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Of this issue of the Street Railway Journal, 8200 copies are printed. Total circulation for 1906 to date, 204,400 copies, an average of 8176 copies per week.

Alcohol Motor Cars

The passage by Congress of the bill to provide for the cheap production of denaturized alcohol raises an interesting question as to the possibilities of this fuel for railway purposes. As our readers know, there has been a strong movement during the last year toward the construction of gasoline motor cars, and if all the claims made for denaturized alcohol as fuel are correct, it would seem as if there might be a future for it in traction. The evidence, however, is that comparatively little has been done abroad with alcohol motor cars, although gasoline and independent steam cars are employed to a considerable extent and denaturized alcohol is used quite largely in Germany and some other Continental countries for illumination and in stationary motors.

At the present time alcohol motor-cars seem to have been used for traction purposes in Germany only in certain coal mines. For this service the cost of fuel per ton-mile, as reported by the manufacturers, the Gasmotoren-Fabrik Deutz, which makes engines which can be used with either gasoline, alcohol or petroleum, is about $.002 for locomotives of 8 hp. On the other hand, there seems to be a wider field for the use of alcohol in stationary internal combustion motors as well as for lighting, heating and cooking purposes. Its substitution to any great extent for any of these varied uses would greatly relieve the present demand for the lighter petroleum distillates, which have shown a marked tendency to increase in cost in late years. Altogether, therefore, the direct field open for alcohol in traction does not seem to be large unless important improvements are made in the type of engine to be used with the fluid or in the employment of alcohol itself. For instance, certain tests recently made in France seem to show that a mixture of alcohol and gasoline is more desirable as a fuel than either by itself. With the inventive genius which will be brought to bear on this problem, future improvements seem by no means visionary.

Exciter Driving

A point which often comes up in the design of an alternating-current plant is the method most desirable for exciter driving. For large generating units, say above 300 kw, the advantages of direct connection are so great that there is rarely any question about the matter, but with the low-capacity units needed for excitation there is something to be said in favor of the belt drive. In the first place, it is less expensive, and it is also more flexible in that the exciter may be readily moved to another part of the plant in case of emergency. It can be used as a motor in case of need, and in the event of a sale of equipment, is likely to bring a better price than a more restricted machine adapted only to direct driving. The higher efficiency of a direct-connected exciter set counts for very little in a water-power plant, where energy in small quantities is exceedingly cheap; and in installations where a driving shaft is available the belted excited, taken as a whole, is probably more efficient than a motor-driven exciter. An exciter belt driven from a generator shaft is generally as efficient, or nearly so, as one driven by a small direct-connected water wheel. Spare armatures can be carried in either case.

On the other hand, there is no denying that belts are a source of a great deal of trouble, even in small sizes and short lengths. The direct-connected exciter is almost certain to mean economy of floor space, less trouble and inconvenience generally. In a plant consisting of steam-driven alternators, motor-driven exciters with a single steam exciter for starting service are probably the best solution of the problem, which is, after all, largely one of convenience rather than efficiency. As the direct-connected unit will ordinarily run at a slower speed than the belted outfit, there will be a slight gain of efficiency for this cause. If an exciter battery is in service, the problem of flexibility drops out of sight. Compactness and simplicity are strong points in favor of direct connection, especially in steam plants.

An Inside View

The report of a committee of the Master Mechanics' Association upon electric traction upon steam railroads, which we publish this week, is most interesting as affording a view of a much mooted topic from the railroad man's point of view. The report is rather of a preliminary nature, and the committee has hesitated to attack the most serious problems, in view of the changing state of the art, yet it has gone fairly upon record in deliberate and, we think, unbiased judgment upon some important matters. The committee unhesitatingly takes the position that whenever the density of traffic is considerable it will pay steam roads to handle local suburban and interurban traffic electrically, but over separate tracks from the regular train service. This apparently passes over the common case where local suburban traffic is carried on the regular tracks in large volumes. There certainly are many cases in which the density of traffic should warrant electric service carried on as a substitute for existing local service, without independent tracks. Electric trains on the multiple-unit system can be worked on the regular tracks quite as easily as local trains with locomotives, in fact much more easily, on account of the more rapid acceleration possible. Of course, when local traffic is dense enough to require separate tracks, it goes almost without saying that electrification is desirable, which is perhaps what the committee really meant to imply. It is interesting to note that the committee considers the history of electric railway working in its effect on other motive powers as almost a complete argument against the steam car or other types of self-propelled cars, except for special situations.

As regards a. c. vs. d. c. traction, the committee very wisely declines to commit itself at this time. It does, however, call vigorous attention to the fallacy of theoretical comparisons of cost based on assumed roads. We have seen and published various such comparisons, and do not feel ourselves unduly critical in saying that the results figured necessarily followed from the assumptions with which the computation was intentionally started. In other words, the conditions have been assumed to fit the thesis defended.

The report goes into considerable detail upon the subject of gasoline cars. The committee evidently regards the gasoline-electric cars, in their various forms, as involving complication and expense altogether outweighing their advantages in facile control. On the other hand, the regular gasoline car, as typified by the motor cars used on the Union Pacific system, is evidently considered as a good practical solution of the transportation problem for branch lines with light traffic. In fact, the report states that the service thus accomplished is highly lucrative, and figures that in this class of work the gasoline car costs materially less than locomotive service or electric cars, per car mile, the charges including fuel, labor, maintenance and similar charges. The reports from these Union Pacific motor cars have been uniformly favorable, and it looks very much as though they were of a type that would often prove valuable on lines hardly yet economical for electric service. The great simplicity and moderate weight of these cars are very strong points in their favor, while the reduced height and the pointed and smooth exterior enables high speed to be easily made. More than one valuable innovation has come out of the West, and it would not be surprising if these cars, with their advanced design and convenience in operation, should come into somewhat considerable use.

Sub-Station Equipments

The article we publish this week on the sub-stations of the Long Island Railroad is a good compendium of sub-station work as at present practiced. So long as direct-current motors are the main reliance for heavy traction, sub-stations with synchronous converters are part of the program. In general there is nothing in the least sensational about them, since the apparatus in this country has been pretty thoroughly standardized, so that a sub-station specification may be put up as a sort of prescription running somewhat in this wise:

℞

M kw type Q converter, 25 cycles........	1
$\frac{M}{3}$ kw type R transformers...............	3
H. T. panel board, type S................	1
L. T. panel board, type T................	1
Lightning arrester, 3ph, type U...........	1
Oil switches and cables, q. s.	
Make up in brick box.	
Sig. Take one station for each N miles of track.	

W. WAGGLES, E. E.

Our friends of the Long Island Railroad seem to have tired of this dull routine a bit, and besides planning stations carefully with regard to future traffic, have made very skillful use of the portable sub-station, really the most interesting development of the system.

Having to deal with the enormously heavy traffic of a couple of popular race-tracks, the Long Island Railroad was confronted with a shifting load of very formidable character. To meet this either exaggerated capacity in fixed sub-stations was necessary, or some means of locally reinforcing the capacity, hence the portable sub-stations. In these we have, compressed into the limits of a single large steel car, a complete sub-station of 1000-kw capacity, equipped with all necessary and no unnecessary accessories, and capable of being worked at short notice at any point of the entire high-tension system. The whole equipment is of the most compact and workable description, and is invaluable in helping out the regular sub-stations at times of excessive load, or of being pushed into service to tide over a temporary breakdown if one should occur. The whole electrical apparatus weighs only about 70 tons.

For such portable sub-stations there is no inconsiderable field of employment in general electric railway service. There are many interurban systems of which portions are liable at times to exceptionally severe loads, and we see no reason why the portable station should not be very freely used in dealing with them. It could very readily be shifted from town as occasion might require, following up the shifting of spare cars and supplying additional power even at somewhat severe loss in the high-tension feeders. In fact, some interurban lines are trying the plan, although hardly in the generalized way which we have here suggested. There has been a strong tendency toward consolidation of connecting electric lines, yet much remains to be done in making the most of the advantages of consolidation. The wandering of the load from hour to hour can not be remedied, but something certainly can be done to remedy the larger shifts that occur at irregular but determinable intervals, by furnishing extra rolling stock, extra men, and additional power. There is no reason why the portable power station should not become an important part of the equipment of the larger electric railway systems, whether for such occasional use or to meet the exigencies of normal growth by shifting sub-station locations to correspond with the shifting of the center of load.

Discipline and Promotion

One of the sessions at the Columbus Convention is to be devoted to a consideration of the best methods of handling employees, and other proof that this subject is attracting much more attention than in the past is shown by several papers on the same topic at various recent conventions. The questions of discipline and promotion go hand in hand, and many good results have come from the adoption of modern systems of discipline, particularly the merit system. The tendency to introduce the merit system of discipline in street railway work is increasing, largely, perhaps, on account of the influx into the field of steam railroad operators, most of whom are familiar with the plan as practiced on the steam roads under the name of the Brown system. The fundamental basis of the Brown, or merit system, the absence of the lay-off, can be adopted by any road, but it is a question whether its refinements as employed by many of the smaller electric railway companies and on steam railroads with beneficial results would be equally successful on large street railway systems.

The reason is not far to seek. It is well known that the trainmen on the smaller roads usually come of sturdier stock and are more amenable to discipline than many of the city-bred car men on the extensive urban lines. In the former case, and the same is true in the case of steam railroads, the work is sought as a permanent calling, but on the city roads the applicants, particularly those for the back platform, often seem to seek employment as a convenient hold-over until they can return to some previous trade. It follows that employees of this type are not likely to have their conduct favorably influenced by the purely moral effect of the ordinary merit system. As a recent paper on this subject stated, "complete success cannot be attained unless some more substantial reward is given." This is a truth which applies with double force on comprehensive city properties.

The fact may be recognized that, owing to the closer regulations existing between the traffic employees and the public in the smaller cities and on interurban and even steam railroad systems, passengers are far more likely to report good or bad actions than in the larger cities. There the rider seldom comes in contact with the same trainmen day after day, and few passengers will take the trouble to report deficiencies in the service, even if serious. Still less is the average passenger apt to notify the company of politeness or other commendable action on the part of the conductor. The only exception to this rule of ignoring the service of the car crews is the chronic misanthrope, whose criticism is usually so unfair that an attempt to grade the men on his communications would be very apt to inflict injustice. Again, the crowded condition of most city thoroughfares is responsible for so many accidents, blockades and other injuries that it is very difficult indeed to decide at times whether the trainmen should receive demerits for street troubles. Car inspectors are not omnipresent, and there is plenty of opportunity for unjust censure, a situation which does not tend to secure the good will of the platform man. It is evident that these conditions make it impossible to keep such accurate records of car performance in large cities as are made by small companies.

Since accurate classification of city railway car employees along the lines of the merit system is impracticable, except as regards flagrant offenses, some other criterion for conduct must be adopted. In most cases the only course possible is the adoption of the seniority rule, on the theory that that car man is best who has served the company the longest. Every one admits that this rule does not hold strictly true, but if accompanied with the exercise of discretion in promotion, is perhaps the best policy, because it can be most impartially enforced. On practically all large roads, therefore, it is customary to increase the wages of platform men annually to a stated maximum.

But the ambitious man must be offered the opportunity of ultimately attaining something better than an increase of several cents an hour. One of the largest roads has solved this problem satisfactorily by providing a position beyond that at the front or rear end of a car. The plan is based on the fact that the average motorman or conductor is not an engineer in embryo. Consequently the official organization is so divided that the traffic department is an entity, kept altogether separate from any feature involving engineering ability. This scheme makes it possible to promote an experienced car man to the position of traffic inspector and eventually to that of car-house foreman. No man is advanced from the ranks until he has been in the company's service for at least five years. As a traffic inspector his principal duty is to keep the rolling stock in his territory to schedule, but he is not asked to make engineering reports, that work being done by others. Even when advanced to the care of a car house, his new duties are still a development of his old ones except that they cover a larger field.

This method of rewarding car men by appointing them to higher positions for which their experience and temperament fits them has proved an excellent incentive in holding the better grades of men in the company's employ. Conversely, there is less trouble in securing good discipline through the medium of men who have been through the mill than would be the case if the traffic department was in charge of engineering men. Of course, the practice outlined would not be feasible on small systems where one man must combine engineering and traffic handling duties, but it certainly offers some hints to the larger systems where some inducements must be offered to secure high-class men.

THE ROTARY-CONVERTER SUB-STATIONS OF THE LONG ISLAND RAILROAD

BY W. N. SMITH

Previous articles in this paper have described, first, the main power station which furnishes electrical energy for train propulsion on the Long Island Railroad (see STREET RAILWAY JOURNAL for April 7), and, second, the power transmission line (see STREET RAILWAY JOURNAL for June 9 and 16). Attention is now invited to the general scheme of power distribution to the several railroad lines.

The article in the issue of June 9 specified the divisions which have been changed from steam to electricity, and the locations of the various temporary and permanent sub-stations. The arrangement adopted lends itself readily to the gradual development of a comprehensive system of electric rapid transit, suitable, and in fact necessary, to the suburban territory served. Ample provision has been made in the general design not only for permitting the increase of equipment in the present sub-stations, but also for adding other sub-stations as may be required from time to time, which can easily be done without altering the present ones, and with the addition of only a small amount of apparatus.

The central position of Woodhaven Junction (see map on page 896 of June 9) led to its adoption as the principal distributing point for the high-tension circuits, the main trunk line of the transmission system being brought to that point from the power station. This particular sub-station is, therefore, somewhat more complicated and makes use of somewhat heavier apparatus than is required in most of the other sub-stations. For this reason, the Woodhaven Junction sub-station will be referred to hereafter somewhat more in detail than the others, particularly as regards the switching equipment.

The distances from Woodhaven to the various sub-stations are as follows: East New York, 3.2 miles; Grand Avenue, Brooklyn, 6.2 miles; Rockaway Junction, 3.4 miles; Hammel, 7 miles. Belmont Park is distant from Rockaway Junction 3.5 miles. Springfield Junction is distant from Rockaway Junction sub-station 3.4 miles. The branch feeder lines to the portable sub-stations at these two latter points are manipulated from Rockaway Junction, where they can be thrown to one or both of the two main transmission lines which connect Rockaway Junction sub-station with Woodhaven Junction sub-station and Long Island City.

SUB-STATION CAPACITY

The capacity of the sub-stations was determined after a very careful examination of the electric schedule proposed by the Long Island Railroad officials. The heaviest traffic movement over the Atlantic Division is that due to the operation of racetrack trains to Belmont Park, besides the regular trains, and particular attention was given to the conditions that prevail at the time of racetrack train movement, which, of course, affects the output required for the Atlantic Division and the amount of equipment needed in the four sub-stations which supply the division.

A portion of the Rockaway Beach Division is also used by Brooklyn Rapid Transit trains, and while these trains are not as heavy as the Long Island trains, they are sometimes on much closer headway and the power required for them is supplied chiefly by Woodhaven Junction and Hammel sub-stations, which are powered accordingly.

Due consideration of the tonnage and the proposed schedule of (a) the initial traffic, and (b) that ultimately to be handled on these lines, led to the adoption of machinery at the various sub-stations, in accordance with the table given below, which shows, first, the amount of machinery that constitutes the present or initial installation, and second, the ultimate installation that can be accommodated in each of the sub-stations as now constructed.

The principal feature of each sub-station is its equipment of rotary converters and transformers. In a single instance, namely, at Hammel, a storage battery was installed as an adjunct to the sub-station machinery. The location and arrangement of all the sub-station buildings is such as to enable the ultimate use of a storage battery should future conditions justify it, and the apparatus in each building is so laid out that if the storage battery should be installed the necessary boosters can occupy the space allotted to one rotary converter.

Station	Rotary Converters Kw.	Transformers Kw.	Boosters Kw.	A. C. Feeders	D. C. Feeders
Grand Avenue:					
Present installation..	3-1000	9-375	....	2	5
Ultimate capacity...	5-1500	15-550	....	4	11
East New York:					
Present installation..	3-1000	9-375	....	5	6
Ultimate capacity...	4-1500	12-550	....	12	16
Woodhaven Junction:					
Present installation..	3-1500	9-550	....	12	10
Ultimate capacity...	6-1500	18-550	....	18	18
Rockaway Junction:					
Present installation..	2-1000	6-375	....	4	6
Ultimate capacity...	4-1500	12-550	....	11	16
Hammel:					
Present installation..	2-1000	6-375	2-162	2	6
Ultimate capacity...	5-1500	15-550	2-162	5	13

At Hammel, the initial installation also includes one storage battery of 32 ampere-hours capacity at the one hour rate at 6000 volts.

The sub-station equipment also includes the two portable sub-stations mentioned in the previous article. Each consists of a car containing one 1000-kw rotary converter, three 375-kw transformers, and the necessary blower and switchboard panels, high-tension oil circuit breaker, and connecting leads to the outside circuit breakers.

After carefully investigating the applicability of the storage battery to the Long Island Railroad distribution system, its value as an adjunct appeared to be chiefly in proportion to the protection from interruption afforded by it. Consequently, it was decided to employ a storage battery at a sub-station where the insurance feature could demonstrate its value to the best advantage. A battery was accordingly installed at Hammel, which is farther from the power station than any of the other sub-stations, and which, by reason of the exposed position of the transmission line running across Jamaica Bay, might be considered somewhat more liable to interruption in service through accident to the transmission. The marked fluctuations in load at this point, due to heavy travel to Rockaway Beach on summer afternoons and evenings, affords a better opportunity than almost any other location for testing the general applicability of the battery. The fact that the station load in the winter time is extremely light enables it to be operated for much of the time at this season from the battery alone, with the minimum cost of sub-station attendance during the greater part of the year. The storage battery equipment consists of 300 cells of 3200 amp hours capacity and two boosters of 162 kw capacity each.

Besides the rotary converters, transformers and battery apparatus listed in the foregoing table, there is in each sub-station the requisite equipment of minor auxiliary apparatus, which will be duly described in detail.

SUB-STATION BUILDINGS

The sub-station buildings are of a uniform type of construction throughout, excepting at Grand Avenue, where the reduced area of the lot made its adoption impracticable. This type consists of a central section of about 51 ft. span, which is wide enough to accommodate two 1500-kw rotaries and the necessary transformers. The central space is flanked on each side by a narrow section, that on one side being devoted to high-tension bus-bars and switch gear, while that on the other side contains the low-tension switchboard and operating gallery. These leading features are illustrated in plan and elevation in Figs. 1 and 2.

The bents which form these three parallel sections are spaced 16½ ft apart. At Woodhaven Junction and Hammel there are four of these bays, while at East New York and Rockaway Junction there are three. The low-tension gallery section is uniformly about 13 ft. wide. The high-tension gallery section varies in width, depending on whether one or two sets of high-tension bus-bars are required. For reasons which will appear later, some of the sub-stations are fitted with one set of high-tension bus-bars, and others with two sets, requiring the above-mentioned variation in the extreme width of the buildings. The length of the building, i. e., the dimension along which it can be extended in the future if desired by adding more standard bays, varies with the amount of equipment of rotary capacity allowed for in the initial installation as noted in the table of sub-station capacities. The general dimensions of the standard building, indicating how these varying conditions of length and width are met, are given in Fig. 1.

All of the sub-stations except Woodhaven Junction received an initial equipment of 1000-kw rotary converters. The machine foundations and general interior arrangement are, however, such as will accommodate a complete outfit of 1500-kw units at all stations, should traffic requirements in the future make it necessary to fill the buildings with apparatus to their utmost capacity.

The only variation in the heights of the buildings is due to the presence of overhead high-tension circuits. Where underground circuits only are used, as is the case at East New York and at Hammel, there are but two floors in the high-tension gallery. At Woodhaven and Rockaway Junction, however, where overhead circuits are employed, a third story is added to the high-tension gallery, and serves the double purpose of affording a convenient entrance to the building for the cables, about on a level with the cross-arms, and of providing a suitable chamber for enclosing the high-tension lightning-arrester apparatus.

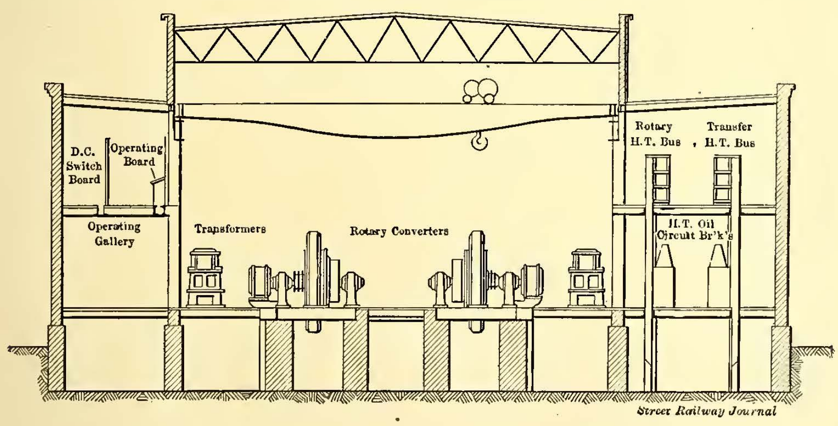


FIG. 2.—CROSS-SECTION OF TYPICAL SUB-STATION

The main portion of the building is about 30 ft. in height from the main floor to the bottom of the roof trusses. Each story of the side galleries is about 12 ft. in height. At Woodhaven Junction and Rockaway Junction, where the overhead lines require a third story, this lightning-arrester gallery is about 18 ft. higher.

The only external architectural effect sought is to provide a permanent and durable structure of simple and dignified but pleasing appearance, in harmony with the general treatment of the main power station building, where the same motive was worked out.

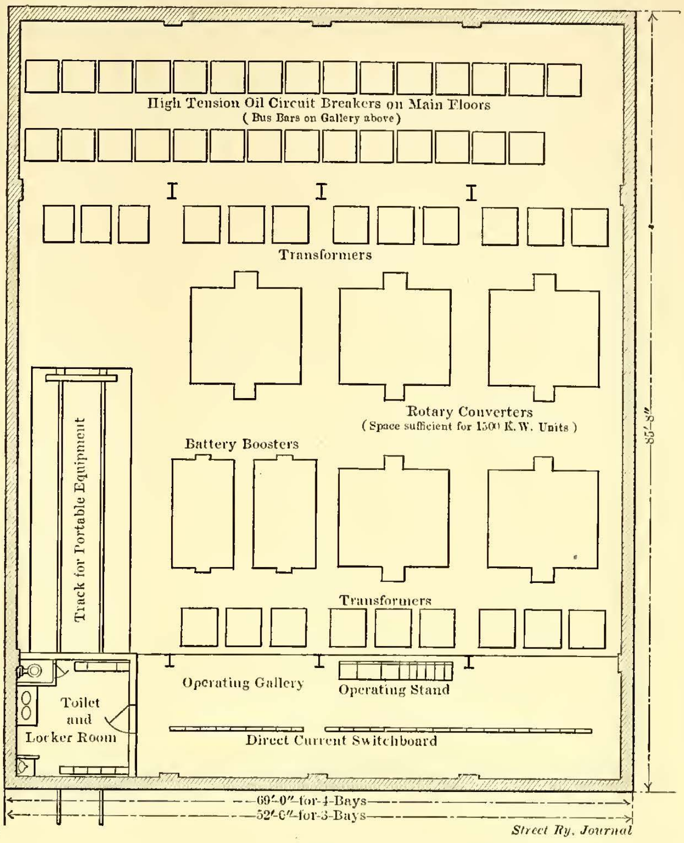


FIG. 1.—TYPICAL SUB-STATION, WITH A DOUBLE ROW OF ROTARIES

All the buildings have a white granite ashlar footing course as a base, extending up nearly to the floor level. Above this the walls are entirely of brick, faced outside with hard burnt repressed red brick laid in white mortar. The window sills, cornice, coping and the name panel are of terra cotta, of about the same color as the brick. All the small window openings and door openings are spanned by Kahn truss lintels with flat ground brick arches. Rowlock arches are carried over the large window openings. All window frames and sash are of 16-oz. sheet copper throughout, made up in hollow form and riveted together so as to be mechanically rigid before soldering, and soldered before erection in order to secure a suitable finish and to exclude the weather. The sash are all glazed with ¼-in. Mississippi rough wire glass. The doors are of the metal-covered type, completely encased in 16-oz. sheet copper.

The steel framing consists mainly of the columns between the bays, together with the crane runway and roof trusses which they support, and the floor beams for the main floor and galleries, the outside ends of which bear upon the walls.

The floors consist throughout of concrete slabs, reinforced with ⅜-in. twisted bars, of a thickness conforming with the load to be carried. The roofs consist of 4-inch cinder concrete slabs reinforced with ⅜-in. bars and waterproofed with 5-ply tar paper, pitch and gravel. All stair strings and railings are of steel with slate treads.

Each sub-station is served by a 16-ton Niles crane, hand-operated from its trolley, thus obviating the usual hanging chains. It spans the central bay and it is available not only for handling the permanent heavy sub-station machinery, but also the apparatus of the portable sub-stations, which (excepting at Grand Avenue) can be run under it upon a track that enters one of the end bays of the building.

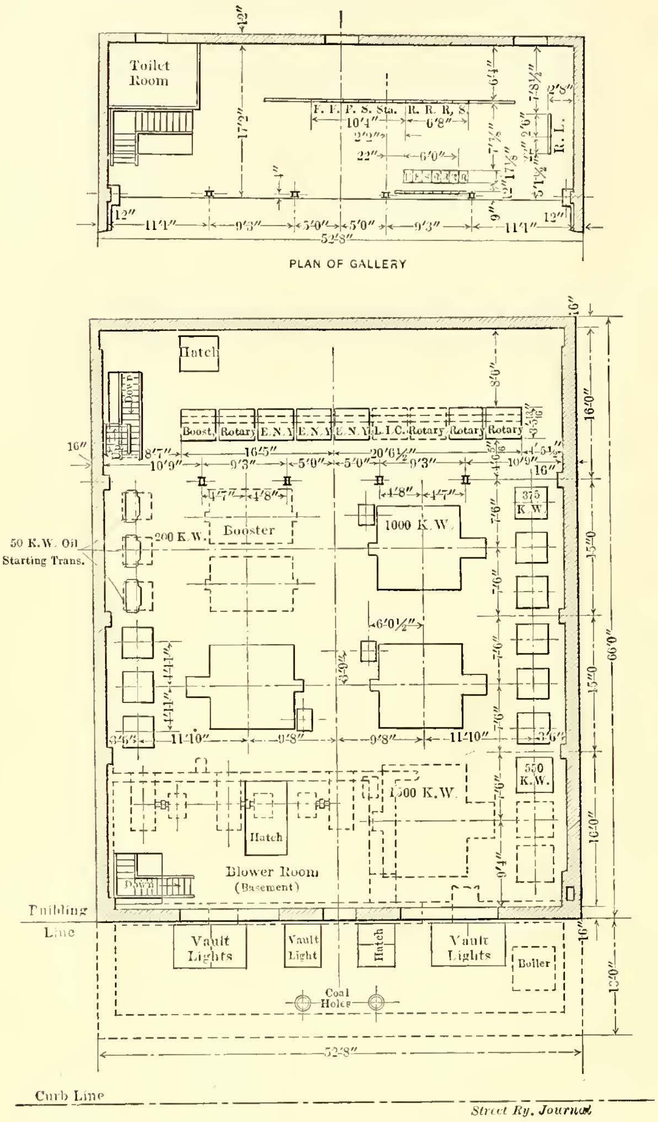


FIG. 3.—OUTLINE OF SUB-STATION AT GRAND AVENUE

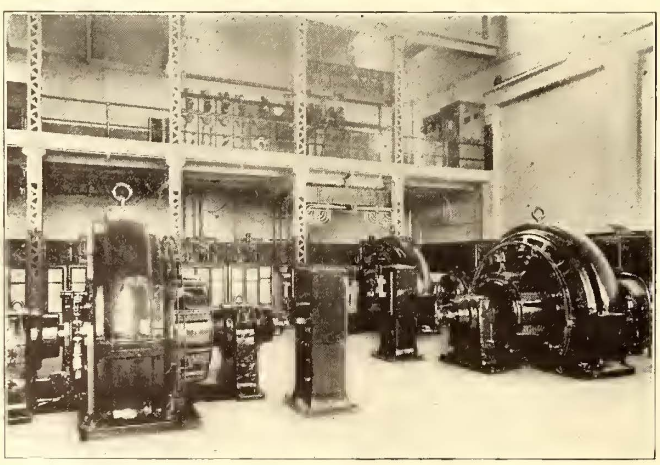


FIG. 5.—A VIEW IN THE GRAND AVENUE SUB-STATION

Sub-station No. 1, at Grand Avenue, is located in the building-up section of Brooklyn, and its interior arrangement was therefore modified to conform to the available ground area. The building consists of a series of bays carrying the crane girders, which traverse the building lengthwise from front to rear. The switchboard gallery is installed at the rear end instead of on the sides. The switching equipment, being somewhat simpler than that at other stations, was more easily taken care of in the reduced space, and the basement was utilized for the high-tension bus-bars, so that only one gallery was needed above the main floor.

FIG. 4.—THE GRAND AVENUE SUB-STATION

The position of the building in the lot is such as to provide room for the construction of a battery house in the future should it ever be needed. The building itself is 52 ft. 8 ins. wide and 66 ft. deep. A general plan of its arrangement is shown in Fig. 3, and a view of its exterior in Fig. 4.

The rotary converter foundations are arranged in two lines, from front to rear, with room enough for the accommodation of five 1500-kw machines, should that amount of rotary capacity ever be required. The transformers are placed in banks along the side walls. The location of this station, adjacent to a subway section of the Atlantic Avenue Improvement, makes it impossible to provide a track entrance for the portable sub-station, all provision for which is consequently omitted. Fig. 5 is a view of the interior.

Sub-station No. 2, at East New York, is situated at the southeast corner of the intersection of the Atlantic and Manhattan Beach Divisions, on railroad property large enough to afford room for a possible future extension of the building

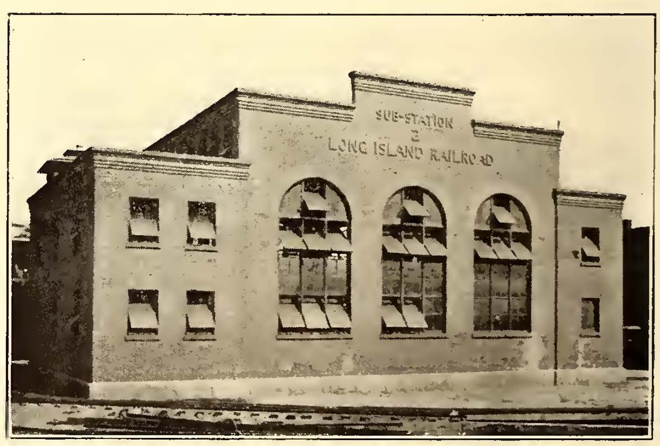


FIG. 6.—THE EAST NEW YORK SUB-STATION

should it ever be desired to install storage batteries. This building is of the standard type of construction, three bays in length.

A side track enters the station, the first bay providing space enough to permit the entrance of a portable sub-station, which can thus be coupled up with the apparatus at this station if required. This track was also of material assistance in unloading the apparatus into the sub-station during construction. The location of East New York sub-station is such as to preclude the possibility of overhead high-tension line construction, and consequently all arrangements for entrance and exit of high and low-tension feeder cables are through a vault in the basement. As two sets of alternating-current bus-bars are required at this station, the high-tension gallery is built to the maximum width. A view of this sub-station from the northeast corner is shown in Fig. 6.

Sub-station No. 3, at Woodhaven Junction, is similar to that at East New York, but has an additional story over the high-tension gallery to accommodate the entrance and exit of the incoming feeder trunk lines from the main power station, and the outgoing line to Hammel. This station is also longer than No. 2, consisting of four bays instead of three, which will enable it to ultimately accommodate six 1500-kw rotaries instead of four. Fig. 7 is the general plan of the main floor and galleries of this station. The high-tension section is of the maximum width to per-

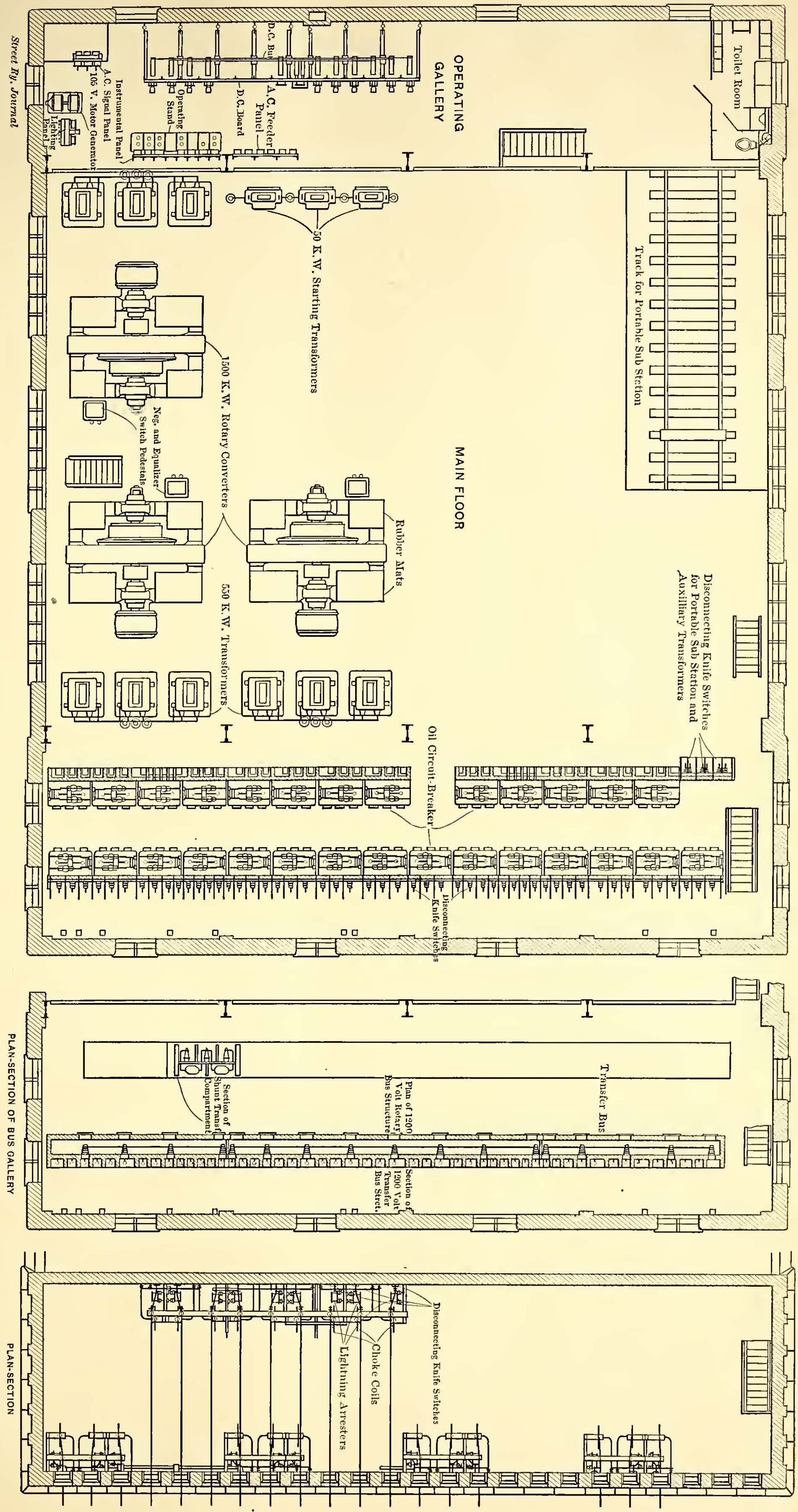


FIG. 7.—GENERAL PLAN OF MAIN FLOOR AND GALLERIES OF THE WOOD HAVEN SUB-STATION

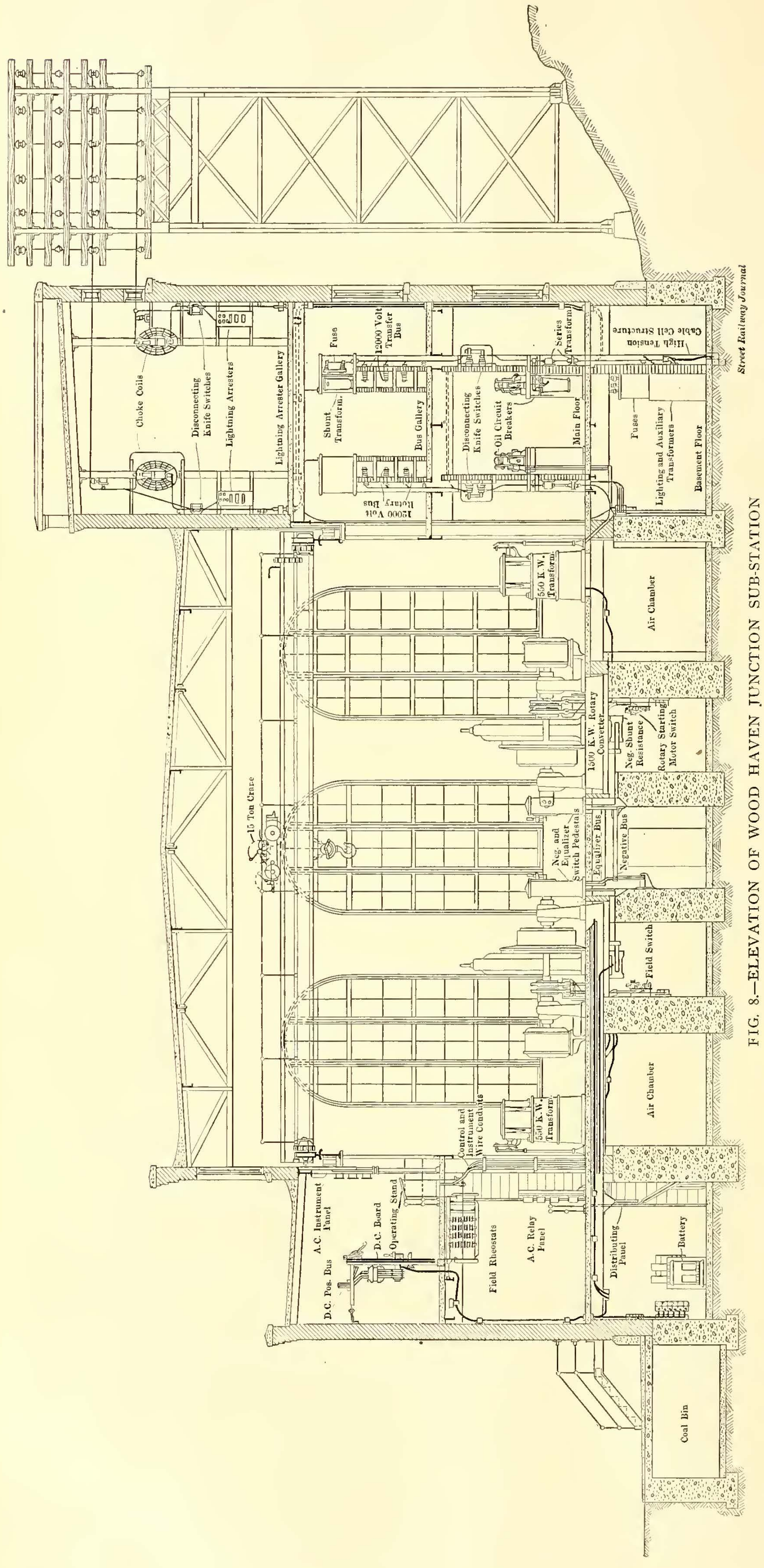


FIG. 8.—ELEVATION OF WOOD HAVEN JUNCTION SUB-STATION

mit the installation of two sets of high-tension bus-bars. The size of the building as compared with other standard-type buildings is readily noted by referring to Fig. 1, and then to Fig. 8, which is a complete sectional elevation of the building. This station, like sub-station No. 2, is provided with a track entrance for the portable sub-station. It stands on railway property of sufficient size to accommodate a battery house immediately in its rear, should one ever become necessary.

Sub-station No. 4, at Rockaway Junction, is also of the standard construction, comprising three bays in its lengthwise dimension. At this station all the high-tension circuits are overhead, necessitating the upward extension of the high-tension gallery into a lightning arrester chamber of the same type as at Woodhaven. The portable sub-station houses at the two race-tracks are supplied with high-tension current through this station, which, as a distributing point, thus requires two sets of bus-bars; so that the high-tension gallery of this station is of the same width as at Woodhaven and East New York.

The sub-station is situated in the middle of a block, a short distance to the west of Rockaway Junction. It is so placed that in case an enlargement is necessary in the future, the station can be extended toward the rear of the lot, where there is also room for a storage-battery house. This provision necessitated placing the gallery for the incoming and outgoing high-tension overhead lines along the east side of the building, and the cable terminal rack is designed to carry the cables from the railroad right of way around the corner of the building, and to distribute them properly for entrance along the east side of the house. An external view of this sub-station is shown in Fig. 9. This building also has a track entrance for a portable sub-station.

Sub-station No. 5, at Hammel, comprises a main sub-station building of the above described typical construction, four bays deep, and a storage-battery house. The entrance and exit of feeder cables is underground at this station, because it is too short a distance from the Beach Channel drawbridge to make it worth while to change from underground to overhead transmission. The fact that no transfer bus is required in this station permits the high-tension gallery section to be narrower than that in stations Nos. 2, 3 and 4. The main floor level of the building is about 4 ft. above the ground line in order to bring it to the same height as the floor in the portable sub-station car, there being track space provided to introduce it here, as in the other stations.

The sub-station building is 78 ft. 10 ins. x 69 ft. 4 ins. outside. The battery house, which forms an extension of it, is 101 ft. 8 ins. x 63 ft. This battery building is of special reinforced concrete construction throughout, there being no exposed metal used in any part of it. It is a one-story structure with brick walls about 15 ft. high, surmounted by a low parapet, and having a monitor roof about 15 ft. wide and about 6 ft. in height running the entire length of the building at the center. A photographic view of the building is given in Fig. 10. Wooden doors and window frames are used throughout in the battery house, and the sash is glazed with ¼-in. ribbed wire glass.

PORTABLE SUB-STATION BUILDINGS

The portable sub-stations, while being used at the race-tracks, are housed in buildings especially designed to accommodate them. The buildings are located at Belmont Park and Springfield Junction, and are each 88 ft. 4 in. long and 17 ft. wide over all, with a tower at the end opposite the entrance, about 36 ft. in height, for the purpose of affording a convenient entrance for the high-tension cables and providing an enclosure for the high-tension lightning arresters. The buildings were illustrated on page 832 of the Street Railway Journal for Nov. 4, 1905, and each can accommodate two portables.

ROTARY CONVERTERS

The electrical machinery in the sub-stations is all of Westinghouse manufacture.

The rotary converters are of the two-bearing type with field frames divided in a horizontal plane. Each converter is provided with a starting motor, whose frame is mounted upon an extension of the base of the rotary converter. The base frame is set into the floor so that the top of it is level with the floor line. It is entirely open below the commutator so that there is easy access to the lower brushes from the pit in the interior of the foundation, which can be easily reached from the basement.

The 1000-kw rotaries are rated to deliver 1600 amps. at 625 volts, and 1667 amps. at 600 volts. The three-phase potential at the alternating end is approximately 370 volts, for 625 volts at the direct-current end.

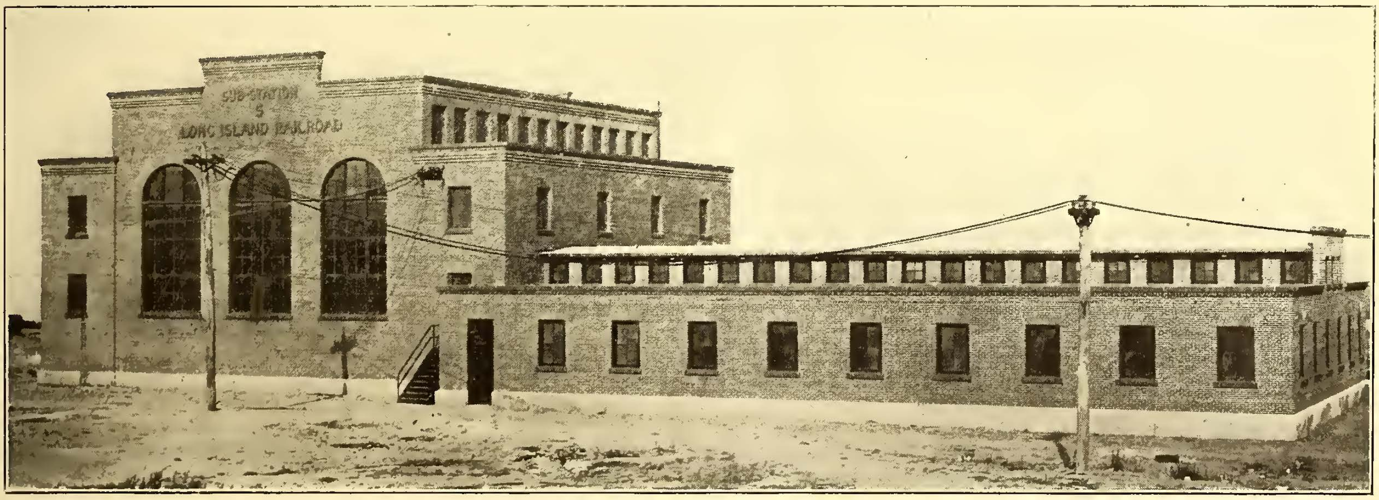


FIG. 10.—THE HAMMEL SUB-STATION

The 1000-kw machines have eight poles and operate at 375 r. p. m., corresponding to a frequency of 25 cycles per second.

The 1500-kw rotaries are rated to deliver 2400 amps. at 625 volts, or 2500 amps. at 600 volts. They have twelve poles and run at 250 r. p. m.

In nearly all respects the two sizes of machine are very similar. The fields are compound wound with the shunt winding arranged for self-excitation. The machines are so over-compounded, that if operated as direct-current generators at constant speed, the voltage will rise from 600 volts at no load to 650 volts at full load. The converters are guaranteed to stand overloads of more than 2½ times the normal load at 600 volts d. c. without falling out of step, providing the e. m. f. at the alternating end is maintained within 14 per cent. of the normal. Ample provision is made for ventilation by passages through the armature core and windings and also through the field coils.

FIG. 9.—SUB-STATION AT ROCKAWAY JUNCTION

TRANSFORMERS

The transformers used with the converters are of the air-blast type throughout. Those for the 1000-kw rotary converters are grouped in banks of three 375-kw transformers to one rotary converter. For the 1500-kw converters they are in groups of three 550-kw each.

The high-tension winding is designed for a normal e. m. f. of 12,000 volts, with taps arranged to enable other voltages to be utilized down to 10,000 volts. The low-tension winding is designed to normally carry 400 volts, with taps which will enable other voltages to be taken off it down to 340 volts. The high-tension terminals are at the top of the transformer. The low-tension leads are brought to suitable terminals in the bottom of the transformers.

AUXILIARY TRANSFORMERS

In each station there are four sets of auxiliary transformers which supply current for the following purposes: (1) To the rotary converter starting motors. (2) To the motors driving the booster generators and their exciters. At Hammel station these transformers are made large enough to also drive rotary starting motors at the same time. (3) For driving the transformer blower motors, and an induction motor generator set, used to charge the small auxiliary storage battery that supplies current for the electric switch-control system. (4) For house lighting.

The following particulars regarding these four sets of transformers are of interest.

At sub-stations Nos. 1, 2, 3 and 4, where there are no storage batteries, a group of three transformers is employed to furnish current for the starting motors of the rotary converters. These are of 50 k. v. a. capacity each, the bank being able to start up and synchronize three 1500-kw rotary converters simultaneously, and are of the oil-insulated, self-cooling type, reducing the three-phase, 25-cycle current from 12,000 volts to 400 volts. They are placed in a row on the main floor and are connected to the rotary bus by an automatic oil circuit breaker, electrically operated from the main control stand.

At sub-station No. 5, where a storage battery is employed that involved the use of two 162-kw booster generators, each driven by a 235-hp induction motor, there is provided a bank of three 200-kw air-blast transformers, affording sufficient capacity not only for operating the battery boosters under the maximum conditions of load, but also for simultaneously starting one rotary converter without dropping the secondary voltage of the transformers sufficiently to affect the booster regulation. These transformers are set on the main floor over the air ducts for the main transformers and in line with the latter.

The 7.5 k. v a. transformers are provided for the blower motors and the induction motor which operates a small booster generator used for charging the auxiliary storage battery that furnishes current for the electrically-operated switch control system. At Woodhaven Junction these are of 10-kw capacity. These transformers are of the oil-insulated type, with the windings placed in substantial sheet-iron cases, with cast-iron top and base. The transformation is from 12,000 volts to 400 volts.

STORAGE-BATTERY EQUIPMENT

As previously outlined, storage batteries are provided at Hammel sub-station only, though provision is made in the design of the other sub-stations for the ultimate installation of storage batteries should future conditions appear to require them.

The equipment installed at Hammel sub-station, with its auxiliaries, is made up as follows: The battery itself comprises 300 elements of the Electric Storage Battery Company's chloride accumulator, each element containing fifty-five type R plates, in regular service. At the temperature of 70 degrees F. they have the following capacities:

Rate	Time	Capacity
700 amp	8 hrs.	5600 amp. hrs.
1000 "	5 "	5000 "
1500 "	3 "	4500 "
3200 "	1 "	3200 "

The normal rating of the battery is the one hour, for which time it can discharge at the rate of 3200 amps. In case of necessity, however, there is sufficient capacity in the battery to discharge at the rate of 6400 amps for a space of twenty minutes. For instantaneous fluctuations it can discharge up to a momentary maximum rate of 9600 amps, or three times the one-hour rate. The positive plates are of the so-called "Manchester" type, composed of cast grids, the holes in which are circular.

To properly effect the charging and discharging of the battery when used as a regulator for the rotaries, there are two direct-connected, motor-driven, separately-excited boosters, each consisting of one three-phase induction motor and one direct-current generator mounted on a common bedplate. The booster generator is rated to deliver 1200 amps at 135 volts continuously, with a rise of temperature not to exceed 40 degs C. above the temperature of the surrounding air. It has an overload capacity of 1600 amps for one hour, and of 3200 amps for two minutes. Two of these boosters in parallel are required to take advantage of the full discharge rate of the battery. It was thought desirable to split the booster capacity so that in case of accident to the booster the whole battery capacity of the station would not be tied up by the failure of a single booster unit. The two boosters together can, therefore, completely discharge the battery in one hour,

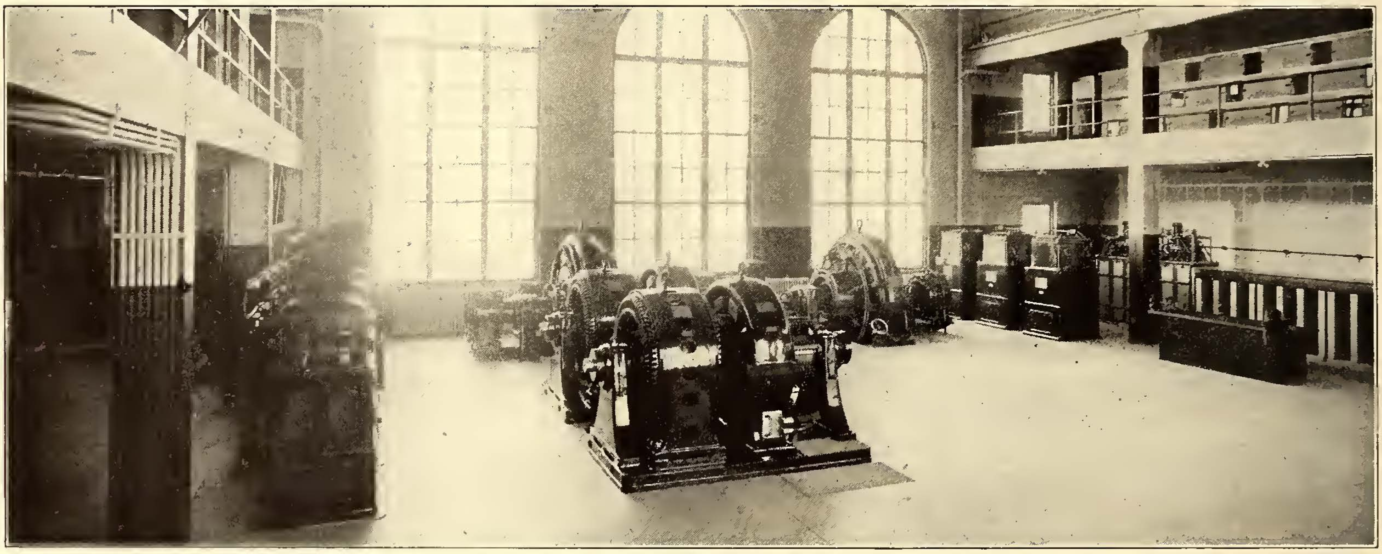


FIG. 11.—BOOSTERS, ROTARIES, TRANSFORMERS AND SWITCHBOARD IN HAMMEL SUB-STATION

as their combined rating of 3200 amps for one hour is equal to the one-hour discharge rate of the battery.

Each booster motor is of the three-phase induction "squirrel cage" type for 25-cycle current at 400 volts, rated at 235 hp. The transformer equipment which supplies the induction motors consists of the three 200-k. v. a. air-blast transformers previously described. Fig. 11 shows the interior of Hammel sub-station with the motor-driven booster rotaries and transformers.

In order to use the battery to maintain a comparatively steady load on the rotary converters, the boosters which are in series with the battery and the third-rail circuit must have their magnetic field excitation changed, both as to intensity and as to polarity, by an amount that will cause the boosters either to change the battery from the rotaries or, when reversed, to discharge it to the third-rail circuit; and they must effect this regulation as nearly as possible instantaneously with the fluctuations as they actually occur in the system. In other words, the function of the storage battery and booster is to act as an instantaneous reservoir of power to relieve the rotary converters of the instantaneous fluctuations in load.

The effectiveness of the battery for this purpose, therefore, depends upon the quickness with which the intensity of the booster field can be varied and its polarity altered. This is accomplished by means of a small booster-exciter generator driven at a constant speed by an induction motor. The current from the armature of this exciter flows directly through the field of the booster. The desired change in the conditions of strength and polarity in the booster field can, therefore, be effected by altering the output of this little exciter generator and reversing its polarity. This is done by strengthening, weakening, or reversing the field coils of the exciter, which is introduced into the system simply because it can deliver the relatively large current needed for exciting the booster field —this amount being much greater than it would be possible to pass through the very sensitive regulator, which can, however, easily and instantly change the small magnetic field excitation of the little exciter. The action of the regulator is shown diagrammatically in Fig. 12.

As mentioned above, the booster is in series with the battery across the 600-volt station bus-bars. From the opposite ends and from the middle point of a section of 100 cells of the storage battery three circuits are led, one of which passes through the field of the small exciter to a connection that joins together two piles of carbon disks which are subject to the pressure of a lever. The outer end of one carbon pile is then connected to one of the wires leading to the positive pole of the 100-cell section of storage battery, and the wiring from the outer end of the other carbon pile is joined up to the negative end of the 100 cells. Two circuits are thus formed, each of which includes a separate half of the battery section and one carbon pile, while both have a common connection from the center of the battery section, which passes through the field of the little exciter. The resistances of the two carbon piles, when subjected to equal pressures, are equal, and current will then flow from the battery through both carbon piles and back to the negative pole of the battery, there being then no tendency for any current to flow from the central point of the two carbon resistances back to the central point of the battery or vice versa, through the field of the small exciter.

The lever which bears upon the tops of the two carbon piles is balanced upon a knife edge, and from one end of it is freely suspended the soft iron core of a solenoid, through the coil of which passes the entire output of the rotary converters. To the other end of the lever is attached a helical spring whose tension may be adjusted by hand to counterbalance the pull of the solenoid at any desired load on the machines. Through the action of the suspended core of the solenoid slight variations of load above or below this amount will cause changes in pressure on the carbon piles by means of this lever, and will result in wide variations in the contact resistance in the carbon piles. The pile that is compressed through the action of a small increase of current in the solenoid will have its resistance reduced, and more current will flow through it than through the other one upon which the pressure has been simultaneously released. If the carbon pile thus pressed happens to be the one whose outer end is attached to the positive pole of the battery section, for instance, the current will flow from the positive terminal of the battery around through the compressed pile and through the booster exciter field to the middle point of the battery, inducing polarity in one direction in the booster field to an extent corresponding to the increase of current that caused the solenoid to compress the carbon plates. When the current in the main circuit is slightly reduced, the solenoid action is reversed, pressure on that partic-

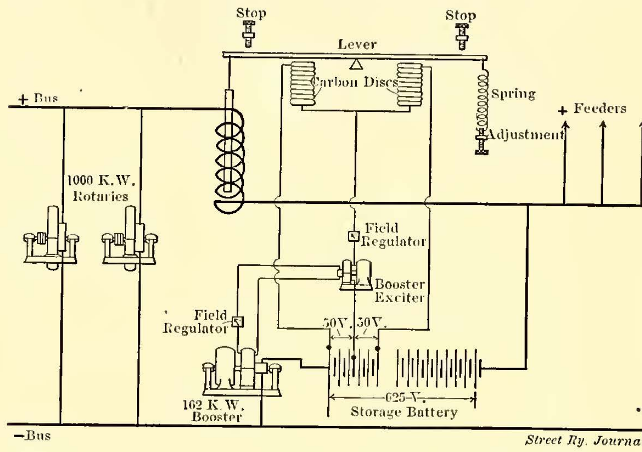


FIG. 12.—DIAGRAM OF WIRING FOR CARBON REGULATOR FOR THE HAMMEL BATTERY

ular pile is released, and the other carbon pile, whose outer end is coupled to the negative pole of the battery section, is compressed, the current in the regulator circuit flows from the middle point of the battery back through the booster-exciter field in the opposite direction, and through the other pile to the negative pole of the 100 cells. The booster-exciter field is thus reversed, which reverses the polarity of the booster field, and consequently the polarity of the booster itself, finally resulting in the reversal of battery action. The action of the regulator is somewhat analogous to that of the Wheatstone bridge.

By means of this regulator mechanism, the strength and the polarity of the booster-exciter field coils responds instantly to the fluctuations in the main power circuit from the rotary converters. The action of the exciter is simply to multiply this effect in the field of the booster itself, which changes its intensity or polarity in exactly the same way, and consequently charges or discharges the battery in almost instantaneous harmony with the changes in load upon the rotary converters.

The solenoid, through whose action the pressure on the carbon piles is varied, is shown in the diagram as a plunger working up and down in a coil inserted in the bus; but as installed here for handling large currents, it consists simply of a soft iron inverted U magnet suspended over the main busbar. It has practically no inertia, so that the only lagging effect in the train of operations is that due to the self-induction of the field coils of the booster exciter and the booster itself. It responds to a very small change in the generator load, and no preliminary determinations are required. The tension of the spring is easily adjusted by hand, the effect of this adjustment being to raise or lower the total amperes that will exert a given amount of action in the regulator, i. e., to raise or lower the neutral point between charge and discharge. The range of action of the apparatus is thus very easily altered.

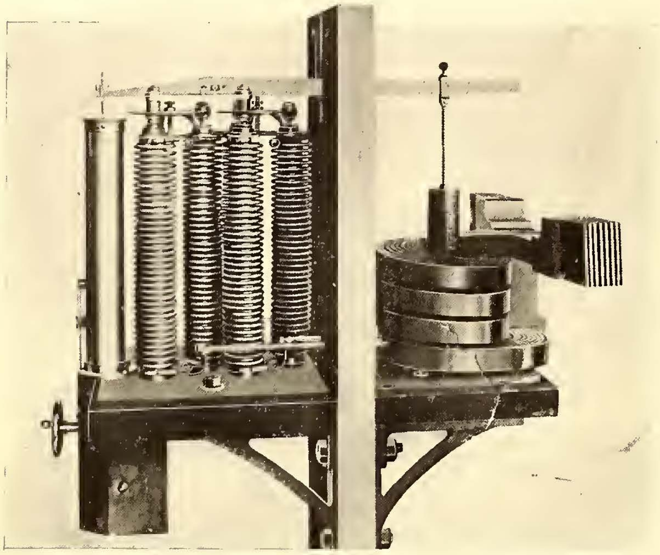


FIG. 13.—CARBON REGULATOR FOR STORAGE BATTERY

The action of the lever is limited in either direction by adjustable stops which limit the battery charge and discharge, so that any further swing of the load will be handled by the rotaries only. The sensitiveness of the regulator can be adjusted by varying the resistance in the exciter field circuit. It has the additional advantage of obviating the necessity for carrying the total output of the station around the booster field, and simplifying the station wiring, and it is equally sensitive over a very wide range of load.

Fig. 13 is a typical view of this carbon regulator as applied for general work, and illustrating the principle above outlined. The arrangement of bus-bars and solenoid is different from that adopted in the Hammel installation, but the apparatus on the front of the panel is shown exactly as furnished.

By means of this system of regulation, the battery can be made to charge and discharge at any rate within the limits of 3200 amps. charge to 6400 amps. discharge, within ten seconds. By means of the adjustments above mentioned, the load upon the rotaries can be prevented from fluctuating by more than 5 per cent on either side of the average. Increased fluctuations on the rotaries by as much as 50 per cent on each side of the average can be permitted if desired.

This carbon regulator for automatic booster control was designed and manufactured by the Electric Storage Battery Company, of Philadelphia. The small exciter for the storage battery booster is of special design on account of the peculiar work demanded of it. It is of capacity sufficient to excite the fields of both booster generators when operating continuously. In order to overcome the counter e. m. f. of induction quickly, and thus enable the booster to pick up its load rapidly, the exciter is able to give a voltage considerably in excess of that required for a steady maximum booster excitation. As the booster generator responds to this exciter, the retrograde action of the regulator automatically reduces the excitation of the exciter. The exciter is driven by an induction motor wound for three-phase, 25-cycle current at 400 volts, provided with an auto starter. The two machines are mounted on a common bedplate. The booster exciters are located in the operating gallery near the low-tension switchboard.

SYSTEM OF HIGH-TENSION CONNECTIONS

Before describing the high-tension switchboards, bus-bars and circuit breakers, the general scheme of feeder distribution will be reviewed in order to convey a clear understanding of the objects to be accomplished.

In the initial installation all high-tension feeders are run in one trunk line from the power station to Woodhaven Junction. From this sub-station three general branches of the transmission line are run, one westward to East New York and Grand Avenue, one eastward to Rockaway Junction, to the two portable sub-station terminal houses, and to Valley Stream, and one south to Hammel. The general working diagram of the feeder system (Fig. 14), which fully illustrates the method of distribution, is reproduced from the issue of June 9 for the convenience of the reader.

Referring to this diagram, it is to be noted that two other sub-stations besides Woodhaven, namely, East New York and Rockaway Junction, each have to distribute alternating current to feeders supplying the outlying sub-stations near the terminals of the railway system. At these three principal sub-stations mentioned, therefore, the scheme of connections was so designed as to provide flexibility in shifting feeders about among all the sub-stations. This is done by an extra set of bus-bars suitably subdivided into sections and called the "transfer bus" in distinction to the regular working bus-bars of the station, which are hereinafter referred to as the rotary bus.

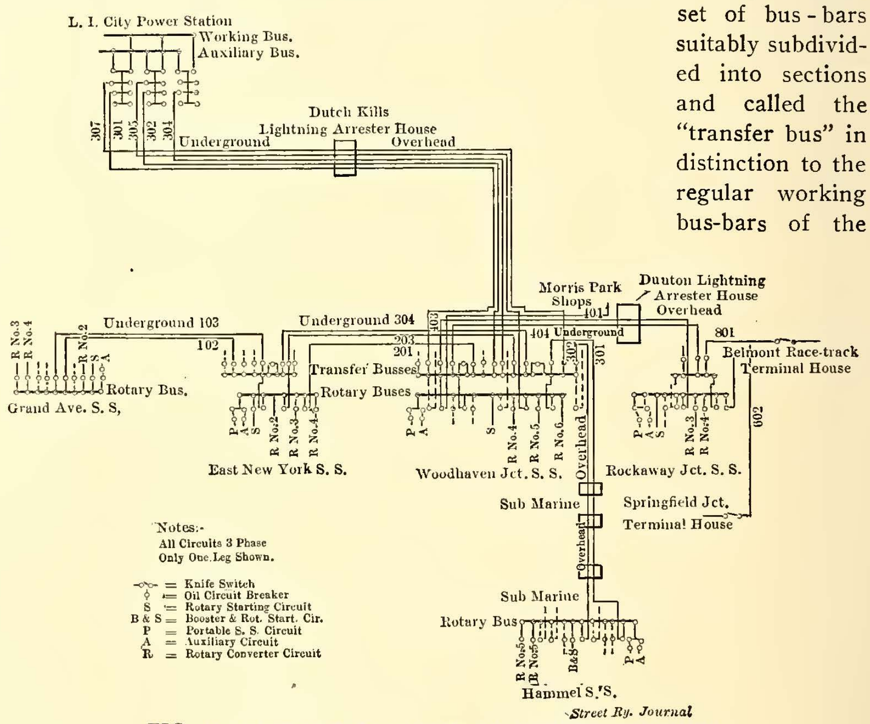


FIG. 14.—OUTLINE DIAGRAM OF FEEDER CIRCUITS

The rotary bus in each station receives current directly through a feeder independently of the transfer bus in that particular station. This enables high-tension current to be passed through an intermediate sub-station to one or more beyond, independent of the operation of apparatus in the former. The diagram in Fig. 15 illustrates the high-tension connections at Woodhaven sub-station on a larger scale, and shows how the three outgoing branches of the feeder line each receive current through a separate section of the transfer bus in that station, each section having an independent feeder on the main trunk line coming from the power station.

The transfer bus is sectioned by non-automatic oil circuit breakers, so that all branches can be run separately or together as desired. A separate feeder connection to the Woodhaven rotary bus is also clearly shown, as well as the other bus connecting switches which enable the Woodhaven rotary bus to be coupled to either of the three sections of the transfer bus.

As will be noted in Fig. 14, the general arrangement at East New York and Rockaway Junction sub-stations is similar to that at Woodhaven, but considerably simpler, as less apparatus is required in the initial installation at those two stations. In the ultimate installation it is planned to have main feeders run direct from the Long Island City power station of the Pennsylvania Railroad Company to each of these three principal sub-stations. The feeders now connecting to these transfer buses will then be available as relays.

At sub-station No. 1 and No. 5, the only bus needed is that required for the operation of rotary converters, there being no stations beyond to which power is to be sent. Consequently the switching apparatus at these two sub-stations consists simply of that required to connect the incoming feeders and the sub-station apparatus to a single bus.

HIGH-TENSION BUS-BARS AND CIRCUIT BREAKERS

The disposition of the high-tension switching apparatus varies slightly at the different sub-stations, due to the considerations mentioned above. The most complete development is at Woodhaven Junction sub-station on account of its position in the system, and the arrangement of this place will, therefore, be described and illustrated quite fully. The other sub-stations will be mentioned mainly in connection with the more important variations.

The sectional elevation of Woodhaven Junction sub-station, Fig. 8, shows the high-tension cables entering through the lightning arrester gallery in the third story. The cables are then carried down the wall into the basement, where they cross to septums built into the back of the brick cubicles enclosing the oil circuit breakers on the main floor of the high-tension gallery. This bank of oil switches is directly underneath the transfer bus and controls all the circuits that enter and leave the bus. The incoming cables of each circuit, therefore, run first to the proper oil switch, continuing thence up to the transfer bus in the gallery overhead, each cable being run in a separate brick septum. The outgoing branch circuits are tapped out of the transfer bus, each tap coming down a septum in the back wall of the bus structure to the oil switch directly underneath. The oil switches both for the incoming and outgoing circuits are all in the same line underneath the transfer bus on the outer side of the gallery.

On the inner side of the gallery, the station or "rotary" bus-bars and the switches connecting them to the transformers and rotary converters in this station are arranged in line in like manner, on the two gallery floors. The brick structures enclosing the oil switches and bus-bars of these two distinct sets are practically identical in design. From Fig. 8 the general course of the high-tension cables from the lightning arrester gallery through switches, bus-bars and transformers to the rotaries can be readily traced. Between every oil switch and the bus to which it is connected is a set of three disconnecting knife switches, one in each phase. These are mounted upon the wall which extends upward from the back wall of the circuit-breaker compartments, and are on the opposite side of the wall from the circuit breakers. The switches are of the hook type, and are mounted upon porcelain insulators and are opened and closed by hand by means of a hook on the end of an insulating wooden rod. The blade of the switch is hinged on the dead side of the connection when open. Their function is to isolate completely the circuit breaker from the bus-bars, to facilitate inspection, cleaning and repairs. Their capacity is proportionate to that of the oil switches they protect.

At Woodhaven Junction sub-station two of the outgoing branch circuits emerge underground, while the third leaves by the overhead route. The underground feeder cables drop directly from their oil circuit breakers into septums in the basement, where the three cables of one circuit are brought together into a single three-conductor, high-tension cable, lead covered, which carries the current out into the underground portion of the transmis-

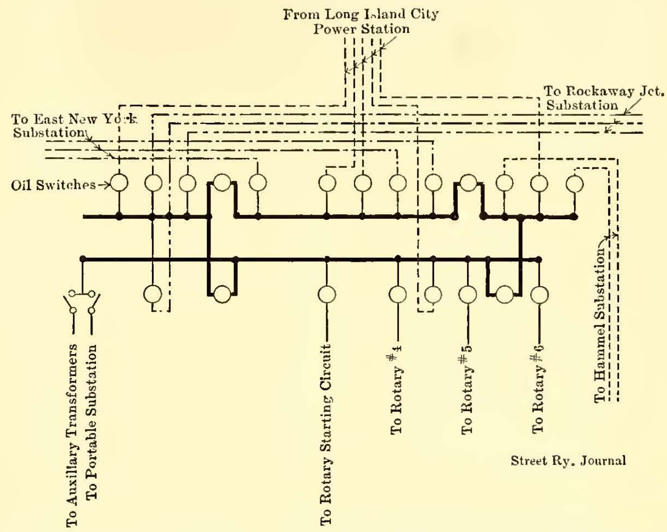


FIG. 15.—ARRANGEMENT OF CONNECTIONS TO HIGH-TENSION BUSES AT WOODHAVEN

sion system. At East New York, both the entrance and exit of high-tension cables is underground, and there is no need of a lightning arrester gallery. The incoming cables enter the basement, run up to the switches and transfer bus-bars and down again to their exit into the conduit system toward Grand Avenue. The arrangement of bus-bars, transformers, switches, and rotaries is practically identical with that at Woodhaven Junction.

Sub-station No. 1 at Grand Avenue has but a single set of bus-bars. The feeder cables all enter by underground conduits. The general arrangement is therefore quite simple. The rear end of the basement is utilized for the bus structure, the line of the oil circuit breakers being upon the main floor directly over the bus structure and under the operating gallery, all this gear being at the rear end of the building.

Rockaway Junction has no underground cables, so all circuits enter and leave overhead through a lightning arrester gallery like that at Woodhaven Junction. As the conditions here are quite similar to those at East New York, the arrangement of transfer and rotary buses, oil switches and apparatus generally is practically identical.

At Hammel there is no transfer bus, and the feeder cables enter the station under ground. So there is but one set of bus-bars, the high-tension gallery is narrower than in the other sub-stations of standard design. In other respects the relative arrangement of bus-bars, oil switches and cables on the floors of the operating gallery is the same as at the other stations.

The high-tension bus-bars each consist of three sets of bars of rolled copper mounted on porcelain pillars and carried in closed compartments placed one above the other in a structure of yellow pressed brick with alberne stone slabs separating the three tiers. The holes by which the taps enter and leave the compartments are made through alberene stone slabs bushed with heavy porcelain insulating bushings. Where the bus-bars are sectioned, the compartments in the same tier are completely divided off by stone slabs. Every precaution was taken to isolate electrically every bar and live connection from every other and from the ground. The potential transformers are in separate closed compartments on top of the bus structure. The type of structure is practically identical for all stations. On the back of each bus structure is built a set of vertical septums or compartments to separate the cables that enter and leave the structure to tap the bus-bars. The septums are continuous with those in the upward extension of the back walls of the oil switch structures, which are type C Westinghouse oil circuit breakers. They are all lined up directly underneath the bus structure excepting at Grand Avenue, where their relative positions are reversed.

HIGH-TENSION SWITCHES

The switches for manipulating the 12,000-volt current for the feeders and for the leads to the main transformers are three-pole, with two stationary contacts per pole, one for the incoming and the other for the outgoing lead of the same phase. The connection between the switch terminals of these two leads is made by raising into contact with them against the force of gravity, a bridging piece which is held against the contacts by mechanism operating against the force of gravity, which consequently tends to keep the switch open. The contacts are submerged in oil, the bridging piece of each pole of the switch being at the lower end of a heavy vertical wooden rod. Each pole of the oil circuit breaker is enclosed in a separate fireproof chamber of brick, capped with a slab of alberene stone upon which the operating gear is mounted. The front of each compartment is enclosed by a cover of asbestos lumber, held in place by eccentric clamps.

These oil circuit breakers are nominally of 600 amps. carrying capacity, but can handle short circuits of a maximum kilo-volt-ampere capacity equivalent to a generator capacity of 33,000 kw. The switches will open or close the circuit within one-half second after the control handle on the operating stand has been moved to the open or closed position. Even if the tripping coil be energized while the closing magnets are also energized, the circuit breaker will open as soon as the circuit of the closing coil has been opened by the operator.

Both automatic and non-automatic circuit breakers are employed. They are all automatic except those used for connecting the sections of the transfer bus and for connecting the two transfer buses to the rotary bus. The switches controlling feeders that pass through a station, and also those which control apparatus supplied from the rotary bus, are all automatic.

The non-automatic circuit breakers are electrically controlled from the operating galleries, but are not provided with automatic tripping attachments. The automatic circuit breakers, although electrically operated by the manual control of switches on the operating stand, are also automatically opened through relays by the current in the circuit in which the circuit breakers are located. These operating appliances will be described under the head of "Indication and Control Apparatus." A view of the high-tension switch gallery on the main floor level of the Woodhaven Junction sub-station is shown in Fig. 16.

INDICATION AND CONTROL APPARATUS

As may have been surmised from the description of the high-tension feeder system, comprising as it does both the working or rotary buses and a set of transfer buses, in the three principal stations, the indicating and control apparatus governing the movement of these switches is somewhat intricate. For the sake of clearness in description, it is perhaps best to classify the various functions performed by the switches before describing in detail the individual pieces of apparatus by which control is effected.

Being the central distribution point, and having the largest equipment of high-tension connections, Woodhaven Junction sub-station will again be taken as a typical illustration. The apparatus in the other sub-stations is all identical with this as to type and general arrangement, the only difference being that due to less apparatus and resulting greater simplicity.

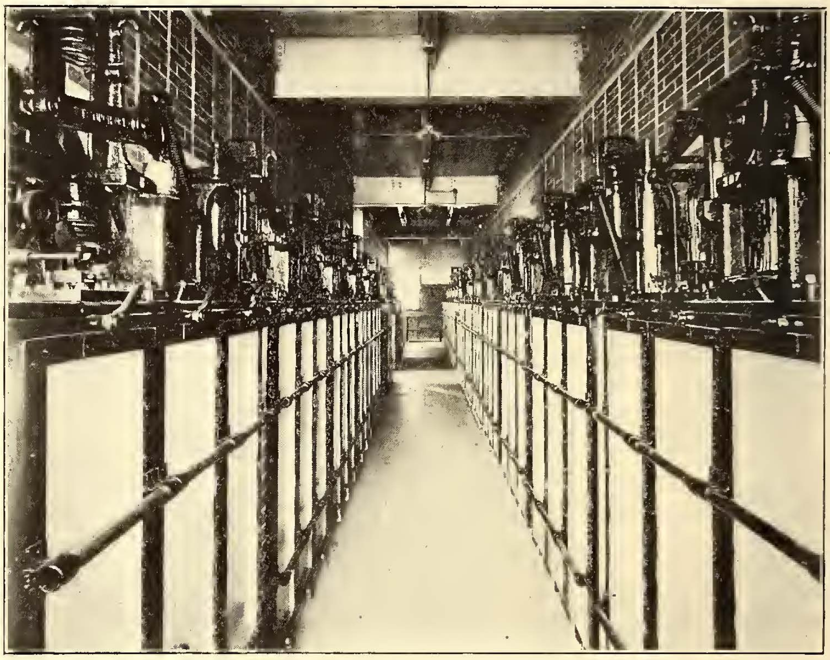


FIG. 16.—HIGH-TENSION SWITCH GALLERY IN THE WOODHAVEN JUNCTION SUB-STATION

At Woodhaven Junction, the switches may be divided into a group of three classes for each bus. The first group is as follows: (1) Switches controlling incoming feeders from power station to transfer bus. (2) Bus junction switches connecting the sections of the transfer bus. (3) Outgoing high-tension feeders from transfer bus to sub-stations.

The second group is as follows: (4) Switch controlling the feeder from the power station direct to rotary bus. (5) Switches connecting the transfer bus with rotary bus. (6) Switch connecting main transformers (for rotary converters) with the rotary bus.

The apparatus controlling the first group of switches, which deal entirely with the transfer bus, is mounted on a separate set of three marble panels, each 24 in. wide and 8 ft. 1 in. high, set to the left of the main operating stand. Upon the central one of these three panels are mounted, four ammeters for current indication, and four operating handles for switch control, with provision for two more, for the ultimate capacity of six incoming feeders for which this sub-station is designed. On this panel are also mounted two controls for the two bus junction switches needed for connecting the three sections of the transfer bus. At the right and left of this central panel are similar panels upon which are mounted four feeder ammeters and four switch-operating handles, each to control an outgoing high-tension feeder leading to a sub-station. Each one of the above-described panels has provision for mounting upon it the following apparatus:

Six 500-amp A. C. ammeters.
Six controllers for type C automatic circuit breakers.
Six red signals for control indication.
Six green signals for control indication.
Two controllers for type C non-automatic circuit breakers.
Two red signals for control indication.
Two green signals for control indication.

The second group of control apparatus, which has to deal with the apparatus directly operated in the sub-station itself, is mounted upon a separate bank of control stands and instrument panels, so arranged as to form a single fixture composed of unit sections, and capable of extension in either direction. The control stand portion of this apparatus consists of a bench with an inclined top, upon the front and top of which are carried the control instruments. The operator stands directly in front of this, and the space immediately over it is left vacant, permitting the operator to have an unobstructed view into the station. Above the level of the operator's head there is mounted a system of unit-instrument panels of the same width as the control panels upon the bench and corresponding each to each across the width of the bench. The control panels and the instrument panels are each 12 in. wide.

Going from the left to right, the designation of the control and instrument panels in this bench and overhead framework is as follows:

(1) Two rotary bus connecting switches. (These connect the rotary bus with the transfer bus.)
(2) A. C. feeder direct from power station to rotary bus.
(3) Blank panel reserved for booster in case of storage battery installation.
(4) Switches connecting rotary bus with transformers supplying rotary converter starting motors (and booster motors when installed).
(5) Blank panel for future rotary converter.
(6) Panel for rotary converter installed.
(7) Panel for rotary converter installed.
(8) Panel for rotary converter installed.

The apparatus on each one of these control panels on the top of the bench consists of either one or two switch-control handles as the case may be, each with a red and a green lamp signal for control indication. Each of the booster panels has one switch control with lamps, and these two panels are also fitted with two booster and motor-starting switches and a relay push-button, which is used to stop the ringing of the circuit breaker alarm gong.

The rotary converter panels are each fitted with a control operating handle, a red and a green signal lamp, a starting motor switch, and a synchronizing receptacle.

On the front of the operating control bench are panels 12 ins. wide extending across the entire front of the bench. Beginning at the left-hand end, the first five of these panels are blank. Upon the last three, which correspond to the control panels of the rotary converters now installed, are mounted rheostat handles for the fields of the three rotaries.

The instruments which indicate the conditions of the circuits corresponding to each one of the control panels are mounted upon the corresponding panels directly over the operator's head. Beginning at the left, upon the rotary bus connecting switch panel are mounted a synchroscope and a voltmeter, beneath which is a row of 3-4-point voltmeter receptacles. Upon the second instrument panel corresponding to the a. c. feeder in the power station, there is room for two a. c. ammeters, and there is also an eight-point voltmeter receptacle. Upon the third panel corresponding to the blank booster panel there is room for mounting two polyphase indicating wattmeters, of which one is now in position. Upon the fourth panel is mounted one indicating wattmeter with room for another. The fifth panel is blank, being reserved for a rotary converter. The sixth, seventh and eighth panels are identical, there being mounted on each:

One power factor meter.
One polyphase indicating wattmeter.
One polyphase integrating wattmeter.
One synchronizing lamp.
One field pilot lamp.

As above explained, the larger amount of apparatus in Woodhaven Junction sub-station, due to the greater extent of the transfer bus, results in its having more switches and a larger switchboard. The control stands and instrument panels at the other sub-stations are identical with that above described, as regards their general makeup and the order of panels from left to right, except at Grand Avenue, where the order is reversed.

The description of one is, therefore, a description of all.

The control apparatus by means of which the electrically-operated switches are worked from the control stand consists of a circuit supplied by a storage battery, whose current is conveyed to the two closing coils and the one tripping coil of each oil circuit breaker, the control circuits being closed either by means of a handle on the control stand or (if control is automatic) by the time-limit relay which is actuated from a series transformer in each high-tension circuit. The contacts operated by the switch handle on the control stand, and this time-limit relay, are in multiple across the switch-opening circuit; while contacts operated by the control handle only are used to close the switch-closing circuit.

The position of the switch is indicated to the operator by means of a red and a green signal lamp placed one on each side of the switch handle upon the control stand. These signal lamps are lighted by current from the above-mentioned auxiliary storage battery, and the lamp circuits are closed through a little rocker-type double-throw knife switch on top of the oil-switch structure, which is thrown to the one side or the other by the oil-switch mechanism when it changes from one position to the other.

There are sixteen relays in the Woodhaven Junction sub-station, enabling the automatic control of that number of oil circuit breakers. Of these sixteen circuit breakers automatically controlled, five are from the incoming power circuits from Long Island City, three are in the out-going circuits to East New York and Grand Avenue, two are in the outgoing power circuits to Rockaway Junction, two are in the outgoing circuits to Hammel, and three control the rotary converter circuits in the sub-stations. The remaining one controls the circuit supplying the auxiliary starting transformers. The bus junction and bus connecting switches are non-automatic, and therefore no relays are provided for them. The relays are mounted on a black-finished marble panel on the main floor directly under the operating gallery. The source of supply for this electric system is separate from that of any of the other electrical circuits in the station, consisting of a small storage battery of 53 cells of the Electric Storage Battery Company's type D-5.

DIRECT-CURRENT SWITCHBOARDS

Direct current for the third-rail and track circuits is distributed from the rotaries to the outgoing circuits through panel switchboards of the standard direct-current type, the panels consisting of marble slabs of standard dimensions, upon which are mounted switches, circuit breakers and instruments of standard design for the various functions required of them. These direct-current switchboards are situated in the operating gallery which contains the high-tension control apparatus mentioned above, and is directly opposite the gallery containing the high-tension oil-circuit breakers and bus-bar connections. All the essential switching and control apparatus used in regular operation is, therefore, easily handled by a single operator. The only exceptions to this are the equalizer and negative rotary converter switches, which are on pedestals adjacent to the rotary converters on the main floor.

The direct-current switchboard at the Hammel sub-station differs somewhat from the others on account of the storage battery which is there installed as an adjunct to the rotary converters. At the top of the booster regulator panel is mounted the carbon regulator which has previously been described. The carbon piles rest upon a bracket on the rear of the board and the balanced lever passes through a slot in the panel; from the rear end of this lever the horse-shoe magnet which actuates the control is suspended over the positive bus-bar, while the balancing spring with its adjusting screw and hand wheel are mounted upon a bracket upon the front of the panel. Directly beneath the regulator are two carbon break circuit breakers, one in the field circuit of each booster, i. e., the main circuit of the booster exciter. Below these are the booster field ammeters, which are of the round pattern. Directly beneath the ammeters are a set of small switches used to transfer the connections between the main battery and the carbon piles from one 100-cell section of the battery to another, so as to equalize the current consumption over the various sections of the battery. Below these are the two rheostat regulating hand wheels for the fields of the boosters and the exciters. On the booster panel are mounted four small switches for separately controlling the field circuit and the armature circuit of the two booster exciters.

The two booster panels are identical, each having two 3000-amp. switches so arranged that the booster and battery can be placed in series across the main bus, or the battery can be placed across the bus without the booster if desired. The booster panels each have circuit breakers of 4000-amp. capacity, and an ammeter of 2500-0-5000-amp. scale. The station load panel carries a Thomson recording wattmeter and the main ammeter of 15,000 amp. capacity, with two voltmeters above. There are six feeder switches mounted upon four panels, there being also a spare feeder panel arranged as described on the Woodhaven switchboard.

There is also provided at this station a battery panel of 4000 amps. capacity, upon which are mounted a large brush type circuit breaker, two switches, and a double-reading Thomson recording wattmeter. This panel is in series with the negative bus connection of the storage battery.

PORTABLE SUB-STATIONS

Frequent reference has been made in the foregoing to the portable sub-stations which were made necessary by the extremely heavy but very infrequent loads incidental to the service of race-tracks during the racing season at Belmont Park and at the Metropolitan race-track south of Jamaica.

Two portable sub-stations were provided, each consisting of a 1000-kw rotary converter with transformer, switchboard apparatus, and the necessary auxiliaries, carried in a heavy steel car resembling a freight car in general appearance. A plan of this freight car is given in Fig. 17, which shows the disposition of the apparatus. The bottom of the car is of very heavy steel beam construction, but the superstructure is as light as is consistent with the proper amount of strength. The end of the car containing the rotary converter is so built that it can be readily taken to pieces and, in fact, entirely knocked down so that the rotary converter can be easily taken apart, if necessary, by being run under the crane in any of the sub-stations.

The car in which the portable sub-station is mounted weighs without load, including trucks, draw-bars, brakes and other fittings, 49,000 lbs. The weight of the equipment mounted in it, including rotary converter, transformers, high-tension switch, low-tension switchboard panels, transformer blowers, etc., is 142,400 lbs.

Besides the rotary converter, which is identical with the previously described standard rotary converters of 1000-kw capacity, are three 375-kw transformers of the air-blast type, fitted with a blower and motor of a type similar to those described above for the sub-stations. The high-tension switching apparatus consists of a standard type "C" oil circuit breaker in a standard brick setting which is arranged between the incoming connector lugs and the transformers. High-tension current is taken into the portable sub-station through three connecting lugs placed at the high-tension end of the car, which afford a connection to three flexible leads properly supported over the track in the portable sub-station buildings. Direct current is led out of low-tension connecting lugs, placed opposite an opening in the side of the car. Lightning protective apparatus for the high-tension circuits is located permanently in the tower at one end of the building, which has been already described. The construction and arrangement of this tower is practically identical with that of the lightning-arrester houses on the trestle. It contains room for two complete arrester outfits for the protection of two entering high-tension circuits (of which only one is now installed), comprising simply the usual choke coils, low equivalent arresters and disconnecting switches. Access to the tower containing this apparatus is by means of a ladder extending up from the platform at the end of the house farthest from the entrance. Permanent low-tension connections suitably mounted on the wall within the sub-station building are connected directly to the third rail and the tracks.

The apparatus can perhaps be best described in detail by following the course of the current through it.

The high-tension connections enter through an opening in one end of the car which, when not in use, is closed by a steel flap hinged so as to fall directly over the aperture. Three connections are provided for the three-phase current, which are tapped directly to lugs that project through the rear of the oil-switch structure. The oil switch is identical in type and construction with those used throughout the sub-stations, being of 600 amp. capacity, three-pole, and electrically operated. It is set in the usual pressed yellow brick cubicle with alberene stone top and trimmings. Just before entering the oil switch, taps are taken off for two potential transformers, both of them being used for the wattmeter connections, and one of them being used as the line side of the synchronizing apparatus.

After leaving the oil switch the main connections pass through series transformers of the through type, from which run connections for the integrating wattmeter. The main connections thence run directly to the main transformers, where they fasten to the terminals of the high-tension coils. On the low-tension side of the main transformers, four connections are made between each transformer and a transformer terminal panel. These four taps are arranged so as to give four different voltages for the rotary converter, as on such a large system as this it is quite likely that the voltage at different sub-station points may vary from time to time under different conditions. This transformer terminal panel is provided with several switches, making possible four combinations of voltage. From this transformer terminal panel the main alternating connections run directly to the a. c. rotary converter panel through heavy bus-bars running up past the top of the panels. On the main a. c. panel, taps are taken off for the rotary starting motor and also for the synchronizing transformer on the machine side. From this panel the main cables run direct to the a. c. side of the rotary converter.

It should be stated here that the portable sub-station rotaries are synchronized from the low-tension side, by means of a synchroscope. That is, the rotary converter is started up by the starting motor after the transformers have been cut in, and by the aid of a synchroscope the low-tension a. c. switches on the rotary panel are thrown in by hand at the instant of synchronism. From the d. c. side of the rotary the negative connection runs direct to a lug mounted on a slab placed conveniently at the side of the car opposite the opening through which connections are made to the fixed lugs in either the portable sub-station house or in the permanent sub-station. There is no switch in this connection. The equalizer is also taken from the negative pole of the machine and run to an equalizer switch mounted on the inside of the car, conveniently to the slab supporting the outgoing lugs, whence a connection can be made to the other portable sub-station if it is in the same

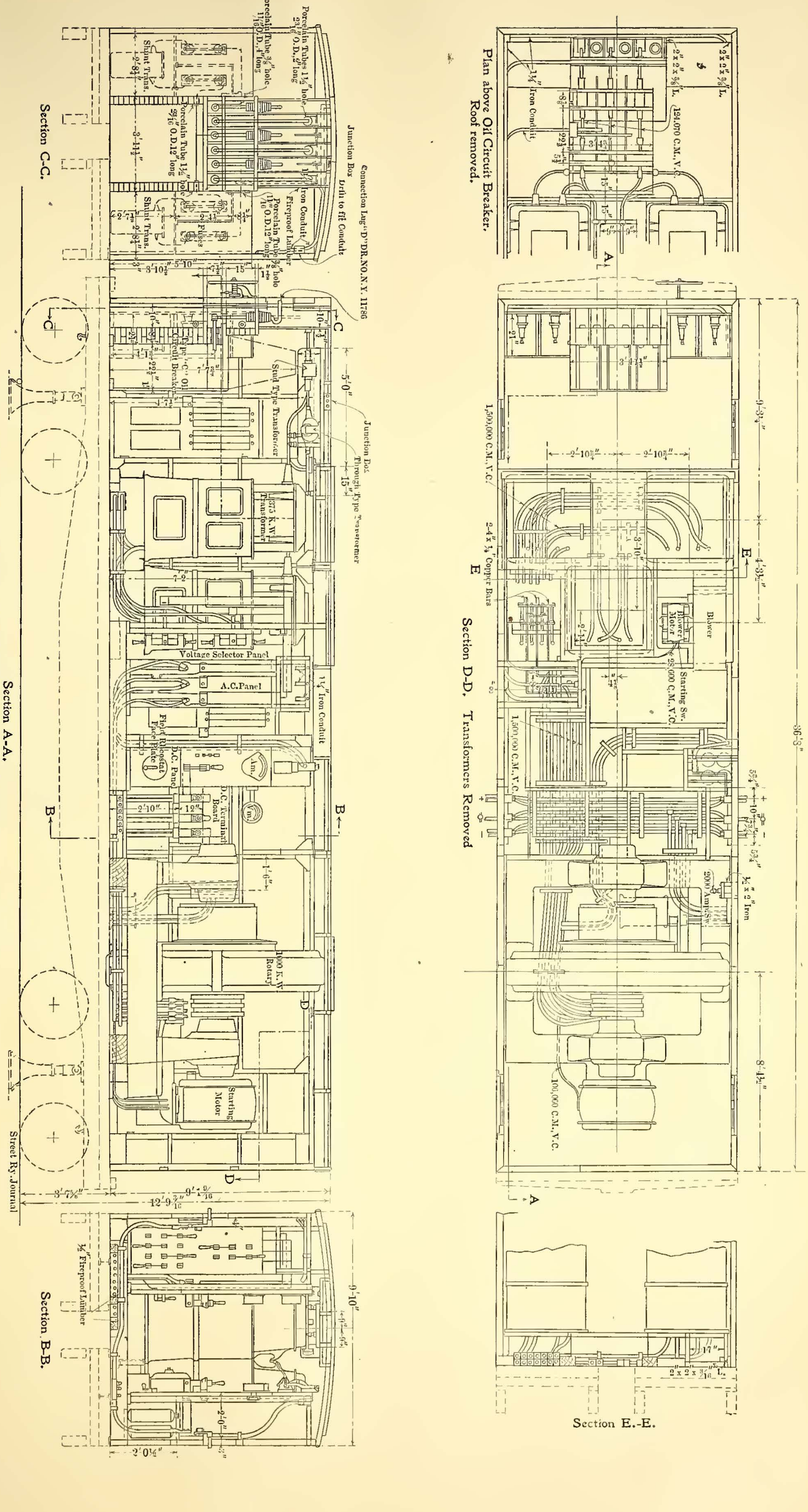


FIG. 17.—LOCATION OF ELECTRICAL APPARATUS IN SUB-STATION CAR

house, or to the equalizer bus of the permanent sub-station if that is where the portable sub-station happens to be working. The positive leg goes to a direct-current panel in the car which carries a single 2000-amp. switch, with 3000-amp. ammeter and circuit breaker. From the circuit breaker a connection is led to the slab where the taps are made to whatever third-rail circuits the portable sub-station is connected.

On the a. c. rotary converter panel are connected the power-factor meter, voltmeter, synchroscope, integrating voltmeter, an overload relay, synchronizing lamp, and the controlling handle of the oil switch.

This control is practically identical with the controls governing the switch operation in the permanent sub-station, except that as no auxiliary storage battery is carried in this car, the solenoids operating the oil switch and governed by the control handle are wound for 500-volt current taken directly from the third rail, which, of course, is always alive when it is necessary for the sub-station to be in action. There are two closing coils on the switch, and one tripping coil for opening the circuit, which operation is completed by gravity when once the tripping coil has been actuated.

The three 375-kw air-blast transformers are kept cool by a 50-in. steel plate blower fan which is able to deliver 4500 cu. ft. of air per minute at one ounce pressure when running at 710 r. p. m. This fan is driven by one 3-hp three-phase 400-volt induction motor receiving current from the a. c. rotary panel. Fig. 18 shows the car in position and connected up in the interior of a sub-station.

HIGH-TENSION LIGHTNING ARRESTERS

The disposition of the apparatus in the high-tension gallery at Woodhaven Junction sub-station is shown in Figs. 7 and 8. The arresters are of the Westinghouse low equivalent type, mounted upon marble panels which are carried on a steel angle-iron framework. The three arresters on the three legs of the high-tension circuit are separated by barriers of asbestos lumber. The arresters are all provided with knife switches so that they can be readily disconnected. There is a choke coil in series with each main circuit, mounted near the top of the steel framework. The arresters are mounted upon special porcelain insulators, and the use of wood is entirely dispensed with in the lightning-arrester gallery, thus insuring fireproof construction. The openings in the side of the house through which the cables enter are 18 ins. square, enclosed by two glass plates 3/8 in. thick, and separated 5 ins., having 2½-in. holes in the centers through which the cable and feeders pass without touching the glass. Access of rain or snow through the openings is prevented by a thin brass disk about 2½ ins. in diameter which is fastened upon each cable between the two glass plates. Standard straight-line insulators are used for supporting the bare wires inside of the building.

HEATING SYSTEM

Each sub-station is fitted with a hot-water heating system supplied from a boiler situated in the basement. The boiler burns anthracite coal and is composed of seven sections, with grates 30 ins. wide, the whole boiler occupying a space about 3½ x 4 ft.

SUB-STATION LIGHTING EQUIPMENT

The lighting in each of the sub-stations is accomplished through a transformer which has been mentioned along with the other auxiliary transformers, which supplies a 105-volt three-wire lighting bus. Switches for the lighting circuits are mounted upon a separate marble panel situated at one end of the operating gallery, which also carries the indicating and control apparatus for the small motor generator set which charges the battery that supplies current to the electrically-operated switch-control system.

Ten lighting circuits are distributed from fuse slabs carried on the back of this panel, enclosed type fuses with ferrule contacts being used. Two of the lighting circuits are fitted with double-throw switches by means of which they can be thrown either on the 105-volt transformer bus or on the direct-current bus which connects the small generator with the above-mentioned auxiliary storage battery. The switchboard panel carries a 150-volt voltmeter and a round-pattern ammeter, 25-amp. circuit breaker, and a field rheostat for controlling this small generator, and also a battery switch. Besides the foregoing there are ten switches for the accommodation of the various lighting circuits that run about the building. The number of lamps in the sub-station lighting circuits is as follows:

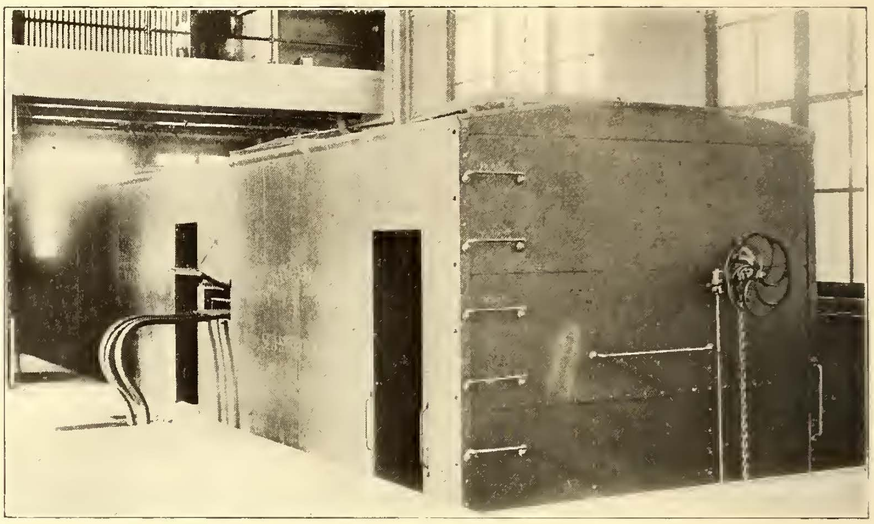


FIG. 18.—PORTABLE SUB-STATION CAR CONNECTED UP IN ROCKAWAY JUNCTION

	Incandescents	Nernst
Grand Avenue	124	6
East New York	124	6
Woodhaven Junction	184	8
Rockaway Junction	140	6
Hammel	209	8

The incandescents are 16-candle power and the Nernst lamps have four glowers each.

TRANSFORMER BLOWER OUTFIT

As the main transformers in these sub-stations are all of the air-blast type, electric-driven blowers are provided to furnish the necessary draft. They are in two sizes. At Woodhaven and at Hammel sub-stations there are two fans running at 480 r. p. m., built to deliver 18,000 cu. ft. of air per minute, at 70 deg. F., against a maintained pressure of 1 oz. per square inch. They are operated by 9.8 hp motors.

At each of the other three stations there are two blower sets, each being able to deliver 12,000 cu. ft. of air under the same conditions as above, and requiring a 6.6-hp motor at 480 r. p. m.

The fans are built of steel plate, full housed, with horizontal top discharge. The floats of all the fans are of No. 10 U. S. gage steel plate. The side sheets are of the same thickness, and the scroll sheets No. 11 U. S. gage. The shafts are about 2 11-16 ins. in diameter.

The smaller fans are built up with one spider carrying all the fan blades, while on the larger fans there are two spiders.

There are two fan bearings designed for lubrication by grease.

The motors, which are coupled direct to the fans through flange couplings, are of the three-phase induction type, operating at 400 volts from auxiliary transformers.

SIGNAL-SERVICE APPARATUS

The railroad lines are protected by a block signal system especially devised to work with alternating current, by which means it becomes possible to make use of the well-known feature of short-circuiting the two rails of the track without requiring that one of them shall be devoted only to signaling purposes, which would cut down by one-half the capacity of the track return circuit. Accordingly this power is taken from a set of transformers placed in the Woodhaven Junction sub-station. There are two transformers of 100 kw each, only one being in service, the other being used as spare. These take 11,000-volt current (single phase) and transform it to 2200-volt current for use in the signal system. The transformers are located in the basement and are supplied through a type B, 11,000-volt oil switch mounted on a separate marble panel.

AIR-CLEANING SETS

There is provided at each sub-station an electric-driven air compressor of the Westinghouse Traction Brake Company's "type D-4." The motors driving these compressors are wound for 600 volts direct current. Their capacity is 50 cubic feet of free air per minute, up to 100 lbs. pressure. The motor is geared to the compressor. The compressor supplies a system of air piping running to outlets conveniently placed for blowing air into the rotary converters and the switching apparatus for cleaning.

CONCLUSION

The sub-stations were first supplied with high-tension current from the overhead lines, and tested out on April 27, 1905, and current was first furnished from Woodhaven Junction to the third rail for car tests May 13, 1905. The portable sub-stations were first placed in operation June 12, 1905. Regular operation of the permanent sub-stations began July 26, 1905.

The design and construction of the foregoing sub-station system was carried out by Westinghouse, Church, Kerr & Company, engineers for the Long Island Railroad Company, under the direction of George Gibbs, chief engineer of electric traction of the Long Island Railroad Company, subject to the approval of an electrical committee consisting of the chief operating officials of the road, with the president as chairman.

The Pennsylvania Railroad Company has made another movement in its fight against trolley competition between Mount Holly and Philadelphia. Shortly after the lines of the Burlington County Railway Company were placed in operation and connected with what are now the Public Service Corporation's lines between Moorestown and Camden, the electric railway rate was fixed at 46 cents for an excursion trip between Mount Holly and Philadelphia. About a year ago the Pennsylvania Company evidently felt the effect of the competition, and its excursion fare was reduced from 70 cents to 59 cents, and tickets sold in strips of ten were reduced so that the excursion rate would be 54 cents. Those who frequently make trips to Philadelphia took advantage of the strip tickets, but the return to the Pennsylvania lines was so great that now 100-trip tickets, good for one year from date of issue, have been placed on sale, at the rate of $17.50. This makes an excursion trip to Philadelphia cost but 35 cents, which is eleven cents less than the trolley road offers.

REPORT OF COMMITTEE OF AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION ON ELECTRICITY ON STEAM RAILROADS

The instructions of your committee on electricity on steam railroads read as follows: The committee to consider and present to the association the relative advantages of the different systems of electric traction now in use as applied to interurban and suburban lines; also, as far as possible the relative cost of operating such lines by electricity and steam. The committee are also instructed to include in its investigations the different systems of gasoline, gasoline-electric and steam motor cars. This commission is almost the first recognition in this association of other motive power than the steam locomotive, and your committee doubts its ability to cover the whole ground of its instructions in a perfectly satisfactory and comprehensive manner, for the reason that the factors in each railroad proposition vary from its neighbor even as men vary in their personal characteristics.

We understand that main-line operation is not to be considered, but that branch lines, suburban and interurban lines which are feeders to main lines are to be discussed. We understand, also, that the question relates mainly to passenger traffic on account of the expression "now in use," as electric traction of freight is carried on to a limited extent only at the present time. Mail, baggage and express are being handled, but these are generally considered in connection with or a part of the passenger traffic. No steam railroad will consider abandoning its freight service in favor of electric passenger service, and we are therefore under the necessity of considering provisions for both classes of service, and for convenience the passenger service will be taken up first. The class of service we have to consider breaks away from the steam-railroad ideas of trains of cars drawn by locomotives, and takes up the individual car or cars, each provided with means of propulsion taking power from some central source.

The main business of railroads is to sell transportation, and the only object in considering electric traction is to ascertain whether the cost of carrying passengers can be decreased or the amount of travel be so increased as to provide additional revenue to the road offering it. Inasmuch as the proposition in hand is based on the street car idea and methods it might be well to look up the history and development of that branch of traction which began in this country about 1850, the cars being drawn by horses. In 1873 the cable system was introduced, and after twenty-five years very few survived, although the cost of their construction was very heavy. The early development of motor-driven electric cars occurred mainly after 1880, and in the year 1890 the census report gives for the United States the following mileage for street and suburban railways:

Electric	1,261.97	miles
Animal	5,661.44	"
Cable	488.31	"
Steam	711.30	"
Total	8,123.02	"

In 1902 the mileage was:

Electric	21,907.59	per cent, increase	1636.
Animal	259.10	per cent, decrease	95.4
Cable	240.69	per cent, decrease	50.7
Steam	169.61	per cent, decrease	76.2
Total	22,576.99	per cent, increase	177.9

Thus it will be seen that, although there was a very large increase of total mileage in the above twelve years, yet the greater proportion of the increase of electric traction was at the expense of the other methods of traction. During this period there were some ephemeral experiments in the use of batteries and of stored compresssd air for power purposes on cars, but none of these survive.

The above figures show the backward development also of the steam-driven or "dummy" for such service, despite the vast advance in steam railroading proper during these years, and this in itself is almost a complete argument against the steam car or other types of self-propelled car, except for special situations.

In early electric street railway traction several attempts were made to utilize an electric locomotive, but these were generally abandoned, although it is customary now on some roads to have trail cars attached to leading motor cars. The latest and most advanced practice is to have all cars equipped with motors controlled from the leading car. The development in electric cars has been marked, not only by their increase in size and carrying capacity, but also in the size of motors employed. The earlier cars had 15 or 20-hp equipment, but it was soon found that these were inadequate to properly accelerate loaded cars, and now many heavy suburban cars are equipped with four 75-hp motors each, and in some cars the motor equipment totals 400 hp. We have, therefore, available for comparison the steam railroad train, consisting of a locomotive with as many cars as the service demands, running at infrequent intervals, and covering perhaps 200 miles per day, as against the same road operated with individual electric cars, obtaining power from a general source, running at frequent intervals and fairly equivalent mileage. It is perfectly apparent that the density of traffic is the ruling factor as to whether the steam or the electric road will prove the more profitable.

It is quite well known on old-established lines what the passenger returns will be with fairly steady business conditions, provided there is no change in the train accommodations, but if there is an increase in train service it is almost sure to build up an induced traffic, the amount of which is difficult to estimate. Unless, therefore, there is a reasonable basis of expectation for such traffic, the steam railway that can fully care for its own is not in need of a new system, and the expediency is doubtful. On the contrary there are many sections of the country, well populated and suburban districts, where an increase of travel may be induced by improved facilities, the amount of which can be gaged by the density of population.

The travel which is contemplated is the local, short runs, which in many cases has been taken from steam railroads by competing electric lines, this proving that the more frequent service and general convenience of the trolley line is more attractive. Absence of smoke and cinders, open cars in season, connections with city lines, all add to the popularity of the trolley and give a business that can be profitably carried at lower rates, which, after all, is the main inducement. It is believed, therefore, that where there is a sufficient density of traffic it will pay steam railroads to handle their local suburban and interurban travel electrically, giving frequent trains and frequent stops, equaling the convenience and accessibility of trolley lines, for which the public does not have to stop to consult time tables, buy tickets and go to inconvenient points to get on trains. Traffic of this kind should have its separate tracks, as it would get in the way of fast through trains and itself would be impeded by slow freight trains, using the same tracks.

It would be possible to make a combination service in some territories, running slow freight through at certain hours when travel was light, or if the character of the freight would permit, to have special separate freight units which could keep out of the way of passenger traffic. As before stated, the particular class of service and the system to be used must be chosen with special reference to the situation, and these vary so that no general rule or information will apply. It is our belief, however, that few situations will figure out profitably with the combination service, and that if electrification is warranted for passenger traffic, that a complete change will be desirable, except possibly where there is through travel involved also.

RELATIVE ADVANTAGES OF DIFFERENT SYSTEMS OF ELECTRIC TRACTION NOW IN USE

By far the greater portion of the present car equipments are for the use of direct current, but of late alternating current has entered the field and there are some very interesting single-phase operations, the motors employed being capable of running on either direct or alternating current, and by having suitable transformers on the cars, high line voltage may be carried, thus reducing the cost of distribution.

Long-distance distribution is best accomplished by alternating current of high voltage, and if direct-current motor equipments are used the current is transformed at sub-stations at suitable intervals and generally not over ten miles apart. These stations are equipped with transformers for stepping down the voltage, and with rotary converters for changing the current direct at suitable voltage for the line. Sub-stations on lines employing single-phase machinery have only the transformers, no rotaries being required, and this also cuts off cost of attendance except occasional inspection.

The single-phase operation is economical on account of high voltage used on the line, and cheapens very much the cost of distribution from the sub-stations, there being no difference between the power station and sub-stations. The car equipments, however, are more expensive than direct-current apparatus, so that, assuming both to be of equal efficiency, the number of equipments and apparatus required must be considered, and their extra cost weighed as against the low cost of direct-current machinery and more expensive distribution to the line. The present New York Central-New Haven Railroad situation is an interesting example of the application of these two systems of electric traction, and the ultimate working out of these two great problems will add greatly to the shaping and development of the future of electric traction.

RELATIVE COSTS OF OPERATING BY ELECTRICITY AND STEAM

The relative costs of operation with electricity and steam are difficult to state as there is very little accurate information of value. The results obtained by attempting to draw comparisons from hypothetical roads would depend entirely upon the assumptions which were made. For instance, a set of conditions could be assumed which would show a much lower cost of operation by electricity than by steam; another set could be assumed which would show practically equal cost, and a third set which would show that steam operation would be the most economical. In view of the fact that the assumptions would govern the results, it is believed that information of this nature would not be of value to the association and might lead to erroneous assumptions and misunderstanding.

A number of electrifications are under way at the present time, employing various systems of distribution, and a considerable amount of data will no doubt be available in the near future.

Relative subjects which would be of interest and value to this association are the character of the shops, shop equipment and apparatus necessary for the maintenance and repair of electric equipment; also the power houses and their equipment.

GASOLINE, GASOLINE-ELECTRIC AND STEAM MOTOR CARS

Some time prior to the development of electric interurban railways the steam motor car or dummy, in many cases hauling a trailer, was used to a moderate extent, but at the present time few of these remain. In response to a demand from railroad managers for a motor car to operate on branch lines and special situations, there has been recently a development of motor cars employing gasoline in an internal combustion engine, this engine either directly driving the car or driving a dynamo to generate current to be used for driving motors in the trucks. Some builders interpose batteries between generator and motors to store the current when it is not all needed for propulsion, and to assist in starting on grades when the generator capacity may be insufficient. There is very great flexibility and convenience in this combination, but it is attained at very considerable expense and complication, and requires unusually skilled attendance not commonly available in railroad service.

The examples of the gasoline engine, electric generator, battery and motor types are the cars of the St. Joseph Valley Traction Company's line, built by F. M. Hicks, and the Strang car that lately made a successful run from New York to Kansas City. The gasoline engine on these types is set to run at a constant speed, and this characteristic is essential for the best economy of the internal combustion engine. The size of the engine used may be proportioned to the average power required for normal operation, and the speed variation and excess of power above normal requirements may be supplied by the battery equipment, which also comes into play for lighting and short movements and would also be available to bring the car in in case of a breakdown of the engine or generator.

The gasoline-electric type not employing batteries is illustrated by the D. & H. car recently built by the General Electric Company. The generator on this type of car has to be equal to the maximum requirements, and in order to vary the current for the conditions to be met, the field excitation is handled by a separate exciter, chain-driven from the main generator. The controller is semi-automatic and can be set for any predetermined maximum acceleration, and the speed of the car is governed by varying the field strength of the generator. The speed of the engine remains constant after acceleration. This application is very ingenious and effective, and we understand that the car has been put into regular service between Schenectady and Saratoga.

The Union Pacific motor car, representing the direct mechanical drive application of gasoline power, is driven by a six-cylinder reversible gasoline engine, with crank shaft at right angles to the length of car; a sprocket mounted on same, driving a special chain, transmits the power direct to the driving axle through a second sprocket attached to the axle. The chain easily shows a transmission of power with an efficiency of 97 per cent, which clearly demonstrates that this method of transmission is very close to the maximum efficiency possible. For the initial start of car, or putting it in motion, a reducing gear is used, and, until the car attains a speed of six or seven miles per hour the economy of this transmission is somewhat reduced; but, as the use of the gears is only temporary and lasts only a few seconds, it can almost be left out of consideration.

The roof of the Union Pacific motor car is 24 in. lower than the standard height of coach roof. As the car is built of steel, with pointed end and smooth exterior surface, the wind resistance is materially reduced, enabling a 100-hp gasoline engine to drive the car at the rate of 65 to 70 miles an hour.

The car framing is a combination of steel shapes and braces, the whole tied together by steel plates, making a unit structure, each part supporting the adjacent ones and bearing its proportion of the burden imposed upon it. These cars weigh, motor and all, 26 tons, which of course is a very material factor in the high speed attained by cars in service, and affords considerable economy in comparison with the heavier steam motor cars, some of which weigh seventy-five tons and over, with the same seating capacity. Motor car No. 7 has seating capacity for seventy-five people, and has, in actual service, carried ninety-five. One of the most important features in the development of the steel motor car is the reduction in height of car and consequential reduction in weight and decreased wind resistance, a result of which is the system of ventilation—taking fresh air from the front of a car, delivering it at floor level and by suction drawing the foul air out of the roof.

Motor car No. 7 is equipped with metal round-sash windows—a window impervious to cold air, dust or water; in fact, is tight as a porthole on an ocean-going vessel. These windows have demonstrated themselves to be a great luxury to the traveler. The enclosed inside steps, with side-door entrance, have also proven very popular with the traveling public. This side-door entrance is permissible with steel-car construction without weakening it. The side sill is depressed and divided, a portion being carried over the door and the other portion under, all being tied rigidly in combination with the plate and steel sheathing of the car. This forms a structure of such strength as to eliminate the usual weakness caused by a side aperture the size of door-opening in these cars. The first cars—55 ft. in length, seating capacity seventy-five and with an engine of 100 hp—are particularly adapted for branch-line service, where the traffic is insufficient to support a steam service or anything like electric service.

Interest in the steam car is also being revived, as, for example, the Ganz cars imported from Budapest by the Florida East Coast Railways; also the Erie Railroad and the C. P. R. R. are experimenting with a steam car equipped with a Scotch marine type of boiler, using a superheater and oil fuel. It is believed that some one may undertake to make a so-called flash boiler that will be applicable to this service.

SERVICE AND UTILITY OF MOTOR CARS

It is recognized that the so-called motor car, one carrying its own motive-power plant, whether gasoline, gasoline-electric or steam, occupies a distinct field of usefulness. On many branch lines, now existing, where travel is light, and on new extensions into unsettled country where the business will not return a profit on steam train service, it would have to be run at a loss until a sufficient business was induced or built up by the travel facilities afforded. These situations are the distinct field of the motor car, which can be operated for less per car-mile than by regular steam train or electric methods until the volume of business will warrant the regular transportation methods.

The use of motor cars on the Union Pacific is picking up passengers on branch lines; and in delivering passengers at connecting points for through trains, the service of these motor cars is exceedingly lucrative. The matter of giving the branch-line patrons of any steam road increased service, with more frequent trips per diem, is very much appreciated by the local community, and their good will is beneficial.

On the hypothesis of the same density of traffic, with the same class of service as would be encountered on one of the ordinary branch lines of the territory west of the Missouri River, the cost per mile for local train service, equipment consisting of two cars and a locomotive, would be about 24 cents, including repairs, fuel, oil, labor, cleaning, etc.; this for passenger, as well as baggage, mail and express service.

Electric service equipment, consisting of one car and trailer, figuring that the density of traffic is sufficiently regular to support same seven days in a week, is estimated at about 18 cents a mile.

The gasoline service (mechanical-drive only considered), consisting of one car and trailer, with baggage, mail and express service, would cost 15 cents per mile. The latter, of course, would be independent of whether service was six days or seven days per week, the cost simply depending upon the service rendered.

Railroads, therefore, have a choice of the various systems proposed, and a study of the conditions to be met and facilities afforded, both in the way of care and maintenance, as well as the train service proposed, will give the elements by which each situation will have to be studied. The motive power departments will be called upon to participate more and more in advising as to these questions, and in order to be qualified to undertake such work it is very desirable to introduce information and discussion of these subjects in this association.

C. A. Seley, Chairman,
W. R. M'Keen, Jr.,
L. R. Pomeroy,
C. F. Street,
F. J. Cole,
Committee.

DEPRECIATION TO BE DISCUSSED AT ACCOUNTANTS' CONVENTION

W. B. Brockway, the president of the American Street and Interurban Railway Accountants' Association, has sent an important letter to the members, calling their attention to the fact that the subject of depreciation is one which this association has not carefully discussed, although it received some attention at the organization convention in 1897. For several years it has been contemplated by the different administrations of this association as a subject for the convention programme, and each time it has been, for various reasons, laid aside for future consideration. Mr. Brockway feels confident that the members agree with him that it cannot longer wait for careful and searching investigation, not only on account of its own worth and importance, but also because of the report upon municipal trading to be made by the National Civic Federation before the 1907 convention will be held. This year the Accountants' Association has the hearty support of the American Street and Interurban Railway Association, and that, in connection with the importance of the subject itself, bids fair to put before it the most far-reaching subject it can consider for some time to come.

The executive committee has discussed the method of approaching the subject, and has decided to arrange an executive session at the coming convention in Columbus, and to hold the publication of the discussion completely within the range of those companies represented. It must be explained that it is by no means intended to try to make this one session cover the whole subject. It is intended to only form the groundwork, so that what further steps may be taken will be left to the action taken by the meeting.

Arrangements so far made provide for a paper, or more properly a review, of what can be found upon the subject of "Depreciation and Appreciation as Applied to Electric Railways." This is being prepared by Robert N. Wallis, treasurer of the Fitchburg and Leominster Street Railway, Fitchburg, Mass., and second vice-president of this association. This will place before those present the subject as he finds it. Then, with what has been written upon the subject in mind, there will be an academic discussion upon the question, "Does the Maintenance of an Electric Railway, at a High Standard of Efficiency, Eliminate the Necessity of a Charge for Depreciation?" It is intended to hold the discussion quite to this question, bearing in mind that other questions and other features of the subject will, in all probability, follow for consideration at another time.

In conclusion, President Brockway requests the members to write their views to him as promptly as possible, care of the Hotel Schenley, Pittsburg, Pa., that he may gather the opinions for the use of the executive committee.

SINGLE-PHASE EQUIPMENT FOR RICHMOND & CHESAPEAKE BAY RAILWAY COMPANY

The Richmond & Chesapeake Bay Railway Company, which was recently incorporated to build an electric railway from Richmond to Ashland, Va., has decided to equip about 15 miles of track immediately with single-phase apparatus. Eventually this single-phase road will extend from Richmond to Chesapeake. The contracts for the equipment of this section have been let to the General Electric Company.

The road will practically parallel the Richmond, Fredericksburg & Potomac steam road from Richmond to Ashland, and it is the intention to maintain a fast schedule between these two points, operating cars at very frequent intervals.

The line in general will follow the plans which several roads in the Middle West have adopted, but the trolley voltage will be higher. The catenary method of suspension will be used, adapted for a trolley potential of 6600 volts. Each of the cars will be equipped with four GE A-603 (125) single-phase motors. Multiple-unit control will be furnished, using the Sprague-General Electric system. The air-brake system will be of the combined straight and automatic type, with C. P. A.-52 motor compressors.

Power for the operation of the new road will be furnished by the Virginia Passenger & Power Company. Two generating sets will be furnished, both to be operated ordinarily by water power, but arranged for electrical drive when necessary. The first unit will consist of a 750-kw, 6600-volt, three-phase, 25-cycle generator, mounted on the same shaft with a 750-kw, 2300-volt, 60-cycle, three-phase generator, the shaft being extended at one end for connection with a water wheel of sufficient power to drive both generators at their rated output.

The second set will be made of a 25-cycle, 6600-volt generator, a duplicate of the first, but instead of being mounted with a 60-cycle machine, this generator will be mounted on the same shaft with a 750-kw, 550-volt direct-current machine. When there is sufficient water to operate all of the water-wheel generators in the station, these sets will be driven by the water wheels; if at any time there is sufficient water to drive the generators, or flood conditions render it advisable to close the gate valves, the sets will be disconnected from the wheels and operated as straight motor-generator units. In their respective cases, the 60-cycle generator will run as a 60-cycle synchronous motor, and the 550-volt machine will operate as a direct-current motor. Power for driving the motor end of the 25-cycle sets in this way will be obtained from the engine-driven units of the Virginia Passenger & Power Company already installed. When the motor-generator units are operated as water-wheel driven machines, the 60-cycle generator will be operated in parallel with the present 60-cycle machines, and the 550-volt machine in the other set will run in multiple with the present 550-volt machines. The

750-kw, 25-cycle generators in each set will for the present be operated as single-phase machines, and will supply current directly to the trolley of the Richmond & Chesapeake road at 6600 volts.

In addition to the main apparatus outlined for the road, there will be a lighting station at Ashland. This will consist of a 100-kw, 2300-volt, 60-cycle, three-phase generator mounted upon a common base with a 150-hp, 440-volt, 25-cycle single-phase induction motor. This set will be operated from the 6600-volt trolley through a 150-kw, single-phase, oil-cooled transformer. The motor-generator set will be provided with a direct-connected exciter mounted on an extension of the shaft. The voltage will be controlled by a Tirrill automatic regulator, which will insure a uniform voltage at the generator end of the lighting service regardless of the fluctuating trolley voltage.

PRESSED STEEL CAR AT ATLANTIC CITY

The Pressed Steel Car Company, of Pittsburg, which has recently gone into the building of steel passenger cars on a large scale, and which delivered last spring to the Metropolitan Street Railway, of New York, a steel street car for the Broadway line, has within the last few days completed another steel street car for San Francisco.

The latter is of the California combination type. Although built of steel it has the same general appearance as a wooden street car, due to the graining of the visible steel posts, etc., so as to resemble wood. Hence it is not noticeably different from a wooden car of the same general type.

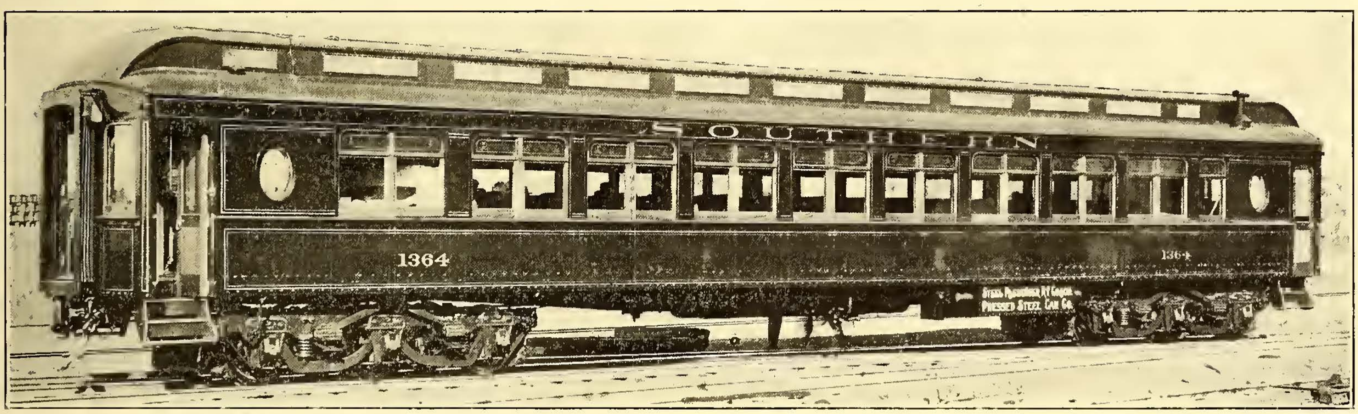
The Pressed Steel Car Company has also under construction a number of all-steel and combination steel and wood passenger cars for electric and steam railroads, among which may be mentioned three passenger coaches for the Southern Railway. The company had one of these Southern cars on exhibition at the Master Mechanics' and Master Car Builders' Conventions at Atlantic City this week, and as these cars represent entirely new departures in passenger construction, a short description of them may be of interest, even if the car itself will not be used directly in electric railway work.

The length over the platforms of these cars is 74 ft. 6 1/4 ins.; length over the body end sills, 66 ft.; total inside length, 65 ft. 3 1/4 ins.; distance from the center to the center of the trucks, 50 ft.; width over the side sheets, 9 ft. 10 1/4 ins.; width inside between finish, 8 ft. 10 3/4 ins.; height from the top of rail to the top of the body, 14 ft. 2 ins.

These dimensions are those of the standard coaches of the Southern Railway, and the interior arrangement of seats, smoking room and saloons, as well as the general equipment of the car, is the railway company's standard whenever practicable. The underframe, superstructure, platforms, platform sills, body carlines, and the side sheets of the cars on the outside below the windows are made of steel in the form of plates, pressed, rolled or built-up parts, according to the requirements and the adaptability of the material.

The interior finish, doors, windows, window sash, upper part of floor, roof, and the outside above the window sills is made of wood. The floor is of 1/8-in. steel plates upon which are laid two courses of wooden flooring, each 3/4 ins. thick, with 1/8-in. felt paper between. The top of the floor is covered with 3-16-in. thick linoleum. The framing at the ends consists of angles at the corners and of three channels reinforced with plates on each side of the door. The platforms are supported on the center sills and on 6-in. channels. The platform end sills are pressed of 5-16-in. steel plate into channel shape and to suit vestibule fixtures.

All vertical lines of rivets on the outside of the car are covered with special drawn-steel mouldings, which give the appearance of broad panels as used on some wooden cars. On account of using the Railway Company's standard six-wheel trucks with standard height of bolsters and center plates, it was impossible to make the depth of center sills over the trucks sufficient to bring the center line of the draw gear above the lower edges of the center sills; the center line of the draft gear is therefore below the sills.



PRESSED-STEEL CAR FOR TRUNK-LINE SERVICE, BUILT FOR THE SOUTHERN RAILWAY

The following specialties are used on these cars: Westinghouse high-speed automatic air brakes and Lindstrom hand-brake lever; Diamond special brake beams; Buhoup three-stem couplers; Pantasote curtains with Forsythe fixtures; Southern Railway standard draft gear; Gould car-heating system, and one 16 "D" stove; McCord journal boxes; the Pintsch system of lighting; Buhoup platforms, wide vestibules, with King automatic closers; Chicago automatic frictionless side bearings, and 36-in. steel-tired McKee-Fuller wheels.

The construction of these cars has been worked out by the Pressed Steel Car Company, subject to the approval of important parts by Mechanical Superintendent A. Stewart and Consulting Mechanical Engineer R. L. Ettinger, of the Southern Railway, and while the construction as a whole, as well as in details, may be more or less changed in future similar cars, it shows a decided improvement in the right direction, namely, a car offering greater resistance to damage in accidents as well as minimizing danger to passengers in such emergency. It is understood that the Pressed Steel Car Company is now preparing drawings of still further advanced types of steel passenger coaches and steel trucks, these constructions to embody the use of fireproof materials.

EXTENSIVE TRANSMISSION PLANT AT WINNIPEG

On May 30 the Winnipeg Electric Railway Company officially completed one of the most modern water-power constructions on this continent. The hydro-electric station just built utilizes the water of the Winnipeg River at a point about 65 miles from Winnipeg, where a head of about 40 ft. has been obtained. The power station, which is of concrete, contains four 1000-kw and five 2000-kw 60-cycle, three-phase, General Electric alternators coupled to McCormick turbines and Lombard governors, as well as a number of smaller machines, exciters, etc. Power is generated at 2300 volts and is stepped up to 60,000 volts, which is the transmission voltage. There are fifteen transformers comprising five banks, consisting of two banks of 830 kw and three banks of 1800 kw. The secondary and primary coils are provided with taps for the following voltages: 2200, 2300, 2400 volts secondary; 40,000, 50,000, 60,000 volts primary. The transformers are arranged for delta connections on both the high and the low-tension side; the voltage in operation is stepped up from 2300 volts to 60,000 volts for transmitting to the sub-station at Winnipeg over a distance of 65 miles. The 1800-kw transformers bear a manufacturer's guarantee of efficiency at full load of 98.2 per cent; regulation non-inductive, 1 per cent; regulation, 90 per cent power factor, is 2.5 per cent. The 830-kw transformers have a guarantee of full-load efficiency of 97.7 per cent, the regulation to be the same as that of the 1800-kw transformers.

As the transformers are of the oil and water-cooled type, there is provided a duplicate system of piping for both water and oil, with valves so that any one transformer or any bank can be cut off. The water piping is tapped from the tube of the exciter water wheel. The oil system is operated from oil tanks in the basement of the generator room by means of an air compressor driven by a three-phase, 220-volt induction motor, which was furnished by the Canada Foundry Company. There are three oil tanks, a receiving, a supply and an emergency.

From the power house duplicate transmission lines of No. 2-0 cable, with a hemp center, are run on steel towers to the sub-station at Winnipeg. The line crosses the Winnipeg River with a span of about 760 ft., on 72-ft. towers, each weighing about six tons, with a sag in the line of about 23 ft. at 50 deg. F. The standard towers are spaced 500 ft. apart, are 40 ft. high and the line sags about 14 ft. at 50 deg. F. Each tower weighs about 2400 lbs. There are four railroad crossings. The Red River crossing at Winnipeg near the sub-station has a span of about 1100 ft., the towers being 105 ft. high, the sag in the line about 45 ft. at 30 deg. F. Each 105-ft. tower weighs about 15 tons. The railway and the river crossing towers are built up on concrete footings. All of the towers are well grounded and are provided with lightning arresters, consisting of steel rods with ends pointed, bolted to the verticals and projecting mid-air above the highest point of the line. The transmission line, which has ten complete transmission spirals, is paralleled by a telephone line of No. 8 hard-drawn copper wire on the towers, which is transposed at each tower. The telephones are of the iron-box type, purchased from the Mayer & Englund Company, Philadelphia, with 2500-ohm ringers, so arranged that when the door of the telephone is closed the ringer is cut out of the circuit. These instruments are located every five miles along the line. There will be six patrolmen who will also be provided with watch-case transmitters for testing purposes.

Where the line leaves the power house and where it enters the sub-station, there are left in the wall of the building openings in which are mounted 60,000-volt insulators, and on the outside of the buildings there are provided hoods of expanded metal with cement coating, the bottom of which carries a high-tension Locke bushing, using 24-in. tube which has withstood test voltage of 130,000. The line passes through these bushings over insulators supported on brackets to the towers. The line was designed for a drop not to exceed 10 per cent.

The sub-station at Winnipeg is a brick and steel structure, having a length of 176 ft. and a width of 70 ft. 6 in., the height being 49 ft. 10 in.

The high-tension switches, the low-tension transformer and bus sectionalizing switches are of the motor-operated oil type. The feeder and motor-generator oil switches are of the solenoid-operated type. Disconnecting switches are placed between the high-tension and the low-tension buses and the oil-switches.

The source of supply for operating the motor-operated and solenoid-operated oil switches consists of 55 cells of chloride accumulators located in the basement of the building. The storage battery panel containing the 500-volt charging rheostat is located on the switchboard gallery about in the center of the main switchboard, where it is convenient for the operator. The low-tension buses are located in pressed brick compartments back of the low-tension switches, each phase being separated by a concrete slab.

In the sub-station there are six 1800-kw and nine 800-kw step-down transformers. The transformers are oil and water-cooled, with the same guarantee as to efficiency and regulation as those at the power house.

For direct-current railway and stationary motor work the ultimate capacity of the station will be seven 800-kw synchronous motor-generator sets operating at a speed of 400 r. p. m., with 2300 volts on the alternating side, 550 to 600 volts on the direct side. The generators may also be operated as shunt-wound generators at 600 volts. With a proper shift of the brushes the direct-current machine may operate as a direct-current motor giving 630 to 700 kw from the synchronous motor operating as a generator. These machines are provided with 17-kw, 125-volt exciters mounted on brackets on the extension of the synchronous motor shafts, and are provided with speed-limiting switches and end-play devices. The cost of the complete plant will amount to approximately $4,000,000.

The officers of the Winnipeg Electric Railway Company are as follows: William Mackenzie, president; William Whyte, vice-president; F. Morton Morse, secretary and treasurer; W. Phillips, manager. F. S. Pearson, of New York City, is the consulting engineer of the whole work, the details of which were carried out by L. J. Hirt, as mechanical and hydraulic engineer for Mr. Pearson.

The electrical apparatus was furnished by the Canadian General Electric Company, Limited; the turbines by the S. Morgan-Smith Company; the towers, air compressers and centrifugal pumps by the Canada Foundry Company, Limited; the transmission line copper by the Ansonia Brass & Copper Company, and the insulators by the R. Thomas & Sons Company.

The National Fire Protection Association, at its meeting in Chicago, passed a series of resolutions calling attention to the tremendous fire waste in this country, which it says involves a loss per capita several times greater than in other countries, and the public protection has not kept pace with the growth of buildings and increase of valuation in congested centers. The association therefore issued an urgent appeal to adopt approved methods of construction and introduce automatic sprinklers and other private protection.

SARATOGA CONVENTION OF THE NEW YORK STATE ASSOCIATION

As previously announced, the twenty-fourth annual convention of the Street Railway Association of the State of New York will be held at the Grand Union Hotel, Saratoga, June 26 and 27. Morning and afternoon sessions will be held on Tuesday and a long morning session on Wednesday to complete the work of the convention.

The executive committee announces the following list of papers and reports:

In addition to the reports of regular committees important recommendations will be made by the special committees on "Standard Application Blanks and Forms for Employees"; "Collection and Compilation of Mechanical Costs"; "Interchangeable Coupon Books"; "Rules"; and "Revision of Constitution and By-Laws."

Papers will be presented as follows: Three papers on "Sale of Water Power," by S. B. Storer, general manager Niagara, Lockport & Ontario Power Company; Charles E. Parsons, electrical engineer Hudson River Power Company, and G. A. Harvey, electrical engineer International Railway Company, Buffalo. Paper on "Interurban Railways," by C. Loomis Allen, general manager Utica & Mohawk Valley Railway Company. Paper on "Car Inspection," by D. F. Carver, general superintendent Rochester Railway Company.

There will also be a question box, comprising the following questions:

1. What has been your experience during the past year with steel wheels?
2. What has been your experience during the past year with the brake-shoe question?
3. What progress have you made in oil lubrication?
4. What is the best form of car sign for indicating routes?
5. What new methods or schemes for creating summer pleasure travel have you found?
6. What new methods or schemes for creating winter pleasure travel have you found?
7. What is the status of the express and freight question on electric roads? What are some of the "does" and "don'ts" that have come under your observations in connection with this matter?
8. State one or more particular things done by you that have reduced, or tended to reduce,
   - (a) Maintenance of track and roadbed?
   - (b) Maintenance of electric line?
   - (c) Maintenance of steam and electric plant?
   - (d) Maintenance of cars and equipment?
   - (e) Miscellaneous shop expenses?
   - (f) Cost of producing power per kilowatt-hour?
   - (g) Number and cost of accidents?
9. Has Young Men's Christian Association work proved a desirable adjunct in electric railway operation?
10. How can we enlarge the scope and usefulness of the Street Railway Association of the State of New York

The entertainment committee promises a number of pleasant events and outings, among which will be a carriage drive in and around Saratoga for the ladies on Tuesday afternoon; banquet Tuesday evening; trolley ride and luncheon Wednesday morning; dancing party in the ballroom of the Grand Union Hotel, Wednesday evening. On Thursday there will be an excursion to the General Electric Works for such of the delegates and guests as desire to remain after the convention adjourns. Luncheon will be served at the works.

The steam railroads have made the usual reduction of a fare and a third for the round trip to Saratoga, but in order to secure advantage of this reduction each attendant must obtain a certificate from the railroad ticket agent at the time the ticket is purchased, and this certificate must be vised by the secretary at the meeting.

There will be no official exhibits under the auspices of the association, but a cordial invitation to attend is extended to representatives of supply houses and manufacturing concerns. It has been decided to charge representatives of manufacturing and supply houses $15, payable as a registration fee at the time of registration for the annual meeting. This fee will entitle the concern or company to send two representatives to the annual meeting, and will include one banquet ticket. If more than two representatives are sent, a fee of $10 will be charged for each additional representative, and each such additional fee will also include one banquet ticket. Additional banquet tickets will be sold at $6 each.

If attendants take last year's convention badge to Saratoga a new bar for this meeting will be furnished free. Anyone requiring a new badge will be charged $1, or actual cost, of the same.

It is probable some action will be taken at the Saratoga meeting looking to the admission of electric railway companies located in adjacent and neighboring states, not now included in any of the state or sectional associations, to associate membership in the New York State Association. This will also apply to the roads in the portion of Canada bordering on New York State. It is probable the associate membership class will also be extended to include individuals, firms and companies identified with engineering, financial and other interests associated with electric railway work.

The executive committee in issuing the call for the meeting extends a cordial and urgent invitation to be present and co-operate in the convention to everyone in any way interested in, or identified with, electric railway work, including representatives of member companies, non-member companies in the state, railway companies located near New York State, and representatives of engineering, financial, supply and manufacturing houses.

A BOOKLET ON SYDNEY'S TRAMWAY SYSTEM

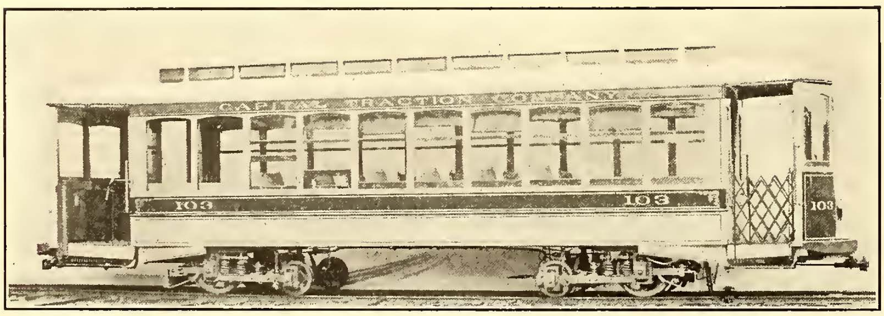
That the American railway manager is not the only one who practices the art of inducing traffic through advertising is clear from a little booklet issued by the New South Wales Railway Commissioners on the Sydney tramways. Flamboyant posters and multi-colored cards are all right in their way when some special event at an amusement resort is to be advertised, but there is also room for the unobtrusive pamphlet which tells the traveler where and how to go to the places worth seeing almost any time. In this publication is given a list of all the localities on the system, what is to be seen along and at the end of the route, the time of travel, cost, and other facts to assist both the stranger and the native. The Sydney tramway system is quite a comprehensive one, as may be noted from the fact that 1450 cars arrive and depart daily from the circular quay in the ten hours between 8 a. m. and 6 p. m. Almost any point in the city or its suburbs may be reached, the routes varying from 3 to 11 miles in length. The traffic superintendent is John Kneeshaw.

The Detroit United Weekly of June 14 says: "In the summer months there are many uses for one's eyes. Reading is not among them. One has little time for reading in the out-of-door months. Heretofore, the Detroit United Weekly has appeared every seven days in the year. We are precisely four years old. We are going to take a vacation. We are going to give our clientele and own intellectual equipment a rest. In other words, the Detroit United Weekly these coming weeks will join the riotous pursuit of that summer boon that makes a vigorous youth and contented old age. During the recess we may be missed. We hope we shall be. But that will but make our welcome return to familiar fields the more tumultuous."

FIRST SEMI-CONVERTIBLE CARS FOR WASHINGTON

The Capital Traction Company, of Washington, D. C., has recently placed in service a number of cars built by the J. G. Brill Company, of the type shown in the illustration. The heavy traffic on the lines and the large number of short-trippers carried has necessitated the use of types of cars which have a large amount of standing space and facilitate ingress and egress. A large part of the equipment consists of longitudinal seat cars, the majority of which have been furnished by the Brill Company. The type shown in the illustration is of the first lot of semi-convertible cars to be used in the city of Washington, and is intended to suit both the heavy traffic conditions and the service on the long lines running into the suburbs; therefore transverse seats are used. Considerable standing space is obtained by having a longitudinal seat 5 ft. 6 in. long at each corner which occupies the space of two windows. There is also a 6-ft. Detroit platform at the rear end, furnished with a dividing rail. The vestibules are of the standard round-end type of the builder, and are without doors. Folding gates form the closures. The window system is the builders' grooveless-post, semi-convertible type with pockets in the side roofs.

The cars are mounted on "Eureka" maximum traction trucks, which have the advantage of carrying them extra low. The step heights are given on the diagram, and will be found to be the same as a car mounted on a single truck. Instead of the usual draw-bar slide of stirrup form, a curved eye-beam, secured to the platform timbers under the bumper, serves as a guide for a casting which is bolted to the draw-bar. The bottom framing is of the standard type used with this form of semi-convertible car, and includes 4-in. x 7¾-in. side sills, with 12-in. x ⅜-in. sill plates on the inside and 5¼-in. x 6⅞-in. end sills. The cars seat forty passengers, and the seats, folding gates, sand boxes, alarm gongs, signal bells, angle-iron bumpers, ratchet brake handles and other furnishings are of Brill manufacture.



SEMI-CONVERTIBLE CAR FOR THE CAPITAL TRACTION COMPANY

A recent report from the Capital Traction Company shows that it is now building an extension to the Fourteenth Street line, embracing about 1¾ miles of double track on which the conduit system is used. This extension will open up a practically new section which heretofore has had no street railway facilities. On this new branch is being constructed a fire-proof car house 537 ft. x 200 ft., built of reinforced concrete. In addition, the traction company is making some important improvements in its shops.

The new Vauxhall Bridge, which was opened for service last month, will be the first London bridge to carry an electric railway. This connection will greatly shorten the time taken by those residents in South London whose places of employment are in the neighborhood of Victoria. The line over the bridge connects the existing tramways at Vauxhall Cross with Victoria Station,

TRAMWAY STATISTICS OF NEW SOUTH WALES

The railway commissioners of New South Wales, Australia, have recently published a report giving some interesting facts regarding tramway development in that State up to March 31, 1906. It appears that there are 126 miles of track in operation, for which the quarterly revenue was $1,071,946, an increase of $77,318 over the same quarter of 1905, although the track increase was only one-quarter of a mile. The operating expenses were $777,108, a decrease of $5,735, which reduced the percentage of expenditures to earnings from 78.73 to 72.51. These exceptionally high percentages are due in some measure to the heavy depreciation charges on certain old cable and steam motor lines. The number of car miles run was 4,076,201, or 28,732 car-miles more than the corresponding quarter of 1905. The earnings per car mile were 26 cents, and expenditures 19 cents. In all, 37,672,452 passengers were carried, an increase of 2,627,610 over the same quarter of 1905.

A DEPARTURE IN CUBAN RAILWAY WORK

The city of Havana, Cuba, is well equipped with electric railways. Within the city limits the lines are operated by the Havana Electric Railway Company, while the interurban service between Havana and the surrounding towns is handled by the Havana Central Railway Company. These companies are developing rapidly. The equipment for both the present and additional rolling stock and track material is of American manufacture. The Havana Electric Railway, the city line, has recently ordered 100 GE-52 railway motors for additional cars. The Havana Central Company operates an electric railway system between the Cuban capital and several surrounding towns. The entire equipment is of the most modern type, including Curtis steam turbines. Both electric locomotives and motor cars are employed in the service, ten 40-ton G. E. locomotives being used for freight and about twenty-five motor cars for passenger traffic. The cars are equipped with GE-73 railway unit control, so that they can be operated singly or in trains.

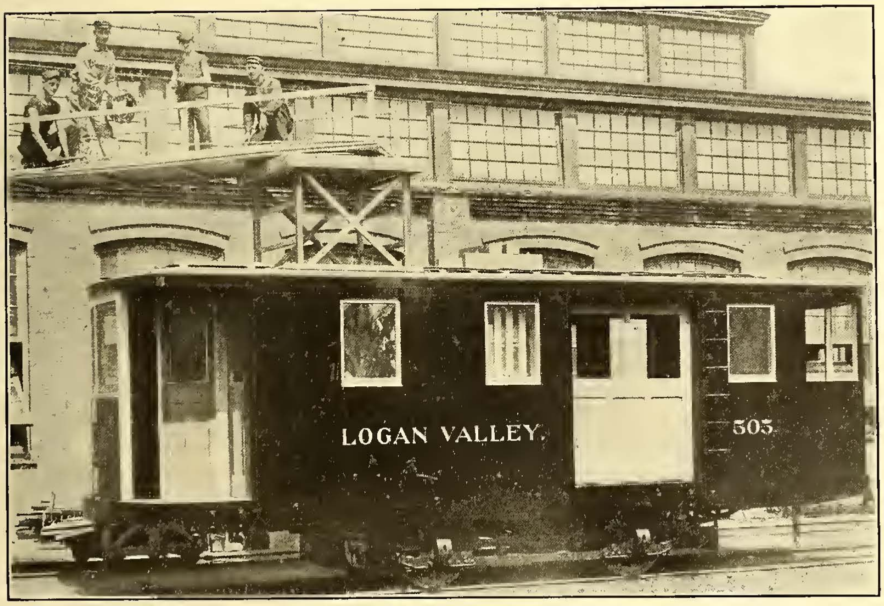
The transmission system from the central power station at Havana electrically connects the capitol with many places where there are at present no lighting stations. The Havana Central Railway Company is therefore preparing to supply a lighting service to the cities of Guinea, Guanajay, San Jose and Regla, making use of the present railway transmission system and constructing sub-stations at the towns mentioned, to change the 25-cycle current to one of higher frequency for lighting purposes.

For this purpose, the five sub-stations are each to be provided with an indication motor alternating-current generator set which will transform the present 25-cycle alternating current into one having a frequency of 60 cycles. Each set comprises a 150-hp, 750-r. p. m., 370-volt induction motor, taking current from the step-down line transformers, and direct connected to a three-phase, 100-kw, 750-r. p. m., 2300-volt alternator, delivering current at approximately 60 cycles. For stepping down the railway transmission line current, a single 150-kw three-phase transformer is to be installed at each sub-station. The windings on the transformers are provided with taps to take care of variations in line voltages, and are so arranged that the transformers can be operated on either 19,000 or 33,000 volts, and the secondaries connected to give 370 volts or 185 volts on either of the primary connections. Including the necessary switchboards, instruments, wire and cable, the complete sub-station apparatus will be furnished by the General Electric Company.

Beside the fixed sub-stations at the points mentioned, two complete portable sub-stations of like capacity and equipment will be constructed. These will be mounted on regular freight trucks so that they can be easily transported by rail to points where there is a special local demand for electric lighting. The whole arrangement presents an interesting development in railway street lighting, particularly since it is taking place in a country which has adopted electricity within a very few years.

COMBINATION TOWER AND CONSTRUCTION CAR FOR THE LOGAN VALLEY RAILWAY

The interesting tower car shown in the illustration has just been shipped to the Altoona & Logan Valley (Pa.) Electric Railway Company by the John Stephenson Company. The tower is of the McArdell type and is equipped with a revolving platform. The tower is raised with gears and pinions, and when lowered the platform extends slightly over the end of the car. The main compartment has 5-ft. sliding doors and is intended for construction material. The motorman's compartments at each end are entered from small triangular platforms at diagonal opposite corners of the car.



COMBINED TOWER AND CONSTRUCTION CAR FOR THE LOGAN VALLEY RAILWAY

The dimensions are as follows: Length over the end panels, 20 ft. 10 ins.; length over the vestibules, 28 ft. 6 ins.; width over the sills, including the sheathing, 8 ft. 1½ ins.; height from the floor to the ceiling, 7 ft. 4¼ ins., and height from the under side of the sills over the trolley boards, 8 ft. 6¾ ins. The side sills are 4 ins. x 12 ins., and the cross members 4 ins. x 6 ins.; cross pieces, 3¾ ins. x 16 ins.; thickness of the corner posts, 4⅝ ins. and 4¾ ins.

The Dayton & Western Traction Company has made an interline arrangement with the Chicago, Cincinnati & St. Louis Railroad (steam) for through business between Dayton and Chicago. The traction line makes connection with the steam road at Richmond. Last week the company made a $4 round-trip rate to Chicago and handled quite a large excursion, the rate being considerably lower than ever before offered to that city .

VACUUM DRYING AND IMPREGNATION OF COILS

The Standard Varnish Works, of New York, announce that they have recently installed in their factory at Elm Park a complete Passburg system for the vacuum drying and impregnation of coils. This method is receiving considerable attention from the mechanical and electrical engineers in charge of large railway systems, as it is expected greatly to minimize motor field troubles.

The method consists in placing the wound field coils in closed vacuum chambers equipped with steam coils. The heat vaporizes the moisture in the cotton covering of the wire used in the coil, at a comparatively low temperature, and this is drawn from the vacuum chamber through a condenser. After about two hours under a heated vacuum, the air and the moisture in the coils have been exhausted and they are therefore in the best possible state to receive the insulating compound. The vacuum chamber is connected by means of a pipe line with a similar tank, into which has been previously placed a solid insulator. This solid compound is brought to a liquid state by means of heat, and after the evacuation of the coils has been completed, the line connecting the vacuum chamber with the melting tank is opened and the compound is forced over the coils in the vacuum chamber by atmospheric pressure. Sufficient of the liquid compound is allowed to flow over fully to cover the coils in the vacuum chamber. The line connecting the two chambers is then closed and air is put on until a pressure of 60 lbs. to the square inch is shown in the vacuum chamber. This pressure is maintained on top of the compound in the vacuum chamber for a period of from one to four hours, depending upon the number of turns and layers of wire in the coils. The pressure is then taken off and the compound forced back into the liquor tank by means of air pressure, or allowed to flow back by gravity. The vacuum chamber is then opened and the coils taken out and allowed to cool, after which they are ready for assembling.

The solid compound, which is made liquid under heat, again solidifies immediately upon exposure to air temperature. This method not only produces a coil which is absolutely impervious to the action of water, but provides for superior heat-conducting properties, as the compound has filled the interstices in the coil, thus practically cementing together each turn and layer of wire in the coil. This process further produces the best possible insulation, and the cementing and holding together the turns and layers of wire in the coil absolutely prevents possible short circuiting from chafing, by vibration, when the motor is in operation. It is claimed that the method outlined is theoretically and practically perfect where care is observed in operating the machinery required.

In addition to this apparatus, the Standard Varnish Works have a full line of solid compounds of varying dropping points which are suitable for use in impregnating field coils, small armatures and armature coils. They also have compounds which are made especially for use in impregnating transformer coils designed to operate in the oil bath. This latter compound has all the properties of the ordinary impregnating compounds, and in addition is absolutely impervious to the action of hot transformer oil.

THE MASTER CAR BUILDERS' AND MASTER MECHANICS' CONVENTIONS AT ATLANTIC CITY

The annual conventions of the Master Car Builders' and the American Railway Master Mechanics' Associations were held at Atlantic City, June 13-20. The Car Builders convened on the mornings of June 13-15, and the Master Mechanics on those of June 18-20. The meetings were held in the music room of the steel pier, and the rest of the pier, about 58,000 sq. ft., was devoted to the usual exhibits. The attendance was larger and exhibits were more numerous than ever before in the histories of the two associations.

Only one paper relating directly to electric railway work was presented. This was the report of the committee of the American Railway Master Mechanics' Association on "Electricity on Steam Railroads," and it is published in full in another column of this issue. The interest of the convention from an electric railway standpoint centered, therefore, largely in the exhibits, and especially those of cars and locomotives at the terminal on Atlantic Avenue of the West Jersey & Seashore Branch of the Pennsylvania Railroad. Here were collected the most modern types of steam locomotives and cars, together with one of the New York Central electric locomotives and the electric cars which are to be used on the New York Central lines and on the Pennsylvania Railroad between Philadelphia and Atlantic City. The New York Central electric locomotive has already been described in these pages, and no further account of it need be given. The opportunity to inspect it was embraced by a large number of the delegates, and many comments were made upon its small size and weight compared with those of the neighboring steam locomotives which had the same tractive power.

Adjoining the New York Central locomotive was one of the steel cars to be used in the New York Central service. These cars were illustrated from the preliminary drawings in the STREET RAILWAY JOURNAL for Nov. 4, 1905, but photographs of both the exterior and interior are presented herewith. They were built by the American Car & Foundry Company, are mounted on American Locomotive Company's trucks, equipped with General Electric Company's motors, and are lighted by gas and electricity. Adjoining this car were two of the trucks upon which these cars are mounted. These trucks were fully described in the STREET RAILWAY JOURNAL for April 28, 1906.

On an adjoining track was the car adopted by the Pennsylvania Railroad for its electric service between Philadelphia and Atlantic City. This car, as will be seen by the photograph presented, bears a close resemblance to the standard Pennsylvania Railroad coach except in the construction of the vestibule, which is fitted with the General Electric master control and the Westinghouse traction brake lever. The car was built by the Wason Car Company, was mounted on Baldwin Locomotive Works trucks with Symington boxes, and was fitted with Hale & Kilburn seats and Curtain Supply Company's shades. It is lighted by five electroliers of five lights each, and is fitted with two trolley poles and third-rail shoes. The trolley poles are provided with trolley catchers manufactured by the Manhattan Railway Specialty Company, of Little Falls, N. Y.

Adjoining the electric cars was the Union Pacific motor car No. 7, which was run with its own power from Kansas City to Atlantic City. An account of this car is given in the report of the committee of electricity on steam railroads already referred to, and a great deal of interest was taken in it.

No attempt will be made to describe all of the exhibits, but the following were among the most interesting from an electric railway standpoint:

CONVENTION NOTES.

THE BULLARD AUTOMATIC WRENCH COMPANY, of Providence, R. I., exhibited the famous Bullard wrench, now in general use in steam and electric railway repair shops. J. L. Blaisdell attended the convention and demonstrated the application of the wrench.

SPRAGUE ELECTRIC COMPANY, New York. The Sprague electric mono-rail crane was exhibited at the convention, and its actual operation was shown uniquely in a space not over 10 ft. or 12 ft. long. Flexible steel armored conduits, Greenfield flexible steel conduits and steel armored flexible cord outlet boxes were also exhibited. Represented by A. E. Bradford, A. C. Bakewell and F. S. Douglass.

AMERICAN LOCK NUT COMPANY, Boston, Mass., exhibited the American lock nut. Considerable interest was manifested in the absolute locking qualities of this lock nut. William A. Eldredge, Geo. F. Higgins and Henry P. Allen attended the convention.

NATIONAL BRAKE COMPANY, of Buffalo, N. Y., was represented at the convention by its treasurer and general manager, G. S. Ackley and E. C. Rutherford, of Toronto, Can. A type of brake, similar to the well-known Peacock brake now in universal use on electric roads, applicable to steam passenger and freight car service, is being placed on the market by this company. With the interest shown in this brake at the convention, its construction and merit and the business energy behind it, there is no question of its ultimate adoption and success among steam roads.

THE COMPOSITE BOARD COMPANY, New York, was represented by Edward H. Chapin.

RUBBERSET BRUSH COMPANY, of Newark, N. J., had on exhibition all sizes and styles of paint brushes. The company was represented at the convention by A. L. Holtzman.

AUTOMATIC VENTILATOR COMPANY, New York, had its ventilators installed on one of the railway coaches on exhibition at the Pennsylvania depot. This company has recently secured an order from the New York Central Railroad for the equipment of 180 cars with its ventilators. These cars are to be operated within the electric zone in New York City. The company was represented at the convention by its general manager, George H. Ford, and Ross Taylor.

CROCKER-WHEELER COMPANY, Ampere, N. J., was represented at the convention by Rodman Gilder, H. C. Petty, F. B. De Gress, Julian Roe, S. Russell, Jr., and H. L. Patterson. Catalogues, pamphlets and literature of the company were distributed from its booth to the delegates to the convention. The well-known trade mark of the company was prominently in evidence throughout convention week.

CONSOLIDATED CAR HEATING COMPANY exhibited at the convention its standard electric heaters and some new types, as follows. Cross-seat type of heater designed for New York Central steel cars, cross-seat type with junction box, designed for Brooklyn Rapid Transit Company, and independent vestibule heater. Also special switches for use on heater circuits, car light circuits and arc lights, and a complete switchboard for use on elevated cars. Also steam heating equipments for use on all classes of railroad cars, and the McElroy automatic axle lighting system. The company was represented at the convention by Francis C. Green, general manager; James F. McElroy, consulting engineer; Cornell S. Hawley, general sales agent; William S. Hammond, Jr., district manager; S. Butler Keys, district manager, New York office; C. C. Nuckols, of the New York office; F. W. Brownell, of the Albany office. Consolidated Car Heating Company's electric heaters are installed in the New York Central steel car, for suburban service, exhibited at the convention. This is one of the 180 cars building for the New York Central Railroad, all of which are being equipped with these heaters. There are thirty-six heaters per car, arranged for four gradations of heat. The cab heaters are wired in series with the car heaters, and short circuited by an automatic switch when no heat is required in the cabs. This switch is placed in the line of movement of the cab door.

STANDARD PAINT COMPANY, New York, had an attractive booth, exhibiting its ruberoid roofing for cars and ruberoid red and brown roofing, flexite metal preservative paints, Giant and P. & B. insulating paper, and P. & B. backing and air-drying varnishes. Those present were Paul M. Wade, J. N. Richards, E. C. Beckman and H. J. Thomas.

GOLDSCHMIDT THERMIT COMPANY, New York, had an attractive exhibit, consisting of samples of thermit welds of rails, shafting and piping, samples of patterns, flasks for making molds and molds for thermit welds; cans of thermit and ingots to increase the temperature and purify the iron to prevent blows, automatic and flat-bottom crucibles in which thermit is ignited to produce the enormous temperature of over 5000 degs. F.; elaborate illustrative drawings were also exhibited. Demonstrations of the actual application of thermit in welding were also made on the beach adjoining the pier. Geo. E. Pelissier and A. M. Gunther were in charge of the exhibit.

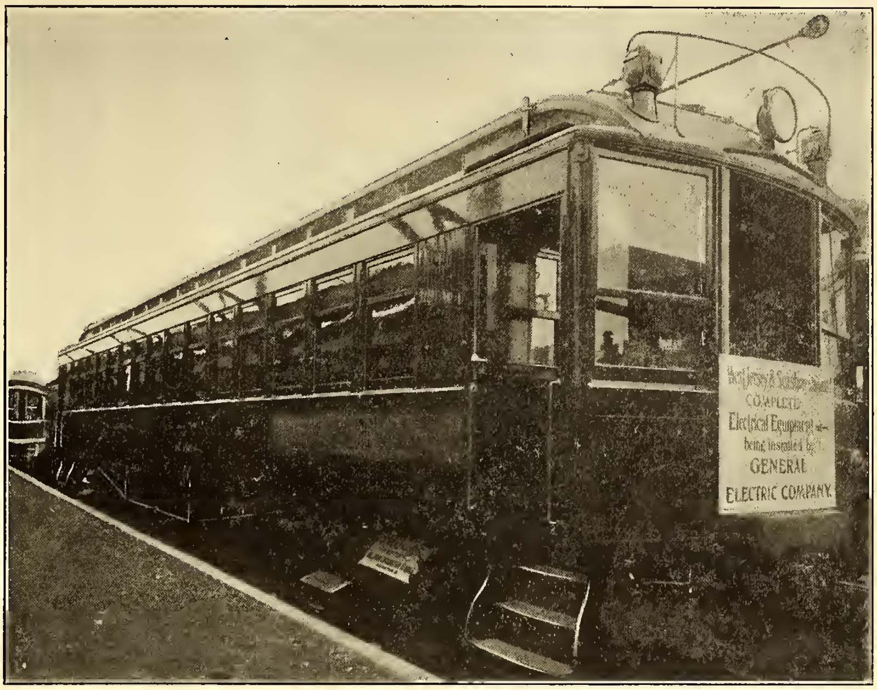
GREENE, TWEED & COMPANY, New York, exhibited its Palmetto packing, Exacto packing gages and cutters, and its favorite reversible wrenches. H. S. Demarest, F. E. Ramsley and B. H. Ham attended the convention.

AMERICAN BRAKE-SHOE & FOUNDRY COMPANY, New York, was represented at the convention by Otis Cutler, J. B. W. Sargent, J. D. Gallagher, F. L. Gordon, W. S. McGowan, Chas. Heron, F. W. Sargent, J. S. Thompson, L. R. Dewey, R. T. Hatch, A. L. Streeter, F. H. Coolidge, C. C. Higgins, E. L. Janes, H. S. Bradfield, E. B. Smith, E. J. Searles, W. F. Walsh, N. J. Holden, B. H. Grundy and J. H. Yardley. A comprehensive exhibit was displayed. All types of brake-shoes, together with a number of worn shoes, showing the nature of service and the wear to which brake-shoes are subjected, were exhibited. The company had one of the prominent locations on the pier, and distributed, as a souvenir, an attractive leather-bound memorandum book.

PANTASOTE COMPANY, New York, had a neat and comprehensive exhibit of pantasote for coach curtains and car seats.

AMERICAN MASON SAFETY TREAD COMPANY, Boston, Mass., exhibited carborundum and carbolith safety treads and Mason lead. Represented by W. S. Lamson, H. C. King and J. W. Scott. As a souvenir the company had some tasteful paper-weights in the form of a safety tread.

GOULD STORAGE BATTERY COMPANY, New York, exhibited its batteries for signal and train lighting service. This

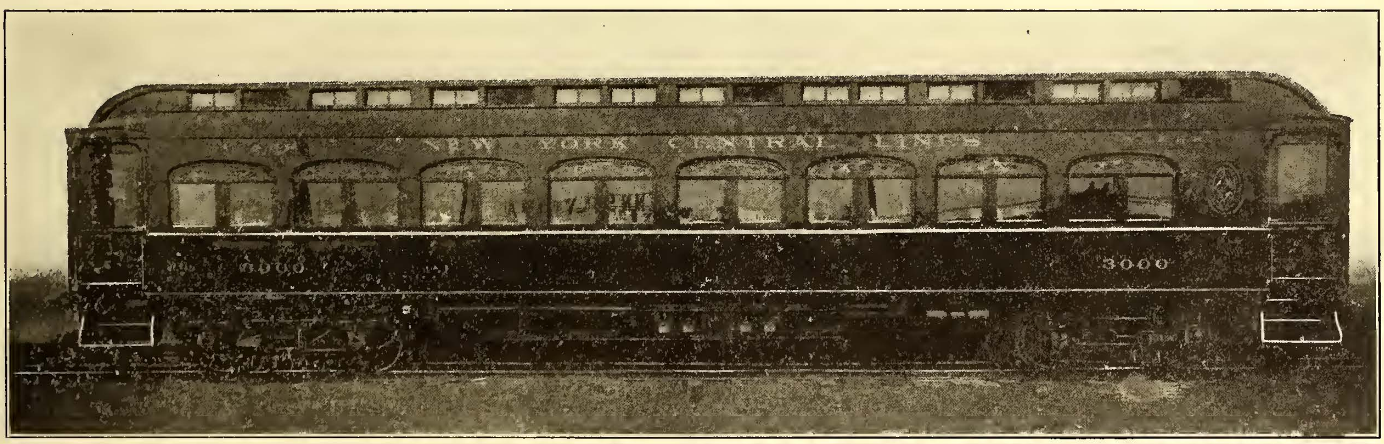


STANDARD MOTOR CAR FOR THE WEST JERSEY & SEASHORE RAILROAD

company was represented at the convention by W. S. Gould and George S. Milne.

GOULD COUPLER COMPANY, New York, had a comprehensive exhibit of Gould couplers, Gould spring tender buffer, Gould Z-beam steel platform with friction buffer and draft gear, and Gould C. M. B. journal boxes. Those representing the company at the convention were W. S. Gould, C. M. Gould, F. P. Huntley, W. F. Richards and T. L. McKeen.

THE BRADY BRASS COMPANY, New York, was represented at the convention by its president, Daniel M. Brady, Chas.



ALL-STEEL MOTOR CAR FOR THE NEW YORK CENTRAL LINES

John High and D. E. Bonner dispensed the hospitality of the company to the delegates at the convention.

CLING SURFACE MANUFACTURING COMPANY, Buffalo, N. Y., had a neat exhibit, illustrating the difference between belts treated with Cling surface and ordinary belts. Chas. F. Chase, of New York, attended the convention.

WEST DISINFECTING COMPANY, New York, was represented by E. Taussig and W. R. Noxon. Exhibit consisted of liquid soap containers and disinfectants of all kinds, as well as automatic disinfecting apparatus.

M. Reubens, William Krantz and Henry Lahey, and had an extensive exhibit of its Cypress bronze journal bearings, motor bearings for electric railway service, Brady genuine babbitt metals and Cypress anti-friction metals. A very handsome souvenir in the form of a pig-skin pocketbook was distributed. This is the thirty-third convention of the Master Car Builders and Master Mechanics which has been attended by Mr. Brady, who received many congratulations upon this record.

ROBINSON COMPANY, Boston, Mass., had on exhibition the Robinson exhaust nozzle for locomotives, an automatic brake-slack adjuster, air strainers for air pumps, and track jacks. Chas. L. Snow, Frank Robinson and Frederick Parker were present at the convention.

POWER SPECIALTY COMPANY, New York, was represented by E. H. Foster and L. B. Nutting. Foster superheaters and Duval metallic packing were exhibited.

INTERIOR OF NEW YORK CENTRAL CAR

DOSSERT & COMPANY, New York, were represented by E. A. Dossert, J. J. Dossert and H. B. Logan. All types of the well-known Dossert joint were exhibited.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., jointly with the American Locomotive Company, had on exhibition tracks at the Pennsylvania depot, a complete electric locomotive, built by these two companies for the New York Central Railroad in New York City. An all-steel car for the New York Central electric service, with full electrical equipment, was also exhibited, as well as one of the West Jersey Seashore cars, similarly equipped. At the booth on the steel pier, F. H. Gale dispensed the hospitality of the company to the delegates of the convention. The company was represented at the convention by C. C. Peirce, Ralph Moore, L. R. Pomeroy, H. D. Hawkes, W. B. Potter, J. G. Barry, H. D. Tremper and J. R. Lovejoy.

O. M. EDWARDS COMPANY, Syracuse, N. Y., had a well arranged and extensive exhibit of all types of its window fixtures. Model windows were shown illustrating the application of these fixtures to all types of coach construction, as well as the facility and ease with which windows operate when the Edwards fixtures are employed. One type of fixture has been especially designed to meet the requirements of steel passenger cars, which at the present time are coming into use. The well-known Edwards vestibule platform trap-door and the Edwards brand of tin rollers were shown. This company's business has expanded to such an extent that its present factory is entirely inadequate to take care of its increasing orders. A new plant is at the present time being erected in the center of Syracuse, and will be ready for occupancy in the early fall. This plant is 211 ft. x 55 ft., five stories high. It will be constructed of steel and brick. There will be one wing running off of the main building three stories high, which will be used for woodworking purposes. Another wing running off from the main building will contain boiler and engine rooms. A large brass foundry will be erected, in which all the various types of brass castings used by this company will be turned out. A tinning and tempering plant will also be erected, as well as a dry kiln for lumber. The plant, when erected, be one of the most complete of its kind in the country. The company was represented at the convention by O. M. Edwards, E. F. Chaffee, G. G. Nooris, G. E. Bake.

E. L. POST & COMPANY, New York, exhibited Post's "Zero" and motor metals for journal bearings. Those representing the company at the convention were E. L. Post and F. O. Ketcham.

THE CELLULOID COMPANY, of Newark, N. J., exhibited its "Texoderm" material for car curtains and car seats. The company was represented at the convention by W. S. Sillcocks and W. C. Crosby.

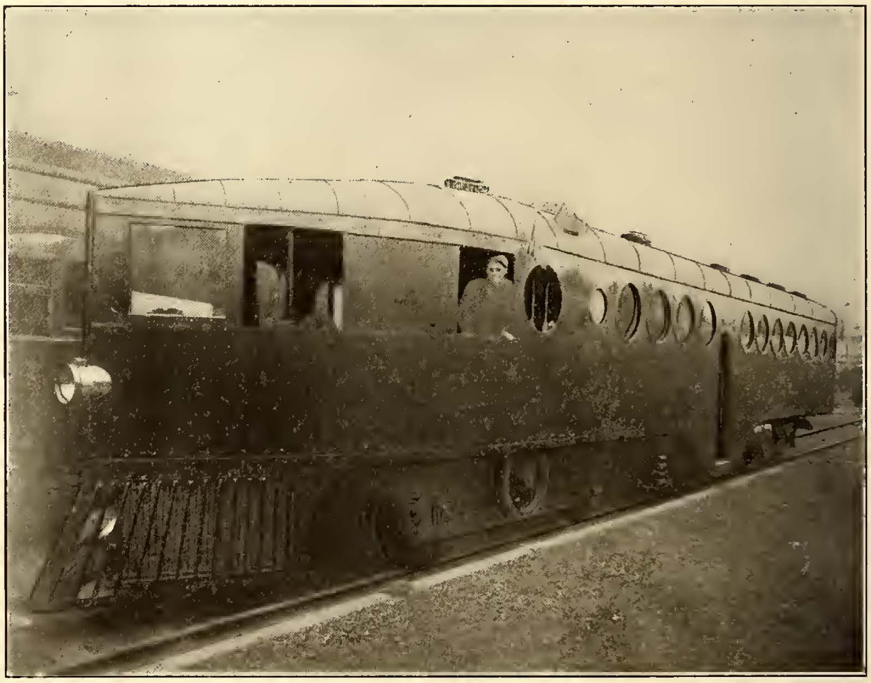
THE DRESSEL RAILWAY LAMP WORKS, of New York, exhibited all its types of headligihts, switch lamps, semaphore lamps and locomotive headlights. The company was represented at the convention by F. W. Dressel, C. H. Dressel, Robert Black, F. W. Edmunds, E. W. Hodgkins and Jos. M. Brown.

THE GENERAL STORAGE BATTERY COMPANY, New York, exhibited its battery for signal car lighting and power regulation. The company was represented at the convention by R. C. Shaal and F. E. Booss.

THE NORTON GRINDING COMPANY and NORTON EMERY WHEEL COMPANY, of Worcester, Mass., had, together, one of the largest and most complete exhibits of all types of its grinding machinery. Large samples of piston rods, valve stems and crank pins, ground and polished by the Norton emery wheels, were on exhibition. All shapes and grades of its India oil stone were displayed. Alundum ore, crushed, and in its original form, was also on exhibition. The company was represented at the convention by George C. Montague, George A. Stone, Chicago manager; Arthur C. Scott, New York agent.

THE GOLD CAR HEATING & LIGHTING COMPANY, New York. This company had an extensive exhibit of the improved Gold system of car heating by direct steam apparatus as well as hot water circulation, temperature regulators, automatic steam traps, steam couplers, locomotive reducing valves and train pipe valves, refrigerator car heating apparatus and electric heaters for electric railroad service. The company was represented at the convention by Edward E. Gold, John E. Ward, William E. Banks, W. H. Stocks, A. E. Robbins, J. M. Stayman, J. V. Brombaugh, Richard Voges and E. B. Wilson.

THE ANGLO-AMERICAN VARNISH COMPANY, Newark, N. J., and Montreal, Can. William Marshall and Franklin W. Fort distributed attractive advertising matter from the company's booth on the steel pier.



UNION PACIFIC GASOLINE CAR NO. 7

THE AMERICAN LOCOMOTIVE COMPANY, of New York, exhibited at the Pennsylvania depot on the exhibition tracks a splendid example of locomotive construction in the Erie Pacific type locomotive and the Baltimore & Ohio consolidation locomotive, electric motor trucks for the New York Central electric service, together with the trailer trucks for the same service. In joint exhibit with the General Electric Company were shown the electric locomotives for the New York Central electric service. The rigid and ponderous construction of this locomotive was admired by all the delegates who examined the exhibit. The company was represented by F. D. Sawyer, G. M. Basford, R. J. Gross and J. E. Sague.

THE YALE & TOWNE MANUFACTURING COMPANY, of New York City, was represented by W. C. Bigelow, who had charge of the check padlocks, and by C. W. Beaver, who represented the hoist and trolley department. The exhibit comprised 20-ton triplex chain blocks, 2-ton electric hoists built in trolley, 2-ton electric hoist with graduated speed control, 5-ton triple chain block in operation under load, one triplex and differential chain block, padlocks for switches, toolhouses, etc., standard car doors, controlled by Blount coach door check, and hardware for station use, cabinet locks, etc., for dining and Pullman cars. The company had as a souvenir a neat paper-weight in the form of a Yale lock.

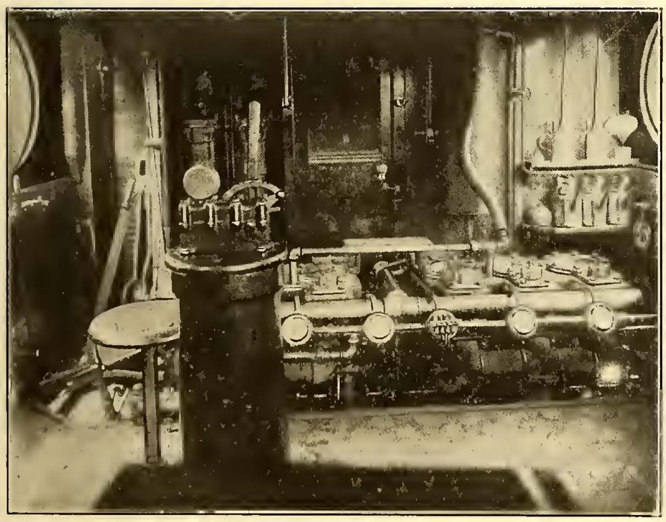
JOS. DIXON CRUCIBLE COMPANY, of Jersey City, N. J., displayed the various Dixon graphite specialties and lubricants. The company was very liberal in the distribution of its lead and indelible pencils. It was represented at the convention by W. A. Houston, Lewis F. Lyne, Malcolm McNaughton, E. M. Taussig and C. H. Spatts.

THE WILLIAM C. BAKER HEATING & SUPPLY COMPANY, NEW YORK, was represented at the convention by Mrs. L. Baker Vaux, James G. Demarest and J. H. Gadsden. The exhibit consisted of Baker double-coil car heaters with steam attachment, the mighty midget Baker heater No. 4, and the street car heater No. 6. Various independent steam attachments and supplies were also exhibited.

THE HEYWOOD BROS. & WAKEFIELD COMPANY, Wakefield, Mass., had a very complete and comprehensive exhibit of car seats, upholstered in plush, rattan and leather. The company was represented at the convention by its New York agent, Bertram Berry, C. H. Lang, Jr., E. C. Lang and C. W. H. Frederick.

THE NATIONAL LOCK WASHER COMPANY, of Newark, N. J., had a neat exhibit of car curtains and curtain fixtures, sash locks, sash balance and the well-known National lock washers and nuts. Those present at the convention from this company were William C. Dodd, Frank B. Archbald, John B. Seymour and Daniel Hoyt.

AMERICAN STEAM GAUGE & VALVE MANUFACTURING COMPANY, Boston, Mass., exhibited American dead-weight gage tester, locomotive muffled and open pop safety valves, steam heat gage, American duplex gage, locomotive steam gages, hydraulic relief valves, American-Thompson improved indicator



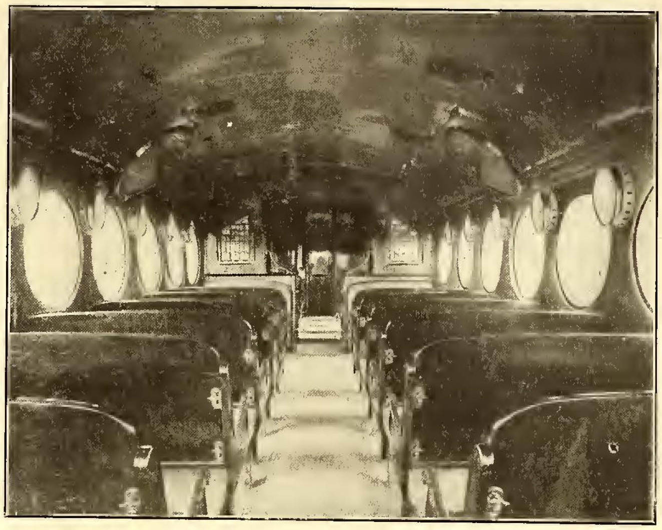
MOTORMAN'S COMPARTMENT OF GASOLINE CAR

with new improved detent motion. Represented by Ralph B. Phillips, W. E. Jerauld, Chas. A. Allen, R. M. Turner, C. H. Craig, Jr., Horace Parker.

A. O. NORTON, INC., Boston, Mass., exhibited Norton ball-bearing jacks and Sure-Drop jacks. Represented by A. O. Norton, H. A. Norton, Chas. G. Erickson and J. O. St. Pierre.

THE PATTON PAINT COMPANY, of Newark, N. J., and Milwaukee, Wis., exhibited its well-known railroad paints and "Iron-Hide" rustless paint for iron and steel. The representatives from this company present at the convention were James G. Mowry and John L. Brown.

VACUUM CLEANER COMPANY, New York. This company had a very interesting exhibit on the exhibit track at the Pennsylvania Railroad station, in a Kenney portable vacuum cleaning plant for cars, stations and subways. The portable plant is extensively used by both steam and electric railroad managers for the cleaning of cars, stations and subways. The portable plant



PASSENGER COMPARTMENT OF GASOLINE CAR

is especially adapted for this purpose, as it can be moved with facility and ease from one part of the road to the other. The company was represented at the convention by R. C. Hallett.

H. W. JOHNS-MANVILLE COMPANY, New York, had a very complete exhibit of all of its asbestos products, transite for the fire-proofing of electric railroad cars, fire-proof lumber fibers, and cements, asbestos textile materials, pipe covering cement, felting and roofings. Vulcasbestos pump packing, piston-rod packing, throttle-rod packing, Keystone combination pump packing and its 85 per cent magnesia and fire-felt sectional boiler lagging. The company was represented at the convention by L. B. Melville, J. C. Younglove, M. Fuhrer, W. F. Taylor, E. C. Sawyer, F. M. Gilmore, H. O. Fettinger and J. E. Meek.

UNITED STATES METAL & MANUFACTURING COMPANY, New York, had on exhibition at the Pennsylvania depot, the Ideal draw-bar centering device, "Almetl" lumber stake, collapsible brake staff and Columbia lock nut. On the steel pier were displayed Columbia lock nut, Western malleable iron brake jaws, "Victor" cast steel replacer and pressed steel car replacer and an automatic hose reel. Those present at the convention were B. A. Hegeman, Jr., E. D. Williams, Fred. C. Dunham, Fred. Atwater and John J. Varian.

MAJOR MANUFACTURING COMPANY, New York, represented by A. Major, exhibited Major cement, compartment water coolers and head rest.

THE ASBESTOS SHINGLE, SLATE AND SHEATHING COMPANY, of Ambler, Penn., had an exhibit of asbestos "Century" shingles, asbestos building lumber and other fire-proof building material. The company was represented by its chief engineer, Charles Edward Wade.

THE AJAX METAL COMPANY, of Philadelphia, showed specimens of its plastic bronze locomotive bearing, car journal brasses, phosphor and manganese castings and ingots as well as a line of anti-friction metals. The repesentatives were G. H. Clamer and S. E. McClure.

DODGE & DAY, the well-known consulting engineers of Philadelphia, had a representative on the ground in the person of H. F. Sanville.

THE PITTSBURG SPRING & STEEL COMPANY, of Pittsburg, was represented by its president, D. C. Noble.

H. B. UNDERWOOD & COMPANY, of Philadelphia, makers of the portable valve seat rotary planer, were represented by A. B. Pedrick and E. W. Whitaker.

THE DUFF MANUFACTURING COMPANY, of Pittsburg, Pa., occupied space No. 514, with a line of Barrett lifting jacks and Duff roller-bearing screw jacks. The roller-bearing jacks comprise a new line for handling loads up to 70 tons. Each jack contains two roller bearings made from crucible steel, which are said to give better service than any other anti-friction bearing made. The No. 130 Barrett geared ratchet jack shown has a capacity of 35 tons, and is used for the rapid handling of coaches and loaded freight cars. The company was represented by Chas. A. Foster.

THE LEHIGH CAR WHEEL & AXLE WORKS, of Catasaqua, Pa., was represented by B. F. Swartz.

THE PHILADELPHIA AIR BRAKE & MACHINE COMPANY had a genial representative in its manager, Col. W. W. Lambert.

THE HOME RUBBER COMPANY, of Trenton, N. J., showed a complete line of N. B. O. sheets, tubular gaskets, diaphragms, inlaid matting, O. I. M. packings, air brakes and steam hose, etc. The company was represented by G. J. O. Stokes, Chas. E. Stokes, H. M. Royal and A. R. Foley.

THE UNION SPRING & MANUFACTURING COMPANY, Pittsburg, was represented by A. M. McCrea, president.

THE STANDARD STEEL WORKS, of Philadelphia, showed a number of 33-in. and 34-in. diameter rolled-steel wheels and steel-tired wheels. The representatives present were the following: H.W. Sheldon, New York; Frank Carpenter, Philadelphia; George F. Jones, Richmond; Robert Radford, Philadelphia; C. H. Peterson, Chicago; H. De H. Bright, Philadelphia, and Edward B. Halsey, St. Louis.

DUQUESNE STEEL FOUNDRY COMPANY, Pittsburg, occupied sections 589 to 592, inclusive, where it showed a number of solid rolled steel car wheels and open-hearth steel railroad castings. The gentlemen in attendance for the company were as follows: Thomas H. Barewell, vice-president and treasurer, Pittsburg; Arthur W. Field, general sales agent, New York and Boston, and Lewis A. Way, chief clerk, Pittsburg.

BAEDER, ADAMSON & COMPANY, Philadelphia, exhibited a complete refrigerator car showing their method of refrigeration and hairfelt insulation. The company was represented by Henry J. Bellman.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, Pa., had a very extensive exhibit of standard and specially designed types of storage battery cells for railroad car lighting, automatic block and semaphore signal, track circuit and interlocking service. Both stationary and portable cells were shown. A feature of the exhibit was the car-lighting cells in rubber jars and lead-lined tanks, encased in strongly constructed wood boxes, with a special elastic compound between the rubber or lead cell and the containing box. Five sizes of these cells were shown. There was also a standard railway switchboard panel, equipped with the Electric Storage Battery Company's carbon regulator. A large chloride accumulator cell, of type R-73 in type R-83 reinforced tank, was exhibited as a sample of 2692 similar cells contracted for in connection with the electrification of the New York Central terminal lines to New York. A cell of type R-55 in type R-57 reinforced tank, illustrated the battery of 313 cells of this size installed at the Hammel station of the Pennsylvania, New York & Long Island Railroad. Manchester positive and box negative plates of the standard chloride accumulator type were shown mounted on attractive panels. There were also shown an automatic water filling device and a recording and signaling hydrometer for pilot cells. Bulletins giving complete description of types of cells recently developed for car lighting and signal service were distributed, as well as bulletins illustrating the application of large chloride accumulator batteries in central station work. The exhibit, which presented a most attractive appearance, was in charge of Chas. Blizard, J. A. White and H. E. Hunt.

THE LANDIS MACHINE COMPANY, of Waynesboro, Pa., had an exhibit consisting of regular bolt cutters and of machines adapted for stay-bolt cutting without the aid of a lead screw. The Landis machine is a departure from the hobbed dies machines. The dies of this machine are milled from flat pieces of steel, which have teeth cut their full length on one side. The chasers are 4 inches long, and can be reground many times. The life of this die is said to be from ten to twenty times that of the hobbed. The lead in the die is positive, insuring correct pitch. The rake is flexible to suit any kind of material to be cut. The throat is permanent, allowing the machinist to cut close to shoulders and heads of bolts, and it has a wide range for special work. Another important feature is that one set of dies will cut all diameters of the same pitch. The machine is built in single, double and triple heads, ranging from 1/4 inch to 2 inches. The company was represented by J. G. Benedict.

THE GEORGE W. LORD COMPANY, of Philadelphia, the well-known manufacturer of Lord's boiler compounds, had an attractive booth and exhibited samples of different boiler compounds. The company was well represented by V. O. Lawrence, Col. Nat. P. Lane and Capt. J. E. Doughty, who had charge of the exhibit.

JOHN LUCAS & COMPANY, of Philadelphia, had one of the most attractive and unique paint and color displays at the pier. The most prominent feature of the exhibit was a series of panels which enabled the visitor at a glance to get acquainted with the products of this firm, which makes a specialty of coach and car colors. Lucas' Mirac, which removes old paint and varnish, was also shown. The house of Lucas was represented by a corps of able, hustling representatives, whose geniality made them many warm friends. The Lucas "souvenir" was a "glad hand," which consists of a celluloid hand with the index finger showing white lead that has rubbed off, and telling the advantage of Lucas' tinted gloss paint. A calendar on the cuff made the gift valuable, as it can be used as a book marker. An attractive match-box was also distributed. H. A. Clark, W. C. McMullin, W. I. Lewis and J .C. Holmes looked after Lucas' interests.

THE PHILLIPS-LAFFITTE COMPANY, of Philadelphia, exhibited its Laffitte welding plates and many test welds in steel castings. The welding of locomotive frames without dismantling the engine was of particular interest to railroad men, and can be successfully done by the use of Laffitte welding plates. This is done by jacking the frame apart and dressing out fracture to a V-shape. A fire-brick furnace is then built around the fracture. The frame and a V-shaped "dutchman" (slightly larger than the fracture) are brought up to a cherry red heat by the use of an old blaze. A piece of Laffitte plate is then placed V-shape over the "dutchman" and inserted into the fracture. The jacks are then released, allowing the frame to spring into position and the whole is brought up to a strong heat. The pressure from the spring of the frame is sufficient to effect a perfect weld. Physical tests show that steel castings welded with Laffitte plates not only have the strength of a solid casting, but increase tensile strength per square inch over 7000 lbs. while elongation is practically maintained. Welds in soft steels are said to show an increase of 4000 lbs. to the inch. The representatives at the exhibit were F. Rees Phillips and W. Vernon Phillips.

THE McCONWAY & TORLEY COMPANY, of Pittsburg, was represented by William McConway, Jr., E. M. Grove, I. H. Milliken, and had on exhibition a full line of passenger, freight and tender couplers, including the company's latest production, the Pitt freight coupler, which combines all of the requirements of the Master Car Builders' Association, and which throws the knuckle to a full coupling position from any point. The company also showed its Buhout three-stem coupler applied to the Standard Coupler Company's steel passenger platform. This coupler has only been on the market a little over ten years, but already almost 8000 passenger cars have been equipped with it. A recent example of its adaptability is its application to the electric cars built for the West Jersey & Seashore division of the Pennsylvania Railroad, was shown by the sample car on exhibition at the conventions. In view of the fact that a number of steam railroads are considering the question of electrifying their branch roads, this coupler seemed to attract a great deal of attention, as it will couple with the cars on the main line, and on account of its pivoted head will operate around curves where it would be impossible to run a rigid coupler.

THE F. R. PHILLIPS & SONS COMPANY, of Philadelphia, Pa., exhibited its Velos high-speed steel and Velos high-speed twist drills, both of which are made in Sheffield, England, by the Walter Spencer Company. The Velos drill is not only capable of running at high speeds but is designed for very heavy feeds. In tabulating results of tests made in 197 different plants the company reports that 174 firms report the Velos drill to be superior to any high-speed drill they have ever used. The company's representatives at exhibit were F. Rees Phillips, W. V. Phillips and C. A. Gridley.

WESTINGHOUSE EXHIBIT.—The exhibit of the Westinghouse companies was at the extreme end of the Steel Pier, and comprised the products of the Westinghouse Air Brake Company, the American Brake Company, Westinghouse Automatic Air & Steam Coupler Company, and the Westinghouse Electric & Manufacturing Company. The apparatus on exhibition by the Air Brake Company was very elaborate, and naturally was devoted in large part to steam railroad service. It included the equipment for two 75-car freight trains arranged in parallel, so as to demonstrate the advantages of the new quick-service freight triple, designated as the type "K," over the present standard quick-action freight equipment. In addition, the Air Brake Company showed sectional models of the new apparatus as well as samples and full-sized sections of the Westinghouse friction draft gear and of the new cross-compound locomotive air pump. The American Brake Company, of St. Louis, Mo., had on exhibition a rack showing the opeation of the slack adjuster for passenger cars and models of the equalized brake as applied to both locomotive driving wheels and engine trucks. The Westinghouse Automatic Air & Steam Coupler Company, of St. Louis, Mo., exhibited car models, showing the application of its automatic couplers as applied to modern rolling stock. The Westinghouse Electric & Manufacturing Company showed a full line of arc lamps for all currents, also their alternating and direct-current fan motors for desk and wall service. Motors for use on alternating and direct currents for shop driving were exhibited, including the well-known types "S," "R" and "CCL." A very extensive collection of Westinghouse current-measuring instruments were also shown, as well as other miscellaneous electrical apparatus suited for use in and about railroad shops. The exhibit was lighted by Cooper Hewitt mercury vapor lamps. Four type "K" lamps and six type "H" lamps with automatic tilters were kept burning. The company also distributed a pamphlet, recently issued, and entitled "Electricity in Heavy Railway Service." It contained some figures on cost of electric railway operation, tables of draw-bar pull of electric and steam equipment, and data in regard to the New Haven and Swedish Government lines, and from other heavy traction and single-phase lines built by the company. The representatives present included for the Air Brake Company, John F. Miller, A. L. Humphrey, W. S. Bartholomew, Joseph R. Ellicott, E. L. Adreon, T. A. Hedendahl, F. V. Green, Chas. Paine, S. G. Down, S. J. Kidder, F. T. Reese, S. D. Hutchins, Walter V. Turner, C. C. Farmer, C. J. Olmsted, M. Arthur Johnson, Robert Burgess, C. P. Cass, Henry S. Mann. For the Automatic Air & Steam Coupler Company, N. F. Niederlander. For the American Brake Company, E. L. Adreon. For the Electric Company, E. M. Herr, C. F. Street, J. H. Klinck, J. M. Barr, D. D. Pendleton, Charles Robbins. For the associated interests, Frank S. Smith, O. H. Miller and J. C. McQuiston.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, was represented at the convention by F. C. Randall, C. A. Tupper and Guy Slafer. The company's booth was devoted to showing samples of stationary motors for repair shops and steam turbine vanes and discs.

THE AMERICAN CAR & FOUNDRY COMPANY had as its principal exhibit the all-steel passenger coach of the New York Central Railroad. This car is illustrated and described elsewhere in this issue. The interests of the company were cared for by Scott H. Blewelt, W. M. Hager, N. A. Williams, Clarence Price, A. E. Ostrander, T. R. Brown, W. C. Dickerman and E. S. Marshall.

THE BALDWIN LOCOMOTIVE WORKS, of Philadelphia, were represented by W. J. McCarroll and Fred. Woollven. Although the company's exhibit was for the most part in its steam railroad locomotive department, the company's electric railway work was represented by the trucks under the West Jersey & Seashore Railroad. A view of this car is published on another page.

THE HALE & KILBURN MANUFACTURING COMPANY, of Philadelphia, showed a full line of car seats for steam railroad work of the walk-over and reversible types, upholstered in plush, leather, rattan, etc. Although the exhibit was devoted in most part to the company's steam railroad seats, considerable attention was given by the electric railway men present to the company's new seat, adapted to the narrower electric cars used on high-speed urban and interurban railways. This seat has a low curved arm rest combined with the regular steam railroad seat movement. All parts of this seat movement are of metal, and it is equipped with an automatic single foot-rest, which makes the car very easy to sweep. The aisle end and the base of this seat are very handsome. The company also showed photographs of the fireproof seats built for the Chicago City Railway and the Boston elevated and surface lines. The company is finding that a great deal of interest is being taken in fire-proof seats, and there is a considerable demand for the company's steel seat frame, which is built entirely of pressed steel. These seats are in all cases upholstered with rattan, which has been treated so as to make it non-inflammable. It was also a significant fact that all of the cars exhibited at the Pennsylvania station in Atlantic City were equipped with Hale & Kilburn seats. The company was represented by A. F. Old, of New York; H. T. Bigelow, of Chicago; S. A. Walker, of New York, and T. F. Tilson, of Washington.

S. F. BOWSER & COMPANY, of Fort Wayne, Ind., occupied one of the large spaces on the south side of the pier, and exhibited their method of measuring and storing oil. Those present representing the company were E. M. Savercool, C. A. Dunkelberg, W. T. Simpson and A. H. Collins.

THE BROWN HOISTING MACHINERY COMPANY, of Cleveland, exhibited a full line of views of different hoisting installations made in different parts of the country. They included photographs of coal and ore-handling machinery and different types of cranes. Richard Devens and J. P. Case cared for the company's interests.

THE CARBORUNDUM COMPANY of Niagara Falls, attracted attention at Atlantic City by its samples of carborundum and carborundum products. Those attending the convention in the interests of the company were E. J. Eames, C. O. Taylor, C. C. Schumaker and W. W. Sanderson.

THE KALAMAZOO RAILWAY SUPPLY COMPANY, of Kalamazoo, Mich., exhibited an interesting line of pressed steel wheels for hand cars, car jacks, etc., but called particular attention to the Root pneumatic track scraper and the Moore track drill. The Root scraper has now been adapted for pneumatic operation, and the equipment for a steam locomotive was shown in the exhibit. The same apparatus could equally as well be employed on any electric motor car equipped with air reservoirs. The scrapers are mounted on a shaft and are raised and lowered by pneumatic power from the motorman's cab. Any pressure can be applied to the scraper springs according to the conditions of snow, whether dry, wet or packed. The scraper cleans the rail and removes the snow 8 ins. on each side. It also cleans the groove of a grooved rail, and thus prevents the wheel flanges from compressing the snow into ice. The Moore track drill also attracted much favorable comment, and figures were given by those in charge of the exhibit of a test recently made on the Pennsylvania Railroad of the efficiency of this drill. The company presented as a souvenir a key-ring and leather case, and was represented by H. G. Haines, F. N. Root, John McKinnon and D. A. Moore.

THE PHILIP CAREY MANUFACTURING COMPANY, of Cincinnati, showed an extensive line of boiler and pipe coverings of asbestos and magnesia, as well as roofing, asphalt paints, packings, etc. Those representing the company at Atlantic City were N. S. Kennedy, S. J. Bowling and F. R. Collins, Jr.

THE CURTAIN SUPPLY COMPANY, of Chicago, had a tasteful booth near the end of the pier. Its headquarters were fitted up with comfortable chairs and rugs, and were presided over by W. H. Forsyth, A. L. Whipple and R. F. Hayes. The company showed a large number of fixtures, including the Forsyth, Keeler, Climax, Acme and Burrows, also a new fixture, known as the ring fixture. There was also a full line of curtain material for steam and electric cars.

THE JOHN DAVIS COMPANY, of Chicago, exhibited a full-sized model of reducing valves for train heating, hose couplers and armored hose. George F. Hughson was present.

THE HARRISON DUST GUARD COMPANY, of Toledo, exhibited the Harrison car journal lubricator, vestibule journal box and engine cylinder lubricator in various sizes suitable for steam and electric cars. The vestibule box is set into the journal box of the car and is held by spring pressure against the journal. As there is an air space between the box and the lubricator the temperature of the journal is reduced, and as the lubricator houses practically all of the packing, if any dirt or grit drops into the bottom of the box it does not foul the oil. The lubricator can be removed from the journal box in half a minute by withdrawing a bolt. The box itself is completely enclosed and protected by two covers. The company was represented by Frank B. Harrison and Lacey Y. Williams.

THE CRESCENT MACHINE COMPANY, of Letoonia, Ohio, showed a Crescent angle-band saw, No. 3, saw table and jointer and a 36-in. band saw. C. G. Wilderson was in attendance.

THE CHISHOLM & MOORE MANUFACTURING COMPANY, of Cleveland, Ohio, exhibited a fine line of hoists, including the direct differential block, Moore anti-friction block and the Cyclone hoist, which is new in principle and is very rapid. In this hoist the chain drives an internal gear by an eccentric shaft, so that the load is positively and absolutely held at all times. The block needs no oiling, as all of the six bearings are fitted with anti-friction bushings. J. V. Vetterlein represented the company.

THE ADAMS & WESTLAKE COMPANY, of Chicago, had one of the largest and handsomest booths at the convention, and showed a full line of its steam railroad fittings, car hardware, electric fixtures, signal lamps and a model of its axle lighting system. The representatives present were F. B. Jones, J. L. Longworth, A. S. Anderson, F. N. Grigg, William S. Ham and R. N. Newbold.

THE G. DROUVE COMPANY, of Bridgeport, Conn., exhibited window and skylight opening devices. A. C. Bradley, W. F. Plass and S. Cibulas were present.

THE GREENAWAY COMPANY, of Detroit, showed steam and oil separators, steam traps and exhaust separators. G. A. Harris and A. Schade were present and distributed fresh carnations, the company's souvenir at the convention.

THE GRIP NUT COMPANY, of Chicago, had on exhibition at Atlantic City a full line of grip nuts, which are eccentrically cut and so hold the bolt. They are useful both for track work and for miscellaneous work, as on motors and elsewhere where the bolt is subject to jar. George W. Carhart and R. S. Wickersham were present for the company.

MERRITT & COMPANY, of Philadelphia, had samples of their metal lockers at the pier. They were represented by L. S. Fngless and S. Morris.

THE AMERICAN WATER SOFTENER COMPANY, of Philadelphia, exhibited a model of its water softening apparatus and photographs of typical installations made in different parts of the country. A. S. Garrett, G. S. Garrett, W. H. P. Fisher and A. C. Tomlinson were present.

THE BELLE CITY MALLEABLE IRON COMPANY, of Racine, Wis., had on exhibition its anti-rail creeper and adjustable draft-plate. J. H. Dwight and T. W. Harvey were present in the interests of the company.

THE L. J. BORDO COMPANY, of Philadelphia, exhibited a full line of its locomotive specialties, valves, cocks and couplings. L. J. Bordo, L. W. Kramer, C. R. Weaver and E. A. Knowlton were present.

THE STAR BRASS MANUFACTURING COMPANY, of Boston, Mass., had quite an extensive exhibit in the form of valves, gages, whistles, cocks and other appliances for engines. The following were present: George H. Musgrave, James H. Sewell, William S. Levins and J. H. Edgar.

THE QUINCY-MANCHESTER-SARGENT COMPANY, of Chicago, Ill., made an extensive exhibit of Stanwood car steps, car and engine replacers, snow flangers and shop tools, represented in some cases by the actual apparatus and in other cases by photographs. Those present in the interests of the company were C. F. Quincy, G. H. Sargent, Percival Manchester, Paul R. Brooks, C. H. Holbrook, R. G. Cumback, George C. Isbester and B. T. Lewis.

THE RIVERSIDE METAL COMPANY, of Riverside, N. J., exhibited an extensive line of phosphor bronze, german silver and white metal products in the form of castings, sheets, rods and wire. The exhibit of the company proved especially popular on account of the attractive souvenirs which were issued, and which were manufactured of white metal. Those present from the company were Wm. P. McGlynn, H. W. Berroth, T. F. McGlynn and L. J. Kane.

THE SCHOEN STEEL WHEEL COMPANY, of Philadelphia, exhibited samples of its wheels in different stages of manufacture, from which the character of the process could easily be seen. The company had no electric car wheels at the convention, but reported a growing interest in the use of rolled steel wheels for electric cars. Those present were C. T. Schoen, W. Martin Johnson, M. Jackson and N. B. Twist.

THE MODOC SOAP COMPANY, of Cincinnati, Ohio, had an exhibit in which the representatives present demonstrated the method of cleaning cars with the Perfect Car Cleaner. The company distributed to good advantage its booklet of instructions for car cleaning. The president, Henry Rober, who was the representative in attendance, says that it is his intention to bring the means of cleaning cars to the attention of street railway companies. The real object of the Perfect Car Cleaner is to save painting bills and keep the cars in trim, neat condition all the time at a comparatively small cost. At the Pennsylvania depot the company showed an example of its work in cleaning part of one of the cars there and leaving the rest uncleaned.

JAMES BOYD & BROTHER, of Philadelphia, agents for the Electric Hose & Rubber Company, had on exhibition a reel containing 1250 ft. ¾-in. electric hose in one continuous length, the longest piece of hose ever manufactured. A better appreciation of this achievement may be had when it is understood that 50 ft. is the longest length attained by other manufacturers except where 50-ft. sections are spliced by unwieldy joints, as is the case in one or two instances at present. The electric hose is made by a new and improved process and used only by the Electric Hose & Rubber Company. The fabrics, consisting of seine twine, are braided directly on the hose, independent of each other, without ends, laps or seams, all forced into a solid and homogeneous mass by hydraulic pressure during vulcanization. The hose is light and durable, and cannot be unwound or readily kinked. It is made for all purposes, and is especially adopted to rough usage. It is in use by the largest railroads and manufacturing and mining concerns in the United States, and large quantities of hose are now being exported to all foreign countries and as far away as Japan, Austrialia, South Africa and the Philippine Islands. So rapid has been the growth of the business of the Electric Hose & Rubber Company that the works have been enlarged as required, new machinery installed, until all available space has been occupied, and new additions are now under way that will double the present capacity. The Electric Hose & Rubber Company confines itself to the manufacture of hose exclusively. James Boyd & Brother are the Eastern sales agents, and are rapidly expanding their business in the sale of these goods. Those present in the interests of the firm were C. P. Green, T. W. Watson, B. Travis and W. Hymas.

THE T. H. SYMINGTON COMPANY, of Baltimore, had an interesting exhibit of the well-known Symington journal boxes of various kinds for both steam and electric railroads. Baltimore ball-bearing center and side bearings for steam and electric cars were also shown. The sample car of the Pennsylvania Railroad to be used on the Camden & Atlantic electric line was equipped with Symington boxes. The representatives of the company present were T. H. Symington, H. W. Baldwin, J. F Symington, D. L. Symington, C. J. Symington, T. C. de Rossett, Carll Tucker and A. H. Weston.

THE McGUIRE-CUMMINGS MANUFACTURING COMPANY, of Chicago, was represented by John J. Cummings, W. J. Cooke and Edward M. Kerwin. The company's principal exhibit, an interurban snow-plow, did not arrive during the first few days of the convention. Mr. Cooke, however, showed blue prints of this plow which attracted a great deal of attention. It consisted of a car 53 ft. over all, equipped with a nose plow at one end, a sweeper at the other end and a derrick in the center between the two cabs. The snow-fighting apparatus was arranged so that it could be easily unshipped, so that in summer the car could be used as an ordinary work car and the center loaded with track or other material of any kind. The 10-ton derrick was arranged to be driven with a 25-hp motor, and the sweeper end was fitted with a shaft by which the motor could drive either one of the two sets of brushes. An interesting feature of the car was that it was fitted with the company's new rain door, with which 2300 cars of the Alton Railroad have been equipped.

THE WHEEL TRUING BRAKE-SHOE COMPANY, of Detroit, exhibited samples of wheel truing shoes for both steam and electric roads. The company has 400 patterns of brake-shoes in stock, and is constantly adding to this number, so that it can supply shoes for any type of wheel used in either steam or electric railway work. J. M. Griffin, president of the company, and F. Griffin, treasurer of the company, were present. As a souvenir the company presented a handsome pack of playing cards.

THE DEARBORN DRUG & CHEMICAL COMPANY, of Chicago and New York, had an elaborate exhibit at the convention. One of the most striking features was a handsome hardwood case, in which various products of the company were exhibited, together with samples of pitted boiler pipes and incrustations caused by using water containing sulphates. At the rear of the booth were posted leaves from the company's calendar for the year. Those present were Robert F. Carr, first vice-president and general manager; W. B. McVickar, second vice-president and Eastern manager; George R. Carr and G. F. Duemler. Sample bottles of perfumery were presented to the delegates as a souvenir of the convention.

THE DUNER COMPANY, of Chicago, exhibited toilets for railway use. John C. Duner, F. L. Wells and J. A. Bunting were present.

THE FOX MACHINE COMPANY, of Grand Rapids, Mich., attracted much favorable comment by its exhibit of milling machines, cutters, mitering machines, saws and drills of various patterns. The representatives of the company present were S. Owen Livingston, Hiram W. Fox and George Schow.

THE GALENA SIGNAL OIL COMPANY, of Franklin, Pa., which had one of the largest spaces at the convention, devoted its space to a reception room, which was handsomely fitted with rugs, paintings and pictures. As souvenirs a very attractive telephone directory was presented to the delegates with a pamphlet on car and engine lubrication. The latter was written in colloquial style, and described an imaginary conversation between a number of steam railroad engineers and firemen and an expert of the Galena Signal Oil Company. The company was well represented by S. A. Megeath, J. S. Coffin, Robert McVicar, C. C. Steinbrenner, W. E. Amann, E. H. Baker, W. E. Brumble, J. W. Bunn, J. B. Ferguson, J. F. Gettrust, B. H. Grundy, E. W. Grieves, F. A. Guild, J. E. Hall, A. F. Miller, G. L. Morton, J. S. Patterson, J. A. Roosevelt, J. S. Seeley, W. O. Taylor, W. A. Trubee, A. Turner, J. A. Wilson, J. W. Walsh E. McVicar, Wm. Steel, and L. S. Baddour.

THE CHICAGO PNEUMATIC TOOL COMPANY, of Chicago, had one of the largest exhibits at the convention. Pneumatic tools of all kinds were on exhibition, including hammers, riveters, drills and compressors. The company also showed storage batteries and speed recorders. Those present in its interests were W. O. Duntley, J. W. Duntley, Julius Keller, W. H. Traver, Thomas Aldcorn, W. P. Pressinger, W. Curtis, G. A. Barden, Fred. Severin, Jas. M. Towle, C. E. Walker, W. Keller, H. E. Epley, B. H. Tripp, H. Hunter, H. Keller, Julius Keller, Jr., Jas. L. Fannon, Charles DeC. Aldcorn and R. Kimman. A great deal of interest was taken in the Duntley electric drill which has recently been put on the market by the Chicago Pneumatic Tool Company, and which is especially adapted for drilling rails on electric roads. Power is taken from the trolley wire, and the rail is pierced in a few seconds.

THE COLUMBIA BOLT & NUT COMPANY, of Bridgeport, Conn., was represented by F. Atwater and exhibited samples of the Columbia lock nuts.

THE DETROIT LUBRICATOR COMPANY, of Detroit, Mich., had an attractive exhibit of lubricators of various kinds designed especially for locomotive service but including some of other types. Those present in the interests of the company were F. W. Hodges, A. B. Wetmore and A. D. Homard.

THE HOMESTEAD VALVE MANUFACTURING COMPANY, of Pittsburg, Pa., exhibited valves of various kinds, including blow-off valves for locomotives and stationary engines, straight-way, three-way and four-way valves and Homestead locking cock. The company was represented by C. B. Ault and F. R. Schuchman.

THE INGERSOLL-RAND COMPANY, of New York, had a large exhibit of pneumatic tools of various kinds, including chipping and riveting hammers, drills, fans, forges, air compressors, reservoirs, etc. Among those representing the company were C. H. Haeseler, J. H. Jowett, James Moran, W. H. Armstrong, C. Bollinger, George F. Zollers, C. R. Hewitt, J. W. Mooney, R. H. Cunningham, Philip Weiss, E. P. Mooney, W. H. Stephens, Alan Wilson, James Bradley, Clarence Peck, Caid Peck and Marion Priseler.

THE OLIVER MACHINERY COMPANY, of Grand Rapids, Mich., exhibited a large number of interesting views showing its machinery and supplies. George C. Hubbard and J. W. Oliver were present in the interests of the company.

THE PENNSYLVANIA RUBBER COMPANY, of Jeanette, Pa., had an extensive exhibit of rubber goods, including packing, gaskets, hose of all kinds, rubber tiling, mats and matting. The exhibit attracted considerable attention from the delegates present, and the advantages of the company's products were explained by L. L. Torrey, Wilmer Dunbar, George Shiveley and H. Wifred DuPuy.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, of Scranton, had an exhibit of its railway department car, "Scranton," at the exhibit tracks on Atlantic Avenue. Those present were W. M. Mitchell, Frank McManamy, C. B. Congor, W. J. Hill, J. F. Cosgrove and E. E. Ramsey.

THE NILES-BEMENT-POND COMPANY, of New York, had a working exhibit close to the Pennsylvania Railroad tracks on Atlantic Avenue, of a 90-in. extra heavy driving wheel chucking lathe. Locomotive drivers were taken from a car equipment, hoisted by a Niles crane, and put on the lathe, where they were turned down. The company also had an office near the ball room, where its freinds were entertained. It was represented by James K. Cullen, J. W. McMurray, Frank B. Ward, E. C. Lewis, D. A. Normoyle, Geo. T. Watts, J. P. Ilsley, W. W. Ricker, L. A. Williamson, J. J. Hay and Henry Cleaver.

THE V. O. LAWRENCE COMPANY, of Philadelphia, had a very interesting exhibit of its patent trap for car vestibules. This trap, known as the "Filion" trap, differs from others in that the trap is hinged in a diagonal line, making two triangular pieces. The outer piece is hinged on to the door, and the inner piece to the side of the car. The trap opens and closes with the door by the pressure of the foot upon a treadle. As the parts are hinged there is a tendency to crush any ice which may form on the lower side of the trap. When the door is open the two parts fold behind it so as to offer no obstruction to egress from the car. The trap is also arranged to be raised by a lever between the cars if desired. The trap is covered in the usual way with rubber, and the edges are bound with brass. The trap has been adopted by some eight or ten railroad companies, and the Canadian Pacific Railway has recently given an order for the equipment of all of its vestibuled cars with this trap. The company was represented by V. O. Lawrence and N. P. Lane.

J. H. WATTERS, of Augusta, Ga., presented a model of his company: E. Taussig and W. R. Noxon.

THE SEAMLESS TUBE COMPANY OF AMERICA, with headquarters in Pittsburg, Pa., exhibited seamless wrought steel boiler tubes, forged steel superheater tubes and other steel products. The company was represented by George A. Dickson, C. M. Porcher, Charles E. McInness, I. W. Bollinger, Julian L. Yale, Horace L. Winslow and H. Llewellyn.

THE CLEMENT RESTEIN COMPANY, of Philadelphia, was represented by Norman Bruce Miller. The company exhibited packings for all general purposes and for high-pressure steam and hydraulic work. Among the brands shown were the "Bell," made of flax; "Red Seal," which is a rubber cord packing; "Belmont," and "Asbestos Diagonal." The company also had on exhibition "Belmont" steam hose.

WENDELL & MacDUFFIE, of New York, the well-known supply house, were represented by both Messrs. Wendell and MacDuffie, and contributed greatly to the enjoyment of the delegates by furnishing the cast for a play at the supply men's entertainment on Friday night. On this occasion Mr. Wendell and his brother, with two friends, acted in the attractive dramatic sketch, "Col. Carteret, V. C.," and displayed histrionic ability which would have been the envy of many professionals.

THE PRESSED STEEL CAR COMPANY, of Pittsburg, exhibited a new steel car, recently built by the company for the Southern Railway. This car was used by the representatives of the company in going to Atlantic City from Pittsburg, and developed no hot boxes or other troubles. A view and description of this car appears on page 987 of this issue. Those present in the interest of the company were C. E. Postlethwaite, O. C. Gayley, C. A. Lindstrom, F. M. Robinson, J. F. McEmulty, L. O. Cameron, C. D. Terrell, W. H. Wilkinson, H. S. Reeder, J. H. Mitchell, John S. Turner and D. J. Farragut.

STEAM LINE TO BE PARALLELED FROM SANDUSKY TO PEORIA

The Lake Erie & Western Railroad (steam), a subsidiary property of the New York Central, will soon be paralleled by traction lines throughout its entire length from Sandusky, O., to Peoria, Ill. Of the 417 miles of main-line track 225 miles are now paralleled by roads in operation. The Lake Shore Electric Railway will shortly commence work on its line from Sandusky to Fremont, and next summer the Western Ohio will build from Fostoria to Fremont. Last week a contract was let for a line between Peoria and Bloomington, Ill., and when these are in operation the paralleling of this road will be complete. This line has suffered perhaps more than any other steam road in the country from the competition of the electrics, because its through passenger business is not heavy and it has had to depend largely upon the local trade.

FINANCIAL INTELLIGENCE

WALL STREET, June 20, 1906.

The Money Market

A somewhat firmer tendency developed in the local money market during the past week, rates for all classes of accommodation ruling about ¼ per cent higher than those heretofore prevailing. At the beginning of the week, quotations for all maturities ruled comparatively easy, but later on there was a general marking up in interest charges. Call money advanced to 5 per cent, owing to the shifting of loans preparatory to the payment of the Standard Oil and other corporate dividend disbursements, but later on there was a gradual easing off in the rate to 3½ per cent. Time money, on the other hand, has remained decidedly firm throughout the week. The demand for the long periods has been considerably larger, despite the heavy liquidation in the stock market. The supply of funds, however, was not large, and banks and other lenders experienced no difficulty in holding the market firm at 4¾ per cent for sixty and ninety days, 5¼ per cent for six months and 5½ per cent for over the year maturities. It is not expected that time money rates will work materially higher until preparations begin for the usual outflow of funds to the interior for crop-moving purposes. Already foreign bankers are disposed to offer with some degree of freedom, at prevailing rates, and the offerings of finance bills for this purpose have been the principal factor in bringing about a sharp decline in the rates of sterling exchange. The successful flotation of the Pennsylvania loan in Paris is also calculated to relieve the local monetary situation. It is pointed out that, while the placing of this $50,000,000 loan abroad may not result in a resumption of gold imports in the near future, it will certainly increase the supply of credits, and thus eliminate the possibility of gold exports. Another factor in favor of the continuance of the present conditions is the large supply of new gold from the Klondike which is now practically assured. Conservative estimates of the receipts from that source during the coming season are considerably in excess of $35,000,000. The first consignment of gold from the North, amounting to $2,000,000, was received this week, and it is expected that from now on the arrivals will be frequent. As this money is usually transferred from San Francisco to New York by telegraph, the money at once becomes available for market purposes. Another favorable development was the decision of the Secretary of the Treasury to place $12,000,000 special deposits with the banks at San Francisco, part of which may eventually find its way to this center. About the only unfavorable factors in the situation are the heavy July 1 disbursements for interest and dividends, preparations for which are usually accompanied by flurries in call money rates, and the fact that on July 10 the banks will be obliged to pay into the Government Treasury $10,000,000 special deposits. The European markets have ruled easy, despite the Russian disturbances. The bank statement published last Saturday was unsatisfactory. Loans increased $913,700. Deposits were $1,046,700 larger than in the preceding week, thus increasing the reserve required by $261,675. Cash increased $173,000, which, deducted from the increase in deposits, diminished the surplus by $88,675. The surplus now stands at $7,073,375, as against $7,209,500 in the corresponding week of last year; $38,869,975 in 1904, $10,099,575 in 1903, $12,158,250 in 1902, $6,611,350 in 1901 and $17,498,750 in 1900.

The Stock Market

The past week has been one of depression in the stock market, and under pressure of liquidation and short selling, prices recorded very substantial declines. The selling movement culminated in a sharp drive at the market late on Monday, and it was then obvious that the market was pretty well oversold. This break was followed by the official announcement that the Pennsylvania loan of $50,000,000 had been successfully placed in Paris. The effect of this was a sharp decline in sterling exchange and an upward movement in stocks, the recovery having been due to a retreat of the short interest, rather than to the advent of any new buying. The market has been entirely professional, and the public continues to ignore Wall Street and to give its attention to other speculative ventures, principally real estate. Speculative conditions have been adverse to bullish operations in stocks. The delay in passing the railway rate bill by Congress, together with unfavorable crop advice, supplemented by strength in the grain markets, encouraged bearish operations, but the more important influence was the opposition of banking and other large interests. Speculation has run largely into a comparatively small number of stocks. These had been advanced to unreasonable levels, and the market became top-heavy. There has been liquidation in Union Pacific, St. Paul, Copper and Steel stocks, and in Reading, the latter having been a conspicuously weak feature. On the other hand, Baltimore & Ohio has advanced sharply, the stock selling at the highest price ever attained. The buying of the stock was based upon the expectation that the directors of the company declare a dividend on the stock at the rate of 6 per cent, as compared with the 5 per cent annual rate now paid, and which was subsequently fulfilled. Fundamental conditions are all that can be desired. Call money is likely to remain cheap up to near the end of the month; the activity and strength in iron and steel continues unabated; railway earnings are largely in excess of those for the corresponding periods of last year, and crop reports are more favorable than those put out earlier in the week. The country's foreign trade for the fiscal year ending June 30 next, promises to break all previous records. Should May and June show as large a monthly average as the previous ten months, the imports will reach a total of $1,225,000,000 and the exports $1,786,000,000, making a total of $3,011,000,000. The position of the market was greatly improved as a result of the heavy liquidation above referred to. Sentiment was more cheerful, and it looks as if the downward movement in prices is near its culmination.

The local traction stocks were prominent in the week's transactions, the feature having been the break of 7 points in Interborough-Metropolitan common, on withdrawal of pool support. Brooklyn Rapid Transit declined on selling by a bear pool. There is nothing in the traction situation that is unfavorable, other than the efforts to force the Brooklyn Rapid Transit Company to carry passengers from Manhattan to the seaside for a single fare.

Philadelphia

Very little activity developed in the local traction shares during the past week, and prices generally reflected the weakness prevailing in other quarters of the market. Philadelphia Traction was exceptionally firm, the price advancing ¼ to 99 on purchases of a few hundred shares. Philadelphia Rapid Transit was under pressure and declined to 24, the lowest price recorded for the stock for some time. About 2500 shares were traded in. Philadelphia Company common, after selling at 51 declined to 50 on light transactions, and the preferred sold at 49¼. Other sales included Union Traction at 63¾ to 63¼, Railway General at 6⅞, United Companies of New Jersey at 263, American Railways at 51½ and 52, and United Traction of Pittsburg preferred at 51.

Chicago

Dealings in Chicago street railway issues were considerably smaller than in the preceding week, and prices generally reacted rather sharply. West Chicago lost 5½ points to 32, on light transactions. Chicago Union Traction ran off from 5 to 4⅝, and the preferred sold at 14. Metropolitan Elevated lost 2 points to 28, and the preferred declined to 67¼. South Side Elevated lost 1½ to 96½ on sales of 265 shares. Northwestern Elevated common rose from 25¾ to 27⅞, and the preferred brought 67. Chicago & Oak Park brought 6⅞.

Other Traction Securities

Trading in the Baltimore tractions was confined almost entirely to the United Railway issues, and particularly to the income bonds. In the early part of the week the incomes held firm at 74¾ and 74⅞, but toward the close heavy selling developed which carried the price off to 73. The selling was accompanied by the usual crop of rumors, none of which could be confirmed.

About $600,000 of the free bonds were dealt in. About $100,000 of the deposited bonds brought 72¾ and 72½. The 4 per cent bonds were quiet and unchanged at 92⅜ and 92½. Other transactions included 150 United Railway free stock at 16¼, 300 deposited stock at 16, $16,000 Norfolk Railway & Light 5s at 99¼, and $15,000 Macon Railway & Light 5s at 101½.

There was a marked falling off in the dealings in Massachusetts Electric, and prices for both issues reacted rather sharply. The common, on sales of about 1100 shares, declined 1½ points to 20½, while the preferred dropped from 74¾ to 71 on transactions aggregating about 1000 shares. Otherwise the market was dull and devoid of feature. Boston Elevated rose from 152 to 153½ on purchases of odd lots. The Boston & Suburban sold at 22½, Boston & Worcester at 36, the preferred at 88, West End common at 96½ and 97, and the preferred at 112½ and 112. In the New York Curb market, $15,000 Jersey City, Hoboken & Paterson 4s sold at 73 and interest, and $10,000 Public Service Corporation certificates at 69 flat.

There was little trading in traction securities in Cincinnati last week. Cincinnati, Newport & Covington common declined fractionally to 73¼. The preferred sold at 98. Cincinnati, Dayton & Toledo lost fractionally, selling at 26⅛. A small lot of Scioto Valley preferred sold at 98. Toledo Railways & Light sold at 33¾. A block of Northern Ohio Traction 5s sold at 100½.

In spite of a fresh outbreak by the city administration, Cleveland Electric made a slight gain in Cleveland last week, selling up to 79½ on lots aggregating about 600 shares. Lake Shore Electric came in for a small amount of activity, the old preferred selling at 67 and the new preferred at 60. Northern Ohio Traction & Light sold at 30½ for a small lot. Aurora, Elgin & Chicago common sold at 35½ and the preferred at 79¾, a slight decline from last sale.

An unexpected announcement of a second dividend on the stock of the Columbus Railway & Light Company was the signal for considerable activity in that stock at Columbus. Several hundred shares changed hands at from 83 to 85. The new stock of the Columbus, Delaware & Marion Railway made its appearance, and a small lot sold for 45. Since the recent refinancing, the preferred was exchanged for bonds, and the new company has but one kind of stock. The road is making numerous important improvements and its earnings are increasing rapidly.

Security Quotations

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

	June 13	June 20
American Railways	52½	51½
Boston Elevated	151	152
Brooklyn Rapid Transit	84⅛	81½
Chicago City	170	167
Chicago Union Traction (common)	4⅞	4⅞
Chicago Union Traction (preferred)	13	15¼
Cleveland Electric	80	80
Consolidated Traction of New Jersey	81½	81
Detroit United	95	94½
Interborough-Metropolitan Co. (common)	51	42½
Interborough-Metropolitan Co. (preferred)	85	77¼
Interborough-Metropolitan Co. 4½s	—	—
International Traction (common)	58	59¼
International Traction (preferred), 4s	80	80
Manhattan Railway	151	149
Massachusetts Electric Cos. (common)	22⅜	20
Massachusetts Elec. Cos. (preferred)	73⅝	70
Metropolitan Elevated, Chicago (common)	29	26
Metropolitan Elevated, Chicago (preferred)	70	66
Metropolitan Street	112	105½
New Orleans Railways (common)	32½	32½
New Orleans Railways (preferred)	82	81½
New Orleans Railways, 4½s	89¼	89¼
North American	97	96
North Jersey Street Railway	27	27
Philadelphia Company (common)	51	51
Philadelphia Rapid Transit	24¾	24
Philadelphia Traction	99	99
Public Service Corporation 5 per cent notes	95½	95
Public Service Corporation certificates	69	69
South Side Elevated (Chicago)	98	96½
Third Avenue	128	128
Twin City, Minneapolis (common)	114⅛	112¾
Union Traction (Philadelphia)	*63	63¼
West End (common)	—	—
West End (preferred)	—	—

a Asked. * Ex-dividend.

Metals

The "Iron Age" reports the dissolution of the Southern Foundry Association, an organization based upon a gentlemen's agreement among the leading Birmingham furnace companies. For months Northern furnaces have taken the greater part of the business coming up in foundry iron. The crisis was reached this week, one of the Southern makers entering the market. Just how much business was secured cannot be determined, but one of the principal transactions was the sale of 10,000 tons of No. 2 Birmingham at $13, a decline of $1 a ton. The situation is entirely different in the markets for steel making irons. The markets are absolutely bare of Bessemer, and there is not much basic immediately available. The demand for finished material is very good. The leading interests during the first half of this month booked an aggregate of orders in excess of its best shipping records. Some large orders for structural material have been entered. Steel rail makers have added 37,000 tons to their 1907 commitments.

Copper continues firm on the basis of 18⅞ for spot lake.

PLANS OF THE UNITED RAILWAYS OF BALTIMORE

Copies of the plan of the Income Bondholders' Association, recently formed by several banking firms for the purpose of offering the United Railways & Electric Company funds for immediate improvements and for paying interest on the income bonds, have been shown to trust companies with a view of having them join in the underwriting, says the "Wall Street Journal."

The plan provides for an issue of $7,500,000 of debenture bonds, which are really a third mortgage on the property of the United, and which are to run from ten to twenty years. While all the details of the plan have not been made public it is understood that a bonus of $4,000,000 of stock, equal to 80,000 shares, is asked for. The United Railways has in its treasury $9,000,000 of stock. The par is $50 and the market about $16.

It is said that the plan provides for the issuance at once of $3,500,000 of bonds, reserving the other $4,000,000 for future improvements. The plan provides for interest on the income bonds up to June, 1907. The interest on the bonds amounts to $1,400,000.

There is no assurance that this plan will be accepted by the United Railways. The management is working on a plan of its own, to provide for the use of the charter of the Maryland Electric Railway Company, which it owns, in raising funds. The feature of the association's plan, however, is that it will be underwritten when offered to the management. It will probably be submitted this week.

IMPORTANT TRACTION CONSOLIDATION IN EASTERN PENNSYLVANIA

The banking house of William A. Read & Company, of New York, and Forrest & Company, of Philadelphia, are now working out the financial details involved in the proposed equipment and control of the existing electric railway and lighting interests in and adjacent to Schuylkill County, Pa. All of the properties have been examined and reported upon by J. G. White & Company, of New York, who are also to operate the consolidated companies. The electric railways included in this merger are the Pottsville Union Traction Company, Pottsville & Reading Railroad Company, Schuylkill Haven & Orwigsburg Street Railway Company, Schuylkill Electric Railway Company, Tamaqua & Lansford Street Railway Company, Tamaqua & Pottsville Electric Railway Company, Coal Castle Electric Railway Company, and the Port Carbon & Middleport Electric Railway Company.

The plan comprehends, besides ample capital for future extensions and acquisitions, provision of over $1,500,000 to cover the cost of immediately making contemplated railway connections, additions and improvements as well as improving the lighting properties. The mileage of the foregoing lines is 57.18, and with the 20 miles to be built there will be in all 77.18 miles to serve a population of about 110,000. The capitalization is to be made up of $1,000,000 5 per cent cumulative, convertible preferred stock, $5,000,000 common stock, and $6,000,000 in 5 per cent first mortgage thirty-year gold bonds.

CHICAGO TRACTION AFFAIRS

The Chicago City Railway Company and the Union Traction Company have about completed the preparation of figures of the value of their tangible properties, to be submitted to the City Council committee on local transportation. According to Walter L. Fisher's proposed plan of settlement of the companies with the city these figures are to enter into the purchase price paid by the city when the city takes over the lines.

Mr. Fisher's draft of an ordinance for the permanent settlement of the traction question along the indeterminate license plan, as outlined in the last week's issue of the STREET RAILWAY JOURNAL, has been pronounced satisfactory in its essential features by representatives of the traction companies.

John P. Wilson, for the Chicago City Railway Company, stated that he saw nothing objectionable in the general features of the draft, and that his company would be prepared to take up the details of the draft and negotiate with the city as soon as the figures on the value of their properties were ready.

W. W. Gurley, general counsel of the Chicago Union Traction Company, said there were two or three objections to the general features of the draft.

The ordinances permitting the trolleyizing of the cable lines of both the Chicago City Railway and the Union Traction Companies and ordering the Union Traction Company to lower its tunnels were vetoed by Mayor Dunne, and the ordinances were again passed by the City Council with the amendments suggested by the Mayor added. The added clauses provide:

That within sixty days of the date at which the Council has ordered the trolley wires and poles removed the companies shall get them off the streets.

In case the companies do not so remove them within the sixty days' time, then the wires and poles shall become the property of the city.

The companies have ten days to accept the ordinances. Mayor Dunne, in giving his reasons for agreeing to the ordinances, said that he felt that ultimate ownership by the city would be the result of present negotiations. The trolleyizing of the North and West Side lines, he said, was necessary, because of the Federal laws requiring the lowering of the tunnels under the river. There was, however, no such necessity for trolleyizing the Chicago City Railway lines, but he did not think that the street car patrons of the South Side should, under any circumstances, be discriminated against in the matter of the good service which has been promised by the companies upon the granting by the city of trolley permits. He therefore favored granting the permits for the South Side, as well as for the North and West Sides. He said that heretofore the city could not safely grant permits for this purpose, because the companies made extravagant claims under the so-called ninety-nine-year act, and there was danger that trolley permits might possibly have strengthened these claims in law.

APPLICATION FOR UNDERGROUND AND SURFACE GRANTS IN PITTSBURG

Under the title of the Pittsburg Subway Company the right is asked the city of Pittsburg to construct a tunnel from Smithfield to Neville Streets, with a loop around the down-town district, and a number of connecting surface lines to the East End. The request was made in the form of a communication which was sent to Mayor Guthrie and to Councils. An ordinance has been prepared for presentation at a later date. In the application of the syndicate it is signified that the promoters of the enterprise stand ready to meet the all important requirement of compensation to the city. A percentage of the gross receipts to be agreed upon later will be paid to the city. The communication reads in part as follows:

To the Honorable Mayor and Councils of the City of Pittsburg:

The Pittsburg Subway Company, proposing to construct an underground passenger railway in the city of Pittsburg, hereby applies for the consent of the local authorities to such construction.

The company is incorporated under the elevated and underground passenger railway act of June 7, 1901 (P. L. 523). By its charter from the Commonwealth it has the franchise to construct and operate such railway around a circuit described as follows: Beginning at the intersection of Smithfield Street and Oliver Avenue; running thence along Oliver Avenue to Liberty Street, along Liberty Street to Ferry Street, along Ferry Street to Third Avenue, along Third Avenue to Smithfield Street, and along Smithfield Street to the place of beginning.

Under the authority of its charter, the company has also located branches or extensions over the following lines:

The first, beginning at the intersection of Smithfield Street and Oliver Avenue; running thence along Virgin Alley to Grant Street, thence across Grant Street, thence in a straight line to a point in the westerly line of Neville Street, 130 ft. northerly from the north line of Center Avenue, thence across intervening properties and streets a distance of about 255 ft. to the intersection of Center Avenue and Enfield Street, thence along Center Avenue to Penn Avenue, thence across Penn Avenue to Frankstown Avenue, thence along Frankstown Avenue to the angle in that avenue next easterly from Finley Street, thence across intervening properties to a point in the westerly line of Fifth Avenue extension opposite Kelly Street.

The second, following the line of the first to a point from which a perpendicular to the southward will intersect the center line of Bouquet Street at its intersection with the center line of Bayard Street, and thence southward along the said perpendicular to Bouquet Street; and,

The third, following the line of the first to a point from which a perpendicular to the southward will intersect the northerly line of Forbes Street at its intersection with the westerly line of Brady Street; thence southwardly along the said perpendicular to the northerly line of Forbes Street, and thence over the surface of Forbes and Brady Streets to the northerly end of the approach of the Twenty-Second Street bridge.

The plan of this company is to make its downtown circuit a common terminal loop for passenger traffic coming into the business district from all directions; thus taking off the crowded surface a great proportion of the cars which now impede traffic, and putting them under ground.

The plan is to reach the Southside, the West End and Allegheny by means of tunnels under the rivers, so that cars operated on the surface of the suburbs can be handled under ground in the crowded district.

It is also proposed to reach the East End by means of a tunnel connecting with the downtown loop at the corner of Smithfield Street and Oliver Avenue, and running thence directly through Herron Hill on the line of the above first branch to a point in Junction Hollow, just north of Center Avenue, coming out of the hill on the west slope of Junction Hollow at such a level that cars may be run from that point, both on the surface of the East End Streets, and also through a subway under Center Avenue. From this point it is proposed to extend the underground construction by the line above described to Kelly Street. From the latter terminus also the cars can be run out over the surface to the north, east and south.

The first construction which this company proposes to undertake in connection with the downtown circuit is the branch from Smithfield Street to Junction Hollow. Afterward the extension of this branch to East Liberty and Kelly Street can be undertaken, as well as the branches extending to Allegheny, the West End and the Southside.

For the present purpose this company therefore asks the consent of the local authorities to its construction of its proposed underground railway around the said circuit under Oliver Avenue, Liberty Street, Ferry Street, Third Avenue and Smithfield Street; also from Smithfield Street along the said branch locations to Neville treet, to Boquet Street and to Brady Street; all this on such reasonable terms and conditions as may be deemed proper by the Mayor and Councils.

THE TUNNEL TO LONG ISLAND CITY—STATUS OF THE WORK

William Barclay Parsons, vice-president of the company which is constructing the Belmont tunnel under the East River from Forty-Second Street to Astoria, testifying this week before Justice Fitzgerald in the Supreme Court, in connection with the differences between the New York & Long Island Railroad Company and the City of New York, told some interesting facts relative to the progress of the work. Mr. Parsons informed the court that the work of construction is being pushed forward with great rapidity. The tunnel is practically finished under Forty-Second Street from Fourth Avenue to the East River, and out under the river for 30 ft. beyond the pier line. In round figures the company has dispensed $1,000,000 in the acquisition of property necessary to the work of construction, while $2,000,000 has been expended for the labor of digging the tunnel.

It was not brought out what the company's plans are in regard to future extensions and proposed termini, with the exception of the statement by Mr. Parsons that there would be a terminal at or near the Grand Central Station.

The Supreme Court hearing is a part of the proceedings in the city's attack on the validity of the franchise under which the tunnel is being constructed. The city contends that the construction of the work lacks legal support, and that a franchise of such magnitude should be a much greater source of revenue to the municipality than it is. The company sued to have the city restrained from interfering in any way with the work. The city bases its contention that the route proposed twenty years ago has been abandoned. The company says that with the extensions which have been granted from time to time it has until Jan. 1, 1907, to finish the tunnel.

THE TEMISKAMING & NORTHERN RAILWAY TO USE ELECTRICITY

The Temiskaming & Northern Railway, being built by the Ontario Government, is operating from North Bay to New Liskeard, about 130 miles, and is building 100 miles, so as to tap the Grand Trunk Pacific when it reaches the junction point this fall. Owing to the danger to the valuable forests through which the road runs from sparks from the locomotives, the Government has decided to do away with steam altogether, and substitute electricity as the motive power, at an estimated cost of $1,000,000. Tenders will be called for as soon as the plans and specifications are prepared. Information may be obtained by communicating with D. E. Ryan, the secretary of the Government Commission, Toronto, Ont.

STONE & WEBSTER ENGINEERING CORPORATION

An engineering and construction company, with a fully paid-in cash capital of $250,000 has been organized by Stone & Webster, under the laws of Massachusetts, to engage in a general engineering and construction business in connection with large undertakings. The Engineering Corporation will take over the engineering part of the business of Stone & Webster, which was originally the important part of their general business.

Stone & Webster, some sixteen years ago were among the first to enter the field of electrical development as electrical engineers and experts, the business soon reaching large proportions. During the last few years, however, on account of other important interests of the firm, their efforts along these lines have been almost exclusively devoted to the requirements of the various companies under their management. As the firm desire to devote their time and energies to financial affairs and the management and development of the numerous properties which they operate, they have formed the Stone & Webster Engineering Corporation, the personnel of which will largely consist of men who have been associated with the firm for years in connection with the engineering and construction side of their business. In addition, arrangements have been made to associate with the new company engineers of prominence in their various lines with the idea of placing it in a position to undertake engineering and construction work of importance throughout the country. All the stock of the company has been taken by Stone & Webster and their associates.

BROOKLYN AND NEW YORK AT ODDS OVER BRIDGE PLANS

Brooklyn and New York are at odds over the plan of Bridge Commissioner Stevenson for connecting the Williamsburg and Brooklyn Bridges by an elevated loop. Naturally, Brooklyn contends that the loop is essential to the solution of the traffic problems confronting that borough. New Yorkers on the East Side are opposed to the structure in what is the most crowded part of the city, and favor a subway, which, from many standpoints, would not answer at all as a temporary expedient. When the hearing was called in the City Hall last Friday there was a goodly array for and against the plan. Dr. McKelway, editor of the "Brooklyn Eagle," was foremost among the Brooklynites representing that borough. The meeting was adjourned until Friday, June 22. The commissioners appointed by the Appellate Court to consider subway routes in Brooklyn have approved a loop connecting the two bridges, the line from the Williamsburg Bridge crossing over Delancy Street to a point near Norfolk Street, and thence under the Bowery, Walker and Center Streets to Brooklyn Bridge, and Bridge Commissioner Stevenson has opened bids for the construction of an underground station in Delancy Street at the Manhattan end of the Williamsburg Bridge. The purpose of this station is to receive both elevated and trolley cars from Brooklyn and eventually to become a part of the subway system connecting the two boroughs. Five bids were received, as follows; Richard Henningham, $1,345,662; Snare-Triest Company, $1,167,000; Norton & Company, $1,260,000; Degnon Construction Company, $1,297,930, and John J. Hopper. Mr. Hopper's bid in one place stated that he bid $1,000,799, and in another place it stated that he bid $1,799,000. The detail of the items would seem to indicate that the larger amount is correct. If the other is correct Mr. Hopper will be the lowest bidder, so, in order to settle the question, the matter will be referred to the Corporation Counsel for an opinion.

TERMS OF NORTHERN OHIO MERGER

The terms for the consolidation of the Canton-Akron system with the Northern Ohio Traction & Light Company have been signed, but the actual consolidation will not become effective for about sixty days, owing to the many details to be carried out. The first step will be the consolidation of the three Tucker-Anthony properties, the Canton-Akron Railway Company, the Canton & New Philadelphia Traction Company and the Tuscarawas Traction Company, into one company. This new company will then be merged with the Northern Ohio Traction & Light Company. The Tucker-Anthony properties have a total outstanding debt of $4,500,000, and capital stock of $1,038,000. To take care of these issues, the stock of the Northern Ohio Traction & Light Company will be increased to $7,938,000, and the bonded indebtedness to $10,500,000. The consolidation is, therefore, simply an exchange of securities, and the Eastern interests which owned the Canton-Akron will be represented on the directorate of the Northern Ohio Traction & Light Company. The merged properties will have nearly 200 miles of track, with annual earnings of $1,600,000.

THE MASSACHUSETTS MERGER BILL

Massachusetts worked itself into a frenzy over the "merger" bill, relative to investments by railroad companies in street railway companies, and then the legislators referred the measure to the next session. Considering the power vested in the Railroad Commissioners, whose rights it was not proposed to curtail, some of the statements made by the opposition as to the results likely to follow the passage of the act seem positively asinine. The bill was simply nothing more nor less than a measure to effect an end that even now can be accomplished by a home corporation controlling another home company through the medium of a holding corporation.

SCHOEPF SYNDICATE GETS A CONNECTING LINK

It is reported that the Schoepf syndicate has finally concluded negotiations for the control by lease of the Dayton & Western Traction Company, whose lines extends from Dayton to Richmond, Ind., and includes about 43 miles of track. The syndicate had been negotiating for this property for the past year or more, as it was needed to connect the Ohio and Indiana properties of the syndicate and complete a through line from Indianapolis to Columbus. The road was owned by Valentine and J. H. Winters, of Dayton, and it was unique in that it had no bonded or floating debt, and was paying 5 per cent dividends on $850,000 of preferred stock and 2 per cent on $450,000 of common stock. According to report the owners will receive 6 per cent per annum on the total capitalization of $1,300,000. The road gives the Schoepf syndicate an unbroken line of 310 miles from Terre Haute, Ind., to Zanesville, Ohio, and with the exception of the Dayton & Troy and the Western Ohio, leading north from Dayton, it now has all the lines necessary to carry out its plans for a system connecting up the leading cities of Ohio and Indiana.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JUNE 12, 1906

822,924. Brake-Shoe; Frank P. Collier, Wilmette, Ill. App. filed Feb. 20, 1905. Details of construction of hard metal insert plates.

822,925. Brake-Shoe; Frank P. Collier, Wilmette, Ill. App. filed April 1, 1905. Has a transversely corrugated plate at or adjacent to the back of the shoe.

822,951. Railway Signal; John S. Jeffrey, Columbus, Ohio. App. filed Nov. 15, 1905. A device for flagging a train consisting of a manually-operated swinging arm carrying a signal device and car-operated means to withdraw the signal.

822,961. Trolley Placer and Guide; Edgar A. Leake, Lawrence, Mass. App. filed Oct. 18, 1905. Guiding eccentric plates having a tapered flange adjacent the wheel mounted to turn on each side of the trolley wheel, the widest portion of the flange being normally uppermost, and each eccentric plate having inwardly-projecting overhanging lugs.

823,003. Car Fender; Einar Tallaksen, Chicago, Ill. App. filed Dec. 20, 1905. The fender is mounted upon an auxiliary truck, thereby causing it to follow curvatures of the track.

823,040. Automatic Safety Trolley Pole; John R. French, Los Angeles, Cal. App. filed March 3, 1905. The trolley pole has a hinge near its upper part, and the hinged section is connected with the tension spring at the base of the pole, so that when the wheel leaves the wire the hinged section is caused to fly upward, which movement at the same time relaxes the spring and allows the trolley pole to drop.

823,067. Electric Railway System; John L. Moore, New York, N. Y. App. filed Nov. 16, 1904. Details of a sectional conductor, the divisions of which are successfully energized during the passage of the car.

823,095. Slack Adjuster; Charles O. Anderson, Omaha, Neb. App. filed Aug. 26, 1905. Relates to means for automatically taking up slack which may occur in the brake rigging, due to wear on the brake-shoes or other parts.

823,136. Apparatus for Operating Railway Switches; Martin M. McNeley, Des Moines, Ia. App. filed Sept. 29, 1905. Two pairs of levers connected at their ends by a cross-bar, and each lever pivoted to the under side of the car and provided with a cam on its lower free end, and treadles for throwing either pair of levers into engagement with the switch point.

823,147. Railway Switch; Edward Wartman, South Bend, Wash. App. filed Sept. 18, 1905. In a single-track road, means whereby each car in passing automatically reverses the switch at turn-outs, so that the next car will be switched upon the diverging track.

823,196. System of Train Control; August Sundh, Yonkers, N. Y. App. filed Dec. 4, 1905. Relates to a multiple-unit control system for electric trains.

823,255. Car Brake; Henry T. Brown, Wilkinsburg, Pa. App. filed Sept. 25, 1905. A combined track and wheel brake adapted to be simultaneously actuated by the operator.

823,285. Car Brake; Charles B. Mead and Robert S. Fullerton, East Palestine, Ohio. App. filed Feb. 28, 1906. An emergency brake of the "chock-block" type.

823,292. Rail-Bond; Edwin W. Robinson, Punxsutawney, Pa. App. filed July 12, 1905. The rail-bond has threaded ends which project through the web of the rail and are engaged by conical nuts, which may be set up to bring the bond into close engagement with the rails.

823,310. Self-Acting Switch; William H. Taylor, Philadelphia, Pa. App. filed Feb. 2, 1906. A system of levers by which the switch may be thrown from a moving train.

823,311. Metallic Railway Tie; Frederick H. Urban, Brazil, Ind. App. filed Sept. 28, 1905. A metal cross-tie provided with a pair of oppositely extending and inclined rail-holding abutments, one of which is integral with the cross-tie and the other is removably secured thereto, a plate of wood or other similar material between the rail-holding abutments upon which the rail rests, and removable means for holding the wooden plate in place.

823,315. Air Supply Apparatus for Air Brakes; Ernest B. Allen, Louisville, Ky. App. filed Feb. 13, 1906. An auxiliary air-pump driven by the car axle, is automatically started the moment the brakes are applied, to thereby store air in a tank from which the train line pressure is quickly replenished when the brakes are released.

823,325. Step Holder for Cars; Joseph Edwards, New York, N. Y. App. filed March 15, 1906. Means for securing the step in its folded position, consisting of a vertical stem slidably mounted in a sleeve and having a hook adapted to engage the upper edge of the step.

823,332. Trolley Finder; William J. Hinton, Danville, Ill. App. filed Aug. 16, 1905. Guiding arms pivoted in the trolley harp are placed in operative position by pulling upon the trolley cord.

823,438. Trolley Hanger; Thomas Price, Minneapolis, Minn. App. filed June 5, 1905. The hanger is provided with depending ears, which engage the trolley wire, and which may be clamped thereagainst by a hollow sleeve and pressed downward thereon.

823,478. Safety System for Motor-Propelled Cars; John A. Miller, Baltimore, Md. App. filed Nov. 6, 1905. The motor circuits are prevented from completion by circuit breakers under the car until the doors are closed.

823,490. Electric Motor Truck; William Dalton, Schenectady, N. Y. App. filed Aug. 29, 1905. Details of a truck designed to afford improved facilities for the support of the motor and brake rigging.

823,491. Locomotive Truck; William Dalton; Schenectady, N. Y. App. filed Aug. 29, 1905. Details of construction.

PERSONAL MENTION

MR. WILLIAM B. FLYNN, assistant electrical engineer of the New York, Westchester & Boston Railway Company, was married June 16 to Miss Edna Anson, of Hasbrouck Heights, N. J.

MR. ARTHUR A. LIGHTFOOT, who has been connected with the office of the Hartford & Springfield Street Railway Company for the past four years, has resigned his position to become assistant superintendent of the Fitchburg & Lowell Street Railway Company.

MR. GEORGE FOWLER has resigned as superintendent of the Southern Car Company, of High Point, N. C., and returned to Amesbury, Mass. Mr. Fowler has been superintendent at High Point for three years. Before moving to High Point he was superintendent for the Briggs Car & Carriage Company, for fourteen years at Amesbury.

DR. SCHUYLER SKAATS WHEELER, president of the Crocker-Wheeler Company, Ampere, N. J., sailed June 14, on the Lloyd steamship "Barbarossa" for a short European trip. He was accompanied by Prof. Francis B. Crocker, professor of electrical engineering at Columbia University, who has been associated with him in business for many years.

MR. WALTER L. ADAMS, general superintendent of the Milford & Uxbridge Street Railway, had a narrow escape from serious injury on June 15, when, in attempting to turn his automobile in the Hopedale (Mass.) Cemetery, the machine ran backward down a 20-ft. terrace. Mrs. Adams suffered from a dislocated shoulder and a cousin was seriously injured. Mr. Adams was only slightly injured.

MR. WALTER HURD, a steam road man, has been appointed general passenger and freight agent of the syndicate territory about Columbus. Mr. F. A. Burkhardt, of Lima, has been appointed to a similar position in charge of traffic of the lines centering at Lima. Both men will come under the jurisdiction of Mr. D. G. Edwards, general traffic manager of the Schoepf-Morgan system of Ohio and Indiana.

MR. GEORGE FLETT, managing director of Dick, Kerr & Company, Ltd., of London, left New York this week for London, after a stay of a few days. This will complete a trip around the world lasting six months. On June 18 Mr. Flett was entertained at a farewell luncheon at New York, at which there were present Messrs. F. J. Sprague, J. G. White, H. H. Vreeland, H. McL. Harding, James H. McGraw, T. C. Martin, P. G. Gossler, J. M. Wakeman, H. G. Stott, M. G. Starrett, S. M. Curwen, W. S. Burnham, J. Goodell, A. N. Connette and W. S. Doran.

MR. S. W. MOWER, secretary of the American Railway Mechanical and Electrical Association, has resigned his position with the Detroit United Railway Company and has accepted that of general manager of the Southwestern Traction Company, of London, Ont. This is the company which is planning to use three-phase electric railway operation under the Ganz patents. It has already built about 20 miles and has 9 miles under construction. Mr. Mower has occupied the office of secretary of the Engineering Association and its predecessor, the American Railway Mechanical and Electrical Association since the organization of the latter in Detroit in 1902. His many friends will congratulate him on his appointment as manager of this company, whose work in this country is so unique that it will possess a special interest to all railway managers and engineers.

MR. J. R. HARRIGAN, general manager of the Canton-Akron Railway system, has announced several changes in the personnel of the operating force of that company. Mr. William E. Rolston has been promoted to master mechanic and chief engineer of the Canton-Akron Railway Company, Canton-New Philadelphia Railway Company, and the Tuscarawas Traction Company. Mr. Rolston formerly was superintendent of the Dayton & Troy Electric Railway Company, and came to Canton March 1, and assumed his duties as engineer at the power station. Mr. D. A. Scanlon has been appointed division superintendent of the Canton-Akron City lines and the Massillon City lines. Mr. Scanlon formerly was superintendent of the Raleigh Electric Company at Raleigh, N. C. Mr. George E. Barber has been appointed train master of the Canton-Akron Railway Company and the Canton-New Philadelphia Railway Company. Mr. Barber formerly was connected with the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, Newark & Zanesville Electric Railway Company, in the capacity of despatcher. Mr. William T. Luxton has resigned as superintendent of the Canton-Akron Railway Company.