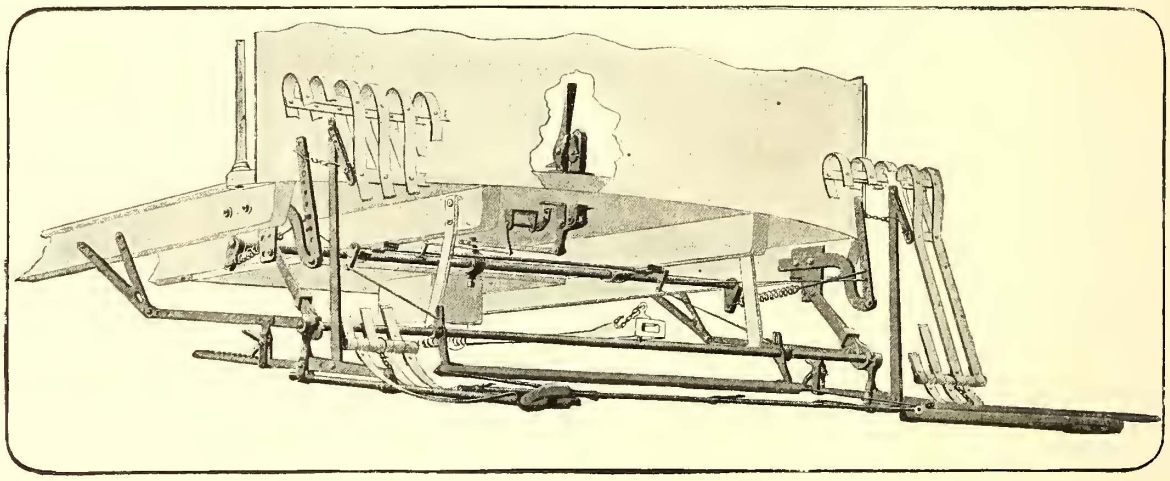


FIG. 1.—AUTOMATIC FENDER

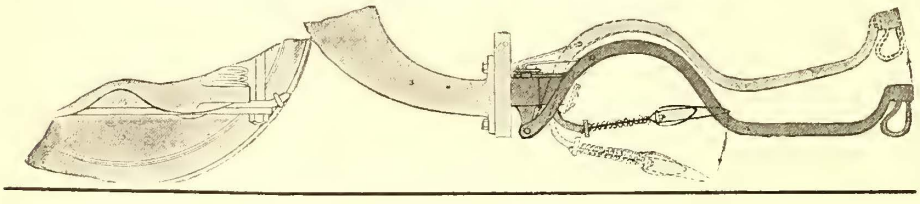


FIG. 2.—AUTOMATIC WHEEL GUARD

Mr. Watson has also devised the wheel guard illustrated in Fig. 2, the full lines showing the guard in its normal position and the dotted lines in its operating position. It is dropped by means of trip-bar, which is raised on coming in contact with a body larger than would pass under the truck pilot board. The guard comprises a buffer, from which several fingers project, held outward by springs. When a finger strikes an object it is pushed back into the buffer until the latter slides over the obstruction and permits the finger to swing clear of it. This construction avoids injury to parts and allows the guard to keep close to the roadbed, to prevent it from passing over a body. The guard swings around curves with the truck.

LONDON LETTER

(From Our Regular Correspondent.)

Having duly paid one half-penny each for their ride on the inaugural car of the London County Council Tramways the Prince and Princess of Wales, accompanied by their two little sons, formally opened the first section of the immense system of electric tramways, which the London County Council is at present engaged in transforming from horse to electric traction in the South of London, and a full description of which will be found in this number. The inaugural services were held in a large marquee in the grounds of St. Thomas's Hospital in the presence of about 2500 persons. On the platform to receive the Prince and Princess of Wales were Lord Monkswell, chairman of the County Council; Mr. J. Allen Baker, vice-chairman; Mr. J. W. Benn, chairman of Tramways Commitee; Mr. A. Baker, general manager of the tramways; Mr. J. H. Rider, chief electrical engineer; Mr. Gerald Balfour, president of the Board of Trade, and other distinguished guests. Mr. Benn made a capital speech and referred to the cars which were now to be put in service as the "People's Motor Car," which all of them could employ at the modest sum of one half-penny and took the opportunity of having a sly hit at the legislature across the river when stating that he was very sorry that he had to apologize for not having been able to have a car meet their Royal Highnesses at the other end of the bridge. Mr. Gerald Balfour also made a congratulatory speech as to the successful completion of the first section of the tramways of London, after which the Prince of Wales duly declared the line open to public traffic, and in a peculiarly felicitous speech afterward stated how glad he and the Princess were to identify themselves in a scheme of that kind intended to benefit the working classes of London, and that they and their two little sons were looking forward with great pleasure to their ride on the first car from Westminster to Tooting. In order to begin properly he stated that though they were going to ride on the inaugural car they had no desire to defraud the London County Council, so they had provided themselves with four half-pennies, with which to purchase their tickets, an announcement which was received with great good nature and satisfaction by those present. Needless to say these four half-pennies, which were afterward collected by Mr. Baker, the general manager of the tramways, will be carefully preserved and duly deposited among the valuable archives of the London County Council. The most intense enthusiasm attended the procession of cars numbering about fifty, the whole way from Westminster to Tooting, where the Prince and Princess alighted to inspect the new model workmen's dwellings which have there been erected by the London County Council, and which were particularly admired by the Prince and Princess. The whole function was most successful, and augurs well for the future success of the tramways in London, and it is gratifying to note that the London County Council is making herculean efforts to overcome the apathy which has heretofore marked the projects which have been devised for the improvement of London tramway communication.

The annual report of the general manager of Newcastle Tramways for the year ending March 25, 1903, shows that the result of the year's working from all sources amounted to £153,822, and the total working expenses to £89,319, leaving a gross surplus of £64,512.

Preparation for the through running of the eleetric cars between Manchester and Salford under the new agreement has now been begun. The Manchester Tramways eommittee commenced the fixing of the poles along Bridge Street from Deansgate to the River Irwell Bridge. The Salford authorities some time ago completed their portion of the work, with the exception of the overhead wires, from the bridge to Chapel Street, and it will in a few days be possible for Salford cars to journey into Deansgate by way of the Albert Bridge. At Regent Bridge little need be done besides connecting the wires, and at Blackfriars the Manchester Corporation will have to equip the short length between the bridge and Deansgate.

The Bradford Tramways committee recently made application to the Board of Trade for the official sanction of an increase of the speed run by the tramcars on the Bradford system. A letter has been received by the Town Clerk stating that on these parts of the system on which the maximum speed has been 8 miles an hour the maximum may in future be 12 miles; where it has been 6 miles, 9 miles an hour may be run; and where it has been 4 miles, 6 miles may be run.

The Tramways and Light Railways Association held its annual members' dinner in London on April 28, at which there was an attendance of over a hundred members. Mr. L. A. Atherley-Jones, K. C., M. P., presiding. After the dinner Mr. Philip Dawson read a paper on Interurban Communications, which was afterward pretty fully discussed by the members present. The great difficulty of the variation in the gages of adjoining towns was referred to, as well as the difficulty of harmonizing private company enterprise, which would build the interurban road with municipal authority, which guards the streets and tracks of the cities and towns.

A most important function took place on Sunday, May 3, when the newly electrified Mersey Railway from Liverpool to Birkenhead and various other points on the other side of the Mersey was formally opened by the chairman and directors and a number of their friends who were invited to the ceremony. A full description of this interesting railway was published in the April 4 issue, so that nothing further regarding the equipment need be said at this time. The guests were invited to assemble on the platform of the Liverpool Central Low Level Station at 10 a. m. on Sunday, May 3, Sunday having been selected so as not to interfere with the traffic, the regular service for this railway not being used on Sunday mornings. At that time the full complement of trains was running at the regulation intervals on about three minutes, and the guests proceded by one of the trains to Rockferry station in the regulation time of eleven minutes, stopping at each intervening station on the way, so as to accustom the motormen and conductors to their future duties. A return was then made to the Birkenhead Central station, where the guests alighted to inspect the station, and afterward proceeded by another train to James Street station, Liverpool, where the guests were all taken by the lifts to the street level, descending afterward and taking another train to Birkenhead Park station. This station being duly examined, another train was taken back to Hamilton Square, where a visit was paid to the adjacent generating station on Shore Road. After half an hour spent at this interesting generating station a return was made to the Adelphi Hotel, Liverpool, where an excellent luncheon was served by the company, Mr. James Falconer presiding. Being Sunday there were no toasts made, but some excellent speeches were indulged in, Mr. Falconer formally welcoming the staff of the Westinghouse Company, who were present in large numbers, and the members of the press who were the chief guests on this occasion. Mr. Falconer reminded the guests that they had been running through a full-sized railway tunnel by electric trains for the first time in the history of this country. The tunnel had been thoroughly cleaned from the deposit of steam, smoke and sulphur which has been accumulating for the last seventeen years, and it is hoped that with a better atmosphere in the tunnel a successful era would be commenced. It was in any case an epoch in the history of the country, as the system was the first steam railway to be electrified in Great Britain. Speeches were also made by the Lord Mayor of Liverpool, the Mayor of Birkenhead and by Colonel Cradock of the British Westinghouse Company. It is particularly interesting to note that the traffic on the line which was opened for public service about noon the same day showed an immense increase, this, however, being most likely due to curiosity. The returns after having been made for the first week's electric working show that there has been an increase of 37,619 local passengers, the receipts for the week having been increased 45 per cent. During the week ended May 9, which was the first week of electrical working on the Mersey Railway, 125,272 local passengers were carried, being an increase of 37,619 passengers, as compared with the previous week when steam working was in force. The additional receipts were £278 1s 9d, being an increase of 45 per cent. Compared with the corresponding week of last year, the local increase is 32,871, representing £255 or 40 per cent increase. The figures relating to through bookings from other companies' lines are not immediately obtainable, but so far as could be ascertained, the through traffic has not yet felt the impetus which it is bound to receive from the improved service and the increased facilities of communication. These figures of increased traffic for the opening week are the more striking in view of the fact that the competing trams and ferries have suffered no decrease, thus proving once more the established axiom that increased facilities create increased traveling. Owing to the enormously increased seating accommodation provided by the Mersey Railway Company's frequent service, the 37,000 additional passengers made no apparent difference, the platforms being kept continually clear by the constant procession of trains. This should surely encourage other companies which are on the point of considering electrification, and the Mersey Railway is undoubtedly to be congratulated upon the good start which has been made.

We understand the well-known firm of Witting Brothers, Ltd., electrical engineers and contractors, are moving to more commodious offices at Temple Bar House, E. C. This is necessitated by the large increase in their business. The firm has the enviable distinction of having supplied and erected the largest direct-connected generators at present in operation in this country or on the continent of Europe. There is also a change in the style of the firm, owing to Mr. A. C. Eborall, who has had the technical management of their business from its commencement, having joined the firm, the style of which is consequently to be altered to Witting, Eborall & Co., Ltd. These improved facilities will result in a still greater increase of their business as electrical contractors for the

carrying out of complete installations in connection with traction, power and lighting work, which is their specialty.

Mr. Gerald Balfour, president of the Board of Trade, introduced recently a Government bill "to facilitate the introduction and use of electrical power on railways." It consists of seven clauses, the first of which, containing the most important provisions of the measure, runs as follows:

1.—(1) With the object of facilitating the introduction and use of electrical power on railways the Board of Trade may make orders for all or any of the following purposes, namely:

(a) Authorizing a railway company to use electricity in addition to or in substitution for any other motive power, and for any other purpose;

(b) Authorizing the company to construct and maintain generating stations or other electrical works on any land belonging to the company;

(c) Authorizing agreements between the company and any body corporate or other person for the supply to the company of electrical power or the supply to, or use by, the company of any electrical plant or equipment;

(d) Sanctioning any modification of any working agreement so far as the modification is agreed to between the parties thereto, and is consequential on the introduction or use of electrical power;

(e) Authorizing the company to subscribe to any electrical undertaking which will facilitate the supply of electricity to the company;

(f) Securing the safety of the public;

(g) Authorizing the issue of new capital by the company for any of the purposes of this act;

(h) Any other matters, whether similar to the above or not, which may be considered ancillary to the objects of the order, or expedient for carrying those objects into effect.

2.—An order made by the Board of Trade under this act shall, on coming into operation, have effect as if enacted by Parliament.

Clause 2 refers to powers for acquiring land for the purposes contemplated by the bill. Clause 3 provides for appeals to the Railway Commissioners in cases where, orders having been applied for, the Board of Trade propose to introduce provisions to which the applying company object. Clause 4 prescribes that the board shall satisfy itself that all necessary notices have been given to parties concerned. Clause 5 refers to certain expenses and fees to be defrayed by money provided by Parliament; and Clause 6 to the board's power to make rules as to applications. Clause 7 is an interpretation clause; and also provides that the act shall come into force on Jan. 1, 1904.

The bill has passed its second reading, and according to its promotor will undoubtedly facilitate the introduction and use of electrical power on railways by enabling railway companies to acquire the necessary powers by means of Board of Trade orders instead of leaving them to the more expensive process of going to Parliament.

Mr. Balfour Browne, K. C., in opening the case of the Strand District and Cheltenham Tramways bill before a committee of the House of Commons, stated that the bill contained the novel feature that the company which was asking for incorporation proposed to work the tramways, which would run on the main roads, traversing some of the Gloucestershire valleys, with motor cars, on the overhead trolley system, without rails. This system has been adopted in various places abroad with success. One objection to it was that it would necessitate two overhead wires instead of one, as in the case of ordinary tramway traction, where the current was returned by means of the rails. On the other hand, it was contended that the double-wire system was safer than the ordinary system. One other disadvantage was that there would be more friction to be overcome, and therefore a greater amount of power would be required. As against this the gain in the matter of cost would be very great indeed, because whereas ordinary electric tramways cost about £7,000 a mile to lay, tramways worked in the manner proposed in this case by means of overhead traction would cost only about £1,000 a mile to lay. Stroud was the center of the district to be served, and it was proposed to run along the roads to Chalford on the east, Nailsworth on the south, Stonehouse on the west, and to Cheltenham on the north, while at Brockworth, midway between Stroud and Cheltenham, the tramway would connect with the light railway which the Gloucestershire County Council is authorized to construct to Gloucester.

The Parliamentary committee appointed to inquire into the City & North-East Suburban Tube Railway bill decided last week, after several days hearing, that the preamble was not proved, and accordingly the bill was thrown out. The bill was thrown out entirely on financial reasons, the promoters not being able to guarantee definitely that the necessary fund would be forthcoming.

The provisional order of the Board of Trade authorizing the substitution of electricity for steam in connection with the Barrow tramways states that in addition to this being done on the present routes to the docks, Furness, Abbey and Roose, a new tramway is to be laid to the ferry in Old Barrow. The British Electric Traction Company is to be bound to run workmen's cars morning and evening. The Corporation has the option of purchase at the end of seven or fourteen years, the price being £15,150 for the old undertaking, as valued last August, in addition to the whole of the capital expended by the present company in reconstruction and equipment.

The tramways committee of the Wolverhampton Corporation has decided to offer no detailed observations on Mr. Shawfield's report, which will come before the Town Council shortly. It was, however, resolved by six votes to four to recommend the Council to take over the 11 miles of Lorain track already constructed on condition that the Lorain Company make certain modifications, including new and more durable surface plates to the contact boxes. Should the Lorain Company decline to accept the suggestion to make the alterations then the committee recommend that the whole question be referred to arbitration.

After waiting about a year in studying various systems of traction for the new tramways, the tramways committee of the Swansea Council has finally decided definitely to recommend the adoption of the overhead system.

Mr. John Young, general manager of the Glasgow Tramways, has issued a long report on the question of season tickets. Mr. Young has communicated with the officials of all municipal corporations and public companies operating tramways in Great Britain and Ireland, and also with the officials of a large number of tramway companies on the Continent, and the replies show that such tickets are more or less in use in Aberdeen, Blackpool, Burley, Edinburgh (Portobello route), Guernsey, Ipswich, Leicester, Oxford, Portrush, Rochdale, Southport, Stirling and Bridge of Allan, and Wigan. Season tickets were in use in Birmingham, Huddersfield, and St. Helens, but have been discontinuel. On no other tramway system in this country have season tickets been introduced, and none are used on street railways in America. While they are in general use on the continent, especially in Germany, very little satisfaction is expressed regarding the working of the system. His conclusion is that the chief objections to the issue of season tickets are in regard to checking, identification, and loss of revenue.

By fifty votes to fifteen the Birmingham City Council has decided to take over the tramway system at the expiration of the present lease, the last of which falls in 1911, and consequently to reject the offer to lease which was made by the British Electric Traction Company which now works the system, and which sought to obtain an extension of its leases for twenty-four years. A. C. S.

TROLLEYS CAPTURED THE TRAFFIC

An interesting illustration of the effect of a new trolley line on steam road traffic was brought out by Vice-President Edgar van Etten, of the Boston & Albany Railroad, at a hearing recently held before the Massachusetts Railroad Commission. Certain citizens of Newton Lower Falls have petitioned for the replacement of Sunday trains on the Lower Falls-Riverside branch of the system. In quoting figures to show that it is not profitable to operate the line on Sundays, Mr. van Etten said that the expense of running the trains in question on the branch was about $10 per day, while the earnings were about $2 per day. In October and November, 1902, the average patronage of the branch was eighty-three persons per day, and in December, fifty-four. In the year ending June 30, 1894, which was before the trolleys reached Lower Falls, the total number of passengers carried on the branch was 96,286. For 1898, the year in which electric cars first reached the Falls, the total was only 64,680. Subsequently the railroad travel diminished, so that in 1901 the total for the branch was but 51,239. In 1902 it increased to 56,201 and the estimated 1903 travel is about 62,000. At present thirty-eight trains per day on week-days are run over the branch.

Newton Lower Falls has a population estimated at about 700, and is a section of the city of Newton, about 13 miles from Boston. Twenty-five-ride tickets are sold by the Boston & Albany for $2.75 each, and the running time to the city is about thirty-eight minutes. A single ride thus costs 11 cents. The regular fare is 25 cents. The fare by electrics to any part of the Boston Elevated system is 10 cents, and the running time to Park Street Subway station about one hour, for a distance of about 12 miles. The trolley ride from Boston to Lower Falls via the Beacon Street and Commonwealth Avenue Boulevard, through Washington Street, Auburndale, is one of the most delightful that can be enjoyed around Boston.

A combination steam and passenger car was operated for some time on the Lower Falls branch by the Boston & Albany, but it has been taken off by the road, it being generally understood that it was unsatisfactory as a competitor of either the steam locomotive or electric car.

PARIS LETTER

(From Our Regular Correspondent.)

A novel traction system is to be experimented on in France on a short state-operated line in the "Houille Blanche" (Grenoble) region. This line connects La Mure to St. Pierre de Commiers, and is at present operated by steam locomotives. The length of line is 30 km, maximum grade 2.7 per cent over a continuous length of 25 km; minimum radius of curve 100 m; weight of rail 30 kg per meter; gage of track 1 m. The traffic is mostly freight and coal, with small passenger service. The capacity of the locomotives is about 200 hp.

A three-phase locomotive of Ganz Company has already been tested on this line. There is now to be tried a Thury locomotive built for direct current 2400 volts. Mr. Thury is well known in Europe as the champion of the direct-current series distribution and direct-current traction. The Thury Company has obtained considerable experience in connection with the tramway line known as the Grenoble-Chapareillan tramway, a three-wire system having been installed, running under 1200 volts. These wires are brought into the City of Grenoble itself. The same system will be used at La Mure, but with double the voltage, i. e. 2400 volts between outside wires. It is somewhat surprising that the direct-current will have to be transformed from three-phase alternating current, furnished by the neighboring station of Champ. The total power of each locomotive will be about 375 kw. Only one locomotive is now to be tested. The locomotive itself will be furnished with four motors in series of two on both sides of the three-wire system. The track forms the neutral return circuit.

Two bows will take the current from the overhead wires. The return will be made through the frame of the car and the wheels. The circuit as above stated will be 2400 volts, and as two motors will be coupled in series on each of the two outside wires, only 600 volts tension will be used on each commutator. By reason of the narrow gage these motors (revolving at high speed) are fitted with double reduction gearing. There is no special interest attaching to the compressed air apparatus or the electrical brake appliances. These consist in principal in resistances through which the motors work as generators before stopping. No more data is at present available on this machine, although the test will soon take place when the results will at all events be made known.

An electric fire engine has lately made its appearance in Paris. No rails are required, the principle being the same as the electric automobile. The motor is fed from an ordinary storage battery and develops 4 kw. A double transmission allows its action either on the axle or on the pump shaft. Owing to its rapidity of getting to the scene of action, and its mobility and ever ready state, it is quicker in service than the ordinary steam engines. It will find its uses apart from the ordinary steam pump, especially in cases of emergency. The steam fire engine will not be discarded, but only assisted by this machine.

Returning now to the engrossing and wearing subject of transportation in Paris, we have to mention the opening up for service of the new Metropolitan station called "Place de la Nation." This terminus, which was formally opened on April 2, occupies in the eastern portion of Paris the same relative position, both as regards situation and centrality, as does the Etoile station in the west end of the city. The line No. 2 here terminates in a junction with No. 1 line, and of course serves as a transfer for passengers and permits of the folk from the center of the city reaching its northern portions by making a circuit of two sides of a triangle. This, in view of the incompleteness of the lines which will make more or less direct routes from north to south.

A great many passengers before the opening of the Nation station even used to travel as far as the Etoile in the extreme west of the city in order to change routes and take No. 2 line, following the northern outer boulevards, and in order to arrive at a relatively northeast portion of the city. The opening of the Nation station will in some measure obviate this, but there will necessarily be a large number of people who must wait until the opening of the direct route, north and south, in order to gain the full advantage which the Metropolitan lines will then offer.

It is worthy of remark that the total increase in traffic to be ascribed to the opening of the terminal junction Place de la Nation. is something like 10 per cent. Again the addition to the receipts of these two lines through the operation of line No. 2 is about F. 25,000 per day, of which two-thirds represents the receipts proper of line 2, and one-third the increase over the previous figures of line No. 1, by creation of new traveling facilities to the public.

Now that the Metropolitan exploitation is better known, a few figures may be cited regarding the operation which cannot be considered as anything but satisfactory. The coefficient of working expenses to total gross receipts averaged in 1902 about 41 per cent. For the last month of the same year the same was but 35 per cent, but there is little hope that this figure will be maintained, and the best that can be anticipated appears to be from 38 to 41 per cent. The current consumption amounts to 1,500,000 kw-hours continuous current, of which 500,000 to 600,000 kw-hours represents the current used in lighting. The cost price per kw-hour works out at F. 0.079 (1.6 cents). This represents the average cost of the current consumed by the Metropolitan lines, and this current is in part supplied by outside companies who furnish three-phase current for the rotary converters of Metropolitan sub-stations. The cost price of the current produced in the power station belonging to the Metropolitan Company is only F. 0.07 (1.4 cents) per kw-hour.

The coal consumption per kw-hour is 1400 grams (about 3 lbs.). This at F. 30 the ton works out at F. 0.042 per kw-hour. The operating expenses per kw-hour are F. 0.014. Sundry expenses work out at F. 0.014.

The annual meeting of the Metropolitan Company will shortly take place and a dividend will be voted, particulars of which can not be given until the next letter.

The great success of the Metropolitan lines has once more been echoed by the recent resolutions at the annual general meeting of the Cie Generale des Omnibus and similar or allied companies. The Cie Generale des Omnibus held its annual general meeting on March 31, 1903, and the situation, as explained by the president, appeared very gloomy. The company intends to change its policy and holds out some rather encouraging prospects for the immediate future. The president explained that the advent of the "Tramways de Penetration" (lines obtaining franchise to have their terminus in Paris on condition that they connected outlying districts with the city) have already affected the profits, when the Metropolitan exploitation commenced and immeditely began to eat into the already diminished receipts. The latter competition soon developed to be the most severe, for the Omnibus Company's receipts have fallen from F. 5,500,000 in 1899, to 4,900,000 in 1901, and finally to 4.800,000 in 1902. The year 1900 cannot be included as a fair basis of comparison, as the Paris Exposition caused the receipts to be exceptionally good.

From the figures given it is easy to see that the Cie Generale is greatly concerned about its affairs. The expenses have somwhat been reduced, but the deficit for the year in 1901 was F. 4,316,892, which in 1902 further increased to F. 4,944,038. The radical remedy for this state of affairs appears to be appreciated by the president, who proposes to reconstruct entirely the system by abandoning the lines in direct competition with the Metropolitan, which, of course, gives a more rapid and better service. The Cie Generale has therefore prepared a project to be submitted to the city authorities, and which proposes the creation of a number of new lines connecting the main arteries of transportation. These lines are primarily intended as feeders to the Metropolitan. The scheme will also have to be submitted to the authorities who originally granted the franchises to the company.

It will also be remembered that the company considers that it has certain grievances against the City Council which after granting franchises to the surface lines for a monopoly of the transportation in the city, has since allowed the Metropolitan Railway Company and other tramway companies (Tramways de Penetration) to run a competitive service. The case comes on for hearing on May 5, but it is impossible to foresee the outcome. The result may be that an arrangement will be reached, by means of which the Cie Generale will have free franchise for the execution of their new plans above outlined.

The traffic of the Cie Generale is still large, and the total number of passengers carried in 1902 was 262,400,000, and in 1901, 267,000,000.

As foreshadowed in my previous letter the rates of the Cie de l'Est Parisien have been raised. Other companies, believing themselves affected by similar conditions, are trying to obtain the same privileges in respect to fares. Not only is an increased fare asked for, but a reduction in schedule and the substitution of larger cars for the present ones.

A curious experiment has been made of the relative commercial speed of the Metropolitan road over those offered by the omnibusses and tramways over the same routes. The match was made for the route Etoile to Place de la Nation, and back by the line No. 2 around the outer boulevards, a length of about 20 km by the Metropolitan lines. Two journalists arranged the match and the time was to include that spent in actual travel, and the delays owing to tranfers, etc.

The man taking the tramway route left the Etoile at 2.53 p. m. and reached that point on his return at 4.57 p. m. On the other hand, the Metropolitan traveler started at 3 o'clock from the Etoile and arrived at La Nation at 3.24, making 24 minutes for the entire distance of 8.7 km. The total number of stops was 14, and the average duration of stop was 12 seconds, giving a commercial speed

of 21.8 km per hour. The total stopping time was 14 x 12 equals 168 seconds, equals 2 minutes and 8 seconds, which, deducted from the total time of 24 minutes, gives an actual running time of 21 minutes and 24 seconds, corresponding to a running speed of about 24 km an hour for the distance of 8.7 km. The acceleration averaged 45 cm per second per second, and the maximum speed varied between 45 to 50 km per hour. Coming back by the outer boulevards, he lost some time by delays, but finally arrived at the Etoile at 4.15. The net result, as will be seen, was 2 hours and 4 minutes for the tramway and omnibus rider, and 1 hour and 15 minutes for the Metropolitan man. The experiment is merely cited as an interesting illustration of the results and benefits accruing to the traveling public by reason of Metropolitan lines and easily explains the fact that large numbers of passengers prefer to make the large detour afforded by the junction at one or other of the terminii of line No. 2, rather than take the slower and more cumbrous route, even if more direct, offered by tramway and omnibus.

STATE CONTROL IN MICHIGAN

Both houses of the Michigan Legislature have passed a bill providing that electric railways shall be brought under the control of the Commissioner of Railroads to the same extent and in the same manner that steam railroads are now controlled. This bill was not given immediate effect, and will, therefore, not become a law until ninety days after the adjournment of the Legislature, which will make it effective about Sept. 1.

The bill provides that the Railroad Commissioners shall have complete authority to investigate the operation and managements of companies as regards their interests of the public; that power shall be given the Railroad Commissioners to subpœna witnesses; that complete power to making critical examination of properties and ordering changes shall be given the commissioners; that the Railroad Commissioners shall be given authority to designate the precautions that shall be taken to prevent accidents at crossings.

ELECTRIC RAILWAY PROGRESS IN CENTRAL NEW YORK

The Utica & Mohawk Valley Railway Company, which runs through Rome, Ilion, Little Falls, Frankfort, Herkimer and other New York towns, has become so popular that propositions are now on foot to double-track the lines in Ilion and Mohawk. As an illustration of the decrease of traffic on the steam lines, it is said that the New York Central Railroad's train No. 74, which passes through Little Falls at 7.49 p. m. brought 191 passengers to Little Falls on the Sunday night previous to the opening of the electric railway. The same train brought just five people on a recent Sunday. In consequence of this great decline, the New York Central Railroad decided that it would be useless to spend the $10,000 which had been appropriated for building a new station in Little Falls. The "busmen" in the towns have also been hard hit by the invasion of the trolley, which has taken their interurban business.

BROCKTON & PLYMOUTH FOLDER

A neatly printed and well-arranged advertising folder has just been issued by the Brockton & Plymouth Street Railway Company, of Massachusetts. It succinctly describes the attractions of its route through one of the prettiest South Shore regions of the State, and is well supplied with half-tone cuts of the noted monuments, burying grounds, halls, rocks and hills of Duxbury and Plymouth. Reproductions of famous Pilgrim pictures are also included, and there is an excellent map of the road opening flat in the middle of the folder, which is about 3½ ins. x 6½ ins., and well-fitted to the pocket. An attractive time-table is printed at the end of the folder, preceded by several artistic illustrations of the Mayflower Grove Park, which is located on the main line in the town of Pembroke, some 13 miles from Plymouth. The summer schedule goes into effect June 15.

A PLEA FOR COURTESY

Three signs have been conspicuously hung over the platforms of the Sullivan Square Terminal in Boston, each reading as follows: Notice: Running against others, pushing or other disorderly conduct is prohibited. Passengers must conduct themselves with due regard to the rights and safety of others.

Some 125,000 people per day transfer between the elevated and surface lines at this station, and it is undoubtedly true that the hanging of these signs has already improved the traveling public's manners to a marked degree, and eliminated many unpleasant personal encounters. Similar signs might be posted in certain other cities to advantage.

AN INTERURBAN SYSTEM BETWEEN MADISON AND FOND DU LAC, WIS.

Three years ago the Wisconsin Midland Railroad Company was incorporated for the purpose of constructing an electric railway from Berlin north via Weyauwega to New London, with branches from Weyauwega to Waupaca and from Poysippi, on the main line, to Pine River. The route traversed a very rich farming section isolated from all steam railroads or other shipping facilities, and also was a cut-off for a large passenger business both north from Berlin and south from the northern part of Waupaca County to Waupaca, the county seat. Failing to get this company financed, the promoters concluded to go farther south to start a system that would ultimately be extended to cover the same route proposed by the Wisconsin Midland.

Last August the Madison & Northeastern Railroad Company was incorporated to build this road. This company has just completed a survey from Madison to Fond du Lac, and has profile completed of the same. The distance between the city limits of the two cities is 67 7-10 miles. All franchises have been secured, and the last of the right-of-way grants are being closed. The road will follow the old military road from Madison to Fond du Lac, and is almost an air line. The private right of way adjacent to the highway will be secured, the line taking the center of the street through the cities of Waupun, Beaver Dam, Columbus and the village of Sun Prairie, and traffic arrangements being made with the Madison Traction Company, of Madison, and the Fond du Lac Street Electric Railway & Light Company, of Fond du Lac, to enter those cities over the lines of the local companies. This route is the only one out of Madison not covered by a steam railroad, as all roads leading south from the Fox River Valley make toward Milwaukee, and all traffic between the Fox River Valley, as well as the towns along the line, to reach Madison must go by way of Watertown or Jefferson Junction. This does not permit a round trip being made the same day, if any time is to be given to business at the State capital. An express car service between Fond du Lac and Madison would naturally get all the passenger business between those points.

The Madison & Northeastern Railroad Company also proposes to haul freight. It will control its own right of way and is organized under the general railroad law of Wisconsin. It has not yet been financed, although certain New York parties have made overtures toward buying the rights, franchises and options of the company, all of which were rejected. The promoters plan to build the line from Janesville to Madison during the present year. The line from Green Bay to Kaukauna is now being constructed, and with the building of the Madison & Fond du Lac line there would be a continuous line from Rockford to Green Bay. Two other branches proposed by the Madison & Northeastern Railroad Company lead out of Waupun, one an air line to Oshkosh, the other via Ripon to Dartford, the great Green Lake summer resort, and thence to Berlin.

ELECTRIC SPEED COUNTER

The Allgemeine Elektricitäts-Gesellschaft, of Berlin, Germany, has just brought out a novel device for measuring electrically the speed of railway trains, or the peripheral speed of any machine.

This apparatus consists of a small generator, the terminals of which are connected with a voltmeter. For speeds greater than 600 r. p. m. the shaft of the machine whose speed is to be measured is connected to the small generator by a flexible coupling. Gearing or belting is required for speeds less than 600 r p. m. In railway cars the connection can be made directly to the armature shaft or by gearing to the car axle.

If desired the indications can be read in a number of places simultaneously by making additional connections to the generator terminals. This device is made for either direct or alternating current.

NEW ORLEANS STREET RAILWAY MATTERS

There are indications that some interesting arrangements are being made in connection with the New Orleans traction systems. As stated in a recent issue, Elwyn C. Foster, manager of the Massachusetts Electric Companies, has accepted an offer made him by the board of directors of the New Orleans Railways Company, to assume the management of that company within a few weeks, and with him, on his recent visit to New Orleans, were H. Hobart Porter, Jr., and Francis Blossom, of Sanderson & Porter, engineers and contractors, of New York, who are still in the city.

Mr. Foster is said to have expressed the opinion that the prop-

erty is one of the best in the country, particularly as to its roadbed and rolling stock. Certainly great credit is due the management of the company and its employees for the efficient manner in which the crowds attending the convention of the United Confederate Veterans were handled. It is estimated that 75,000 to 100,000 visitors were brought to New Orleans last week by steam railroads, and the New Orleans Railways Company carried, without any serious accidents, over 300,000 passengers daily during the convention, a number substantially equivalent to the population of the city.

NINETY NINE-YEAR FRANCHISE LAW MUST BE CONSIDERED

In a letter of instruction to the board of receivers of Union Traction, West and North Chicago Street Railroad Companies, Judge Peter S. Grosscup, of the United States Circuit Court, discussed the so-called ninety-nine-year act in its relation to the court's functions as conservator of the properties. The letter was prepared at the request of R. R. Govin, James H. Eckels and Marshall E. Sampsell, who, as receivers, asked Judge Grosscup for advice in settling the franchise problem Judge Grosscup instructs the receivers to appear before him June 18 to present the court in a petition all the facts obtainable relative to the ninety-nine-year act, also to "invite the bondholders, the railway companies and the city to supply such facts as they may think helpful, and to take part in the discussion." The text of the letter follows:

CHICAGO, May 27, 1903.

To Messrs. Rafael R. Govin, James H. Eckels and Marshall E. Sampsell, Receivers:

Refcrring to paragraph 33 of your petition for instructions, filed May 14, and to the conversation this morning respecting the attitude to be taken by the receivers in the pending negotiations for franchise extensions, I have, on reflection, thought it best to put my directions into permanent form.

The property of the street railway companies, in the hands of the court, is there for conservation. You are in this matter the trustees of the court. The real parties interested, whose interests must never be lost sight of, are the bondholders, the stockholders and the public; the bondholders as the people who largely have furnished the capital; the stockholders as the people furnishing a part of the capital and interested in its management, and the public as owner of the streets, and affected in one of its deepest concerns by the character of street railway service given. To the extent that each of these parties is interested in the pending negotiations you as receivers are interested, and as between them your attitude should be one of impartiality and strict justice.

Though in the negotiations pending there are questions of the amount and form of compensation to the city, of the unification of the railway systems and service and of street maintenance, etc., the chief interest, I am told, centers about the act of 1865, known as the 99-year act, and its waiver by the street railway interests as a prerequisite to negotiations. I have gone far enough into the subject to have ascertained that the first street railways of Chicago were sought to be installed under an ordinance of the city granting franchises in the streets, passed in 1858; that the power of the city to grant such franchise being questioned, an act was passed by the Legislature in 1859 validating such ordinance, and that the act of 1865 amended this act of 1859 in no respect other than to enlarge the franchise from one running for 25 years to one running for 99 years.

It would seem from this that unless the underlying basis of the street railways' rights to be in the streets at all has been transposed so as to arise now from some authority or legislation other than the act of 1859 as amended by the act of 1865, those acts are still the underlying authority of the street railways to be in the streets, as also the basis of the financial credit on which a portion, and perhaps the larger portion, of their securities have been sold. There can therefore be no adequate conservation of the property in the hands of the court that does not keep this relative place of the act of 1865 clearly in mind. Indeed, if it be valid and applicable, the act is fundamental to the railway companies' present vested property interests.

This is a court of law. As such it has no rightful power arbitrarily to give to one the property of another. It is of no consequence that the proposed donee may be the public; the function of the court is to protect rights, not to confiscate them or make them the subject of donation to anyone. If, therefore, the act of 1859, as amended in 1865, be valid and applicable, so as to constitute a part of the property rights of the street railway owners and creditors, the court cannot decline to enforce it, though every inhabitant of the city may be disappointed; and if invalid the court should not determine to enforce it, though every dollar invested in the railway securities may be irretrievably sunk. In this respect the act of 1859 as amended in 1865 stands in court precisely as would the grant of land to a settler under an act of Congress, or the grant of an invention to a patentee under the patent laws of the United States.

Of course the stockholders can, if they choose, relinquish their rights to this, as to any other claim of property; so also the bondholders, so far as it constitutes a part of their securities, but the bondholders cannot relinquish for the stockholders, nor the stockholders for the bondholders; nor—and this is the point that concerns you—the court for either or both. Only in case the act is invalid, or is no longer applicable, can the court disregard it as an asset, along with other assets, to be conscientiously conserved.

I am told that the act of 1865 is challenged as unconstitutional; that, assuming it to be constitutional, the street railway companies in the ordinances since accepted, and in their other dealings with the city, have waived this act as the basis of their rights in the streets, and that it is denounced as vicious and as having been procured by bribery and fraud. Of the latter, of course, I can as a court of law take no notice. The act stands in the official statutes unrepealed and unannulled. To the eye of the law it is an existing law of the land as much so as the laws creating the offices of Mayor and Alderman. Nor—laying aside for the moment the eye of the law—do I believe that an informed public insists upon subjecting nearly forty years after the event innocent investors to "revenge and retribution," such possibly as ought to have overtaken the men who passed these measures through the General Assembly of 1865.

But the contentions that the act is unconstitutional, and that, assuming its constitutionality, it has been waived by the street railway companies in their former dealings with the city, are subjects for legitimate and controlling inquiry. The questions thus raised lie at the basis of the court's duty respecting the property intrusted to its care. They must be settled, in the mind of the court at least, before the full length of its protecting arm can be intelligently used. I therefore instruct you to prepare a petition bringing to the court all the facts respecting this issue. I instruct you also to invite the bondholders, the railway companies and the city to supply such facts as they may think helpful, and to take part in the discussion which I set down for June 18 next at 10 o'clock a. m. I will hear all or either of these interests without the entry of an appearance, and with the stipulation that no jurisdiction to enter any order shall be predicated upon their participation in the discussion. I will make it an occasion simply of the court seeking for its own guidance light from every source from which light is obtainable.

I take it for granted, of course, that no one misunderstands the duty of the court as custodian of the property rights of the street railways, in case the act is believed to be valid, or underestimates the power of the court to command all the resources of the Federal government in the performance of such duty; for adequately to protect property in the custody of the court in accordance with its own judgment as to what is in actual custody is, until modified by the controlling order of some higher court, an exercise of the court's power, as much so as would be the enforcement of its formal order or decree. If the parties wish—but only in case they so wish—a mode of intervention could be devised that would get the quick judgment of this court in a formal order which, appealable to the Supreme Court, could be heard by that court in the coming autumn. This might be a desirable way to determine the questions, for one thing seems certain, that unless waived by the parties who respectively have the sole right of waiving the whole inquiry respecting the application of the act—an inquiry clearly involving Federal questions—must ultimately reach the Supreme Court of the United States, either through error prosecuted from the State Supreme Court or an appeal from the court.

I have thus far confined myself to the strict legal rights of the parties. The court is not, however, without power to look at the practical side of the situation, and take such a hand in the reorganization of the street railway companies as would subserve their interest and the interests of the public. The public interest, as I conceive it, looks to speedy settlement of the street car situation—to a settlement that will embody in one system all the lines to be operated, thus insuring universal transfers, modern equipment and the highest character of service. A hitch now over the act of 1865 may leave many of the principal streets in the occupation of the old companies. Should other companies be installed in the streets not thus occupied there would be war instead of peace; gradual dismemberment instead of unification; makeshifts in equipment instead of the high character of equipment and service desired. Such are some of the dangers of a controversy to the city.

The dangers to the companies are not less manifest. Pending final determination the court would certainly require them greatly to improve their service—a requirement that would involve the putting of considerable fresh money at the hazard of lawsuit; and if the act of 1865 were ultimately declared invalid it might be then too late to get such extensions as their interests needed. The situation as an entirety is one of those that skilled business men usually settle by unacrimonious discussion and concessions.

But, this, primarily, is the concern of the city on one side and the bond holders and shareholders on the other, and unless invited into it, in the belief that the court might aid in bringing about a just and prompt settlement, you will not intrude.

PETER S. GROSSCUP.

DECISION AGAINST AN ACCIDENT FAKIR

A damage suit for $30,000 brought against the Cleveland Electric Railway Company by Frank Lieblang, of Cleveland, for malicious prosecution on the part of the company, was settled in favor of the defendant in the Common Pleas Court at Elyria, a few days ago. The suit was the outcome of a series of incidents which attracted considerable attention in the street railway field in 1901. It was reported that Lieblang was a professional tumbler; that he had pretended to be hurt in several cities, and that as a result of his dexterity in feigning injuries he had been enabled to collect damages from a number of street railway companies.

Lieblang appeared in Cleveland and the Cleveland Electric Railway Company detailed a detective to follow him and watch his methods. Either with or without the consent of the company (this point was one of the chief controversies in the suit above mentioned) the detective, a Mr. Hosman, became an understudy to Lieblang, and was instructed to the art of falling from a car and feigning injuries which would deceive physicians. It is claimed a partnership was effected, and Hosman had "accidents" in New York, Cleveland, and Detroit. In each case, it is claimed, Lieblang was on the car and exhibited the greatest consideration toward the "unfortunate stranger." He called ambulances and physicians and then endeavored to effect settlements with the companies. At Detroit, the Detroit United Railway settled for $200 and then had Lieblang arrested for obtaining money under false pretenses.

Hosman appeared as one of the chief witnesses for the plaintiff. But for some reason or other the case was permitted to drag and finally Lieblang was discharged.

Lieblang then brought suit against the Cleveland Electric Railway, charging malicious prosecution and conspiracy with the Detroit Company. He obtained a change of venue to Lorain County, claiming he could not get a fair trial in Cleveland. After hearing the testimony, the Lorain County Court directed the jury to bring in a verdict for the company. The chief contention of the court was that the prosecution instituted in Detroit was not a transaction that would come within the scope of the authority of either the attorney or the claim agent of the defendant company, without authority for its institution from the defendant. Further, it was held that no evidence had been brought to show that the company had authorized an act of this character. Aside from this point, the court expressed the opinion that the matter in Detroit was clearly a fake, since by his own testimony Lieblang admitted this was the third time he had seen Hosman fall from a car, although he claimed to suppose it was a bona-fide accident. In three cities he had "happened" to be on the car from which Hosman fell and had seen this man get up after his second fall within a day or two. Lieblang also admitted that he received one-half of the Detroit money. In consideration of these points the court said he felt justified in instructing the jury to render for the defendant.

PROGRAMME OF THE MECHANICAL & ELECTRICAL ASSOCIATION CONVENTION

The official programme of the convention of the American Railway Mechanical & Electrical Association at Saratoga Springs next September has been settled upon and announced by President Farmer. The convention will be held on Sept. 1 to 4, and sessions will be held both morning and afternoon of the first day, and in the mornings of the preceding days. The following papers are being prepared:

"Care and Maintenance of Car Bodies," by C. F. Baker, superintendent of motive power and machinery, Boston Elevated Railway, Boston.

"Improvements in Street Car Motors," by E. W. Olds, superintendent of rolling stock, Milwaukee Electric and Light Co., Milwaukee.

"The 'M' Type of Control," by W. O. Mundy, Master Mechanic, St. Louis Transit Company, St. Louis, Mo.

"Use and Abuse of Controlling Mechanism," by D. F. Carver, chief engineer, the Cleveland Electric Railway Company, Cleveland, Ohio.

"Shop Kinks," by H. H. Adams, superintendent of shops, the United Railways and Electric Company, Baltimore, Md.

"Car Shop Practices," by Alfred Green, master mechanic, Rochester Railway Company, Rochester, N. Y.

C. C. Lewis, chief engineer of the Schenectady Railway Company, and Herschel A. Benedict, electrical and mechanical engineer of the United Traction Company of Albany, have been appointed to act on the local committee of the association.

The association has now seventy-five members enrolled, counting active, honorary, associative and junior, and a successful convention is assured.

The association will issue, about Aug. 1, a notice concerning railroad rates, etc., which will be mailed to all members.

WALKOVER SEATS IN EUROPE

G. D. Peters & Company, of London, have recently added to their already large business a new department, that of seats for steam and electric cars. Arrangements have been made by the firm with the Hale & Kilburn Manufacturing Company, of Philadelphia, whereby the latter company will manufacture the various seats held under Messrs. Peters' patents, while Messrs. Peters will act as sole selling agents for the seating manufactured by the Hale & Kilburn Company. A large showroom, occupying the whole floor in Messrs. Peters' offices and work at Moorfields, E. C., has been devoted to the exhibition of numerous samples, and the department is under the management of S. Seymour Follwell, who has a wide acquaintance with the methods of car seating, both in Great Britain and the United States.

As was stated in the issue for May 23, Messrs. Peters have been fortunate in introducing the Hale & Kilburn seating in the new electric trains which have been built for the District Railway under the supervision of the well-known engineer J. R. Chapman.

Both the reversible and the "Walkover" types of car seat have also been adopted by the Lancashire and Yorkshire Railway for their new electric cars, and are under consideration by many other prominent railways and tram companies in the United Kingdom.

A LONG LEGAL BATTLE ENDED

By a decision of the Supreme Court, of Pennsylvania, just handed down, the Croydon controversy is settled for good and all time, after a legal battle which has lasted for more than seven years, and cost thousands of dollars. The Bristol & Neshaminy Elevated Railroad Company may now complete its overhead structure and operate cars over the same, thus closing the only break between Philadelphia and New York. For more than seven years a stage coach has been run, first for a mile and later for a distance of 2000 ft. between the connecting ends of the Philadelphia, Bristol & Trenton Street Railway. The overhead structure is partly placed, and the balance will be in position very shortly, so that it will be possible to run cars from the center of Trenton to the center of Philadelphia, so far as track connections are concerned. A break of 100 ft. in Morrisville will be closed about the same time, as the Pennsylvania Company will then be running over its new tracks, permitting the Philadelphia, Bristol & Trenton Company to connect its tracks with those of the Yardley, Morrisville & Trenton Company.

In handing down the decision, Justice Potter, of the Supreme Court, holds that Henry L. Gaw, Jr., and the Pennsylvania Railroad Company have no grounds upon which to base their appeal, and as a consequence the appeal is dismissed with the costs upon the appellants. The court holds that the Bristol & Neshaminy Elevated Railway Company is a perfectly legal corporation under the Focht-Emery Act, of June 7, 1901, and thereore entitled to build the road, securing land through the right of eminent domain. It is just possible that the elevated structure may never be completed, as it would seem to be the best thing for Mr. Gaw and the Pennsylvania Railroad Company if they would agree to a surface railroad, and thus obviate the necessity of an elevated structure alongside a country highway, on a level plain, which will serve the purpose stated by Judge Yerkes, in his opinion when he dissolved the preliminery injunction, in which he said:

"There is no reason why the Legislature of 1901 may not enjoy the honor of a memorial to its genius for franchise legislation, through the beautiful mechanical contrivance proposed to be erected at Croydon. There, suspended in mid-air, without an apparent purpose, according to the contestant, it will forever commemorate our commonwealth at the acme of its greatness, in corporate creations, and there upon line of the greatest of them all, it will meet the wondering gaze of the countless thousands who speed by between the great capitals of the Western world. The ruins of the temple upon the Acropolis bear testimony to the learning and refinement of the Athenians, and the Column Vendome displays the prodigious greatness in the war of Napoleon. Why may not the Neshaminy Elevated Railway have some such purpose.?"

The fight between the steam and electric railway companies has been a bitter one. It first began in 1895, when the Philadelphia, Frankford & Bristol Street Railway reached the lands of Henry L. Gaw, Jr., at Croydon. Mr. Gaw secured an injunction, as did also the Pennsylvania Railroad Company, preventing the electric railway company from completing the break of half a mile between the Croydon and Bristol ends of the line, and also preventing the operation of the half-mile of track in front of the Negus Estate. For a time power was secured from the Newtown Street Railway Company for the operation of the Bristol end, but an injunction stopped that, and for five years a horse car did duty over that 2 miles of track, while a stage coach transferred the passengers over the break. Eight charters were secured, the last of which was the Bristol & Bridgewater Railroad Company. A right-of-way was condemned and the case fought through all the courts to a successful finish when the Focht-Emery Act was passed, and by this act it became illegal to run cars from a steam to an electric railroad track, or vice versa. Wilbur F. Sadler, Jr., who made a fight in Trenton for an independent road the year before, secured control of the Philadelphia, Bristol & Trenton Street Railway, which absorbed the Philadelphia, Frankford & Bristol Street Railway, and he secured the Bristol & Neshaminy Elevated Railway charter. The case was fought through the lower court, and Judge Yerkes finally handed down a decision in favor of the elevated railway, which was at once appealed. In the meantime a small engine and generator had been installed at Bristol, and the old horse cars were abandoned. Later the power house at Croydon was sold to a power company, and this company in turn strung wires along the highway and furnished power to the Bristol end of the line. The Negus Estate compromised with the company, and all but 2000 ft. of the road was put in operation. A $20,000 bond was filed with the court covering possible damages to the Gaw property, and part of the elevated structure has been constructed, the lower court having refused to allow the appeal act as a stay to the building of the road.

MONTREAL STRIKE OVER

The strike of the employees of the Montreal Street Railway Company was officially declared off Thursday, May 27, and the men instructed to apply at once for reinstatement. The strike was declared on Saturday, May 23, and will go down to record as one of the most ill-advised in the history of street railroading. The men were instructed to repudiate an agreement entered into after the strike of last February, simply that recognition of the union might be obtained. Needless to say, public opinion was entirely against the men. The company in a statement to the public directly after the strike was declared, pointed out convincingly how the strike of February had converted the men from civil and careful employees into arrogant, rude and careless servants, and how it was almost impossible to mete out proper punishment. Some thirty-six of the men refused to go out when the strike was declared, and it was with these men that service was resumed at once. On Sunday, the second day of the strike, practically the only attempt at violence was made. The authorities, however, were equal to the emergency. On Wednesday 150 cars were in regular operation, and the strikers knew that the strike had been broken. On Thursday the full complement of cars was in operation, and the only thing that remained was for the men to declare the strike off.

TOPICS OF THE WEEK

The commission appointed by the Postmaster-General to test a device for mailing letters in moving street cars has made a favorable report to Mr. Payne, recommending the adoption of the system. Cars are fitted with a slot in the side big enough to admit letters and packages. While the device is constructed to receive letters dropped into it at street crossings only and when the speed of the car has been momentarily checked for the purpose, the commission in its report states that on trial "it was found that letters could be easily deposited while the cars were running at nearly the maximum speed allowed on city streets."

A big, stout party who had taken a nip too often hung to the strap in the crowded car and swayed and rolled like a balloon. When the conductor took his fare he asked in a tipsy voice if that car passed Sears Building. No, it did not. Presently he inquired again how near it went to Sears Building, and still again he begged to be let off as near to that edifice as possible. The conductor nodded assent, but the passenger would not be pacified. "I say, put me off at Sears Building!" "What do you want with that building?" rejoined the irate conductor, jerking the bell. "It says up there," pointing to a card above him, "For space in this car apply at Sears Building."—Boston Herald.

An ambitious boy recently perfected an unusual arrangement with the Cleveland & Southwestern Traction Company. He formed a paper route among the residents along the entire main line from Cleveland to Wellington. He takes the early morning combination passenger and baggage car, and with papers rolled to the smallest possible diameter, he manages, with an aim evidently developed in the baseball field, to deliver papers near the doorsteps of the homes of his patrons. Portions of the route are very thickly settled, and with houses on both sides of the line and three kinds of papers to deliver some startling acrobatic performances are sometimes witnessed in the baggage compartment, particularly if the car happens to be somewhat behind time.

The plan to develop suburban tracts by extending trolley lines into them from large cities has worked so well that some promoters of electric railway projects think it possible to build towns with a trolley system for a starting point. The projectors of the New Martinsville, Sisterville & Melbourne Electric Railway, of which Robert Miller, of Pittsburg, is the chief promoter, propose to establish an industrial town at Paden's Valley, 4 miles from Sisterville, W. Va. The land taken by the company at Paden's Valley includes, it is said, about 200 acres of bottom land, which will be, for the most part, laid out into lots with a main street paved the entire length. The trolley enterprise is largely an advertising feature for the real estate, but it would seem to be rather an expensive one.

Under the title, "Instructive Municipal Object Lesson," the Kansas City Journal compares the management of the Metropolitan Street Railway Company, of that city, under private control, with the water works, owned and managed by the city. About a year ago the Metropolitan Company secured from the city certain franchise extensions, in return for which it agreed to make stated improvements within a limited time. Almost simultaneously with the granting of the new franchises announcement was made of the improvements to be made to the water works. The Journal, after following the progress of the work on both improvements for almost a year, says in part: "The people own the water works, and it seems that they should be able to get done with their own property whatever they want. Yet, how do the improvements that have been effected in the water works compare with the improvements that have been effected in the street car system? The street car company is almost through with its improvement work, while the city practically has not got started. We draw attention to the contrast as an example of how badly public ownership works in Kansas City as compared with private ownership under public regulation. From the water works system the people get poor and precarious service, which costs them as much as, or more than it would if the system were in private hands; and instead of deriving large sums in taxes from it they are going to have to bond themselves to make needed improvements. From the Metropolitan, on the other hand, they get fairly good service at a price which at least is no greater proportionately than their water service costs them directly; they don't have to vote bonds for the system's improvements, and, in addition, the city, the county and the State all get considerable sums of money from it in the form of taxes. This combination of private ownership and management and public control of utilities will, we believe, be the system which American municipalities generally will find it wisest and most profitable to adopt."

PERSONAL MENTION

MR. M. E. NASH, for several years superintendent of the Milford & Uxbridge Street Railway Company, of Milford, Mass., which includes five lines centering in Milford, has been relieved of the duties of that office and appointed claim agent of the company. General Manager E. W. Goss, it is understood, will personally look after the superintendent's duties, although no positive announcement has been made.

MR. HENRY F. GENTRY, city passenger agent of the Pacific Electric Railway Company, at Los Angeles, Cal., has been appointed general passenger agent of the system. The office is newly created and is rendered absolutely necessary by the company's rapidly-growing interurban business, which can now be handled only by a large department, of which Mr. Gentry is the chief. Mr. Hugh F. Stewart has been appointed assistant general passenger agent and Mr. George B. Kelley city passenger agent.

MR. THEODORE STEBBINS, who has for so long a time been associated with the General Electric Company, has decided to make a change in his business, and after June 1 will be located in Boston, and will be connected with the large interurban railway and other properties controlled by Mr. A. E. Appleyard and his associates. Mr. Stebbins, although a young man, has been connected with the General Electric Company and its predecessor since 1887, when he took a prominent part in the early electric work carried on by the Thomson-Houston Company. He has recently been the engineer of the committee on local companies of the General Electric Company, which, it is well known, represents that company in its extensive interests as stockholders and bondholders in a large number of electric light and railway properties throughout the country. This work has called Mr. Stebbins to all parts of the country, and has given him a familiarity with electric railway and lighting practice, from both its engineering and financial sides, which is possessed by few men in the country. Previous to his connection with the committee on local companies Mr. Stebbins was for years in general charge of the construction work of the General Electric Company. He is a native of Iowa, was graduated in the engineering course at the Massachusetts Institute of Technology in 1886, and has been a member of the American Institute of Electrical Engineers since 1888.

THEODORE STEBBINS

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. *a* Including taxes, damages, tolls and rents.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., Apl. '03	61,656	35,208	26,449	23,063	3,385
	1 " " '02	49,425	28,527	20,898	16,995	3,903
	4 " " '03	236,753	137,826	98,928	86,338	12,589
	4 " " '02	190,559	114,862	75,697	63.079	12,618
ALBANY, N. Y.						
United Traction Co.	1 m., Apl. '03	134,501	97,085	37,416	24,645	12,771
	1 " " '02	117,072	81,527	35,545	23,603	11,941
	4 " " '03	505,004	349,954	155,050	97,295	57,755
	4 " " '02	464,409	339,293	125,116	92.806	32,310
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Apl. '03	17,336	10,179	7,156	------	------
	1 " " '02	14,834	9,841	4,993	------	------
	10 " " '03	182,717	105,512	77,204	------	------
	10 " " '02	170,455	94,867	75,588	------	------
BUFFALO, N. Y.						
International Tr. Co.	1 m., Apl. '03	295,332	167,669	127,663	127,168	495
	1 " " '02	250,850	142 515	108,336	123,422	†15,086
	4 " " '03	1,154,805	662,577	492,227	505,471	†13,244
	4 " " '02	998,919	580,979	417,940	497,053	†79,113
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Apl. '03	15,161	6,242	8,918	------	------
	1 " " '02	13,057	5,930	7,128	------	------
	4 " " '03	51,196	24,948	26,248	------	------
	4 " " '02	44,749	23,634	21,114	------	------
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co	1 m., Mar. '03	94,830	*a*56,296	38,534	22,608	15,926
	1 " " '02	86,238	*a*49,917	36,321	21,141	15,180
	3 " " '03	275,305	*a*165,476	109,828	66,848	42,980
	3 " " '02	250,447	*a*148,810	101,636	62.820	38,816
CLEVELAND, O.						
Cleveland & Southwestern Traction	1 m., Apl. '03	33,536	20,201	13,335	------	------
	1 " " '02	21,065	12,681	8,384	------	------
	4 " " '03	117,266	75,899	41,367	------	------
	4 " " '02	78,149	50,512	27,637	------	------
Cleveland, Painesville & Eastern	1 m., Apl. '03	14,900	9,100	5,800	------	------
	1 " " '02	13,312	7,550	5,762	------	------
	4 " " '03	52,939	33,904	19,035	------	------
	4 " " '02	47,175	28,634	18,541	------	------
Eastern Ohio Traction & Light	3 m., Mar. '03	38,668	27,389	11,279	------	------
	3 " " '02	32,810	22,610	10,200	15,283	†5,083
DETROIT, MICH.						
Detroit United Ry.	1 m., Apl. '03	336,048	*$205,019	131,029	82,009	49,020
	1 " " '02	294,501	*171 794	122,707	77,518	45,189
	4 " " '03	1,273,544	*773,388	500,156	326,748	173,408
	4 " " '02	1,150,513	*670,149	480,364	304,621	175,743
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Apl. '03	51,177	30,983	20,693	10,225	10,468
	1 " " '02	41,174	22,105	19,069	9,604	9,465
	4 " " '03	182,989	115,425	67,564	40,769	26,795
	4 " " '02	152,435	89,991	62,444	38,443	24,001
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Apl. '03	33,295	20,191	13,104	8,333	4,771
	1 " " '02	29,641	19 000	10,641	8,333	2,308
	4 " " '03	129,396	80,383	49,012	33,333	15,679
	4 " " '02	117,467	72,539	44,927	33,333	11,594
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co	1 m., Apl. '03	22,057	13,421	8,636	------	------
	1 " " '02	18,736	11,943	6,793	------	------
	4 " " '03	83,294	53,898	29,396	------	------
	4 " " '02	70,247	41,033	29,215	------	------
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Mar. '03	37,851	23,243	14,608	15,967	† 1,359
	1 " " '02	33,540	18,285	15,255	16,635	†1,380
	10 " " '03	404,052	224,585	179,467	161,640	17,827
ITHACA, N. Y.						
Ithaca St. Ry. Co.	3 m., Mar. '03	23,592	13,966	9,627	5,518	4,109
	3 " " '02	23,028	20,453	2,577	5,735	† 3,158

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
LONDON, ONT.						
London St. Ry Co	1 m. Apl. '03	11,818	7,928	3,890	2,155	1,735
	1 " " '02	9,942	6,395	3,547	2,335	1,212
	11 " " '03	46,201	31,802	14,399	8,510	5,889
	11 " " '02	39,188	26,723	12,465	8,896	3,569
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1m., Apl. '03	239,967	121,005	118,962	70,711	48,251
	1 " " '02	206,047	99,154	106,893	64,108	42,785
	4 " " '03	940,706	491,373	449,334	280,611	168,723
	4 " " '02	833,547	401,276	432,271	257,901	174,370
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Apl. '03	317,178	151,970	165,208	78,400	86,808
	1 " " '02	263,243	131,388	131,855	76,017	55,838
	4 " " '03	1,231,174	594,299	636,875	313,600	323,275
	4 " " '02	1,059,565	512,040	547,525	304,067	243,458
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Apl. '03	172,086	107,876	64,210	19,717	44,493
	1 " " '02	154,390	83,850	70,540	15,848	54,692
	7 " " '03	1,189,577	759,932	429,646	119,856	309,790
	7 " " '02	1,079,110	679,457	399,652	106,234	293,418
NEW YORK.						
Manhattan Ry. Co	3 m., Mar. '03	3,340,161	1,464,128	1,876,033	743,572	1,132,461
	3 " " '02	3,000,173	1,400,378	1,599,795	658,335	941,460
	9 " " '03	9,193,221	4,158,704	5,034,517	2,136 295	2,898,222
	9 " " '02	8,323,174	4,117,479	4,205,695	2,043,821	2,161,874
OAKLAND, CAL.						
Oakland Transit Consolidation Co	1 m., Feb. '03	76,412	44,097	32,315	------	------
	1 " " '02	63,374	44,072	19,302	------	------
OLEAN, N. Y.						
Olean St. Ry. Co.	1 m., Apl. '03	6,270	3,204	3,066	1,952	1,114
	1 " " '02	4,432	2,314	2,118	1,146	972
	4 " " '03	59,896	31,785	28,111	16,095	12,016
	4 " " '02	46,167	23,925	22,242	13,488	8,754
PEEKSKILL, N. Y.						
Peekskill Lighting & R. R. Co	3 m., Mar. '03	22,888	* 15,750	7,138	6,250	888
	9 " " '03	79,434	* 49,567	29,867	18,750	11,117
PHILADELPHIA, PA.						
American Railways	1 m., Apl. '03	95,285	------	------	------	------
	2 " " '02	79,611	------	------	------	------
	10 " " '03	1,004,467	------	------	------	------
	10 " " '02	810,655	------	------	------	------
PUEBLO, COL.						
Pueblo & Suburban Traction & Lt. Co.	1 m., Apl. '03	39,223	------	------	------	------
	12 " " '03	151,587	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry.	1 m., Apl. '03	97,582	48,889	48,693	25,448	23.245
	1 " " '02	86,215	47,023	39,192	24,729	14,462
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., Apl. '03	62,612	35,646	26,966	19,238	7,729
	1 " " '02	56,008	31,349	24,659	19,025	5,634
	9 " " '03	621,049	345,622	275,428	190,463	84,965
	9 " " '02	574,652	316,908	257,744	190,196	67,548
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., Apl. '03	127,563	*a*69,710	57,853	40,360	17.493
	1 " " '02	106,358	*a*64,536	41,822	37,833	3,989
	4 " " '03	495,217	*a*258,674	236,544	160,099	76,445
	4 " " '02	431,596	*a*227,978	203,618	151,328	52,291
Lake Shore Elec. Ry Co	3 m., Mar. '03	109,089	89,265	19,824	------	------
	3 " " '02	86,714	71 905	14,809	------	------
YOUNGSTOWN, O.						
Youngstown - Sharon Ry. & Lt. Co.	1 m., Apl. '03	41,766	25,071	16,695	------	------
	3 " Mar. '03	120,164	* 77.423	42,740	------	------
	12 " " '02	444,986	*244,972	200,014	------	------