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The Coming Conventions

The approaching convention in September of the International Tramway & Light Railway Association, at Vienna, is indicated in this issue by the publication of the programme of the Vienna meeting, and also by the interesting report on the Control of Transfer Traffic which is to be presented at that meeting. At the same time the approaching date of the Street Railway Accountants' convention is presaged by the appearance in this number of the question box of that association to be discussed at St. Louis. Another approaching convention is that of the New York State Street Railway Association at Utica.

The convention of the New York State Street Railway Association has always attracted a wider attention and larger attendance than that of any other State association, and the convention this year promises to be of unusual interest. As already announced, it is to be held at Utica on Sept. 13 and 14, and a number of important topics are to be discussed. There is no doubt that a State body of street railway managers can accomplish many things which are outside the scope of a national association. As the attendants are all from the same section of the country, their operation is conducted under similar conditions, and as they are neighbors, the local conditions on each system are pretty well understood by all present. For this reason each company gets the maximum amount of benefit from the treatment of the different topics. The introduction this year by the New York association of a question box is somewhat of a departure from former traditions, but the practical utility of a set of topics of this kind has been demonstrated at other conventions, and the innovation is a wise move on the part of President Connette and his associates.

The Vienna convention of the International association also promises to be a most interesting one. It is a great pity that it is not practical for more Americans to be members of this association, but the time required for a trip to Europe to attend the meetings of this association, and the complications introduced by the employment of French and German in the discussions, practically preclude any of the American companies from taking an active part in the association to which, however, they are eligible. Although in certain respects the conditions in Europe are different from those in America, street railway practice in the two continents is more nearly alike than many American managers realize. The problems which confront the companies and the policies which they pursue are extremely similar, and it has been this fact which has prompted this paper to devote the attention which it has to descriptions of European roads and discussions of European operating problems. The conventions of the International Tramway & Light Railway Association are models for the amount of work which is accomplished in them and the value of the information which is disseminated. The date of the Vienna meeting, which is now set for Sept. 5 to 8, has been advanced one week, to permit a number of the members who wish to visit St. Louis in October to do so.

The Indiana Servitude Case

The case recently decided in Indiana, and reported in our issue of July 16, as to whether the operation of an interurban railway upon a city street constitutes such an additional servitude as would require the interurban company to purchase a right of way like a steam road, was one which was watched with a great deal of interest by all interurban men in Indiana. An adverse decision would have threatened the very existence of the interurban roads. It is well established in Indiana that the operation of a street railway is not an additional servitude

upon the street, and injures property no more than the other legitimate uses of the street. Those who brought this suit claimed that the operation of heavy interurban cars, with occasional freight and express cars, introduces so many new elements that it is beyond the legitimate use of a city street. The decision of the court was that the operation of cars of an interurban road over a street was not materially different from that of a city railway. The court further added that such roads were of much benefit in building up a community, thus intimating that it would be against public policy to hamper them by a decision requiring them to condemn a right of way through the city. The judge held that there was a wide difference between an interurban road operating one or two electric cars in a train over a street and a steam road using steam locomotives and hauling long, heavy trains. The case was such an important one that naturally all interurban roads in Indiana were interested in a favorable decision. While of course this suit and others of the same nature were brought by property owners, who claimed injuries to property because of the operation of interurban cars over the street, there will always be a strong suspicion in some minds that steam railroad interests were more instrumental than the property owners in the prosecution of these cases.

Abusing the Transfer

The abuse of the transfer privilege is one of the most common difficulties which the electric railway manager has to face, and the ingenuity of the public in this direction is almost beyond the belief of one outside the transportation business. The more complicated the system the greater becomes the difficulty of keeping the scheme of transfers within its proper bounds, and there is no doubt that a large amount of money is lost each year by operating companies through the misuse of these troublesome bits of paper. At a recent suit in Boston, the representative of the street railway company estimated the annual loss to his road in this way as something over $50,000, or nearly one-half of 1 per cent of the gross receipts from operation.

It is claimed by the transfer abuser that it makes no difference to the company who rides upon its cars and that it is therefore allowable and right for him to sell his transfer to another person if he does not wish to continue his ride. In other words, the passenger feels that the company still owes him certain transportation if he does not ride to the limit of his fare, which is only another way of saying that the passenger assumes to pay tariff in proportion to the distance traveled, as in certain European cities. This view is, of course, a mistake, for the passenger pays for transportation in American cities at a flat rate, which is well nigh universal in this country, although we are told of an interurban road in Colorado which proposes to base its charges upon the avoirdupois of the passengers! There is certainly no more ground for the company's owing a passenger additional transportation because he has not personally used it up to the fare limit than there is for the government to give a man a rebate for every stamp used in city delivery because it might have been required for the same money to carry a letter from New York to San Francisco. In most American institutions there is a certain continuity in the transfer between the coin of the realm and the service or materials rendered, and the street railway business is no exception. The argument that it costs the company no more to carry a second person who receives a transfer from a paying passenger may be true as far as operating expenses go, but it is utterly fallacious, on the ground of absolute cost, since the company is deprived of the fare which it would otherwise take from the second passenger. Then there is the argument that the company has no right to make its transfers non-transferable from person to person, and therefore it is right to beat the road out of a fare if possible. This is only another illustration of the morals of the ticket scalping profession, as evidenced by the number of persons who are willing to pass themselves off as somebody else for the purpose of traveling at a reduced rate.

As a general thing, the practice of giving a transfer upon receipt of a transfer is not regarded favorably by operating roads, although exceptional cases seem to demand the granting of this privilege on some lines. It is most important, in the interests of good service, that fixed and definite rules be observed by employees in regard to these checks. Thus, in many cities, the passenger can receive a transfer only by asking for it when he pays his fare, while in other cases the conductor collects all the fares before issuing any transfer checks. In either circumstance good service demands that the rules be strictly followed, in justice to both passengers and the company. Sometimes a change of conductors on the line deprives the passenger of receiving a transfer which he has asked for when paying fare, but which cannot be issued until nearly all the other fares in the car have been collected. These little points should be carefully watched, because the company's interests and the passenger's are identical when both are considered on the ground of fair and square business dealing. Conductors should be instructed to courteously explain the use and granting of transfer checks in all cases where doubt arises, or else plainly printed placards should be posted in the cars of systems which have a complex transfer traffic.

Losing Time in Switches

The maintenance of a close schedule in the congested district of a city is one of the most difficult problems encountered in the operation of street railways. However carefully the running time may be tried and calculated from point to point, the motorman can never tell at just what moment his track may be obstructed by the complex traffic which wanders at will over the route of the cars, or at what time a serious blockade may be precipitated by the breakdown of some heavy dray which has taken to the rails in its slow and cumbersome journey. The result of this uncertainty is the allowance of a certain leeway, say from five to ten minutes, in the schedule of surface cars at the end of the route, reinforced in some cities by the running of extra cars from the barns in case the regulars are delayed. All this means extra expense in the operation of the road whose cars are delayed in the crowded parts of a city; partly through the loss of time of the regulars and consequent decrease in car mileage per crew-hour, and partly on account of the additional men and cars required to start out upon the schedule time of the late comers in order to maintain the schedule originally laid down.

Anything which will offset the delays of the crowded thoroughfare without unduly increasing the cost of operation in other ways is therefore worth careful study on the part of transportation officials. Some of the most annoying and needless delays which lengthen out the running time of city and suburban roads occur in special work, one or two of which are worth recording in this connection.

The first case is that of a system in Colorado which has a large loop terminal in the heart of the city that it serves. A main line track passes the loop on the way up town, a switch

leading from this track to the loop over which the majority of the cars pass. The delay is incurred by stopping the loop cars upon the main line before they take the loop switch, instead of bringing them first to a standstill upon the loop itself, close by the platforms provided for passengers to use in entering and leaving the terminal. In addition to the extra stop, which wastes power and adds to the wear and tear of the equipment, the through cars of the main line are delayed upon their approach to the loop switch. The distance between the objectionable stopping point and the center of the loop platform is not far from 100 ft., and there would seem to be no reason why the first stop could not be omitted.

Another line, located in Minnesota, runs cars to a residential suburb by a double-tracked route, which turns into a single track for the last mile of the trip. The schedule is planned for the outbound car to pass its inbound predecessor at the end of the double-tracked section. Over and over again, the inbound car makes a stop for passengers at a street corner on the single-track side of the switch, instead of coming to rest on the double-track section, perhaps 50 ft. beyond, and permitting the waiting outward-bound car to proceed without delay.

The practice of marking stopping places at street corners and at other points where passengers may enter or leave cars has a direct bearing upon the schedule time. There should always be something printed or suitably marked to show where cars will stop, in cases where some streets are down for stops, while others are always omitted. Attention to these little details of operation goes a long way toward perfecting the service, and there is certainly constant opportunity to study the saving of time upon every growing electric railway system.

The Automobile and the Law

A few days ago a wholesale inspection of automobiles was made by the Boston police, with a view toward ascertaining how well the regulations of the Massachusetts Highway Commission were being observed. Out of 234 machines examined, only 126, or less than 55 per cent, were found to comply with the law in regard to numbering, badges, certificates and lamps. There were sixty-two operators who could show no certificates, either for the machine or the chauffeur; five cars without lamps; thirty-five machines without numbered lamps; one car with no number, and others which were improperly marked, which failed to display numbers in the right places, and whose numbers disagreed with one another, or were illegible.

This woeful showing is a pretty fair illustration of the present day law-abiding tendencies of the average automobilist, and as a bit of transportation statistics deserves to be stowed away in the quiver of the street railway man who has so often to bear the undeserved blame of accidents and a reputation for careless operation which should rightfully be laid at the door of the automobile. More than once we have called attention to the ease with which an unnumbered or poorly designated automobile can take to its heels after an accident, in comparison with the ease with which the general public can identify an electric car, and there is reason to believe that the automobilist who scorches a zig-zag trail at his own sweet will along the highway has many times taught the public, by his excessive speed, to overestimate the danger of rapid transit over the fixed right of way upon which the trolley car travels. We have no quarrel with the law-abiding automobilist, and doubt not that many of the Boston offenders were possessed of good intentions in lieu of licenses and numbers, but the incident serves to bring out the importance of enforcing laws if they are to protect the welfare of the community at large. Good intentions may serve very well as a pavement for the unmentionable abode of evil-doers, but they amount to little in the safe conduct of transportation, whether by motor vehicles or by electric cars.

The Intramural at The World's Fair

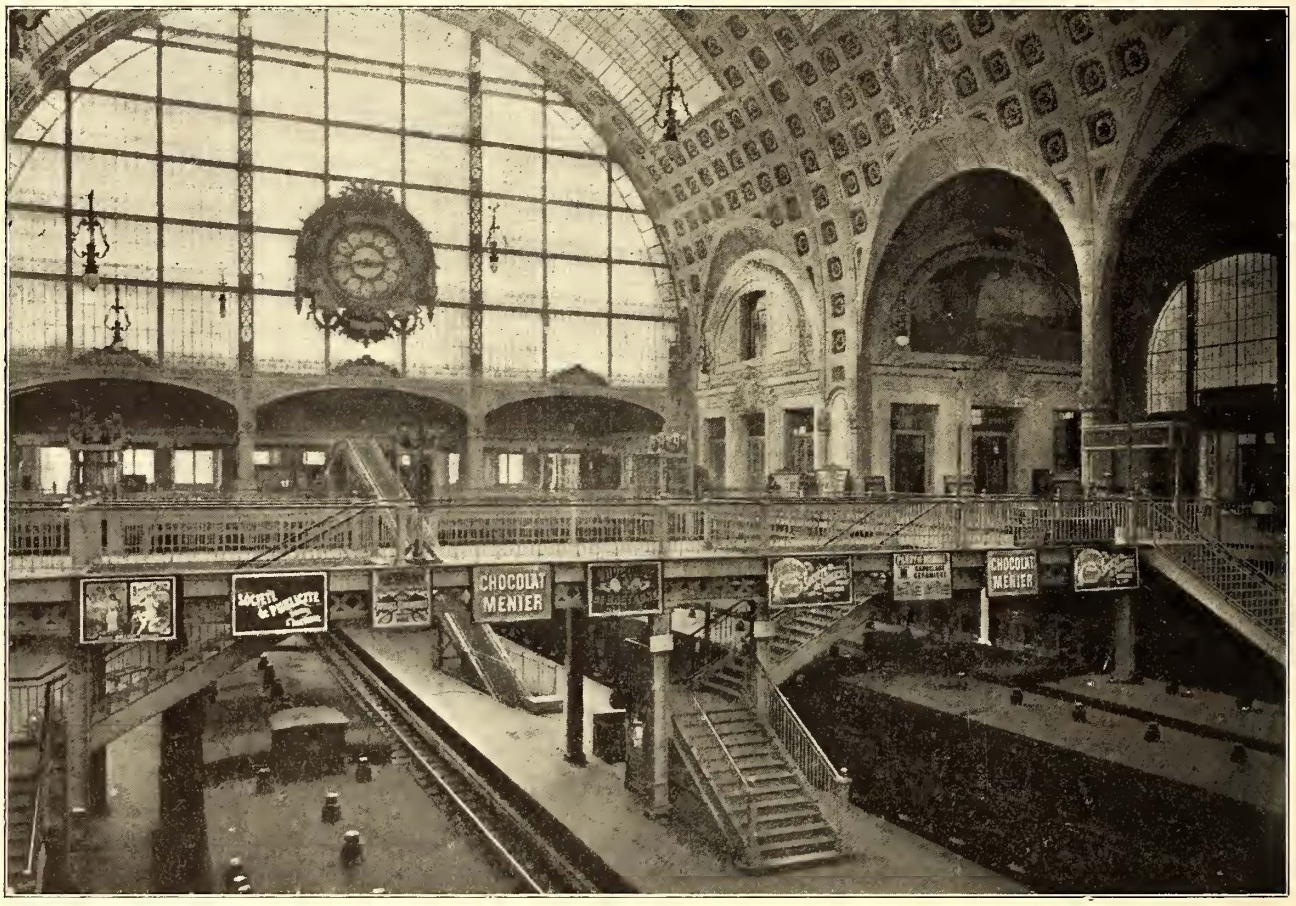
At the time when the question was being decided whether there would be an intramural railway at the World's Fair in St. Louis, we took occasion to enter a vigorous protest against any attempt to conduct a large exposition of this kind without some means of electric railway transportation within the grounds. Those who have already visited the Exposition and have had to cope with the immense distances, realize how important intramural transportation is in an exposition. It is to be regretted that the arrangement of buildings on the Exposition grounds would not have permitted the Intramural Railway to take a more accessible route. As useful as the road is at present, it could be made much more so had it been possible to select routes which would be nearer to the principal centers of attraction of the Exposition. Could such a route have been selected, the Intramural would have been heavily patronized for much short distance riding, which it does not now get, and which the public would gladly give to it were its stations located nearer the principal centers of the Exposition. As it was, the only route left to the engineers was around the outer edge of the Exposition. While it is extremely useful in serving the outlying portions, it is of practically no other service than this, and to convey passengers from one side of the grounds to the other by a circuitous route.

We do not wish anything said here to be construed as belittling the importance of the Intramural, or the judgment of the engineers who selected the route. Circumstances practically forced the adoption of it as it is. We can only regret that circumstances were such. Should there ever be another exposition on such a large scale as that at St. Louis, the location of intramural transportation routes should be borne in mind from the first in laying out the general plan of the grounds, instead of leaving this important matter to be worked in as best it can, after the general plan of the Exposition has been decided upon. Even at best, the amount of walking done by the average person at an exposition of this kind is so much as to become very tiresome, and may even detract seriously from the pleasure of the visit. Local transportation is of first, and not secondary, importance in such an undertaking.

Incidentally, it may be remarked that it is the belief of not a few that the location of the route of the Intramural at St. Louis has been responsible for many of the reports that have been given out by early visitors to the Exposition that the Exposition was in a very unfinished state. The main buildings and roadways of the Exposition on opening day were in a very creditable state of completion. Outlying buildings and roadways were many of them unfinished. These outlying buildings and roadways were the very ones passed by the Intramural Railway, and, naturally enough, nine out of every ten visitors took a ride around the Intramural almost the first thing, in order to get, as they thought, a general idea of the grounds. As a matter of fact, no such general idea was obtainable by a ride of this kind, and the main impression left on the visitor's mind was a chaos of uncompleted roads and buildings. All this worked to the detriment of the Fair, and it is only right to the Exposition management to make this explanation of why so many reports of the unfinished buildings and grounds were given by the early visitors.

EXTENSION OF THE THIRD-RAIL SYSTEM OF THE PARIS-ORLEANS RAILWAY

Descriptions of the electrical division of the Paris-Orleans Railway Company of France were published in the STREET RAILWAY JOURNAL for Dec. 21, 1901, and Nov. 15, 1902 (International Editions for January, 1901, and December, 1902). The Paris-Orleans Railway is one of the large steam trunk lines of France, and its electrical division is very similar in character to that proposed by the New York Central and the Pennsylvania railroads in securing an entrance into New York City—that is, the through steam trains are stopped at the Austerlitz station, which is near the outskirts of the city, and are then hauled by electric locomotives a distance of 2½ miles (4 km) to the Quai d'Orsay station, not far from the Champs de Mars. The electrical equipment was put in operation about May, 1900, and since that time from 150 to 200 trains have been hauled daily by electric locomotives between the Austerlitz station and the main station at the Quai d'Orsay.



INTERIOR OF ORSAY RAILROAD STATION, THE TERMINUS OF THE ELECTRIC SERVICE—THE ELECTRIC ELEVATOR FOR HOISTING TRUNKS AND OTHER BAGGAGE IS SHOWN AT THE REAR OF THE MIDDLE PLATFORM

The original power station contained two groups of 1000-kw units, generating at 5500 volts, three-phase 25 cycles. Two sub-stations, each of 500 kw capacity, furnished with a battery of 1100 ampere-hours' capacity at one-hour discharge rate, boosters and transformers (5500-volt to 440-volt) of the air-blast type completed the stationary traction machinery. Polyphase distribution was adopted because, although the line was only 2½ miles in length, the company anticipated the extensions to the system which have just been completed. The rolling stock comprised eight locomotives, equipped with four G.E.-65 motors. The third-rail distribution is used throughout, supplemented by stretches of overhead conductor formed of an inverted 27½-lb. channel in places where the third-rail construction was too complicated or inconvenient.

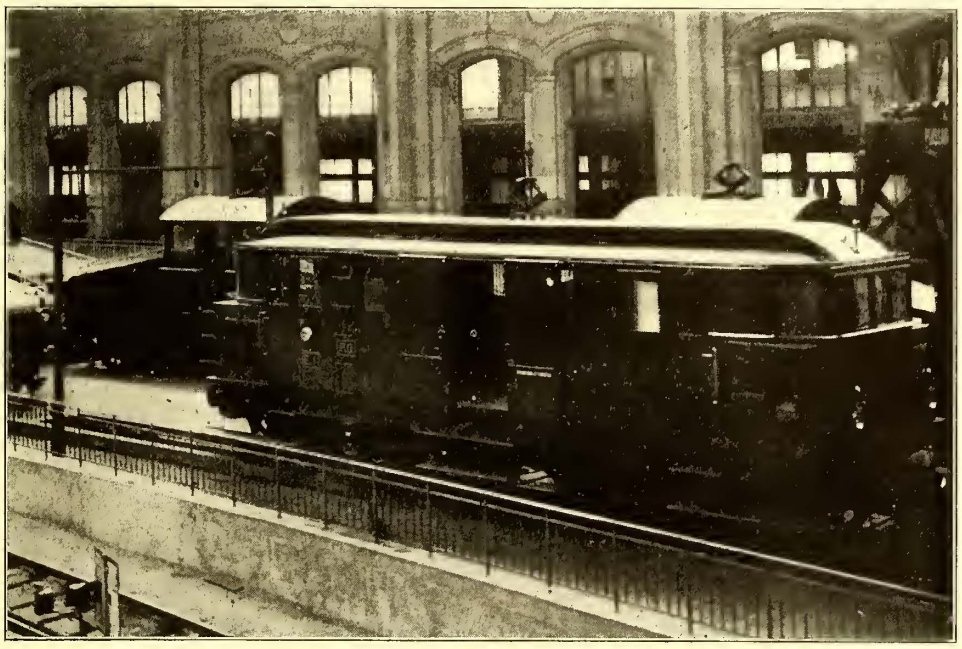
The multiple-unit system of traction, which was just being introduced in 1900, at the time that this system was installed, was considered unsuited to the proposed service of the Orleans Railway, which consisted solely of hauling the main line and local trains from the old to the new terminus, the line running mostly in a tunnel, where steam traction was undesirable. Nevertheless the capabilities of the multiple-unit system for suburban service early attracted the attention of the company's officials, and soon after the Paris Exposition the company put in service an experimental train of two cars.

The Paris-Orleans Company has a far more important railway system than can be judged from the number of trains arriving at the terminus each day. It extends to the Spanish frontier and furnishes the most direct communication to Toulouse and Bordeaux in the south, and reaches to the important commercial city of Brest in the west of France. Its suburban traffic, however, has never been very large, a somewhat strange fact when it is remembered that the tracks extend for some distance along the Seine valley and tap one of the most favored districts in the southeast of the metropolis. One reason for this lack of suburban traffic is perhaps the fact that the old terminus of Austerlitz was too far from the business center of the city to attract commuters, while the new station is even yet not so well known to the Parisian populace as a noisy steam railroad station might be.

To remedy this state of affairs and to create rather than develop a paying suburban traffic through a district as yet untouched by the fast interurban tramways, which are now beginning to make their way in the neighborhood of Paris, has been the work in which the management of the Orleans Company has been engaged for the past eighteen months. To accomplish this they decided to introduce electric traction on a large scale, not only for the suburban trains, but also for all trains arriving at Paris, excepting only a few "rapides" or limited trains, which are not scheduled to stop at the present terminus of the electric extension.

The new extension includes about 12 miles of double track,

together with a number of sidings and switchings, all equipped with the third rail, the track being used as a current return. As shown in the accompanying map, it extends from the old terminus of Austerlitz to Juvisy, which is an important junction with the "Grande Ceinture" or large belt railway encircling Paris, and also connecting with the Paris, Lyons & Mediterranean Railway. This extension runs through a flat district on the banks of the Seine, and the curves and grades may be considered negligible, averaging ½ per cent on the new extension. All of this territory is well adapted for building purposes. The Orleans Railway Company has doubled the two existing tracks in this territory, making four tracks in all, the two outer tracks being supplied with a third rail. New stations have been built and there has been inaugurated a fast and frequent suburban service between Juvisy, the new terminus of the electric lines, and Paris-Orsay. This service is being handled by a number of trains equipped with multiple-unit type M equipments of the latest Sprague-General Electric type.



NEW 55-TON ELECTRIC LOCOMOTIVE

Three new locomotives, containing similar apparatus to that in the first lot of eight machines, have been purchased, and certain changes have been made in their equipment and arrangement to adapt them to the new service.

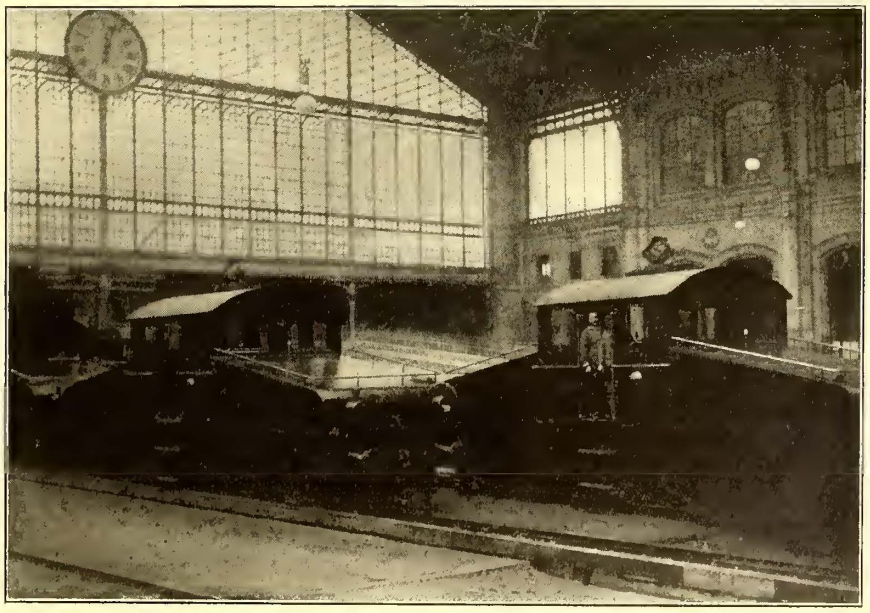
Instead of changing steam locomotives at Austerlitz, as in the past four years, the steam locomotives of the through trains will be uncoupled at Juvisy and the remainder of the journey to Paris run behind the electric locomotives. Juvisy is also the changing over station for the outgoing trains. Only a few "rapides" or "limiteds" arrive at the Paris (Austerlitz) terminus in charge of steam locomotives, no stop being made at Juvisy.

The above remarks apply only to the passenger traffic, as the freight trains are made up, as usual, at the Austerlitz freight yard, outside the passenger station, by steam locomotives.

The original locomotives had a gear ratio of 4 to 1, and in view of the faster service demanded of the machines this has been changed to 2.23 to 1. In addition to this every machine has been supplied with a commutating switch, the function of which is to place each of the motors of each pair of motors either in series or in parallel, by which means a greater range of efficient speed control than otherwise would be possible has been obtained. One of these eight original locomotives has always been connected (all four motors) in series, and has been used for station work, switching, etc. The gear ratio of this machine has been changed to 3.04 to 1, being thus intermediate between the fast service given by the 2.23 ratio and the 4 to 1, as first supplied. The changes mentioned are the principal ones made to the first lot of electric machines, which have given every satisfaction since the starting up of the service in 1900.

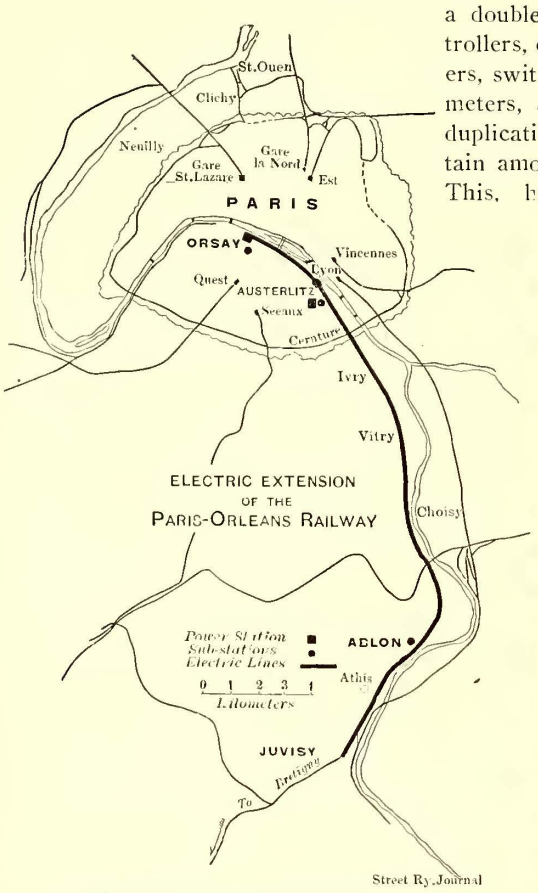
The three new locomotives are very different in appearance and construction to the above machines, although the equipment is practically identical. The new locomotives have a length of 10.2 m, with a width over all of 2.84 m. The height

SECTION CABIN FOR UNDERGROUND TRANSMISSION CABLES



GROUP OF OLD-STYLE LOCOMOTIVES IN AUSTERLITZ STATION

is 3.87 m. The distance between center pin of each double truck is 5.63 m. The wheel base of the truck is 2.38 m. The baggage type of car construction has been preferred, the compartment for luggage being between two end cabs, in which the controller and other apparatus are placed. This involves a double set of controllers, circuit breakers, switches and ammeters, as well as a duplication of a certain amount of cable. This, however, has evidently been considered of secondary importance to the advantages obtained. Commutating switches similar to those added to the old locomotives have been furnished with the new machines, and the gear ratio is the same, viz: 2.23 to 1. Weston ammeters with a scale of 2000 amps. have been provided. Owing to some slight trouble to the ammeters of the original locomotives, caused by the vibrations of the locomotives, the Weston Instrument Company has made certain modifications in the method of support.

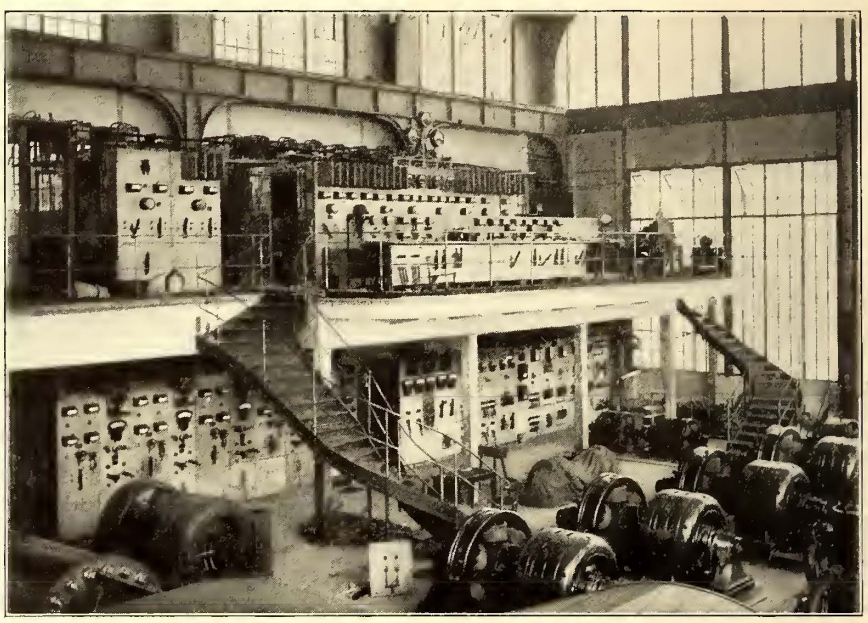


MAP SHOWING ELECTRIC EXTENSION OF THE PARIS-ORLEANS RAILWAY

The cabs of the new locomotives are of steel, lined with Uralite insulating sheeting, and the cabling is asbestos braided, painted a slate color, reducing chances of abrasion by friction. The motor and shoe leads are passed through brass flexible tubing. The construction of the new locomotive has involved an additional weight, now approximating 55 tons.

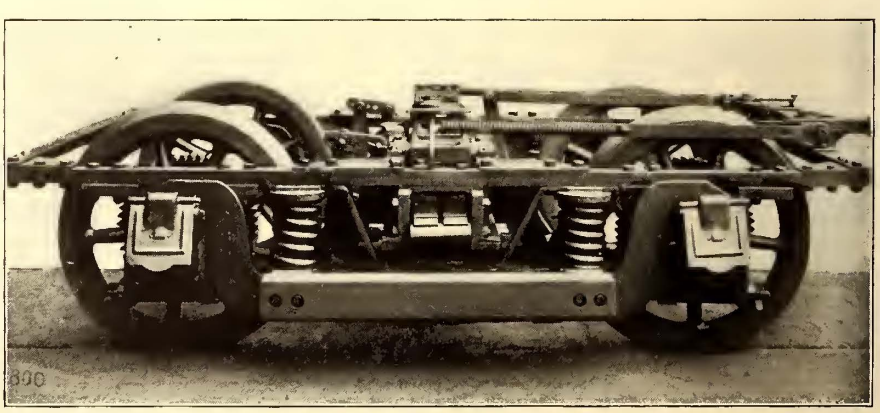
The multiple-unit system is represented on the line by two trains, comprising each two motor cars and a number of trailers. These two trains perform the local suburban service, running between Orsay and Juvisy as frequently as possible. There are six stops between Juvisy and Austerlitz, each occupying about a minute. The 12-mile run between the above points is performed in thirty minutes. The motors are of the GE-66 type (125 hp), the same as used on the Manhattan elevated railway in New York. The gear ratio is 3.08 to 1.

The arrangement of the train-control apparatus is somewhat different to that in common use in the United States. All the apparatus is placed inside the car cab, including contactors, reversers and relays. The last three devices are all placed on slabs of insulating material, and the type T and CG rheostats are provided with insulated bolts, holding them in position. No boxes are used for the contactors and reversers. The reason for this was the fear on the part of the railway engineers that dust could not be perfectly excluded from boxes placed under the car. Necessary precautions have, of course, been taken to separate the rheostats from the controlling apparatus, and also for their ventilation. The rheostats are placed high up in the cab and suitable partitions, lined with uralite, separate them from the remainder of the apparatus. In this way bare wiring has been used between contactors and reversers, and the cabling on the car has been reduced to a minimum. Flexible armour has been used for shoe and motor-leads, similar to the locomotives.



MAIN SWITCHBOARD, IVRY POWER STATION, SHOWING LIGHTING SWITCHBOARD BELOW GALLERY—MACHINES IN FOREGROUND FORM PART OF IVRY SUB-STATION

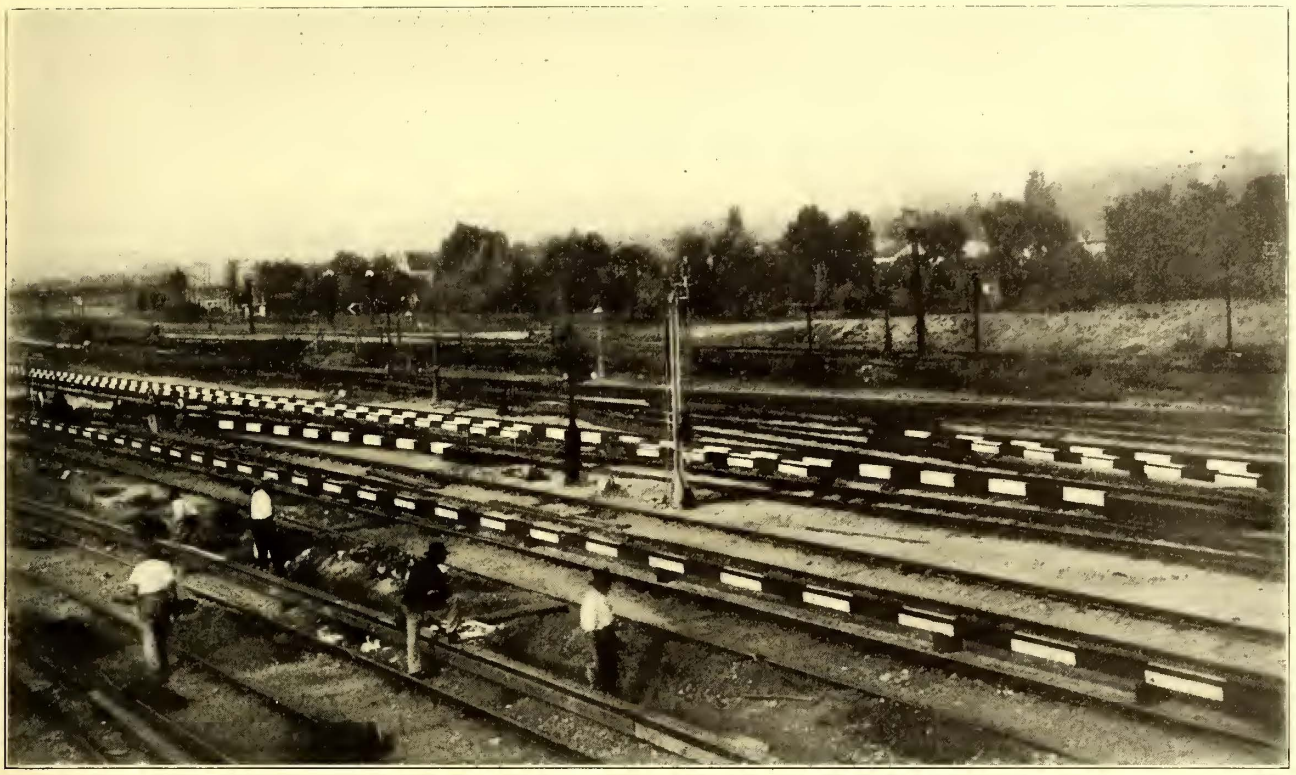
One air compressor per car is used. It is of the CP-10 type of the General Electric Company. The MQ type of circuit breaker, as supplied for the first locomotives, has been replaced by a fuse and fuse-block. The first locomotives were supplied one type CP-10 air compressor per locomotive, but in consequence of the stringent conditions existing of French railways, these were increased, and two are now used per machine, normally connected in multiple.



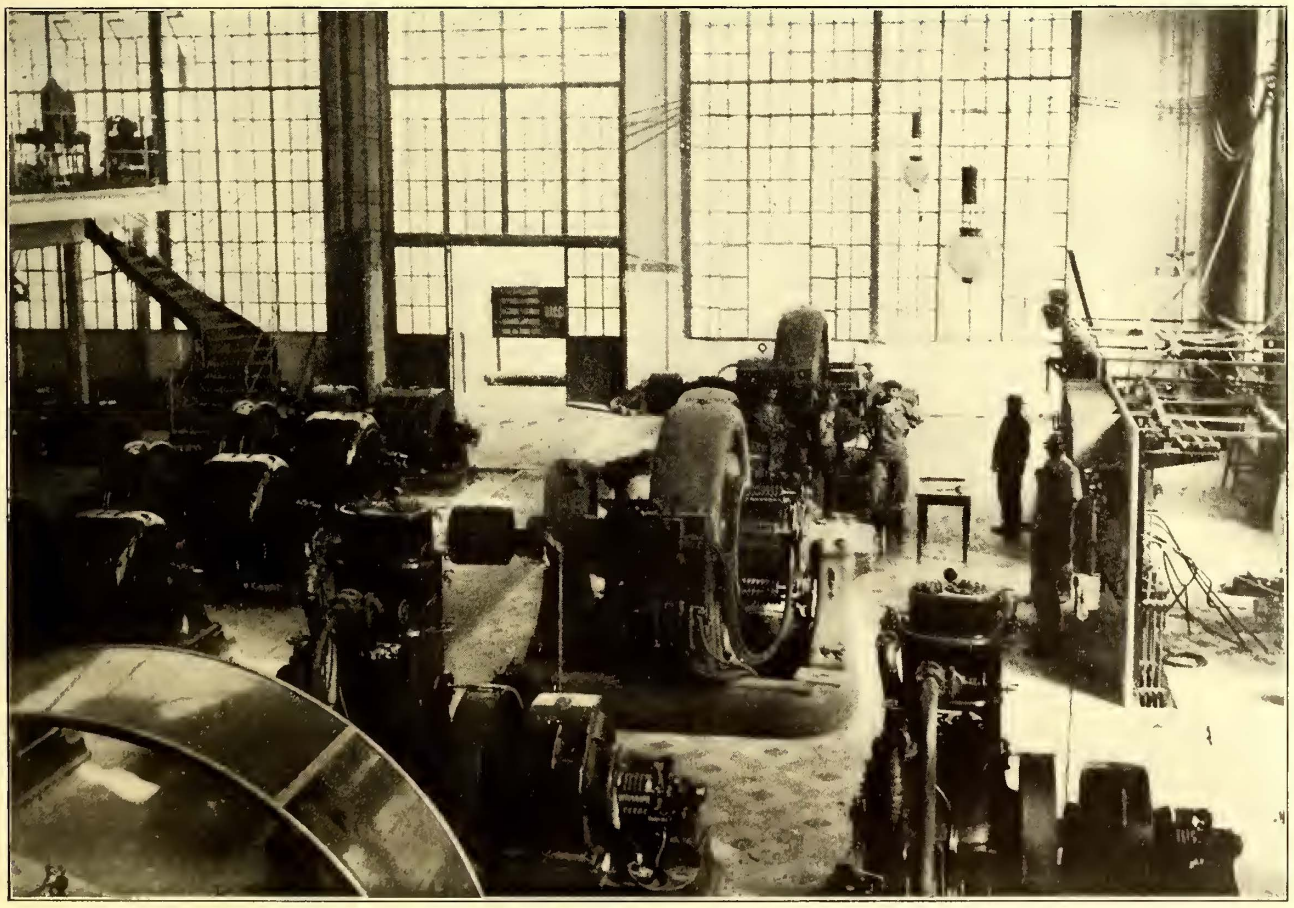
SIDE VIEW OF MOTOR CAR TRUCK

The motor cars are 17.3 m long, 3.8 m high and 2.8 m wide. The distance between center to center of truck bolt is 12.4 m.

The weight of the car empty, without trucks, is about 30,000 lbs. Baldwin Locomotive Works trucks are used; the two trucks, without wheels and axles, each weigh 6300 lbs., and are mounted on 40-in. wheels. The wheel-base is 6 ft. 6 ins. The four motors weigh 4300 lbs. each. The motor car is arranged for third-class passengers and has accommodations for over thirty. There is also a smaller compartment for the conveyance of baggage. The standard color for the Orleans locomotives is dark green, picked out with vermilion, and the new locomotives and motor cars present an attractive appearance thus painted. Two new sub-stations have been provided, one of the old ones abolished, and the machinery contained therein distributed over the two new ones. Thus the Austerlitz sub-station contained two rotary converters, four-pole, three-

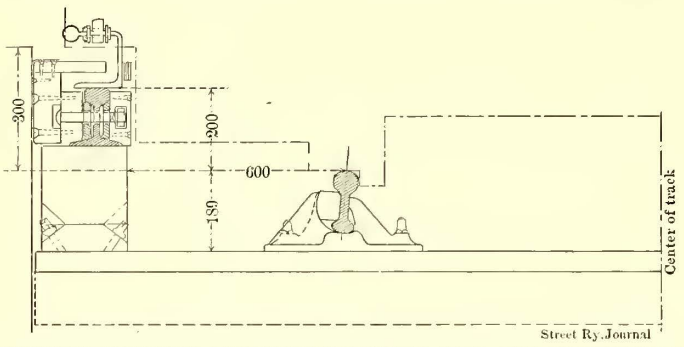


LAYING THE THIRD RAIL OUTSIDE OF JUVISY JUNCTION



IVRY SUB-STATION, SHOWING SWITCHBOARD ON RIGHT AND CORNER OF POWER STATION SWITCHBOARD GALLERY ON LEFT

phase 250 kw, 340 volts to 550 volts, and also six three-phase, 5500 volts to 340 volts air-blast transformers. One of these converters and three of the transformers have been placed in the new Ivry sub-station, situated at one end of the power station itself. The other converter and transformers have been removed to the second new sub-station, built at Ablon, a



SECTION SHOWING LOCATION OF THIRD RAIL AND PROTECTION USED AT STATIONS

few kilometers from Juvisy. The remainder of the machinery of the old sub-station of Austerlitz, including lighting sets and the buffer battery (increased to 1500 amp.-hours at one-hour discharge rate), has been installed at the Ivry sub-station.

In other respects the Ivry and Ablon sub-stations are practically identical, each containing two rotary converters of General Electric make, six-phase, 500 kw, six-pole, changing 440 volts three-phase alternating current 25 cycles to 600 volts direct current.

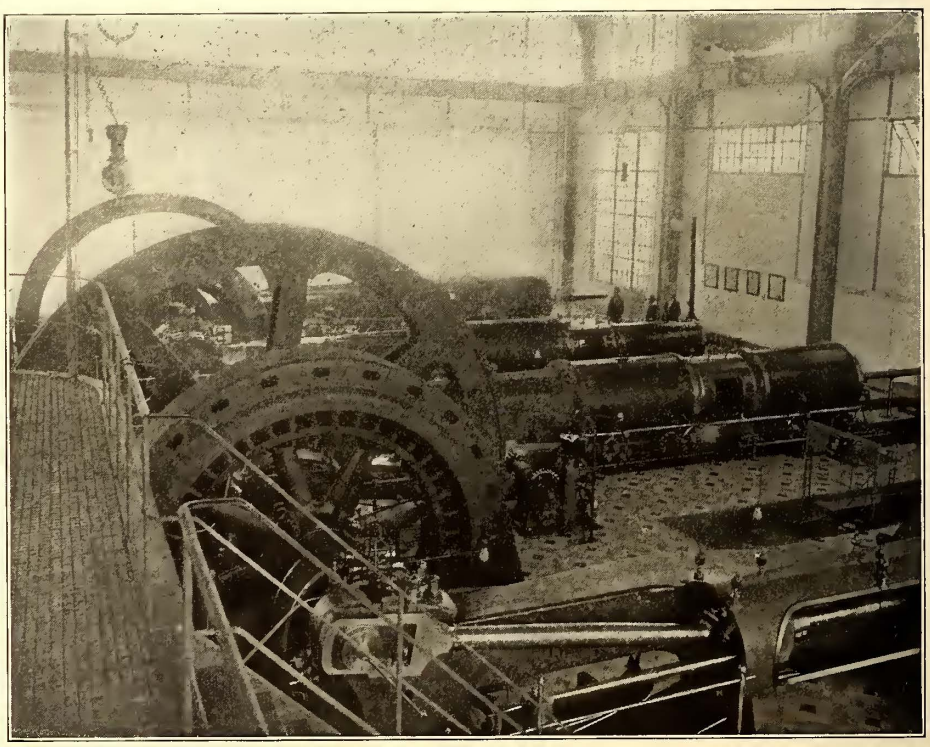
The transformers are of the air-blast type, six-phase, 550 kw, stepping down from 5500 volts to 440 volts. Whenever the voltage of the plant should be changed to 11,000 volts the transformers can be altered to this voltage, the primary windings being arranged with this end in view. Necessary reactances, rheostats, booster and controlling apparatus are installed. At Ablon there is also a motor-generating set for the five-wire lighting system and a 1500 amp.-hour storage battery, taking care of the load in the small hours of the morning and used as a buffer battery at any time. The rotaries are started by means of the battery.

The usual feeder, machine and lighting panels are installed in the sub-stations, most of the apparatus used, especially the alternating-current instruments, being of the horizontal edgewise switchboard type of the General Electric Company. The oil switches and laminated toggle switches and breakers are also of the same make. The direct-current instruments have been supplied from various sources, Chauvin and Arnoux being the most prominent make. The ultimate use of 11,000-volt circuit has, of course, necessitated the use of switches and instruments arranged for this tension. The main change in the second of the first two sub-stations which were built in 1900 is the increase of the storage battery from 260 to 290 elements (1100 to 1500 amp.-hours). The voltage of the third rail is about 600.

The transmission line is laid entirely underground. This form of transmission line was adopted because the insulation of an overhead construction, though cheaper, was thought to be liable to depreciation from the gases of combustion thrown off by the steam locomotives. There are two transmission cables, usually connected in multiple, established for a 11,000 circuit, but now run under a tension of 5500 volts, three-phase 25 cycles. They have a total length of 25 km and are formed of three-core conductors, each of about 80 sq. mm section. They are paper insulated, lead covered and steel armoured. The outside covering is tarred hemp. The cables are being laid in 100-m lengths, and are also divided for purposes of testing into four sections by three section houses. In these houses are transformers, static dischargers, oil switch and measuring apparatus. The resistance of copper is 17.5 ohms maximum at 15 degs. C. per kilometer for a section of 1 sq. mm.

The power station has been increased by the addition of one alternator of 1000 kw, direct coupled to a Dujardin engine, identical to those already furnished in 1900. The station thus comprises three similar units, one of which is used as spare. In this connection it might be said that the Orleans Railway Company at first contemplated the installation of a steam turbine set when additions to the power house became necessary. The decision in favor of engines was based principally upon the desire to maintain the homogeneity of plant so that, with the exception of a few minor improvements in the engine, the generating units are identical.

The boiler installation has been increased by the addition of four Babcock & Wilcox boilers, each of a heating surface of 260 sq. m (2800 sq. ft.), this being an increase over the eight boilers originally installed, which have a heating surface of 186 sq. m. Two Green economizers with 224 tubes have been added. The Meldrum stokers supplied for the first plant have been withdrawn and their place has been taken by Bennis mechanical stokers, built in Bolton, England, and which are



GENERAL VIEW OF GENERATING STATION—ON THE LEFT IS A CORNER OF OLD SWITCHBOARD GALLERY, NOW BEING DEMOLISHED TO MAKE ROOM FOR NEW 1000-KW GROUP

now used for both the old and the new boilers. Coal and ash conveyors are also used.

The stoking and conveying apparatus is driven from two semi-enclosed direct-current motors, one of 10 hp and the other of 20 hp. One motor operates the coal collecting and distributing mechanism and mechanical stokers, the other motor being reserved for the ash conveyor and elevator. The stokers are guaranteed to produce 5500 lbs. of steam per hour per

boiler (heating surface 2800 sq. ft.), at a temperature of 536 degs. F., and at a steam pressure of 185 lbs. per sq. in., with the use of not more than 924 lbs. of combustible, composed of a mixture of 50 per cent of cinders (removed from the smoke-boxes of locomotives), and 50 per cent of coal of a calorific value of 7500 calories or 13,500 British trade units per pound. This figure amounts approximately to a production of 13.2 lbs. of steam per kilogram, or 2.2 lbs. of the above combustible. With the above conditions remaining the same, but by forcing the fire, this vaporization can be increased to 6600 lbs. of steam per boiler per hour. The above being guaranteed, the actual performance can be taken to be 15 or 20 per cent above these figures.

Another chimney of 50 m height has also been built.

As regards the actual operation of the plant during the years 1900 and 1904, it may be said that the service has been maintained without any interruption from any cause. In view of the cost of the first installation and the necessity for keeping a large percentage of reserve both in generating and traction machinery, the cost of operation and maintenance can scarcely be expected to compare very favorably with that of the steam service conducted by the Orleans Company. Thus, the electric machines have been making an average of 30,000 km (18,600 miles) yearly, whereas the average for a steam locomotive on this railway is over 43,000 km (26,660 miles). Similarly the two employees have made something like 17,000 km (10,500

BREAKING UP OLD TRACK WITH SLEDGE HAMMERS AND WEDGES IN LONDON

miles) yearly, against an average of over 50,000 km (31,000 miles) for the engineer and fireman on a steam locomotive. It is anticipated, however, that with the increase of length of electric lines in service, quite out of proportion to the increase of rolling stock and generating plant, that more favorable results will be secured.

The present extension constitutes a very prominent piece of railway engineering as far as France is concerned. The Paris-Orleans Railway was the first of the larger steam railways of France to convert any part of its existing line to electric traction, and it is certain that the management looks upon the system with favor, inasmuch, as previously stated, the company contemplates a further extension of 13 km to Bretigny, when the transmission will be raised to 11,000 volts. The generators, it may be added, will have to be rewound for this voltage, but no trouble is anticipated from this score.

It might be stated that, although this paper is not at liberty to publish any of the actual operating costs of the first installation, the Orleans Railway Company has expressed a willingness to communicate the same to representatives of such railway companies as may be interested, in the way this class of information is usually exchanged.

CONVERSION OF THE BRIXTON CABLE LINE IN LONDON TO ELECTRICITY

The march of progress in the electrification of the surface lines of London to electricity was marked during the last few months by the conversion of the Brixton & Streatham cable

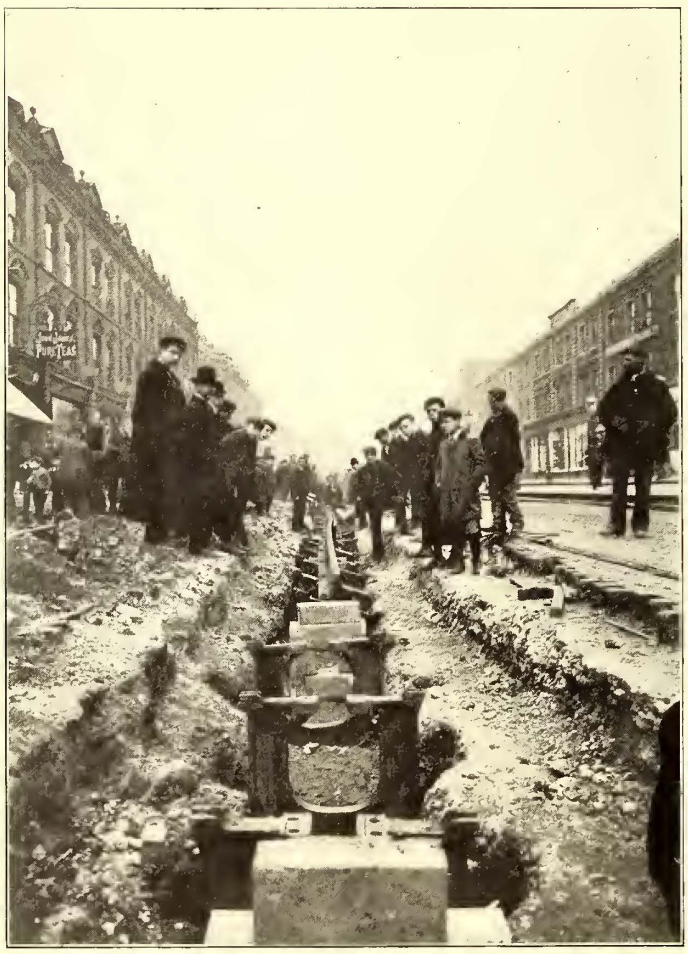
JACKING UP OLD TRACK—RAIL LIFTER IN FOREGROUND

line to electric power. On March 2, this year, the London County Council officially notified J. G. White & Company, Ltd., that they had been awarded the contract for this change. In view of the importance of this thoroughfare, it was stipulated that the work must be finished by July 1. When one considers the difficulty of tearing up 18,000 ft. of double cable line which has been well laid and also allows for inevitable delays in delivery of material and the short notice given, it will be conceded that the task of completion within the specified time was one calling for wide experience and first-class organization.

I. Fisher, who had already constructed some 30 miles of conduit in South London for J. G. White & Company, broke ground on April 6. For the breaking up of the old cable road some interesting devices were adopted by Mr. Fisher. In lifting the wheel-rail, Barrett jacks were used, as on the first Tooting track, but in order to save time in starting the operation, a jaw was fitted around the head of the rail, and this jaw was raised by two jacks mounted on iron wheels. In this manner the necessity of breaking up the roadway at each fresh start

was obviated. To avoid the tedious process of unbolting the slot rail from the yokes, wedges of varying thickness were driven into the slot, whereby the slot rails were forced apart, carrying the shoulders of the yoke with them. The concrete enclosing the old cable tube was found to be very hard and difficult to remove, but after the first ten days it was discovered that by driving the wedges (four men to a wedge) a certain distance back on either side of the tube, a seam was opened up. The finding of this seam enabled the concrete to be taken out in large blocks.

During the first week the number of men employed was increased daily until some 1600 men were at work, and such



TRENCH WITH YOKES IN AND SLOT RAIL

progress had been made that on May 18 a car was run over the double line from Kennington Gate to Water Lane, a distance of 1¾ miles. On this section the roadway under the Brixton Railway bridge was lowered 8 ins. from building line to building line. The Board of Trade inspection took place on May 20, five weeks before time.

It is interesting to note that two weeks before commencing work a schedule of daily progress was made out, in which the date for the completion of tearing up was given as June 2. This part of the work was actually finished on that date. The average of progress by all the gangs was 1000 ft. of single track per day.

The work was completed on June 13, and the first car ran to the terminus on the fifteenth. The Board of Trade inspection was held on June 18, and the line was thrown open for traffic on June 19, seventeen days ahead of the stipulated date. There can be no doubt that could the manufacturers have delivered material earlier the whole work would have been completed by June 1.

Maurice Fitzmaurice, engineer to the Council, made several alterations in the original construction of the track as carried out on the first Tooting line. The rail length was increased from 30 ft. to 45 ft. On the Tooting line the rails were laid with "Dicker" joints without any provision for anchoring. On this road the anchor rail joints were used; the rails were also anchored between joints. The position of the sumps was also changed from the margin to the center of the track, and the sumps were spaced 140 ft. instead of 180 ft., as formerly. The conduit tubes discharge directly into the sumps. The difficulties found in keeping clear the pipe connections from tubes to sumps are so avoided. At insulator pockets paving plates were inserted, carried between yoke and stirrup support in panel. For slot switches in the special work Hadfield's design was adopted. The castings were supplied by the Anderson Foundry Company, Ltd.; the tie-rods by Bayliss, Jones & Bayliss, Ltd., and the cement by the Associated Portland Cement Manufacturers, Ltd.

The whole of the work was executed under the supervision of A. N. Connett, chief engineer to the contractors.

NEW LARGE POWER PLANT AT NEW ORLEANS

As a supplement to the description of the various existing power plants of the New Orleans Railways Company, given in issue of Street Railway Journal of June 18, 1904, an engraving is presented herewith of the new central station, on

BONDING CONDUCTOR RAILS

which construction has just been commenced. It will be known as the "Main Station," and will be located on the square bounded by Market, Water, South Peter and Richard Streets.

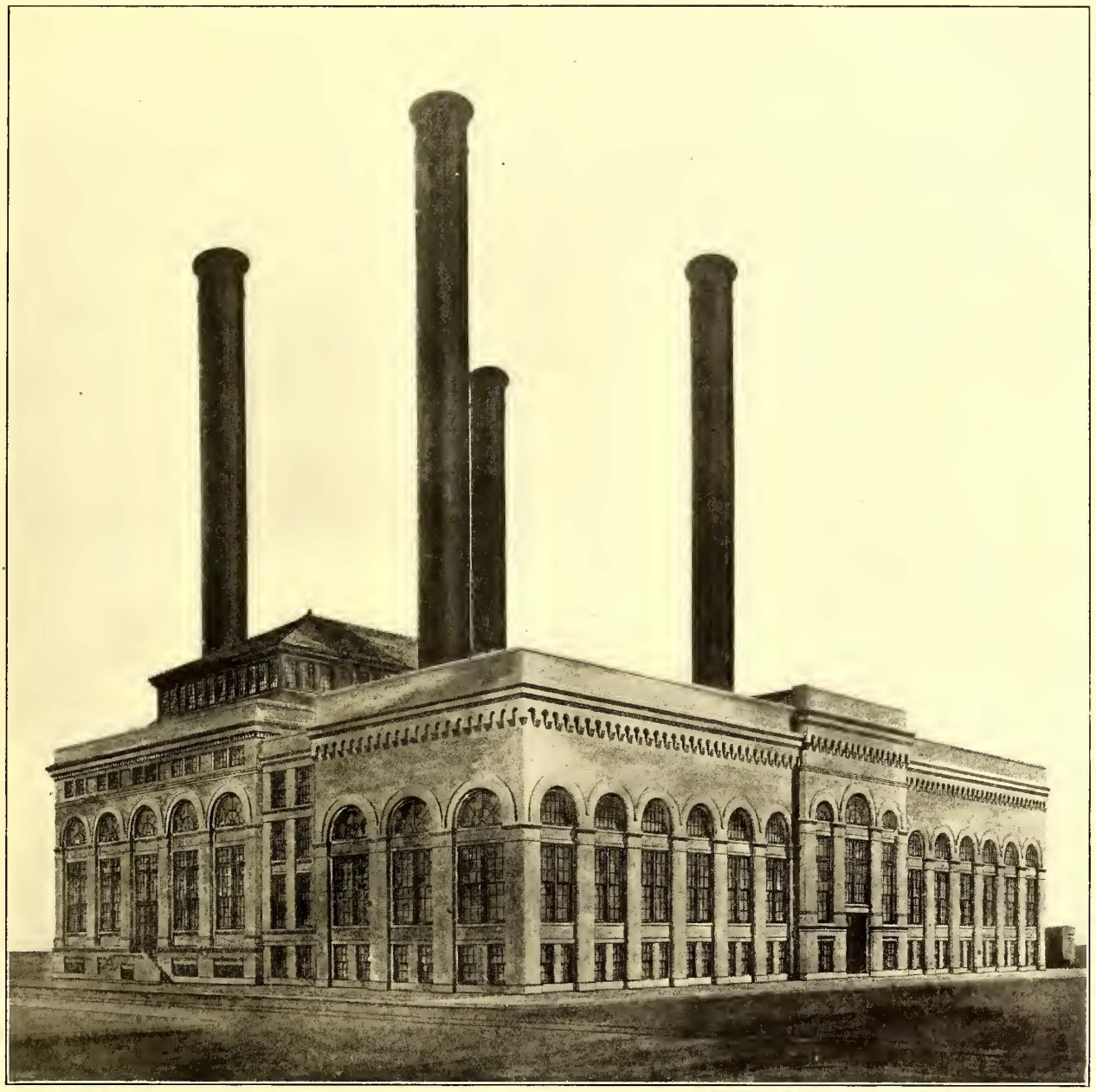
Within the past year a new engine room, known as the Annex Station, and described in the previous issue mentioned, has been built by the company. This engine room forms a portion of the new central station, which will have an ultimate capacity of 60,000 hp. When completed it will be twice as large in capacity as the combined size of all lighting and railroad power houses now operating in New Orleans, and which

are, with their total of 30,000 hp, barely sufficient to meet the demands of the rapidly increasing business of the Railways Company.

On the square where this central station is to be erected there now stands the new Annex engine house, referred to above and shown on the right hand side of engraving, just beyond the middle, or off-set, panel; the old engine house of the City Railroad Company, and that of the Edison Company; two boiler houses extending through the center of the square, and four large underground storage tanks for fuel oil. There is also an unoccupied area on which machinery can be unloaded and stored. The plans contemplate the demolition of the present boiler houses and the erection of a new one measuring 115 ft. x 250 ft., and running across the square in a direction transverse to the present old boiler houses and parallel to the new Annex engine room. The new boiler house will be double deck, as shown.

The new engine room will be enlarged from 70 ft. x 100 ft. to 95 ft. x 250 ft., or to more than treble the present area, and will contain an equivalent of 60,000 ihp capacity when completed. The entire equipment will not be installed at once, but from time to time, as the needs of the system require.

The new generating units will be turbo-alternators. Three 1500-kw units will be installed at once, followed later by larger sizes of about 5000 kw capacity each. The installation will be of the latest modern character, with high-pressure water-tube boilers, mechanical stokers, superheaters, high vacuum condensers, and corresponding auxiliary and switchboard equipment throughout. The use of a double-deck boiler house and steam turbines permits the most advantageous utilization of the property owned by the company, and economizes on foundations and piling. The design is of a sectional character, especially adapted to the making of progressive installations at minimum cost. The distribution of energy from the station will be by alternating current, except in the case of the three large direct-current railway units mentioned.



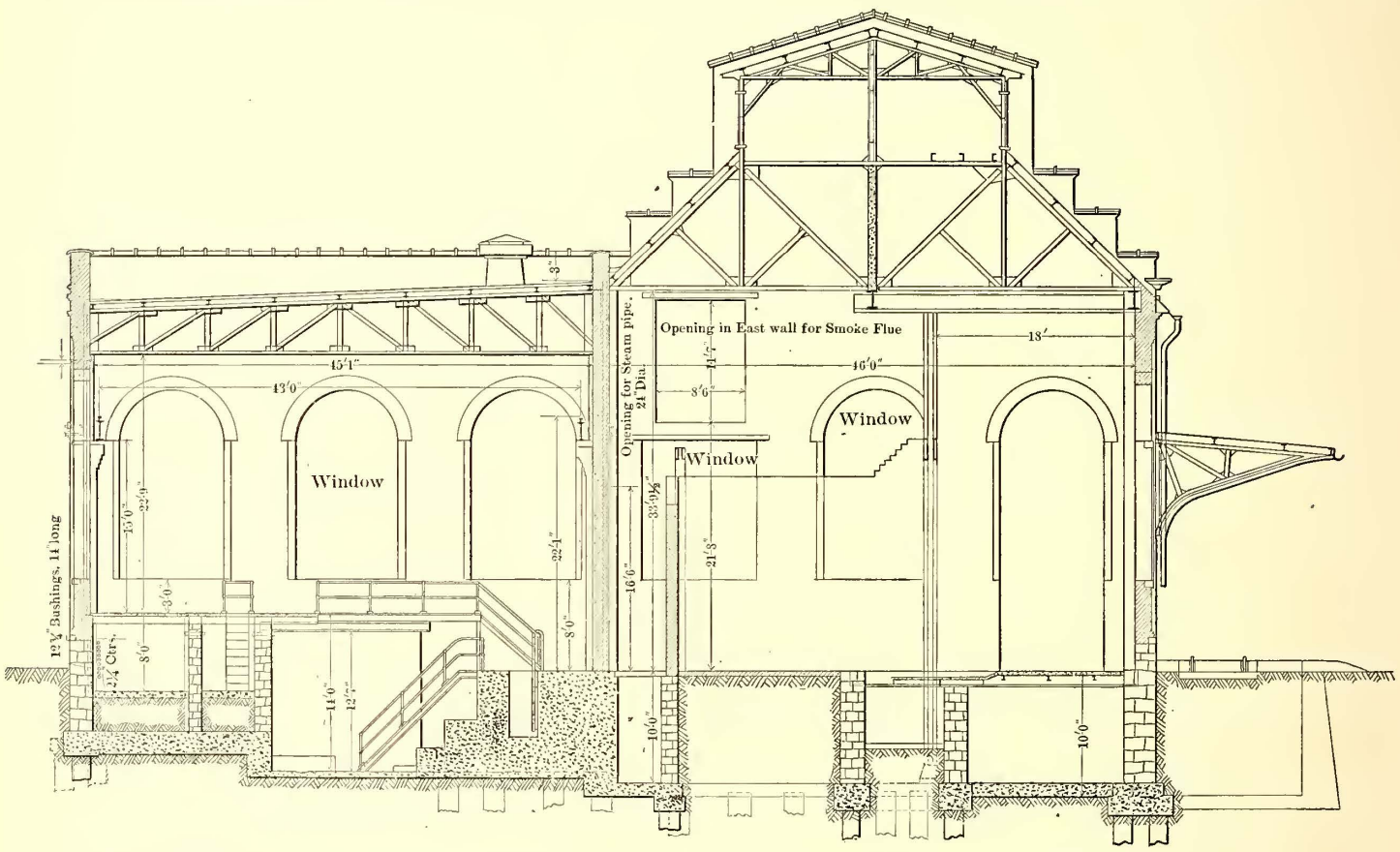
PERSPECTIVE VIEW OF NEW POWER STATION, NOW BEING ERECTED IN NEW ORLEANS

The immediate installation will be in the neighborhood of 8000 hp. This is in addition to the 10,000 hp capacity in Annex Station, recently installed in three vertical cross-compound condensing engine units, direct coupled to 575-volt direct-current generators, used for railway purposes.

The consulting engineers for the New Orleans Railways Company are Sanderson & Porter, of New York, from whose drawing the engraving is photographed. The work of constructing and equipping the new station is also being done by Sanderson & Porter as general contractors.

A LARGE NEW STEAM TURBINE POWER PLANT INSTALLATION FOR DUBUQUE, IOWA.

Many trial installations have been made for the experimental use of the steam turbine and for otherwise determining its possibilities, and much interest has been shown in the very favorable results that have in most places resulted. The proposed new power plant described in the accompanying article is, however, the first for electric railway service, at least, which has been planned originally for the exclusive use of steam turbines. This plant is being installed at Dubuque, Ia., by the Union Electric Company, for the combined operation of their electric railway, power and lighting circuits, and is notable for the exclusive use of Curtis steam turbines. As stated in a recent issue (June 25, page 956), the work of construction upon the plant has, after considerable delay, now been begun and is progressing rapidly. Many special features have been incorporated in the design, which will make the plant one of the most modern and up to date to be found in this country, and for various reasons its operation will be watched with interest by those interested in modern power-plant construction.



CROSS-SECTION OF THE NEW STEAM TURBINE POWER PLANT BUILDING OF THE UNION ELECTRIC COMPANY, DUBUQUE, IOWA, SHOWING DETAILS OF CONSTRUCTION

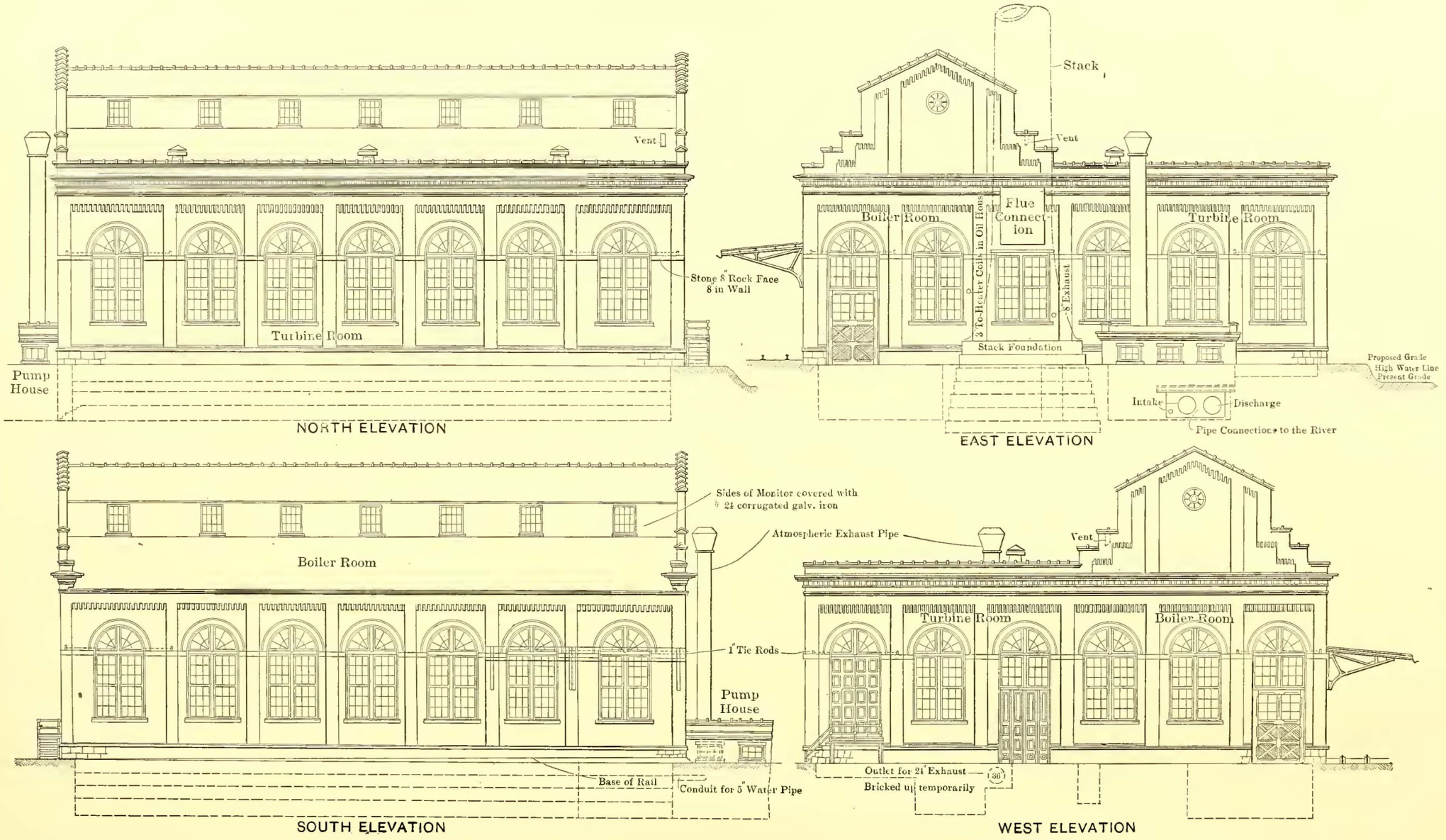
This company has, up to this time, operated its railway service by two independent power plants, but is now arranging for a new single-generating plant, to be located at a point convenient to the river, for condensing water, from which the power will be transmitted. This work is the natural outcome of the remarkable development which this company has experienced in its electric railway service, as has been the case in most other cities, and in taking this advance step it was the desire of the company to install a plant which would be as nearly complete as possible, and involve the very latest practice in every detail. As a result, the plant will be found a model, and is particularly interesting for the originality of its design, which is naturally of a special nature to provide for the exclusive use of turbines.

The new plant is located at the foot of Eighth Street, in Dubuque, in close proximity to the Mississippi water front, in order to obtain the advantages of an abundant supply of water for condensing purposes. This location is not central in relation to the power consumption, but the facility of electrical transmission renders the matter of location insignificant when compared with the advantages of operating condensing. The foundation requirement was of less importance in governing the location, as on all available sites pile foundations would have been required. A special condition was imposed in this position, however, in that provisions had to be made for the protection of the in-take-pipe connections on account of the destructive action of this waterway during freshets. A special bulkhead was installed near the in-take, which provides against obstructions and filling-up at the intake, and also serves the purpose of protecting the shore adjacent to the station. The top level of the masonry is some distance above the original level of the river bank, and will protect the plant in periods of abnormally high water that are prevalent at this point in the spring.

THE POWER HOUSE BUILDING

The design of the power house is remarkable in many respects. The noticeable feature in which it is differentiated from power houses designed for reciprocating engines, appears in the small floor area and greatly reduced head room required for the turbo-generator room. The total clear height provided above the floor in this section is only 22 ft. 9 ins., which is 11 ft. less than that required in the boiler room. The provision of a 14-ft. basement, beneath the turbines, which is partly open to the main turbine room, is another feature of interest, which is characteristic of Curtis turbine installations; the ease of access thus provided to the condensers is of great importance. The arrangement of the framing carrying the elevated coal bunkers in the boiler room is also novel in this plant, and the foundation provisions for the turbo-generator units are remarkable for their lightness.

An important feature of the building construction was the



EXTERIOR ELEVATIONS OF THE BUILDING FOR THE NEW TURBINE POWER PLANT OF THE UNION ELECTRIC COMPANY, DUBUQUE, IOWA, TO SHOW THE CHARACTERISTIC ARCHITECTURAL FEATURES

use of concrete piles for the foundation, 450 piles of this interesting new type having been installed by the Raymond Concrete Pile Company, of Chicago, Ill. The piles, as used, are all of the tapering wedge type, 20 ins. in diameter at the butt and 6 ins. in diameter at the point. This type of pile is said to give, by virtue of its shape, very great carrying capacity, estimated to be equal to that of three ordinary wooden piles of the same length. It is important to note here that these piles, as installed for the stack foundation, were designed to carry loads from 60,000 to 70,000 lbs. each; this is an unusually heavy load per pile, but it has been found that this type is easily capable of sustaining it. An important advantage of the concrete pile lies in the fact that it will never rot out, whether in dry or in wet soil, but, on the other hand, tends to grow stronger with age. The location of the water line in the soil may also be disregarded in the use of the concrete pile, as the upper part may project as far above the water level as desired, without fear of deterioration, as is the case with wooden piles.

GENERAL VIEW OF THE DUBUQUE POWER PLANT FOUNDATIONS AFTER THE INSTALLATION OF THE RAYMOND CONCRETE PILES—SECTIONS OF THE SHEET-IRON SHELLS, USED IN DRIVING, APPEAR IN FOREGROUND

In construction of the concrete piles a taper core of shape similar to that of the finished pile is encased with a sheet-iron shell and driven in a manner similar to that of driving the ordinary wooden pile, by the use of the usual steam pile-driver. The core is then, by means of a patent process of the Raymond Company, collapsed, or slightly reduced in size, which allows it to be withdrawn from the shell, so that the interior may be filled with the concrete at leisure. The shell remains in the ground and forms a perfect mould for the concrete, which is afterward introduced and tamped solid as it is filled in.

The use of the concrete pile is a comparative novelty in power-plant construction, but it appeals to the engineer as a step in advance over the former method of using piles. The greater carrying capacity of this concrete pile results from its tapering or wedge shape, which provides a considerably greater bearing surface. This feature makes the driving somewhat more difficult, although in ordinary soils no trouble is experienced. In this installation, it was found that for the last 4 ft. of the driving of each pile, the penetrations that were obtained were only from 3-16 in. to ⅛ in. per blow of a No. 2 steam hammer. All of the piles used there were struck from 650 to 700 blows, and some of them as high as 800 and 900 blows, the number of blows required depending upon the character of the soil at the point of driving. In spite of the greater difficulty of driving, however, from eighteen to twenty piles were driven per day by a single hammer; the soil encountered was a very firm mixture of clay and sand, with clay predominating. It may be added that the reason why greater penetrations are not obtained at each blow with this pile toward the end of the drive, as is the case with the wooden pile, is that in driving the core for the concrete piles its wedge shape offers a continuous obstruction to its peneration into the earth; in the case of the ordinary wooden pile, after the hole is once well started, the comparatively straight outline of the pile permits it to follow the hole already made, which places the resistance offered to driving entirely at the point.

The architectural features, as well as the details of construction of the building, are clearly shown in the outside elevation drawings and the building cross section. The building is plain, architecturally, yet the appearance is indicative of the substantial character of its design. A symmetrical arrangement of arched windows was obtained, and also an attractive cornice design presents a pleasing effect. The most noticeable feature of the building is the arrangement of the flat roof over the turbo-generator room and the higher inclined roof, with lantern, over the boiler room. It is important to note that the circulating pumps, used in connection with the circulating system for the condensers, are located in a separate pump house, built on the basement level just outside the east end of the building.

The power house is a substantial building of brick, with a steel frame, concrete floors and fireproof tile roof, occupying a ground area of 114 ft. x 96 ft. It is divided into two sections by a division wall, the boiler room being 46 ft. wide between walls and the turbo-generator room 45 ft. inside. The

VIEW OF THE PILE FOUNDATION FOR THE STACK, SHOWING THE CONCRETE PILES IN PLACE AND THE STACK ANCHOR BOLTS LOCATED READY FOR FILLING IN THE CONCRETE FOUNDATION BODY

generator room has a free height under roof trusses of 22 ft. 9 ins., while the boiler room has a similar clear height of 33 ft. 9 ins. The turbine room has a 14-ft. basement on the south side, which contains the condenser equipment. Easy access is given to this portion by conveniently located stairways, as shown. The basement under the opposite side of the room,

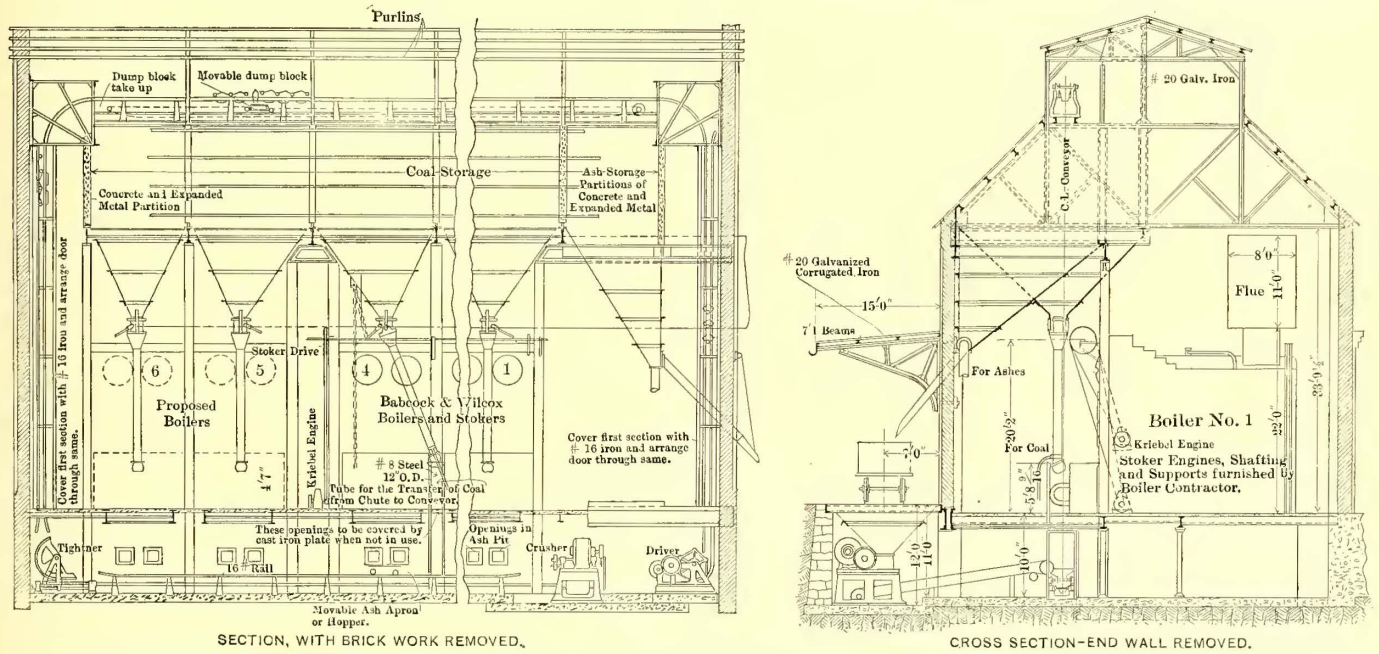
which provides for the wiring connections to and from the switchboard, is 8 ft. high. In the boiler room a 10-ft. basement has been provided, which gives convenient access for the handling of ashes, the care of the blow-off and other auxiliary piping. The floors are of granolithic composition throughout, providing for maximum cleanliness and absolute fireproof qualities. The general building contract was undertaken by Witherspoon, Englar & Company, Chicago, Ill., the structural steel work being installed by the Morava Construction Company, also of Chicago.

The turbo-generator room roof is carried upon substantial roof trusses of eight panels each, which are 6 ft. in height at the division wall end, sloping to a height of 4 ft. at the opposite end for roof drainage. The boiler-room roof and lantern are carried by a roof structure consisting of composite trusses of the type shown in the cross section; this construction was required for carrying the weight of the elevated coal bunkers at the south side. The lower cords of the trusses on the south side, which carry the coal pockets, are heavily reinforced with plate girders of 30-in. web; these are assisted in carrying the load by floor supports in the form of steel posts located between the boilers and in line with the boiler fronts. They support the plate girders at points 18 ft. from the outside boiler-room wall. This special construction is clearly shown in the longitudinal and cross sections of the boiler room. It will be further noticed that a concrete division wall is constructed between the two king-post trusses along the center line of the boiler room, which serves to retain the coal entering the bunkers. In this way the roof truss space at the south side may be entirely filled with coal, while the truss space at the opposite side and over the boilers is left free for light and ventilation.

The roofs are constructed of tile, the well-known form of book tile, laid upon inverted T-bars for purlins, being used. The roof is carried by 7-in. 15-lb. I-beams, arranged longitudinally, one over each vertical member of the trusses; the T-shaped purlins are laid crosswise upon these and properly spaced to carry the book tiles. The usual felt, tar and gravel roof covering is laid above the tiles over the turbine room for waterproofing, slate being used over the tile on the boiler-room roof. This type of roof is not only water and weather-proof, but is also absolutely fireproof and condensation proof.

COAL AND ASH-HANDLING SYSTEM

The above-mentioned special longitudinal and cross-section drawings of the boiler room show also the arrangement of the coal and ash-handling equipment, together with the elevated coal and ash storage. This equipment involves many interesting features, representing the latest and most approved methods. Coal is delivered to the handling system by discharging directly from the railroad cars into a receiving hopper underneath the side track running along outside the boiler-room wall. The hopper is arranged so that by the use of hopper coal cars coal may be discharged into the system without handling. The receiving hopper beneath the side track delivers the coal into the handling system through a self-contained coal-crusher mechanism, which reduces all large lumps of coal into cubes of suitable size for use in the automatic stoker, after which it delivers on to a cross-line belt conveyor for delivery over to the longitudinal bucket conveyor. The bucket conveyor, which is of the McCaslin overlapping gravity bucket type, surrounds the boiler room, passing beneath the floor in front of the boiler ash pits and above the coal bunkers next to the roof, like an endless belt, as shown in the engraving.



PART LONGITUDINAL AND CROSS-SECTIONS OF THE BOILER ROOM OF THE DUBUQUE POWER PLANT, TO SHOW ARRANGEMENT OF COAL AND ASH STORAGE BINS, AND DETAILS OF MECHANICAL HANDLING SYSTEM

The arrangement of this apparatus, both in the basement and above the bunkers, is clearly shown in the sectional drawings.

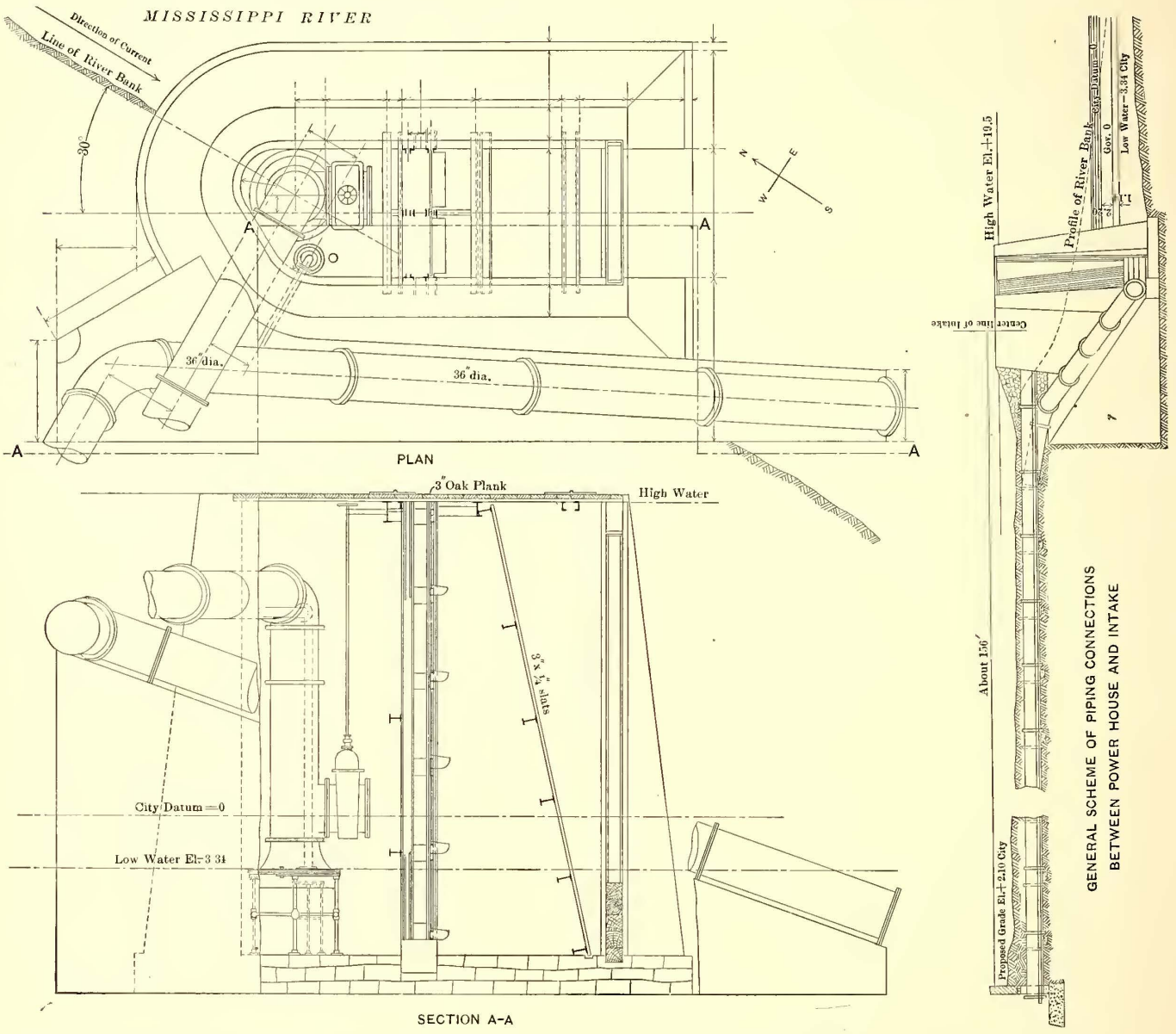
For the removal of ashes from the boiler ash pits, a special movable apron hopper is provided to run on a pair of rails above the bucket conveyor in the basement, so that by moving it along in front of any ash pit door the ashes may be raked out from within, and thereby delivered on to the conveyor without danger of overloading the buckets or of spilling the ashes on to the working parts of the conveyor chain. This apron hopper is very conveniently arranged for this work, and can be easily moved for handling ashes out of any pit. The conveyor carries the ashes overhead to the upper part of the building in the same manner in which coal is handled, from which it may be dumped into the ash storage pocket at one end of the boiler room. This entirely obviates any manual handling of the ashes and ensures the greatest possible rapidity in removal. The elevated ash pocket is provided with off-bearing chutes, one projecting through the end of the boiler room and the other through the side wall over the side track; in this way the ashes may be dumped, either into railroad cars or into carts brought alongside the end of the power house, for removal.

Inasmuch as the stoker equipment was designed for burning the cheaper grades of coal, special provision was necessary for the prevention of spontaneous combustion in the bunkers, to which the lower grades of the Western coals are liable when stored for any length of time. An arrangement has been made

whereby coal thus affected may be drawn off from any bunker when signs of heating are noted, and directed into the lower leg of the conveyor system in the basement, and thence reconveyed and elevated again to the same or to a different coal bunker, as desired. This is accomplished by special chutes, which may be inserted through holes provided in the boiler room floor between the boiler fronts, as indicated in the boiler-room longitudinal section; the down spout is swung over in line with this chute, and the coal permitted to pass through and enter the conveyor in the ash room below, whence it is elevated. It has been demonstrated that spontaneous combustion

amount of coal delivered from the receiving hopper through the crusher, and in turn into the conveyors, is regulated. The cross-line conveyor is operated from the coal crusher mechanism. The conveyor driving mechanism for operating the main line McCaslin conveyor is of the self-contained, direct-connected type, located in the loop at the point indicated on the drawing. The starting and speed regulating controller, also provided for this motor, enables the speed of the conveyor system to be changed, and will operate at from 35 lineal ft. to about 45 lineal ft. per minute.

The coal-crusher mechanism being installed at this plant is of



DETAILS OF THE SPECIAL INTAKE CONSTRUCTION UPON THE RIVER FRONT TO PROTECT THE CONDENSER CIRCULATION SUPPLY PIPES AND ENSURE AN UNINTERRUPTED SUPPLY

in coal piles always occurs at the bottom and near the center, namely, at the point of greatest pressure; in the case of a bunker of the shape used here it usually occurs near the entrance to the down spout. In this way, by drawing off a few tons from the lower part of the bunker, when heating occurs, combustion may be easily and successfully prevented; this is a valuable provision, as it has always been found that pouring water on the coal in such a case only increases the liability of heating.

The capacity of the coal crushing and coal and ash conveying equipment being installed will be from 40 tons to 45 tons per hour. The coal crusher mechanism is operated by General Electric three-phase variable-speed induction motor, provided with a starting and speed-regulating controller, by which the

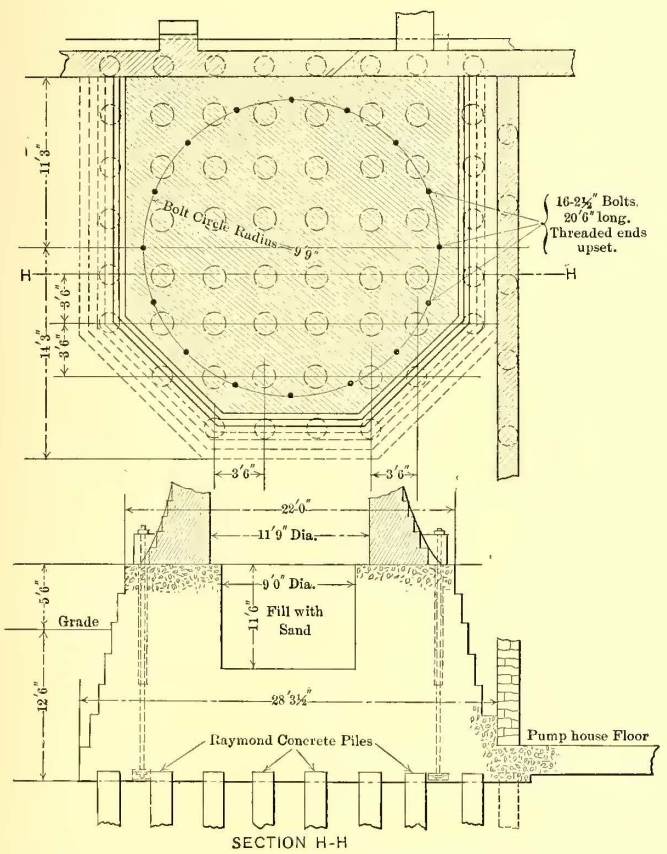
the well-known McCaslin single-roll type, provided with a swinging corrugated counterweighted baffle plate, with adjusting screws for regulating the size of cubes to be crushed and counterweighted sufficiently only to hold the baffle plate in position for crushing the kind of coal to be used. In case a car link or other foreign substance is contained in the coal, this swinging baffle plate will move backward and permit the coupling link or other foreign substance to pass down through the crusher without damaging same. This is a most important feature, since it is very necessary that the coal-crusher mechanism shall be capable of continuous duty as much so as the coal and ash handling equipment.

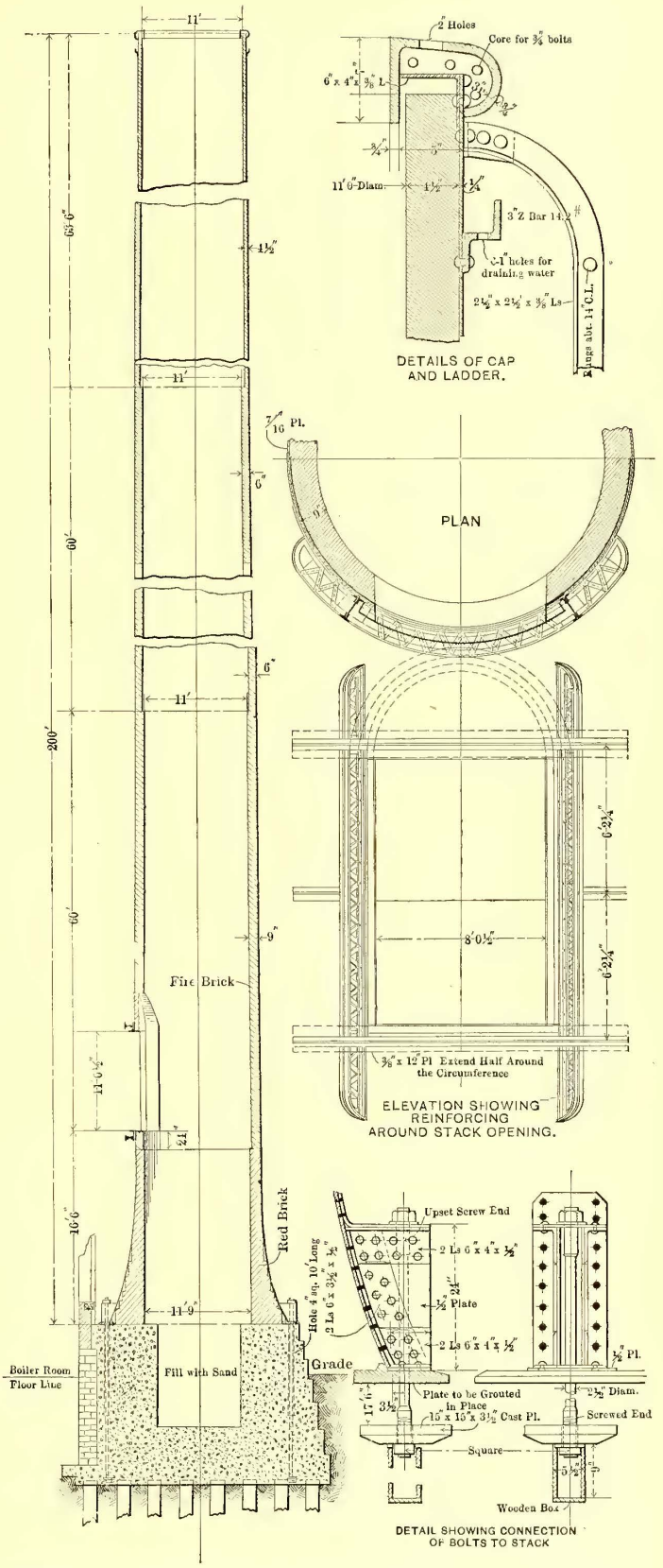
The coal and ashes are discharged from the upper horizontal run of the conveyor into the elevated coal and ash bunkers by

means of a movable tripper supported on a trackway provided for it. This tripper may be shifted over any bunker and set into operation from either end of the upper run, so that coal and ashes can be delivered at any point or points along the trackway. This entire coal and ash handling equipment, including the coal crusher, was furnished by John A. Mead & Company, of New York.

BOILERS

The present boiler equipment that is being provided consists of four Babcock & Wilcox horizontal water-tube boilers of 400 rated horse-power capacity each. As will be noted from the plan, however, space is provided for another battery of two additional boilers, which will be installed when needed. These boilers are of the new all wrought-steel construction recently developed by this company for high-pressure work, and are designed for a working pressure of 200 lbs. per square inch. Each boiler is equipped with a Babcock & Wilcox superheater, which will give 150 degs. F. of superheat to the steam delivered. The furnaces are equipped with the well-known Babcock & Wilcox chain-grate stokers, which are to be driven by Kriebel vertical engines. These engines are belted to the countershaft above the boiler fronts, which operate the stokers, so that either one may be used as desired. Coal is delivered from the coal bunkers directly into the hoppers of the stokers by conveniently arranged swinging chutes, as shown in the longitudinal view of the boiler room. These chutes are provided with



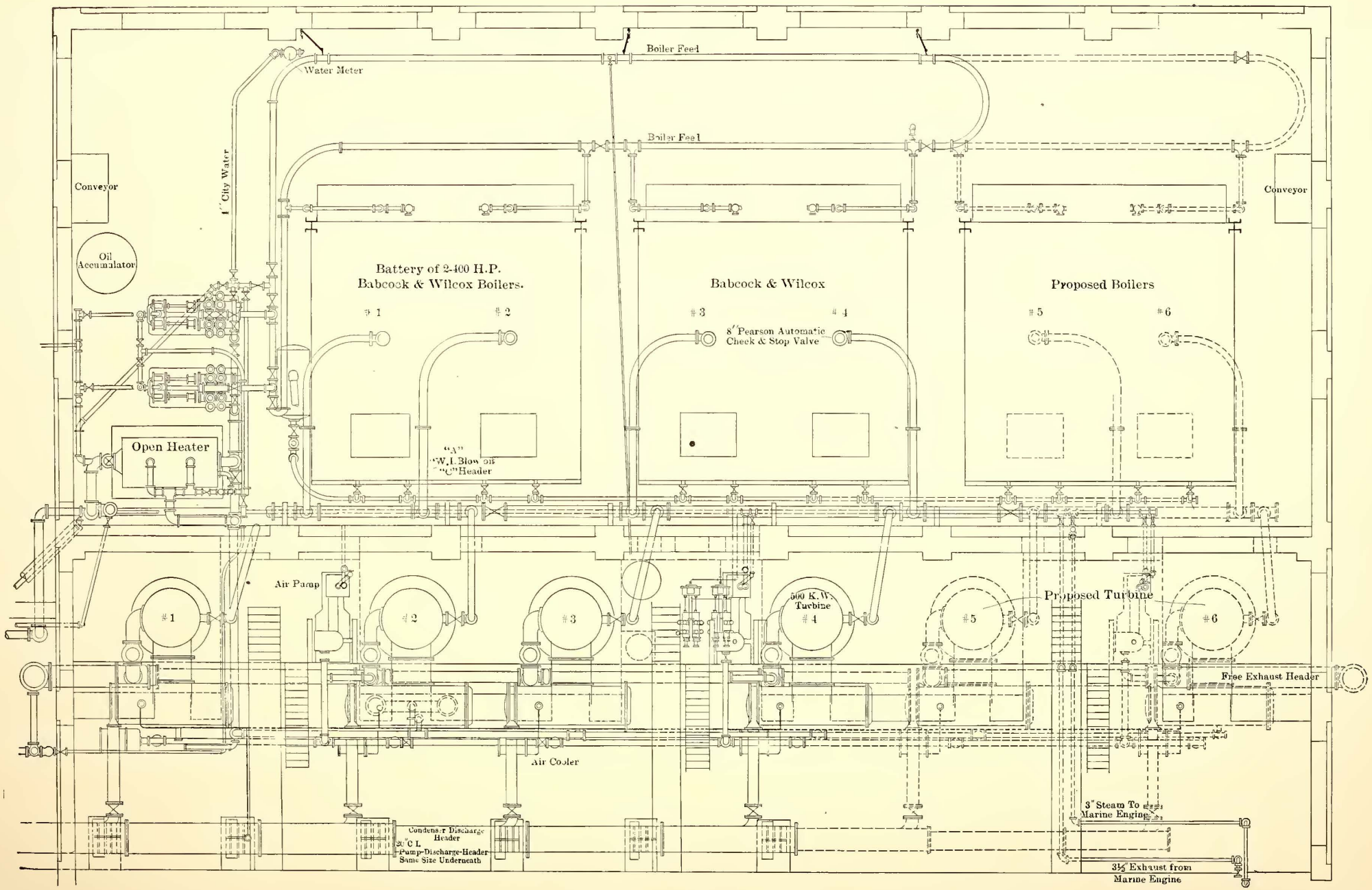


DETAILS OF THE FOUNDATION FOR, AND THE PRINCIPAL FEATURES OF CONSTRUCTION OF, THE 200-FT. SELF-SUPPORTING STEEL STACK AT THE DUBUQUE POWER PLANT

swiveling connections to the bunker outlets, being hinged so that they will operate at any convenient angle. They may thus be arranged to deliver into any part of the stoker hoppers, or into the special chutes for delivery to the conveyor system in the basement, if necessary. Valves are provided at the bunker outlets for admitting the coal to the chute, which are operated by chains running to the floor, as shown.

THE STACK

The stack provided is of interesting construction in that it is of the self-supporting steel type, 200 ft. high, with a solid fire-brick lining extending the entire height, and also in that it has an admirable arrangement of reinforcing around the flue openings. The details of the stack, as well as also of the foundation, are presented in the accompanying drawings. As may be noted, it has a clear opening of 11 ft. throughout; the lining is of radial blocks of fire-brick. Fifty-eight of the Raymond concrete piles are used for the support of the stack; the foundation rests upon the piles at a depth of 12 ft. 6 ins. below grade level, extending to 5 ft. 6 ins. above grade. Upon this the stack rests directly, being held down by sixteen 2½-in.



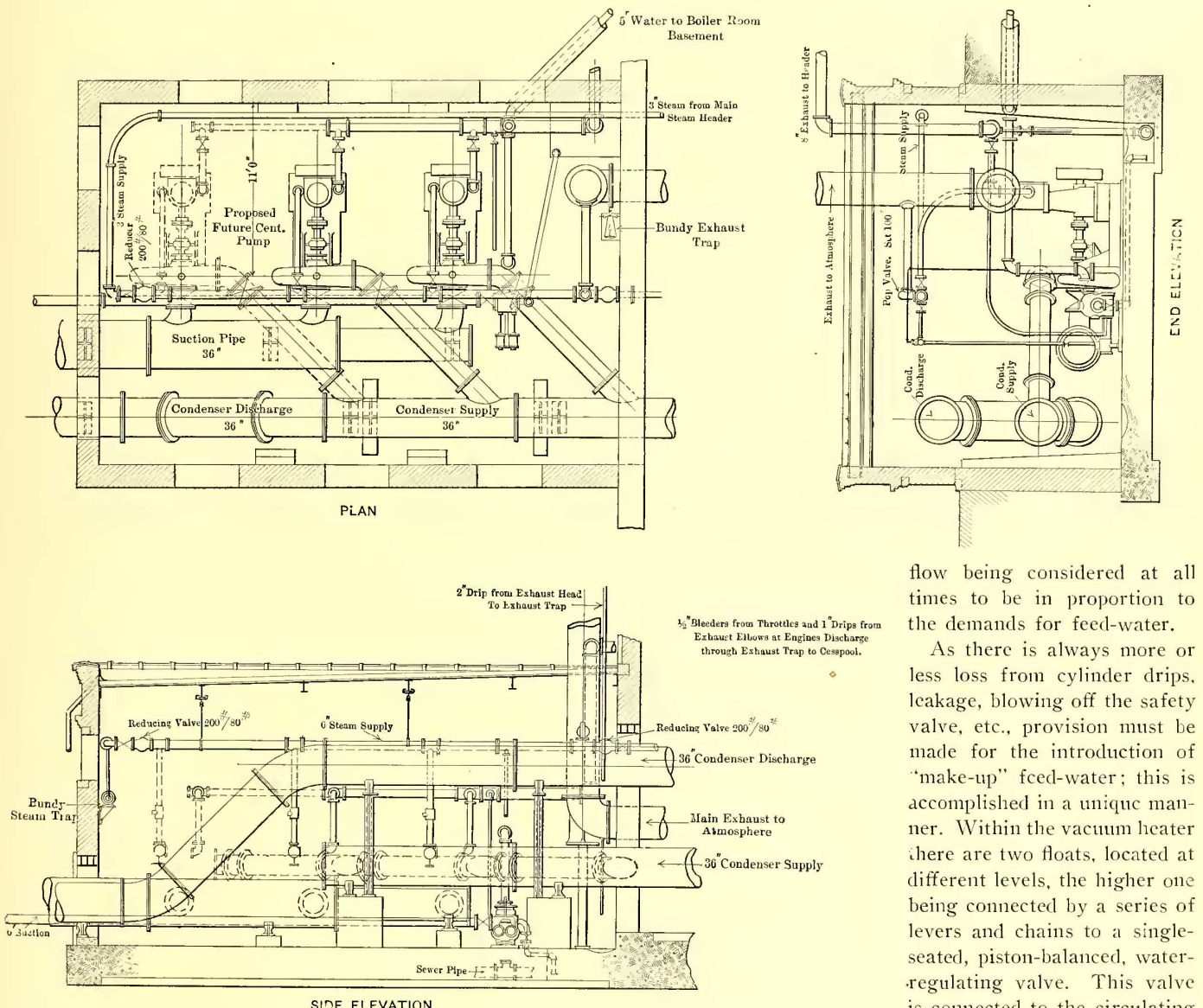
PLAN OF THE NEW STEAM TURBINE POWER PLANT OF THE UNION ELECTRIC COMPANY, DUBUQUE, IOWA, SHOWING THE GENERAL ARRANGEMENT OF APPARATUS AND THE MAIN STEAM PIPING SYSTEM, EMBRACING THE MULTIPLE-POWER PLANT SCHEME

bolts, which are 20 ft. 6 ins. long, extending to the bottom of the foundation. Special bolt connections for anchoring the stack to the foundation are provided, as shown in the detail view; these connections are very heavily constructed of structural shapes, and riveted to the lower portion of the stack, as indicated. The details of the reinforcement around the flue openings are also made clear in the detail view. Another interesting feature of the stack is the special cap construction, which is also clearly shown in an additional view. This stack is being erected by S. Freeman & Sons Manufacturing Company, Racine, Wis.

BOILER AUXILIARIES

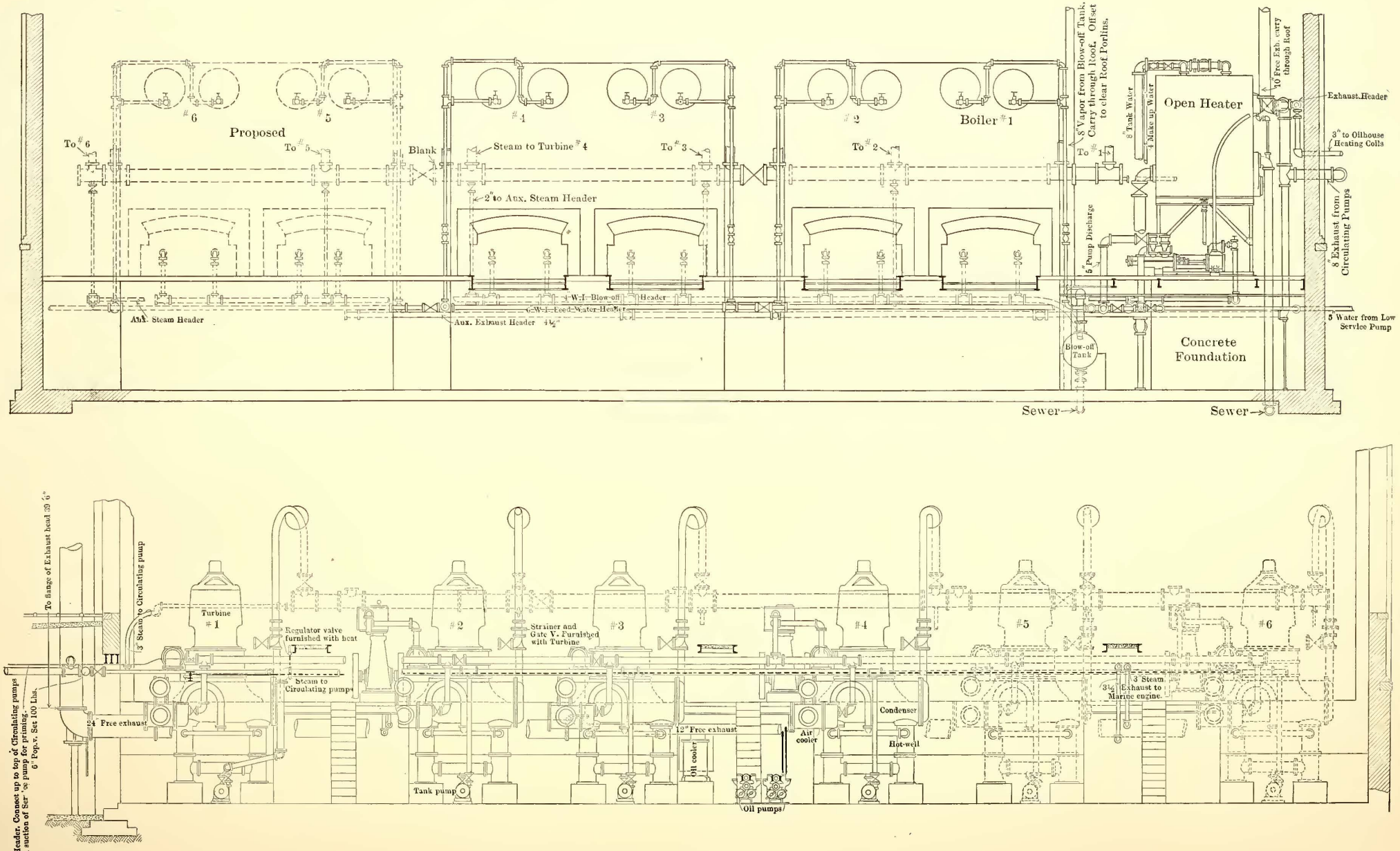
The boilers are fed by two horizontal duplex feed pumps furnished by the International Steam Pump Company. These pumps are of the pressure pattern, having separate removable valve chambers and plungers, instead of pistons. They have 12-in. steam cylinders and 7½-in. water cylinders, with a common stroke of 10 ins. The feed water is heated by a large Webster vacuum feed-water heater and purifier of 4000 hp capacity, which was furnished, together with the necessary auxiliaries, by Warren Webster & Company, Camden, N. J. It is important to note that in this plant the approved method of reserving the exhaust steam from the auxiliary engines for the heating of feed water has been adopted.

The feed-water heating system of this plant embodies some new and interesting features, and in many points may be rightfully considered an advanced step in power-plant practice, particularly in view of the use of a vacuum heater in connection with a turbine plant. Both wet and dry vacuum pumps are used in connection with the condenser, the wet vacuum pump being of the centrifugal type, removing the water directly from the bottom of the condenser and discharging through an 8-in. pipe into the water-sealed inlets of the vacuum feed-water heater. The use of a centrifugal pump in this connection is the most recent practice of the General Electric Company, who are the first to adapt this form of pump to this service. The only difference in the pump and condenser connections at this point is the introduction of a check valve, to prevent breaking the vacuum when the wet pump is stopped. There is no regulating device of any kind to govern the admission of the hot-well water into the feed-water heater, the accumulation and flow being considered at all times to be in proportion to the demands for feed-water.



DETAILS OF, AND ARRANGEMENT OF APPARATUS IN, THE PUMP HOUSE OUTSIDE THE EAST END OF THE POWER HOUSE, CONTAINING THE CENTRIFUGAL CIRCULATING PUMPS FOR THE CONDENSING SYSTEM

As there is always more or less loss from cylinder drips, leakage, blowing off the safety valve, etc., provision must be made for the introduction of "make-up" feed-water; this is accomplished in a unique manner. Within the vacuum heater there are two floats, located at different levels, the higher one being connected by a series of levers and chains to a single-seated, piston-balanced, water-regulating valve. This valve is connected to the circulating water eduction pipe from the condenser, and also to the smaller inlet on the top of each condenser, which is in communication with the exhaust side. In this way, when "make-up" feed-water is required, the water level in the feed-water heater falls to the upper float, which opens the "make-up" feed valve, admitting the warm circulating water directly into the condenser; this increases the condensing effect, and at the same time saves a portion of the heat which would otherwise be lost in the circulating water. From this point "make-up" feed-water takes the same course as the other hot-well water, and is handled by the centrifugal pumps. If at any time the turbines should be running non-condensing, the feed supply to the vacuum heater is taken from the city mains through the single-seated, piston-balanced regulating valve, controlled by the second float within the heater, which operates



LONGITUDINAL ELEVATIONS THROUGH THE BOILER AND THE TURBO-GENERATOR ROOMS OF THE NEW TURBINE POWER PLANT OF THE UNION ELECTRIC COMPANY, DUBUQUE, IOWA, SHOWING ARRANGEMENTS OF MAIN STEAM AND AUXILIARY PIPING AND OF AUXILIARY APPARATUS

from the lowest water level. The whole water supply system is thus entirely automatic.

The style of heater used is the Webster star-vacuum feed-water heater and receiver, Class C, manufactured by Warren Webster & Company, Camden, N. J. It is a special type of heater, with a very large receiver, and is especially fitted with the Webster self-cleaning oil separator for freeing the exhaust steam of oil in order to deliver the feed-water pure. The size of the heater is nominally 4000 boiler-hp. It is built entirely of cast iron, fitted with perforated copper heating trays, all of the parts in contact with the steam or water being made of either cast-iron, copper or brass. The filter is of the upward filtration type, in which the water, after being heated, flows first to a receiving compartment below the filtering material, where the heavier impurities are deposited, the water rising in an upward direction through the filtering material. The special Webster vacuum line attachment is provided for operation in connection with the heater, when the supply of exhaust steam is insufficient to heat the feed-water to the boiling point or, what is equivalent to the same thing, to maintain atmospheric steam pressure within the heater. This device automatically removes the air and gases from the heater, which are given off from the feed-water, and maintains within the heater a pressure below that of the atmosphere, which gives a partial condensing effect on the auxiliaries.

TURBINES

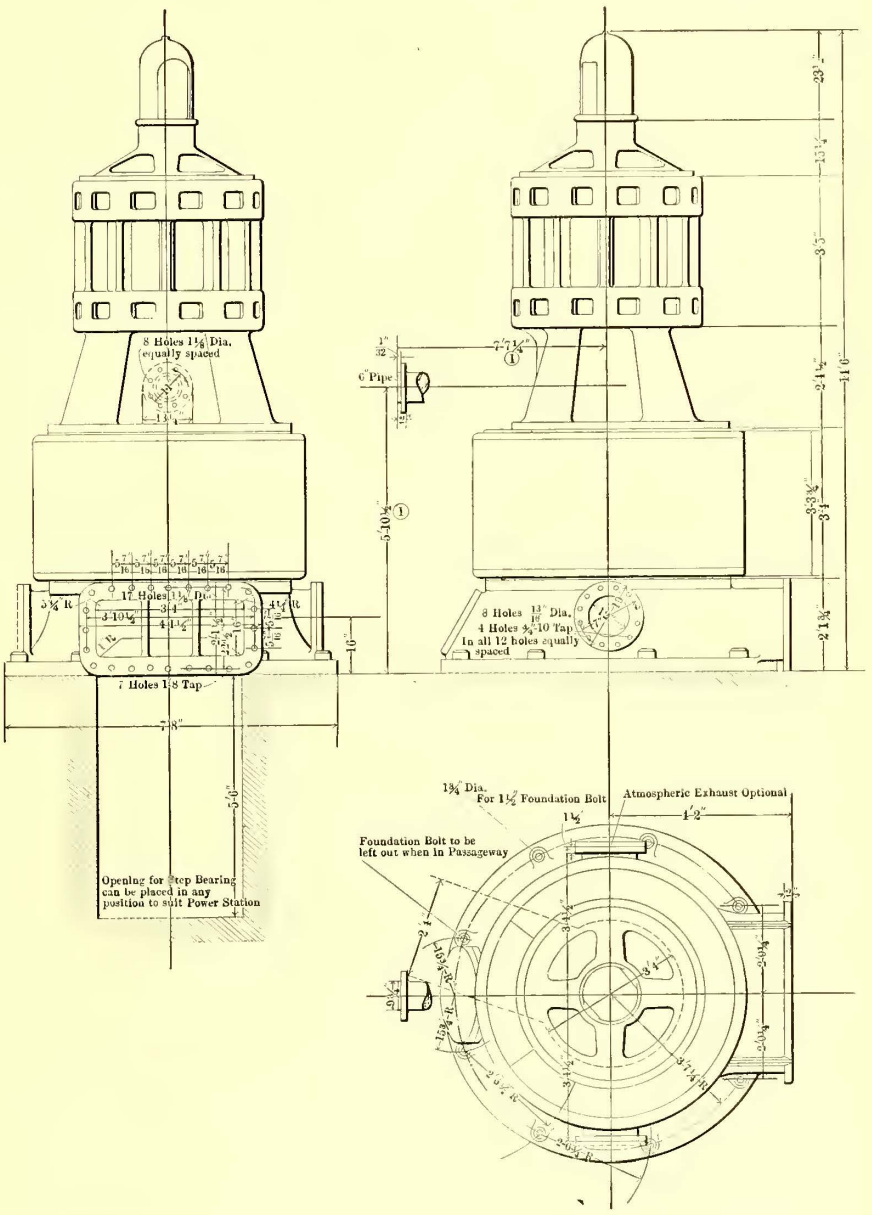
The turbine equipment consists of four 500-kw four-stage Curtis turbines, which are designed to operate at 200-lbs. steam pressure, with 150 degs. F. superheat. These turbines involve the latest improvements which have been embraced in the Curtis turbine design, the most novel of the many improvements involving the use of water for lubrication of the step-bearing instead of oil, which was employed formerly. The lower surface of the step-bearing is, in these turbines, made of wood. Oil is used for the lubrication of the upper bearings, which is fed from a small reservoir mounted at the top of the generator, through sight-feed oilers. The amount of oil required by the upper bearing will not exceed ¼ gal. per minute per turbine. A pressure oiling system is to be installed for this service and other lubrication.

Each of these turbines will also be provided with a brake that can be conveniently operated from the outside, and can be used to take the whole weight of the revolving part in case the step-bearing should fail. Another more important function of this brake is to stop the machine when it is desired to do so, as these turbines will revolve for several hours after steam has been shut off unless load is placed upon it or the brake is applied.

CONDENSERS

The condensing equipment consists of four Worthington surface condensers, fitted with brass tube heads and hot wells and coolers, each condenser having 2000 sq. ft. of cooling surface. The condenser equipment is supplied with cooling water from the Mississippi River by two 14-in. Worthington steam-driven volute circulating pumps, located in the pump house at the east end of the power house; these volute pumps are each direct connected to vertical engines built by the New York Safety Steam Power Company. The hot water of condensation is removed from the hot wells by four 1-in. volute hot-well drainage pumps, direct driven by 3-hp induction motors. These drainage pumps deliver the condensation to the Webster open heater for returning directly to the boilers. Make-up water for the boilers is ordinarily to be taken from the circulating system, this being regulated by the float in the heater; arrangements are also made for the use of city water for this purpose.

Two rotative, dry-vacuum pumps are provided for the removal of air and other gases, this pump being of the reciprocating type, with 8-in. steam cylinders, 16-in. vacuum cylinders and 12-in. stroke. The steam cylinders of these pumps are fitted with Corliss valve gears for highest economy of operation, and a novelty is introduced in the placing of the vacuum cylinders vertically, the steam cylinders being located horizontally, and the connecting rods of the two cylinders being attached to a common crank-pin.



EXTERIOR DRAWINGS, SHOWING OUTLINE OF THE NEW TYPE OF FOUR-STAGE CURTIS TURBINE, TO BE INSTALLED AT THE DUBUQUE TURBINE POWER PLANT

The condenser arrangement at this station is somewhat novel. The volute drainage pumps for the removal of the water of condensation from the hot wells are located below the level of the hot wells, so as to receive their suction by gravity. In this way the pump always runs a little ahead of the water, and there is no necessity of floats, valves or other automatic devices. Furthermore, there is also no possibility of air binding, as in reciprocating pumps, as used for this purpose. An important

advantage is obtained by the use of the novel type of dry vacuum pumps with vertical vacuum cylinders and horizontal steam cylinders, as it not only saves considerable room, but permits freer access to the valve gear mechanism. This entire condensing equipment, as well as also the boiler feed pumps, were furnished by the International Steam Pump Company, of New York.

ELECTRICAL EQUIPMENT

This company operates, in addition to the street railway system, commercial lighting and an arc street lighting system, the feeders for the various circuits being operated at high voltage upon the three-phase alternating system. The turbo-generators deliver 60-cycle three-phase alternating current at 2300 volts. There will be two sets of bus-bars on the switchboard, one for the lighting load and the other for the railway system, the connections being so arranged that any one of the turbo-generators may be thrown onto either bus. The commercial lighting circuit feeders will be operated at 2300 volts upon single-phase circuits, while the arc street lighting circuits are to be operated upon the constant-current system by the use of General Electric "tub" transformers; this system involves the operation of 400 General Electric series alternating enclosed arc lamps distributed throughout the city.

The 600-volt power circuit for the street railway system is supplied through four 300-kw rotary converters operated from the street railway bus-bars. The current for operating these rotaries is stepped down by 330-kw air-blast transformers of the new three-phase type recently developed by the General Electric Company; the direct-current sides of the rotary convertors are all arranged for two sets of bus bars, so that the direct-current may be carried independent of the grounded railway circuit when required. The exciter equipment for the turbo-alternators consists of a 33-kw General Electric marine-type steam generating set, and a 30-kw motor generator set, either of which has sufficient capacity for the excitation of the entire installation. All of the electrical apparatus, including the Curtis turbo-generator units, rotaries, transformers and blowers, exciter sets, cable, etc., and the switchboard equipment, was supplied by the General Electric Company.

It may be here stated that the street railway system of the Union Electric Company in Dubuque provides for the operation normally of twenty cars, the entire single-track length of the system being 18 miles. Owing to the short distances of current transmission no sub-stations are required, the rotaries being located in the turbine room of the power plant. The entire rolling stock equipment is practically new, all cars being equipped with General Electric type sixty-seven three-turn motors. Other improvements have been recently made upon the street railway system in the form of reconstruction of the track system. The girder rails formerly used are being replaced by 60-ft. 72-lb. T-rails of high section in the paved street portions of the city, and the A. S. C. E. standard section of T-rail of the same weight in the unpaved streets; these changes involve 11 miles of the most important lines of the city.

This journal is indebted to both L. D. Mathes, general manager of the Union Electric Company, and to the General Electric Company for the information furnished regarding this interesting installation.

The first annual outing of the Cleveland Consolidated Street Railway Employees' Benefit Association was held at Manhattan Beach Park a couple of weeks ago. The programme of athletic events at the park was started at 2 o'clock, and it was almost dark before it was completed. Through the generosity of the street railway company, two employees who sold 1043 and 1000 picnic tickets respectively, will receive free transportation to the World's Fair. The surprise of the day was the donation by George Mulhearn, former superintendent of the Cleveland Electric Railway, of ice cream for all present.

THE TRAMWAY SYSTEM OF SYDNEY, NEW SOUTH WALES

Sydney, the capital of New South Wales, is the largest city in Australia. This pre-eminence has been enjoyed only in recent years, during which the city has had a very rapid growth. The population of the city during the last three decades is shown by the following table:

1881	225,000
1891	383,000
1902	508,510

The tramway situation in the city is unique in that the system is owned not by a private company or by the city, but by the government of New South Wales, which also owns the steam railroad lines within the province. The affairs are governed by three commissioners, who are government officials, viz.: Charles Oliver, chief commissioner; David Kirkcaldie and W. D. Fehon.

The first street railway line in Sydney was put in operation in 1861, but owing to several causes was not a success. In 1879 animal power was abandoned for steam dummies on the short system then in operation. The next few years witnessed a gradual extension of the tramway system. In 1884, 27.5 miles were in operation, practically all by steam power. In 1891, the equipment of a considerable portion of the system with cable was very seriously considered, and one or two short cable lines were installed, but the conversion of the greater part of the system was abandoned in favor of a trial of electric power. The first electric section was 2.25 miles in length, and was put in operation in 1893. Since that time the development of the electric system and the substitution of this power for steam has been rapid.

The real commencement of the present electrical era came in 1899, with the opening of the George Street electric line, which introduced electric traction into the heart of the city. The officials of the Sydney tramway system have made a number of visits to America, and the construction has followed largely American practice.

GRADES AND CURVES

The city is located on a series of hills, and grades of 5 and 10 per cent are frequent; there is one grade of 12.5 per cent. The sharpest curve on the main line has a radius of 66 ft., but on terminal loops there are curves of 46 ft. radius. The fact that many of the lines pass from the city to the summits of the adjoining hills has made the subject of current distribution a serious one, owing to the heavy loads at the ends of the lines. Thus, on the North Shore system, the Mosman line rises 290 ft. in 4620 ft., and the Neutral Bay line has a grade of nearly 10 per cent for a distance of nearly half a mile.

TRACK CONSTRUCTION

Standard gage is used, and the track is laid with from 60-lb. to 83-lb. rails. The standard rail in the center of the city is a grooved rail, weighing 83 lbs. per yard, and 6 ins. in height. A great deal of the track, however, is laid with the T-rail, 60 lbs. to 80 lbs. in weight, and with 42-lb. guard rail, as shown in the cut herewith. Where the grooved rail is used, wood pavement, which is very popular in Australia, is employed, but the T-rail is laid principally in macadam streets, with bluestone ballast. A local wood, called iron-bark, is used largely for ties, and has proved very durable. The ties are 4½ ins. x 9 ins. x 8 ins., and thirteen of them are laid to a 30-ft. rail length. The cost of track construction in Sydney for grooved rail in wood pavements has been about £5,000 per mile of single track, and for T-rail in macadam streets, about £3,000 per mile of single track. Both copper and plastic bonds are used.

A considerable number of joints have been welded during the past year by the Goldschmidt thermit process.

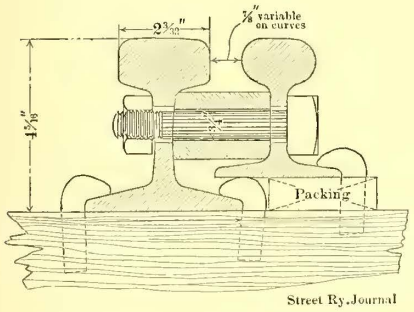
COUNTER-WEIGHT CONSTRUCTION

On the Balmain division a counter-weight is used for a short distance, owing to the 12½ per cent grade that exists on that

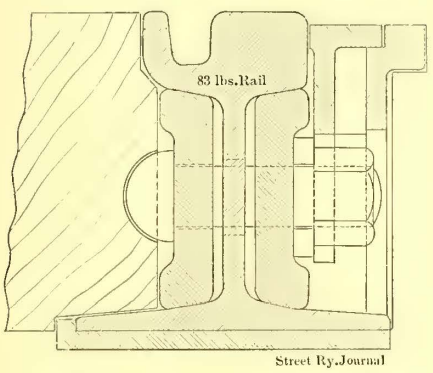
division. As the line is single track, the installation is a particularly interesting one. As in several American installations of this kind, a shallow conduit is laid under the track, with a center slot, through which the trolley car can grip the counter-weight cable. The latter is led around a 6-ft. horizontal sheave at the top of the incline, and its end is attached to a 10-ton counter-weight, which travels on a subway track having a 2-ft. 6-in. gage. At the bottom end of the subway is a hydraulic buffer, with a cylinder 10 ins. in diameter and a stroke of 3 ft. 6 ins. to cushion the blow of the counter-weight when it reaches the bottom of the incline. The cable is carried in the conduit on 15-in. and 12-in. carrier sheaves located 30 ft. apart.

POWER STATION

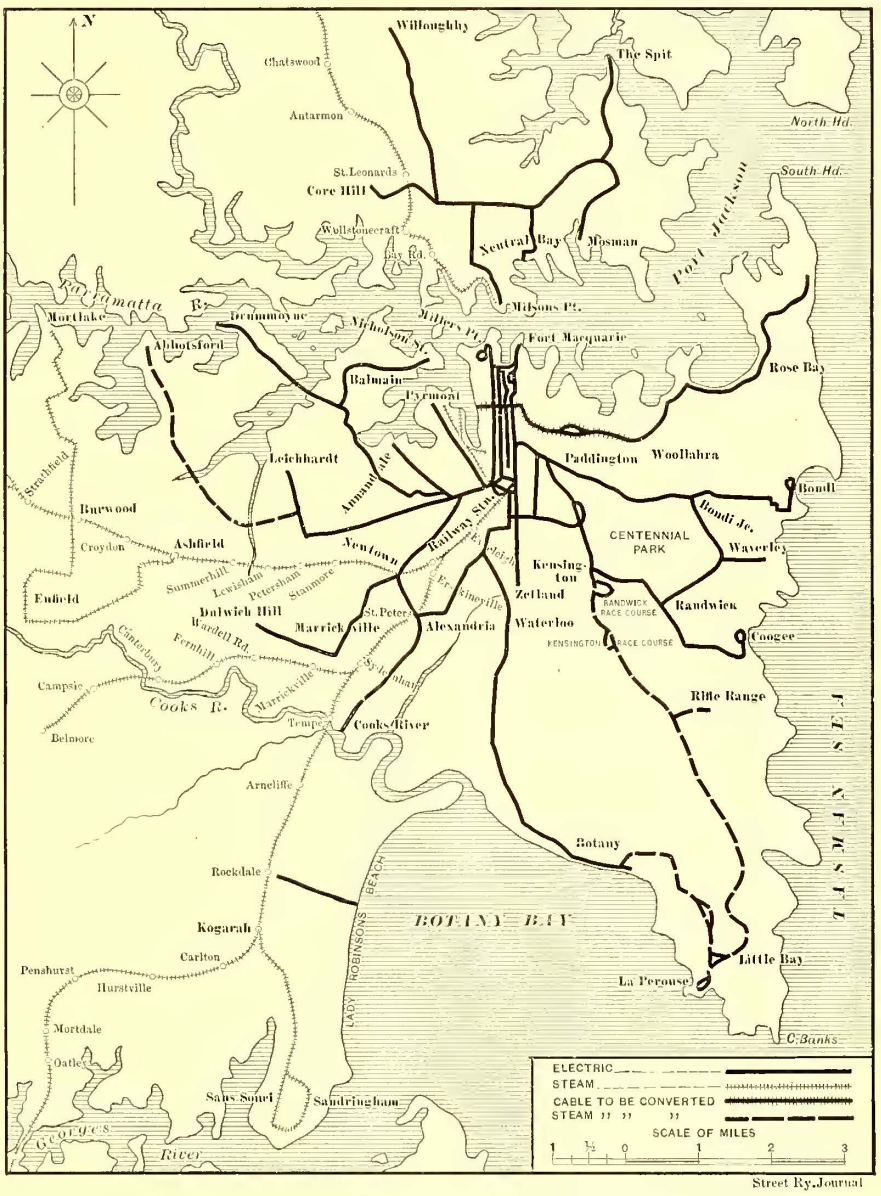
The power station is located in a part of the city known as Ultimo, on the bay, and its ground dimensions are 318 ft. x 186 ft. It is a brick structure, with three brick chimneys of a height of 227 ft. and an internal diameter of 11 ft. There are at present thirty-two Babcock & Wilcox boilers, with sixteen others in course of installation. The boiler house is in two stories, with sixteen boilers at present on each story. Each boiler has a heating surface of 2852 sq. ft., and is equipped with automatic chain-grate stokers. The cost of coal is from 3s. to 4s. 6d. per ton at the pit's mouth, and as it is hauled to the station over the State railways it is obtained at a minimum of cost.



SECTION OF T-RAIL AND GUARD



SECTION OF GIRDER RAIL



MAP OF SYDNEY, SHOWING THE STREET RAILWAY SYSTEM

The engine room measures 275 ft. x 99 ft., and contains four horizontal cross-compound condensing Allis-Chalmers engines. The cylinder dimensions of these engines are 26 ins. and 48 ins. x 48 ins. stroke, and at 100 r. p. m. they are rated at 1250 hp. Each engine is directly connected to a 850-kw General Electric generator. The alternating-current equipment consists of three cross-compound vertical condensing engines, with cylinder dimensions 32 ins. and 64 ins. x 60 ins. stroke, rated at 2850 hp and each driving a 1500-kw three-phase 6600-volt 25-cycle G. E. alternator. In addition, there are two standard exciter engines.

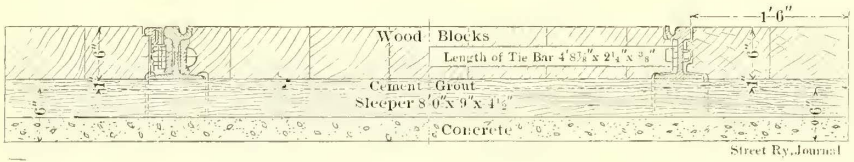
To each pair of horizontal engines is fitted a Wheeler surface condenser supplied with condensing water by a centrifugal pump. There are three such pumps in the pump-room, two for service and one as reserve. They are driven by shunt-wound motors of the General Electric make. The feed-pump is operated by steam. Electric feed pumps were originally installed, but are not now generally used. The auxiliaries for the vertical engines consist of three compound duplex-plunger feed-pumps, made by the Worthington Pump Company, Limited; three Worthington vertical compound beam air pumps for the main engines; three Worthington compound horizontal circulating pumps; two combined air and circulating pumps for the exciter engines; and a stoker engine. The feed pumps have each two high-pressure cylinders 9 ins. in diameter, two low-pressure cylinders 14 ins. in diameter, and four single-acting outside-packed plungers 7½ ins. in diameter, all of 10-in. stroke, and running at thirty double strokes per minute to deliver 150,000 lbs. of water each per hour. The circulating pumps have two high-pressure steam cylinders of 12 ins. diameter, two low-pressure cylinders of 17 ins. diameter and four single-acting motor cylinders of 22 ins. diameter, with a common stroke of 16 ins. And two of the trio are capable of supplying three main-engine condensers. The exhaust from all the auxiliaries is conveyed to two feed-water heaters, each of 1500 sq. ft. heating surface. These are situated beneath the floor of the upper boiler room.

Above the upper tier of boilers are a pair of coal bunkers of a total capacity of 2500 tons of coal, sufficient to supply all

demands for at least ten days. The coal is dumped from the trucks through a crusher, which reduces it to a 3-in. gage, on to a bucket elevator 576 ft. long, carrying 288 buckets, with a total capacity of 14,400 lbs. of coal. The crusher is driven by an enclosed motor of 20 hp, and the elevator by a motor of 15 hp. The normal speed at which this works is twenty buckets per minute, but it is capable of a great increase on this 30-ton an hour rate. The coal is delivered to any part of the bunkers by automatic dump blocks, whence it is carried by chutes to the automatic chain-grate stokers. The conveyor also handles the ashes.

Lubrication is carried out by means of an oil pump in the basement and a tank on the roof of the engine room, through a complete gravity system.

All parts of the added portion of the engine room can be reached by a traveling crane with a single span of 96 ft. This crane is operated by three independent motors of 30 hp for main hoist, with a speed of 10 ft. per minute at full load; 5 hp for trolley traveling, with a speed of 100 ft. per minute, and 50 hp for bridge traveling, with a speed of 150 ft. The limit



SECTION OF TRACK IN PAVED STREET

of the crane's weight-lifting capacity is 35 tons. The older portion of the room is similarly provided for.

The direct-current and alternating-current switchboard were supplied by the General Electric Company.

The station is piped with compressed air at 80 lbs. pressure, supplied by a Christensen compressor.

SUB-STATIONS

There are at present five sub-stations erected and in active work, and a sixth has been completed and is now being equipped. Each of the five stations contains two 450-kw shunt-wound rotary converters, and two battery boosters, each capable of boosting a current of 1000 amps. Each sub-station is equipped with two A. F. A. batteries, supplied and erected by Messrs. Noyes Brothers, of Sydney and Melbourne. Each battery consists of 280 cells, with a capacity of 500-ampere-hours at a one-hour rate of discharge. There is also a similar storage battery at the Ultimo power station.

Each sub-station is also equipped with six air-blast 175-kw transformers, with G. E. switchboards. The return boosters, which following the English practice are used in Sydney, were supplied by the Allgemeine Elektricitäts-Gesellschaft. In addition there are several feeder boosters, some of the General Electric and some of the Westinghouse make.

TURBINE EXTENSION

Large as the present plant is, the company has recently given a contract for the installation of a 1875-kw Parsons turbo-generator, with an additional equipment of sixteen Babcock & Wilcox boilers, with chain-grate stokers, Parsons condenser and air pump, Worthington circulating pump, and Worthington feed pump. The Parsons turbine will be the largest in Australia. The generator will be a two-pole machine running at 1500 r. p. m. and delivering current at 6600 volts and 25 cycles.

OVERHEAD SYSTEM

The overhead trolley system is employed, and side poles, center poles and span construction are all used. In the main streets of the city, the lines are equipped with Mannesmann steel poles. The wooden poles are of iron-bark. The trolley wire is of 186,000 circ. mils, and both figure 8 and circular wire are used. The feeder cables were supplied by the W. T. Henley Telegraph Works, and the British Insulated & Helsby Cables, Limited, of Prescot, England.

ROLLING STOCK

The company has four types of cars, viz.: the double-truck combination car, double-truck closed car, single-truck closed car and single-truck open car. A few of the cars were supplied by the J. G. Brill Company; the others were built locally. Both maximum traction and standard four-wheeled trucks are used. As a rule, the cars are run in trains of two motor cars each. Electric couplings are used between the two cars and the two motors on each car are controlled by a four-motor controller. Ordinarily, the cars are kept permanently coupled.

The rolling stock consists of 584 motor cars, 96 trail cars, 33 grip cars and 40 trail cable cars, 96 steam dummies and 123 steam trail cars. The motor cars are equipped as follows: 200 cars with G. E.-67 motors, 280 cars with G. E.-1000 motors, 64 cars with Westinghouse No. 68 motors, 21 cars with Westinghouse No. 49 motors, 15 cars with Westinghouse No. 56 motors, 4 cars with Dick, Kerr & Company 35-hp motors. Both motor cars and trail cars are equipped with air brakes. Three hundred and fifty cars have the Westinghouse Traction Brake Company's axle-driven compressors and 230 are provided with the Christensen motor-driven compressors. One Westinghouse magnetic brake is also used.

OPERATION

The average speed in the city is 8 miles an hour and in the suburbs 12 miles. On the principal thoroughfares the cars are run on a headway of thirty seconds, and the cars stop on the near side of the crossing. The lines are divided into penny sections, with an average length of 2 miles in the city. The longest run is 11½ miles, the fare for this distance being 6d.

The company has 5000 employees. The conductors' wages average 7s. and the motormen's 8s. 3d. per day. The scale of wages is as follows: Conductors, 6s. 6d. per day for the first two years' service; 7s. per day after two years' and up to four years' service; 7s. 6d. per day after four years' service. Motormen, 7s. 6d. per day for first year's service; 8s. per day after one year's service and up to three years' service; 8s. 6d. per day after three years' service. Signalmen, 8s. per day for first year's service; 8s. 6d per day after one year's and up to two years' service; 9s. per day after two years' service. Starters and ticket examiners, 8s. 6d. per day for first year's service; 9s. per day after one year's service. Working hours are forty-eight per week, with pay for overtime. The drivers are all locally-trained men, recruited chiefly from the old steam and cable trams.

The wages paid during the financial year 1902-3 were thus distributed: Maintenance branch, £105,983; electric branch, £145,606; traffic branch, £263,603; total, £515,192. In this return wages paid for new work are included, amounting to £73,353.

The following are the statistics for the last two years:

	1901-2	1902-3
Length of line (street covered)	86m. 79ch.	98m. 60ch.
No. of passengers	102,662,843	123,167,581
Total earnings	£591,697	£700,493
Working expenses	£512,472	£610,252
Cost of construction and equipment	£2,629,009	£3,082,603

Measured as single track the system comprises 148 miles without sidings, crossovers, etc., or 172 miles when they are included.

The total cost of construction was £1,741,677, working out at a shade over £17,663 per tram mile. Adding £1,340,926 for power houses, sub-stations, plant, machinery, workshops, furniture and rolling stock, a total of £3,082,603 is obtained, giving a cost per mile for construction and equipment of a little over £31,215.

OFFICIALS

The tramways are under the general charge of the New South Wales Railway Commissioners, as already mentioned.

The following are those who have special charge of the tramways: John Kneeshaw is traffic superintendent, G. R. Cowdery engineer of way, O. W. Brain electrical engineer, and W. Thow chief mechanical engineer.

SOME QUALIFICATIONS OF THE RAILWAY ACCOUNTANT

BY W. B. BROCKWAY.

Nothing can be thoroughly explained or understood without having in mind the force that controls or directs it. No system of accounting, nor the scope of its methods, can be clearly understood without taking into consideration the personality of the head of the accounting department. And, it must be acknowledged, no system of any kind, be it ever so perfectly planned, can be depended upon unless it has a properly qualified directing head.

Very much has been written about system, the need of it and what it can accomplish; but very little has been said about the human element in it. Certainly "Messages to Garcia" have appeared, but they are in general terms and do not specialize. The intention of this article is to give briefly suggestions upon some of the requirements necessary to make an accountant all he should be as the head of a very important department of electric railroad practice.

Beyond the fact that he should have ability and understand his particular work, and be accurate in his work—requirements which it is assumed he fills, else he would not be so situated—there are at least four other elements necessary to make his work well rounded. They are honesty, individuality, tact and imagination. Two of these are not usually considered prerequisites, but this article, it is hoped, will show their importance.

The first of these, honesty, is always considered, but always from a dollars and cents point of view, which is, of course, important; but that does not comprise all. It should mean fairness and the ability and the desire so to regulate the acts of his department that it be fair to all concerned. Honesty also includes stability and that steadiness in belief and action which gives the impression of security. Honesty in the accountant not only means that the company's money is safe so far as it concerns him, but that his work will bear the stamp of sincerity. Honesty is of prime importance.

Individuality means standing upright on one's own feet, not blindly following the ideas and work of others. No machine was ever made, nor system of accounting planned, that is, invented, without in some way showing the personality of the maker. This is so true that it is frequently possible to identify the maker by the workmanship.

No system of accounting can be placed in a man's hands without sooner or later showing marks of his own particular treatment. It must, in the nature of things, eventually become an expression of himself. It is not too much to say that if he is positive in action, so will his work probably be. If he is changeable and drifting, his work will bear the earmarks of it. A strong individuality inspires confidence in the strength, resourcefulness and ability of the possessor to do without precedent if necessary. Individuality is so necessary to the accounting of a corporation that it should be fostered when found, and not be lost amid red tape or custom.

Tact is patience, waiting, understanding conditions and bringing them about. Tact is so important that native or acquired ability will be largely or wholly neutralized without it. Tact in handling men, in explanation, in contact with the public, in hundreds of ways, is needed in the make-up of a man almost as much as a just cause. Tact will succeed often when force or the authority to force will fail. There is no gainsaying its importance.

The last of the four requisite qualifications in the successful accountant is imagination. At first glance, imagination may be thought as outside the "dry work of business," but a little thought will show that it is not. In its last analysis, imagination is simply the momentary translation in the mind of ideas into realities to judge effects. An accountant most certainly needs this talent, for it permits him to plan a system, the same as an architect plans a house, with it complete in his mind, while he is arranging the details to bring about the complete system. Imagination may be intuition or it may not; be that as it may, a man endowed with it makes fewer failures than one who is so practical that he can not place himself in the future or in the past as regards figures or the realities for which they stand.

Some of these enumerated requirements are such that when obtained they establish the standing of this officer in the community. Especially is this true of the smaller companies where he meets the public constantly, and the public understands the company through its contact with the representatives of the company. Therefore, his standing, his reputation, is no small matter.

The work of an accountant has reached a plane where something more than bookkeeping is required of him. He should, as a part of the term "ability," understand the operation of a railroad, not as an ex-operating man, perhaps, but certainly he should have a grasp of the theory of operation. The operating manager and he should work so together, and he should be acquainted with the operating conditions in such a real way that he would understand the viewpoint of the manager as well as the advantages and disadvantages under which the men work from whom he receives information. He ought also to see the construction of the property, to understand it, or at least to know the theory upon which it is planned.

The legal department is another fruitful field for him to understand; of course, not as a lawyer, but to know its routine and its relation to the rest of the organization. Nor is it too much for him to know the theory of banking, as many of his duties bring him into close touch with it.

In other words, the successful accountant is a well-rounded man. Remove from him the word "bookkeeper" (who is a recorder only), and find him with the proper qualifications, he becomes an important officer of the company. His understanding of causes, through his experience with them, will make the work of his department clearer and more to the point.

He is essentially a quizzical officer; he it is, of all the officers most called upon to continually ask "Why?" and "What for?" the replies to which will make his analysis of accounts and causes and effects of the utmost value to the operating manager or the president.

The position and work of an accountant are peculiar. His point of contact with every department is the same. Nothing can be done by any department without in some way reaching the accounting department. Everything done, each additional expense and every saving affect the books of the company. The whole effort of the organization focuses upon this department, and from it comes the story of the effort. Therefore, the officer at its head needs all the training and level-headedness possible.

He is a "bookkeeper" no longer; his work is larger and very important. This is being more and more recognized, and where this is so, there is being attracted a higher class of men to the work, which cannot but result in a clearer understanding of conditions, with the resultant benefits to all concerned.

A very eloquent example of how intelligent accounting may assist toward success is given in a history of the Carnegie Steel Company. It shows how the details worked out by the accountant permitted the operating manager to make quick and accurate changes in both manufacturing and selling plans. This illustrates a case where the accountant was more than bookkeeper and had a direct influence upon the success of the company.

Very many successful presidents and managers of to-day

have been such accountants as described herein. They have not been content to keep books only, but have filled their office to all its important limits, and in a postive way. Their preferment came as the recognition of their grasp of causes and effects.

A future is open in this department to men who will see the work and know what they see; who will understand and act upon the certainty that honesty, individuality, tact and imagination are as much a part of their equipment as the knowledge of the difference between a debit and a credit.

REPORT ON THE CONTROL OF TRANSFER TRAFFIC*

I. AND II.—INTRODUCTION

The subjects to be discussed in this paper are not entirely covered by its title. At the London meeting the following additional questions were considered:

I. What is the fare on your system? (a) For continuous trips, (b) When transfers are given.

II. Has the introduction of transfers fulfilled your expectations? You are requested to give the basis of your opinion by citing the evidence.

The object of these questions was to find, by comparing the experiences of the managers of various large companies, whether the introduction of transfers had proved financially beneficial. Considering the large number of members who were expected to reply to the questions, the answers have been comparatively few. Opinions have been received from forty-two railways giving transfers and two who do not. From so few answers it is difficult to form many definite conclusions. In doing so, however, the replies received at the London meeting in 1902 and the exhaustive data on German conditions from the archives of the Deutscher Vereins will be found of value.

The opinion of all the railways operating under similar conditions is practically unanimous on the following dicta:

The adoption of transfers has fulfilled expectations when the fare can be regulated in accordance to the value of additional service rendered; (a) when the additional cost does not exceed the gain in income, and (b) when a transfer system can be regulated in accordance with the local conditions.

These general opinions are more clearly defined by the following:

1. That the issue of transfers has caused very little additional expense in the case of companies using tickets as fare receipts, while it proved very difficult to companies not using fare tickets. (For an exception see answer to following question, III.)

2. That special difficulties in the issue and control of transfers exist only on very large systems with many crossings, as the transfers must be so printed as to be easily understood by conductors and passengers.

With this introduction, Questions III. and V. can be answered more exactly.

III.—FARES CHARGED WITH AND WITHOUT TRANSFERS

A. Railways issuing tickets as fare receipts for all trips have found the introduction of transfers advantageous when fares could be regulated in harmony with the service rendered. Railways in this class have incurred no appreciable additional expense on account of transfers. The application of this experience to the different groups of railways gives the following facts:

1. Railways using the zone rate system charge according to the service rendered, and are therefore not obliged to charge anything additional.

2. Large systems having few long through routes and the uniform-fare system have had unfavorable results until they made an additional charge for transfers.

3. On extensive systems having numerous through lines and low uniform fares, the earnings have decreased, even when an additional fare is charged. On such lines the necessity of transfer passengers paying additional fare, even though the total ride is short, is the only offset the railway can obtain for long through trips.

4. Large railway systems having high uniform fares may be benefited by the issue of transfers, without having recourse to the additional charge. On extensive systems which form a combination of long and short lines having no zone fares, the cars could be divided into two classes, and free transfers could be given to passengers paying the first-class fare, and not to the second-class passengers.

5. Systems of medium size and charging uniform fares incur no loss, although giving as many as three transfers without extra charge. Companies of this type have presented the most favorable reports. The transfers on such lines amount to as much as 50 per cent of the total traffic.

It should be also stated that the fare-ticket systems of the different railways were in no wise changed by the introduction of transfers, and the number of additional employees required must have been very few, as none of the reporting companies mentioned this detail. (For exceptions see answer to A-3 above.)

The use of different classes of cars has had no effect on the foregoing results.

B—Railways Not Giving Fare Tickets for Direct Trip.—All of the railways which reported unfavorably, despite reasonably high fares, belong to this class. They have not always derived an advantage from transfer traffic, and many of them have introduced transfers very unwillingly. While nearly all of these lines carried a heavier traffic in consequence of the introduction of transfers, they found that, in general, the old methods of control were inadequate. On small systems the passengers may be said to exercise a certain inspection over the conductor, but on large lines using the register system no method has proved satisfactory. A general statement of the financial results cannot be made, as very few railways presented detailed statements. The loss through cheating is estimated to be very high, but no details are given as to what extent this loss is offset by the increased income caused by the introduction of transfers.

IV.—TRAFFIC CONTROL METHODS ON LINES USING FARE RECEIPTS

It is absolutely necessary for success that aside from the personal character of the fare receipts, the passenger should be prevented: (1) From using the ticket for the return trip; (2) from using any but the shortest route to his destination; (3) from using his time, after receiving a transfer, for the transaction of personal business, and thus actually getting two trips for one fare.

The first use can be prevented by ordinary traffic rules, and the second and third by prescribing the route the passenger should take and the transfer stations where he can make connections, also by reducing to a minimum the time limit on the ticket for making connections.

The information to be given to the passenger by the conductor of the first car should cover the following: (1) The route already taken and those to be taken; (2) the length of time the ticket holds good.

In accordance with the above, the following information is found on the tickets of most railways: (a) Time of day, (b) date (or its equivalent), (c) entrance zone, (d) transfer points, (e) destination.

The marking is done mostly by punching or by using colored pencils (the latter being preferred where the saving in time is important); not so frequently by stamps, which are used principally for marking the time, and occasionally for indicating the route to be followed by the passenger.

* Report on Question 2, to be presented at the September (1904) meeting at Vienna of the International Tramway and Light Railway Association.

Suppose we now consider each of the five foregoing points in detail:

A, or Time of Day.—Unfortunately the replies on this point are not very complete. Of the railways rendering reports, most of them fail to tell from what time or to what time the ticket remains uncanceled. Besides this, as nothing was said in most cases whether passengers were permitted to leave the car during the time period marked on their tickets, nothing more definite can be stated than the fact that all replies are in favor of the shortest possible time interval and of requiring passengers to use the nearest connection to their destination. The different companies have figured out an average time interval good throughout their systems. This is made up of the longest possible time to make a trip, wait for car and time lost in permitting crowded cars to go by unboarded. These points are based, of course, on the size of the system, on the number of times a passenger may leave the car during the time marked on his card, the schedule and, finally, upon the personal observation of the railway manager. The time a ticket is good varies from twenty minutes to one hour, but it should be noted that a twenty-minute interval simply refers to possible time required for transferring.

What time should be noted by the first conductor? (a) The time of reaching the first transfer point, (b) the time his car leaves the station, or (c) the time the passenger enters the car?

It is plain that the best method is to mark the time of reaching the first transfer point, especially on lines giving but one transfer. This makes it unnecessary to fix a uniform time limit which would be too long for the short trips, and simply requires the conductor to mark the time of reaching the proper transfer point which his experience on the line enables him to do with exactness. If the second conductor also knows this time he will be more certain of knowing that the passenger transferred at the nearest point. If some other system is used, the conductor cannot figure out the matter so exactly, and there is nothing left for the railway to do but to lengthen the period for which the ticket holds good, and thereby lose control over its traffic. It is a fact that on lines where a universal time interval is granted, there are few quarrels between conductor and passengers, which may be explained by the fact that the railway's case rests on very uncertain grounds, as the passenger can allege that the cars were too crowded, or that they refused to stop. In instances of this kind the conductors more frequently believe the passenger than is good for the treasury of the railway company. As a result, the company only exercises a superficial control, which is effective only in very flagrant cases.

Even for railways giving more than one transfer, the better method appears to be to mark the time of arrival at the first transfer point, because it gives control over at least that portion of the trip.

What should be the time when a ticket expires? (a) the time of the last transfer? or (b) the end of the trip?

On this point also the answers are not very clear. Here, too, it is probably better to make the time limit for the last transfer and not for the end of the trip, for the shorter the time interval the more certain the control.

The time of day is marked on the tickets in intervals of one-twelfth, one-quarter, one-third or one-half hour. If the division is made in one-twelfth-hour intervals, it apppears only once on the fare-ticket. In the other cases it is repeated every hour.

As a substitute for marking the time of day, the large railways which have very few crossings generally use a series of numbers for each conductor, so that all the fare-tickets on one car are of the same series.

B—Marking the Date.—The indication of the date is not considered very important by some lines who have good control over their time intervals. The object in such case is to save the conductor the trouble of stamping the date or to save space in printing the tickets. Marking may be saved by a regular or irregular change in the color of the tickets, or of the pencils for marking them, and through changes in the series letters. Space may be saved in printing by eliminating the thirty-one days of the month and substituting numbers 1 to 11, in which case number 11 could be used both for the 21st and the 31st, number 6 for the 16th and 26th. Another method is to use the initial letters of the days of the week. In one case the conductors used a different punch for every day in the week. All of these methods may be considered satisfactory, as it is not likely that the passenger will return for the sake of saving a single fare after a certain number of days, exactly at the same time and place, to continue the trip to the point for which he had purchased a ticket several days before. For the same reason, it has been considered satisfactory in printing the time of the day to refer only to the numbers 1 to 12.

C—Entrance Zone.—The marking of the entrance zone, or the point where the passenger boards the car, as well as the transfer points and the destination, serve to fix the route. This is also done on lines having a single fare, in which case special provision is made for the transfer business.

The zones are usually denoted in one of three ways: (a) By names of streets and places, (b) by number or letters, (c) by a schematic symbol. Method "a" is used most frequently, and is equally clear to conductor and passenger, but on large systems space does not always permit this method to be used, and numbers or letters are used instead, which are not always understood by the passengers. The symbolic method is now becoming popular, as it possesses nearly all the advantages of the others, but cannot be always used for very large, complicated systems.

D—The Marking of the Transfer Points.—This was formerly considered superfluous by many companies, but it is now almost universal. The passenger should be permitted to leave the car only at the transfer point for which his ticket is marked, to prevent him from attending to other affairs before using it. It should be noted that while considerable care is taken to see that the passenger gets on at the right place, no effort is made to see whether he leaves the car ahead of time, although the latter evil is as bad as the former. It is possible, however, that most passengers are not aware that they can do this so easily.

E—The Marking of the Destination.—It is essential that this be done by the first conductor wherever it is likely that the passenger will attempt a return trip on the same ticket. In such cases the direction of travel can be noted by different colors, unless this is plain from other markings. The marking of the destination for a going and return trip is also necessary, but few lines do this. Tickets are canceled in all cases immediately after the last transfer by tearing or punching.

V.—METHODS OF CONTROL ON LINES USING NO FARE RECEIPT

As stated before, railways using fare receipt tickets have experienced little additional trouble due to the introduction of transfers, but this did not prove to be the case with companies not using fare-tickets, and this accounts for the fact that railways of the latter character give but one transfer. The very small lines are the most favorably situated, as the managers of such roads can give close attention to their employees and the passengers also exercise a kind of control over the actions of the conductors. It does not seem to make any difference whether such companies employ conductors or use fare boxes. Where fare boxes are used the motorman gives out the fare receipts. Frequently the passenger receives no information at all, except that the street names may be called out.

When transferring from a car with a conductor to one without one, two things are given: the regular fare receipt and a check-slip. The latter is deposited by the passenger into the

fare-box of the second car. Originally a number of the larger railways used the quite effective method of having inspectors at connecting points, whose business it was to see that only legitimately transferred passengers took the second car, giving either a verbal order or printed slips to the conductor of the latter car. This method was found to be too expensive, and, to-day, employees of this character are stationed only at the most important crossings, and besides attend to other duties. In some cases transfer tickets are handed to passengers, but the register method is retained for straight trips. The lack of control in such cases is due to the simultaneous use of both methods. Unfortunately, only two companies using this system have rendered reports.

VI.—GENERAL—DIFFERENCE BETWEEN UNLIMITED AND LIMITED TRANSFER TRAFFIC

Hitherto nothing has been said as to whether transfers should be given at all crossings or not. No inquiry was made in Question V. on this matter, but it is learned from other sources that the replies of most of the railways are based on the unlimited, or almost unlimited, issue of transfers. The opinions expressed in these replies should hold, however, for limited transfers as well, when it is borne in mind that the majority of railways which voluntarily introduced transfers at a few crossings increased the number when their favorable experience justified such action. Not infrequently a limited transfer system has been introduced to distract attention from districts where the rates of fare were somewhat high. The question whether giving transfers at some crossings would not increase the public's demand for more, may be answered in the negative. There are numerous instances of this kind in cities where transfers have been given for a long time past. It may be stated also that some companies do not give transfers after certain late hours or on Sundays, it being usually claimed in the latter case that the employees and operating equipment would be overworked. More rarely is this action justified by the statement that the peculiar holiday feature of Sunday riding makes transfers unprofitable.

Transfers to Other Systems.—In transferring to the lines of another company the same practice is general as on the lines of the same company. Transferring to other systems is not so frequent in Germany as in France. Where such traffic is carried on it is usually due to some clause in the franchise of one or both companies. Sometimes both lines are benefited by such an arrangement, although not equally so.

Interurban lines rarely give transfers, because of the greater difficulty of making connections and the fact that they charge fares according to zones.

Results of Transfer Traffic.—Those railways which did not introduce transfers simultaneously with the electrification of their lines, have been in position to observe the results of giving transfers. The results are frequently a heavy increase in business, especially at the traffic centers. In one case the increase in one district proved so great that regular passenger traffic was delayed, and the company therefore charged 5 pfg. (1.25 cents) extra for transfers. Such abnormal increase, which is an obstruction to regular passengers riding to the heart of the city, can be be used as a reason for not giving transfers where the company charges a single fare.

Most of the railways use the same ticket for straight and transfer trips, the ticket being specially marked when a transfer is wanted. Special fare tickets for both kinds of traffic are given out by some lines which desire to make a more careful study of the traffic ratio.

Another method is to give the passenger a transfer slip with his ticket, the former being good only when presented with the latter. This scheme is used on large systems, as it permits great flexibility without increasing the size of the regular ticket, and also permits the counting of transfer passengers. While this method does not eliminate cheating entirely, yet it is considered as indispensable by many companies.

A fourth method is to give an extra fare-ticket covering the cost of the transfer.

QUESTION BOX FOR THE ACCOUNTANTS' ST. LOUIS CONVENTION

As already announced in these columns, the Street Railway Accountants' Association of America is planning to have a "question box" at its St. Louis convention next October. Secretary W. B. Brockway, of the association, is sending to the members of the association the list of questions, and has requested replies before Sept. 1. In explanation of the question box, Secretary Brockway's circular says:

"Since its organization, this association has endeavored to make no move nor establish any customs except those that would be for the benefit of the association as a whole. Therefore, the present effort toward enlarging the opportunity of the members to ask questions and to obtain answers to them is based primarily upon that endeavor.

"In accordance with the circular No. 27, issued May 20, 1904, giving the opportunity to ask questions, those printed herewith have been received. They are now sent out to all the members for their replies. Each member is expected to answer as many of the questions as he can, the idea being to make the replies as comprehensive and valuable as possible.

"Each member is requested to give his answer in the form of a letter, and to identify the reply to a question by quoting the number printed opposite the questions herein. The letter should be addressed to the secretary. It is proposed to publish the name of the company making reply, but this will be withheld upon request.

"Attention is drawn to the fact that replies must be returned before Sept. 1, 1904. This is imperative to the success of the plan."

The questions follow:

QUESTIONS

1. Is it proper to register transfers? And what amount of checking is necessary to insure their proper use? No doubt the subject is old, but we want the latest light upon it.

2. In a city of 27,000 people, where car tickets are sold six for 25 cents, what percentage of the total receipts should be cash?

3. To what extent does your company issue advertising mileage in subsidizing newspapers, after paying cash for authorized insertions?

4. Please explain a system which could be made standard, as to the manner of getting the correct and actual monthly operating expenses, to be shown on its monthly report?

Is it not the practice of some street railways to arrive at their operating expenses by classifying the bills according to the standard classification, charging them direct to the operating and construction accounts, and using the totals of the operating account columns in compiling the operating expenses for the month, without considering inventories, shop clerks' or storekeepers' reports?

5. What are your average per cents of cost for maintenance of accounts Nos. 6 and 7 for nine months ending June 30, 1904?

6. How can the ticket accounts be arranged to show each day the exact amount of the different kinds of tickets in the hands of the public not yet used?

7. Is it always fair to consider new paving as a construction charge? It brings additional expense for maintenance. Does it add to the earning capacity or value of the road?

8. When bills are approved and passed for payment by voucher, what records can be kept which will make it convenient for the accounting department to find out quickly if

the bill is a duplicate of another bill which has been passed and paid?

9. What method is used in issuing transfers to conductors?

10. Do members generally use a work order system for their expense and construction accounts? We have started this in one department and I have a few questions to ask before adopting in other departments.

11. Is it customary to use total mileage (i. e., work car, special car and snow plow added to regular passenger-car mileage) in figuring income per car-mile and expense per car-mile?

12. Is it of sufficient benefit as a record to pay for the extra work necessary to keep a separate ledger account with regular vouchers?

13. In the case of a company reconstructing tracks during operation, and using motor cars for hauling material, is it not proper to charge reconstruction with the current consumed and credit power house expenses?

14. Should the property of a street railway company—its tracks, for instance—stand on its books forever at its original cost? Or should the account representing its cost be reduced from year to year, or month to month, by reason of wear?

15. Should accruals of rental under a lease be treated as a liability of the lessee and appear on a balance sheet as a liability prior to the date such payment is due?

16. What should be the dividing line between "Maintenance" and "Betterments?"

17. When a piece of track, or a car, is renewed, should the cost of the old track or car be charged to expense, or against income? Would it not be better to make such a charge from month to month, or year to year, estimating the amount from time the company begins to use the track or car, so as to have it off the books when it is worn out?

18. What is the best method of computing the effect upon net earnings, of an increase in free transfer privileges?

19. If land or other property of a street railway company increases in value, should the appreciation be shown on the books?

20. Should dividends be charged against the net income for the year and the balance of net income be transferred to surplus, or should the net income be added to surplus and the dividends charged against the total?

21. What is the usual percentage of passes, and of transfers, to total passengers, or to total cash fares?

Ours are to total passengers: Passes, 0.77 per cent; transfers, 0.79 per cent; to cash fares: Passes, 0.829 per cent; transfers, 0.844 per cent.

22. Is there any way whereby a correct balance sheet can be prepared, showing receipts and expenses incident to operating a pleasure park? Many managers when asked if it pays to operate a pleasure park in connection with an electric railway line reply "Yes." As a matter of fact, few of them know surely whether it does or not. Please give your experience in handling this matter. Do you attempt to arrive definitely at the increased receipts and expenses properly attributable to the park?

23. In your daily, weekly and monthly reports, to what extent do you make statement of weather conditions? Of special events, as fairs, fete days, parades, special picnics, excursions, etc., which would make sudden changes in receipts or expenses?

It is announced that the employees of the Brooklyn Rapid Transit Company are to have a band. The company has secured the services of W. S. Mygrant, a prominent Brooklyn bandmaster, who organized the Firemen's Band in New York. Applications for membership in the band will be received from all the members of the Brooklyn Rapid Transit Employees' Mutual Benefit Association. Instruments will be furnished to all those who do not own them already.

THE VIENNA CONVENTION

The biennial convention of the International Tramway & Light Railway Association, as stated, will be held in Vienna, Sept. 4 to 8. The titles of the papers to be presented at the meeting were published in the STREET RAILWAY JOURNAL for Sept. 19, 1903, but for the convenience of those who do not wish to refer back to that issue, are given below:

1. "Renewal Accounts," by M. Haselmann, manager of the Société des Chemins de fer Vicinaux, of Aix-la-Chapelle.

2. "Transfer Tickets," by a committee consisting of J. Grialou, manager of the Compagnie des Omnibus et Tramways, of Lyons; A. Janssen, secretary of the Société des Tramways Bruxellois, of Brussels; E. Lavalard, manager of the Compagnie Generale des Omnibus, of Paris; von Pirch, manager of the Tramways de Barmen-Elberfeld, and H. Vellguth, secretary of Verein Deutscher Strassen- und Kleinbahn Verwaltungen, of Berlin.

3. "Economy in the Consumption of Current by Cars," by M. Scholtes, manager of the Nuremberg-Furth Tramways.

4. "Brakes," by M. Petit, chief engineer of the Société Nationale des Chemins de fer Vicinaux, of Brussels.

5. "Protection of the Trolley Wire Against Accidental Contact with Telephone and Other Aerial Wires," by M. Pavie, general manager of the Compagnie Generale Francaise de Tramways, of Paris.

6. "Operation of Trail Cars in City Service," by M. Klitzing, manager of the Magdebourg Tramways.

7. "Advantages and Disadvantages of Electric Traction on Interurban Railways," by M. H. Luithlen, Chief Commissioner of Inspection of the Austrian State Railways, of Vienna.

8. "Character of Current for Interurban Lines," by M. Pforr, chief engineer of the Union Elektricitäts Gesellschaft, of Berlin.

9. "Track Construction for Interurban Steam Lines, by M. C. de Burlet, General manager of the Société Nationale des Chemins de fer Vicinaux, of Brussels.

10. "Legislation on Tramways and Interurban Roads in Different Countries in Europe," by R. H. Scotter, of London.

11. "Standard Form of Operating Report," by M. H. Geron, manager of the Société des Tramways de Cologne (in liquidation), of Brussels.

12. "Control of Electrical Installations and Maintenance of Trolley Wires," by M. G. Pedriali, chief electrical engineer of the Société des Tramways Bruxellois, of Brussels.

13. "Use of Motor Cars and Locomotives on Railway and Tramway Lines," by M. E. A. Ziffer, president of the Bukowina Railway Company.

FIVE-CAR ELEVATED TRAINS FOR BOSTON

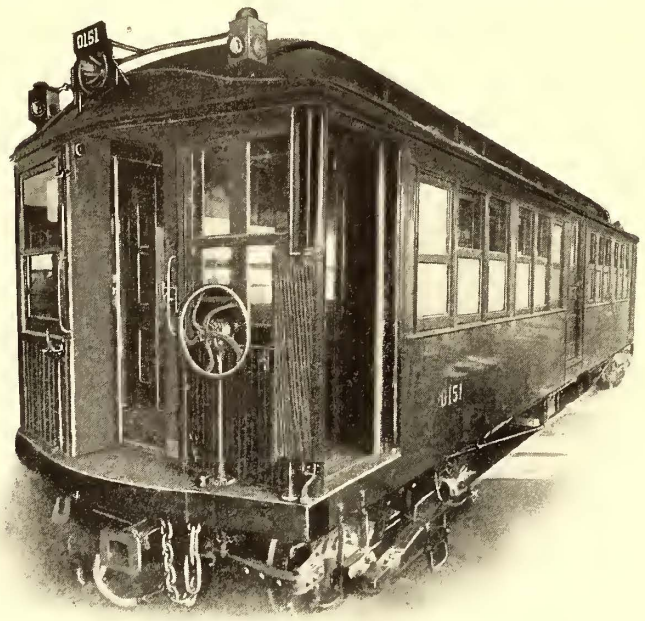
The Massachusetts Railroad Commission's recent order in regard to platform extensions at the elevated stations in Boston marks a notable prospective increase in the carrying capacity of the system. Five-car trains will be handled instead of the four-car trains now operating upon the elevated and subway lines, although the order of the commission does not include the subway platforms as suitable for extension. The method of handling the longer trains at the underground stations has not yet been made public, so that it will be interesting to keep an eye out for the solution of this rather perplexing problem.

It is safe to say that these platform extensions, coupled with the new type of cars adopted by the road, and recently described in our columns, will increase the traffic capacity of the elevated division by at least 25 or 30 per cent. Although the work is largely a carrying through of original designs to a logical completion, it is a matter of congratulation that the sometimes hypercritical Boston public appreciated the advantage of the increased facilities.

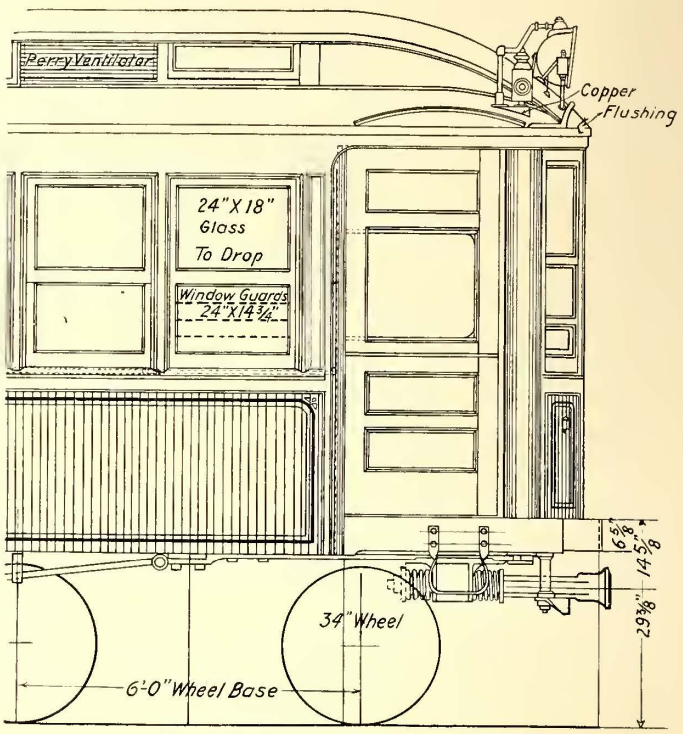
A recent cable despatch reports that Major-General Von Budde, Prussian Minister of Public Works, has invited the Allgemeine Company and the Siemens-Halske Company, who participated in the recent high-speed experiments, to a conference at the end of August concerning the proposed Berlin-Hamburg Electric Railway, with a projected schedule of 100 miles an hour.

THE NEW TYPE OF ELEVATED CAR WITHOUT PLATFORMS, BOSTON ELEVATED RAILWAY COMPANY

Brief mention was made in the STREET RAILWAY JOURNAL for July 9 of a new type of elevated car, of which twenty-four have recently been built and will soon go into service upon the elevated and underground lines of the Boston Elevated Railway Company. It will be remembered that the radical departures embodied in this new car construction involves the abandonment of the usual type of open platform in favor of including the platform space within the car body, the introduction of pneumatic door opening and closing devices, and other facilities which will greatly assist in the rapid loading and unloading of passengers. This is one of the most important changes in car construction that has appeared for this class of service, rivaling only the new design of car adopted upon the Illinois Central Railroad for suburban service out of Chicago, in its wide departure from former standards of design. The accompanying engravings and drawings illustrate this interesting new car, and indicate at a glance the many advantages to be gained by this new construction.

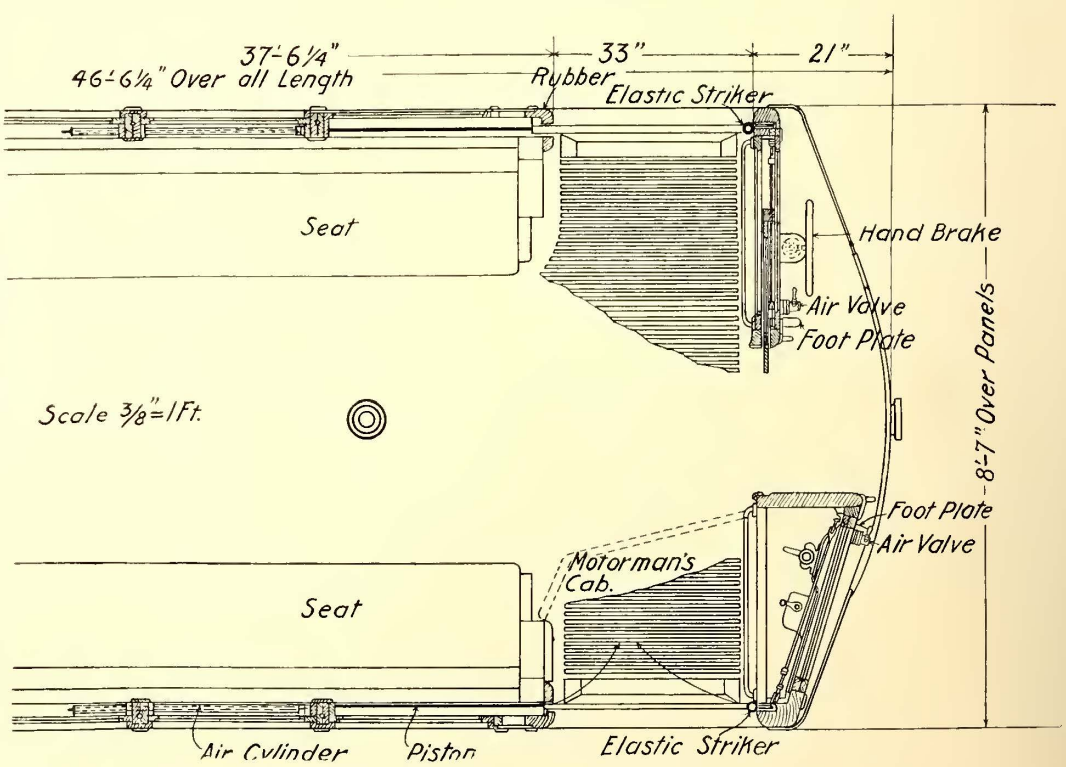


EXTERIOR END APPEARANCE OF THE NEW TYPE OF CARS FOR THE BOSTON ELEVATED LINES, SHOWING ARRANGEMENT OF PLATFORM DETAILS



PART SIDE ELEVATION OF CAR

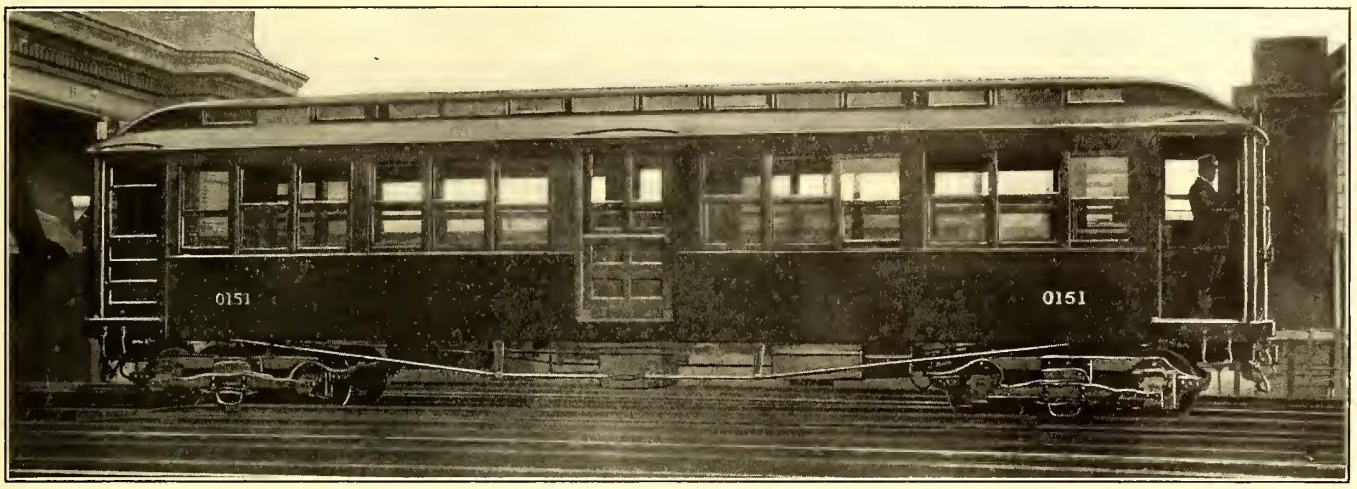
The cars which are at present in use upon the Boston elevated lines, except as to a door midway of the side, are of the so-called Manhattan type, with the usual open-end platforms, enclosed by gates of the "swing-back" type, controlled by levers which are operated by the brakemen standing on the ends of both platforms. During the hours of heaviest traffic the usual difficulty with this type of car has been experienced, in that the opening and closing of these gates is accomplished only after much pushing and discomfort on the part of passengers and delay to the train at the station. Such delays seriously impair the capacity of the road, as they reduce the number of trains which it is possible to operate in a given period. Still further, the end doors of the cars constitute a restricted point which impedes the easy access and egress of passengers, as is found to be the case upon all cars of this type.



PART PLAN OF CAR, SHOWING ARRANGEMENT OF ENCLOSED PLATFORM DETAILS AND OF FOLDING MOTORMAN'S CAB

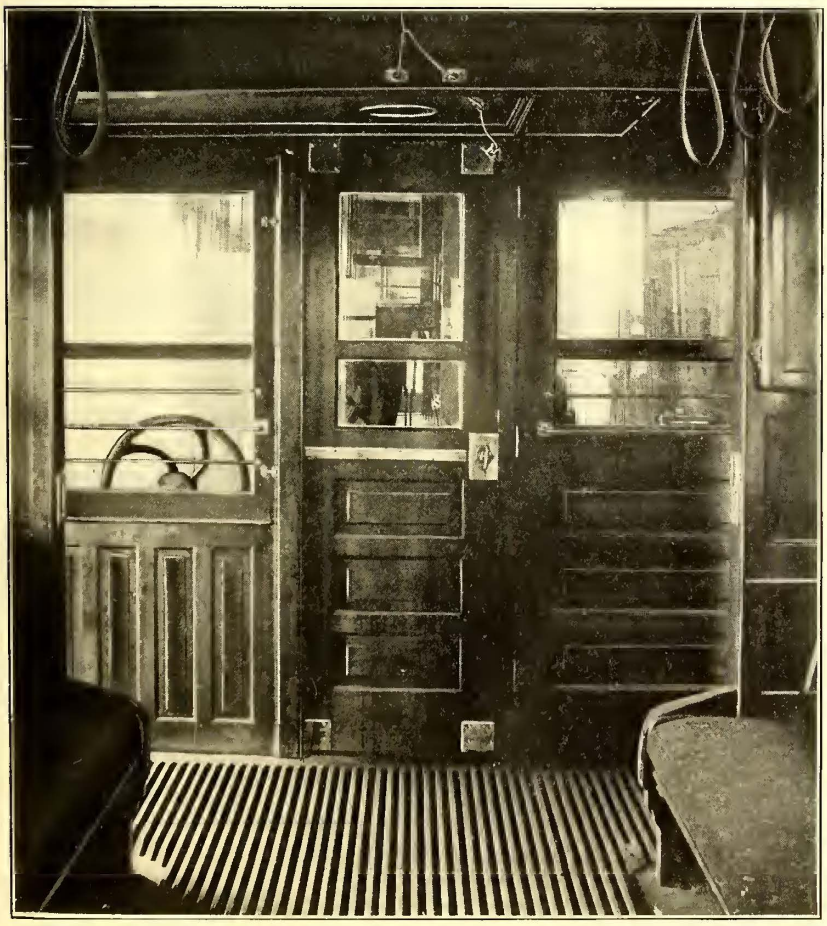
The new cars have therefore been constructed without any open platforms, the space occupied by the end platform being taken into the car and the access provided by sliding doors at

the ends instead of the former gates. In order to remove all risks of passing from one car to another, an end door has been provided solely for the use of the brakeman. It is thought that these and the other interesting changes which have been incorporated in the new design will tend to overcome at least some of the difficulties which are experienced with the present type of car. The new departure will be of more than usual interest to the operating officials of all roads handling traffic of a similar nature.



SIDE VIEW OF THE BOSTON ELEVATED CAR

The removal of the end bulkheads and doors facing the platforms from the ends of the cars produces a novel effect, as may be seen from the end inside view of the car; the side seats are merely carried up to the end of the body of the car, where they end abruptly adjacent to the platform. As may be seen, the platform floor is not changed materially, but resembles that used upon the usual types of car. A great increase of speed in handling passengers will result from thus avoiding the usual end door, which is left out in much the same manner as is the case in the new Illinois Central side-door suburban cars, which were described in the April 30, 1904, issue (page 661). This valuable provision causes the entrance and egress capacity at each end of the car to be dependent only upon the width of the sliding side doors, as the platform is thus contained in the body of the car. The side doors are made very wide, so that passengers may enter two abreast, and when inside they are not confronted by another narrow entrance door. This method of en-

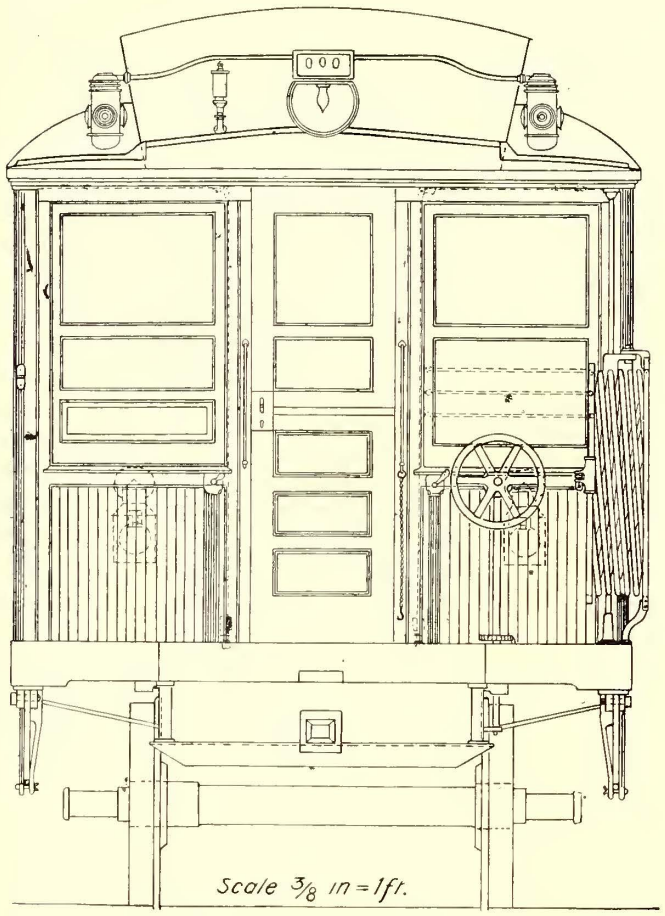


INTERIOR END VIEW OF CAR WITH END DOOR SHUT AND MOTORMAN'S CAB COMPARTMENT CLOSED

VIEW ACROSS ENCLOSED PLATFORM, SHOWING LARGE SIDE DOOR OPENING

closing the entire floor of the car will effect an important protection for the guards as well as passengers in winter weather.

As above stated, the sliding side doors at the ends of the cars are operated by means of compressed air cylinders, which are to be controlled by the guards standing across the two platforms in end-door openings, in a manner similar to that which is usual upon the cars with the open-end platforms. These door-operating air cylinders are arranged in the side walls of the cars, with their piston rods attached directly to the sliding doors, and they are operated by means of air valves which admit compressed air to either end of the cylinder at will. The doors will be normally held in their closed position by means of a spring latch, which may be released for opening



EXTERIOR END ELEVATION OF CAR

the doors by means of foot levers convenient for the guards. The details of the cylinders, foot levers, air valves, etc., are well shown in the plan drawing of the car, and also in view in the half-tone engravings.

Another decided novelty lies in the provision against the shock of the quick closing of the side doors. The door in closing comes to a stop, at the end of the air-cylinder's piston travel, some little distance from the door frame; this open space, which is provided to prevent catching the clothes or hands of passengers in closing, is filled in by an elastic striker consisting of a pneumatic cushion, 1 11-16 ins. in diameter, which will permit of the easy removal of any clothing that may happen to be caught in this way, and would not cause injury to a passenger's arm or limb if caught thus in closing.

To open the door the brakeman steps on the foot lever which unlocks the spring latch; then by operating the four-way air valve, he releases the air from the back of the cylinder and admits it at the front, forcing the door open. The valve is held in this position for a moment, after which it is placed in mid position, which lets the air exhaust from the cylinder into the atmosphere. In closing the door the shock is taken up by the above-mentioned rubber cushion at the back of the door; a weather-proof fit is made between the door and the frame by means of the elastic striker.

A number of other advantages are gained by the doing away with the present platform, among them being an increase in the interior carrying capacity of the car, greater comfort for the guards by being less exposed to the weather, and also in that they can make their station announcements from one place, instead of being obliged to cross both platforms. Furthermore, the interesting arrangement of the folding motorman's cab is worthy of special attention. It is arranged to provide an enclosure upon the platform which will accommodate the master controller, air-brake apparatus, etc., and give ample room for the motorman. When not in use, this compartment folds up into a very compact space in the car end beyond the platform; its position, when open, is shown in dotted lines in the plan drawing.

Acknowledgement is due to C. S. Sergeant, vice-president of the Boston Elevated Railway Company, for the information and illustrations which show very clearly these interesting features of car construction. The cars were built by the St. Louis Car Company, the order embracing twenty-four cars of this new type. The trucks are of a new design of all-steel construction and unusually heavy, being supplied by the Taylor Electric Truck Company, Troy, N. Y. The new General Electric-69 motors will be used, and the National Electric Company's Christensen system of air braking which is standard upon this road.

THE PROPOSED TRACK ASSOCIATION

Although not much has been said lately about the proposed organization of track and way men, it must not be thought that the matter has been dropped, nor that the movement has met with any lack of interest. F. G. Simmons, of Milwaukee, who has taken upon himself the work of crystallizing the sentiment of electric railway track men regarding the movement, has received over 100 replies from those directly interested in the subject of an electric railway track and maintenance of way association; all of which have been favorable, but which differ very greatly in the ideas expressed as to the best way of carrying out such an organization. As the readers of the Street Railway Journal for the past six months know, one plan proposed which has found considerable indorsement, involves the reorganization of the American Street Railway Association, so that all the allied associations covering different departments of electric railway work will become branches or sections of the parent body. Another plan proposed has been to enlarge the scope of the American Railway Mechanical and Electrical Association, so as to include track work as well as maintenance of rolling stock and power houses. These two plans, together with the original idea of forming an entirely separate association for the track men, make up the three schemes which have found the most favor. The carrying out of the first one outlined is dependent upon the action of the American Street Railway Association. That the American Street Railway Association will take such action at its next meeting is rather doubtful, as the distractions of the exposition are likely to cause the sessions of that organization to be very brief, and to take up only the regular programme. It would seem to be the part of wisdom for the track men to go to the St. Louis convention prepared to take whatever action seems best at the time, but in any event, to form some kind of an organization. If it is decided that the track men can be accommodated in the American Railway Mechanical and Electrical Association, well and good; or if one of the other two plans find the most favor, well and good. Something should be done, and no doubt will be done, by the track men to enable them to discuss their problems at conventions yearly to a greater extent than has heretofore been possible.

NEW ROLLING STOCK AND TRACK EQUIPMENT FOR THE EVANSVILLE ELECTRIC RAILWAY

The Evansville Electric Railway Company, of Evansville, Ind., has recently added several new equipments to its rolling stock, to take care of increased traffic, part of which has been occasioned by the growing popularity of Oak Summit Park, conducted by the company.

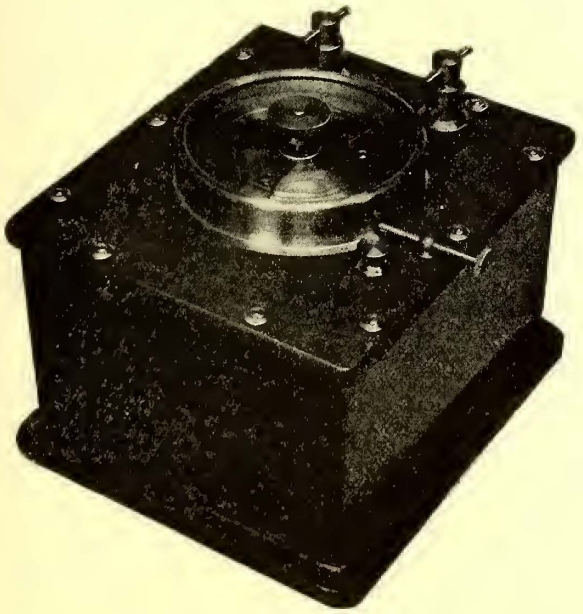
Of the new equipments, four are of the Brill semi-convertible type, with 28-ft. bodies, seating forty passengers. These are equipped with four G. E.-67 motors, Christensen AA-1 compressors, Hunter fenders and Brill-27 double trucks. There have also been added to the equipment four single-truck cars, seating thirty-two passengers. A description of these cars appears on page 212 of this issue.

A. H. Mann, master mechanic of the system, is doing some novel work splicing cars at the shops. The company has on hand several five-bench open mule cars, which in their present condition are worthless. Two of these are used to make a car measuring 27 ft. 6 ins. over all. The method used is to take the sills and floors off the old cars and construct a completely new bottom framing and floor. The tops, seats, etc., of the small cars are then set over on the new farming and spliced in an effective manner.

The company has found it necessary to make some extensions of track in different portions of the city. This has all been laid with 7-in. 70-lb. T-rails.

ELECTRICAL MEASURING INSTRUMENTS

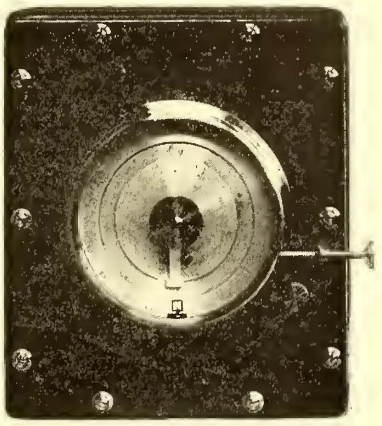
The Westinghouse Electric & Manufacturing Company has recently brought out a line of portable measuring instruments, of which several are illustrated herewith. In principle, these instruments operate on the mutual attraction between two systems of movable and stationary coils arranged in inductive relation to each other, the two systems of coils being so arranged as to neutralize the mutual induction and the effect produced by any external field. The readings are thus equally accurate with direct and alternating currents, and there is no



AMMETER

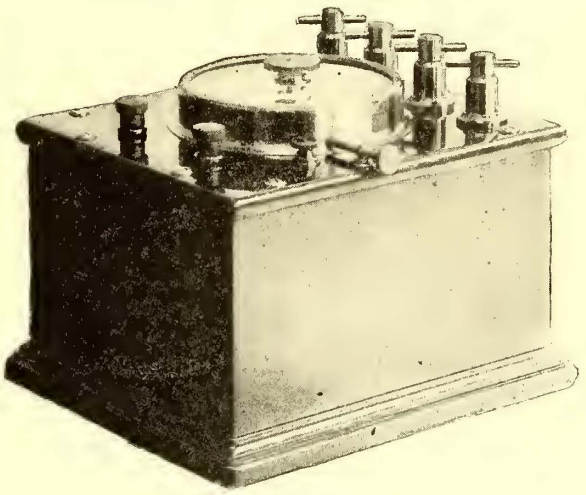
necessity for reversing the readings on direct currents as with ordinary standards. The controlling force is very large, rendering negligible any friction effects.

The voltmeter dial illustrated shows the general form used in the different instruments. The scale is accurately graduated upon a 5-in. circle, all the divisions being uniform and thus equally legible over the entire range. By means of the vernier, tenths of a division may be read, giving a range of 2000 readable divisions. The sight wire is shown in a square frame which is attached to the movable system.



VOLTMETER DIAL

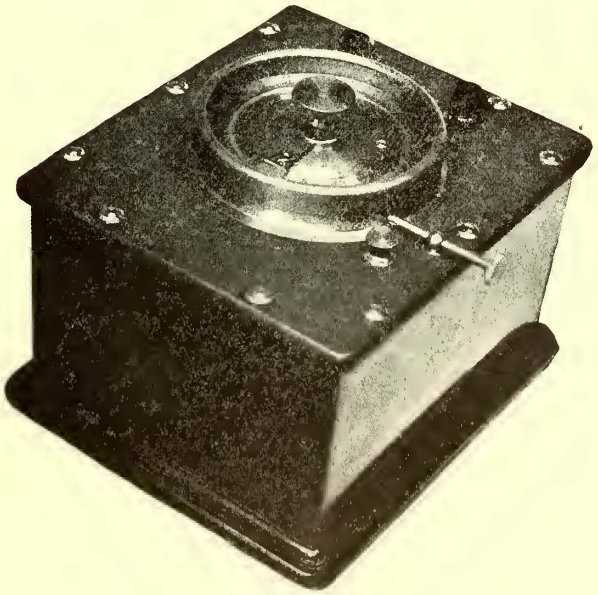
The voltmeter and ammeter dials are similar. The inner graduations are so spaced that their value is proportional to the square root of the deflection, allowing readings to be taken direct, without calculation. When readings of fractional parts of divisions are required, the outside scale with the vernier may be used, and the corresponding value of the reading on the inner scale determined from the table of square roots furnished with each instrument. In the wattmeter there



WATTMETER

is but one set of graduations, similar to those shown on the outer circle of the voltmeter scale.

The resistance or multiplier is used in the potential circuit



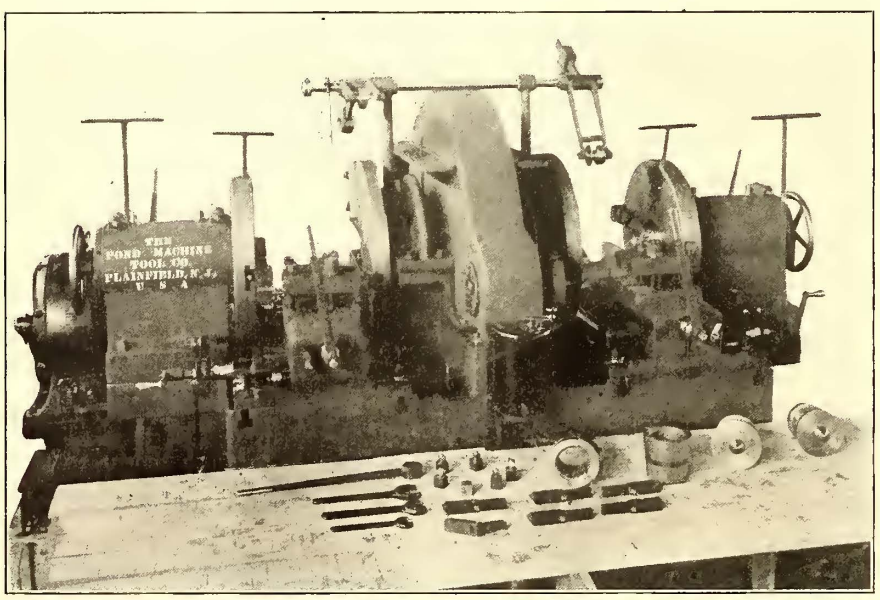
VOLTMETER

of the voltmeter and wattmeter. The potential coils of the instruments are adjusted to a uniform resistance of 100 ohms, and the external resistance is subdivided so as to give total values of 1000 ohms or multiples thereof.

STEEL-TIRED CAR-WHEEL LATHE

The steel-tired car-wheel lathe illustrated in the accompanying engraving is especially designed for truing up electric railway car wheels, a number of these machines having been furnished to the street railways in Boston and New York. The great problem in work of this character is the holding of the wheels rigid under the cut. Ample power is supplied to the machine by 15-hp motor, which drives through worm gearing, giving all the power at the tools that modern tool steels will stand. The lathe is provided with a device for chucking the journals, which insures the tread of the wheel being concentric with the journal, and a very strong rigid chuck holds the inside of the tire, absolutely preventing the springing of the axles and allowing the full power of the lathe to be used at the tools. A special arrangement for electric railway wheels is provided, by which dogs, engaging the teeth of the gear in which the motor pinion meshes, help to drive the wheels. This also does away with the necessity of removing the gear from the wheels.

The makers, the Niles-Bement-Pond Company, recommend the following procedure in turning wheels: The steel for the tools should be of sufficient size to prevent springing or breaking. Large tools also have the advantage of carrying off rapidly the heat generated at the cutting edge. The most desirable size



STEEL-TIRED CAR-WHEEL LATHE

of tool steel has been found to be 3 ins. x 1¼ ins., and none but the best grades of self-hardening steel should be used. First, the ordinary round nose tool, with just clearance enough to cut free, is started next to the flange, using a ⅜-in. to a ½-in. feed, or whatever the tool will stand. This operation should take from twenty-four to forty-five minutes, according to depth of cut and hardness of tire, etc. Then the outer edge of the tire should be rounded; next, scrapers should be applied which will make the wheel perfectly smooth with one or two revolutions of the lathe. This consumes about five or six minutes, and the tread is finished. The top of the flange can now be cut down to the proper height through the flat nose tool, this taking on an average from three to six turns of the lathe.

Next, the outside of the flange should be roughed to something near shape with the same kind of a tool used on the tread of the wheel. The outside of the flange should then be finished with a flange tool filed to the exact gage of one-half the flange. The back of the flange should then be roughed out the same as before and finished with the flange tool of required shape. The flange tool should be of the best grade tool steel, tempered hard, and should be kept in shape by grinding on the top. The actual time in taking out a pair of wheels and putting in another pair should not consume more than from twelve to fifteen minutes, with wheels convenient to the lathe. The lathe under the aforesaid conditions, with an experienced operator, should turn from five to seven pairs of average wheels in ten hours, this having been done for years in several places. The lathe should be set so that wheels can be easily rolled in, doing away with the necessity of any crane or hoist. There should also be a pit for the operator to stand in for his convenience. The lathe to be properly equipped should have twelve R. H. and twelve L. H. roughing tools to provide for grinding, dressing, etc. Also two R. H. and two L. H. of each kind of flange tools; also two sets of scraper blades and twenty-four cold chisels made of 1¼ steel, dressed narrow and blunt, and a 5-lb. hammer to take out flat spots, and a good, strong, ambitious, hustling operator.

DINING CAR SERVICE ON THE GRAND RAPIDS, GRAND HAVEN & MUSKEGON (ELECTRIC) RAILWAY

A very popular innovation has been inaugurated by the Grand Rapids, Grand Haven & Muskegon Railway, of which T. L. Hackett is general passenger and freight agent. On July 25 the company's first dining car left Grand Haven. The Grand Haven interurban management has for some time been thinking of experimenting with the system, and as it has proven so successful it will probably be maintained the balance of the season. The Goodrich boats from Chicago have from 40 to 100 passengers every morning for the Interurban going to Grand Rapids, and the limited car generally leaves so soon after the steamers arrive that these people have no opportunity to get breakfast. Consequently the dining car system was proposed. The cars are generally so crowded that lunches will be served the passengers in their seats. The run from Grand Haven to Grand Rapids, 34 miles, is made in one hour and twenty minutes. A combination car is used on this train, in which baggage is carried.

LAKE SHORE ELECTRIC RAILWAY MAKES TRAFFIC ARRANGEMENT WITH STEAM ROADS

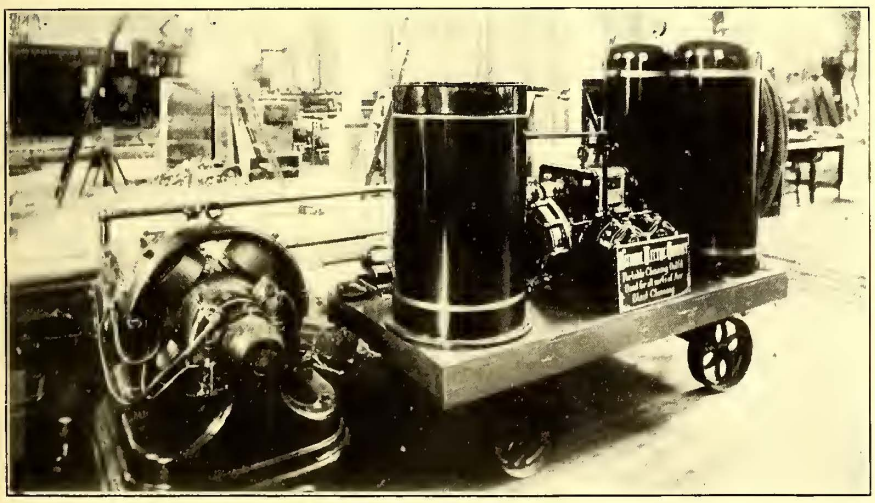
The Lake Shore Electric Railway Company has completed arrangements with Western steam roads by which it can ticket passengers from any point on the electric line to any of the important cities of the West. The arrangement is of importance because the electric fare is less than the steam road. In the case of the through passengers the electric road carries them to its terminus and then turns them over to the steam road. The steam road gets its full fare; the electric road also gets its full fare, but the passenger has the advantage of a rate lower than the prevailing rate from his home town. For instance, the Lake Shore Electric is turning over to its steam road connection in Toledo a lot of passengers who are not from Toledo territory, who ordinarily should take the steam road at other points. The traction line gets a long haul from them and the steam roads get business without cost in developing the trade.

The Cleveland Electric Railway Company has resumed the touring car service, which proved so successful last summer. This year there will be five different tours throughout the city, each taking two hours to cover. Instead of requiring all passengers to board the car at the Public Square, as was done last year, stops will be made at the leading hotels and at the intersection of important lines.

MOTOR-DRIVEN AIR COMPRESSORS AT ST. LOUIS

The use of compressed air for special purposes, such as braking, cleaning and the operation of small tools, has come into such wide application that compressors have been built especially to meet each requirement. For such work a central plant with an expensive piping system for distribution is too expensive and inflexible. The Christensen air compressors meet these requirements admirably, because they are compact, automatic, motor-driven and, if need be, portable. These compressors are shown in operation in the exhibit of the National Electric Company in the Electricity Building at the World's Fair. The portable type, shown in the illustration, is largely used for cleaning generators, railway motors and sub-station sets; it is a well-known fact that with its use the life of the machine is prolonged one-third. The outfit consists of a 4-hp motor directly geared to a 6½-in. x 3-in. compressor, giving 20 cu. ft. of free air per minute at 90 lbs. pressure, running at 175 r. p. m.; two 16-in. x 45-in. reservoirs; a controller, and 50 ft. of hose, with a flat nozzle, all mounted upon a substantial four-wheel truck.

A stationary consolidated single-stage compressor of 75 cu. ft. capacity is alongside. This is used for shop purposes, cleaning cars, or for hoists, jacks and pneumatic tools. The motors are especially designed and built by the National Electric Company for this work, and are made for any standard voltage. The base of the motor forms the top of the compressor, and the gear, keyed on the crank shaft, is enclosed in a suitable cast iron casing, which entirely encloses the interior of the compressor. The space in the compressor base is partly filled with oil through an oil-filling elbow, and insures a very thorough lubrication of all moving parts. The oil chamber in the pump base communicates with the gear case, which carries oil up to the pinion on the armature shaft. Seamless cold-drawn steel suction and discharge valves are arranged in the cylinder head, each working independently of the other, with access to either. No springs are used with these valves, they being seated by gravity, and are interchangeable.



PORTABLE MOTOR COMPRESSOR FOR STATIONS, SHOWN AT ST. LOUIS

The accompanying illustration shows the exhibit of a three-car multiple-unit air-brake equipment, which is the same as used on the World's Fair Intramural Electric Road, Boston Elevated, South Side Alley "L," Chicago, and others. These equipments can be operated on any number of cars, and are controlled and the air applied from any part of the train. Where there is one car it is as readily operative for a single unit. The motor and compressor combined consist of a series wound motor and duplex single-acting compressor, provided with two pistons. The connecting rods are operated by a steel crank shaft, with the cranks set at such an angle as to give the best balance to the moving parts. The crank shaft is extended at one end to receive a double helical gear which meshes with the pinion of the armature shaft directly above. The compressor is started by closing a switch. Current then passes through the switch, through the fuse, through the governor, which is automatically closed by the current, through the motor, and from thence to the ground, thus operating the motor compressor which accumulates air pressure in the main reservoir. The pressure finds its way up to the engineer's valve, and by placing the engineer's valve handle in "application position" an unobstructed passage is afforded for compressed air to pass from the main reservoir into the train pipe and brake cylinder. The brakes are thereby applied with a force at all times under the control of the operator, who may increase or decrease the force by moving the handle to the right or left, thereby letting compressed air into or out of the brake cylinder.

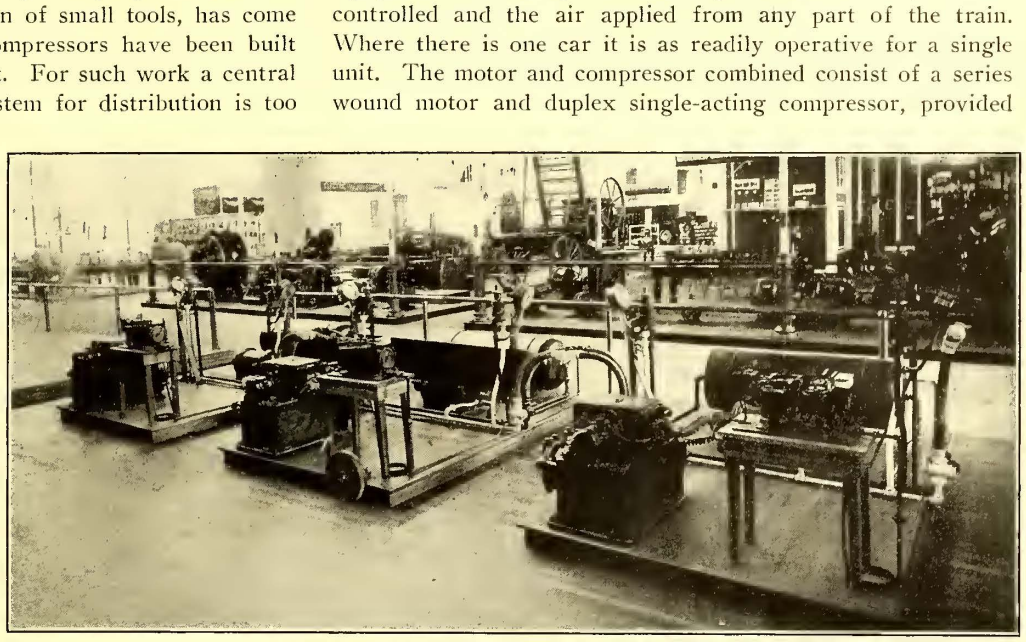


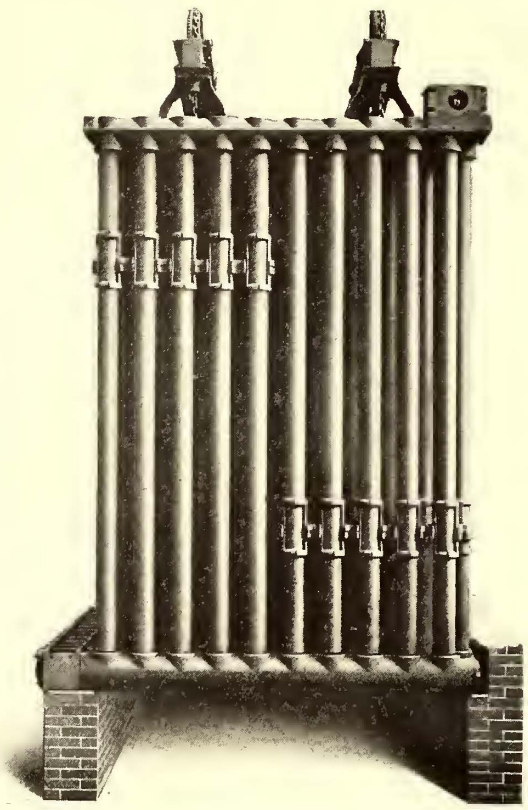
EXHIBIT OF THREE-CAR, MULTIPLE-UNIT AIR-BRAKE EQUIPMENT AT ST. LOUIS

There is also in the exhibit a practice, or school equipment, mounted on a car under-framing, which under-framing is open to view, and shows brake levers, cylinder, pull rods and the operation; in fact, of every part of the air-brake apparatus; thus making it plain and simple for the instruction of new motormen, or students in any capacity.

Besides a complete display of air-brake apparatus, the National Electric Company has a 400-kw engine type generator, 250 volts, 120 r. p. m., 1600 amps.; a type M. B. 150-kw 550-volt, 273-amp., 625 r. p. m. generator, driven by a 20-hp 220-volt; a 60-hp 500-volt motor-generating set, and a 2300-volt 150-kw 40-amp. three-phase, 60-cycle, 720-r. p. m. alternator, driven by a 24-hp 220-volt motor. In addition to the above, there are samples of armature coils and field coils, and a workman shows the method of the company for winding and assembling armatures and fields. In the Palace of Machinery the National Electric Company has a 1500-kw 6600-volt alternator, which furnishes power to operate the Cascade pumps.

ECONOMIZERS FOR RAILWAY POWER PLANTS

The type of economizer described and illustrated herewith is the product of the B. F. Sturtevant Company, of Boston, Mass., and has been installed in numerous power plants throughout the world. It is built in many sizes to meet the needs of different power plants. To make this flexibility possible the sections of this economizer contain an odd as well as an even number of pipes, from four to twelve inclusive; thus



STANDARD ECONOMIZER FOR BOILERS OF 350-HP AND ABOVE

four widths more are obtained than is possible by the use of sections containing only an even number of pipes. The piping arrangement is very important and divides economizers into two general classes.

A straight pipe economizer has all pipes arranged in straight rows running lengthwise of the economizer, with free intervening spaces. The hot gases in passing through these free spaces do not necessarily envelop the whole of each pipe—that is, between any two pipes laterally there are inert gases which have but little heat to deliver while the heat-laden gases pass quickly through the free longitudinal spaces, carrying away a considerable amount of heat that might be more efficiently utilized for heating the water in the pipes.

To utilize the maximum amount of heat in the gases the pipes of this economizer were designed to set staggered. The several sections are so arranged that the pipes of any one section stand longitudinally opposite the spaces between the pipes of the adjoining sections. Two sizes, similar in design, are constructed to meet all conditions—the standard and the pony types. The standard economizer, which is shown in the accompanying cut, is installed in conjunction with boilers of almost any capacity, but is more practical for boiler capacities of 350 hp and over. The pony type is more commonly used with plants of from 50 to 500 hp capacity.

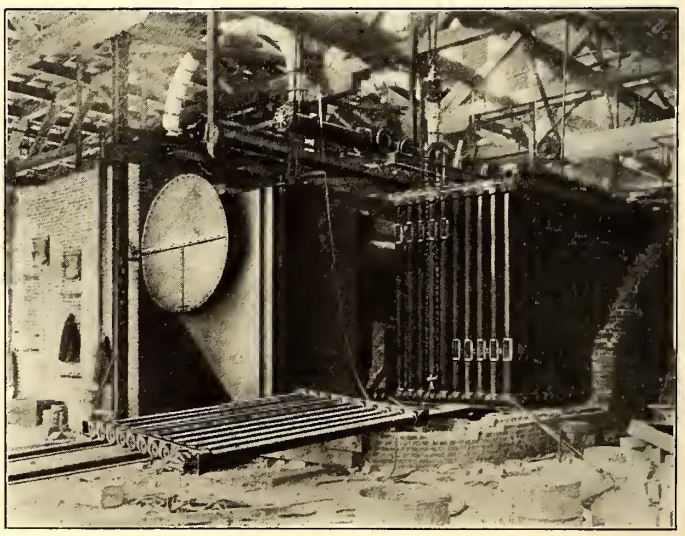
Patterns are carried to build this economizer with all its improvements as a straight pipe economizer; this is done to fulfill certain specifications which specify this type more from custom than from merits of design or economy. Although this type may be furnished, yet its use is not recommended, particularly as the saving effected is less.

The Sturtevant economizer is constructed with as few joints as is consistent with good design. To make the deteriorating effect resulting from the many joints as little as possible, each section is fitted into its wall box or branch pipe with tapered iron to iron joints. All pipes are cast on end and made of tough gray iron. Both ends are tapered and the pipes forced into the headers by hydraulic pressure, insuring perfectly tight joints. Any pipe can be easily removed and another put into its place without disturbing the other pipes, sections or enclosing walls, as the joints are made taper iron to iron without any packing or cement.

All caps have taper ground iron to iron joints and can be easily removed for cleaning. The caps directly over the pipes in the top headers are tapered, so that the greater the pressure in the economizer the more firmly the caps will set themselves. All the other caps are held in place by through bolts, which clamp them tightly to the headers. The bolts do not come into contact with the water, and therefore are not subject to deteriorating effects from rust and corrosion.

The headers are made of the best cast iron and designed with due regard to strength and durability. The bearing parts are properly machined and finished to gages, that the taper joints may be perfectly tight and the headers exact duplicates. As a substitute for the manifold header, with its branch pipes and numerous pipe joints subject to leakage and the necessary repairing, a special wall box was designed. This wall box, as its name implies, is placed in the front side wall of the economizer forming a part of the wall. The whole weight of the economizer, instead of being unevenly distributed on the foundations, is thus evenly distributed throughout the wall box surface. It is evident that with this arrangement perfect rigidity is assured.

The economizers are all provided with relief valves, which may be set at the desired steam pressure as a safeguard against using too much pressure in the economizers. By means of the blow-off valves the soft deposits may be blown out, or the economizers may be emptied, as desired. Cast-iron soot-pit



STANDARD ECONOMIZER WITH 1500-HP BOILERS

doors are provided as a means of cleaning out the soot chamber. Before leaving the works each economizer is tested by hydraulic pressure to 350 lbs. per square inch, and when erected to 250 lbs. pressure.

The cleaning mechanism of this economizer consists of an interchangeable bevel-edge triple-staggered scraper, with lifter rods and guides operated by an improved pulley motion and positive reversing wheel. The cast-iron scraper bars with tapered slots which receive the tapered lugs on the scrapers cause the scrapers to scrape pipes on the upward movement and clear them on the downward movement. The guards keep

scraper lugs in the slots. The scrapers, scraper bars and guards are easily removed and replaced if necessary.

The foundations are usually of brick, but sometimes of structural steel; in either case they must be strong and rigid. The form of wall box previously mentioned assures perfect rigidity. With brick foundations a chamber is formed under the economizer in which soot accumulates. The inlet and outlet flues may be of brick or sheet iron. When of iron it is customary to build the side casings of iron sheets, placed about an inch apart, which are filled in with a non-conducting material.

THE PRIVATE CAR "MABEL" AT ST. LOUIS

The accompanying illustrations show the interior and exterior appearance of the private car "Mabel," recently built by the St. Louis Car Company for the Lewis Publishing Company, publishers of the "Woman's Magazine." This car is to be used during the World's Fair period to entertain visitors and friends. It is made of a gage to operate over the St. Louis Transit Company's tracks. The length of this car over all is 45 ft., and the body alone 43 ft. 8 ins. The width over all is 8 ft. 4 ins. The height from the bottom of the sill to the top of the roof is 9 ft. 3 ins., and from the rail to the top of the roof 12 ft. 4 ins. The bottom construction is of combined steel and wood. The interior of the car is divided into a buffet and smoking compartment and a parlor compartment, all compartments being divided by the center vestibule, which forms the entrance. The buffet compartment has a sink and combination table and refrigerator, with a locker on top. There is also a china, glass and linen locker. The toilet room has a washstand and a locker. The entrance to the toilet room is from the center vestibule only.

The ceiling in the buffet is pea green; the chairs are of cane. The portiere and carpet are in harmony with the ceiling. The parlor compartment is very beautifully furnished, and has in the center a handsomely carved and upholstered settee. The upholstery is in light yellow fabrics, to match the ceiling, curtains, portieres and other furniture. A handsome desk is located near the vestibule entrance. The inside finish of the

THE PRIVATE CAR "MABEL" COMPLETELY EQUIPPED

entire car is of the finest African mahogany, with neat and artistic marquetry designs. The roof is of the Empire type. The ventilator lights are Colonial pattern, with opalesent iridescent glass. The upper sash, which are also of the Colonial pattern, are stationary, and are filled with beveled plate glass, with a center piece of art glass. The lower sash, which are filled with plate glass, drop into pockets covered by flaps.

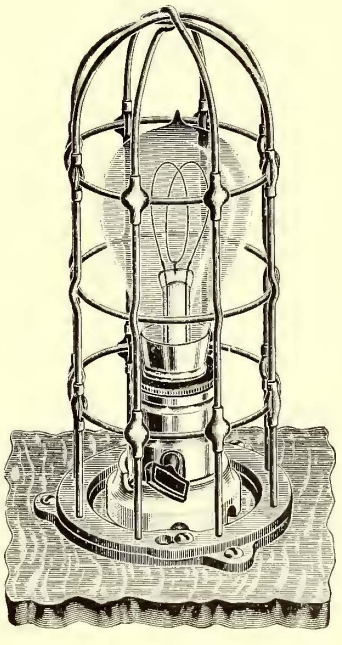
Particular attention is called to the lighting of this car, as it is of unusual beauty and efficiency. In the center of each compartment is an arc light of the car builder's design. Besides the arc lights in each compartment and in the vestibule, there

INTERIOR OF PRIVATE CAR

is a row of frosted incandescent lamps in handsome short pendants along each side of the deck sill. This distribution of incandescent lamps gives a uniform light in all parts of the car, and the use of frosted bulbs avoids all painful glare. The car is mounted on the St. Louis Car Company's short wheel base No. 47 truck.

NEW STATIONARY LAMP GUARD

The stationary lamp guard, as shown in the accompanying illustration, is manufactured by Porter & Berg, of Chicago,



STATIONARY LAMP GUARD

and although it has but recently been put on the market, they report a rapidly increasing demand for this article among electric railways.

The guard consists of a strong wire cage, heavily tinned to prevent rusting, mounted on a brass plate, and a wall plate,

which is provided with four screws for the purpose of permanently attaching it to the wall or the ceiling over the lamp socket. The cage can be attached or removed from the wall plate by the means of a bayonet-locking device. The guard is made for use with 16-cp lamps only, and will fit over any wall socket or receptacle.

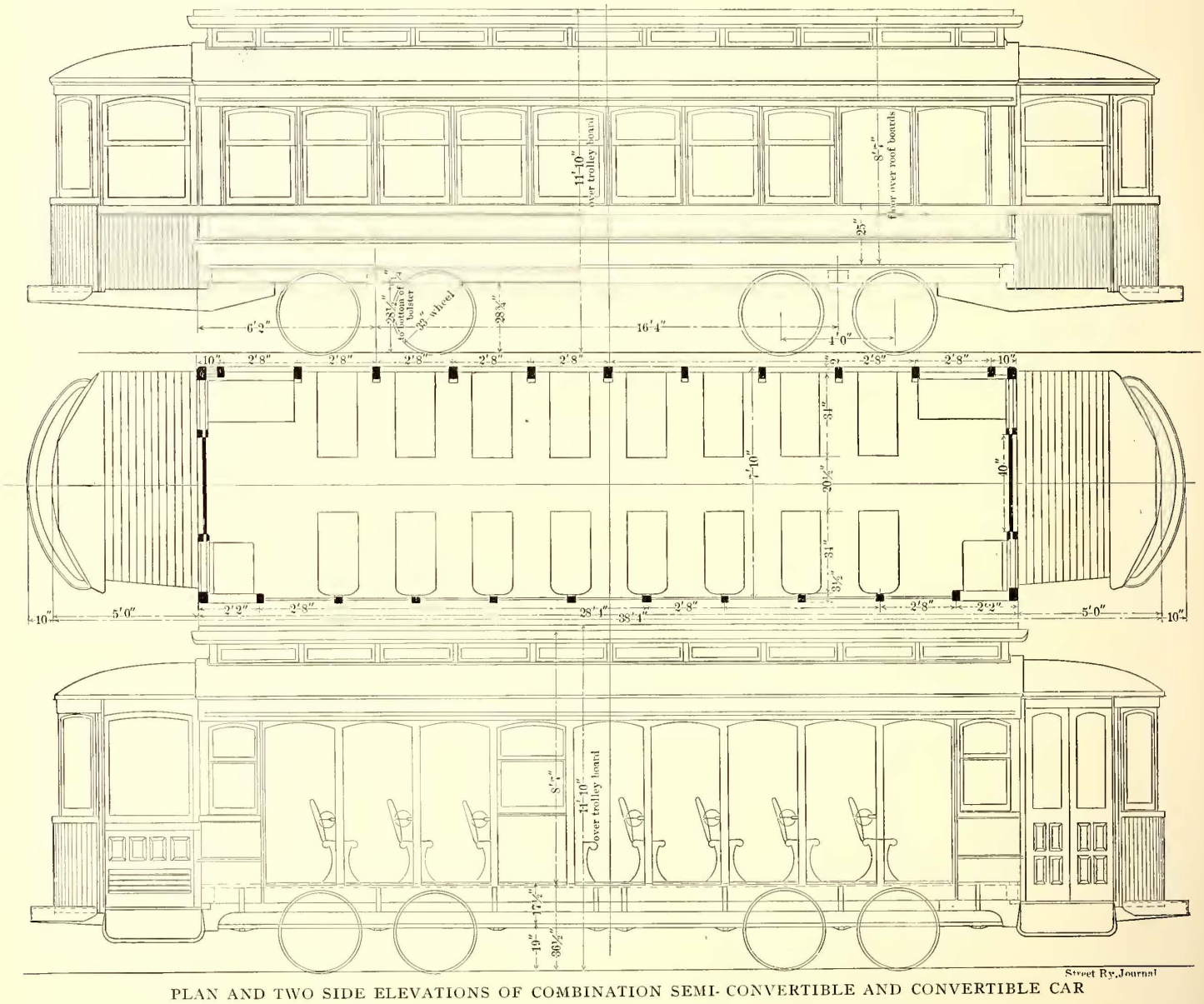
There are a number of places in car shops, car pits, car houses and stations where a guard of this kind may be used to good advantage, as they not only prevent the breaking of lamps, but also their being stolen or removed from their proper place.

A REMARKABLE COMBINATION SEMI-CONVERTIBLE AND CONVERTIBLE CAR FOR CITY SERVICE

A remarkable type of car has just been finished at the shops of the J. G. Brill Company for the Montreal Street Railway Company. It combines the well-known patented convertible and semi-convertible systems of the builder, and is unusually interesting, not only because of its being the first to have one side convertible and the other semi-convertible, but also because it is particularly suited to the operating conditions of Montreal—conditions which are duplicated in many of our large cities. Loops at the terminals provide for the cars running in one direction, therefore the entrances are permitted to be all on one side, having one side closed and solidly paneled. This arrangement carries with it the advantage of not requiring a running board on one side, and thereby increasing the space between passing cars—a most valuable feature in connection with lines operating on narrow streets. It also prevents passengers entering or leaving the car on that side, which many are prone to do when there is only a guard rail.

The short summers of Montreal, with cool evenings, and rapid changes of temperature during spring and fall, limit the usefulness of the ordinary type of open car, while, with the new arrangement, complete provision is made for weather changes, and the expense of keeping a set of summers cars, which can only be used for a few months of each year, is avoided.

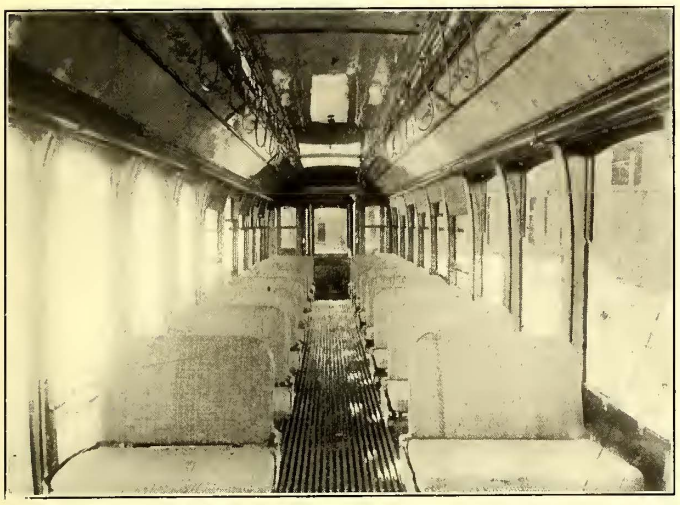
The window system of both sides of the car is identical. The lower sashes have trunnions at the corners, which move in all metal runways, one to each post, and on being raised this sash carries the upper sash with it into pockets in the side roofs. On the right side of the car, in addition to the sashes



PLAN AND TWO SIDE ELEVATIONS OF COMBINATION SEMI-CONVERTIBLE AND CONVERTIBLE CAR

sliding into the roof pockets, flexible metal panels are arranged to slide into the same pockets, so that in a few minutes this side of the car may be made entirely open. A running board of the usual type is furnished, which with the platform steps gives entrance at any point along the side. Six years' use in cold climates have proved very conclusively that these flexible panels are as efficient non-conductors of heat and cold as the paneled walls of the ordinary type of car. By staggering the side posts the seats on the semi-convertible side are brought between posts, with the ends against the side line, thus adding several inches to the width of the aisle.

The window sill for the semi-convertible side is provided with arm rests of the builder's type, as the top of the sills are

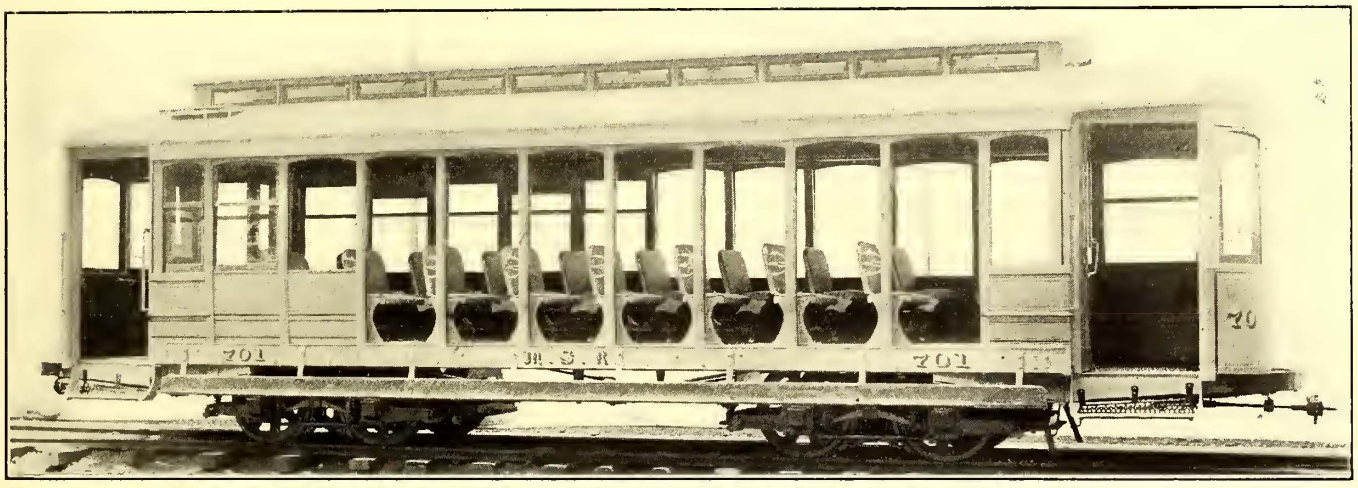


INTERIOR OF COMBINATION CONVERTIBLE AND SEMI-CONVERTIBLE CAR

24⅝ ins. from the floor, too low to be reached by the elbows of adult passengers. The seats are 34 ins. long, and the aisle 20½ ins. wide, the width of the car over the posts being 7 ft. 10 ins. Single seats are used at the corners of the convertible side and longitudinal double seats at the opposite side. The total seating capacity of the car is thirty-eight. Instead of using grab handles on the posts of the convertible side, the brackets which close the space between the seat back and the posts are formed to serve that purpose.

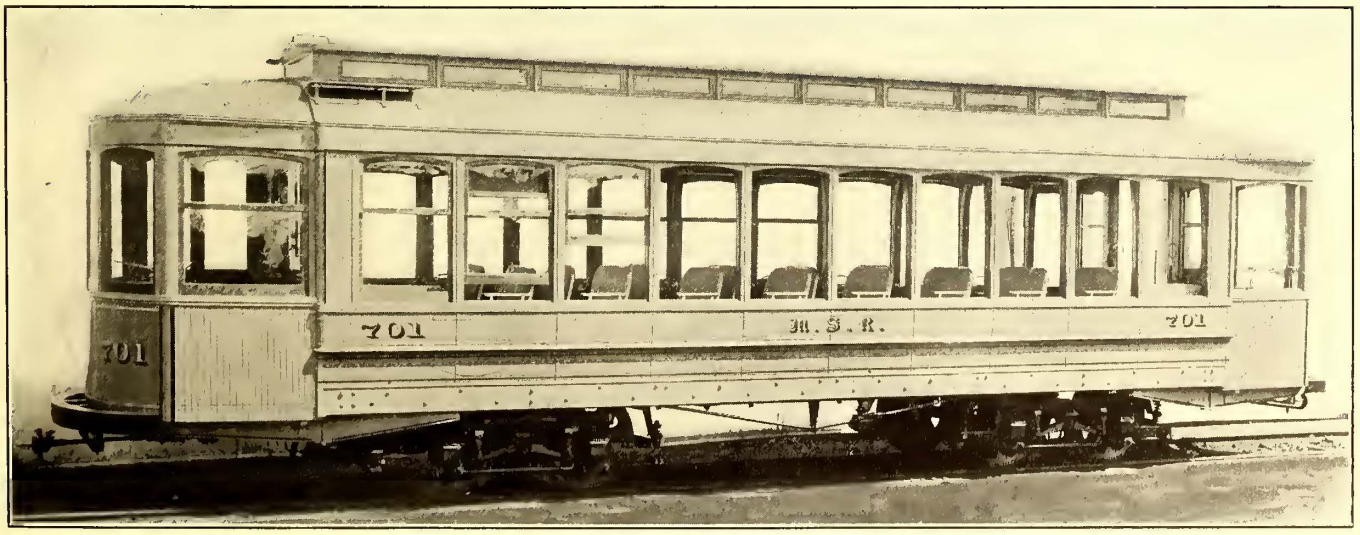
The sides of the vestibule opposite the entrance are furnished with extra large windows, both sashes of which drop into pockets in the wainscoating. The three sashes in the end of the vestibule are composed of single lights, and also have pockets into which they may be dropped. Curtains at the convertible side may be drawn completely to the floor, so that in case of a light shower which promises to be of short duration, ample protection is furnished without drawing down panels and sashes. The interior is handsomely finished in cherry, with ceilings of decorated birch. "Dumpit" sand boxes, angle-iron bumpers, "Dedenda" gongs, radial draw bars, ratchet brake handles, round corner seat end panels and other of the builder's specialties are included in the furnishing of the car, which is mounted on Brill No. 27-G trucks.

The construction throughout is very substantial, including double-corner posts at each side, 3¾ ins. thick. The side posts of the convertible side are 3⅜ ins. thick., and on the semi-convertible side, 3¾ ins. The sweep of the posts is 1¾ ins. Sill plates 8 ins. x ⅝ in. are used on the outside of the side sills. The size of the side sills is 4¾ ins. x 7 ins., and of the end sills, 5¼ ins. x 7 ins. The length over the end panels is 28 ft. 4 ins., and over the vestibules, 38 ft. 4 ins. The width over the sills and the panels is 7 ft. 7½ ins., and over the posts at belt, 7 ft. 10 ins. Other dimensions are given in the illustration.



VIEW OF COMBINATION CAR, ILLUSTRATING THE FULL CONVERTIBLE FEATURE

The J. G. Brill Company is building a car for Cleveland



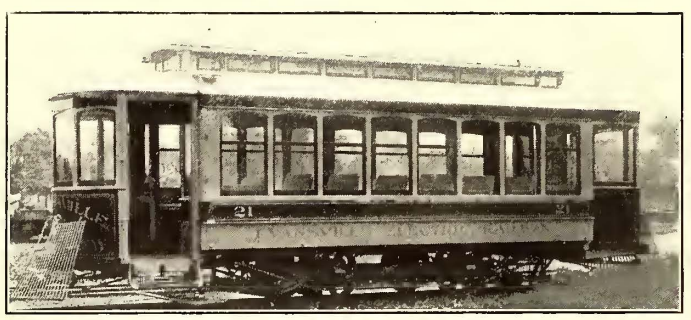
APPEARANCE OF THE COMBINATION CAR, SHOWING THE SEMI-CONVERTIBLE FEATURE

similar to the one described, but with a center vestibule. It is confidently believed that the type formed by the combination of these thoroughly tried systems will be generally accepted as one most suitable for city where the cars may be run in one direction. Reports of the operation of the car in Montreal and Cleveland will receive wide-spread attention.

SEMI-CONVERTIBLE CARS FOR EVANSVILLE, IND.

The Evansville Electric Railway Company, of Evansville, Ind., has lately put on its lines four semi-convertible single-truck cars of the Brill type, built by the G. C. Kuhlman Car Company, Collinwood, Ohio. The railway company operates a city and suburban system, with more than 30 miles of trackage and about one hundred cars. The company controls a popular amusement park in the suburbs, and the lines reach three other parks, which attract large crowds during the season. Evansville is the second city in size in the State, and is the commercial center of Southwestern Indiana.

The cars are vestibuled at both ends, with entrances at one side, an unusual style of vestibule for cars of this length. All



SEMI-CONVERTIBLE CAR USED IN EVANSVILLE, IND.

the sashes in the vestibules are arranged to drop into pockets, while the windows in the side of the car are raised into pockets in the side roofs when not in use. The car is seated for thirty-two passengers, the seats being 34 ins. long and of the step-over type. The interior is finished in Mexican mahogany, and the ceilings are three-ply birch veneer, neatly decorated. The two windows opened at the rear of the car, shown in the picture, give an idea of the lowness of the sides. The large windows not only give an open appearance to the car in warm weather, when the windows are raised into the roof pockets, but also make it very bright and attractive in winter.

The general dimensions of the cars are as follows: Length over bodies, 20 ft. 8 ins., and over crown pieces, 30 ft. 1 in. From end panel over crown pieces, 4 ft. ½ in.; width over sills, 7 ft. 9½ ins., and over post at belt, 8 ft.; thickness of corner posts, 3¾ ins., and side, 2¾ ins.; sweep of posts, 1¾ ins. The side sills are 3¾ ins. x 5 ins., and the wheel pieces, 4¼ ins. x 5 ins., plated with 6-in. x 3½-in. angle iron. The end sills are 3¾ ins. x 6⅝ ins. The cars are equipped with No. 21-E trucks, angle-iron bumpers, radial draw bars, conductor gongs and other Brill specialties. The trucks have a wheel base of 7 ft., 33-in. wheels and 4-in. axles.

ADVERTISING ON THE NEW HAMPSHIRE TRACTION COMPANY'S SYSTEM

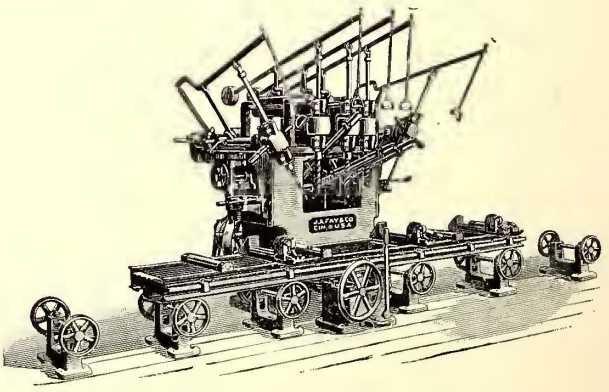
The New Hampshire Traction Company is issuing a number of attractive circulars to stimulate traffic, including a small semi-weekly bulletin, which is issued on Wednesdays and Saturdays. The bulletin contains short sketches of street railway life, programmes of the entertainments at the park theatre, etc. A feature of Children's Day at the park, on July 26, was the distribution of free tickets to the merry-go-round to the first 1000 children entering the park on that day. This department of the company's business is in charge of E. P. Hulse.

OHIO SINK HOLE FILLED AT LAST.

C. A. Alderman, chief engineer of the Great Northern Construction Company, of Springfield, Ohio, has succeeded in filling the sink hole on the line of the Urbana, Bellefontaine & Northern Railway. This hole has been giving the company an immense amount of trouble during the past year, and the progress of the work has been referred to in these columns on several occasions. Mr. Alderman states that the company is now running cars over the place, and the work seems to be standing up all right, and he hopes there will be no further trouble with it. The line crosses a marsh which is about 1600 ft. long and about 250 ft. of track sunk. Soundings in this portion showed 18 ft. of peet bog, while the balance ranged from that to 10 ft. of peet bog. Last fall, when the road was built, the company dumped about 1000 yards of gravel and broken stone at this point, but apparently no impression was made. Some work was done this spring, but it was ineffectual on account of rainy weather, which turned the marsh into a pond. Lately a determined effort was made to fill up the place, and it seems to have been effectual. Over 9 acres of brush were put in for a foundation, and 6000 yards of gravel and stone were filled in. The filling has resulted in an extensive upheaval of earth all around the place. The Big Four (steam) tracks, which parallel the tracks of the electric line, were laid fifty years ago under similar conditions, and it required several years to get the road into shape at this point.

VERTICAL CAR BORER

An improved machine especially adapted for heavy wood boring in car shops, made by the J. A. Fay & Egan Company, of Cincinnati, Ohio, is shown in the accompanying cut. The capacity of the machine for boring large holes has been greatly increased, and every convenience has been incorporated to do the boring easily and quickly. The spindles are of improved construction. The outside boring cones have angular adjustment of 45 degs. inside and 60 degs. outside. Material 14 ins. square can be bored; the spindles will travel 13 ins. and the vertical movement of end spindle frames is 8 ins. The outside spindles can be instantly locked at any angle desired; there is no strain, and short bits can be used with facility.



FIVE-SPINDLE VERTICAL CAR BORER

The table is a steel traveling carriage of any length desired, is provided with necessary stops, and has a device for firmly clamping the stock. It has rack and pinion feed under instant control of the operator, and has connections for making fine adjustments. When desired a stationary table 9¼ ft. long, with nine rolls, can be furnished.

A supplemental under-boring spindle especially useful for under-boring can be furnished, boring independently or at the same time as the upper spindle, and short bits can be used to advantage. This improvement will prove very beneficial to all those who have this class of work to do.

LONDON LETTER

[*From Our Regular Correspondent.*]

Perhaps the most important event which has taken place in tramway circles during the past month has been the struggle in the House of Commons on the question of granting compulsory powers to the Tyneside Tramways Company for parts of the lines of the Newcastle Corporation. This has, of course, brought up the whole subject of whether companies operating urban lines outside the boundaries of the city will be permitted to run cars into the center of adjacent cities. One or two examples of this kind have already fortunately been made, notably that of the Liverpool Corporation with the South Lancashire Tramways Company. The present struggle has been brought up by the attempt of the Tyneside Tramways Company to compel the Newcastle Corporation to allow it to run certain of its cars into the center of Newcastle, which would appear to all who look at this question from a business point of view, and not from one of close municipalism, to be a most sensible proposition. Meetings of municipal tramway managers have been held in many of the cities, and a general meeting has been held in London with the purpose of devising means to defeat the bill in Parliament. A most vigorous discussion took place in the House of Commons, which resulted in the House deciding to send the bill back to the select committee, which virtually means a victory for the municipalities for the present. It would appear as if the Board of Trade was in favor of compulsory powers being granted companies for running on corporation systems, and it would seem that there would be little doubt that in future a bill of a similar character will be passed. While the writer does not wish to detract in the slightest degree from the magnificent work which municipalities have done in Great Britain in building up the splendid system of tramways which nearly every municipality in Great Britain now owns, a large tendency has developed to pursue a "dog in the manger" policy. Instead of trying to accommodate the public by making a sensible business arrangement with outside companies who own running powers in the vicinity by which their cars could be run interconnecting, they have pursued a most exclusive policy, and in almost every case have prevented that inter-communication which is absolutely essential to the success of tramway development. Perhaps one of the most unfortunate causes of such a bitter struggle between company and municipality is that most of the companies are controlled by one gigantic monopoly, whose policy has certainly not endeared it to the municipalities. If the company, instead of using sledge-hammer blows to force itself into the territories of municipalities, would endeavor to appease the municipalities, and show them how their own receipts could be increased by entering into arrangements with them, just as in the case of the Liverpool and South Lancashire Tramways Company, an amicable system of working could readily be arrived at.

After all, it is a question of business management, and one must never lose sight of the fact that tramways are put down for the use of the public, and not for the aggrandizement of municipal officials. One cannot stop the wheels of progress, and it will most assuredly come in future years that a man when he boards a tramway car outside a large city will not be compelled to change his car when he comes to the municipal boundary. It behooves municipal authorities to put off a certain amount of their exclusive policy, take a wider view of the situation, and commence business negotiations with the outlying tramway companies, or else they will undoubtedly find themselves in a position some day when these tramway companies will obtain compulsory powers which will prove very unpleasant for them.

It has been broadly hinted for some time that the working of the electrified portion of the London County Council Tramways, in the southern area of London, has resulted in a deficit, and the report recently presented to the committee amply bears out this surmise. It appears that there is a deficit of £8,283, while on the northern system, which is still operated by horses and under company management, there is a profit of £27,657. London County Council officials explain naturally enough that most of this deficit has been caused by the disruption of traffic owing to the conversion of the system to electricity. Too great stress need not be put upon these results, however, although the whole tramway industry of Great Britain is much interested in them. Next year's report ought to show clearly whether the Council can make a substantial profit or not on the electrified portions. It would appear also in view of this deficit and the already large capital involved in the tramways, that no further conversion of any magnitude will take place at present, the Council being now willing to rest on its oars and await results, and, it is to be hoped, practice such economics as are possible. Such work as it intends doing in the near future will be in the way of connections from one point to another, so that the system already electrified may be complete in itself.

The ninth annual convention of the Incorporated Municipal Electrical Association was this year held in the Midlands, Derby, Nottingham and Sheffield having been selected as the cities in which the meeting would be held, T. P. Wilmshurst, the president of the association, being electrical engineer for the Derby Corporation, and that city being elected as the official place of meeting. Six papers were provided, the most important of which, from a tramway point of view, being that of C. E. C. Shawfield, of Wolverhampton on surface contact tramways, published in the Street Railway Journal for July 9. This paper elicited an important discussion, and brought out some valuable information from Mr. Wetmore, of the Lorain Company, who made the Wolverhampton installation. In the afternoon the mayor and corporation of Derby invited the delegates to an excursion by special train to Rowsley, from which point brakes were provided to take the members of the party either to Chatsworth or Haddon Hall, both parties uniting again at Matlock Bath, where suitable refreshments were provided. The second day of the meeting was held at Nottingham, S. L. Pearce, of Manchester, reading an important paper on polyphase sub-stations, which, however, was much of a description of the work coming under his own immediate supervision. The paper was much criticised by other speakers. The Bristol switchboard fire was the subject of the next paper, and it would appear as if there were as much uncertainty as ever as to what really caused the fire. The delegates were invited in the afternoon to visit the electric power house and the tramways department car sheds, and Mr. Madgen, managing director of the Brush Electrical Engineering Company, invited a large party of the delegates to visit its works at Loughborough, where a very pleasant afternoon was spent in inspecting a large amount of work which the Brush Company has at present on hand for various corporations and tramway companies. The manufacture of steam turbines seemed to attract visitors most, as this company has already on hand quite a number of steam turbines which it is manufacturing under a special license from Mr. Parsons. Considerable interest was also shown in the new engines which the Brush Company had recently developed, and the car building department and the manufacture of Brush trucks also attracted great attention. After tea, provided in one of the spacious rooms of the office, the party was conducted back to Nottingham in ample time to dress for the annual dinner in the evening. This dinner was held in Nottingham, but from a social point of view did not appear to be much of a success, and the smoking concert after the dinner collapsed entirely.

The third day of the convention was held in Sheffield, and "Boiler Economies" were indulged in, after which there was a councillors' debate upon the financial aspect of electric lighting installations. Most of the members afterward accepted Messrs. Hadfield's kind invitation to visit their works, who, as usual, provided a most handsome entertainment for the delegates. About two hours were consumed in walking about the extensive works, the visit commencing with the inspection of a 4⅛-in. Krupp gun, which afterward fired two projectiles through hard-face armored plate. The inevitable photograph was afterward taken, and after seeing the usual work of tramway points and crossings, and all the varied manufactures for which Hadfields are famous, the delegates gathered in the tea room and were entertained to a most sumptuous tea. Mr. Hadfield himself was present on this occasion, and welcomed the visitors to the works. He stated that though it had been necessary some years ago to send to America for the class of work they were now making, they were now, and had been for some years, in a position which made it totally unnecessary to send to America for any work connected with tramway construction, and that they were ready to undertake anything that any engineer connected with tramway construction work could possibly specify.

The annual general meeting of the association was held the following day at Derby, when the new officers were duly elected, as follows: Officers for 1905—President, F. A. Newington, Edinburgh; vice-presidents, R. A. Chattock, Birmingham, and S. E. Fedden, Sheffield.

The Maidstone Tramways have just been successfully completed by Messrs. Dick, Kerr & Company, Ltd. The contract included the permanent way, overhead equipment, cars, car shed and an addition to the switchboard. The route length of the permanent way is just over 2 miles, and is of single track, with passing places throughout. The gage of the line is 3 ft. 6 ins. The form of construction adopted is as follows: The portion of the track within the town proper is paved with 9-in. x 3-in. hard wood blocks, and for a part of the length, where the gradient approaches 1 in 15, the track has been paved with 5-in. x 4-in. granite setts.

The remainder of the track, amounting to about a mile in the outlying portion of the town, where the traffic is slight, has been paved with a serration of granite on either side of the rails, with macadam filling in between, this form of construction lending itself particularly well to roads subjected to light traffic, and is of course particularly favorable upon grounds of economy. In connection with the granite serration and macadam paving, the concrete bed has been put in to the full width of the tramway formation to provide for paving the track throughout at a later date, should the corporation decide to do so.

The rails used are the British standard No. 2 section, weighing 95 lbs. per yard. The joints are of the Dicker type, fixed by 6-in. bolts, fitted with the Eureka lock. Tie-bars are spaced at 6-ft. centers, and are of the patent rolled weldless type. The track has been bonded throughout with 4/0 Neptune bonds.

The car shed has been built to accommodate six double-deck cars. The main shed proper contains pit accommodation for four cars.

The overhead equipment is on the span wire system for a pressure of 500 volts, and is of a particularly neat and rigid construction. Each of the six cars has a seating capacity of forty-eight persons, twenty-two inside and twenty-six outside, and is supplied with a complete electrical equipment. The motors are Dick, Kerr's standard 25-B type.

The Exeter City Council has accepted the tender of Dick, Kerr & Company, of London, for practically the whole of the work in connection with its tramways which it anticipates commencing immediately. A large number of tenders were sent in, but Dick, Kerr & Company appear to have carried off the whole of the work, including construction of the track, overhead equipment, the conduits for underground cables, which will, of course, be sub-let, and the supply of twelve electric cars. The price for the track construction is £29,227; for the overhead equipment, £6,341; for the underground cables, £2,897, and for the electric cars, £6,933, the total for the whole order being £42,055 17s. 9d.

The Nottingham City Council has decided to seek Parliamentary powers to carry out a further large extension of the city's electric tramway system, upon which, up to the present, over £600,000 have been spent. The extension is to meet the needs of a district in the eastern part of the city, which is becoming increasingly populous, and it is estimated to cost £110,000. The lines will involve the demolition of much old and insanitary property, which has long been condenmed.

Hearing that several railway companies were having directly driven petrol cars designed for their branch and suburban services, the corporation of Perth determined to try a tramway car built on similar lines before facing such an expenditure as electricity would need. It was therefore decided to get a tramway car from Messrs. Stirlings, Limited, of Granton Harbour, Edinburgh, driven direct from a petrol engine. This vehicle is built for the narrow gage (3 ft. 6 ins.) of the Perth lines, and seats forty passengers, eighteen inside and twenty-two out. The engine is the same as is used in Messrs. Stirlings' omnibuses and lorries of the larger type, being a four-cylinder one of 20-brake hp. As the Perth lines have a number of bad curves, the speed limit will be 10 miles an hour. Powerful hand brakes are provided, acting on all the wheels. The car is well finished, and looks very neat. The roof is of the double-deck type, and gives plenty of room inside. Curtains are fitted, and stained glass used in the upper windows. Passengers can communicate with the guard and driver from their seats. The exterior is painted in pale yellow, with deep red panels and gold lettering, "Perth Corporation Tramways."

The full service of electric trains to be run on the 37 miles of railway in the neighborhood of Newcastle, upon the conversion of which from steam to electric traction the North-Eastern Railway Company has been engaged for the past eighteen months, was commenced last month. Sir George Gibb, the general manager of the North-Eastern, has thus made good the promise he gave when the first section of these lines was opened for electric working in April last—namely, that the whole work should be completed by June 30. In the time tables of the company for July to September, which have just been published, four and one-half pages are taken up with the announcements of the electric trains. There is to be a circular service running every half hour between Newcastle (Central) and Newcastle (New Bridge Street), via Wallsend, Tynemouth and Monkseaton, in addition to the local services between the Central Station, Newcastle, and Monkseaton, and between Benton and New Bridge Street, Newcastle. Then hourly trains are to be run by electricity between Newcastle (Central) and Tynemouth over the Riverside branch, and, further, there is to be a service of express electric trains between Newcastle and Monkseaton, Whitley Bay and Tynemouth, via Backworth, covering the journey to the coast in twenty minutes.

Doubtless the trains will be made more frequent when the initial difficulties of starting the new system of working have been overcome; but it is highly creditable to the railway company and to the electrical contractors, the British Thomson-Houston Company, of Rugby, that they have been able to bring the whole of the electrified lines into use within so short a time after the conversion was decided upon.

A contract has just been entered into between the Count Ramon de Berenguer, of Gerona, Spain, and W. T. McCaskey, York House, Norfolk Street, Strand, London, England, under the terms of which a company with the title of Sociedad Hidro-Electrica Del Ter is to be formed, to develop a water-power of 1500 hp on the River Ter, Province of Gerona, Spain, and to distribute the force for lighting and other industrial purposes to Gerona, the capital of the province, San Feliu de Guixols, Palamos and other towns in the vicinity. The capital of the company is to be 3,000,000 pesetas, being 1,500,000 pesetas of series "A," or preferred shares, and 1,500,000 pesetas of series "B," or common shares. All the machinery, apparatus and supplies will be purchased by W. T. McCaskey, York House, London.

A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

The great cutting made in front of the Paris Opera House to provide the Opera station for the Paris Metropolitan Railway has at last, after about a year of obstruction, been covered, and the interior works for the new station are well advanced. It will be remembered that this station comprises some three levels, each level for a separate line running E.-W., N.-W. to S.-E. and NE.-SW. The top story only is as yet completed, being for the new No. 3 line (Courcelles-Opera). The earth was transported by tunnels as far as the Ouest Railway station of St. Lazare, and there placed on the ordinary cars. The heavy traffic on the streets under which this line runs made necessary this manner of disposing of the displaced material. Over 300,000 tons of earth and limestone were in this way removed in ten months, and Paris was ignorant of the work in hand.

The Metropolitan Railway Company is still looking for a reliable insulator for its third rail. The present insulator has given rise to many slight accidents, especially during the fall of 1903. The insulator consists of ambroine, the thickness and quantity of which is too small for the current, especially when exposed to the weather on the exterior lines. The third rail is rather heavy, about 100 lbs. per yard (50 kg per meter). It is said that the current losses from defective insulators amounts to several hundred kilowatts.

The order for motor and trail-cars for the Underground Electric Railways Company, of London (District Railway, Mr. Yerkes' group), was placed in France entirely on the question of price. The joinery work is considerably cheaper in France than in England, even when taking the transportation charges into account.

It appears that accidents to workmen are quite numerous on the new third-rail extension of the Paris-Orleans Railway. Every day on the average a man is severely shocked, and this is undoubtedly due to the negligence of the men alone, as is clearly proved. The new locomotives have been run as high as 100 kms per hour, with satisfactory results.

The immense facilities which Italy offers for exploitation of small rivers and mountain falls, of which there is an abundance everywhere, have long been pointed out in these columns. A new company has just been formed to undertake the harnessing of the river Adda, in the state of Trezzo, for industrial uses. The capital is some 2,000,000 lire ($400,000), and is subscribed in great part by the Milan Edison Company and the Crespi family.

The Ouest Railway Company seems inclined to consider the electric traction for the St. Germain line, 12 miles from Paris. There are many interests yet to be reconciled before the scheme will make much headway.

Some statements have been made to the effect that the transformer of 2000 kw now at Niagara is the largest in the world. It would appear that this is not the case. There is now in course of erection for the Société Electro-chimique de la Romanche at Livet, near Grenoble, six transformers, each of 2500 kw output. They are built by Brown-Boveri & Cie., of Baden, and are oil insulated, water cooled. Three of them are destined to raise the generator voltage of 3500 volts to 32,500 volts, and the other three, installed at Grenoble, reduce 32,500 volts to 5000 volts.

Tests are still being carried out by the city authorities on a new form of paving, consisting of the usual (Travers) asphalt, in which is mixed a composition, mostly of powdered granite.

The new paving is said to be non-slipping, very resistant to wear, and supports an intense traffic. It is to be hoped that it will become standard in place of the deplorable wood blocks, which give such poor results along the main arteries of traffic, especially where railways run.

The general situation in France for electrical matters is improving fast, and now would appear to be a fitting time for American representation. The needs of the market should be studied, and supply material should be able to make a good showing when properly pushed. M. V.

NOTES FROM GERMANY

[*From Our Regular German Correspondent.*]

Within recent years German street railway companies have not been annoyed as much as they formerly were by the importunities of the inventors of impracticable life-saving devices, such as fenders and wheel guards. It is worth noting that the great majority of such inventors is composed of non-technical men, probably because no other mechanical contrivance is so familiar to the general public as a street car. These laymen inventors usually expect that they will make a large fortune by some single invention, and as they fail to realize the practical difficulties in the way, their efforts go no further than wasting considerable money and condemning the railways for refusing to adopt their "positively life-saving" apparatus. There are, unfortunately, no statistics available relative to the useful life of fender patents, but it is known that to-day there are at least a thousand of them in existence, and very few of their inventors have ever recovered their expenses. Statistics are available, however, regarding the life of all patents issued in Germany, from which it is plain that only a very small fraction of the patents issued attain commercial success.

The average age of all German patents since the founding of the Patent Office is only 4.7 years. Of the 106,682 applications granted between 1889 and 1903 inclusive, 31,466, or 30.6 per cent, had not expired. Of these, 14,217 were in their first to third year, 10,561 in their fourth to sixth year, 3482 in their seventh to ninth year, 2085 in their tenth to twelfth year, and 1121 in their thirteenth to fifteenth year, the latter year involving the expiration of the patent. In 1903 the annual fees required in Germany were paid for only 138 of the patents issued in 1889, and of this number 29 must be classified under "Dyestuffs" and 10 under "Electrotechnic." No other classification had more than 6, and in 40 classes every patent had been permitted to go by default before the fifteenth year! In all, patent fees for the fifteenth year were paid on 1340 patents. As 50,780 applications had been granted by the end of 1889, it is evident that only 2.6 per cent attained the maximum legal life. Despite the innumerable fender patents, not more than ten of those over five years old were considered worthy of further protection. Would-be fender inventors may well draw a lesson from these figures.

The report for 1903 on the electric railways of Saxony has recently been issued by the officials of that kingdom, and shows that while there were no important extensions there was an increase in cars, passengers and revenue, and a decrease in accidents. The length of all street railways and cable railways is given as 408.4 km (245 miles), an increase of 9 km (5.4 miles) over 1902. The rolling stock comprised 1081 motor cars and 519 trailers, the first covering 45,600,000 car-km (27,360,000 car-miles), and the latter 9,000,000 car-km (5,400,000 car-miles). The number of passengers carried was 167,400,000, against 154,000,000 in 1902. The lines of Dresden and vicinity, embracing 130 km (78 miles), carried 77,000,000 passengers, and those in and about Leipzig 69,000,000 on lines covering 112 km (67.2 miles.) The accidents numbered 330, or 23 less than in 1902. Of these, 273 were injured and 16 killed in 228 collisions. Carelessness in entering and leaving cars caused injuries to 87 passengers. The ratio of passengers carried to passengers injured was 1,000,000 to 1.63.

The use of self-contained motor cars on light railways, instead of the customary steam-drawn trains, is meeting with increasing favor. While this will open up a very promising field for electric traction, the supporters of the latter must reckon with the competition of steam and gasoline motor cars which have been developed recently to a high state of efficiency. In this connection the figures which some railways have published relative to motor car operation deserve the serious attention of the makers of electric railway apparatus. A Hungarian light railway gives the following data obtained in 1903:

The motor cars consisted of two steam cars (de Dion-Bouton) and one gasoline car (Daimler.) The performance of each car was as follows: Speed, when traveling alone 40 km (24 miles) an hour; with three trailers weighing six tons, 30 km (18 miles) an hour; with freight cars weighing 26.4 tons, 15 km (9 miles) an hour. The three cars traveled 93,189 car-km (55,914 car-miles) in 1903, carried 140,350 passengers and brought in a revenue of 71,695 kroner ($17,386.) The operating expenses with steam cars proved to be 21.29 heller per km (8.6 cents per mile.) The cost of power (exclusive of lighting) was 7 heller per km (2.8 cents per mile), and of repairs 4.4 heller (1.8 cents.) The operating expenses when using the gasoline car were 22.05 heller per km (8.9 cents per mile), power costing 9.8 heller per km (3.95 cents per mile), and repairs 4.5 heller (1.8 cents.) It is expected that the cost of gasoline can be brought down to 5.7 heller (2.4 cents.)

This line operates through a sparsely settled district and under the old conditions freight and passengers were carried on the same train, the service being slow and unsatisfactory. Since the introduction of the motor cars, transportation costs have been reduced 58 per cent, fare per passenger has been reduced 43 per cent, increase in gross earnings 80 per cent, decrease in operating expenses 30 per cent. It should also be borne in mind that a locomotive covered annually only 30,000 km (18,000 miles), while a motor car can cover twice as much in the same period. It has been found that the life of the track is longer under motor-car operation, despite the greater mileage. Even if motor cars do not give as good returns as locomotives, they should be preferred, owing to the more frequent service that they can give. With these facts before them, why should the electrical companies hesitate to enter such a promising field?

Here and there are found electric cars which have been especially designed for service on light railways. One of these cars, which appears to be giving satisfaction, is made up as follows: The car consists of two similar self-contained single-truck cars, connected by a middle platform. Each truck has a wheel base of 4 m (13 ft.) As the middle platform is swiveled to the end platforms of the single-truck cars, the entire car can pass around curves. The wheels are 1 m (39.37 ins.) in dia. The total length of the car between buffers is 18.9 m (62 ft.), width 3.12 m (10 ft. 3 ins.), and height above rails 3.8 m (12 ft. 6 ins.) The height of the car body interior is 2.5 m (8 ft.). The motorman's vestibules, which are separated by sliding doors from the rest of the car, have each standing-room for five passengers. Each of the two regular compartments seats forty passengers, and the middle platform offers standing-room for eight more.

The battery equipment consists of 148 cells, placed in air-tight, hard-rubber receptacles under the seats. The capacity of this equipment is 430 amp-hours, discharging at 140 amp, and 365 volts. The batteries are charged at 480 volts from the power supply of the Dresden railway system. The operating equipment consists of four flexibly-supported four-pole series motors, each giving 27 hp at 360 volts. The motors are coupled in pairs, and may be operated either series-parallel or straight series. The braking equipments, besides a hand brake, include magnetic brakes, four of which, when short-circuited through their solenoid, give a braking effort varying from 2000-2400 kg (4000-4800 lbs.), distributed over sixteen brake-shoes. Two regulation stoves are used for heating. The speed of this car is 45 km (27 miles) an hour; its weight, without passengers, 44 tons.

It may be said of Berlin that it is very slow in deciding important transportation questions, refusing permission to those who desire to build new lines, while at the same time doing nothing on its own account.

The traffic from east to west is well developed, due to the early introduction of railways covering the necessary avenues of travel, which fortunately were wide enough to permit the efficient handling of heavy traffic. In this direction cars (frequently including a trailer) run on 25 seconds' headway for about 4 km (2.4 miles) before diverging to other routes, but still maintaining very short headways on the principal streets. For this reason omnibus traffic is not so large in this district as in others.

Traveling north, however, presents very different conditions. Friedrich Strasse, the most frequented thoroughfare, is so narrow as to make impracticable the construction of a street railway. Although there are several lines on parallel streets, they are obliged to take such long detours to avoid the great avenue known as "Unter den Linden" (which may be crossed only at one point) that the public generally prefers either to walk or to ride on the omnibuses, which are not hampered by street railway restrictions. The omnibuses long ago proved utterly unable to cope with this traffic, and as a consequence several attempts have been made by private companies to secure a franchise for an underground railway for this section, but the municipality refused permission because the city of Berlin contemplated building the subway itself some time in the future. At last, matters have reached this stage: The city's building commissioner, Herr

Krause, has finally completed his subway plans, which have been approved by the city's transportation committee. This action is expected to bring matters to a head, as there is little doubt of the approval of the higher State and city authorities. It appears from the accepted plans that the new subway will run from north to south and be 8.04 km (4.8 miles) long. An early design called for curves of 60 m (197 ft.) radius, but it was determined later to have no curves of less than 125 m (410 ft.) radius, owing to the decreased life of equipment caused by such short curves as are used in the first Berlin and Paris subways, and also on the Berlin elevated railway. The cost of the new subway is placed at 49,000,000 marks ($12,250,000), to be secured by a special loan. In addition, 1,500,000 marks ($375,000) are to be set aside for renewal and reserve funds, and 3,500,000 marks ($875,000) for purchasing condemned property. The present private elevated and underground lines are so arranged as to offer no hindrance to the building of the new line.

After considerable argument, it has been decided to have two classes of cars, following the method of the elevated line. On the latter, 15 per cent of the passengers pay the higher class fare, which is 50 per cent more than the lower class fare. This distinction has been found to prove a valuable source of additional income. The fares will follow the schedule of the Berliner Stadtbahn (steam), namely, 10 pfg. (2½ cents) up to five stations; for the remaining stations, twelve or thirteen in all, the fare will be 20 pfg. (5 cents). As noted before, passengers in the higher class coaches will pay 50 per cent additional.

HADFIELD'S STEEL FOUNDRY AT SHEFFIELD, ENGLAND

Reference has been made in the London letter in this issue to the visit of the Incorporated Municipal Electrical Association to Hadfield's Steel Foundry Company, Limited, in Sheffield, and as it possesses one of the largest steel foundries in the world, perhaps the following facts will be found interesting:

The company now owns two steel works, having a total area of 80 acres, and employing about 4000 men. The original works, known as the Hecla Works, were established by the late Robert Hadfield, at Attercliffe. The new works, at Tinsley, were opened in August, 1897. The steel foundry at Tinsley is the largest in the world, being 1020 ft. long and covering 6 acres. There are twenty overhead electric travelers, of a capacity up to 20 tons, and thirteen electrical jib cranes. Other pneumatic and electric appliances are in use in this foundry. The annealing shops are in three separate buildings, and cover an area of 50,000 sq. ft. There are twenty-three annealing furnaces with overhead electric cranes. The fettling shops are in two separate buildings, and have an area of 45,000 sq. ft.; these are filled with electrical cranes, and also other electrical machinery. The grinding shop is a part of the fettling department. It has fifteen sets of emery stones, which are all connected up to dust exhausters to keep the atmosphere pure.

In the smithing department there are some very large hammers, there being a special hammer for fitting wheels on to axles by Hadfield's fast method. The smithing shop and colliery tub department cover an area of 46,000 sq. ft. All tools in the pattern shop are electrically driven. The building covers an area of 96,000 sq. ft. on one floor. The woodworking machinery is also of the most modern description. The pattern store is an important department, as large numbers of patterns are required for the varied work carried on in the steel foundry. There are twelve buildings in all for storing patterns, the floor area being 35,000 sq. ft.

In the track construction department switches and crossings for railway and tramway permanent way which have been made in the foundry are put together as they would be laid on the ground for actual work. There is a power plant for bending rolls and punching and sawing machinery. The lay out floor, which is boarded throughout, covers an area of about 5 acres.

The machine shops are all of large size, covering an area of about 3 acres. They are fitted with a large number of electrically-driven machine tools. There are nine overhead electric travelers. The buildings are 435 ft. long, and there are ten bays in all.

The power station, having a total of 2100 hp, has 5 units. The dynamos are all driven by cross-compound Corliss engines. The engines all exhaust into a central condensing plant, water from the River Don being used. Current is supplied from this station to work the 225 motors, varying from ½ hp up to 150 hp.

Hadfield's Steel Foundry Company, Limited, produces castings and forgings for all branches of engineering work. The management has always made a point of providing special steel for different classes of work, according to the mechanical properties needed for the working conditions. This system has necessitated an extensive laboratory and scientific staff, both for chemical and physical tests. This is a special feature to which the chairman and managing director, R. A. Hadfield, has always given particular attention. Out of this have grown several special grades of steel which are now well known in the engineering trade. The most prominent and best known among engineers is Hadfield's "Era" manganese steel. This steel is very largely used for special permanent way work, for tramways, railways and dock work. It combines, in a manner not possessed by any other materials, the two qualities of hardness and toughness. The material is so hard that no steel tool will cut it; at the same time it is so tough that pieces ½ in. thick can be bent nearly double cold without cracking. These qualities make it specially suitable, therefore, for railway switches and crossings, and the company has introduced a system of producing these parts in one casting to take the place of the ordinary steel built up points and crossings generally in use.

SPECIAL TROLLEY CARS IN BOSTON

The Boston & Northern and the Old Colony Street Railways, which operate some 900 miles of electric lines north and south of Boston, have arranged to conduct a series of special car excursions this summer to all the principal seashore resorts and other places of historic interest radiating from the city of Boston. These trips will be run only in pleasant weather, and at the leading places guides will meet the party and conduct them to places of interest, if so desired. Meals and other accommodations will be arranged for at the request of the passenger, and round trip tickets will be sold including meals at different hotels.

As the companies are making an experiment and wish to find out whether or not the increased facilities for travel in this manner will be appreciated, only weekly trips will be run by the specials, beginning Aug. 2. It is quite likely that the patronage will necessitate the making more frequent trips, and the personally conducted trolley trip in New England is probably destined to become a feature of travel during the pleasant summer weather. While some of the trips are within a radius of 25 miles of Boston, others are planned to run around Cape Ann and through to Newport, the latter being a distance of 80 miles from the Hub, and in all cases the specials will be run through without change, being the longest trip in New England by trolley without change. The trips will be under the personal supervision of R. H. Derrah, the trolley excursion expert.

PROPOSED POLYPHASE RAILWAY IN DENMARK

A short reference was published in the Paris letter of July 2 to a long electric railway proposed between Frederikesund and Nestred. Further particulars of this line are now available. The total length is 96.23 km., and the Ganz three-phase system will be used. The cost of electrical equipment, including overhead line, power station, sub-stations, fourteen double-truck motor cars, and six electric trail cars, is $8,017 per km. of track. A service of about 9000 train-km per track-km per year is contemplated, the passenger trains to run at 50 km per hour and the freight trains at 30 km. The company will be known as the Sjaelland Middle Railway.

NEW CARS FOR NEW YORK ELEVATED

The Interborough Rapid Transit Company has ordered one hundred new "trailer" cars for its elevated lines at a cost of $350,000. In a short time a car will be added to each train on the Third Avenue line which runs through the "rush" hours, making seven-car trains instead of six, as at present. The platform of the City Hall station is being lengthened to accommodate the longer trains, and the extra cars will be put into service as soon as this work is finished.

Of the one hundred new "trailers" ordered, fifty will be made by the St. Louis Car Company and fifty by the Wason Manufacturing Company, although the trucks for the cars built by the latter company will be manufactured by the St. Louis Car Company. These trucks were especially designed by Frank Hedley, general superintendent of the Interborough Rapid Transit Company.

THE ELECTRIC SLEEPING-CAR SITUATION

Joseph W. Selvage, general manager of the Holland Palace Car Company, of Indianapolis, has been going over the various roads between Indianapolis and Zanesville with a view to placing in operation the long-talked-of interurban sleeping car service through Central Ohio and Indiana. He has conferred with the operating departments of the various roads, and this week will go to Boston to take up the matter with the Tucker-Anthony and Appleyard interests which control several of the Ohio roads that would be traversed. It is understood that the Holland Company's proposition is to own and operate the cars and furnish a porter and charge the various roads a certain amount for their use. The distance from Zanesville to Indianapolis is about 235 miles, and the large cities en route are Newark, Columbus, Springfield, Dayton and Richmond. As has already been pointed out by the STREET RAILWAY JOURNAL, a great many steam roads operate sleeping cars over even shorter routes than this, and they are patronized because traveling men are willing to make an all-night trip in preference to spending a good share of the day on such a run. It makes no particular difference if the electric car takes an hour or two longer for the run, and the lower fare and absence of smoke are points which would be greatly in favor of the electric sleepers. It has been stated repeatedly that the trial of the project over this route has been held up on account of a low undergrade crossing at Richmond, Ind., but it is understood on good authority that the managers of some of the roads concerned are fearful that the extreme weight and high power of the Holland cars now ready for operation might prove too great a strain for existing bridges and power stations, which were designed for much lighter cars and motors.

EARNINGS OF THE INDIANA TRACTION ROADS

It is gratifying to know that the Indiana traction roads have done a good business during the first six months of the year, and all have met their semi-annual interest payments, amounting to a third of a million dollars, on bond issues. The past six months were the most unfavorable that Indiana traction roads have had, and when the companies operating them were floating capitalization and figuring expenses on the basis of last year's business, which was a record-breaker, they had an unusually heavy task. One of the largest, the Indiana Union Traction Company, on the ground of necessity, cut its guaranteed dividend on common stock.

It is said that a number of Indiana traction roads the first of this year, though doing a larger business to the mile than they did in 1902, and a great deal more in the aggregate, ran a very close race with obligations, including operating expenses and fixed charges. The business at present, however, is very prosperous and profitable. Other traction companies are showing a good margin between these two items, and when the aggregate gross income and the aggregate operating expenses and fixed charges, including interest, taxes and other items, of all of the roads of the State are cast, it is found that there is a margin on the right side of the ledger.

The seven roads entering Indianapolis (excluding the Plainfield line) are doing a business which, if the present ratios are maintained, will give an aggregate of $2,325,000 or $2,500,000 gross earnings in 1904. Against these estimates there must be checked up operating expenses estimated at 50 per cent of the gross earnings and fixed charges aggregating $636,000, making a total of $1,798,500. Some of the smaller companies that are moderately capitalized will make good margins on operations this year. The Indianapolis & Martinsville Rapid Transit Company and the Indianapolis & Eastern Railway Company are reported to be making upward of 10 per cent.

Floods during the month of March washed out much track and otherwise hindered operation and made additional expense. The cool, late spring retarded park gatherings, etc., and yet all the roads came through the first six months as money makers, and the last half of the year promises exceedingly well. Traction men are expecting a general improvement and an increase in the traction business this fall. The national and State compaign, the State Fair and a large number of conventions yet to be held will no doubt confirm their expectations. The fixed charges have rested heavily on some of the companies, as they have been paying interest on bonds covering mileage that was not open for traffic until late in the spring or summer. Some of these extensions will not only add to the business of their own mileage, but will give connections with other lines, from which they will secure a great deal of through travel and transfers.

RAILWAY EMBEZZLER GETS HIS DESERTS

George B. Ray, alias Ford M. Kinney, alias Philips, alias John Purdy, who was arrested June 22, at Fort Lee, N. J., charged by the New Jersey & Hudson River Railway & Ferry Company with embezzlement, was tried on July 20 and 21 before Judge Zabriskie. Several inspectors, whom the company had secured from Drummond's Detective Agency, of New York, testified that they had been on Purdy's car when he neglected to register fares collected. As a result of their testimony the accused conductor was found guilty as charged, and was sentenced July 25 for four months in the Hackensack Jail. This was the prisoner's first conviction. He was arrested four years ago, charged with grand larceny in Pine Island, N. Y., but was not prosecuted as he settled the matter out of court and the prosecuting witness did not appear.

PROGRESS OF OHIO INTERCHANGEABLE COUPON BOOK

The plan adopted by the different roads of the Ohio Interurban Railway Association for an interchangeable coupon book, good on all the roads, has been held up for nearly three months through the inability of the officials of the association to find a bonding house that would go on the bonds of the various roads. It will be remembered that the agreement between the various roads required that each road put up a bond of $10,000 to ensure the carrying out of the agreement. The bonding houses had never heard of a proposition of this kind and declined to make any kind of a deal that the officers of the association deemed satisfactory. It is understood that this difficulty has now been surmounted and the bonds placed, so that the books will be issued in the near future and the plan will become operative on the various roads within a month or six weeks.

FIGHT OVER UNION TRACTION LEASES IN CHICAGO

About a year ago a new lease was made between the Chicago Union Traction Company and the underlying companies, whose property the Chicago Union Traction Company operates under lease. This new lease was drawn up because of the financial straits in which the Chicago Union Traction Company found itself after the receivers were appointed, which made it impossible for the company to carry out the terms of the lease. The minority stockholders of the underlying companies, who did not like the terms of the new lease, brought suit to have the new lease declared illegal. This suit recently occupied sixteen days before Judge Mack, of the Circuit Court of Cook County. At the close of the trial the Judge issued a temporary injunction forbidding the officers of the Chicago Union Traction Company to perform any official act under the new lease until he could render a decision as to the legality of the lease. The new lease reduced the rentals paid to the underlying companies.

PERSONAL MENTION

MR. F. L. MARKHAM, for several years with George S. Hastings & Company, Cleveland, has become identified with the J. G. Brill Company and will travel in the South.

MR. E. W. LAWSON, for some time assistant electrical engineer of the Canton-Akron and Canton-New Philadelphia systems at Canton, Ohio, has resigned to accept a position in the electrical department of the Public Service Corporation at Jersey City, N. J.

MR. W. E. IRWIN, who for five years has been connected with Pacific Electric Railway Company's interests in Southern California, recently appointed city passenger agent, has accepted an offer of the management of the Albuquerque (N. M.) Street Railway Company.

MR. FRANK E. LONAS, of the firm of Lonas, Clendenin & McCord, New York, sailed July 21 on the French liner "La Savoie" for Paris. He goes abroad in the interests of the firm on railway business, to close pending negotiations for the securities of two steam and two electric railways, which the firm has under contract to finance and build. While abroad, he will go to Berlin and London, and make permanent financial connections for the disposition of the securities of the larger propositions in railways which the firm accept for financing. Mr. G. Otto Elterich, representing the firm, left on July 16, and will carry forward the European business of the firm abroad. Mr. Lonas expects to be gone about six to ten weeks.

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.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. & Light Co	1 m., June '04	80,504	43,274	37,230	23,167	14,064
	1 " " '03	77,971	43,736	34,234	23,259	10,975
	6 " " '04	397,086	228,261	168,825	135,702	33,125
	6 " " '03	388,982	216,793	167,189	133,024	34,164
ALBANY, N. Y.						
United Traction Co	3 m., June '04	444,536	249,660	194,876	80,710	114,166
	3 " " '03	431,523	316,080	115,443	76,916	38,527
BINGHAMTON, N. Y.						
Binghamton Ry. Co	1 m., June '04	24,665	11,374	13,291	------	------
	1 " " '03	23 674	11,022	12,653	------	------
	12 " " '04	241,787	130,888	119,899	77,872	33 028
	12 " " '03	226,702	126,600	100,102	68,100	32,002
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co	1 m., June '04	40,838	15,136	25,702	------	------
	1 " " '03	22,483	7,743	14 740	------	------
	6 " " '04	168,250	72,587	90,663	------	------
	6 " " '03	93,721	39,847	53,874	------	------
Metropolitan West Side Elevated R. R. Co	1 m., June '04	166,384	------	------	------	------
	1 " " '03	167,419	------	------	------	------
	6 " " '04	1,063,328	------	------	------	------
	6 " " '03	1,037,812	------	------	------	------
Northwestern Elevated R. R. Co	1 m., June '04	102,333	------	------	------	------
	1 " " '03	99,856	------	------	------	------
	6 " " '04	651,147	------	------	------	------
	6 " " '03	626 454	------	------	------	------
South Side Elevated R. R. Co.	1 m., June '04	122.107	------	------	------	------
	1 " " '03	127,897	------	------	------	------
	6 " " '04	798,744	------	------	------	------
	6 " " '03	786,714	------	------	------	------
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co	1 m., May '04	107,061	*64,424	42,637	21,354	21,282
	1 " " '03	100,891	*59,688	41,203	20,997	20,206
	5 " " '04	500,522	*301,949	198,573	105,772	92,801
	5 " " '03	469,141	*279,888	189,253	105,328	82,725
CLEVELAND, O.						
Cleveland, Painesville & Eastern R. R. Co.	1 m., June '04	22,364	13,045	9,319	6,830	2,489
	1 " " '03	19,765	11,487	8,278	6,566	1,712
	6 " " '04	91.760	60,465	34,296	------	------
	6 " " '03	91,404	55,910	35,494	------	------
Cleveland & Southwestern Traction Co	1 m., June '04	44,132	24,604	19,528	------	------
	1 " " '03	40,542	22,835	17,707	------	------
	6 " " '04	204.753	144'475	60,278	------	------
	6 " " '03	196,846	120,880	75,966	------	------
DETROIT, MICH.						
Detroit United Ry	1 m., June '04	411,347	*240,737	170 610	90,075	80,535
	1 " " '03	384,935	*222,797	162,138	82,822	79,316
	6 " " '04	2,085,319	*1345515	739,804	533 444	206,360
	6 " " '03	2,034,188	*1217488	816,700	490,765	325,935
DULUTH, MINN.						
Duluth Street Ry. Co.	1 m., June '04	53,377	26,258	27,119	16,517	10,602
	1 " " '03	59,013	29,513	29,500	15,519	13,981
	6 " " '04	292 745	168,953	123,792	98,878	24,914
	6 " " '03	294,391	173,532	120,859	91,512	29,347
EAST ST. LOUIS, ILL.						
East St. Louis & Suburban Ry. Co	1 m., June '04	116,108	51,682	64,426	------	------
	1 " " '03	85,288	40,317	44,971	------	------
	6 " " '04	594,218	292,097	302,121	------	------
	6 " " '03	471,233	237,397	233,836	------	------
FORT WORTH, TEX.						
Northern Texas Traction Co	1 m., June '04	47,214	26,029	21,184	10,029	11,156
	1 " " '03	40,889	19,293	21,596	9,018	1 ,578
	6 " " '04	258,936	147,974	110,761	60,547	50,414
	6 " " '05	206,939	112,430	94,510	54,125	40,385
GREENSBURG, PA.						
Pittsburg, McKeesport & Greensburg Ry. Co	6 m., June '04	68,645	38,551	30,094	------	------
	6 " " '03	55.967	32,935	23,032	------	------
	12 " Dec. '03	124,534	70,455	54,079	------	------
	12 " " '02	99,308	57,520	41,788	------	------
HAMILTON, O.						
Cincinnati, Dayton & Toledo Traction Co.	1 m., May '04	44,463	31,034	13,429	17,33[6]	† 3,907
	1 " " '03	46,174	25,022	21,152	16,05[1]	5,102
	12 " " '04	502,990	301,788	201,208	195,18[4]	6,022
	12 " " '03	489,493	271,812	217,681	193,67[3]	24,008
HANCOCK, MICH.						
Houghton County St. Ry. Co	1 m., May '04	16,441	11,531	4,909	3,455	1,455
	1 " " '03	16,111	10,085	6,026	2,929	3,097
	12 " " '04	188,518	130,672	57,846	36,858	20,988
	12 " " '03	182,167	121,089	61,078	32,875	28,203
LONDON, ONT.						
London St. Ry. Co	1 m., June '04	19 235	12,100	7,134	2,166	4,968
	1 " " '03	16 224	10,778	5,446	1,860	3,586
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co	1 m., June '04	265,906	128 433	137,474	75,236	62,238
	1 " " '03	249,684	121,334	128,350	72,134	56,217
	6 " " '04	1,538,674	801,383	737,291	443,505	293 786
	6 " " '03	1 436,676	734,114	702,562	424,447	278,115
MINNEAPOLIS, MINN						
Twin City Rapid Transit Co	1 m., June '04	370.141	173,638	196 503	74,892	121,611
	1 " " '03	347,745	168,745	178 999	60,890	118.109
	6 " " '04	2,059,362	985,875	1,073,387	435.441	637,946
	6 " " '03	1,918,653	922,372	996,281	365,318	630,963
MONTREAL, QUE.						
Montreal St. Ry. Co	1 m., June '04	232 610	131,589	101,022	26,295	74,727
	1 " " '03	209,377	121,580	87,797	24,198	63,600
	9 " " '04	1,761,917	1,149,936	611,981	175,371	436,610
	9 " " '03	1,571,941	993,652	578,289	164,667	413,622
NORFOLK, VA.						
Norfolk Railway & Light Co	1 m., June '04	65,107	36,192	28,915	17,689	11,227
	1 " " '03	55,026	33,260	21,826	16,460	5,366
	6 " " '04	298,688	181,241	117,447	108,537	8,910
	6 " " '03	271,612	176,665	94,947	107,574	† 12,627
PHILADELPHIA, PA.						
American Railways	1 m., June '04	131,308	------	------	------	------
	1 " " '03	118,734	------	------	------	------
	12 " " '04	1,407,370	------	-----	------	------
	12 " " '03	4,244,798	------	------	------	------
SAN FRANCISCO, CAL.						
United Railroads of San Francisco	1 m., June '04	524,013	------	------	------	------
	1 " " '03	488,113	------	------	------	------
SAVANNAH, GA.						
Savannah Electric Co.	1 m., May '04	45,481	25,895	19,586	10,878	8,708
	1 " " '03	42,940	23,616	19,324	9,631	9,692
	12 " " '04	530,608	305 502	225,105	123,130	101,975
	12 " " '03	498,262	290,471	207,792	115,298	92,494
SEATTLE, WASH.						
Seattle Electric Co	1 m., May '04	197,848	133,593	64,256	23,486	40,770
	1 " " '03	181,797	132,853	58,945	26,648	32,297
	12 " " '04	2,213,898	1,548,917	664,981	273,068	391,913
	12 " " '03	1,994,711	1,421,523	573,188	279,977	293,210
TERRE HAUTE, IND.						
Terre Haute Elec. Co.	1 m., May '04	46,637	31,227	15,410	10,250	5,161
	1 " " '03	36,970	21,864	15,106	6,533	8,572
	12 " " '04	517,124	346,158	170,966	102,338	68,628
	12 " " '03	396,996	275,248	121,748	77,779	43,969
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., June '04	148,635	*76,941	71,694	41,642	30,052
	1 " " '03	141,545	*71,806	69,739	41,135	28,604
	6 " " '04	825,858	*456,964	368,894	250.349	118,545
	6 " " '03	772,178	*401,205	370,973	242,070	128,903