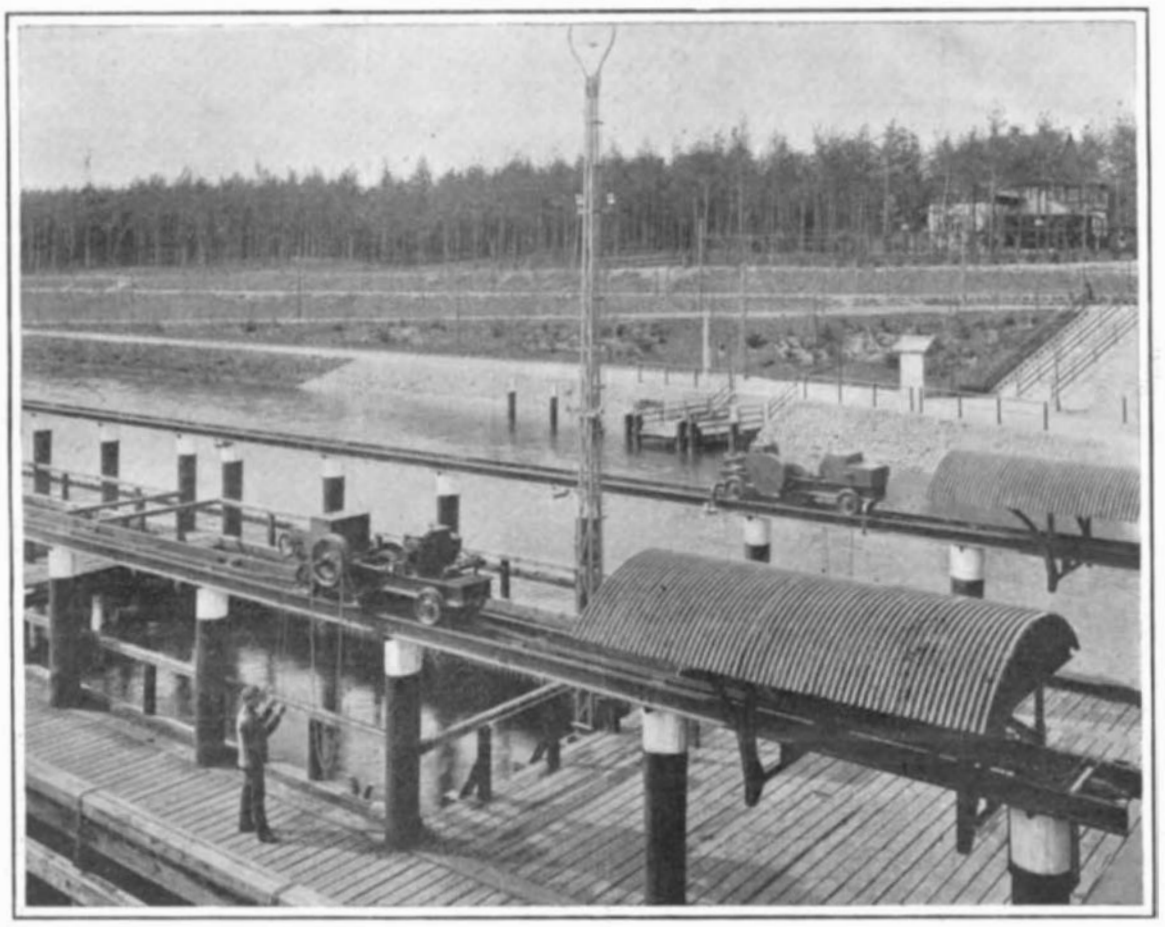
by means of an electric bell and a green lamp signal "Gate off" to the operator in the switching room, who in order to acknowledge switches out both the bell and light. The signal "Stop" is given by means of bells and a red incandescent lamp only in case of emergency. To the south of the gates at the lower pond there is the transformer room, containing three transformers of 25 K. V. A. each for 6000/200 volts, one of which supplies the lighting current to the building close to the sluice, and the other the current for the operation of the fore-gate and for the lighting of the sluice. Three cables leading to the sluice building, switching room, and sluice master's cabin respectively start from the transformer room.

The total time taken by a barge in passing through the sluice, inclusive of its entering and issuing, is only 15 minutes. As the average load of a standard barge is 400 tons, the sluice is therefore able, allowing for a total of 270 working days in the year, to deal with an aggregate annual load of 8.64 million tons, which figure might be more than doubled by adopting a night service.

The Towing Service.—Trials made by Messrs. Siemens & Halske on the Finow Canal at the end of the nineties had shown the cost of operation of electric towing locomotives to be rather low, while the equipment of the plant entailed a most considerable outlay. In order, therefore, to secure a dense

(*Continued on page 268.*)



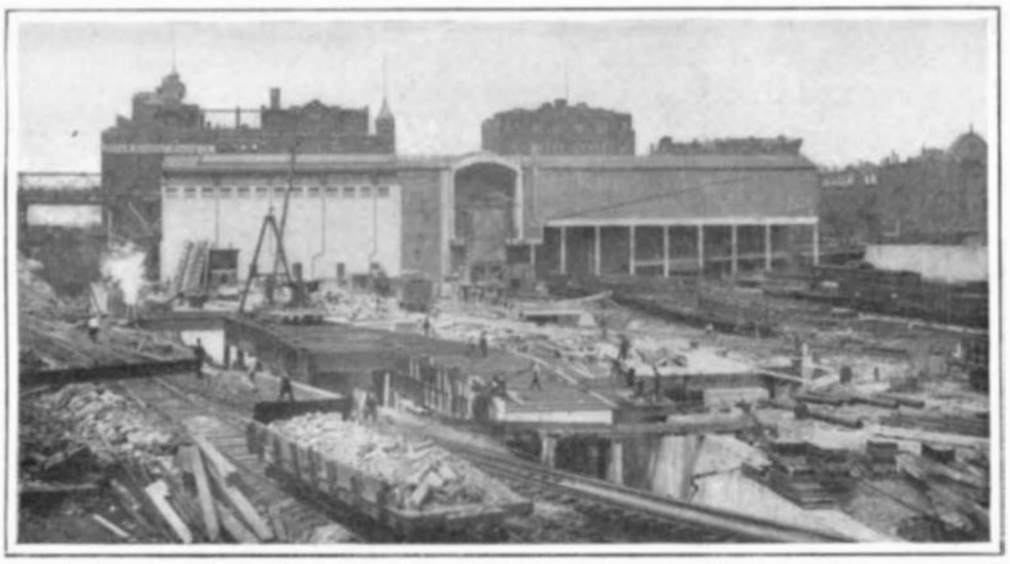
Electrically-Operated Tractors for Hauling the Barges Into a Double Lock.

THE TELTOW CANAL.

PROGRESS OF THE NEW YORK CENTRAL TERMINAL IMPROVEMENTS.

The entrance of the first electric train into the Forty-second Street station of the New York Central Railroad, which occurred on the last day of September, indicates that the first section of this great work of electrical equipment will be soon handed over to the operating department. It is true that this was merely a trial train, carrying the leading officials and guests of the New York Central Railroad, and that it ran over only what is known as the "first zone," which extends from Highbridge for a distance of 7 miles to the Grand Central station. It was of standard weight, however, being made up of eight Pullman and special cars, and weighed altogether 550 tons. The trip was made on schedule time, and served to indicate that the equipment is in running order and is capable of performing the work for which it is designed. It is the expectation of the company that the regular service will be operated electrically by about the 10th of November. The trains will be hauled by electric locomotives to and from Highbridge, where, for the present, the electric locomotives will be switched off, or on, as the case may be, and the steam locomotives take their place. Although only a portion of the whole electric zone will be operated in November, the work of equipping the system as far as Croton Landing on the main line, and White Plains on the Harlem branch, is well advanced, and it will not be long before the trains will be electrically operated between Forty-second Street and those two points. By the courtesy of W. J. Wilgus, vice-president of the company, we present a series of photographs showing the present condition of the work, and by way of making them clear we will briefly recapitulate the leading features of the whole plan of terminal improvement.

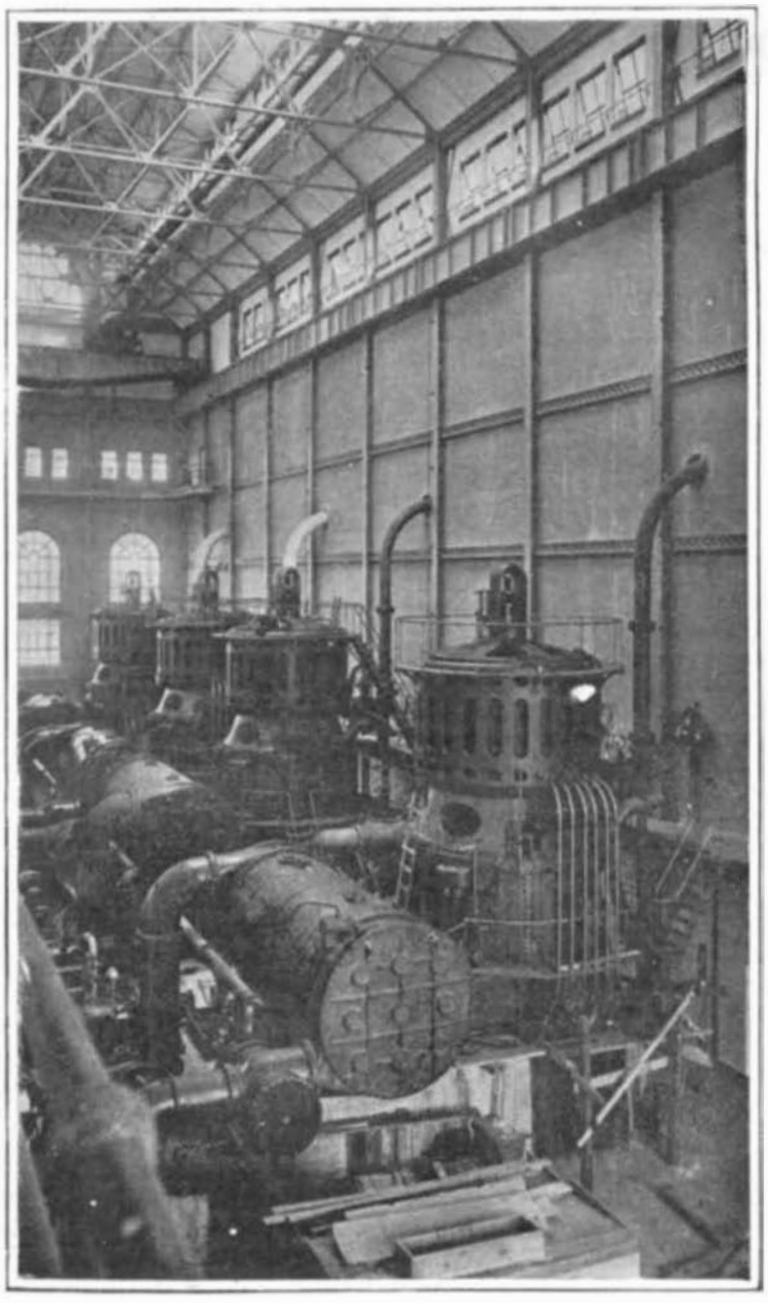
The new station yard commences at Fifty-seventh Street, where the tunnel has been excavated to the



Northeasterly Portion of Grand Central Yard, Showing Sub-station, Express Level, and Steelwork Erected Above Suburban Level.

The tracks are built within the concrete structure, and the station is placed transversely above it. The sloping approach in the foreground is the unfinished street, which is to be carried over the tracks.

The New Highbridge Station.

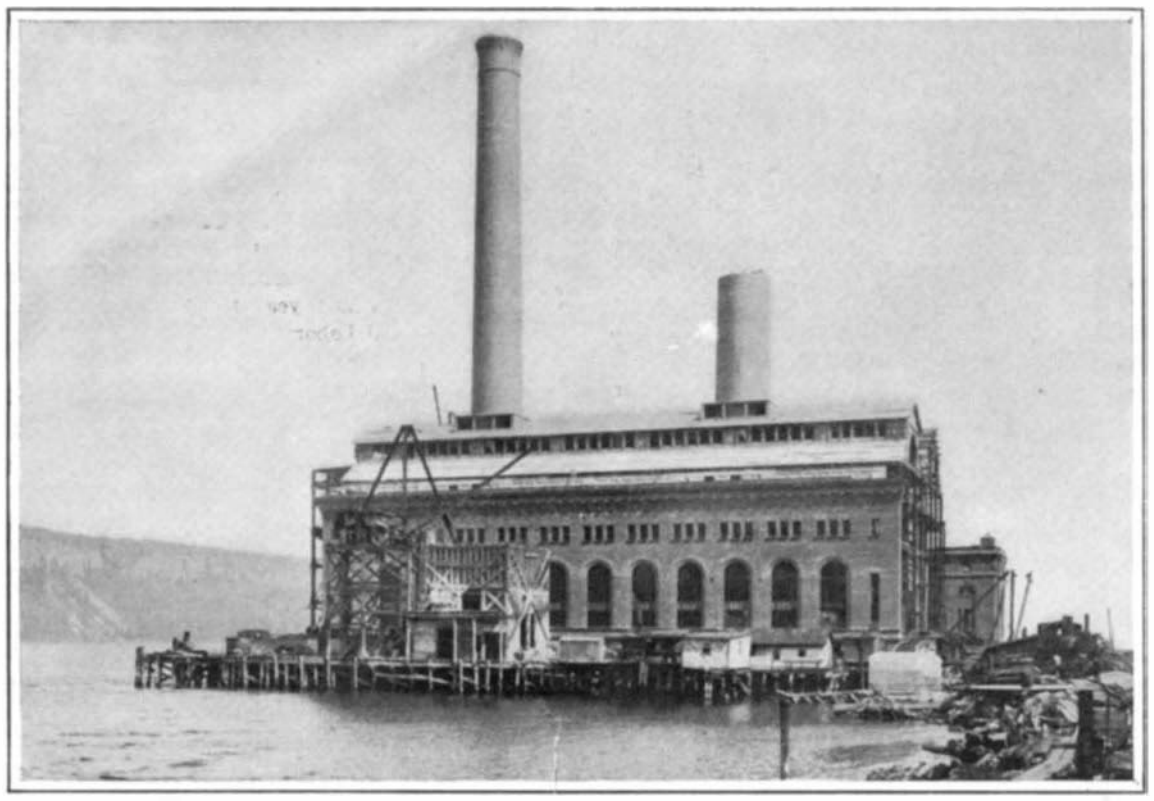


This power house and that at Yonkers are built in duplicate; each will have sufficient capacity to operate the whole electric zone.

Interior View of Port Morris 40,000-Horse-Power Power House.

PROGRESS OF THE NEW YORK CENTRAL TERMINAL IMPROVEMENTS.

full width, 140 feet, of Park Avenue. This provides for ten parallel tracks, which will be continued down to Fiftieth Street, where they will diverge into the main yard, and occupy the space from Lexington Avenue to within 100 feet of Madison Avenue, as far down as Forty-third Street. From Forty-third Street to Forty-second Street the station ground will be bounded by Vanderbilt Avenue on the west, and by Depew Place on the east. Both the station and the yard will be built on two levels, the upper level being devoted to express tracks and covering practically the whole of the area above described, the lower level being reserved for the suburban trains. Of the four tracks in the Park Avenue tunnel, the outer two, which will be reserved for incoming and outgoing local trains, will lead to and from the suburban level by means of two inclines built on a two per cent grade.



Yonkers 40,000-Horse-Power Power House on the Hudson River. The Engine Room Will Contain Six Curtis Turbo-Generators.

The terminal station will be a monumental structure, with a frontage of 300 feet on Forty-second Street, and 680 feet on Vanderbilt Avenue. All of its accommodations have been planned on a vast scale, with a view to meeting the future increase of traffic. The ticket lobby will be 90 feet wide by 300 feet in length, the grand concourse 160 feet wide by 470 feet in length, with a clear height from floor to ceiling of 150 feet. To the north of the station building and over the tracks will be erected a vast office building, of the same architectural characteristics as the main station building, and with sufficient accommodation for the officials and the army of professional and clerical employees of the company.

In order to meet the requirements of the city as to restoration of the streets, the whole of the upper or express level of the station and yard is being lowered 15 feet below the present track level, and the suburban tracks will be 20 feet below this, or 35 feet below the present level. This, however, does not represent the vast amount of excavation that is being done; for within the area of the new yard was included much ground that extended considerably above the average level of the old yard. The total amount of estimated excavation is 2,000,000 cubic yards, and of this over 25 per cent has been taken out.

The work which has been done to date at the terminal has consisted of the widening out of the yard entrance to the full width of Park Avenue, and the excavation of the easterly portion of the express and suburban station yard. At present, practically all of the east side of the 43-acre upper yard has been carried down to its final grade at an average depth of about 30 feet below street level, and excavation is now being done at a depth of 50 feet below the street on the 20-acre low-level yard. The company is completing this easterly portion of both upper and low-level yards first, and building a temporary station beneath the Grand Central Palace, with a view to shifting the traffic over to this portion of the yard and operating it electrically. The excavation of the central portion of the yard and the construction of the main station will then be carried on, and when this is completed the westerly section will be attacked.

The approach to the temporary station and the upper and lower yard levels is shown in two of the accompanying photographs, one of which is taken looking north, and the other south. The tracks which lead from the tunnel to the yard extend on a falling grade past a series of large buildings to the east of Park Avenue, among which are the Steinway factory and a large brewery. The excavation involved some heavy underpinning to these buildings, all of which has now been completed and faced with the heavy I-beams and concrete retaining wall, illustrations of which have been given in our previous articles on this work. The steel work which carries the upper level has, most of it, been put in. The work is being carried forward so rapidly that the whole of the open cut, shown in our view of the excavation looking south, has been roofed over since the photograph, a very recent one, was taken. The yard is bounded along its easterly side by a heavy concrete retaining wall of an average height of 21 feet, and this wall extends from the Grand Central Palace to the large sub-station known as No. 1, which forms the background of the accompanying view of the station yard looking north. The sub-station consists of two buildings in duplicate, with a 30-foot opening between them at the center. Each building is 200 feet in length by 40 in width and 100 feet high, and here will be housed the transformer and converter plant for the use of the yard and tunnel.

The most advanced portion of the work is the construction of the two power houses, each of about 40,000 horse-power capacity, one at Yonkers, and the other at Port Morris. At present each of these is being equipped with four Curtis turbine generators; and there is provision for two other units in each of the plants, making in the two stations a combined capacity of over 80,000 horse-power. The Port Morris station is complete and ready for operation. That at Yonkers is in an advanced stage of construction, and will be all ready for operation within a few weeks' time.

The rolling stock equipment for the electrical service will consist of 95-ton electric locomotives of 2,500 horse-power. This is 1,000 horse-power greater than that of the most powerful express steam locomotives of the New York Central Company. The locomotives will be used for hauling express trains between Forty-second Street and Croton Landing. The suburban service will be operated by all-steel motor cars, similar to those developed on multiple-unit, urban, rapid-transit railways. Each car will seat sixty-four persons, is equipped with two motors, lighted and heated electrically, and in the summer will be ventilated and cooled by electric fans. The belief that the new service will be marked by all those well-known advantages that come from the use of electric traction was verified during the trial trip of the special train, referred to at the opening of this article, when the freedom from jolt in starting and the rapid acceleration and general smoothness of running were very noticeable.

View of Excavated Easterly Portion of Grand Central Yard Looking South, Showing Suburban Level and Steelwork for Carrying Upper Express Level. The Retaining Wall to the Left Fronts on Lexington Avenue.

PROGRESS OF THE NEW YORK CENTRAL TERMINAL IMPROVEMENTS.

THE TELTOW CANAL.

(*Continued from page 267.*)

traffic, a monopoly was obtained from the District Council.

The type of electric towing locomotive adopted comprises a front truck, each of the axles of which is driven by a series motor of 8-horse-power permanent output, with 800 R. P. M. at 550 volts, its operation being effected through a double toothed-wheel gearing. At the back there is a freely-moving axle. The underframe carries a horizontal shaft on which the towing pole is carried vertically and operated by means of a 3-horse-power motor with spur wheel gearing and screw and nut drive. The towing rope is wound up on a drum operated by a 3-horse-power motor through worm wheel gearing, which is connected to the shafts by means of a friction clutch, the springs of which are so adjusted by hand as to have the drum turn round the shaft, the rope being gradually disengaged from the drum as soon as a pull of 1,200 kilogrammes is exceeded. As in starting a pull of about 2,000 kilogrammes (4,400 pounds) is required to deal with a fully-loaded 600-ton barge, the rope is accordingly disengaged gradually, thus avoiding any violent shock. The weight of the locomotive is 7,500 kilogrammes (16,500 pounds). Its design is entirely different from that of the experimental locomotive used in connection with the Finow Canal trials, its output being moreover considerably higher, while even the auxiliary operations are carried out by the aid of electricity.

The current operating the locomotive is branched off behind the lightning arrester and induction coil and goes on, first, to the motors serving to lift the towing pole; second, to the motors operating the rope winch; third, to the electric lighting system; and finally, through a fuse and self-acting switch-out, to the controller of the two traveling motors. The locomotive has been designed for conveying two standard barges with an aggregate useful load of 12,000 pounds at a speed of about 4 kilometers (2½ miles) per hour, or four Finow barges with about 8,000 kilogrammes (17,600 pounds) at a speed of 4.5 kilometers (2.8 miles).