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Through Car Arrangements

One of the subjects discussed at the last meeting of the Ohio Interurban Railway Association, that regarding through car arrangements, is likely to be of increasing importance among interurban companies as time goes on. The question arose in Columbus as to what arrangements should be made between interurban companies and between an interurban company and a city company, in case the cars of one company operate over the tracks of another.

So far, while interurban cars use city tracks, in many instances the operation of special interurban cars over the tracks of another interurban company has been largely in the nature of a complimentary privilege without compensation. When traffic arrangements are made between different interurban companies, as we have frequently urged, some provision must be made for a just division of the expenses and profits between the companies. Steam railroads have worked out this problem and electric roads can do it also, although the conditions are decidedly different.

In the case of a steam railroad it is usually merely a matter of passing along a coach from one road to another. The motive power equipment of one road rarely passes very far from the tracks of the owning company. Where every car is a motor car, however, conditions are somewhat the same as if the locomotive of one company were to be operated over the tracks of another company for long, continuous runs. The electric motor car is capable of much longer runs without repairs than is the steam locomotive, but it can hardly be classed with steam coaches and electric trailers, which have comparatively few parts to require attention. There are some managers who are strenuously opposed to allowing their motor cars to be handled by foreign crews, and have equally strong objections to allowing foreign crews, especially motormen, to operate over their own tracks.

It is self-evident that whatever arrangement is made, some man familiar with the road must be in responsible charge of a car while he is on that road. When regular arrangements are made for the operation of cars over several interurban systems, one way to solve the problem without the expenses of adding an extra man as pilot would be to teach the crews which were to operate these through cars the whole route over which they were to operate, and allow them to take the car through from one end of the road to the other, with the understanding that they would be under the rules and regulations of whatever company's line they were operating over at any moment. The plan of running a car with its own crew and providing a third man for a pilot whenever that crew left its own road, is too expensive a combination to be thought of for anything but occasional special cars.

Cutting Rates to Compete with the Trolley

The reduction of fares in the Connecticut Valley by the Boston & Maine Railroad, which went into effect June 1, furnishes a good illustration of the length to which steam lines will go in these days in the effort to recapture traffic long since diverted to parallel trolley systems. It is stated that fares will be cut down by more than a third in order to equal the tariff in force between various points in the valley, via the electric lines, but that the reduced rates will not be operative after Sept. 1.

We do not believe that the trolley lines operating in this picturesque part of New England will be seriously disturbed by the steam railway's lowered fares, if they will but seize the opportunity to call the attention of the public to the preponderance of advantages in favor of the electric routes. The only point of consequence which can be made by the steam railroad people is that of greater speed in through travel, and even this advantage can be considerably reduced by paying close attention to the maintenance of convenient trolley schedules and the

elimination of delays at meeting points. The steam train fails to score in the matter of frequent service; it is handicapped by its inability to pick up and discharge passengers at any point along the route, and to transfer them upon arrival to connecting city lines; and, lastly, the comfort and enjoyment of a trolley ride in the open air through attractive country is simply beyond comparison with the stuffy, dirty and smoky atmosphere inseparable from steam railway transportation. The fare reduction is likely to have little effect with that class of patrons who would be obliged to travel by the steam road even if the present tariff were increased, and it lies with the managers of the electric lines to bring home to the public at large the points above mentioned, and to leave no stone unturned to secure general appreciation of facts which every street railway man realizes to be true. A few crisply worded cards in the advertising racks of the cars will do a great deal of good, supplemented by a little missionary work on the part of those in charge of the traffic.

The St. Louis Cable Trouble

Elsewhere in this issue are given the bare facts of one of the most disastrous cable conduit troubles ever experienced. This accident, which resulted temporarily in depriving the St. Louis Transit Company of about two-thirds of its power in a very abrupt and uncermonious manner, is certainly worthy of study. It is only by the consideration of such accidents that the most valuable knowledge can be gained for guidance in future construction. Electrical engineers have been taking unusual precautions with high-tension, alternating-current underground feed lines, to prevent the spread of trouble from a short circuit in one cable. To make the possibility of break-down more remote the supply of high-tension alternating current from large power stations is usually so divided between different conduit lines that the shutting down of all the feeders in one conduit will not affect the service. The catastrophe which overtook the St. Louis Transit Company last week, however, was entirely on a direct-current line of underground feed cables. Stated briefly the case is this: An unusual amount of rain had fallen. The company's largest power house has underground cables leading from it in several directions. Practically without warning an enormous short circuit came on the power station, flame burst from manholes along the conduit line and from the iron conduits leading up the poles at the underground cables' terminal boxes. The manholes were so hot for 12 hours afterward that workmen could not enter them. In some cases cables were melted off.

At first appearance this would seem like another case of the "one-horse shay," since the trouble occurred at so many places at once. A closer study of the conditions, however, shows that there was nothing in the event other than might have been predicted, as the result of a short circuit on one cable. It appears that many of the feeders had been solidly connected together by jumpers at various points. This being the case, a short circuit on one cable would have current fed into it from several feeders. The underground cables, being all worked well up to their capacity, heated rapidly under this unusual load and other defects developed. The original short circuit, probably, melted the lead covering of other cables near it, and even if it did not the current flowing was enough to char the insulation of many cables, as was shown by the immense heat generated at so many points simultaneously. The first and most important lesson to be drawn from the occurrence is to avoid solid connections for jumpers between feeders. If feeders are to be tied together at all, as they frequently are, to get full benefit of all the copper installed, they should be so tied or connected through the medium of fuses or circuit breakers. Then a short circuit cannot be fed from several directions at once, longer than the time it takes to open a fuse or circuit breaker, and a wholesale destruction of 500-volt underground cables will be as little known in the future as it has been in the past. True, there is a strong temptation to put solid jumpers around section insulators and between feeders, but if such solid jumpers are used it should be with the full recognition on the part of the management that there is a risk in so doing, that a wholesale burn-out like that at St. Louis will be the price paid for the advantage of not having to bother with circuit breakers and fuses on the line.

Mr. Richard McCulloch has suggested one lesson to be drawn from this accident is that the wearing through, or rather the gradual pressing through, of the lead covering where the cables are hung on hooks in a conduit, should receive more consideration. There is danger of a gradual flowing away of the load covering if much weight comes on a narrow hook. Broader bearing surface is, of course, the remedy for this.

Taken altogether, the accident teaches that even a direct-current, 500-volt underground conduit line can get into wholesale trouble, and when such wholesale trouble comes the effects on the service are as bad as on a high-tension system. To be sure, this was an unusually large direct-current power station, capable of giving 30,000 amps., and a large percentage of this went out over one conduit.

The Electric Railway and the Town Authorities

The advent of the warm season and resulting impetus given to new construction work brings the electric railway face to face once more with the varying requirements of local authorities. Each year produces a crop of new demands from Selectmen, Aldermen and influential citizens along the existing or projective route, and it is a wise manager whose experience has taught him how to meet these representatives of the public in a manner which "disarmeth suspicion" and is fair to all parties concerned.

It certainly is time that local authorities realized more fully that the street railway traversing several towns and the interurban railway connecting larger centers of population have responsibilities to the total number of communities which they serve. In some cases the transportation welfare of half a State may be seriously injured by the imposition of petty restrictions at local points—a policy that is provincial in the extreme, and utterly unsuited to twentieth century methods. Thus, the speed limits enforced on interurban lines may be so low as to annul the good of the fast schedule outside the village. In such a case money invested in high powered motors, ample feeders and liberal power or sub-station capacity, cannot hope to earn legitimate returns. Again, the question of maintaining the highway may be carried to such extremes that the railway company bears a burden of expense all out of proportion to what is right and fair. The town authorities who demand almost unlimited privileges for workingmen, school children, ministers and politicians, run the risk of so hampering the rural earning power of a company that it may take several years for it to reach a point where the best service can be given to the community.

Doubtless, many electric roads, operating in large cities where the traffic is heavy, have earned pretty substantial dividends by virtue of their strategic position in the transportation world. It is quite another story, however, with the average suburban and rural system. The Selectman has thus far, in

many instances, failed to realize that such roads are not the multi-millionaire bonanzas which they have often been denominated.

The street railway is a public servant, just as is the steam road, the electric light and telephone company. None of these corporations can do business, in the long run, successfully, without fair and equitable returns on the investment involved. On the other hand, exorbitant charges for the service rendered are a species of slow business suicide on the part of any corporation which maintains them. Sooner or later the crash is bound to come if the limit of reasonable charge is passed in either direction. The question of fares is not one to be properly settled by any local board of town authorities. It involves an expert knowledge of transportation which cannot possibly be possessed by those of no experience in the work. It is always a matter of difficulty to lay down a tariff of rates in a system newly built through communities that are but sparsely settled—that is, a tariff which shall be entirely just to both the community and the railway. It stands to reason that rural rates must be higher than city rates when we take into consideration the lighter traffic encountered, the distance from steam railways, cost of labor, transportation, haulage of material, removal of snow and ice and heavy maintenance expenses. If a dispute arises in connection with rates, the State Railroad Commission is the proper tribunal to adjudicate the question, or some impartial board of experts in States which do not enjoy the advantages of such a commission.

Given, however, a community with a few fair-minded representative men and a railway management which meets the public with frank, face-to-face treatment, and which is constantly striving to perfect the service rendered for a given return, there will be less and less expensive litigation between the town authorities and the companies, a better understanding of mutual positions and the probability of common prosperity, as far as the influence of electric transportation can affect it.

Fire Prevention for Cars

We have recently called attention to the increasing necessity for fire prevention for car houses and yards, and the article on construction and hazards for car houses and cars by Ralph Swetland, in our issue of May 21, calls attention to some of the precautions which should be taken from the insurance man's standpoint. In this connection the recently inaugurated policy of the Metropolitan West Side Elevated Railway Company, of Chicago, is of interest. As elsewhere described, this company has just put into commission a chemical fire-extinguishing car, for use in extinguishing fires which may start among its cars when standing in its yards at terminals. This car is intended for rapid use at the beginning of a fire, before there is time to put other systems with a more liberal water supply into operation. That this company is awake to the importance of reducing fire hazards is shown not only by the building of this fire car, but by the fact that it is earnestly working in the direction of fireproof construction for its cars. A recent order for cars which it placed specifies a complete steel floor below the regular floor, the main object of which is to prevent the spread of fires originating from electrical causes underneath the car. This, it is believed, will prevent the spread of the majority of fires, since the experience of that company indicates that most fires in which electric cars are destroyed, originate under the floors of the cars themselves.

The company is not, however, stopping at this, and is building, as a sample, an all-steel car, with the idea of gaining information which will enable it to fix on a design for an all-steel car for all future orders. We have recently described the steel car which the Interborough Rapid Transit Company has had constructed, and the partial steel construction of the Illinois Central suburban cars in Chicago. It is evident, therefore, that as far as the heavier rapid transit car is concerned there is a decided tendency toward steel construction, which should materially reduce the fire risk.

The Ninety-Nine Year Decision in Chicago

The result of the first clash at arms between the city of Chicago and the Chicago Union Traction Company as regards the rights of the latter under the ninety-nine year act, passed by the Illinois Legislature in 1865, and which was briefly reported in our last issue, has resulted in a decision which corresponds very closely with opinions given by the legal advisers of the Chicago Union Traction Company some years ago. Although this decision of the court has been heralded by the Chicago newspapers as a victory for the city, it is hard to see wherein the great victory lies. The main contention of the company that the earlier franchises granted were extended ninety-nine years by the Legislative act of 1865 was fully sustained by the court. The theory upon which the court based its decision was that at the time the street railways of Chicago were first granted franchises, the granting of such rights was commonly considered as lying with the State Legislature and not with the City Council. Later, the right to grant franchises was given by the State to the City Council, but in the early days, not only in Chicago, but elsewhere, the granting of rights to street railway companies was, by common custom, considered to be with the State Legislature, which had supervision over other railroads. The judges, therefore, argue that unless an express statement was made to the contrary in the act of the Illinois Legislature of 1865, which extended the rights of the Chicago street railway companies ninety-nine years, this act must be taken as extending not only charters but franchises, since there was at that time no reason for assuming that the City Council rather than the State Legislature had jurisdiction over the length of franchises. The judges considered that the whole question hinged on what the Legislature intended to do when it framed the ninety-nine-year act of 1865. Considering this act from the standpoint of the Legislature of 1865, the judges consider that the intention plainly evident was to extend the existing franchise rights of the street railway companies of Chicago. Only one contention made by the attorneys for the Chicago Union Traction Company was not upheld, namely, that the act of 1865 carried with it extensions of franchises for branch lines subsequently built.

This decision is of interest only as indicating the line of logic likely to be taken by the United States Supreme Court, as the case will be immediately appealed to that body. The traction tangle in Chicago is apparently no nearer to being unraveled than before. If the present decision is upheld by the United States Supreme Court, the companies have important rights on the streets for over fifty years to come. Other important rights are lost to them. While the decision of the court shows that the city officials are a long ways from being able to carry out their threat of throwing the companies off the streets and exacting whatever terms they wish, it is evident that there can never be any satisfactory settlement until the parties to the controversy can stop fighting and talk business. Both have sufficient ammunition in the way of powers and rights, so that they can make matters very uncomfortable for each other, and as long as the war is on and the city continues to use all of its powers to harass rather than to come to a business-like compromise, there is no use looking for a settlement.

AN IMPROVED TERMINAL FOR HANDLING THE HEAVY CONEY ISLAND CROWDS—BROOKLYN RAPID TRANSIT COMPANY

One of the most difficult problems in the handling of heavy pleasure traffic that is to be found in this country is that involved in moving the enormous crowds that frequent the famous seaside resort of New York and Brooklyn, known as "Coney Island." The enormous volume of this traffic has long been a difficult problem for the Brooklyn Rapid Transit Company, as the unprecedented and increasing growth of popularity of this resort from year to year has caused the increased terminal facilities, that they have installed each succeeding year, to be rapidly outgrown. Owing to the large and costly attractions, such as "Luna Park," "Dreamland," etc., that have recently been added to those already there, the demands upon the passenger-carrying facilities grew last year to such proportions that the company found immediate provisions upon a large scale, for the safe and rapid handling of this traffic, to be necessary.

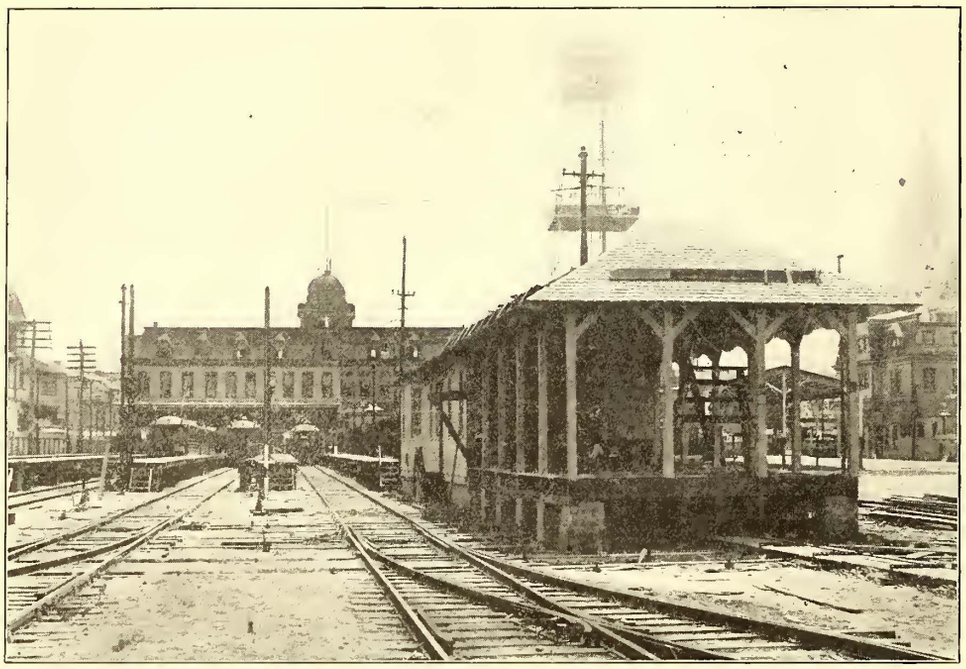


FIG. 1.—VIEW OF THE ELEVATED TERMINAL TRACKS, SHOWING PLATFORMS. TRAINMEN'S PAVILION AND OFFICE BUILDING AT THE RIGHT

A careful study of a suitable provision for this enormous traffic has long been under consideration, and the results in the form of an entirely new terminal plan are shown in this article. The old terminal at Coney Island, known as the "Culver" terminal, which had been considerably increased in size last year, has this spring been almost entirely rebuilt, to a plan which it is thought will provide more carefully than ever before for the safe and rapid handling of the large crowds that frequent this resort. It is true that the determination of this plan was influenced by many governing local conditions, but the general features involved in this new terminal are applicable to a great many other summer resort terminal problems. It is probably the largest and most important pleasure resort terminal in existence, and its interesting features are worthy of careful study.

The traffic to the "Culver" terminal at Coney Island includes not only the heavy surface-car service upon six of the street car lines from Brooklyn, but also that of the elevated railroad lines which are now operated to this district; elevated trains now run direct from the Brooklyn Bridge terminal in New York City of the lines of the Brooklyn Rapid Transit Company, over the two important elevated railroad divisions in Brooklyn, the Fifth Avenue and the Fulton Street elevated lines, to the suburbs, and thence upon private rights of way on the surface to this terminal. This permits high-speed operation and rapid transit in the true sense of the word. Formerly, however, the elevated trains were brought into the terminal and unloaded upon the level, under conditions met in surface-car operation, with all the attendant inconveniences of loading and unloading.

The new arrangement of tracks, which was worked out in rebuilding the "Culver" terminal, is shown in the accompanying yard plan. The elevated train service will be taken care of separately from the surface lines, as shown, the principal feature of the new terminal being this provision for the rapid handling of the crowds by the elevated trains. Four terminal tracks are installed for this purpose, the two upon the east side being intended for the "Brighton Beach Route" elevated trains, and the other two, to the west, for the express and local trains operating over the Fifth Avenue elevated division. As may be noted, convenient track connections are provided for easily handling trains under very close headway; train movements will be greatly facilitated by the very complete system of interlocking switches and signals which has been installed to cover all elevated train movements throughout the yard.

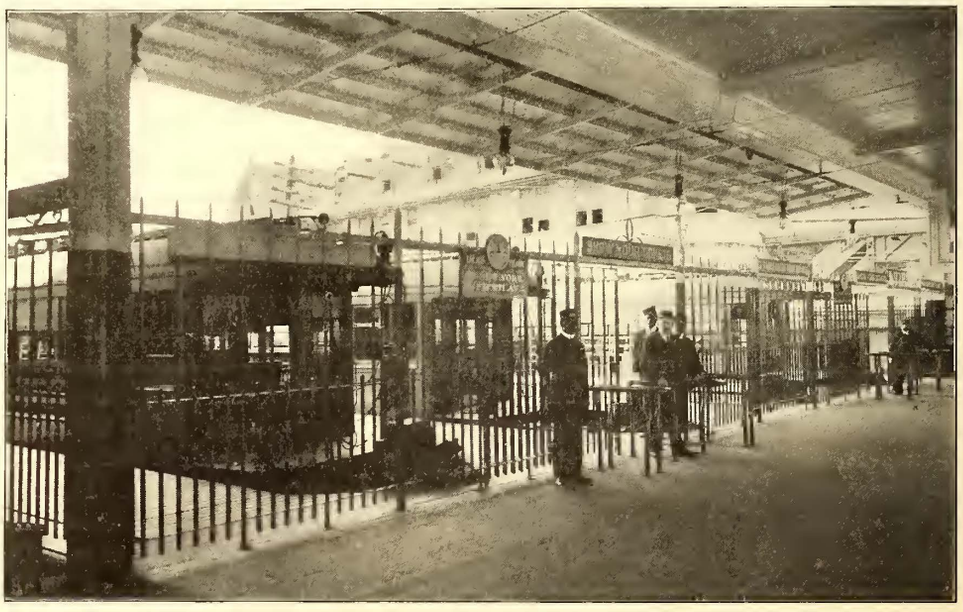


FIG. 2.—THE ELEVATED TRAIN LOADING AND EXIT GATES AT THE CULVER DEPOT AT CONEY ISLAND

The arrangement of the elevated train terminal is shown in an accompanying photograph, Fig. 1. Elevated platforms, of a height of 42 ins. above rail level, are provided on both sides

of every terminal track, five in all, two of which are used for passengers entering outgoing trains, while the other three provide exits for incoming trains. In this way incoming passengers, leaving the trains, are thus kept entirely separated from the outbound passengers, and the disagreeable scrambling and fighting to gain entrance before the cars are emptied is eliminated. As a train arrives at the terminal station the gates upon the unloading, or exit platform side, are opened first, and the train emptied, after which the unloading gates are closed and the opposite gates, on the loading side, are opened for outgoing passengers to board the train. The elimination of the confusion by the separating of the two classes of traffic permits trains to be unloaded, loaded and sent out again with the least possible delay. It is, indeed, thought that this arrangement will permit trains to be operated out of the terminal on a 2-minute headway easily, and, under the pressure of very heavy service, even less, thus bringing the possible capacity of the elevated terminal up as high as 20,000 passengers to 25,000 passengers per hour.

FIG. 3.—THE ELEVATED TERMINAL DEPOT, SHOWING USE OF AN UNUSUAL FORM OF TICKET BOOTH, RESEMBLING THE END OF AN ELEVATED CAR

FIG. 4.—DETAIL VIEW OF THE NOVEL TICKET BOOTH

A feature of importance in the loading of the trains has been introduced in that all passengers for elevated trains are required to purchase tickets before boarding, instead of paying their fare upon the train after starting, as was formerly done at this point. For all the various suburban surface stations of the Brighton Beach and Fifth Avenue elevated lines, the fares are collected upon the trains, as is done in steam railroad passenger practice, and formerly great difficulty was experienced by the conductors in doing so upon trains leaving the beach with the heavy crowds; change-making was a severe burden upon the conductor, and as a result considerable dissatisfaction was caused and many fares were overlooked. Under the new arrangement tickets must be purchased and shown at the entrance gates to the loading platforms, so that all passengers leaving the terminal have tickets, and the duties of the conductors in collecting fares are thus minimized. An entire train can be covered in a very much less time than was the case when fares were collected in cash upon the trains. This arrangement also serves to assist in keeping objectionable characters off trains.

In Fig. 2 is shown the arrangement of the entrance and exit gates at the elevated train terminal. The three unloading platforms have rolling gates, above which are signs, "No Passengers Admitted Here;" the two loading platforms have similar rolling gates with signs above, which read, "Show Your Tickets." The loading platform gates are provided with the best arrangement for guides for facilitating the examining of tickets by directing the entering passengers in two lines. Clock-type indicators are also used to show the times of departure of trains upon the two routes.

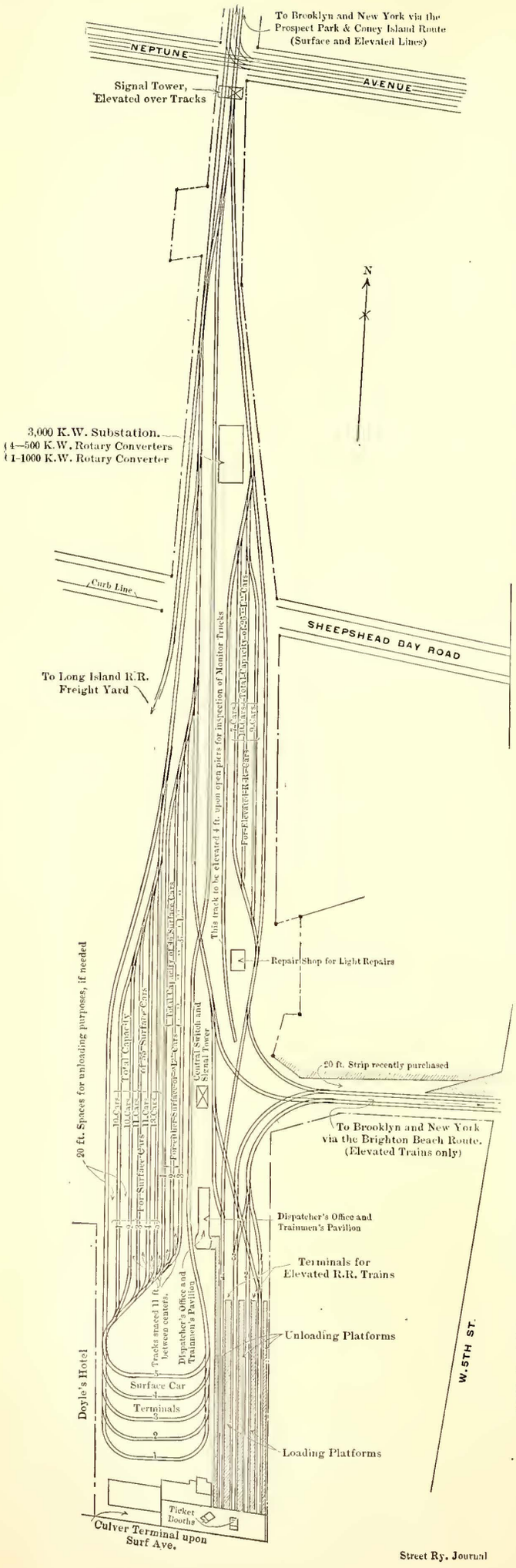


FIG. 5.—PLAN OF THE NEW TERMINAL YARD ARRANGEMENT FOR THE CULVER TERMINAL AT CONEY ISLAND—BROOKLYN RAPID TRANSIT COMPANY

Figs. 3 and 4 illustrate the novel type of ticket booth that has been constructed for use at this new terminal. In harmony with the many other suggestive features of the surroundings at Coney Island, these booths, from their likeness to the front end of an elevated train, suggest that all elevated passengers must purchase tickets before boarding the train. These booths were built to exactly resemble the end of the standard elevated car of the Brooklyn Rapid Transit Company, and are of a very striking appearance, not only as to the platform gates, but even to the headlight and side color lamps upon the hood, are they an exact imitation of the original. Each booth has a ticket window upon either side, under the glass shelf of each of which windows is worded the laconic query to the purchaser of tickets, "How Many?" for facilitating the movement of the crowds.

The switching and signaling system has been installed with unusual care, and provision has been made for handling the most severe combinations of traffic. There are three slip switches in the ladder-track lead to the elevated terminals, so that an entering train may be directed to any one of the terminals; similarly any combination desired is possible for outgoing trains. These switches and their governing signals, as well as those for the adjoining storage tracks, are all controlled from the central signal tower. This tower, which contains sixty-four levers, is conveniently located for the observation of train movements upon all tracks of the yard.

Fig. 5 illustrates this central signal tower and also shows the substantial character of the pipe connections for operating the switches and signals. All pipe carrier gangs for the pipe leads, as well as supports for the "lazy jacks," are mounted upon heavy concrete foundations. The interior of this tower is shown in Fig. 6. At the upper end of the yard an interesting arrangement of elevated signal tower has been installed for the control of all switches and signals at that end, and down as far as the sub-station. These switching and signaling systems were installed complete by the Union Switch & Signal Company, Swissvale, Pa.

The substantial character of construction of this tower, as well as of other features of this installation, is unusual for a temporary summer service of this nature, but it indicates clearly the growing importance of such summer pleasure traffic and of catering to it by providing ample train service.

An interesting feature of this yard is shown in Fig. 1, in the form of a combined train despatchers' office and trainmen's pavilion. It has conveniently arranged offices for the despatchers and other local officials, and at the north end has an open pavilion for the convenience of the trainmen. It is the custom of the Brooklyn Rapid Transit Company to provide lunches for the trainmen on Sundays and holidays, which will hereafter be arranged for in this pleasant open structure, affording the men a pleasant resting and recreation place.

Light running repairs will be provided for by an elevated track and small repair shop just above the signal tower. The track will be raised upon substantial concrete piers, located about 12 ft. between centers, which will bring the rail level 4 ft. above the ground. This provides the same repair facilities that would be obtained by the use of pits, and the trucks are, moreover, rendered much more accessible. The repair shop will contain only such tools as are necessary for light repair work.

THE SURFACE CAR TERMINAL

Elaborate provision has also been made for the handling of the heavy surface car traffic. The former track arrangement at the Culver terminal, involving loops around which the surface cars were turned in discharging and taking on passengers, has been retained, as may be seen by reference to the track diagram (Fig. 5), but an important improvement has been

FIG. 6.—LOOKING NORTH FROM THE ELEVATED TRAIN TERMINAL TRACKS, SHOWING CENTRAL SWITCH AND SIGNAL TOWER AND THE OPERATING PIPE LINES

added to this department of the service by the addition of a number of storage tracks in the yard above. The surface cars enter the yard from the upper end, passing down at the extreme right upon an open lead track, directing them to any one of the five loops; access is given, also, at a point midway down the

FIG. 7.—INTERIOR OF OPERATING ROOM OF CENTRAL SWITCH AND SIGNAL TOWER

yard, to any one of the five storage tracks on the west side, which may be used to receive cars in case of blockades, or whenever it is desired to store them there temporarily.

It will be noticed that the outside lead track and also the first two of the storage tracks are spaced at 20 ft. between centers, which permits of the unloading of passengers at these points in cases of delays upon the unloading loops below, due to heavy crowds and congestion of traffic. This arrangement is the result of past experience with the heavy crowds at this terminal. It has been found that with the heavy incoming crowds in the early evening and at other times of heavy traffic,

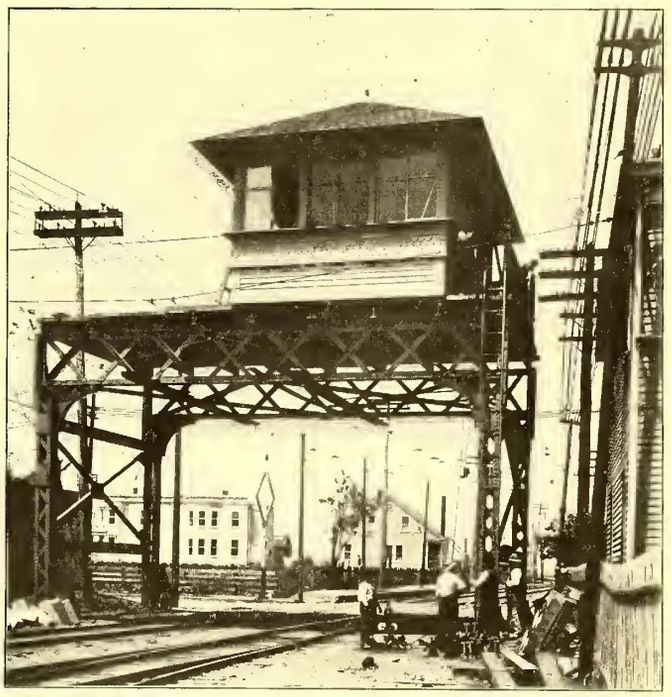


FIG. 8.—THE ELEVATED SIGNAL TOWER AT THE NORTH ENTRANCE TO THE TERMINAL YARD

it is impossible to move cars as rapidly as desired upon the unloading loops below. For this reason the three tracks above mentioned in the storage yard were spaced at convenient distances between centers for unloading, and are surfaced up evenly with gravel nearly to the top of the rail, for convenience to passengers. This arrangement provides convenient facilities for unloading cars in such cases before they reach the departure tracks.

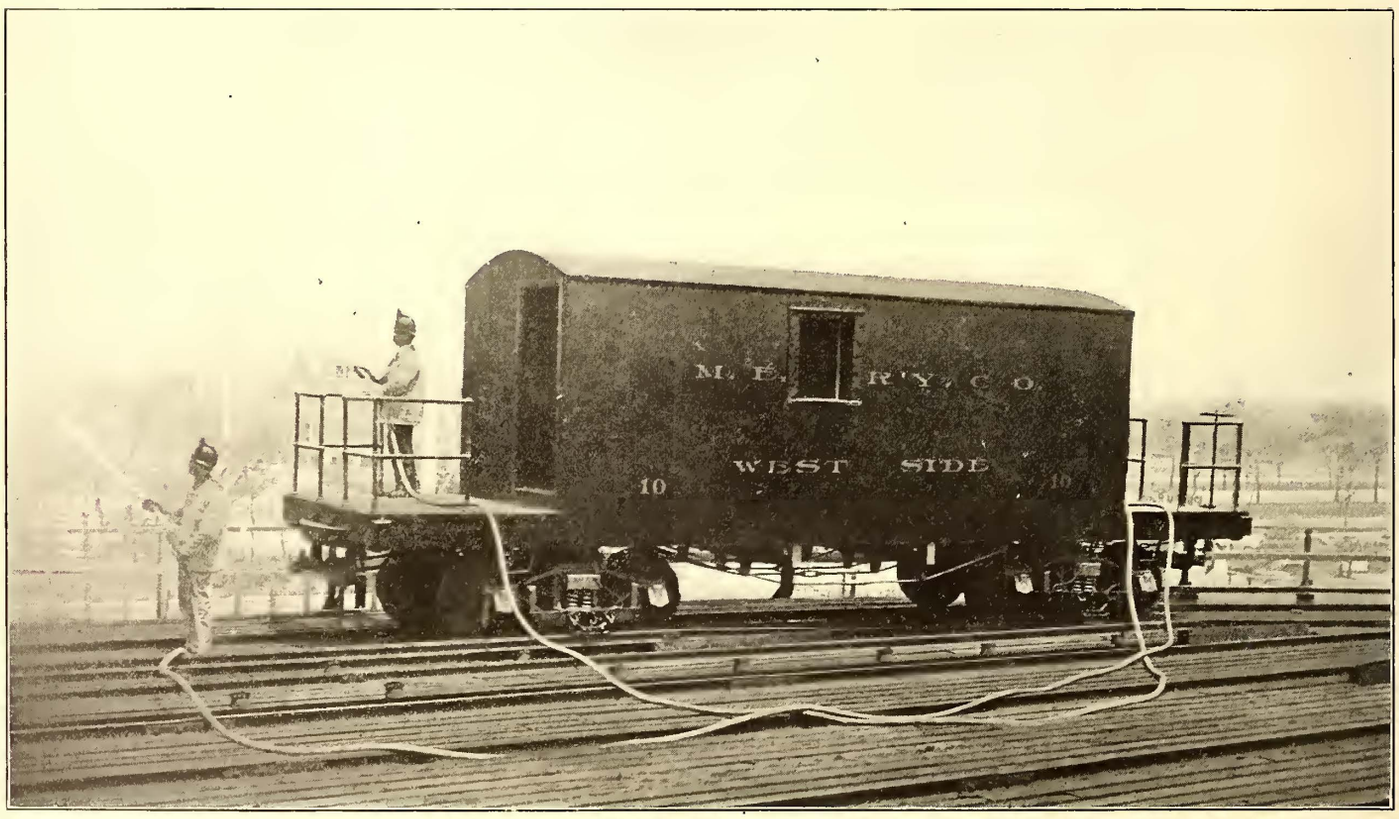
It will be noticed that in addition to the five storage tracks for surface cars, above mentioned, there are also three further storage tracks adjacent which may be used for the storage of either surface or elevated cars. These tracks, together with the other storage tracks which have been installed, provide large storage facilities in reserve for almost any combination of traffic that may be met. The five surface car storage tracks have a capacity for fifty-five surface cars, the three elevated train storage tracks on the east side have a combined capacity of twenty-six cars, and the three tracks adjacent to the surface car storage have a capacity of forty-six surface cars, or thirty-seven elevated cars.

The signaling for departures of surface cars from the loop tracks is handled by the usual method of gong signals of numbered rings for each of the five tracks, which are given by a starter located in an elevated booth near track No. 5. These loop tracks are covered by a substantial shelter, so that passengers may board cars under cover in case of storm. It might also be added that the elevated trains are despatched from the elevated train terminals also by a similar gong-signal system, the number of rings corresponding to the track for which the signal is intended.

ELEVATED CAR FOR FIRE FIGHTING

A novel car equipment for fire protection at terminals and yards has recently been installed and tested by the Metropolitan West Side Elevated Railway Company, of Chicago.

It consists essentially of an outfit of chemical extinguishers of large capacity housed in a fireproof car body. The illustration, Fig. 1, conveys the general appearance of the car, which was formerly a coal car, the hopper having been razed down to the deck, and the house built on it as shown, using the original body frame and trucks.



FIRE EXTINGUISHER CAR ON METROPOLITAN WEST SIDE ELEVATED, CHICAGO

The car is 30 ft. long and 8 ft. wide outside. The house is 20 ft. long, extends clear across the car, with an inside width of 7 ft. 6 ins., and has two doors and two windows, all symmetrically located. The house is covered completely with corrugated iron, and the floor of the 5-ft. platform at each end is of ¼-in. steel plate. The entire structure is very strong and intended to withstand the impact of falling bodies. The system of fire extinguisher used is that of the Nott Fire Engine Company, of Minneapolis, which built and installed the apparatus.

In the car, at one side near the end, the two duplicate horizontal pressure tanks are mounted side by side on the floor, and occupy a space 6 ft. long by 4 ft. 6 ins. wide, thus leaving a 3-ft. passage by them. The ends of these tanks are seen in Fig. 2. Through the center of each tank from end to end runs a shaft, carrying two paddles, and terminating outside, one end in a crank, also seen in Fig. 2. In the top of each tank near the crank is a large hole closed by a cap, which is screwed down tight with the wrench seen lying on the floor in front of the tanks in Fig. 2. Immediately under this hole the inside shaft and paddles are so bent and shaped as to form a cradle, wherein the acid solder or jar is set and held firmly while the whole shaft is rotated. This rotation of the shaft and paddles spills the acid out of its jar, and at the same time agitates the whole mixture, thus keeping up the pressure during the discharge. The water and the soda are also introduced through this large hole and are well mixed with a few turns of the paddles before putting in the acid jar.

On top of each tank is permanently fastened a heavy wire hose-basket. Each basket holds 150 ft. of 1-in. chemical hose, one end of which is coupled to the piping out of the pressure tanks, and the other end has a ½-in. brass nozzle with a shut-off valve. The piping is so arranged as to play either hose or both hose together from either tank, and each hose line has a 250-lb. pressure gage mounted near its controlling valve.

In the opposite corner stands an upright water supply tank, 3 ft. 6 ins. in diameter, of 250 gals. capacity, mounted high enough off the floor to give a gravity flow into the pressure tanks opposite. The space thus left under this water tank is utilized as a cupboard wherein to stow charges of soda, etc. Fig. 2 shows the edge of the water supply tank at the extreme left, and the ends of the two pressure tanks opposite.

To put the apparatus into operation one man leads out the

hose and the other gives the crank a few swings and opens the proper valves. But one tank is discharged at a time, the second tank being reserved, to be discharged when the first is exhausted and is being refilled, thus maintaining a continuous stream; a priceless advantage in checking incipient conflagrations.

RECHARGING

As one pressure tank becomes exhausted action in the other is started by turning its crank, and as the pressure rapidly rises the hose lines are cut off from the first one and thrown on it instantly by the valves. The gas is then blown off from the empty tank by a drain valve and pipe, which leads down through the floor, the cap is unscrewed and the empty acid holder lifted out of its cradle and set one side. One of the little canisters holding a charge of 50 lbs. of soda is then emptied into the cap hole, a 3-in. pipe with a gate valve fills up the pressure tank

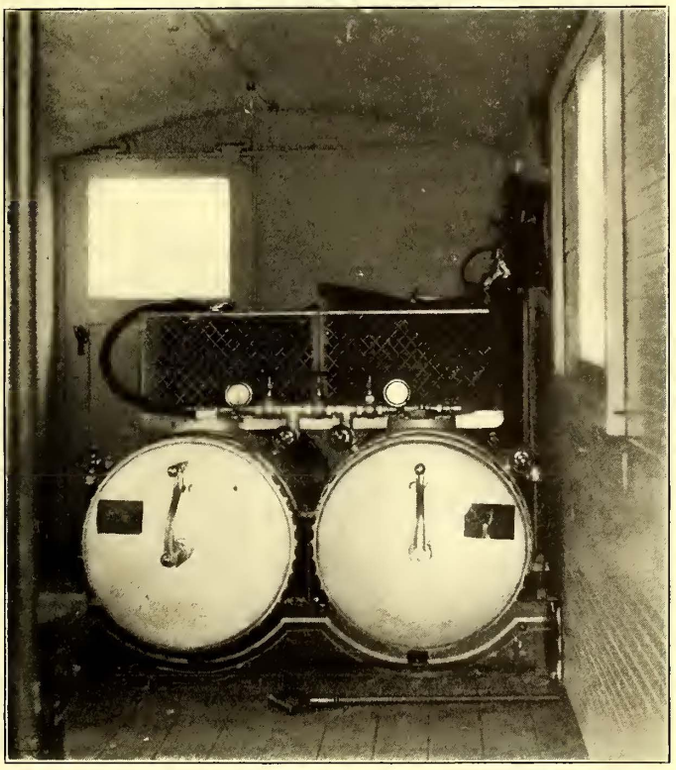


FIG. 2.—APPARATUS IN INTERIOR OF CAR

with water from the supply tank in the corner, and after a few turns of the paddle crank to stir the soda solution, the fresh acid holder is set in, the cap screwed on, and that side is ready for business again. One tank will run 7 minutes when supplying both hose lines simultaneously at 150 lbs. pressure, and the recharging of a tank only requires 4 minutes to complete. Fig. 2 shows the cranks, the two pressure tanks, with their piping, hose and baskets, and their cradles and anchor straps. At the left is shown indistinctly the edge of the water supply tank in the corner, which is fitted with a water glass and water in-take. The car is further equipped with two grappling poles, having a chain at the rear end whereby a car may be hauled out of danger. These are carried on hooks on the walls above the windows. Fig. 2 also shows the two axes, two firemen's helmets and two small Babcock hand fire extinguishers.

This car has no motor, and is intended for use at a yard or terminal, where it will be kept upon a short island in the main lead, next to the night despatcher's office, so that any motor car will be instantly available to move it. The Metropolitan Company is building four more similar cars, as this one has been demonstrated to be a great success.

A clear track will be kept through the middle of each yard, and the fire car can be run onto this track and within reach of any car in a yard as soon as it arrives at a yard.

THE USE OF SUPERHEATED STEAM AND OF REHEATERS IN COMPOUND ENGINES OF LARGE SIZE*

BY LIONEL S. MARKS, CAMBRIDGE, MASS.

The object of this paper was to collect and present the results of a number of unpublished tests made during the past five years on several high-speed, two-cylinder compound engines, all built by the same makers, and all of the same type. The engines tested differ from one another only in size, in cylinder proportions, and in their working conditions. The investigations were made to determine the performance of the engines under different loads, both with and without jacketing and reheating. A comparison of the results for the different tests throws some light upon the influence on the thermal efficiency of large sized four-valve compound engines of the following factors:

(*a*) The use of a reheater.
(*b*) The use of moderately superheated admission steam.
(*c*) The load.
(*d*) The size of the engine.
(*e*) The cylinder proportions.

The results recorded here are for tests made on nine separate engines and for twenty-eight different tests. The engines are parts of three electric lighting plants situated in or near Boston. The engine referred to as *A*, is at the L Street station, South Boston, of the Edison Electric Illuminating Company—a plant which at the time of the test was the property of the Boston Electric Light Company. The tests at this station were conducted by the writer. Engines *B*, *C*, *D*, *E* and *F* are at the Atlantic Avenue station of the Edison Electric Illuminating Company, and they were tested under the joint supervision of an employee of the company and a representative of the engine builders. Engines *G*, *H* and *K* are at the new plant of the Cambridge Electric Light Company, and were tested by the writer.

DESCRIPTION OF THE ENGINES

The engines tested vary from 750 to 2500 rated horse-power, and were all built by McIntosh, Seymour & Company, of Auburn, N. Y. They are all vertical, high-speed, two-cylinder, cross-compound, direct-connected units with overhanging crank. Each cylinder is supported on a heavy, hollow, cast-iron frame at the back and on two inclined steel standards in front. Each high-pressure cylinder is jacketed on the barrel and both heads, and the jackets are piped in series; the steam enters the jacket on the top head, passes into the barrel jacket, goes to the jacket on the lower head and then to the reheater coils. In this way a very active circulation in the jackets is ensured. As there is no separate steam supply to the reheater coils, nor any separate drain from the high-pressure jackets, it was not possible to use either the jackets of the reheater alone. The receivers are of the large cylindrical drum-type, located at the back of the engine and close to the cylinders. The reheater consists of one or more coils of pipe in the receiver. The low-pressure cylinder is unjacketed.

The valves are of the flat, gridiron type, unbalanced and of short stroke. The steam valves on both high-pressure and low-pressure cylinders consist of a main valve cutting off at about .8-stroke, and a Rider cut-off valve, the movement of which can be varied so as to give any desired cut-off. The main steam valves and the exhaust valves on each cylinder are driven from an eccentric on the main shaft through a system of links and levers. The cut-off valves are driven by auxiliary eccentrics, which are controlled by a fly-wheel governor. The action of the valves is rapid; the openings for admission and exhaust of steam are large.

The fly-wheel governors are designed to control the speed within 2 per cent variation between zero load and full load.

* Abstract of paper presented at the Chicago meeting of the American Society of Mechanical Engineers, June 2, 1904

TABLE OF PRINCIPAL RESULTS OF ALL THE TESTS

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	Number of test	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
2	Engine	A	A	B	B	B	B	B	B	B	B	B	B	C	C	C	C	D	D	E	E	F	G	G	H	K	K	K	K
3	Nominal load	1	1	½	½	½	¾	¾	1	1	1¼	1¼	1	1	1	¾	½	1	1	1	½	1	1	1	1	1	½	¼	½
4	Duration of test, hours	10	5	½	½	½	¾	¾	1	2	1	1	8	10	5	4	4	8	8	8	6	8	10	10	9	10	8	⅛	⅛
5	With or without jackets and reheaters	With	With- out	With	With	With- out	With	With- out	With	With- out	With	With- out	With	With	With- out	With	With	With	With- out	With	With	With	With- out	With	With	With	With	With	With- out
6	Nominal H. P. cylinder diameter, inches	28	28	23	23	23	23	23	23	23	23	23	23	29	29	29	29	29	29	29	29	29	18	18	18	31	31	31	31
7	Nominal L. P. cylinder diameter, inches	38	38	48	48	48	48	48	48	48	48	48	48	60	60	60	60	60	60	66	60	60	38	38	38	64	64	64	64
8	Stroke, inches	48	48	48	48	48	48	48	48	48	48	48	48	56	56	56	56	56	56	56	56	56	42	42	42	48	48	48	48
9	Revolutions per minute	118.46	118.46	103.6	103.4	103.1	102.5	102.5	101.9	101.9	101.2	101.3	101.9	97.48	97.64	98.77	99.6	98.2	98.6	99.7	100.7	98.53	118.4	119.1	119.15	116.9	119.1	119.3	118.37
10	Steam pressure at throttle, pounds per square inch	159	161	152.6	151.5	155.3	150	155.1	149.5	155.9	152.6	155.2	101.8	168.6	167	167	169.4	162.8	163.1	159.2	160.4	158.7	186	137	131	136	132	136	135
11	Superheat at throttle, degrees, Fahr	Wet	Wet	4.8	21.8	10.7	17.5	9.2	14.6	14.6	8	13.8	18.6	80.2	78.5	64.5	48.3	98.4	98.4	72.4	70.4	92.7	72.2	75	55.5	64.2	70.3	55.3	73.5
12	Initial steam pressure in H. P. cyl., by cards	156	155	97.8	133.8	131.6	138.7	190	134.8	131.2	181.2	135.9	140	158	155.5	155.4	150.5	157.3	157	156	153.3	150	130.9	136.9	130	132.9	122.4	95	126.1
13	Steam pressure in receiver, gage	21	20	1.33	8.8	7.	13.8	11.	13.8	----	----	19.7	20.	13.7	11.1	10.1	5.5	13.5	12.3	14	7.5	14.5	8.9	11.1	13.1	10.6	5.1	1.5	3.6
14	Superheat entering L. P. cylinder, degrees, Fahr	35.5	23.05	99.8	75.4	Wet	60.5	Wet	46.6	Wet	36.5	Wet	49.4	60.3	Wet	67	84.8	60.5	Wet	60.9	86.0	61.7	Wet	49.1	Wet	40.3	59	79.1	Wet
15	Effective vacuum in L. P. cylinder, ins., by cards	24.05	24.5	26.7	26.	25.8	26.5	25.5	25.8	25.9	24.6	23.6	25.6	23.3	23.9	23.9	24.3	24.3	24.4	24.8	24.4	24.8	11.8	13.2	11.8	11.9	12.1	12.5	12.22
16	Vacuum in exhaust pipe, inches	25	24.5	28.2	28.0	27.25	28.3	27.1	27.7	28.0	25.2	26.8	27.0	24.9	24.7	25.6	26.1	25.6	25.7	25.3	25.4	26.1	26.2	26.3	26.1	25.4	26.4	26.4	25.8
17	I. H. P., total	1,904	1,984	309	552	548	845	831	1,047	1,105	1,498	1,516	1,104	2,967	2,340	1,831	1,239	2,202	2,215	2,230	1,259	2,171	715	716	858	2,184	1,196	716	1,198
18	I. H. P., H. P. cylinders	859	962	121	243	247	316	388	507	608	702	415	689	1,098	1,218	874	573	1,083	1,189	1,119	633	1,008	384	347	464	1,064	605	331	647
19	I. H. P., L. P. cylinders	1,135	1,022	165	349	301	529	443	634	598	890	814	689	1,169	1,022	957	666	1,119	1,026	1,111	926	1,163	391	369	394	1,120	591	385	551
20	Percentage of power developed in H. P. cylinder	43	48.5	39.4	36.8	45.1	37.4	46.7	39.5	45.9	40.6	46.3	37.6	48.5	54.3	47.8	46.2	49.1	50.8	50.2	50.3	46.5	53.7	48.6	54	48.8	51	46.2	54.5
21	Total steam per I. H. P. per hour, lbs	13.59	13.68	14.04	13.71	15.11	13.63	13.72	13.59	14.41	14.57	15.16	13.58	12.72	12.98	12.71	12.38	12.57	11.88	11.67	11.78	11.67	14.13	13.21	13.13	12.50	12.22	12.95	12.90
22	Per cent of total steam used in jackets and reheater	6.8	----	10.2	8.95	----	7.91	----	7.49	----	8.9	----	6.9	6.5	----	7.2	9.3	7.4	----	7.1	9.3	5.6	----	6.45	----	4.89	7.28	9.05	----
23	Wet steam in jackets and reheater per I. H. P. hour, lbs	.92	----	1.43	1.23	----	1.08	----	.95	----	.91	----	.94	.83	----	91	1.15	.85	----	.83	1.09	.65	----	.69	----	.61	.89	1.17	----
24	Per cent of cylinder steam drained from receiver	1.6	6.0	----	----	3.7	----	6.7	----	5.97	----	4.97	----	----	2.3	----	----	----	----	----	----	----	3.35	----	6.12	.93	----	2.75	----
25	Quality of steam at cut-off H. P. cylinder	81.6	75.5	61	58	60	68	72	68	60	79	74	65	86	86	77	65	99	93	93	82	89	76	85	86	92	83	81	80.5
26	Quality of steam at release H. P. cylinder	85.6	79.6	85	85	88	80	74	78	75	93	78	81	83	88	82	80	94	87	94	92	84	75	88.5	83	93	88	88	92
27	Quality of steam at cut-off L. P. cylinder	92.4	87	95	90	65	88	78	90	76	94	88	90	99	89	93	99	100	86	93	85	100	84	89	84	93	92	97.4	80.5
28	Quality of steam at release L. P. cylinder	95.5	93	95	91	88	88	90	91	88	98	89	93	96	91	98.5	99	99	84	93	92	100	87	93.2	82	97	96	100	94
29	B. T. U. per I. H. P. per minute	245	248	298	252	277	251	270	248	267	255	265	241	236	244	235	227	217	226.5	217	217	221	264.9	245.5	243.3	227.3	226.6	241.5	244
30	Thermodynamic efficiency, per cent	17.3	17.1	16.5	16.9	15.4	17.0	15.8	17.2	15.9	16.7	16.1	17.6	18.0	17.4	18.1	18.7	19.6	18.7	19.6	19.6	19.2	16.0	17.3	17.4	18.7	18.7	17.6	17.4
31	Thermodynamic efficiency compared with ideal cycle	65.4	65	58	60	58	60.5	59	62.5	58	66.1	61.5	64.5	68.3	65.6	67.3	65.7	75.4	72.3	72.6	73	70.7	62.8	67.4	68.5	74.2	73.3	66.8	67.5
32	Per cent saving by jacketing and reheating	1.3	----	9.0	----	----	8.0	----	7.0	----	4.0	----	----	3.0	----	----	----	4.5	----	----	----	----	----	7.5	----	----	7.2	----	----
33	Engine friction at no load, I. H. P	118	----	----	----	----	----	----	70.5	----	----	----	----	139	----	----	----	169	----	164	197	----	----	50	50	----	----	----	----
34	Mechanical efficiency at rated load, per cent	94.1	----	----	----	----	----	----	94	----	----	----	----	93.2	----	----	----	92.7	----	93	----	91.4	----	93.4	93.4	----	----	----	----

At the Cambridge electric light station the position of the governor weights can be regulated when the engine is running by means of a small electric motor fastened to the fly-wheel and controlled from the switchboard. This device is valuable for synchronizing in parallel running.

THE TESTS

(The author here described the arrangements made for testing the engines, which was carried out with the greatest possible care with reference to preventing leakage from boilers, feed mains, steam pipes and connections; as all but one of the engines are fitted with jet condensers, their steam consumptions could be determined only by measuring the boiler feed. The diameters of all cylinders were gaged when hot, the weighing scales for coal were carefully tested, and all gages, thermometers and indicators were carefully recalibrated. The results of the tests are summed up in an interesting form in the accompanying table).

RESULTS:

THE VALUE OF HIGH-PRESSURE JACKETS AND OF REHEATING

There are certain facts which the writer believes may be postulated with reference to the effectiveness of jacketing and reheating, and which are supported by the results of these tests. The saving by jacketing varies with the following factors:

(*a*) It increases as the cut-off becomes earlier.

(*b*) It decreases as the superheat of the entering steam increases.

(*c*) It decreases with increase in size of the engine.

There is no saving by reheating when the reheater does no more than to dry the steam. If there is any advantage in using dry and saturated steam in the low-pressure cylinder over the use of wet steam, it can be obtained by the use of a separator between the cylinders. In tests 2, 7, 9 and 24, when the reheater was not in use, the receiver acted as an almost perfect separator, taking away all the condensation which calculations showed to have occurred in the high-pressure cylinder. If the reheater merely vaporizes the condensed steam at the expense of a practically equal quantity of high-pressure steam it is not only non-effective but is also, probably, a source of actual loss, since more work could have been obtained from the total steam used if it had all gone into the high-pressure cylinder.

The reheater then should be regarded merely as a superheating device for the steam entering the low-pressure cylinder, and it may be expected to be more effective the greater the amount of superheat it gives the receiver steam. It is probable that the reheater would be more effective if the only work were superheating, as it might be if the wet steam exhausting from the high-pressure cylinder passed through a good separator before reaching the reheater. As the reheater will have less to do when the engine is running at low loads it may be expected to give a higher superheat at low loads, and, consequently, to be more effective. With the above in mind, an examination of the tests, the principal results of which are presented in the accompanying table, throws some light on the conditions under which the jacketing of the high-pressure cylinder and the practice of reheating are desirable, and shows the saving to be expected from them in large size engines.

In engine *A*, when saturated steam is used, the jackets, at full load, keep the steam about 6 per cent dryer in the high-pressure cylinder and the reheater superheats 35 degs. As the greater part of the 6.8 per cent of the total steam which is condensed in the jackets and reheater must have been condensed in the latter place, it is obvious that the reheater cannot have contributed anything to the small saving of 1.3 per cent.

The conditions in engine *B* are much more satisfactory for effective action of jackets on reheater, especially at the lower loads. The engine is smaller, and its reheater more effective. At half-load, with 75 degs. superheat of the receiver steam,

the saving was 9 per cent; at three-fourths load, with 60 degs. superheat, there was 7 per cent saving; at full load, with 46 degs. superheat, there was still 7 per cent saving, and even at one-quarter overload, with 26 degs. superheat, there was 4 per cent saving. The larger engines, *C* and *D*, with 80 degs. and 98 degs. initial superheat and 60 degs. superheat by the reheater, show but 3 per cent and 4.5 per cent saving respectively.

The engine *G* is only one-third the power of engines *C* and *D*, consequently the jackets are much more effective (raising the steam quality 10 per cent in the high-pressure cylinder), so that with 49 degs. superheat going to the low-pressure cylinder, the saving is 7.5 per cent. The tests on engine *K* at half-load, with 59 degs. superheat by the reheater, show 7.2 per cent saving. The engines *C*, *D* and *K* have sufficient initial superheat and are of such size as to make the high-pressure jackets of but little value, so that the savings shown are due principally to the action of the reheater.

A study of the above results appears to indicate that the reheater will not justify its use (except as a separator) unless it superheats the low-pressure admission steam at least 30 degs. An examination of the qualities at release in the low-pressure cylinders indicates that 100 degs. superheat of the receiver steam will probably be enough to make the steam dry and saturated at release. As it is not desirable to have superheated steam at release, this suggests the probable desirable limit to the amount of superheat to be given by the reheater.

THE VALUE OF MODERATE SUPERHEATING

The engines *C*, *D*, *E*, *F*, *G*, *H* and *K* were all supplied with steam from Babcock & Wilcox boilers, fitted with superheaters giving from 100 degs. to 125 degs. superheat at the boiler when running at the rated power. The amount of superheat at the engine depends on the load at which the engine is running; (*a*) because the superheat at the boiler decreases as its load is decreased, and (*b*) because the fall of temperature in the steam pipe increases as the weight of steam passing through it diminishes. For these two reasons the superheat was less at low loads than at higher loads, except in some cases where the number of boilers used could be decreased as the load decreased. As the superheat going to the low-pressure cylinder when the reheaters were in use varied in the opposite way, that is, increased with decrease of load, these two variations tended to offset one another in their influence on the engine efficiency. The tests without the reheaters in use will then be the most valuable for showing the influence of the superheat of the high-pressure steam. The tests at full load show that engine *A* uses 248 B. T. U. per indicated horse-power per minute with no superheat; engine *C*, of about the same size, with 78 degs. superheat, uses 239 B. T. U., and engine *D*, with 98 degs. superheat, uses 226 B. T. U., a saving of about 9 per cent; some of which, however, is also due to a better vacuum and better cylinder proportions. Engine *B*, a smaller engine, uses 267 B. T. U. with 15 degs. superheat—which is practically the same result as that obtained from engine *G*, a still smaller engine, with a poorer vacuum but with 72 degs. superheat. In the test of engine *D*, with 98 degs. superheat, the quality of the steam at release is 87 per cent, so that it is evident that when the jackets are not used a much greater superheat is desirable in order to prevent condensation in the high-pressure cylinder—probably at least 150 degs. will be necessary. An even greater superheat will be necessary to keep the steam dry in both cylinders. With the jackets in use and with 98 degs. superheat the quality in the high-pressure cylinder at cut-off is 99 per cent., and at release is 94 per cent. The advantage gained by superheating is, of course, greater in the smaller engines.

THE VARIATION OF ECONOMY WITH ENGINE LOAD

The engines *B*, *C*, *E* and *K* were all tested at several loads so as to determine the effect of variation of engine load on the efficiency of the engine. In all the cases (engines *C*, *E* and *K*) where moderately superheated steam was admitted to both cylinders, the important fact was brought out that the heat consumption per indicated horse-power is practically constant through a range of load varying from one-half load to a full load, and probably even to a considerable overload. The apparent exception in the better performance of engine *C* at half-load is probably due to a better vacuum at that load. The general result was to be expected, because the effect of superheat is to reduce the amount of heat disappearing during admission, and, consequently, to permit the increased expansion at low loads to occur without excessive cylinder condensation. In engine *B*, with very small superheat of the admission steam, there is a slight decrease in economy as the load decreases from full load, and in the tests without reheater, and, consequently, with no superheat going to the low-pressure cylinder, this decrease in economy is very marked.

It is, perhaps, hardly necessary to emphasize the fact that the constancy of heat consumption referred to above is in terms of the indicated horse-power. In all these engines the friction horse-power is low, and the mechanical efficiencies at the rated loads are high, varying (see table, line 34) from 91.4 per cent to 94 per cent, and averaging 93.2 per cent. The friction horse-powers were determined by taking cards with no load on the engine, but they really represent more than the friction of the engine proper, since they include some losses properly chargeable to the generator—such as the brush friction, the armature windage, the bearing friction of the armature and, in some cases, a low excitation of the field. Consequently, the real mechanical efficiencies of the engines are somewhat higher than the quantities given in the table.

The low friction of the engine causes the heat consumption per electrical horse-power to change a comparatively small amount as the load decreases; the heat consumption per kilowatt per hour will be some 6 per cent or 7 per cent greater at half load than at full load.

THE RADIATION AND CONDUCTION HEAT LOSSES

In these tests where the reheater was in use, the knowledge of the exact condition of the steam entering the low-pressure cylinder permitted the determination of the heat lost by radiation and conduction from the high-pressure cylinder and the receiver. The total heat of the steam coming to the engine is the sum of the four following quantities:

(1) The heat going to the low-pressure cylinder.

(2) The heat equivalent of the work done in the high-pressure cylinder.

(3) The heat escaping with the reheater and receiver drainage.

(4) The heat lost by radiation and conduction from the high-pressure cylinder and the receiver.

The first three quantities can be calculated from the observations made on the test, and, consequently, the last quantity can be determined by the heat balance stated above. The radiation and conduction loss was calculated for most of the tests, and was found to vary from ½ per cent to 1 per cent of the total heat supply to the engine at full load. As the low-pressure cylinder is as carefully lagged as the high-pressure, it appears that from 1 per cent to 1½ per cent of the total heat supply to the engine at full load will be lost by external radiation and conduction. The larger percentage applies to the smaller engines.

PISTON LEAKAGE

The steam qualities at cut-off and release, given in lines 25 to 28 of the table, show considerable variation in different engines running under practically the same conditions. The reason for this variation is apparently not far to seek, and depends on a phenomenon to which but small consideration is generally given in the discussion of steam engine performances. This phenomenon is piston leakage.

Most of the engines were tested when at rest for piston

leakage, before the runs were made, and in no case was there any but slight leakage. It is probable, however, that a piston which is quite tight when at rest will leak when running. The static leakage tests were made for a small number of piston positions, and did not insure static steam tightness in every position. There is evidence, moreover, to show that even if the piston is tight in every position when at rest, it may leak when in motion owing to the breaking up of the oil film on the cylinder walls. If to the results of the leakage test of the piston is added the knowledge that an intelligent engineer has of the condition of the cylinders of which he has had charge, it is probable that a more accurate statement can be made as to the tightness of the pistons. From such data the following statements may be made as to the condition of the engines tested.

Engine *B*, neither piston perfectly tight, but both in good condition.

Engine *C*, no appreciable leakage.

Engine *D*, both cylinders in very good condition.

Engine *E*, high-pressure cylinder very good; low-pressure piston had not worn down to maximum tightness.

Engine *F*, high-pressure cylinder had been scored a few weeks before test, and had not worn quite tight; low-pressure cylinder unusually good.

Engine *H*, high-pressure cylinder very good; both cylinders better than engine *G*.

The above conditions, as known before the tests, will be found to explain most of the variations in steam quality to which reference has been made. For example, of the two similar engines, *E* and *F*, the latter shows lower quality at cut-off in the high-pressure cylinder, notwithstanding a greater initial superheat—and this quality is seen to decrease throughout expansion. Leakage past the high-pressure piston readily accounts for this. In the low-pressure cylinders of these two engines the phenomenon is reversed, and the remarkably high quality of the steam in engine *F* is presumably due to the unusually good condition of the cylinder.

Similarly comparing tests 22 and 24 on the exactly similar engines, *G* and *H*, under practically similar conditions, a marked advantage is seen in the quality of the steam during expansion in the high-pressure cylinder during the latter test—a result to be expected from the known better conditions of that cylinder.

These examples could be multiplied were it desirable. The effect of the piston leakages, when moderate, on the engine economy is not very great, since steam leaking by the high-pressure piston will be available for doing work in the low-pressure cylinder.

CONCLUSIONS

In summing up the general results of the tests the following conclusions appear to the writer to be justified when applied to large size, high-speed, compound, four-valve engines of common proportions.

The jacketing of the high-pressure cylinder is of but little value when moderately superheated steam (100 degs. F.) is used.

Reheating is probably a source of loss unless it superheats the receiver steam at least 30 degs. F., and is not fully effective unless it superheats about 100 degs. F. In the latter case it may be expected to effect a saving of 6 per cent to 8 per cent of the total heat used per indicated horse-power.

Jacketing the low-pressure cylinder is shown by the steam qualities during expansion in the low-pressure cylinder to be unnecessary and, therefore, undesirable when the reheating is effective. The effect of admitting moderately superheated steam to both the high-pressure and low-pressure cylinders is to keep the heat consumption per indicated horse-power practically constant throughout a considerable range of loads—from half load to about one-quarter overload.

The variation within the ordinary limits of the ratio of stroke to diameter in large size engines of the same power when using moderately superheated steam does not have any marked effect upon the economy of the engine. The size of the engine is an important factor in determining its efficiency. The engine *G* has about 10 per cent greater heat consumption per indicated horse-power than *K*, which is three times larger.

A NEW HIGH-SPEED INTERURBAN LINE BETWEEN BOSTON AND PROVIDENCE

Another high-speed double-track electric railway system is being projected, to operate out of Boston and connect that city and its suburbs to the west, with Providence, R. I. The organization papers have been completed and the necessary locations will be secured. The organization of this road is being carried out by James F. Shaw, president of the Boston & Worcester Electric Companies and allied interests, the new company to be closely related to the present high-speed interurban line between Boston and Worcester, Mass.

It is proposed to utilize the tracks of the Boston & Worcester Electric Railway as far out from Boston as the suburb of Newton, 8 miles distant, from whence the new line will start directly south, running through Needham, Dover, Walpole, Wrentham, North Attleboro, Attleboro and Pawtucket, into Providence. The road will be double-tracked throughout, and will be heavily ballasted for high-speed operation. The plans call for the building of a total of 34 miles of double track, a large proportion of which will be upon private right of way. Where highways are used it is proposed to make use of the boulevard system of arrangement of tracks, with center-pole construction. Large cars of the most recent construction will be provided, and they will be heavily powered for high-speed operation. It is expected that the total distance between the two cities, 43 miles, will be covered in a little over 2 hours. The line is to be equipped with a system of signaling for the safe operation of trains, and a despatching system similar to that used upon the Boston & Worcester line will be installed. It is thought that power for the line will be furnished by the present power plant of the Boston & Worcester line at South Framingham.

The cost of this new line and its equipment is estimated at $2,500,000, which will be provided for by a capitalization of $1,250,000 and a bond issue of like amount. The promoters are sanguine of complete success, and expect that an even greater development of traffic will result from the opening up of this territory than was the case upon the Boston & Worcester line. No trouble is anticipated in securing the rights through the connecting towns, as it will mean an important development of many inaccessible locations and will tend to increase property valuations. Moreover, the section to be traversed is at present inadequately provided with transportation facilities, and the new system will come as a relief. The fare which will be charged between Providence and Boston will probably be 50 cents one way, as compared with the regular fare of $1 which prevails upon the lines of the New York, New Haven & Hartford Railway between these points.

The Montreal Street Railway proposed to erect waiting rooms at several of the terminal points for the accommodation of the public. One has just been completed on Wellington Street; another, formerly the Park & Island station on Victoria Avenue, Westmount, has been improved and refitted, and a third is being constructed at the Harbour Street yard, corner of Notre Dame and Harbour Street, Hochelaga. A two-story stone and brick station is to be erected at the corner of Mount Royal and Park Avenue, to have waiting room and ticket office, and living rooms for the agent and his family.

ELECTRIC RAILWAY BLOCK SIGNALING BY USE OF ALTERNATING-CURRENT TRACK CIRCUITS

In a paper upon the above subject recently read before the Railway Signal Association, J. B. Struble, signal engineer of the Union Switch & Signal Company, referred in an interesting manner to the important pioneer work of installing the first system of automatic block signaling, using alternating current for the track circuits, which was carried out under his direction upon the North Shore Railroad, a suburban system operating out of San Francisco, Cal. This system, which formerly used steam motive power, was recently equipped for electric traction, as described in the January 2d and 9th issues of the STREET RAILWAY JOURNAL, and this special system of track-circuit block signaling for use in connection with the propulsion system, utilizing the rails for the return conductor, where direct-current track circuits would not ordinarily operate satisfactorily, owing to interfering currents, was installed. It is of particular interest to electric railway interests, as it opens up the possibility of operating automatic block signals thus with the certainty and reliability of former systems upon our steam railroad systems. The system upon the North Shore Railroad is referred to in detail upon pages 66 and 67 of the above mentioned articles.

In referring to the system upon the North Shore Railroad Mr. Struble stated as follows:

"Alternating current for signaling purposes opens up a field which is in some respects revolutionary. The point of chief interest, aside from that of immunity from the effects of direct current, whether that of electric roads or that of steam roads, annoyed with foreign current on their track circuit, is that of transmission. Its advantages and possibilities in this respect are very great.

"It was my good fortune to be sent to California about one year ago to install the first alternating-current system of signaling. This was on the North Shore Railroad running north from San Francisco. The part signaled comprised about 10 miles of double track, and included the rather novel arrangement of an old narrow-gage railroad having added to its old steam service the new standard gage electric service. This was done by applying standard ties and the addition of one running rail. The rail which was common to both gages was divided into block sections. Thus trains of either gage or propelled by steam or electricity would operate the signals.

"Current for operating the electric trains, as well as the signal system, was generated at the famous Colgate power house, distant about 180 miles, in the Sierras, and with a water head equal to several Niagaras. The current was transmitted at about 40,000 volts at 60 cycles to their local power house near the tracks, and there transformed to 4500 volts. For signal purposes we here connected to the neutral and one side of the three-phase system, giving about 2300 volts single-phase. At this voltage the electrical size of the wire required for the signal mains was less than that necessary for mechanical strength. In addition to supplying the track circuits, these mains served to supply current for lighting the signals and way stations. The 6-cp signal lights, in that clear atmosphere, gave, with properly focused lenses, an illumination which was very satisfactory.

"A novel feature, and one which appeals to the imagination, was that when making tests of the track circuits we soon learned to tell when a storm was raging in the Sierras, on account of certain peculiar electrical disturbances, and forthwith to postpone further tests until better weather prevailed in the mountains. Another feature, odd to an Easterner, was the fact that they can guarantee weather conditions in advance, so that, during construction, cement and other material can be distributed and left entirely unprotected from harm by the elements.

"Some of the track circuits were about 1 mile in length, and, as it rains with much copiousness during the wet season, conditions were favorable for a test of the system. Ballast was of gravel and well removed from contact with the rails. We were happily surprised to find that under the worst conditions the relays operated with a margin of about 30 per cent to 40 per cent or more above the failing point. We had no failures due to the alternating-current feature, and since it was put into service, about eight months ago, we have not heard from the railroad company, so the signals are presumably working in a satisfactory manner.

"An interesting feature was that of the effect upon animals of the alternating current in the tracks. Although the voltage on the rails was about 8 to 14, horses soon refused to pass over the tracks at road crossings, and things came to such a pass that something had to be done. The simple remedy was that of insulating the block rail at crossings and connecting with a wire run through the road in grooved lumber.

"The signals used were of the Union style "B" electric semaphore type, operated by 8-volt storage batteries, two sets of which were located in the base of the signals. Where two signals were opposite, one set served for both. They were charged at one-fifth ampere rate through resistance from the 500-volt contact-rail. Thus no primary batteries were necessary, and the chances of failure and cost of maintenance were reduced to a minimum. During certain hours of the night the electric train service was shut down, while the steam service continued. Storage batteries then kept the signals operative while the contact-rail was dead."

Mr. Struble stated further, in reference to the use of the alternating-current track-circuit system:

"The scheme of alternating-current signaling was devised to meet the demands of high-speed electric trains. Ordinary direct-current track circuits, as applied to steam roads, would not be satisfactory for this service, because the running rails are here used as return conductors for the motor current. This current would wrongly affect the operation of the track relay, and, of course, the signal. To overcome this difficulty it was necessary to employ a current for the track circuit which would have such characteristic difference from that of direct current as would operate selectively upon the track relay. Alternating current accomplishes this because of its ability to induce a current in another circuit brought within its magnetic field—a property not possessed by direct current.

"The track relay is, therefore, of the induction type, and responds to alternating current and not to direct current. An excess of direct current cannot cause it to go to danger, for if a fuse or other protective device fails to open the circuit the relay coils will be destroyed. With this relay there is no such thing as residual magnetism, and the points of pick up and release are identical, except as effected by twice the mechanical friction of the moving parts.

"Two main feed wires bearing alternating current at, say, 60 cycles and 2000 volts, extend the length of the system, and across these are connected the primaries of the track transformers, the secondary leads of which are connected across the rails at the exit end of each track circuit. Across the rails at the entering end are connected the terminals of the induction relay. We now have a circuit consisting of the secondary of the transformer, the rails and the coils of the track relay. Through this circuit passes simultaneously two kinds of current, alternating, induced by the primary of the transformer, and direct, the return from the car motors.

"Since the direct current tends to make ineffective the alternating current, an impedance coil is connected across the relay terminals, or track rails; this has low ohmic resistance, but high inductive resistance to the alternating current, and serves the purpose of shunting the direct current from the relay," while compelling the alternating current to pass through it."

STREET RAILWAY EXHIBITS AT THE WORLD'S FAIR.

In the Street Railway Journal of May 7, a short description was given of a number of the principal exhibits of street railway interest at the Louisiana Purchase Exposition, in St. Louis. At the time that that synopsis was published the work of placing the exhibits had not progressed sufficiently to allow the publication of any views of individual exhibits. While all parts of the World's Fair are not entirely complete, the railway and electrical exhibits are in very good condition, and a number of the exhibits mentioned in the May 7 issue have been selected

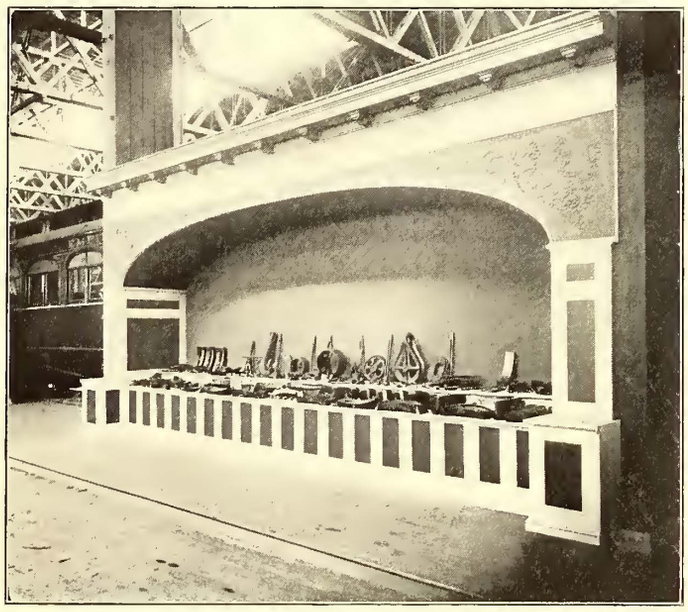


EXHIBIT OF AMERICAN BRAKE-SHOE & FOUNDRY COMPANY

in this issue for illustrative purposes. Other views of prominent exhibits will be published in early issues of this paper.

AMERICAN BRAKE-SHOE & FOUNDRY COMPANY

The American Brake-Shoe & Foundry Company, of Mahwah, N. J., has exceptional facilities for presenting an exhibition showing the development of railway brake-shoes and the different successful schemes which have been adopted to secure high-wearing and frictional qualities. This it has done, beginning with the plain cast-iron shoe and finishing with the modern patented brake-shoes containing various forms of inserts or reinforcements, which enable the brake-shoe to be kept

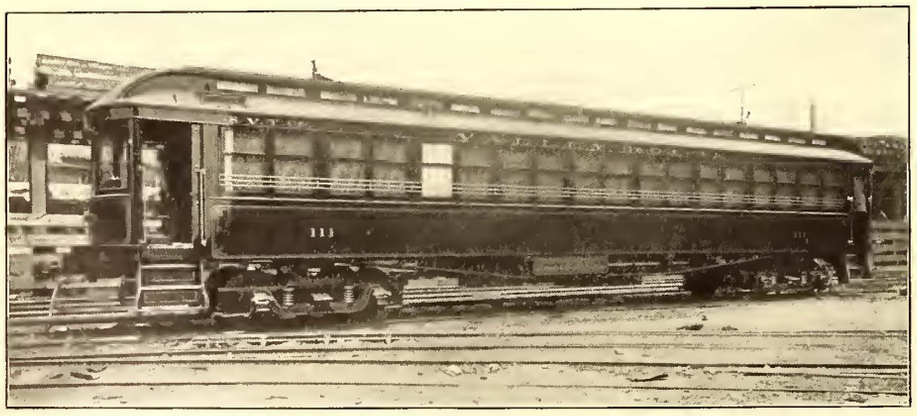


EXHIBIT OF AMERICAN CAR & FOUNDRY COMPANY, EXTERIOR OF CAR

in service after the body metal cracks. An interesting variety of reinforcements are shown, most notable of which are the shoes containing expanded metal around which cast-iron is poured, and those containing soft irregular shaped centers embedded in cast-iron. The exhibition, although not large, is of great educational value to the student of brake-shoe development. The company also shows small steel castings, which it makes by the Tropenas process. This company has the American rights to manufacture under these patents, and has a large steel foundry at Chicago Heights, Ill., devoted to this work. Steel castings by this process are made for motor and gear casings, oil cups and tools. Both large and small work is successfully done by this process.

AMERICAN CAR & FOUNDRY COMPANY

The American Car & Foundry Company has two exhibits in the Transportation Building. The one of most interest to electric railway men is the vestibuled interurban car built by the Wilmington plant for the Scioto Traction Company, of which W. E. Baker & Company, of New York, are the constructing engineers. This car is equipped with four General Electric 150-hp motors, being intended for speeds as high as 75 m. p. h. The car is, therefore, very substantially built; it has composite steel and wood longitudinal sills. The dimensions are: Length over buffers, 60 ft.; length over vestibules, 58 ft.; length of

EXHIBIT OF AMERICAN CAR & FOUNDRY COMPANY, INTERIOR OF CAR

car body, 49 ft. It is divided into two compartments, the ladies' compartment being 37 ft. 6 ins., and the smoking compartment, 10 ft. 10 ins. long. The width over sheathing is 8 ft. 4 ins.; distance between truck centers, 37 ft. 4 ins. The seating capacity of the ladies' compartment is fifty-four, and of the smoking compartment sixteen, which is, as will be seen, high for this length of car. The trucks, which are also built by the American Car & Foundry Company, are of the so-called M. C. B. type, with all contact parts machined to secure good fit. The wheel base of these trucks is 6 ft. 6 ins. The trucks are equipped with the Westinghouse Traction Brake Company's electric brake. The car body follows in general steam railroad construction. There are eighteen windows on each side, arranged in pairs, with upper and lower sash. Both compartments are finished in mahogany. The ceiling is three-ply veneer poplar, decorated in gold. The car weighs, complete, in running order, 86,900 lbs. The wheels are 36 ins. in diameter, with the M. C. B. wheel tread and flange. It was accordingly sent from the factory to St. Louis on its wheels. The couplers are Van Dorn No. 3. It is equipped with Consolidated Car Heating Company's electric heaters and Hale & Kilburn Manufacturing Company's special high-back walkover seats. This car

will probably be one of those submitted to the Electric Railway Test Commission for test of the electric equipment, which is intended for high-speed work.

WILLIAM WHARTON, JR., & COMPANY, INC.

Interesting proofs of the fact that manganese steel-hardened centers, when set in special track work, such as frogs and crossings, will outlast the special work in which it is placed, is offered in several places in the extensive special track work exhibit of William Wharton, Jr., & Company, Incorporated, of Philadelphia, in the Transportation Building. Several samples of worn special work are shown where the frogs and points have lasted as well as the surrounding track. One frog is shown over which 2,570,000 electric cars have passed, and another frog over which 1,600,000 electric cars have passed, but these frogs are worn down in about the same proportion as the rail, and were taken out of the track because the rail was practically worn out. Another prominent feature of the exhibit is the protected heel switch. This is a street railway switch in which the pivot of the switch is not exposed to the hammering of the car wheel, as it is concealed in hardened steel. Another feature is the Wharton unbroken main line switch for steam and interurban railroads, which makes it unnecessary to have frogs in the main line at the switch. Street railway special work with manganese steel centers is, of course, shown. Manganese steel frogs are also being made for steam and interurban railroads, with guard rails having manganese steel reinforcements. Arthur S. Partridge, the well-known supply man of St. Louis, has charge of this exhibit.

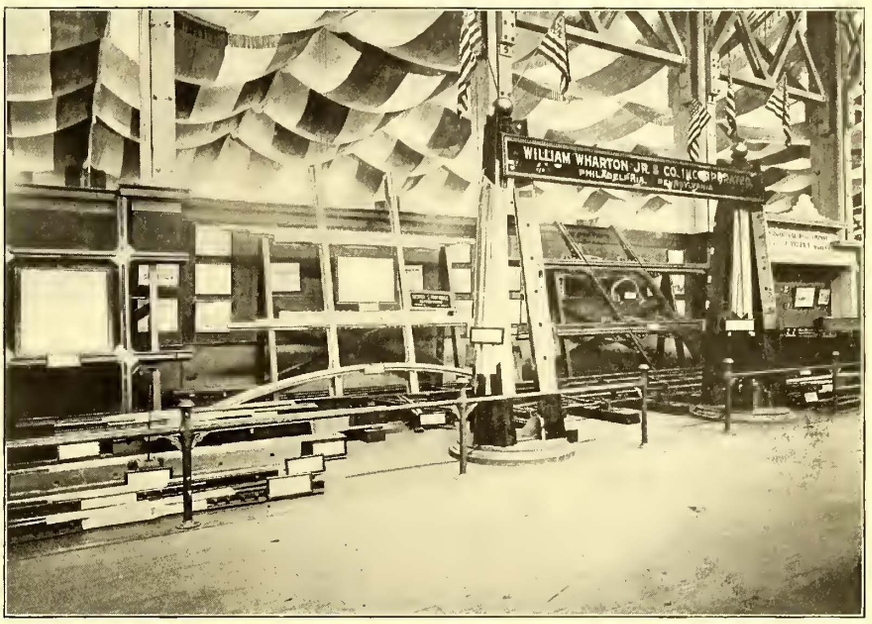


EXHIBIT OF WILLIAM WHARTON, JR., & COMPANY

THE CONTINUOUS RAIL-JOINT COMPANY OF AMERICA

Sample joints for a great variety of sections of T and girder rail are to be seen at the space of the Continuous Rail-Joint Company of America in the Transportation Building. Joints, with a number of the more common types of electric bonds, are displayed, and a new bond this company is preparing to supply is shown for the first time. This bond consists simply of a flat strip of copper forced into a groove in the angle-bar of the joint at the point where the angle-bar bears on the rail base. The copper, therefore, forms part of the bearing surface between angle-bar and rail. A new insulated joint for block signal work shown, employs insulating strips under half of the angle-bar on one side and half on the other side.

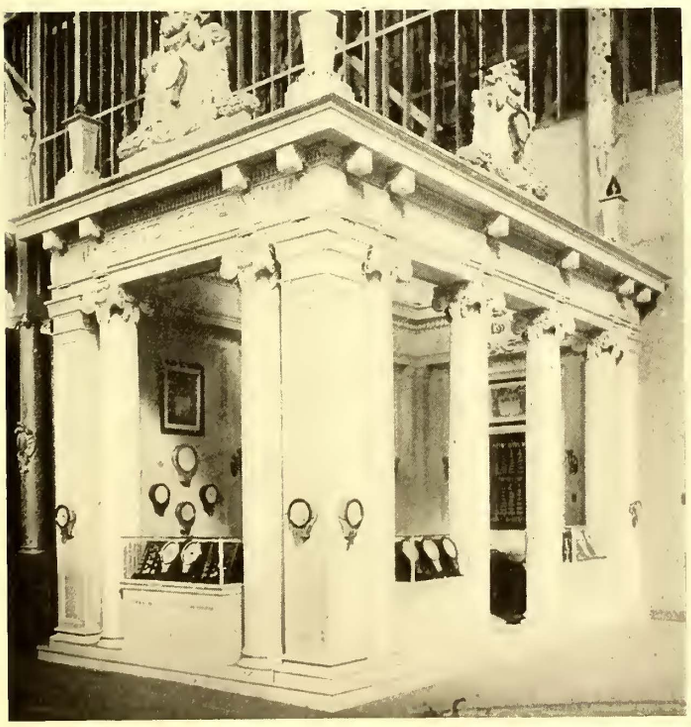
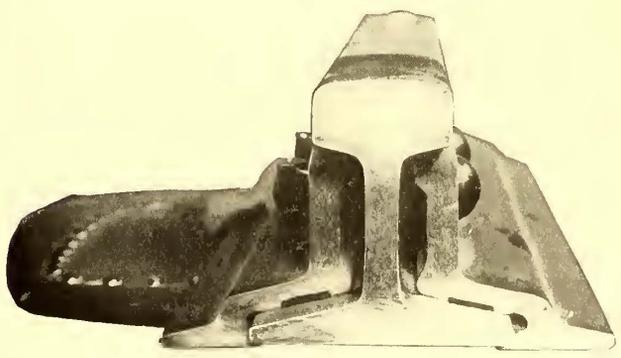


EXHIBIT OF BRISTOL COMPANY

THE BRISTOL COMPANY

Although the majority of street railway men are doubtless fairly well acquainted with the Bristol recording instruments in one form or another, it is doubtful whether they appreciate the large number of uses to which the Bristol instruments have been adapted, as shown in the exhibit of the Bristol Company in the Electricity Building. These instruments are successfully applied to the continuous recording of current, voltage, wattage, steam pressure, water pressure, height of water level and temperatures even up to stack temperatures of 800 degs. F. One improvement that users of Bristol instruments will appreciate and which is shown here, is what is called a stationary dial instrument. On this instrument, instead of removing the circular steel plate when charts are to be changed, the chart only is removed. The chart is slipped under guides in the vicinity of the recording pointer, so that there is no necessity of moving the pointer or danger of bending the pointer and throwing the instrument out of adjustment when renewing a charge. The company makes a very ingenious instrument for recording slight variations in pressure, and which can be cali-



NEW BOND OF CONTINUOUS RAIL-JOINT COMPANY

brated for use in indicating the level of water in a tank or the height of the tide. This consists of a recording pressure gage, connected to a long, very small covered tube about the size of a No. 12 wire, outside diameter. Upon the end of this tube is a sealed metal cylinder. The cylinder tube and recording pressure gage are filled with a liquid. The tube is anchored to the bottom of the tank in which the rise and fall of level is to be measured. The variations in the depth of water cause variations in pressure, which are recorded on the chart of the recording pressure gage. The company makes an electric alarm attachment which can be used on any of its recording instruments, so as to give an alarm either high or low, or both. An alternating-current recording wattmeter is one of the new instruments shown. A 5000-amp. recording ammeter, for use on station bus-bars, is exhibited. All the different types of instruments shown are arranged so that their operation can be demonstrated.

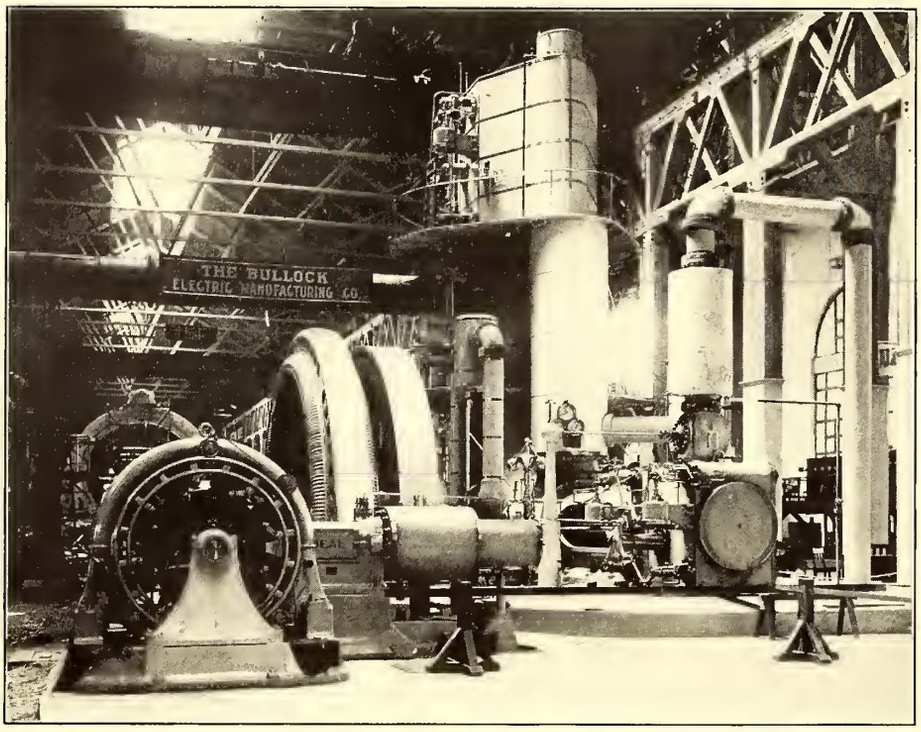


EXHIBIT OF BULLOCK ELECTRIC MANUFACTURING COMPANY

PAIGE IRON WORKS AND BUDA FOUNDRY

The special work and track work specialties of the Buda Foundry & Manufacturing Company and the Paige Iron Works, of Chicago, are shown in Transportation Building. Among the track work shown is a Buda derailing device, which is designed to derail engines or cars passing from a side to a main track except when the switch is properly set. The derail is set about 125 ft. from the main track-switch stand, and connected by a pipe line to the switch stand. The Buda oscillating cattle guard is an ingenious device, resembling in appearance an ordinary cattle guard with V-shaped wood slats. The whole guard, however, is suspended from hangers, so that it swings or oscillates a short distance whenever an animal puts its foot on the guard. This is likely to make an animal wary of crossing the guard. The guard is hung from iron plates bridging from one tie to the next. A switch stand with high semaphore attachment is shown, as well as the Ramapo automatic switch stand. A number of styles of rail benders, both Jim Crow and roller, are shown, and also the Paulus, Buda and Wilson track drills. The Buda standard hand car, with pressed steel wheels with reinforced flanges and straight webs, and specimens of special track work, of course, form part of the exhibit.

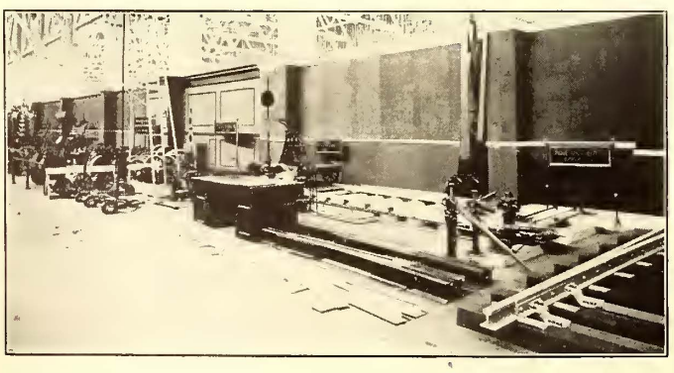


EXHIBIT OF PAIGE IRON WORKS AND BUDA FOUNDRY & MANUFACTURING COMPANY

THE BULLOCK ELECTRIC MANUFACTURING COMPANY

The Bullock Electric Manufacturing Company, of Cincinnati, exhibits for the first time its new street railway motors. It has at its space in the Electricity Building five 50-hp railway motors, one of which is shown open; the others are to be mounted on trucks and shown in operation in connection with a railway controller. These motors are arranged for lubrication by means of pads mounted on springs and bearing against the journals. They are built to open from below. Ventilation is provided through the field cores, and these cores are of laminated iron. In the pole tips every other sheet of steel has been omitted, thus reducing by one-half the amount of iron in the pole tip. Extra precautions have been taken to prevent grease working into the armature windings from the bearings. A prominent feature of this company's exhibit is a 500-kw, 25-cycle rotary converter, intended for railway use. This supplies current for the operation of street railway motors in the exhibit. In connection with this converter there are three 150-kw transformers, reducing the supply voltage from 6600 volts, for use in the rotary converter. A motor generator

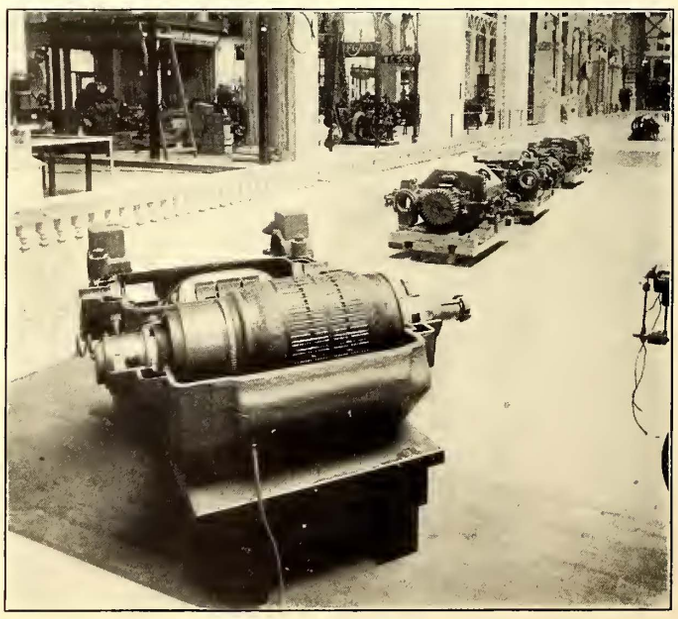


EXHIBIT OF BULLOCK ELECTRIC COMPANY

set, with a synchronous 60-cycle, three-phase motor, and a direct-current generator, with a capacity of 409 amps. at 550 volts, may also be included in the railway portion of this company's large exhibit. A large three-phase alternator, partly assembled, is shown to illustrate the method of coil construction and insulation as well as the arrangements of coils. A 250-kw transformer, water and oil-cooled, for a high-tension voltage of 20,000, and a low-tension voltage of 2300, is shown. The company has equipped its space with a testing table and instruments necessary to make tests to show to interested visitors the performance of the working apparatus in its exhibit. Besides the strictly railway part of the exhibit, a large amount of space is given to showing the application of Bullock motors to the driving of machine tools, which should be of interest to the master mechanics of large railway shops. The company occupies a 104-ft. x 54-ft. space in the Electricity Building, and has provision for the entertainment of visitors. In the Machinery Building one of the most prominent features in the building is the 3500-kw, three-phase, 25-cycle, 6600-volt Bullock generator, driven by an Allis-Chalmers combined vertical and horizontal compound engine. This is the largest generating unit at the Exposition. While available for any kind of service, it has frequently been used to carry the decorative lighting load, and the gradual bringing up of the decorative lighting from darkness to full brilliancy has been accomplished by the gradual bringing up of the field excitation.

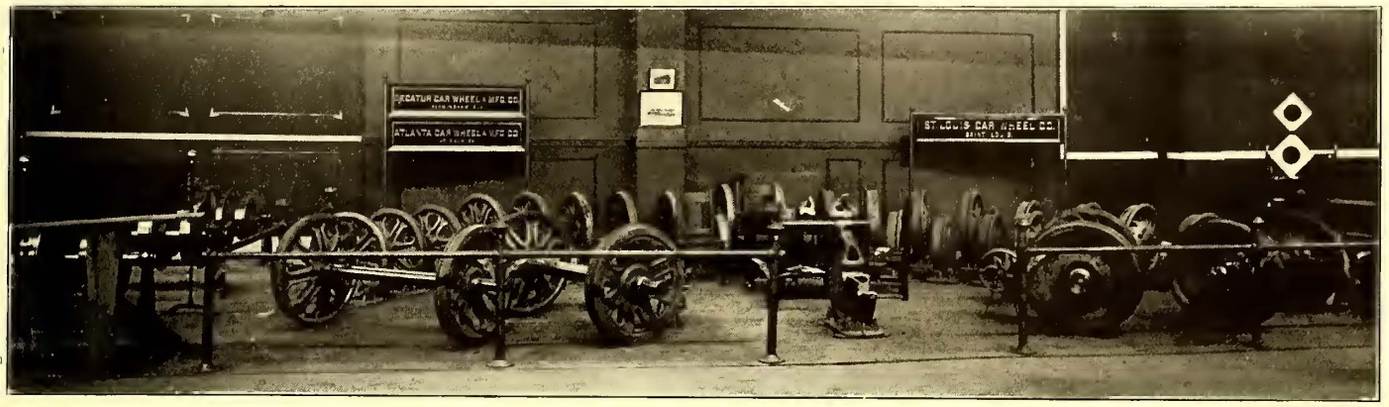


EXHIBIT OF ST. LOUIS CAR WHEEL COMPANY

STANDARD STEEL WORKS

In view of the increasing use of steel-tired wheels in interurban service, which has been forced upon the electric railway man by the increase in weight and speed of cars, the exhibit of steel wheels made by the Standard Steel Works, of Philadelphia, should be especially valuable to interurban managers at this time. This exhibit includes steel-tired wheels and solid rolled steel wheels. Two pairs of very heavy wheels, mounted on axles, with gears for electric railway service, are included in the exhibit. These are such as are used on the heaviest interurban and elevated cars.

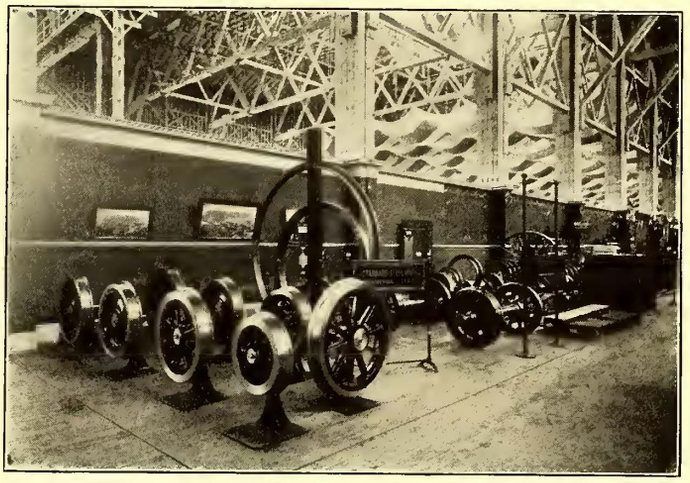


EXHIBIT OF STANDARD STEEL WORKS

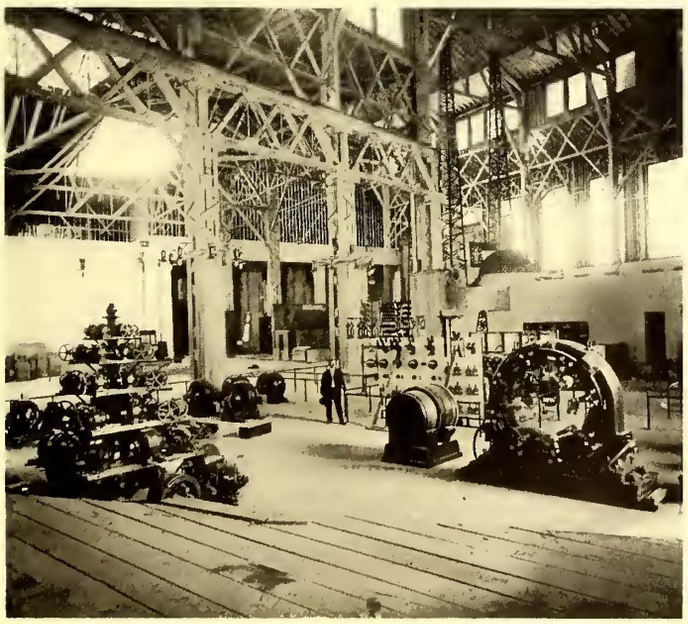


EXHIBIT OF WESTERN ELECTRIC COMPANY

EXHIBIT OF WESTON ELECTRICAL INSTRUMENT COMPANY

THE WESTERN ELECTRIC COMPANY

The Western Electric Company has a very large exhibit, in which it shows a large amount of lighting apparatus and also a machine shop, which will be of interest to master mechanics, which shows in actual operation some of the Western Electric

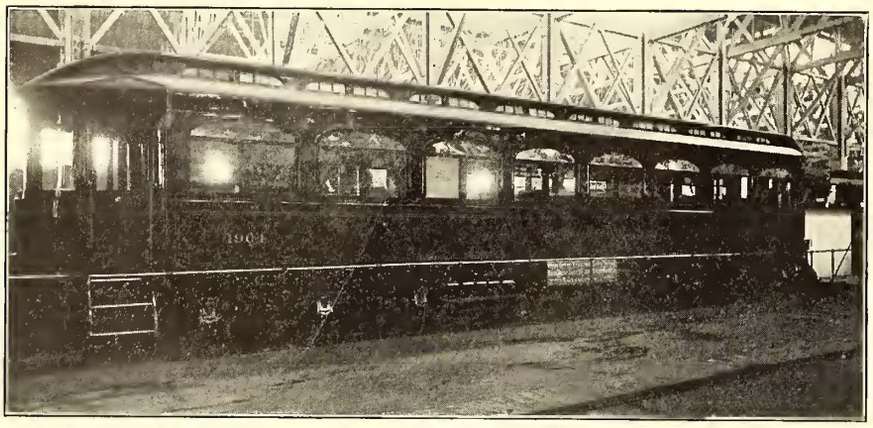


EXHIBIT OF JOHN STEPHENSON COMPANY

motors connected to modern machine tools with variable speed derived from a three-wire multi-voltage system. A new line of emery grinding machines, manufactured by this company, is a feature of this part of the exhibit. Direct-connected and belt-driven generators are shown, and also a number of Cornish cycle gas engines, direct connected to Western Electric generators. This company includes in this exhibit many goods for which it is agent, which will be of interest to the street railway men.

ST. LOUIS CAR WHEEL COMPANY

A large exhibit of cast-iron wheels, of interest both to steam and electric railway men, is shown by the St. Louis Car Wheel Company, of St. Louis. The wheels are all shown unpainted, to give the electric railway man an idea of the way the product actually leaves the foundry. A design of street car wheel having a new spoke, and known as the "Twentieth Century," is one of the types of wheel shown. Among wheels for interurban roads are such as were designed for the interurban service of the Milwaukee Electric Railway & Light Company, weighing 550 lbs. each. There are lighter wheels also, as fur-

EXHIBIT OF NATIONAL CARBON COMPANY

nished for city service. Double-plate wheels with sections cut and broken out, show the depth and quality of the chill. The wheels are mounted in such a way as to be easily inspected for their entire circumference. This exhibit includes the St. Louis Car Wheel Company, the Decatur Car Wheel & Manufacturing Company, of Birmingham, Ala., and the Atlanta Car Wheel & Manufacturing Company, of Atlanta, Ga.

JOHN STEPHENSON COMPANY

The high-speed car exhibited by the John Stephenson Company in the Transportation Building is notable not only on account of the unusual strength and elegance of the car body, but because it is mounted on six-wheel trucks. The object of the six-wheel truck is, of course, to make the car run smoothly at the highest speeds attainable. This truck has 36-in. steel-tired wheels. The middle pair of wheels have no flanges, so that the car can take curves as low as 60-ft. radius. The wheel base is 10 ft. 4 ins. The truck is designed to have the motors placed on the two outside axles. In order to give room to do this the springs under the bolsters have been placed at an angle. The car body is 46 ft. long. A detailed description of this car can be found in the issue of the STREET RAILWAY JOURNAL of April 30, 1904. The bottom frame is very heavy, weighing 20,000 lbs., the vestibules are made somewhat tapering to reduce wind resistance. Everything about the car has been designed especially for high speed, and it is believed that this car will run safely at 120 m. p. h.

THE WESTON ELECTRICAL INSTRUMENT COMPANY

The Weston Electrical Instrument Company has an elegantly fitted up booth with offices in the rear and with show cases containing nearly all the company's different types of portable instruments, both for alternating and direct current. Around the walls are shown switchboard instruments. This company's

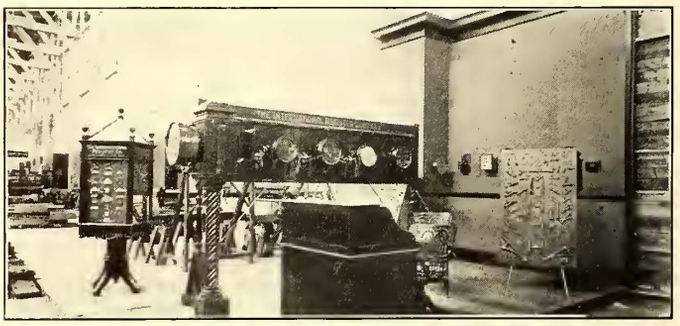
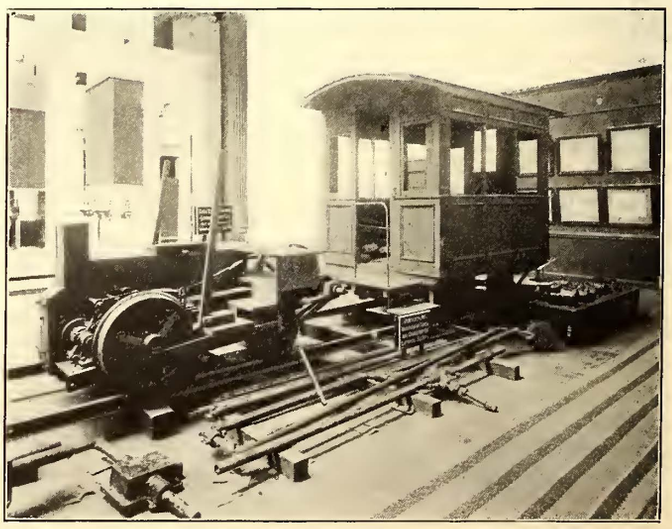


EXHIBIT OF INTERNATIONAL REGISTER COMPANY

instruments are so well known in all their different forms that further comment is unnecessary.

INTERNATIONAL REGISTER COMPANY

The only exhibit of fare registers made at the exposition is that of the International Register Company, of Chicago, which



EDISON FIRST LOCOMOTIVE CAR

has a large display, both of International registers and of the New Haven registers, the manufacturing plant of the latter having been purchased by the International Register Company some time ago. Sixteen different types of registers are shown, beginning with a small counter and going up to the most elaborate forms for registering different classes of fare. The mechanism of different forms of registers is shown open, so that their operation may be studied. Besides registers this company makes punches, brackets, Heeren badges, register and bell cord and smaller supplies, all of which are displayed. A. N. Loper, formerly of the New Haven Car Register Company, will be in attendance at this exhibit during the season.

GOLD CAR HEATING & LIGHTING COMPANY

The Gold Car Heating Company, of New York, has an extensive space, equipped with steam, electric and hot-water heating systems, the two latter being of interest to electric railway men. Among the electric heaters the exhibit includes simply the well-known styles of Gold electric heaters, which have been manufactured for some time past. Some of these heaters are made to be placed flush with the heel board and others are intended to be mounted for circulation of air from all sides. A comparatively new hot-water system is shown, which has been in use on a number of the cars of the North Jersey Traction Company. The novelty of this hot-water heating system is that the heater is not placed in the car, but is suspended below the car body, extending about 26 ins. below the sills of the car at some point near the middle. The heater proper consists of a cast-iron water jacket, in which the fire is placed. This jacket and all is enclosed in a steel casing, which leaves an air space between the casing and the heater proper. The top of the heater is flush with the car floor. The hot water pipes and the smoke pipe pass up through the car floor. The heater is suspended from the car floor by a large steel plate which rests on the edges of the hole in the car floor. Coal can be poured in the fire from above, so that it is not necessary to go out of the car. To remove ashes or shake down the fire, however, it is necessary to go outside the car. Hot water rises from the heater, and after being cooled by flowing through the radiating pipes returns by gravity to the heater. An expansion tank is provided in order that the system may always be kept full of water. The hot water, however, does not

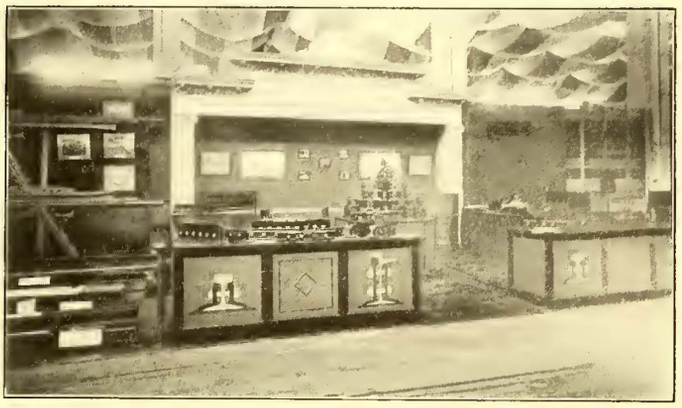


EXHIBIT OF THE CONTINUOUS RAIL-JOINT COMPANY

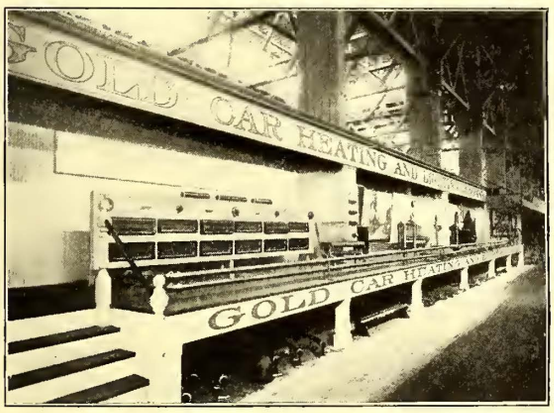


EXHIBIT OF THE GOLD CAR HEATING & LIGHTING COMPANY

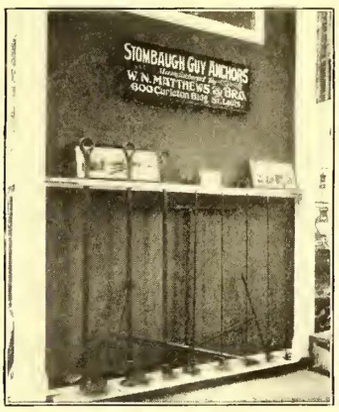
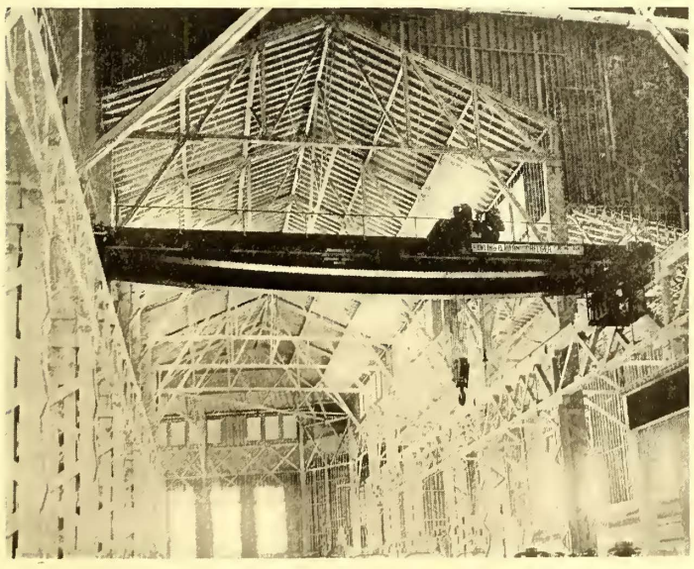


EXHIBIT OF N. MATTHEWS & BROTHER

EXHIBIT OF THE WHEEL TRUING BRAKE SHOE COMPANY



CRANE OF PAWLING & HARNISHFEGER

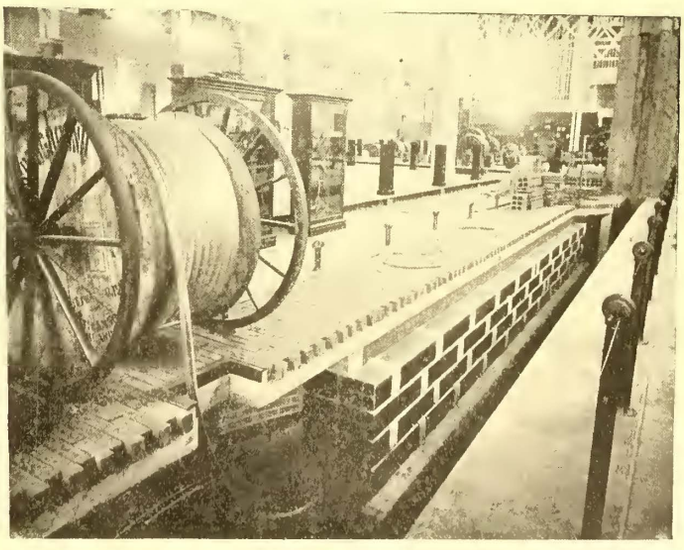


EXHIBIT OF STANDARD UNDERGROUND CABLE COMPANY AND McROY CLAY WORKS

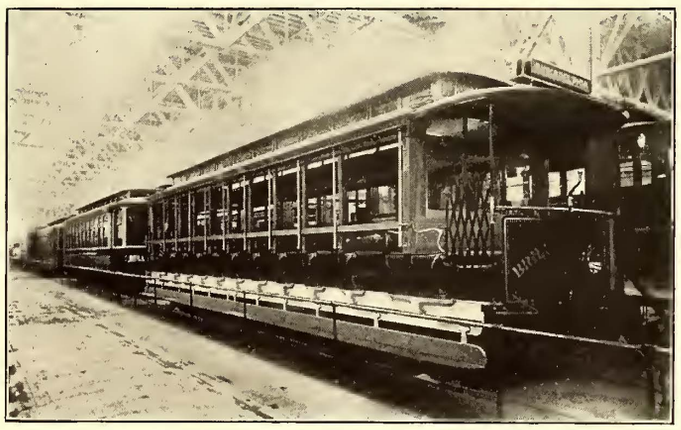
pass directly from the heater to the expansion tank, as in some systems. By means of a jet arrangement the hot water is confined mainly to the circulation pipes, leaving the expansion tank without circulation.

STOMBAUGH GUY ANCHORS

W. N. Matthews & Brother, of St. Louis, make an exhibit of Stombaugh guy anchors in the space of the Wesco Supply Company in the Electricity Building. This guy anchor acts on the principle of an auger and requires no excavation, as it is secured into the ground a sufficient distance to give it a firm hold. This anchor, as shown, is made in sizes small enough to guy fence posts, and in the larger sizes sufficient for anchoring guy wires of the heaviest pole line or stack construction.

PAWLING & HARNISHFEGER

The traveling crane which was used to install the heavy electric apparatus in the west side of the Electricity Building was built by Pawling & Harnishfeger, of Milwaukee. This crane has a capacity of 30 tons and a span of 57 ft. 5½ ins. It is equipped with four electric motors. The movement of the crane is effected with a 20-hp, 220-volt motor, giving a speed of 250 ft. per minute. The movement of the hoist from one end of the crane to the other is effected with an 8-hp motor. The crane hoist has a 30-hp motor, giving a hoisting speed of 25 ft. per minute, and the auxiliary hoist has a 15-hp motor, which will hoist at from 30 ft. to 90 ft. per minute. This crane has, of course, proved of immense convenience in handling the heavy exhibits, which were installed with a celerity never equaled in



BRILL OPEN CAR

any exposition building where such hoisting facilities were not present. This company has also installed a much larger crane for use in the exhibit power plant in the Machinery Building.

WHEEL TRUING BRAKE-SHOE COMPANY

The Wheel Truing Brake-Shoe Company shows in the exhibit of the Wesco Supply Company, in the Electricity Building, brake-shoes of various designs adapted to grinding down cast-iron and steel-tired wheels. These brake-shoes consist of an iron frame containing blocks of an abrasive material, which acts to grind down a car wheel each time the brakes are applied, thus dressing down flat wheels so that they need not be removed or ground down with an emery-wheel grinder. Some of the shoes exhibited are especially designed for grinding down dirt-worn or grooved tires of locomotive drive wheels.

THE STANDARD UNDERGROUND CABLE COMPANY AND McROY CLAY WORKS

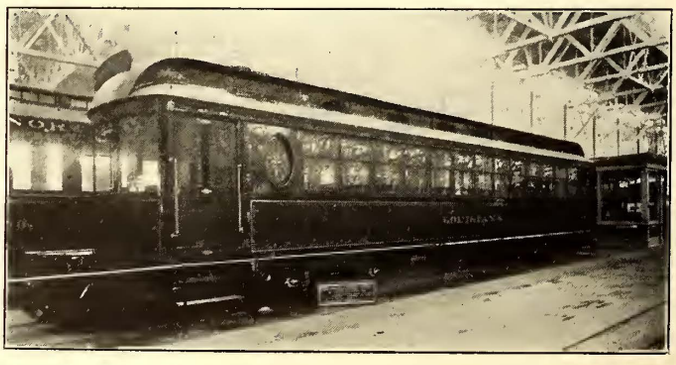
A unique joint exhibit is made in the Electricity Building by the Standard Underground Cable Company and the McRoy Clay Works. The idea of this exhibit is to show on a small scale the operation of laying underground conduit and drawing lead-covered cable into the ducts. The conduit is laid under the floor at about the depth it would usually be laid beneath the street surface. An opening in the floor permits the visitor to descend by stairways and examine the conduit, which is shown in various stages of construction. There are two manholes, and cable is being drawn from one manhole to the next. The conduit consists of seventy-two ducts, some of which are completely laid and some of which are partly finished, so as to show the method of wrapping the joints between lengths of tile and placing concrete at the bottom and top of the ducts. A reel of the Standard Underground Cable Company's cable, such as is actually used in construction work, is placed on the main

BRILL CONVERTIBLE CAR

floor of the building above one of the manholes, and in the manhole at the other end is a capstan rigged up for drawing in cables. From the manholes the cables go to distributing poles to illustrate the method of supplying overhead distribution from underground lines.

THE J. G. BRILL COMPANY AND AMERICAN CAR COMPANY

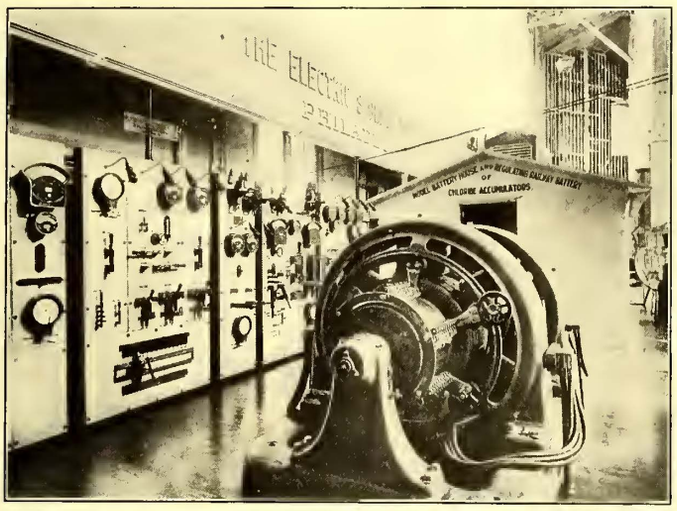
The exhibit of the J. G. Brill Company and the American Car Company in the Transportation Building is characterized by the choice selection that these companies have made of a few cars which are representative of the Brill methods of construction. There has been no attempt to show a great variety, but rather to embody in the few cars shown all the principal features of excellence in car building that this company has introduced in recent years. The same idea has been carried out in the truck exhibit. The Brill car exhibit consists simply of three cars, of the three types of construction most actively pushed by this company the past few years. All of these cars are mounted on double trucks. One is a Brill convertible car, one a Brill semi-convertible, the third an open Narragansett-type car. All these types are now so well known among electric railway men that a description hardly seems necessary. The Brill semi-convertible car, which is probably the most popular



SEMI-CONVERTIBLE CAR—AMERICAN CAR COMPANY

type these days, has window pockets in the roof. When the windows are raised, both upper and lower sashes go up into the roof pockets, leaving the window opening equivalent to that of an open car. The inside width of the car with a given outside width, is greater with this construction than where the windows are stored beneath the sills. At the same time a very low sill is possible, because room need not be provided for storing the windows below the sill. As a result the car with windows open approaches nearer to an entirely open car than any other semi-convertible car that carries its windows with it. The window sills are so low on this car that an arm rest above the

sill has been provided. The convertible car has the same principles in its construction that have just been mentioned in connection with the semi-convertible, with the addition that the



PART OF EXHIBIT OF ELECTRIC STORAGE BATTERY COMPANY

panels, as well as the sashes, slide into the roof. The convertible, like the semi-convertible, is entirely self-contained, carrying all sashes and panels on the car at all times, so that they can be raised or lowered any time, either by conductors or passengers. To avoid sticking, all sliding parts are made metal to metal.

On the semi-convertible car a new and desirable feature is an arrangement for holding the motorman's window at any height. The side vestibule window on this car is very wide, and is so built, under a new patented method, that both sashes are raised at once, and automatically assume their proper places as soon as the full height is reached. The Narragansett regular open car has, as its distinguishing Brill feature, the angle-bar side sill, which gives a maximum amount of room underneath the car for the swiveling of the truck.

In the truck exhibit are shown long and short whole-base swivel trucks of the No. 27 type in several sizes clear up to a very heavy truck for the heaviest passenger cars. A single truck (No. 21-E) with solid forged side frames is shown, and also an Eureka maximum traction truck. On top of the largest and heaviest No. 27 truck is an unpainted forging of a side frame for such a truck, for the benefit of those who are skeptical

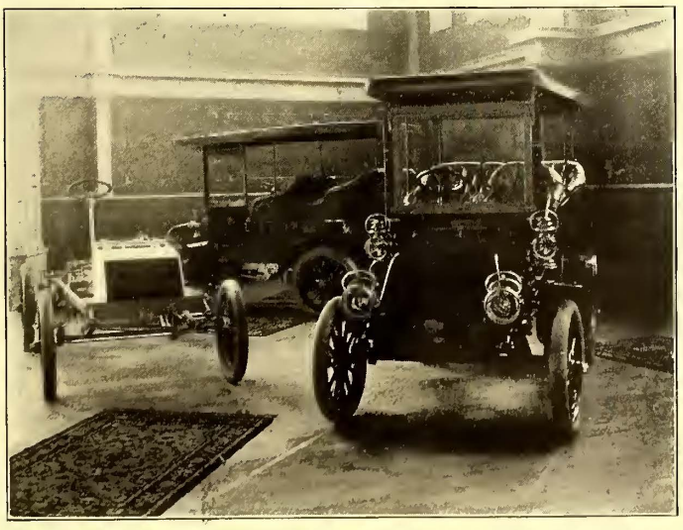


EXHIBIT OF WINTON AUTOMOBILES

enough to question the statement that the side frames of these trucks are forgings. This forging never fails to excite the admiration of experienced blacksmiths who examine it.

The American Car Company part of this exhibit has a semi-convertible interurban car, made under the Brill patents. This car is the most distinctly interurban car of the exhibit, the Brill cars being intended for city and suburban service. This car is 39-ft. body and 52-ft. over the vestibules. It is finished inside in mahogany, Corinthian style, with marquetry panels. The ceiling is semi-Empire, with recessed dome. All floor corners are filled with brass corner pieces to prevent dust catching. The seats are leather covered. The lighting of this car is one feature of special excellence from the standpoint of the illumination secured. The ceiling is dotted with eighty-six frosted-bulb, 8-cp incandescent lamps. The frosted bulbs soften and diffuse the light, while the great number of small units of light give an even distribution of light that is excellent. An M. C. B. type of truck is shown, as recently constructed by the American Car Company, to meet the wishes of customers who may prefer that to the regular Brill trucks. A vestibule door shown on a car in this exhibit is a pleasant surprise to the man who attempts to operate it. This is a folding door, and there is a railing across the middle of the platform parallel with the end of the car, that the doors would be sure to hit in closing were it not that a guide is provided at the top of the doors. The doors close themselves as soon as released.

W. W. LINDSAY & COMPANY

The model electric battery house in the exhibit of the Elec-

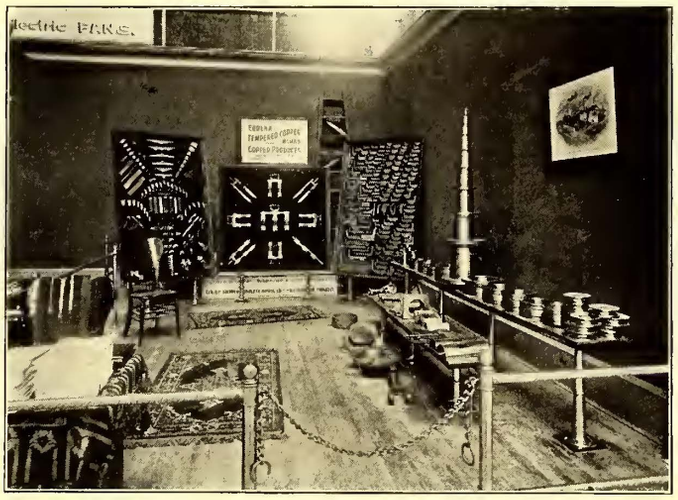


EXHIBIT OF EUREKA TEMPERED COPPER WORKS

tric Storage Battery Company, Electricity Building, represents the construction of W. W. Lindsay & Company, engineers and contractors, of Philadelphia. This model battery house is worth considerable study by those contemplating the use of storage battery sub-stations. The building is of steel and concrete construction, the columns and trusses being of structural steel. All the steel in the building is covered. The roof and walls are of a new building material called ferro-inclave, made by the Brown Hoisting Machinery Company, of Cleveland, and for which W. W. Lindsay & Company are agents. This ferro-inclave is covered both inside and out of the building with cement plaster. This forms a smooth finish and completely encases all the structural steel, protecting it from the battery fumes. The ferro-inclave is fireproof, waterproof and practically indestructible, as well as light in weight. The model battery house is 20 ft. long, 12 ft. 9 ins. wide and 12 ft. 6 ins. high. The batteries in this house are placed on white enameled brick foundations, extending slightly above the floor of the battery room. They are arranged along the walls and along the center line of the building.

THE ELECTRIC STORAGE BATTERY COMPANY

A most extensive and comprehensive exhibit of storage batteries and the auxiliary apparatus pertaining thereto, is made by the Electric Storage Battery Company, of Philadelphia, in

the Electricity Building. The model battery house forming part of this exhibit is described under the head of W. W. Lindsay & Company, who are the contractors for this type of con-

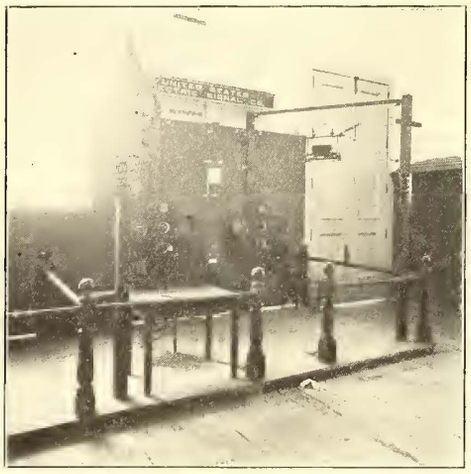


EXHIBIT OF UNITED STATES ELECTRIC SIGNAL COMPANY

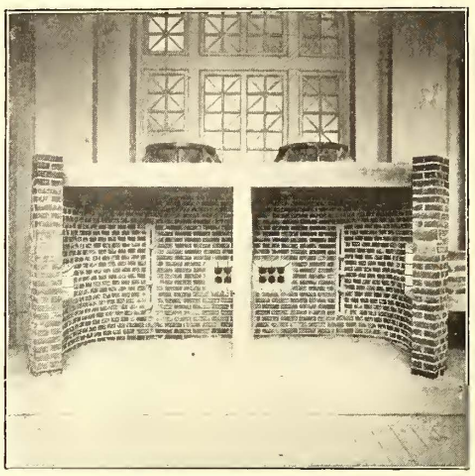


EXHIBIT OF GUY M. GEST

struction. Of course, all the types of "Chloride" and "Exide" battery plates now in use are shown as well as many different types of cells. In connection with the battery in the battery house a small booster is operated, together with a complete switchboard with recording instruments showing the performance of the battery on a fluctuating load. Provisions are made for providing for such a fluctuating load in order to demonstrate the action of the battery. Railway men will be interested in the railway booster of 100-kw capacity, intended for use in making a storage battery take the fluctuations of a sub-station or power station. A 2000-amp. end-cell switch shows the end-cell method of voltage regulation. Altogether, there are five types of storage battery switchboards, which give the visitor an excellent opportunity to study the practice of this company. Back of the space is an immense map of the United States, 30 ft. x 45 ft., indicating the location of each of the 1700 Electric Storage Battery Company's installations, the location of each being illuminated by incandescent lamps mounted behind the map, red lamps indicating railway plants, blue lamps central station lighting plants, green lamps isolated lighting plants.

THE EUREKA TEMPERED COPPER WORKS

A handsome display of commutators, commutator bars, trolley wheels and copper, bronze and brass castings are shown by

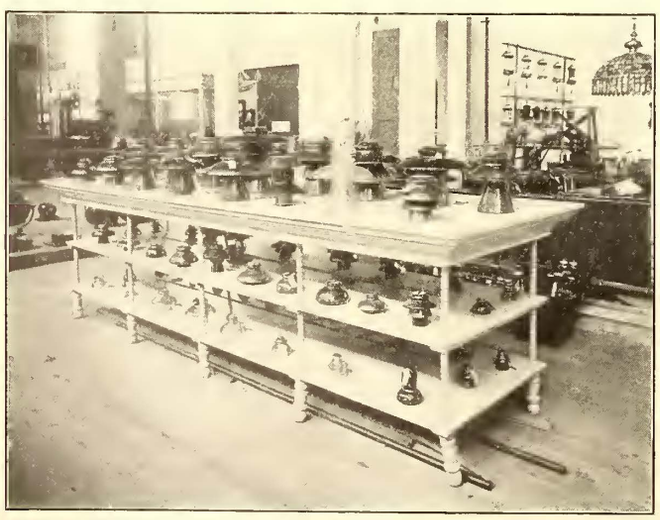


EXHIBIT OF LOCKE INSULATORS

the Eureka Tempered Copper Works, of Philadelphia, in the northeast end of the Electricity Building. The company shows a new swivel trolley harp.

WINTON MOTOR CARRIAGE COMPANY

Street railway officers, looking up automobiles for the use of officers and inspectors, will find that the Winton Motor Carriage Company, of Cleveland, Ohio, which is catering to this class of business, has two touring cars and one chassis ready for inspection in the Transportation Building.

UNITED STATES ELECTRIC SIGNAL COMPANY

Block signals for electric roads are exhibited in the Electricity Building by the United States Electric Signal Company, of West Newton, Mass. This signal system, which is the result of a number of years' careful development and experience in practical use, is one of the few block signal systems for trolley roads that has survived after being on the market several years. With this system, as those who are familiar with it know, an electric car upon entering a block operates with its trolley wheel a trolley-wire instrument which throws signals to danger at the opposite end of the block

EXHIBIT OF WESTERN WHEELED SCRAPER COMPANY

and to caution at the near end. The signals consist of red and green lights, which are thrown into or out of circuit by the operation of the trolley-wire instruments. The exhibit offers a good opportunity to study the details in the working of this block signal system, as all parts are placed so as to be easily investigated.

GUY M. GEST

Guy M. Gest, the contractor, of Cincinnati and New York, has a handsome sample of underground conduit construction work in the court of the Electricity Building. This consists of one-half of a manhole with the tile cable ducts leading from it. The manhole is equipped with a cable hanger, which is placed in a metal slot imbedded in the brick work. The hanger can be put at any height, and only the hooks actually in use need to be put in place.

LOCKE INSULATOR MANUFACTURING COMPANY

A splendid display of high-tension insulators, made by the Locke Insulator Manufacturing Company, of Victor, N. Y., can be found in the exhibit of the Wesco Supply Company in the Electricity Building. These insulators are in all sizes, from the smallest telephone insulators to an insulator 17 ins. in diameter and 15 ins. high. The latter mammoth insulator is designed for working voltages of 80,000 volts, and will stand a break-down test, of course, much in excess of this. It consists

of an umbrella-shaped porcelain top surmounting three porcelain petticoats, which prevent discharges to the pin.

THE WESTERN WHEELED SCRAPER COMPANY

Light dump cars for street railway use are seen in fourteen different varieties at the space of the Western Wheeled Scraper Company, in Transportation Building. Most of the cars are arranged for side dump, with the load so balanced with reference to the pivot that dumping is easy. Four of the cars have rotary boxes, which permit of either side or end dump. The capacities of the smaller cars of this company are from 1¼ yds. to 10 yds. for the side dump, and from 1¼ yds. to 3 yds. for the rotary dump.

ELLIOTT FROG & SWITCH COMPANY

A number of interesting new designs of frogs for steam and interurban rails are shown by the Elliott Frog & Switch Company, of East St. Louis, Ill., in the Transportation Building. These frogs are of both the closed and open type. An inspection of this exhibit is necessary to an understanding of these frogs, and such an inspection is well worth the time of the visiting interurban railway man.

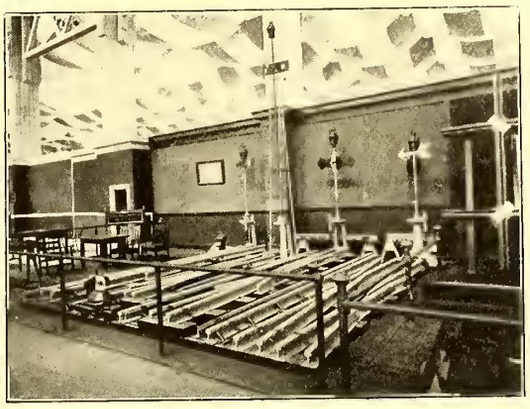


EXHIBIT OF ELLIOT FROG & SWITCH COMPANY

WYCKOFF PIPE AND CREOSOTING COMPANY

At the south side of the court of the Electricity Building the Wyckoff Pipe & Cresosoting Company, of Stamford, Conn., has an exhibit which shows some of the results attained with a process which is not very generally used as yet in this country for the preservation of timber, but which, nevertheless, is likely to come into more extensive use as the cost of timber advances.

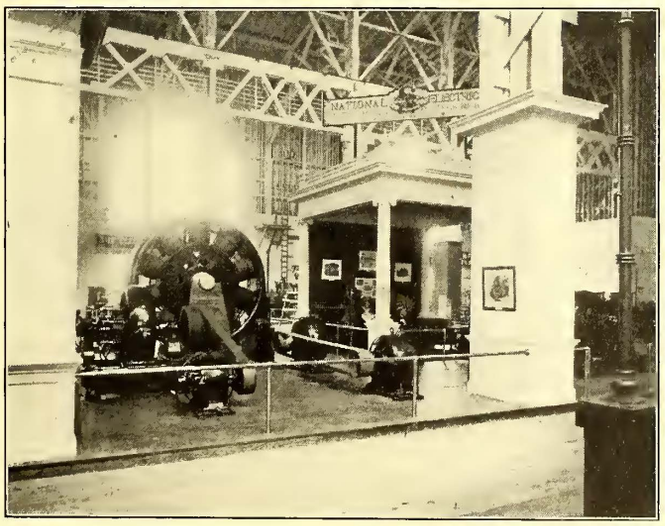


EXHIBIT OF NATIONAL ELECTRIC COMPANY

The company shows creosoted pump-log conduits for underground wires, including several pieces of this conduit laid in Philadelphia by the Bell Telephone Company fifteen years ago, and removed last fall, not on account of their deterioration but on account of the building of a subway in that city. This conduit is apparently as good as the day it was laid, as it shows no signs of deterioration. The company shows poles, cross ties, cross arms and paving blocks impregnated with creosoted oil. To show the penetration of the oil in the heart of the timber, two sections of piling, one creosoted and one uncreosoted, are shown. The uncreosoted section shows the work done by the toredo which honeycombs the piling in a very short time.

ATLAS RAILWAY SUPPLY COMPANY

Rail-joints for standard T-rails, Shanghai T-rails, guard rails and girder rails form the exhibit of the Atlas Railway Supply Company, of Chicago, located in the Transportation Building. Besides this, the work which can be done with the Atlas primer and surfacer in painting cars of street and interurban railways, is demonstrated by a board taken from an ancient car body, upon which a rectangular space has been refinished, using Atlas primer and surfacer, although the board is scarred and weather beaten, the refinished surface looks practically as good as new, and has a tough elastic finish.

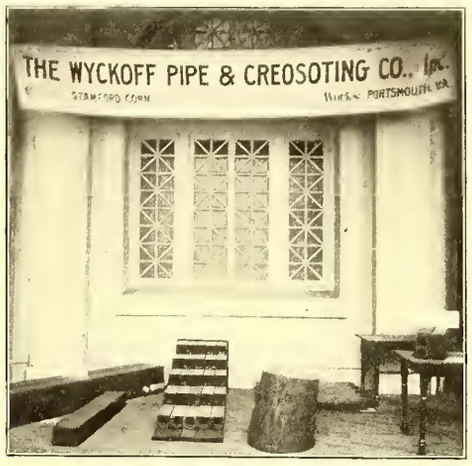


EXHIBIT OF WYCKOFF PIPE & CREOSOTING COMPANY

NATIONAL ELECTRIC COMPANY

Considerable interest naturally attaches to the exhibits made by the National Electric Company at this Exposition, because of its position as a newcomer into the field of manufacture of large electrical machinery. A 1500-kw alternating-current generator is being installed in the exhibitors' power plant in the Machinery Building. The plans for this large alternator were given in the STREET RAILWAY JOURNAL of May 7, 1904. In the company's exhibit in the Electricity Building opportunity is given to study the special features of excellence in the construction of this company's electrical machinery. A direct-current generator of 400 kw is shown, which is fairly representative of this company's direct-current construction for the larger units. This generator has pole tips of soft, laminated iron, the tips being bolted to the cast-field cores and serving to hold the field coils in place. Considerable space is allowed between the series and shunt coils of the fields, so that air can circulate between the coils and allow them to be run at a higher current density without overheating than would be possible with less ventilation. The armature coils are formed from copper strips or bars, but there is no riveted or soldered joint at the end opposite the commutator. A form of coil has been adopted which permits bars to be bent hot and afterward insulated, so that no soldered joint is necessary in the entire coil save where it connects to the commutator bars.

The Christensen straight air-brake equipment for a single car, and also the multiple-unit system, as applied to a train of three cars, is shown. The apparatus, as installed in the exhibit, is mounted on platforms, each platform representing the equipment of one car. The company puts up equipments in this shape for the instruction of employees of those companies having instruction rooms. The single-car equipment has an electric motor-driven compressor, with a capacity of 11 cu. ft. of free air per minute, driven by a 2-hp motor. The multiple-unit equipment has a 4-hp motor on each car, driving a compressor with a capacity of 20 cu. ft. of free air per minute. This multiple-unit system is the same as that which is being used on the Intramural Railway, which furnishes transportation inside the Exposition grounds. The trains on the In-

tramural can be operated with as many cars as desired, all being equipped with the multiple-unit system. Like single-car apparatus, this multiple-unit equipment is intended for straight air brakes. It requires two air pipes connected together for the full length of the train. One of these, which is called the train pipe, is used for the application and release of the brakes from the motorman's three-way valve on any platform. The other air pipe, running the length of the train, is to equalize the air pressure between the storage reservoirs on the various cars. In order to prevent the compressor on one or two cars from doing most of the work on a long train, the automatic electric governor on each car is provided with contacts, so that as soon as the governor on one car cuts in its air compressor-motor, those on the other cars are also started. Another air brake equipment shown is intended for use on large electric locomotives. It has a compressor capable of taking care of 75 cu. ft. of free air per minute, driven by a 14-hp motor. Another piece of compressed air apparatus of considerable use to electric railway companies is a portable compressor outfit, consisting of two tanks and a motor-driven compressor, with a 2.4-hp motor. This can either be used in the shop for cleaning motors and car seats, as well as car interiors, or it can be taken into the yards or out on the road for use in driving track drills, or for other purposes to which compressed air can be put.

EXHIBITS OF THE WESTINGHOUSE COMPANIES AT THE ST. LOUIS FAIR

The main service plant at the Louisiana Purchase Exposition, for which the Westinghouse Electric & Manufacturing Company received the general contract, is naturally a notable feature of the Westinghouse exhibits, and one which appeals, because of the commanding size of the four big electric generating units, each of 2000-kw capacity, and their location in the central aisle of Machinery Hall, to practically all visitors to the Fair. At Chicago, in 1893, the great central station plant, which also was installed by the Westinghouse Electric & Manufacturing Company, was a complete exhibit of the most modern type of electrical machinery at that time, and the twelve 750-kw generators, each at 2200 volts, were the largest alternating-current polyphase machines ever constructed, and constituted the largest polyphase plant then in service. The 2000-kw, three-phase alternating-current generators of the St. Louis Fair plant, which operate at a speed of 83½ r. p. m., and deliver a 25-cycle current at 6600 volts, although of almost three times the individual capacity of those seen at Chicago, are, of course, not at this day remarkable on account of their size, and, indeed, entrance to the service plant exhibit is through a large 35-ft. plaster ring moulded in close representation and in exact duplicate size of the stationary armature of the 5000-kw alternating-current Westinghouse generators constructed for the elevated and subway train service in New York City. The 10,000-kw generators for the Ontario Power Company are now being constructed in the East Pittsburg works of the Westinghouse Electric & Manufacturing Company.

The total space devoted to the service electric plant in Machinery Hall, with the exciter units, condensers, cooling towers and the thirty-five-panel switchboard, is 26,260 sq. ft. The entire steam and electric station was designed and equipped by Westinghouse, Church, Kerr & Company, and all the motive power apparatus in connection with the generators, and in the steam generating plant in the nearby boiler house, was furnished by the Westinghouse Machine Company. In addition, the various organizations associated with the Westinghouse name, which have adjoining exhibit space in Machinery Hall of 26,260 sq. ft., space in the Palace of Electricity of 10,100 sq. ft., where Baldwin-Westinghouse electric trucks and locomotives also are shown, and space in the Palace of Transportation of 3000 sq. ft., a total of 65,620 sq. ft., or nearly ten times the space occupied by the same interests at the Pan-American Exposition at Buffalo in 1901. These companies include besides the Westinghouse Electric, Machine, Air Brake and Traction Brake Companies, Westinghouse, Church, Kerr & Company, the various foreign companies, also the Union Switch & Signal Company, American Brake Company, R. D. Nuttall Company, Bryant Electric Company, Perkins Electrical Switch Manufacturing Company, and other allied corporations.

The Westinghouse exhibits and preparations for the reception and entertainment of visitors are on a scale so complete and elaborate that they constitute a noteworthy feature of the industrial display at the Exposition. In Machinery Hall, in addition to the electric service plant and the main exhibit of Westinghouse gas engines, turbo-generators, rotaries, exciters and motors in operation, all enclosed within ornamental staff walls and columned entrances of classic design, is the Westinghouse auditorium, which seats 350 persons, in which are displayed at regular hours through the day the biograph and mutoscope pictures of scenes in and about the various Westinghouse works in the Pittsburg district, including the first interior photography of the kind ever taken by means of the Cooper-Hewitt mercury vapor lamp.

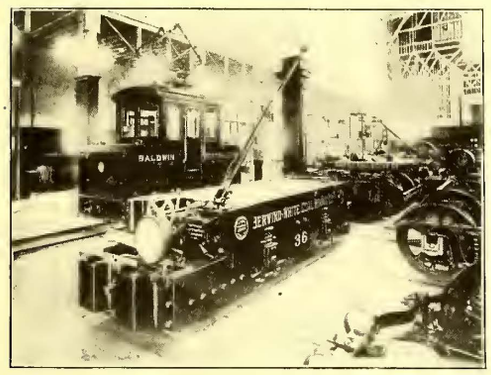
The R. D. Nuttall Company's exhibit of cut and planed gears, trolleys, trolley gears and pinions for electric railway, mine and industrial haulage motors, is in Machinery Hall, near the Westinghouse headquarters.

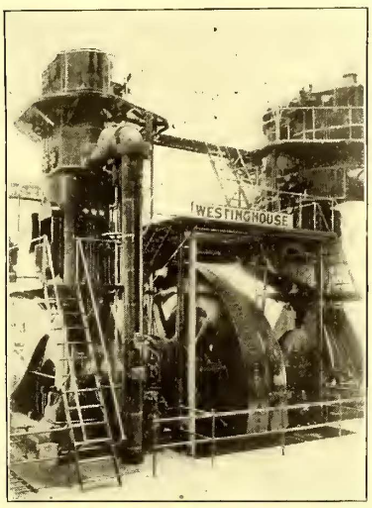
The exhibit service plant, immediately west of the company's headquarters, which is utilized to furnish power for various purposes, includes a 400-kw Westinghouse-Parsons steam turbine generating set, operating at a speed of 3600 r. p. m., and delivering a three-phase, 60-cycle current at a potential of 440 volts. The unit selected for exhibit is of a size that has met with most extended introduction by reason of its applicability to power stations of moderate size, although it is the smallest turbine unit built by the Westinghouse Machine Company. The construction of the rotating field of the generator shown in connection with the turbine on exhibit may best be studied in the Westinghouse exhibit in the Palace of Electricity, where one of similar type is set up but not in operation. The exhibit service plant contains also a 125-hp vertical and a 225-hp horizontal gas engine, the first direct connected to standard two-wire, the second to standard three-wire, double-voltage, direct-current generators. Both single-acting and double-acting types of gas engines at present manufactured by the Westinghouse Machine Company are here represented in their latest form. The horizontal engine will be of particular interest to engineers, as its development has been coincident with the introduction of gas power upon a large scale in this country.

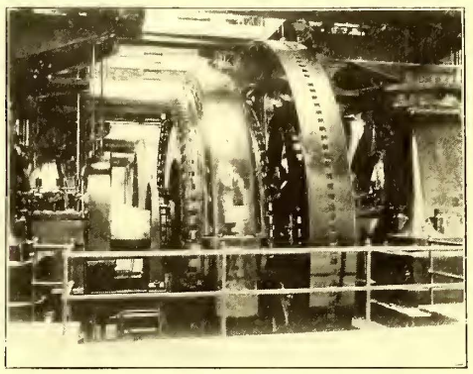
An important part of the Westinghouse installation which is seen by few is the pumping apparatus under the beautiful cascades in front of Festival Hall. This equipment was designed to supply 90,000 gals. of water a minute for these cascades by three large centrifugal pumps, each driven by a 2000-hp Westinghouse induction motor, probably the largest motors ever constructed.

In the Palace of Electricity, the Westinghouse Electric & Manufacturing Company occupies a space of over 10,000 sq. ft., including 1600 sq. ft. devoted to the display of electric trucks and locomotives constructed in conjunction with the Baldwin Locomotive Works. Two locomotives built for mine service are shown, one weighing 20,000 lbs. and the other 30,000 lbs., each equipped with two No. 79 motors at 500 volts. Another 20,000-lb. locomotive, for switching, is equipped with two No. 75 motors, at 220 volts. In the regular electrical equipment display are a 400-kw turbine-type generator, typical generators for direct and alternating currents, for belt or direct connection, rotary converters, motor generator sets, oil insulated and

air blast transformers, direct-current and alternating-current railway motors and controllers, single and polyphase induction motors of constant and variable speeds, direct-current motors of many types, including motors for variable-speed service, from single and double voltage circuits; switchboard apparatus, ammeters, voltmeters, wattmeters, synchroscopes, power factor meters, circuit breakers and switches, many of them electrically operated; portable instruments, instruments of precision, potential regulators and innumerable other forms of auxiliary apparatus and instruments. The alternating-current, series wound, single-phase crane motors, similar in type and general construction to the single-phase railway motors exhibited in the Transportation Building, and the new "Westinghouse unit switch system of multiple control" are also to be seen in this section. The spectacular high-tension sign, using a potential of 50,000 volts, which spells the name "Westinghouse" in lightning-like discharges radiating from large letters over a plate-glass surface—one of the attractions at the Pan-American Exposition—is to be seen in the Westinghouse auditorium.



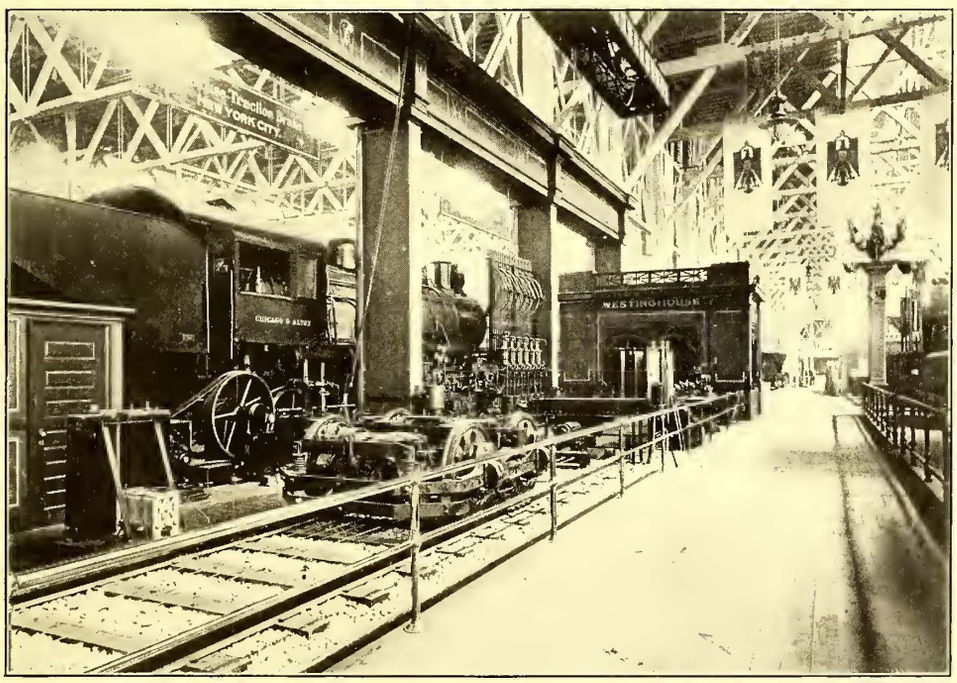




VIEWS IN THE WESTINGHOUSE EXHIBITS

The combined exhibit of the various Westinghouse brake companies extends for 150 ft. down the aisle from the turn-table in the Transportation Building. At the end nearest the turn-table is a reception room for guests, and at the other end is a booth fitted up as a Russian kiosk by the Westinghouse Company, Ltd., of St. Petersburg, to be used as a rendezvous for Russian visitors to the Fair. Included in this operating exhibit is the display of the Westinghouse Electric & Manufacturing Company's alternating-current single-phase railway motors.

The Westinghouse Air Brake Company's exhibit shows a rack made up of apparatus constituting the equipment for a six-coach passenger train with engine and tender, all fitted throughout with the high-speed brake and signal equipment. All valves are placed in duplicate, one sectioned so as to show the internal working mechanism, and connected to the valve in use in such a manner that it moves as the regular valve is operated. The operation of the various valves is thus readily studied. The Westinghouse friction draft gear also is shown in section, with a machine especially designed for testing it in operation. The available power which can be exerted on the draft gear approximates 2000 lbs. A triple-valve testing rack is presented to show the manner in which this device is now being installed in many railroad shops. Sectional parts also are shown of the other apparatus of the Westinghouse Air Brake Company and the Westinghouse Traction Brake Company. The latter's exhibit consists of the magnetic brake and car heating apparatus and the straight air brake for both motor-driven and axle-driven compressors. The magnetic brake is applied to a track 45 ft. long, the truck being equipped on both ends with friction draft-gear buffers, showing the use of this device, which has become extensively adapted to this kind of service. In this connection also is shown the separate brake controller, for use with the magnetic brake when it is decided to add the latter to street railway equipment having an ordinary controller for the motor.



A PORTION OF THE WESTINGHOUSE TRACTION BRAKE EXHIBIT

The straight air-brake rack shows the equipment now used in the straight air outfit on electric cars that are operated by one of the company's standard compressors. The compressors shown are of the axle and motor-driven types, in section for inspection of their internal working parts. One of the sectional compressors is fitted to move with a regular compressor in operation.

The Union Switch & Signal Company's exhibit is a group of signals, full size and in working condition, erected in the Transportation Building. The company shows also examples of electrical apparatus for the operation and control of signals, photographs of various installations and a signal designed for

use in the tunnels of the Pennsylvania Railroad under the Hudson River to New York City, shown in position in a full size model of one of the tunnel tubes. The company's most important exhibit at St. Louis, however, is in installations in actual service, including the Westinghouse electric pneumatic interlocking system at the big Union Station, which controls all of the passenger yard movements, and is much the largest interlocking apparatus ever built.

A brief guide pamphlet to the Westinghouse exhibits may be secured at the headquarters and exhibits office, in the form of a neat folder, which includes maps of St. Louis and the Exposition, and a list of typical Westinghouse installations in St. Louis. Red lines on the St. Louis map show street railways using Westinghouse apparatus.

BRAKE TESTS OF A 400-KW WESTINGHOUSE-PARSONS STEAM TURBINE

The following are the interesting results of a series of tests of one of the Westinghouse-Parsons 400-kw steam turbines at the works of the Westinghouse Machine Company, at East Pittsburg, Pa. This turbine was one of a large number of the same size that were being made, and was placed upon the testing floor of the factory for the purpose of subjecting it to a series of tests, which were conducted by Dean & Main, consulting engineers, Boston, Mass. The turbine was direct connected to an alternating generator, but for the purposes of the test it was decided to remove the generator and substitute therefor a water brake. This brake was placed in the position usually occupied by the generator, the brake shaft being coupled to the turbine shaft.

The arm of the brake rested upon a block upon a platform scale, and the pressure of the brake arm was weighed upon the scale beam in the usual manner.

The turbine was connected to a surface condenser, which was provided with a circulating pump, a dry vacuum pump, and a pump for removing the condensed steam from the bottom of the condenser, all being reciprocating pumps. The surface condenser was tested for leakage and found to be perfectly tight. The discharge of the latter pump was connected to two steel weighing tanks, each mounted upon a good platform scale, so as to be directed into either by means of a tight plug cock. In each test the water discharged was received in each tank 10 minutes.

Two corrections were applied to the water weights, one arising from the circumstance that at the end of a test the height of the water in the "hot well" at the bottom of the condenser was not the same as at the beginning, and the other from the leakage of water from water-cooled bearings into the exhaust. The possibility of the discharge from the dry vacuum pump containing water from the condensing steam, was foreseen, but observation of this, as it was discharged into an atmosphere considerably below the freezing point, revealed almost no vapor, and this source of error was neglected.

The barometer used was of the mercurial type, and stood in general at about 29 ins. The vacuum was taken by a mercury column, and read about 2 ins. less than the barometer except in two tests, during which the vacuum was intentionally reduced in order to ascertain the effect of different vacua on economy.

Since the steam was condensed in a surface condenser and the amount condensed in any length of time could be accurately weighed, the tests were sub-divided into 10-minute intervals. If the load on the turbine were perfectly steady it would be expected that the 10-minute weights would be identical, except for the effect of the height of water in the "hot well" and the bearing leakage to which reference has been made. These weights were nearly uniform, but the total duration of no test was as little as ten minutes. The durations were, for the full-load tests, with 100 degs. superheat, 2 hours, and for most of the others 1 hour. A few tests were made 30 minutes in length.

The detailed results of the tests are given in the adjoining column, to which should be added:

Length of lever arm of brake, 20.09 ins.; equivalent diameter of circle described by brake resistance, 40.18 ins.; circumference of equivalent circle, 10.519 ft.; rated electric generator capacity, 400 kw; rated brake horse-power, 580 hp; rated speed, revolutions per minute, 3600 r. p. m.

In the tests with dry, saturated steam, steam was used which had been superheated sufficiently to be just dry at the throttle. This was accomplished by observing samples flowing through a throttling calorimeter and adjusting the gas-heating supply to the superheater. In the tests with friction load only the brake was used without water. There was a slight pressure on the scale, due to the brake journal friction and the "windage" inside of the brake.

THE ECONOMY OF SUPERHEATING

While the tests did not cover a great range of superheating, the effect was determined as far as the data would allow. Curves were plotted, the vertical distances representing percentages, the amount of dry steam used being called 100 per cent, and the degrees of superheat varying with the horizontal dimensions. In the case of the 77 per cent load only two points were established, and whether the line, if extended, would be straight, cannot be told. In the case of the 2 per cent overload, or rated load, the line connecting three points is nearly straight, while with the greater overload it is somewhat curved. It is fair to say, however, that the saving of steam is about 1 per cent for every 10 degs. of superheat, within the limits of superheat here employed.

THERMAL EFFICIENCY

The thermal efficiency of a turbine can only be determined with correctness on the brake horse-power basis. As, however, the chief interest in the thermal efficiency from a commercial standpoint lies in comparing it with that of a reciprocating engine, and as the latter is always referred to indicated horse-power, what might be called the internal steam horse-power of this turbine was estimated by assuming that it bears the same relation to the brake horse-power that the indicated and brake horse-powers of a reciprocating engine bear to each other. It is difficult to say just what the friction of a reciprocating engine is, as data are variable. Tests that have been made point to 6 per cent as being a common friction rate for engines with generators mounted on their shafts. This gives rise to the "internal steam horse-power" given in the following table, and the other quantities follow:

		Dry Steam	100° Superheat	180° Superheat
1	Rated* load, brake horse-power	593.17	594.60	592.27
2	Internal steam horse-power = B. H.-P. ÷ 0.94	631.03	632.85	630.07
3	Total steam used per hour, lbs	8,249	7,384	6,779
4	Steam used per internal horse-power per hour, lbs	13.07	11.67	10.76
5	Gauge pressure at throttle, lbs	154.40	155.7	153.6
6	Atmospheric pressure, lbs	14.17	14.28	14.24
7	Absolute steam pressure, lbs	168.57	169 98	197.84
8	Superheat	0	109° F.	181° F.
9	Temperature condensed steam	95.3° F.	95.8° F.	94.7° F.
10	Heat of liquid per pound, B. T. U.	339.8	340.5	339.4
11	Heat of vaporization per pound, B. T. U.	854.3	853.8	854.5
12	Heat in superheat per pound, B. T. U.	0.0**	52.3	86 9
13	Total heat in one pound of steam. B. T U.	1,194.1	1,246.6	1,280.8
14	Heat of liquid in condensed steam, B. T. U.	63.8	63.8	62.7
15	Heat used by turbine per hour, B. T. U.	1,130.8	1,182.8	1,018.1

* By rated load in this case is meant the load that was realized when endeavoring to operate the turbine at its rated load.

** This steam contained 2-10 of 1 per cent of moisture, but no allowance has been made for it.

From the above the following are obtained:

CASE OF DRY STEAM

B. T. U. used by turbine per minute (1130.8 x 8249) ÷ 60 = 155,466 B. T. U.

TABLE OF RESULTS OF THE TESTS

		Approximately 180° F. Superheat		Approximately 100° F. Superheat				Dry Saturated Steam				Dry Steam and Low Vacuum		Friction Load
		32 Per Cent Overload	Full Load (2 Per Cent Overload)	31 Per Cent Overload	Full Load (2 Per Cent Overload)	77 Per Cent Load	41 Per Cent Load	26 Per Cent Overload	Full Load (2 Per Cent Overload)	77 Per Cent Load	42 Per Cent Load	20 Per Cent Overload	Full Load (2 Per Cent Overload)	
1	Date, 1903	Nov. 28	Nov. 28	Nov. 28	Nov. 28	Nov. 28	Nov. 28	Nov. 29	Nov. 29	Nov. 29	Nov. 29	Nov. 29	Nov. 29	Nov. 29
2	Test No.	10	9	6	5	7	8	11	12	13	14	16	17	15
3	Duration of test, hours	1	1	1	2	1	1	1	1	1	1	½	½	½
4	Revolutions per minute	3,477.2	3,542.7	3,457.6	3,546.5	3,580 1	3,588.7	3,481.4	3,345.0	3,583.6	3,602.1	3,497.8	3,549.6	3,663.9
5	Travel of point in equiv. circle per minute, ft	36,576.7	37,265.7	36,371	37,305.5	37,658.4	37,749.4	36,620.6	37,290.0	37,696.4	37,890.8	36,792.9	37,338.6	38,539.7
6	Average pressure on scale, net lbs	688.0	524.5	688.5	526	390.2	209.7	656.4	524.9	392.2	210.1	623.1	524.2	4.7
7	Work done by brake, ft., lbs	25,166,214	19,545,094	25,042,534	19,622,670	14,695,078	7,917,945	24,097,794	19,574,617	14,786,041	7,962,374	22,927,153	19,572,126	181,136.7
8	" " " Hp	762.6	592.3	758.9	594.6	445.3	239.9	728.4	593.2	448.0	241.3	694.8	593.1	5.49
9	Average gage pressure of steam near throttle, lbs	151	154	150	156	154	153	153	154	156	156	152	155	157
10	Average temperature of steam near throttle	548° F.	548° F.	469° F.	470° F.	471° F.	454° F.	366° F.	365° F.	373° F.	366° F.	369° F.	368° F.	367° F.
11	Average superheat of steam near throttle	182° F.	181° F.	104° F.	109° F.	104° F.	87° F.	† Dry	† Dry	† Dry	† Dry	† Dry	† Dry	Dry
12	Weight of steam used per hour, lbs	8,520	6,779	9,157	7,384	5,728	3,508	9,928	8,249	6,486	3,876	9,734	8,514	706.
13	Weight of steam per brake horse-power, lbs	11.17	11.45	12.07	12.41	12.86	14.62	13.63	13.91	14.48	16.06	14.01	14.35	128.6
14	Average barometer reading, inches	29.00	29.00	29.09	29.09	29.09	29.09	28.87	28.87	28.88	28.89	28.89	28.89	28 89
15	Average vacuum in exhaust pipe, steam	27.00	27.10	27.10	27.06	27.10	27.10	26.87	26.84	26.80	26.90	25.90	25.91	26.90
16	Temperature of exhaust steam	99.2° F.	99.4° F.	100.0° F.	101.6° F.	99.8° F.	100.0° F.	101.1° F.	101.3° F.	102.9° F.	102.9° F.	115.7° F.	115.7° F.	109° F.
17	" circulating water, inlet	38° F.	38° F.	39.7° F.	38.6° F.	38.5° F.	38 0° F.	37.0° F.	36 9° F.	37.0° F.	37.0° F.	37.0° F.	37.0° F.	37° F.
18	" " " outlet	49.9° F.	45.8° F.	51.7° F.	47.3° F.	45.4° F.	43.0° F.	49.6° F.	46.7° F.	43.6° F.	41.8° F.	49.0° F.	45.5° F.	39.5° F.
19	Average temperature of condensed steam	91.2° F.	94.7° F.	93.8° F.	95.8° F.	95.4° F.	95.0° F.	92.1° F.	95.3° F.	98.4° F.	97.6° F.	109.8° F.	110.5° F.	95.2° F.

† This steam was not strictly dry but was either very slightly moist or superheated. This was not enough to have a measurable effect on economy.

B. T. U. used per internal horse-power per minute, 155,466 ÷ 631.03 = 246.37 B. T. U.

$$\text{Thermal efficiency, } \frac{33{,}000}{246.37 \times 778} = 0.1722 \text{ per cent.}$$

CASE OF 100 DEGS. SUPERHEAT

B. T. U. per minute (1182.8 x 7384) ÷ 60 = 145,563 B. T. U.

B. T. U. used per internal horse-power per minute, 145,563 ÷ 632.55 = 230.12 B. T. U.

$$\text{Thermal efficiency, } \frac{33{,}000}{230.12 \times 778} = 0.1843 = 18.43 \text{ per cent.}$$

CASE OF 180 DEGS. SUPERHEAT

B. T. U. per minute (1218.1 x 6779) ÷ 60 = 137,625 B. T. U.

B. T. U. used per internal horse-power per minute, 137,563 ÷ 630.07 = 218.33 B. T. U.

$$\text{Thermal efficiency, } \frac{33{,}000}{218.33 \times 778} = 0.1943 = 19.43 \text{ per cent.}$$

These percentages furnish the only proper means of judging of the efficiency of the turbine, or any other heat engine, as they take into account the superheat as well as the other heat in the steam. If they should be compared with similar percentages from reciprocating engines it will be found that they stand in the front ranl and are seldom surpassed.

TIES AND RAIL FASTENERS

A bullet on this subject has just been issued by the Bureau of Forestr , written by Herman von Schrenk, chief of the Department of Forest Products. The pamphlet, which is entitled "Bulletin No. 50," discusses very carefully American and European practice in regard to ties and rail fasteninngs, with special reference to treated timbers. The conclusions of the author in regard to the ties themselves may be summarized as follows:

1. It is not desirable to continue the present method of classifying ties as first class, second class, etc., and culls. Instead, an alternative classification is proposed, which substitutes a division into grades A, B, C, etc., each standing for a certain definite size. Such a classification would throw out the cull tie entirely.

2. It is not desirable to decrease the number of ties of the present breadth now laid per rail length, for the reason that even with an increased stiffness of rail a reduction in the bearing surface on the ballast is not warranted, in view of the fact that a larger bearing surface on the ballast is continually being sought for. In this connection it must be remembered that closer spacing of ties will not be possible, since a certain minimum space must be maintained to permit proper track work. In other words, increasing the breadth of the tie will necessarily mean a reduction in number per rail length.

3. Triangular ties are not desirable, and ought not to be used, because they give less bearing surface on the ballast rather than more.

4. Assuming that tie-plates are to be used on treated timbers of inferior grade, it is a waste of timber to require an 8-in. top bearing surface. It is, therefore, proposed that the present requirement be modified so as to admit timbers having a minimum of 6-in. top bearing surface. At the same time it is proposed that the bearing surface on the ballast be increased above 9 ins., to such an extent as may prove advantageous, depending upon the class of timber from which the ties are made. This would make what is termed a "half-round tie." This tie is really trapezoidal in form, is the standard of the Bavarian State railways, and is considered more economical of wood than any other. It has the following dimensions: Top bearing surface, minimum breadth, 6 ins.; bearing surface on

the ballast, 10-12 ins.; thickness, 7 ins.; length, 8 ft. or more.

5. The half-round tie is advantageous, from a mechanical standpoint, because it gives greater bearing surface per mile and a correspondingly more stable track when spaced at approximately the same distance now used with 7-in. x 9-in. ties.

6. The half-round tie is good for the lumberman, because in numerous instances it will make two ties where it would have been possible to make only one of the rectangular form.

7. The half-round tie is good for the forest, because it will encourage the cutting of large trees and the saving of small ones, and, further, will prevent the waste due to leaving many tops in the woods.

8. Taking all these matters into consideration, it would appear that the half-round tie is worthy of trial. Experiments are now under way to test the practicability of sawing large numbers of these ties. These experiments are being made in cooperation with the New York Central & Hudson River Railroad in the Adirondacks, with beech and birch, with the Santa Fé Railroad, in Texas and Arizona, with various pines, and with the St. Louis & San Francisco Railroad, in Missouri and Arkansas, and the Northern Pacific Railway, in Montana and Washington, with red fir and lodgepole pine.

The pamphlet then discusses the relative merits of spikes, screws, screw dowels, and recommends the two latter. The form of screw spike believed most desirable is one used on the French Eastern Railway. Holes are bored in the ties before the screw spike is inserted. In its favor Mr. von Schrenk claims that the screw spike is far preferable to the spike, and that the form suggested combines the advantages of ease of making, cheapness and longer service than the other types of screws, and, moreover, wears out the thread of the wood less than closer wound screws. Tests with this screw are now under way on several of the roads in the United States. It is suggested that these screw spikes be placed in two ways; four screws per tie and six screws per tie, according to the European model.

As the screw spike forms one of the proposed modifications of the present method of fastening, it is desirable that screws be tested on a broad-based rail without any plate, and also with steel and with wooden plates. In buying screw spikes, only such as show a sufficient strength of head should be accepted. Most screws hitherto used have not had strength enough to stand the vertical blow upon the head.

Recent tests show that the ratio of the holding power of the screw spike, as compared with the common spike, ranges from 1.87:1 for white oak to 4.63:1 for long-leaf pine. The result of lateral impacts shows that under the action of a side blow, such as comes on a rail, a common spike is pulled out from one-fourth inch to one-half inch, while the screw spike is not perceptibly started.

The writer also speaks very highly of the screw dowel, one of whose advantages is that it can be applied to ties in which the holes made by ordinary spikes have worn out.

The subject of tie-plates is also considered. For soft and inferior woods, Mr. von Schrenk recommends that, pending experiments with wooden tie-plates in this country, wherever possible, a flat steel tie-plate be used without spines or flanges on the base of the plate. The flat plates should preferably have a flange on the upper side, to hold the outer edge of the base of the rail. He also recommends that tests be made with wooden tie-plates, of the following dimensions: One-fourth, one-half and five-eighths inch in thickness, 6 ins. to 7 ins. long, and the width of the rail base under which they are to be used. These tie-plates should be made out of soft woods, and should be fully creosoted.

The report comes from Schenectady that the New York Central Railroad is planning to use 9 miles of track near that place for testing its electrical equipment.

CABLE BURN OUT AT ST. LOUIS

The St. Louis Transit Company passed through a trying experience June 3 and 4. The cables in the principal conduit leading from its Central power station at Park and Vandeventer Avenue were all temporarily put out of service by what appeared to be a general short circuit of a number of cables. Just how the trouble originated it is difficult to dtermine, but the effects were very disastrous, and resulted in depriving the company instanter of about two-thirds of its power. The greater part of the power from the Central power house (which is entirely a 500-volt direct-current station) is taken by underground conduit lines, extending from two to three blocks from the station, and is then fed to overhead feed lines. One of the principal conduit lines is that extending toward Grand Avenue.

About 6 p. m., Friday evening, June 3, flames began to issue from the tops of the iron pipes which cover the cable where they are run up the poles. About the same time the cover of one of the manholes was blown off, and flames burst out of the manhole. A short circuit, apparently of all the cables in that conduit, necessitated shutting off power from it entirely, until cables could be separated and tested out. As jumpers had been connected across between feeders at various points, the first thing done was to disconnect these jumpers, and also disconnect the cables at the terminal boxes, so that the short-circuited cables could be tested out. Richard McCulloch, who had two days previously come from Chicago to assume charge of the electrical and mechanical work of the St. Louis Transit Company, happened to be near the scene of the accident, and immediately took charge of the work of connecting temporary overhead cables in place of the burned out conduit line. Fortunately, several miles of 500,000-circ. mil cable were found in the city, and some equalizing feed wire, between the Central and Missouri Avenues power houses, was also taken down and put up as a substitute for the underground cables. The manholes were so hot that they could not be entered until 12 hours after the accident. Normal service was resumed on Sunday. Large crowds were carried to the World's Fair on Saturday, the day following, but, of course, with very crowded cars, owing to the necessary reduction in number of cars run. After cables had been disconnected and the conduit cooled down it was found that three cables were uninjured from end to end. The balance all showed defects. Later, upon disconnecting various sections of the cables, many uninjured lengths were found. Everywhere along the conduit lines leading from the station, evidences of great heat were found. Some cables which tested defective by voltmeter test soon after the accident, were later tested all right, and were put back into service. Heavy rains had been falling and there was considerable water in the conduits. Some of the cables were melted off in the manholes and near the terminal boxes. The cables are paper insulated.

The long-drawn out suit between the city of Toronto and the Toronto Railway Company has been terminated, an agreement having been signed by the solicitor for both parties and approved by the Board of Control of the city. The company acknowledges the right of the city engineer to regulate the speed of cars and to determine the service which shall be considered a proper carrying out of the contract. The company is by Sept. 1 next to double-track and extend the lines on six streets and avenues, and from the present terminus of the double tracks on Winchester Street, to and along five other streets. The company must also discontinue the use of open cars between Oct. 15 and May 1 of each year. All cars must be equipped with heaters by Nov. 15, and when necessary are to be heated until April 15. The city engineer, with the approval of the City Council, is to have the right to determine the speed and service necessary on all lines, and at what intervals the cars on all routes shall run.

UNIVERSAL SAW BENCH

The accompanying cuts illustrate the "Oliver" universal saw bench, which was designed primarily with the object to produce a saw bench that could be used equally well for the finest or coarsest work. The street railway jobbing shop is just the place for a saw bench answering this description. Sometimes the requirements are for a 4-in. plank to be sawn, and at other

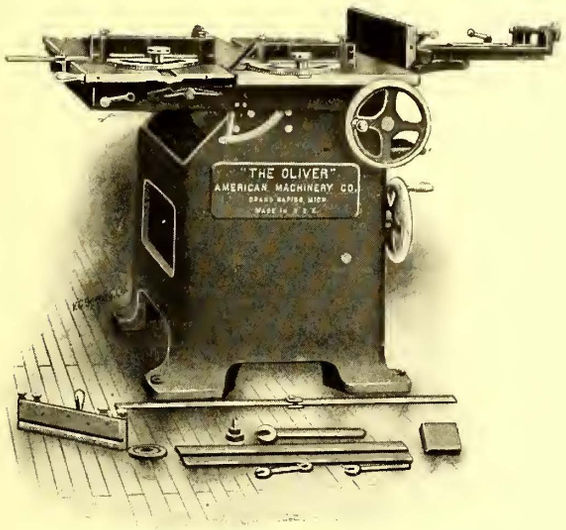


FIG. 1.—COMPLETE UNIVERSAL SAW BENCH

times mouldings and frames must be cut for window casings or other interior work about the cars.

In some places these saw benches are motor driven and mounted upon trucks, and the saw moved to the most convenient position suitable for the work in hand. It has been demonstrated many times that a power saw bench in close proximity

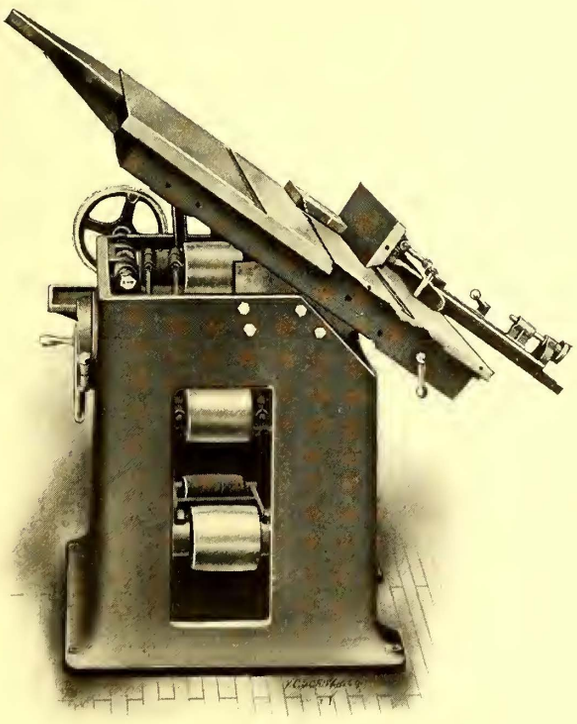


FIG. 2.—UNIVERSAL SAW BENCH, SHOWING TABLE SET AT AN ANGLE

to a car that is being repaired, or a new one that is being fitted up, will save much valuable time.

The complete machine with all the attachments in full view is shown in Fig. 1. Fig. 2 illustrates the machine with the table set at an angle, and the gages set at the proper angle for mitering the joints of a six-sided figure. This makes a compound angle ordinarily extremely difficult to get and figure out; but owing to the fact that the top of the table and the gages themselves are graduated with extreme accuracy, and the dial on the front of the machine (shown in Fig. 1) indicates the exact pitch of the table, work of this sort may be done instantly by any one.

Fig. 3 illustrates the method of ripping stock on a bevel

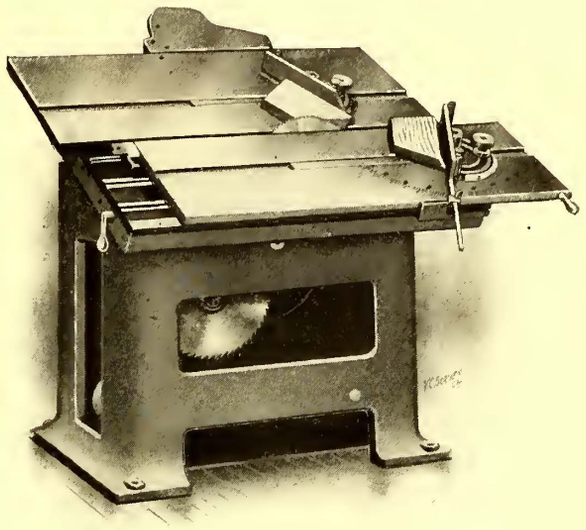


FIG. 3.—METHOD OF RIPPING STOCK ON A BEVEL

by having the gage upon the lower side of the saw; the weight of the work being operated upon is thus supported. The splitting fence shown in this view is capable of being adjusted in every conceivable manner and operated upon either side of the saw.

All the round parts of this machine have been ground upon a universal grinder, making the bearings, especially in the saw arbors, absolutely perfect. Cutter heads may be used upon the machine, as one arbor is especially long for that purpose. A rip-saw may be changed for a cut-off saw while the machine is in full motion, and the table tilted and held at any particular angle without fastening. The sliding table may be locked and the auxiliary gages used instead; or, with the sliding table in use, work 36 ins. wide may be cut off.

This machine is designed for a variety of drives. The countershaft may be set in the rear of the machine or underneath. The motor drive may be either attached to the machine itself, or the motor may be set upon the floor in any convenient position, or secured to the ceiling underneath. The compound idler jack used for taking care of the slack in the belt operates upon both the slack and the tight side of the belt, giving the machine extraordinary pulling power.

Saws from 8 ins. to 20 ins. in diameter may be used with this machine. Its weight is about 2000 lbs., and the size of table 36 ins. x 44 ins.

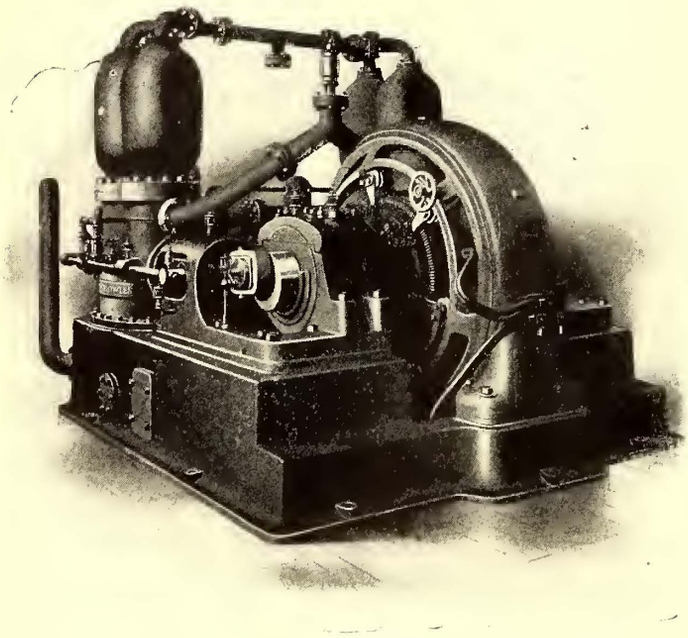
INSTRUCTION MEETINGS ON THE BOSTON & NORTHERN STREET RAILWAY

About once every two months the conductors and motormen of the several divisions of the Boston & Northern Street Railway Company are called together in general meeting—the night crews during the day and the day crews in the evening—and are addressed by superintendents or foremen upon some subject pertaining to the good of the service. This formal address sometimes is supplemented by having conductors and motormen read papers on special subjects. The meetings have been held for some time, and while attendance is in a sense voluntary the company has found that the interest of the men in the meetings is keen and that they are well attended.

HIGH-SPEED MOTOR-DRIVEN PUMP

The operation of pumping machinery by electric motors offers many obvious advantages, such as the centralization of the power plant, elasticity of extension of the system, high efficiency and small first cost and small expense for attendance.

Electric-driven pumps, however, have had one draw-back, which, while not serious, had, nevertheless, to be taken into account. This was the necessity of toothed gearing, belts or



HIGH-SPEED MOTOR-DRIVEN PUMP

other devices to transfer the power from the rapidly revolving motor shaft to the slow-moving crank shaft of the pump.

In the pump shown in the accompanying illustration these objectionable features have been eliminated by the simple expedient of connecting the pump plungers to cranks mounted directly upon the shaft of the motor. This pump has a capacity of about 250 gals. per minute, against 1000-ft. head when running at a speed of about 300 revolutions. So carefully have the internal parts of the pump been designed, however, that its mechanical efficiency is over 93 per cent, approximating closely that of the highest types of large steam pumping engines. The pump is of the duplex type; the cranks at the opposite ends of the motor shaft being set at right angles to each other. The plungers are of the outside packed pattern, and the two plungers of each pump are connected by side rods. The plungers are 3½ ins. in diameter, and have a stroke of 5½ ins. The pump and motor are mounted upon a rigid box-girder frame, and the unit is self-contained and occupies a relatively small space. It contains many novel features of construction, and the most careful attention has been given to the design of the internal parts as well as to the running parts and oiling devices.

It is claimed that this type of pump, which has only lately been introduced, has salient advantages never before attained, including simplicity of construction, small space requirements, cheapness of installation and attendance.

An examination of the following figures, which were obtained in a carefully conducted test, will give an excellent idea of the efficiency of this pump. The pumps are built by the Blake & Knowles Steam Pump Works, of New York, in capacities of from 200 gals. to 4000 gals. per minute, and for heads varying from 100 ft. to 2000 ft. One of these pumps, operated by a direct-current motor, will be exhibited in the space of the General Electric Company, at the St. Louis Exposition.

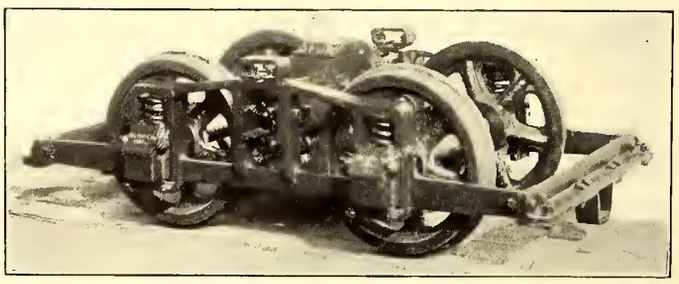
TEST OF HIGH-SPEED DUPLEX PUMP 3½-IN. PLUNGERS, 5½-IN. STROKE, DIRECT-CONNECTED TO 100-HP, SIX-POLE 200-VOLT SHUNT MOTOR

R. P. M.	Motor Input, Watts	Pump		Pump, H. P.	Motor Pump	Efficiencies	
		Gallons Delivered	Pressure, Lbs.			Motor Alone	Pump Alone
					%	%	%
280	28,800	237	110	32.63	78.	86.5	90.1
280	40,600	237	215	48.94	82.2	89	92.36
280	52,550	235	321	62.25	84.4	90.1	93.66
280	60,200	234	425	74.53	84.3	90.9	92.74
309	58,800	232	496	71.79	83.3	----	----

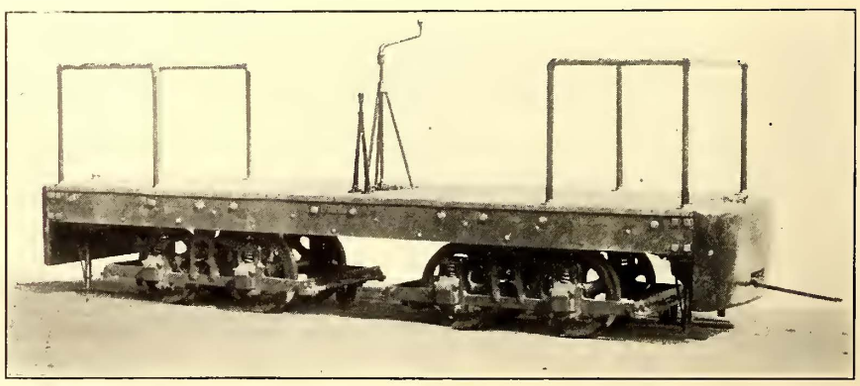
A NEW TYPE OF INDUSTRIAL LOCOMOTIVE

The interesting electric locomotive shown in the accompanying cut was lately delivered to the Whitin Machine Works, of Whitinsville, Mass., by the builders, the J. G. Brill Company. The locomotive was ordered through the General Electric Company, of Schenectady. It is mounted on what are probably the smallest pair of double trucks ever built. The wheel base is only 2 ft. 9 ins., and the wheels 22 ins. in diameter. The track gage is 2 ft. The length of the locomotive over the bumpers is 18 ft., and the width over the sills 4 ft. 3 ins. The bumpers are cast in a single piece, with the face 24 ins. wide, and thickness at center 8 ins. Each bumper weighs 2300 lbs.; the total weight of the locomotive without motors is 13,000 lbs. Four G. E. motors, CB-14, are to be used.

Besides being able to draw a long string of cars the locomotive may be used for carrying heavy materials. Two-inch pipe railings enclose the ends, and sockets are provided for uprights to support a canopy. The sand-box levers and alarm gong are placed at the center, near the brake shaft. The side sills are 4½ ins. x 9 ins., plated on the outside with ½-in. plates. The bolsters are 6 ins. x 9 ins., and there are eight crossings, 3¾ ins. x 5¾ ins. The height from rail-heads to underside of sills is 24 ins.



LIGHT ELECTRIC LOCOMOTIVE TRUCK



DOUBLE-TRUCK ELECTRIC LOCOMOTIVE FOR INDUSTRIAL WORK

FINANCIAL INTELLIGENCE

WALL STREET, June 8, 1904.

The Money Market

Return of currency from the interior of the country continues in exceptional volume, this being the principal factor in the present money situation. It has been enough to offset, with the help of the Japanese gold, estimated at $30,000,000, which has arrived during the last two months, the export of over $60,000,000 of gold to France. Surplus bank reserves were reported last Saturday in round numbers at $31,000,000, which compares with $32,000,000, the high point of the season on Feb. 27. The bank position has been helped considerably by reduction in loans which has amounted in three weeks to $25,000,000, the decrease partly representing loans made by institutions outside the Clearing-House taking the place of similar credits previously furnished by the member banks and partly the return of capital borrowed by syndicates underwriting new securities issues, released as the securities have been disposed of to investors. The outward movement of gold to Paris has ceased, owing, not to any change in our money conditions, but to the indications that the French demands have for the time being been satisfied. Sterling, however, has continued to advance until it is now fully a half-cent higher than when gold was going out to Paris last month. If this rise keeps on a little further, it will become profitable to ship specie to London, and in the opinion of banking experts such a result is reasonably probable in the near future. Be this as it may, there need no longer be any doubt that we shall have easy money from now on until crop-moving time. The accumulation of idle capital at this center, inasmuch as it is a reflection of declining trade, may be expected to continue, and it bids fair to equal whatever gold withdrawals there may be across the water. Barring the applications for credit from corporations having new securities to float, borrowing requirements have sunk exceedingly low, and this, as much as the excess supply, tends to keep money rates down. Quotations for the use of money have returned to the low level at which they stood when gold exports set in a month and a half ago. Call funds on the Stock Exchange are easily obtainable at 1 and 1¼ per cent. For sixty days the figure is 2½ per cent, and for six months 3 to 3¼ per cent.

The Stock Market

Except for a few individual stocks, for the most part outside of the usually active list, the market has remained motionless during the last two weeks. It has been altogether the stupidest and most unprofitable period that Wall Street has known in recent years. Prices have apparently reached a level where the desire to buy and the desire to sell are equally restricted, and where there is not sufficient impulse in either direction to cause even the ordinary fluctuation of a dull trading market. Of the individual movements the most noteworthy have been the strength of the anthracite coal share, Reading and Ontario & Western more particularly, and on the other hand, the weakness of a number of the minor railroad issues for which the market is always extremely narrow. Earnings are better on the coal roads than anywhere else, and it is commonly appreciated that the anthracite industry furnishes the one conspicuous exception to the depression in general business. These are substantial reasons why this group of stocks should be selected as favorite objects for speculation for the rise. It is confidently believed, besides, that the enormous purchases of Ontario & Western within the last few days foreshadow an announcement of the dissolution of the voting trust, which will place the road in a position to be bought up by one or another of the large systems which are seeking an entrance into New York City. The decline in the various minor specialties expresses the view that these are the roads that are likely to suffer most by the falling off in railroad traffic. Attention was drawn more seriously to this feature of the situation by the default of the Detroit Southern Company's bond interest, made known ten days ago. Doubtless the inferences from this episode have been drawn too indiscriminately; nevertheless, it is felt that other roads of a similar rank are in a position where, if earnings were to fall off any further, there would be a question as to their ability to maintain a surplus. Between these conflicting influences, the general market has moved confusedly, with no real tendency either way. The outcome of the crops is the main thing awaited before opinions as to the future can be ventured with safety. Then there are the presidential nominations, which are due within a month's time, to still further increase the disposition to do nothing. According to all the evidence now present, the dull spell is likely to continue for a few weeks longer anyway.

The local traction stocks have not attracted nearly the same degree of speculative interest that they did a fortnight ago. The whole group has held firm, but has not advanced; dealings have fallen off to a comparatively insignificant volume. Professional sentiment is still favorably inclined, especially toward Brooklyn Rapid Transit, on account of its large summer earnings. But until the pools in these stocks take the initiative again, the speculative coterie is not averse to leaving it alone.

Philadelphia

Dealings in Philadelphia have been quite uneventful during the two weeks period. The market has partaken somewhat of the firmer tone displayed in speculative circles elsewhere, but prices have not varied materially from what they were a fortnight ago. Considerable strength has again appeared in Philadelphia Traction, which, after dipping to 95½, rose to 96 and was freely bought around that figure. Philadelphia Electric has also been very active, selling up to 6½ for the certificates on which $8.75 has been paid in. Philadelphia Company common improved from 38 to 38⅝ and the preferred from 44 to 44½. Union Traction was bid up from 49⅞ to 50⅛. One hundred shares of Philadelphia Rapid Transit changed hands at 12⅜, or ¾ under the last previous sale. Odd lots sold of American Railways ex-dividend at 43, of Fairmount Transportation at 22½ and of Consolidated Traction of New Jersey from 65 to 65¾.

Chicago

It is a very long time since the Chicago traction market has been as active and interesting as it has during the last two weeks. The Federal Court ruling, leaning in favor of the traction companies in the long and tedious controversy over the ninety-nine-year franchise clause, is the thing that has given the security dealings their great impetus. Recoveries in prices, especially among the stocks of the surface roads, have been little short of sensational. City Railway, which sold in the 150s only a few weeks ago, has risen to 180, about 1000 shares changing hands between the latter figure and 164, at which the movement began ten days since. North Chicago, on purchases of about 500 shares, rose 10 points from 70 to 80. West Chicago is up 4 points on sales of 800 shares, while heavy buying of Union Traction, centering in the New York market, carried the common stock up from 5½ to 7. Metropolitan Elevated issues have benefited by the outburst of buying in the street railway securities, the common advancing from 17½ to 21, and the preferred from 48 to 53½ on active trading. There was little doing either in Lake Street, which sold at 3, or in Northwestern, which went at 16½ and 16. South Side was a feature, however, declining from 91 to 89 on heavy selling caused by the announcement that a new issue of bonds might be made to take the place of the $7,500,000 new stock recently authorized. The decline in the market price shows that the bond proposition is decidedly unpopular.

Other Traction Securities

Boston Elevated has been the strong feature of the recent trading on the Boston Exchange, advancing from 140½ to 142¾, the highest price of the year. Five hundred shares sold between 142 and 142¾. Massachusetts Electric preferred rose from 72 to 73, but later sold at 70, ex-dividend. The common was neglected around 18. West End common changed hands between 90 and 90½, and the preferred at 111⅜. The directors of the United Railways Company, of Baltimore, voted to suspend the interest on the income bonds, thereby fulfilling the expectation that the road had been seriously hurt by the destruction of property during the fire. The recent weakness of the company's securities finds in this a satisfactory explanation. The income bonds broke 4½ points more to 43¾, rallied sharply to 47½ and then eased to 45½ again. The stock made a new low record at 5¾, 600 shares selling around that figure. The general 4s, after a half-point decline to 89½, rallied to 90. Other Baltimore transactions for the two-weeks' period included Pittsburg Traction 5s at 113, Atlanta Street Railway 5s at 106 to 106½, Virginia Electric Railway & Development 5s from 94 to 95¼, Anacostia and Potomac 5s at 97, Macon Street Railway 5s at 91, Lexington 5s at 100, City & Suburban, of Bati-

more 5s at 112½, and Baltimore City Passenger 5s at 106⅜. On the New York curb there has been very little feature. A few sales of Interborough Rapid Transit were recorded at 112, and Washington Railway & Electric 4s jumped up from 76½ to 78.

Cincinnati Street Railway gained strength in Cincinnati last week. About a thousand shares changed hands at between 129 and 140, the latter the highest price in many weeks; Cincinnati, Newport & Covington preferred sold at 85½, and several good blocks of the first 5 per cent bonds at 109½. Detroit United advanced to 61 on small sales. A small lot of Cincinnati, Dayton & Toledo Traction came out at 20.

Cleveland Electric was slightly stronger at Cleveland last week, a number of sales being made at 7¼. Northern Texas Traction sold at 35. A bid of 3¾ was made for the annual dividends on this security. At present it is on a 3½ per cent basis and the bid would indicate that investors think it will go to 4 per cent when the next dividend becomes due. Aurora, Elgin & Chicago 5 per cent bond receipts sold at 75.

Security Quotations

The following table shows the present bid quotations for the leading traction stock, and the active bonds, as compared with two weeks ago:

	Closing Bid	
	May 24	June 6
American Railways	44½	*43
Aurora, Elgin & Chicago	a14	a13½
Boston Elevated	140½	142¾
Brooklyn Rapid Transit	46⅜	47
Chicago City	156	170
Chicago Union Traction (common)	5½	a6¾
Chicago Union Traction (preferred)	29	28
Cleveland Electric	71	71¼
Consolidated Traction of New Jersey	64¾	65
Consolidated Traction of New Jersey 5s	107	105
Detroit United	61⅜	60⅞
Interborough Rapid Transit	112	111¾
Lake Shore Electric (preferred)	a35	a40
Lake Street Elevated	3	3
Manhattan Railway	143¼	144
Massachusetts Electric Cos. (common)	18	18¼
Massachusetts Electric Cos. (preferred)	71	*70
Metropolitan Elevated, Chicago (common)	16	21
Metropolitan Elevated, Chicago (preferred)	48	52¾
Metropolitan Street	110⅛	110⅝
Metropolitan Securities	77	75
New Orleans Railways (common)	8¾	8¼
New Orleans Railways (preferred)	26⅝	26¼
New Orleans Railways, 4½s	74	74
North American	81	81
Northern Ohio Traction & Light	13½	12
Philadelphia Company (common)	37⅞	38⅜
Philadelphia Rapid Transit	12½	12¼
Philadelphia Traction	95⅝	95¾
St. Louis (common)	13	13¼
South Side Elevated (Chicago)	91	89
Third Avenue	116	116
Twin City, Minneapolis (common)	94½	93¾
Union Traction (Philadelphia)	49⅝	50
United Railways, St. Louis (preferred)	57	57
West End (common)	90½	90
West End (preferred)	111	111

a Asked.

Iron and Steel

Proof that the demand for iron has fallen off heavily within the last month is contained in the figures of the "Iron Age" published to-day. While the total output of pig was 20,000 tons less in May than in April, stocks on hand increased 100,000 tons. This is the first time in several months that a surplus has been shown, and being as large a surplus as it is, it indicates a rather serious state of overproduction. Quotations are as follows: Bessemer pig $13.25, steel $23, steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 12¾ and 12⅞ cents, tin 27¾ cents, lead 4⅜ cents, and spelter 5 1-16 cents.

AN ELECTRIC RAILWAY BASEBALL LEAGUE

J. O. Wilson, general passenger agent of the Cleveland & Southwestern Traction Company, of Cleveland, Ohio, has organized a baseball league, which promises to prove a source of profit to his company. The road touches eight important towns, and in six of these—Wooster, Medina, Grafton, North Amherst, Elyria and Wellington—Mr. Wilson has organized teams. A schedule of regular games has been arranged, under which there are two games a week on each of the two divisions of the system. All of the teams are equipped with suitable uniforms, and the company has agreed to furnish free transportation to the players. The company does not share in the profits of the teams, but expects to derive its revenue through the increased traffic through the attendance at the games. Arrangements have been made by the company with the Cleveland papers and with the local papers in all the towns to give the games prominence, and to show the averages of the teams the same as is done with the regular leagues, and the company further assists in the advertising by means of car signs. Thus far the venture has proved very satisfactory. The rivalry between the various towns has already become quite keen.

IS THE BIG FOUR TO ADOPT ELECTRICITY OUT OF CLEVELAND?

It is stated that M. E. Ingalls, president of the Big Four Railway, has ordered plans prepared for the substitution of electric locomotives for steam locomotives in hauling passenger trains in and out of the Union passenger station at Cleveland. The station is an old one, and poor ventilation, coupled with coal soot, adds greatly to the discomfort of passengers.

THE CLEVELAND LOW FARE DECISION

In the Street Railway Journal of June 4 brief mention was made of the decision of the United States Supreme Court sustaining the United States Circuit Court at Cleveland in finding for the company in the low-fare street railway case. The case had its origin in 1898, when Robert E. McKisson was Mayor of Cleveland. At that time the City Council passed an ordinance requiring the local company to give four-cent fare on two of its leading lines. The case was carried from court to court, until finally it reached the Supreme Court. The decision as handed down by the Supreme Court was read by Justice White. In the franchise ordinance passed by the City Council in 1879 the city reserved the right to reduce the fare on the Kinsman Street line. In 1880, 1883, 1885 and 1893 the city passed extension and consolidation ordinances involving that line and fixing the fare at five cents, with no reservation to reduce it. These ordinances provided for a single fare over the entire system of what was then the Cleveland City Railway Company. But the ordinance of 1898, taking advantage of the power reserved by the ordinance of 1879, fixed the fare on Kinsman Street at four cents.

In his opinion, Justice White declared that the consolidation and extension ordinances passed in 1885 and thereafter, fixing the fare at five cents, superseded the ordinance of 1879. They were binding contracts and could not be impaired by the four-cent ordinance of 1898. Even according to Ohio decisions the ordinances passed in 1885 and afterward were binding contracts. While Sec. 2502 of the Ohio Statutes provides that a company shall not be released from any obligation or liability imposed by a grant, Justice White said it had been held in the case of Clement vs. Cincinnati that a contract between a city and street railroad company may be modified in good faith for the better accommodation of the public.

The court reasoned that the City Council meant to allow the railroad company to charge full five-cent fares because of the longer rides and transfers that came in with the extensions and consolidations. It then declared the ordinance of 1898 void, because it impaired contracts entered into by the city and street railroad companies after the passage of the 1879 ordinance. The same decision, Justice White said, applies to the suit brought by the Cleveland Electric Railway Company to prevent reduction of the fare on the Euclid Avenue line to four cents under the ordinance of 1898.

Judge Sanders, the attorney for the railway company, in speaking of the decision, stated that by the decision the Supreme Court has again affirmed that street railway ordinances, when accepted, are contracts written for the protection of the Federal Constitution, and that so long as the ordinance by its terms remains in force, it is not within the power of a City Council to change its terms or impose new conditions without the consent of the railway company. Judge Sanders claims that the decision will make it impossible for the city to enforce the so-called McKenna or "zone ordinance," which was passed by the City Council some months ago. This ordinance undertook to establish a rate of three cents over a large portion of the system of the Cleveland Company. This case is now in litigation.

SALE OF YOUNGSTOWN & SOUTHERN RAILWAY DENIED

J. H. Ruhlman, secretary and treasurer of the Youngstown & Southern Railway, writes that the statement that the control of the Youngstown & Southern Railway had passed to Eastern interests is erroneous. At the recent annual meeting of the stockholders all the directors were re-elected with the exception of R. L. Andrews, who resigned as general manager and director of the company. The contract for the construction of the road, as mentioned in the last issue of this paper, is in the hands of J. G. White & Company, of New York, who will build the line after plans and specifications made by the engineer of the company, E. Gonzenbach.

THE LEHIGH VALLEY REORGANIZATION

Bondholders of the Philadelphia & Lehigh Traction Company, representing $1,400,000 of the $1,900,000 bonds outstanding, met at Philadelphia Friday, May 3, to hear and discuss the plan presented by the committee for the reorganization of the company. The plan involves the merger under one corporation of the Lehigh Valley Traction Company, the Philadelphia & Lehigh Valley Traction Company, the Allentown & Slatington Street Railway Company, also controlling electric light companies, and the Bethlehem & Nazareth Street Railway Company. A new first mortgage is to be created on the united system for $4,600,000 to take up the present underlying $3,000,000 of Lehigh Valley Traction Company bonds (of which $2,770,000 are outstanding), and $1,830,000 of the bonds is to represent new cash to be used by the company. Of the new capital more than one-half will be spent on the improvement of the system, including the building of a new power house, a new electric light plant and machine shop. The balance of the cash is to pay preferred claims, receivers' certificates and to redeem securities pledged as collateral.

There will be a second mortgage (or more likely deferred bonds secured by a first mortgage) aggregating $2,000,000. These will be distributed among the present bondholders of the various lines, including the Philadelphia line. For the balance of their bonds they are to receive preferred stock. General creditors and preferred stockholders are to receive preferred stock for their claims. Common stock of the Lehigh Valley Traction Company receives common stock of the new company. A syndicate has been formed which will underwrite all assessments and relieve the security holders. The total amount of the underwriting is $1,830,000.

The outcome of the discussion was the adoption of a resolution approving the plan, but not to be binding upon any bondholder until after fuller examination he has actually signed the reorganization agreement.

SEVENTY-FIVE MILES AN HOUR ACCOMPLISHED BY ELECTRIC SLEEPING CAR

On Friday, May 20, Lafayette, Ind., enjoyed the distinction of receiving the first visit of the only electric sleeping car now in active service. The car in question is owned by the Holland Palace Car Company, and it was accompanied by its inventor, Harris F. Holland, and a party of railroad officials, including C. C. Reynolds, general manager of the Indianapolis & Northwestern Traction Company, with members of his family from Lebanon; F. D. Norville, general agent of the road at Indianapolis; J. W. Chipman, manager of the Indianapolis & Eastern Traction Company; Guy J. Jeffries, superintendent of the Indianapolis & Northwestern Traction Company; Charles N. Wilson, general manager of the Columbus Greensburg & Richmond Traction Company; Rev. Alexander McFarran, pastor of the First Presbyterian Church of Lebanon; Joseph W. Selvage, general manager of the Holland Palace Car Company; L. W. Henley, of the Indianapolis "Star," and D. S. Johnson, representing "McClure's Magazine," who is gathering material for a special article on interurban development in Indiana.

It is claimed that the car in its run from Indianapolis to Lafayette broke all interurban transit records, a speed of 75 m. p. h. having been attained on a 5-mile tangent between Zionsville and the Marion County line. The trip was made for the primary purpose of testing apparatus and clearances, and resulted to the entire satisfaction of all concerned. The car was used in the excursion planned by the Indianapolis & Northwestern from Indianapolis to connect with the Manon excursion from Lafayette to Chicago May 21. It was the first occasion in history of a sleeping car being engaged in accommodating regular traffic on an interurban line. The Holland Company management has tendered the use of the "Frances" to Prince Pu Lun for his contemplated trip to Lafayette.

INDEPENDENT SYSTEM SEEKS FRANCHISES IN BALTIMORE

The Maryland Electric Railways Company is once more seeking the right to operate a street railway line in Baltimore. An ordinance granting the company authority to lay tracks on streets in every section of the city has been introduced in the Second Branch of the City Council, and referred to the Committee on City Passenger Railways. The ordinance differs from its three or four predecessors, in that it covers more streets and pledges the company to pave from curb to curb the streets on which its tracks are laid. This is in addition to an annual park tax of 9 per cent of the gross receipts from lines within the city limits and an annual franchise tax to be fixed by the Board of Estimates.

The ordinance was taken to the City Hall by James B. Guyton, a former member of the second branch of the Council. Mr. Guyton and W. Irvington Cross are attorneys for the company. Mr. Guyton said the concern was a new one, composed almost entirely of Philadelphia, New York and other Northern capitalists. "It is a bona fide concern," said Mr. Guyton, "and the passage of the ordinance will mean the expenditure of $6,000,000 or $8,000,000 in Baltimore for construction, street paving and other work."

Mr. Guyton said that there was also some local capital in the new company.

SERIOUS ACCIDENT ON THE LAKE SHORE

One of the worst accidents in the history of electric railroading in the central West occurred on the Lake Shore Electric Railway near Norwalk, Ohio, Thursday, June 2. An eastbound limited car collided, head-on, on a curve with a westbound express car. Both cars were going at a very high rate of speed. The floor framing of the express car was higher than that of the limited, and it swept over more than half the length of the limited before it could be brought to a stop. Six passengers in the smoking compartment of the limited were crushed, five of them being killed almost instantly. One man on the express car was also killed. Only one person was taken out of the smoking compartment alive, and he is in a precarious condition. Sixteen other persons were more or less injured.

The inquest into the accident would seem to indicate that the motorman and conductor of the express car were to blame. The accident occurred at a curve a short distance west of Siding 66 on the main line. The limited had orders to run through to Berlin Heights, where it was to pass the westbound limited and a regular car, nothing being said about the express car. The express cars do not run a regular schedule, for the reason that they are frequently laid up in loading bulk freight, but they receive orders as extras, and the rules provide that they must clear regular cars by five minutes. The testimony at the inquest indicated that the motorman of the express had attempted to make the 6 miles from Berlin Heights to Siding 66 with a margin of time of only seven minutes. The motorman of the express was quite severely injured, and his testimony has not yet been taken.

An interesting point in connection with the wreck was the fact that none of the trucks of either car left the track, and the cars were taken to the shop on their own wheels. This is accounted for by the heavy weight of the motors and the low center of gravity of a heavy car of this type. The limited was making 50 miles an hour and the express 45 miles an hour when the collision occurred. This is the first time that a passenger has been killed or badly injured in the history of the Lake Shore Electric or the four roads which were consolidated in forming this property.

CHANGES IN THE LEGAL DEPARTMENT OF THE NEW YORK CITY RAILWAY COMPANY

The work of the law department of the New York City Railway Company has reached such proportions that on and after July 1, 1904, it will be divided between two departments: one to be known as the "Trial Department," for the preparation and trial of accident cases; the other to be known as the "General Law Department," for the remainder of the company's legal business.

The general law department will continue to be in charge of the general solicitor of the company, Henry A. Robinson. James L. Quackenbush, of Buffalo, will, after July 1, have charge of the trial department, with the title of "General Attorney," and Ambrose F. McCabe will be his chief assistant.

The company has issued a notice to its employees that after July 1 the chief investigators and all other employees of the company whose work is in connection with the preparation and trial of accident cases, will report to the general attorney. All other employees of the legal department, including those connected with the appeal department, will continue to report to the general solicitor.

A TROLLEY INFORMATION BUREAU

A central office for supplying information in regard to the trolley trips possible in the neighborhood of Boston has been opened at 365 Washington Street, in that city, by Robert H. Derrah. Mr. Derrah was one of the pioneers in the trolley excursion business, and was the originator of the Boston and New York trolley trip, over which he personally conducted a party several years ago. At this office itineraries and descriptions of trolley trips in all parts of Massachusetts can be obtained. During the summer Mr. Derrah will also personally arrange for a number of special trips, of one to three or more days in length. The first of these was held on June 6 and 7, when a party left Boston early on June 6, going to Springfield, Holyoke, and Mount Tom, Northampton and Greenfield.

NORTHWESTERN TRACTION COMPANY WINS SUIT

Judge Baker, of the United States Circuit Court, has made a ruling in the case of the city of Crawfordsville and the Consolidated Traction Company against the Indianapolis & Northwestern Traction Company favorable to the latter. The rulings were on demurrers and in favor of the Northwestern in every particular. The decision gives the Indianapolis & Northwestern Traction Company the legal right to the streets of Crawfordsville for the use of the company's tracks as against the claim of the Consolidated Traction Company, which is composed mostly of Crawfordsville capitalists. The ruling fixes the legal status of both companies.

The court held that the franchise granted to the Consolidated Company was unconstitutional, because by such terms a monopoly was created in favor of the Consolidated Company. The right of the Indianapolis & Northwestern Company to occupy the streets for a street railway line is sustained and the restraining order heretofore issued against the Northwestern Company at the instance of the Consolidated Company, together with all collateral orders made under such proceedings, is dissolved and set aside, and the Indianapolis & Northwestern Traction Company is authorized to proceed with the construction of its lines in Crawfordsville.

The case has been in the court for more than a year. The Northwestern Company was first granted a franchise by the city. Later the City Council rescinded its action and granted a similar franchise to the Consolidated Company. The Northwestern Company paid no attention to the later action of the Council and at an unexpected time attempted to lay tracks within the city limits. This precipitated a riot and the police and fire departments were called to suppress disorder. Later the company succeeded in entering and laying its tracks in the midnight hours. At this point the local court granted an injunction against the Northwestern Company. Upon an appeal to the Federal Court the city of Crawfordsville withdrew from the suit, but at the order of the court it was continued a party to the suit. It was the purpose of the city to grant a franchise to the Consolidated Company and require all other companies entering the city to use the Consolidated Company's tracks.

HIGH-SPEED STEAM-LOCOMOTIVE TESTS IN GERMANY

A recent report from United States Consul-General Mason, in Berlin, Germany, gives some additional particulars of the high-speed experiments with steam locomotives on the Berlin-Zossen line, referred to in a recent issue of this paper. The electric motor trials were completed, as will be remembered, during the autumn of last year, with the net result that the two motor cars obtained speeds of 117.32 m. p. h. without injury to the car or motor, or discomfort to passengers.

The track having been carefully examined and the deteriorating effects of the electric-motor-car trials noted and repaired, the experiments with steam locomotives began about the end of February and were continued until a few days ago. The tests included engines of four different types, each built by a different German firm, or company. In order to make the conditions as nearly as possible those of actual service, the load consisted of six vestibule cars of the standard European express type, weighing about 30 tons each, one of which had been equipped with instruments to measure and record speed, oscillation, and draw-bar pull. Each engine was first tested with the full train, and another series of trials made with three cars only.

The first trials were those of a locomotive built by the Egestorf Machinery Company, at Hanover. It is of the same general model as the "Atlantic" type in the United States—that is, carried on ten wheels, viz., the four-wheeled forward truck, then the two pairs of coupled drivers, and a pair of trail wheels under the cab to sustain the afterportion of the boiler, which is of extraordinary size and large heating surface. This machine, with a train of six cars, attained an average speed of 111 km (68.97 miles) per hour throughout the run, and with three cars a pace of 79.41 m. p. h.

The second machine of Grafenstadt construction is a compound locomotive, likewise of the Atlantic type, in which the cylinders are placed far back and the piston head geared by a short connecting rod to the crankpin of the rear driving wheel. This engine made with the full train a run of 118 km (73.32 miles) and with three cars 76.42 m. p. h., and showed good results as to fuel and steam consumption.

The third contesting machine was an eight-wheeled compound engine equipped with Schmidt's device for superhetaing steam. It was designed by Baurath Garbe and built by the well-known firm of A. Borsig, at Tegel, near Berlin. This engine was not built specially for these trials, but is one of a number of the same type which have been constructed by the same firm and supplied for service to the royal Prussian railway administration. The driving wheels are 78 ins. in diameter; heating surface, 963 sq. ft.; surface of superheater, 288 sq. ft.; normal working pressure, 12 atmospheres (176.4 lbs.) to the inch; and weight, when ready for service, 120,051 lbs. This engine attained with the full train 128 km. (79.53 miles) and with three cars a speed of 84.5 m. p. h., the energy developed being about 2000 hp.

The fourth competitor was an engine of a wholly original type, designed by Chief Engineer Wittfeld, of the Prussian railway administration, and built by Henschel & Sons, of Cassel. Before being brought to Berlin it was tested on one of the State lines near Göttingen, and since the trials were finished it has been dismantled and shipped for exhibition at the World's Fair in St. Louis. Its most striking peculiarities are that it is so built that the engineer stands in front within a glazed cab like the motorman of an electric car, and both engine and tender are covered with a sheathing of sheet iron with glazed windows, and so arranged as to provide a covered passage from front to rear. The engine carried on twelve wheels, viz., a four-wheel bogie in front and rear and between them the two pairs of drivers, coupled in the usual manner. This arrangement is for the purpose of securing a smooth steadiness of motion despite curves or irregularities of track surface. The engine is of the compound type, the high-pressure cylinder being located midway between the sideframes, where its piston connects with an inside crank on the forward driving shaft. The low-pressure cylinders, of which there are two of equal diameter, are external and drive two outside cranks set parallel to each other and on the same side of the axle 90° from the inside crank that connects with the high-pressure cylinder. This secures an even balance between the reciprocating parts, from which important results have been expected. The boiler is, from the European standpoint, enormous, having 2,766 sq. ft. of heating surface, and it is calculated that, with a coal consumption of 2.5 lbs. per hp-hour, it will develop about 1775 hp. It weighs 76.8 tons and cost $23,800. The tender weighs 47 tons and carries 7 tons of coal and 4400 gals. of water, which it is equipped to take up at speed. At the recent tests this engine slightly surpassed all its competitors, attaining a speed of 128 km (79.53 miles) per hour with six cars and 85.12 miles with half that number. While, therefore, its speed with the full train was the same as that of the Borsig superheater, the Cassel machine did 1 km (0.62 mile) better with the light load, a difference so slight that it might easily have been influenced by varying conditions of wind.

This, in substance, is what is now publicly known concerning the results of these most interesting trials. The comparative advantages of all the contesting engines—their relative consumption of fuel and steam, their general efficiency at high velocities, and their smoothness of movement on curves of different radius—will be known only to the government experts until the whole mass of notes and records made during the experiments and subsequently on other portions of the line shall have been formulated and published.

Among the incidental demonstrations made by the tests was the fact that with the pneumatic brakes now in use on German vestibule cars it required a full minute and a distance of 1093 yards to stop a train of six cars running at 85 miles an hour.

Pending the preparation and issue of the official report on which the ultimate conclusions will be based, a Berlin engineer, Dr. Reichel, has given some comparisons of cost between steam and electric traction from the standpoint of German practice and illustrated by the recent experiments with both motive forces. A steam train of five cars and a standard locomotive weighs 330 tons, seats 168 passengers, and uses at full speed 1400 hp. The electric train of one motor car and four trail cars weighs 260 tons, seats 180 passengers, and utilizes 1000 hp. Each train and engine costs for initial construction about $100,000. The operating cost of the steam train is fixed by Dr. Reichel at 12½ cents per 100 seat km, and 11½ cents, or 1 cent cheaper, for the electric train.

THE TERMS FOR OPERATING OVER THE NEW BRIDGE IN NEW YORK

Bridge Commissioner Best has issued a formal statement in which are made public for the first time the exact terms and conditions of the contract which he signed on May 21 for the handling of street railway cars on the Williamsburg Bridge. The parties to the contract are the Bridge Commissioner, the Brooklyn Heights Railway Company, the Coney Island & Brooklyn Railroad Company, the New York City Railway Company and the Bridge Operating Company.

In its general scheme this contract is similar to the existing contract for operation on the Brooklyn Bridge. Owing to the different circumstances, however, it has some distinctive features. Among them is the requirement for the incorporation of the Bridge Operating Company, which is to provide cars for the local bridge service as distinct from the through service to be provided by the other companies. Local bridge passengers will pay a fare of 3 cents. The contract provides, however, that the Brooklyn and New York railway companies must carry through passengers across the bridge without charging an extra fare.

The north pair of tracks is to be equipped for use by the underground trolley system, so as to permit operation of through cars across the bridge to the Brooklyn terminal by the Metropolitan system. The south pair of tracks is to be equipped with the overhead trolley system so as to permit Brooklyn cars to cross to the Manhattan terminal. Commissioner Best expects to have the latter equipped in this way ready for service on or before July 15. The equipment of the north pair of tracks will necessarily take some time longer.

The trolley tracks, terminals and equipment are to be constructed by and remain the property of the city; the railway companies merely having a right to use them. For the use of the electrical equipment, terminals, etc., the railroad companies are to pay a rental to the city of $10,000 a year. They are also to pay a toll of 5 cents for each car per round trip across the bridge.

The term of the contract is ten years, from Sept. 1, 1904, but this may be extended under certain conditions.

REMARKABLE LONG DISTANCE RUN

One of the most remarkable long distance runs on record was made across Central Ohio from Dayton to Zanesville on May 27. With a desire to impress the United Commercial Travelers' Association with the possibilities of through electric travel, the Dayton, Springfield & Urbana Railway Company made a proposition to carry the members of the association to a meeting in Zanesville, agreeing to take them in steam road time. Two parlor cars were used. The first car ran from Dayton to Columbus, 77 miles, in two hours and thirteen minutes, over the Appleyard lines, and then from Columbus to Zanesville, 64 miles, over the Columbus, Newark & Zanesville Railway, in two hours and 1 minute, a total of four hours and fourteen minutes for 141 miles. The second car left Dayton twenty minutes behind the first and made practically the same time. The cars ran through on schedule, and the operation of the regular cars was not in any way interfered with. Practically no stops were made, except for grade crossings, but it must be borne in mind that the cars were obliged to observe city ordinances and city schedules over 3 miles of track in Dayton, 4 in Springfield, 1 in London, 6 in Columbus, 2 in Newark and 2 in Zanesville, a total of 18 miles on city streets. The portion of the road from Newark to Zanesville, 33 miles, has just been opened and is not in shape for high-speed work.

NORFOLK & SOUTHERN LETTING CONTRACTS

The Norfolk & Southern Railway Company, the control of which, as noted in the STREET RAILWAY JOURNAL of April 30, has been acquired by the Chesapeake Transit Company, is now letting contracts for additional central power house and substation equipment, cars, etc., to be used in connection with its Norfolk-Virginia Beach, West Virginia, system, which was hitherto a steam line and a competitor of the Norfolk-Virginia Beach line of the Transit Company.

The Chesapeake Transit central station is to be equipped with a 500-kw inverted rotary, to be built by the General Electric Company. The existing equipment consists of two 500-kw, 550-volt General Electric generators, direct-connected to 750-hp Allis cross-compound Corliss engines. There will be three sub-stations, in each of which 300-kw General Electric rotaries will be installed. Twelve cars will be ordered, ten open measuring 45 ft. over all. They will be built by the John Stephenson Company, of Elizabeth, N. J. The open cars will have two 57 General Electric motor equipments each, while the closed will each be fitted with four 73 General Electric equipments. Four 50-ft. cars now used on the steam road will each be equipped with four 73 General Electric motors. The American Electrical Works, of Providence, R. I., will supply the trolley and high-tension cables, and the Magnet Wire Company, of New York, will undertake the contract for the 500,000 c. m. feed wire. The Ohio Brass Company will furnish the bonds and overhead material.

The new Norfolk-Virginia Beach electric line is expected to be ready for operation by July 1.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MAY 24, 1904

760,505. Car Axle; John M. Wilcox, Cleveland, Ohio. App. filed Oct. 13, 1903. Comprises a fixed sleeve, two independent rotable tubular axle-sections journaled therein, wheels fastened respectively to the axle-sections, a tie-rod passing through both axle-sections and having one projecting end which is threaded, a nut on said threaded end and means connecting the tie-rod with the axle-section adjacent to the threaded end, whereby their relative rotation is prevented.

760,536. Automatic Car Gate; William N. Hackett, Boston, Mass. App. filed June 4, 1903. Means whereby the gates may be opened and closed automatically on either side of the car by turning over the seat backs.

760,556. Motor Car; Alexander Palmros, Columbus, Ohio. App. filed Sept. 5, 1900. An electric locomotive in which the side frame thereof is recessed for the reception of the car axle and springs.

760,598. Pole Clamp or Coupling; Clyde B. Wynegar, Greenwood, Ind. App. filed March 7, 1904. A device designed to expedite the replacing of old poles with new ones, and means for automatically aligning the pole.

760,641. Trolley Pole; Alfred W. Morgan, Long Beach, Cal. App. filed Nov. 16, 1903. Details.

760,643. Third Rail Guard for Electric Railways; Vincent M. Newman, Bayside, N. Y. App. filed Feb. 16, 1904. The guard is slotted for the reception of the plow to engage the third-rail and sections of one side of the guard are hinged to permit the removal of the plow when necessary.

760,656. Electric Track Switch Operating Mechanism; Charles W. Squires and James B. Squires, Springfield, Mass. App. filed Jan. 20, 1903. Supplemental switch mechanism for determining of which a pair of solenoids shall be energized to actuate the switch tongue.

760,662. Car Fender; Peter B. Sullivan and George F. Taylor, Randolph, Mass. App. filed Sept. 2, 1903. A novel device connected with the fender, which automatically applies the brake on the car and simultaneously cuts the current from the motor whenever the fender strikes an obstacle.

760,736. Trolley Pole Head; John E. Greenwood, Utica, N. Y. App. filed Sept. 25, 1903. Two trolley wheels mounted in tandem on independent pivoted frames.

760,737. Safety Clamp for Rails; Thomas J. Harleman, Packerton, Pa. App. filed March 28, 1904. A bar provided at each end with special connecting clamps adapted to electrically bridge the rails of a railway when safety signals are to be set.

760,740. Means for Safely Conducting Electric Currents; Edward A. Jarvis, Port Richmond, N. Y. App. filed Dec. 16, 1903. The third rail is laid in a conduit provided with a conducting roof, the collector shoe being provided with a powerful electromagnet which attracts the third rail to the roof of the conduit, whence current is taken by the shoe.

760,781. Car Fender; John C. Cooper, Baltimore, Md. App. filed March 4, 1904. Details of construction.

760,801. Automatic Trolley Controlling Device; Horace W. Nichols, Philadelphia, Pa. App. filed Sept. 9, 1903. A spring drum and ratchet arrangement controlling the trolley cord.

760,828. Trolley; John S. Weckman and Robert J. Millard, Carnegie, Pa. App. filed Oct. 17, 1903. Details.

760,846. Electric Railway Switch; Rupert L. Border, Pittsburg, Pa. App. filed Oct. 15, 1903. Details.

760,916. Running Board for Railway Cars; Martin S. Nolan, Waltham, Mass. App. filed Oct. 21, 1903. A longitudinally shiftable carstep having hinge connections with the carbody and constructed to lift to horizontal and lower to vertical position, and means to support the same in horizontal position.

760,947. Electric Bond for Railway Rails or Other Conductors; John S. Alexander, New York, N. Y. App. filed Feb. 25, 1903. The abutting ends of two rails are recessed to form a chamber

having a contracted opening at the surface of the rail; a spreader is placed in the chamber and a forked conductor is then driven through the narrow opening and forced into good contact with the rails by the spreader.

760,969. Car Fender; Jacob Derx, St. Louis, Mo. App. filed April 4, 1904. A fender mounted for swinging movement to inoperative position at the side of the car.

760,988. Electrically Controlled Switch; William H. Hillyer, Atlanta, Ga. App. filed Jan. 21, 1903. Circuits so arranged that the car automatically takes current from the trolley wire to actuate the magnets which control the switch tongue.

761,000. Trolley; James A. Lavery, New York, N. Y. App. filed Nov. 7, 1903. Two guard fingers mounted on the trolley and adapted to meet at their upper ends above the trolley wire, a rod with which the lower ends of the guard fingers have sliding connection and springs surrounding the rod for moving the upper ends of the jaws together.

761,046. Automatic Switch Mechanism for Railways; William E. Harris, New York, N. Y. App. filed Aug. 4, 1903. Mechanism adapted to be operated a suitable distance from the switch, means carried by a carrier truck for effecting an operation of the mechanism, levers to reciprocate the trucks and resilient members to elevate the levers and reciprocating members to an inoperative position.

UNITED STATES PATENTS ISSUED MAY 31, 1904

761,296. Convertible Car; Henry E. Haddock, Philadelphia, Pa. App. filed Aug. 21, 1903. Details of sliding panel construction.

761,308. Trolley Wheel Guard; Curtic W. Leslie, Pittsburg, Pa. App. filed Nov. 5, 1903. Spring mounted guide arms for guiding the wheel onto the wire.

761,347. Maximum Traction Truck; Walter S. Adams, Philadelphia, Pa. App. filed Sept. 16, 1903. The truck is provided with longitudinally and transversely disposed semi-elliptic springs which support the carbody and means independent of the spring for connecting the carbody and truck to receive all stresses incident to the propulsion of the car.

761,353. Car Truck; John A. Brill and Walter S. Adams, Philadelphia, Pa. App. filed March 22, 1900. Details of construction.

761,354. Car Truck; John A. Brill and Walter S. Adams, Philadelphia, Pa. App. filed April 4, 1900. A truck having large driving wheels and small trailing wheels, a truck frame, a cross-bolster spring-supported from the truck frame outside the wheel base and adjacent the driving wheels, and a draw-bar extending from the bolster toward and adjacent the axle of the driving wheels.

761,417. Safety Apparatus for Use on Railway Cars; Sidney H. Short, London, England. App. filed Feb. 11, 1902. In case of a break down of the insulation of the trolley pole and base, an alarm is automatically sounded so that the pasengers on the roof of the car may be warned before anyone comes in contact with the trolley pole.

761,421. Car Fender; Leo M. Snyder, Dubois, Pa. App. filed April 1, 1904. Those portions of the fender liable to strike a person are composed of elastic air-filled cushions or tubing.

761,432. Collector for Third-Rail Systems; Alfred K. Warren, New York, N. Y. App. filed Feb. 25, 1903. The shoe is mounted at the end of a pivoted arm and is electrically connected with the car circuit by a flexible conductor wound around the axis of the arm.

761,536. Automatic Car Switch; Morris Nuss, Philadelphia, Pa. App. filed Sept. 25, 1903. Details.

761,540. Motor Suspension; William G. Price, Kingston, N. Y. App. filed Nov. 19, 1903. The car truck is provided with equalizer bars which support the motor.

761,553. Third-Rail Support; Louis Steinberger, New York, N. Y. App. filed Dec. 7, 1903. The insulator supporting the third-rail has a conical cavity into which a supporting pin projects, affording certain lateral free movement of the insulator on its support.

761,557. Car Fender; Onesime Thibault, Fall River, Mass. App. filed Jan. 13, 1904. Novel means whereby the fender is caused to automatically follow curvatures of the track.

761,565. Trolley Mechanism; John H. Walker, Lexington, Ky. App. filed July 29, 1903. A flexible conductor between the trolley base and pole.

761,566. Trolley; John H. Walker, Lexington, Ky. App. filed July 29, 1903. Details.

761,567. Trolley; John H. Walker, Lexington, Ky. App. filed Dec. 24, 1903. A sliding contact shoe is mounted to the rear of the trolley wheel.

761,574. Trolley Protector; John H. Best, Jr., Sandusky, Ohio. App. filed Jan. 8, 1904. Details.

PERSONAL MENTION

MR. GEORGE W. BACON, of Ford, Bacon & Davis, was married June 1 at St. Cloud, Minn., to Miss Caroline T. Mitchell, of that city.

MR. FRED BILLINGS, formerly chief engineer of the Manitowoc & Northern Traction Company, of Manitowoc, Wis., has been appointed chief engineer of the Sterling, Dixon & Eastern Electric Railway, of Sterling, Ill.

MR. C. W. OBERT has been appointed associate editor of the Street Railway Journal. He was formerly on the editorial staff of the American Engineer and Railroad Journal of this city, and has had an extended experience in both steam railroad, electrical and technical newspaper work.

MR. EDWIN H. CHAPIN, New York representative of the National Car Wheel Company, has moved his offices from the shops of the company at 556 West Thirty-Fourth Street, to 35 Nassau Street. This downtown office will prove much more convenient to the customers of the company than the former uptown office.

MR. RANDALL MORGAN and a party of Philadelphia gentlemen who are interested in traction properties in the vicinity of Indianapolis and Cincinnati made an inspection of these properties last week. At Cincinnati the gentlemen were entertained at an elaborate banquet by Mr. W. Kesley Schoepf, of the Cincinnati Traction Company, at which time they were introduced to a number of prominent Cincinnati capitalists. After inspecting the Cincinnati city lines, the entire party went over the Cincinnati, Dayton & Toledo Traction line, which adds weight to the report that the Philadelphia interests are increasing their holdings in this property and will provide the money required for practically rebuilding the system with a view to connecting it with the Indiana lines controlled by the syndicate. An outline of the proposed improvements for the Cincinnati, Dayton & Toledo was given in a recent issue of the Street Railway Journal.

MR. C. C. TYLER has resigned his position as superintendent of the works of the Westinghouse Electric & Manufacturing Company at East Pittsburg, Pa., and has been appointed general superintendent of all the works of the Allis-Chalmers-Bullock interests in the United States. Mr. Tyler, who will enter upon his new duties on June 15, will make his headquarters at Milwaukee. His record in the practical management of great machine-shops is one of the best in the country, and it has long been under the appreciative observation of men who understand the value of such ability. Before Mr. Tyler went to Pennsylvania he had made an excellent reputation, and at Pittsburg, where he has been for half a dozen years, he enhanced this by the results he achieved in increasing the efficiency of the Westinghouse electric works. In the equipment of manufactories, in the design and construction of machine-tools, in the handling of machinery and material, in processes of manufacture, and in fact in all that pertains to the economy of machine-shop administration, Mr. Tyler is recognized as an expert who has no superior in this country. In entering upon his larger field of duty, he is sure to carry with him the congratulations of the engineering profession.

MR. W. W. WHEATLEY, formerly manager of the railroad department of the Public Service Corporation, of Newark, N. J., and now general manager of the Federal District Railway Company, which operates the extensive electric traction system (the Wernher-Beit lines) in and around Mexico City, Mex., has issued a circular announcing that Mr. Paul H. Evans has been selected as engineer and purchasing agent for the company. Mr. Evans will have charge of all the engineering of the company—electrical, mechanical and civil—which includes all construction and maintenance work, in addition to purchasing all materials and supplies. The following department heads will hereafter report to him instead of to the general manager: Mr. J. L. McCreary, superintendent of maintenance of way; Mr. H. S. Bolton, electrical engineer; Mr. Marshall Miller, consulting engineer, and Mr. J. C. Jackson, storekeeper. Mr. Evans has been in Mexico for some years. He went to that part of the world first in 1889 as superintendent of construction for the old Thomson-Houston Company, and had charge of all the construction work in which the company was interested in at that time. After that company's consolidation with the Edison Company, and the formation of the General Electric Company, Mr. Evans became chief engineering expert for the Mexico City branch, which looks after the interests of the General Electric Company. During the time of his service with the General Electric Company he placed to his credit the construction of some of the most notable electric power transmission plants in the republic, among them being that of the Guadalajara Electric Light Company at Guadalajara, State of Jalisco, and the Regla-Pachuca plants. Before going to Mexico Mr. Evans was connected for three years with the Atlanta, Ga., street railway system.