

THE OLD BOONTON FORGE.

The building of the great reservoir near Boonton, N. J., which is to furnish Jersey City with its water supply, will cause the final disappearance of one of the most famous landmarks of American history—Old Boonton Forge. This queer structure, half brick and half wood, lies in the valley of the Rockaway River, the river itself almost brushing its side in its journey toward the Hackensack. Directly across the country road which holds its uneven way toward Boonton is the old red house where Washington and Lafayette spent many weary days and weeks at various times during the New Jersey campaign.

Just now the Forge is being used as a machine shop by the reservoir contractors, but in the latter half of the eighteenth century it held a place that was peculiarly its own. The structure was built in 1760, just about the time that the English Parliament issued an edict that no ironwork could be manufactured in the American colonies, and providing severe punishment for any one who violated the command. It so happened that the New Jersey people wanted some ironwork, and Boonton Forge was selected as the place of making. There had never been any ironwork manufactured in the colonies before, but it was executed in earnest at the Forge, and the work of manufacture went on without opposition until the Revolution broke out, being carried on with profound secrecy. The atmosphere about Boonton was exceedingly patriotic, and the people were extremely proud of the Forge, which they had dubbed "Liberty Forge." When Washington's men began operations in New Jersey it was found there was dire need of ammunition, and that the cannon would soon become practically useless because of the seeming impossibility of obtaining the necessary cannon balls. Then it was that the Forge entered upon its proudest days. There was a good deal of iron stored there, originally obtained for purposes of peace, but the consent of the owners was easily secured, and by Washington's order the fire of the Forge soon blazed in the work of casting shot to hurl against the British.

Hundreds of cannon balls were made and turned over to the Continental artillery before the patriotic work ceased, and it is current history that Washington said the task performed at Boonton Forge had much to do with the success of American arms.

Until the building of the reservoir began, the Forge was silent and untenanted, except when occasionally it was found useful for some special work that the equipment of the building lent itself to. It is lively enough to-day, but within a year's time the water of the reservoir will stand one hundred feet deep over its site.

The reservoir whose building has doomed the old Forge will be a notable work when complete. The

land which it will contain is all of historic interest. Some of the farms included have been in the possession of the same families for two hundred years. The reservoir itself will be 21.7 miles long and 1½ miles wide at its longest and widest points, the total circumference being 10 miles. There are 200 acres of woodland to be cleared, and by January, 1902, everything above six inches in height upon the 970 acres of land that water is to cover will have been uprooted and carried away.

It will be necessary for the water to journey 23 miles

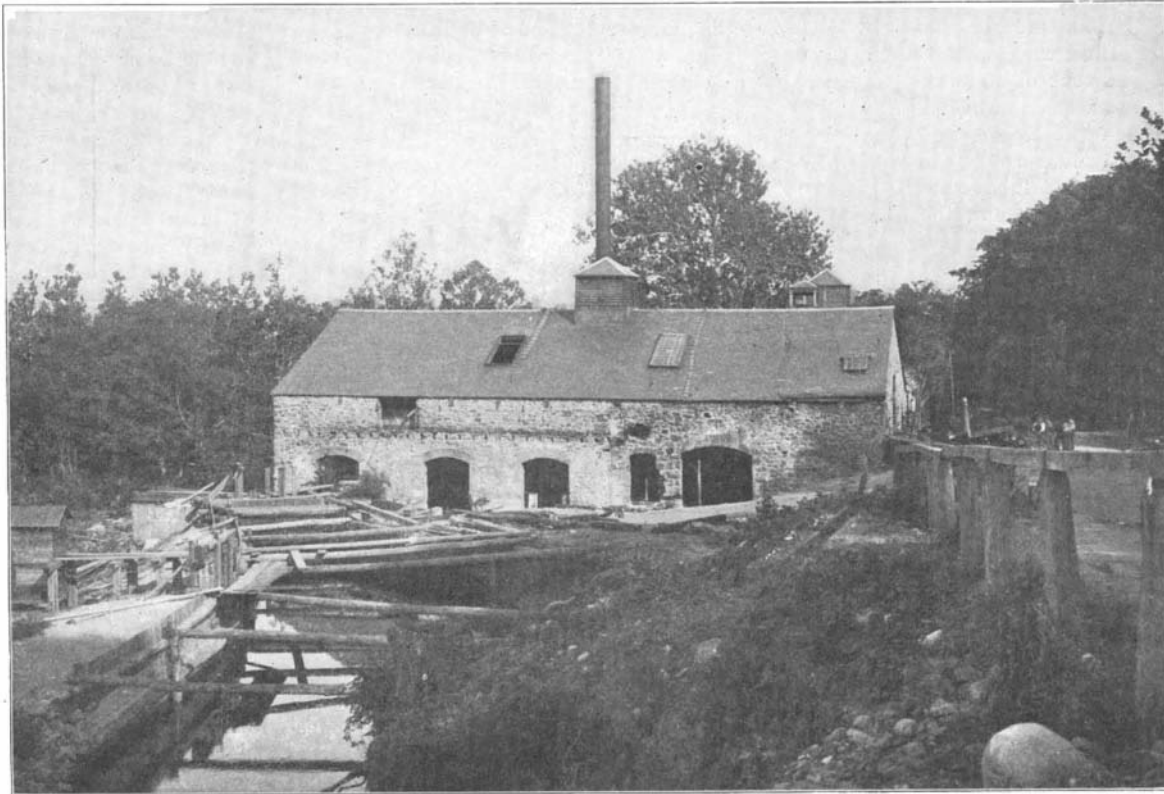
(indeed, it is certain that in the very near future our railroads will have to make an increase in the speed of their so-called fast trains), led the Superintendent of Motive Power of the railroad, Mr. Waitt, to design an express locomotive which is intended to haul heavier trains at the present rate of speed, or the same trains at a higher rate of speed, than is now accomplished. This engine, which forms the subject of our accompanying illustration, is of the very popular Atlantic type, which differs from the American type to which No. 999 belongs in having the four-coupled drivers placed well forward under the center of the boiler with the connecting rod coupled to the rear instead of to the front driver, a pair of trailing wheels being placed beneath the firebox, as shown in the cut.

The primary object aimed at in the new locomotive is to provide a huge boiler with sufficient capacity to insure a plentiful supply of steam at 200 pounds pressure under the most exacting conditions of service. The American type of engine, in which the firebox is carried inside the frames and between the axles of two pairs of driving wheels, necessarily imposes restrictions on the size of the firebox, and limits the grate surface and firebox heating surface. One advantage of the Atlantic type is that by the use of the small diameter trailing wheels, the firebox may be carried above the frames and project laterally beyond

them, and there is no severe limit placed upon the length of the firebox, as there would were it carried between the driving axles. In the New York Central engine the firebox has an internal width of 6 feet 3¾ inches, and a length of 8 feet, with a grate area of 50.3 square feet and a total heating surface of 180 square feet. The outside diameter of the boiler at the first ring is 6 feet, and it contains 396 2-inch tubes, which are 16 feet in length over the tube-sheets. The heating surface of the tubes reaches the enormous total of 3,298 square feet, and adding to this the heating surface of the firebox, and 27 square feet as the heating surface of the water-tubes, we have a total heating surface for the whole boiler of 3,505 square feet. This is by far the largest amount of heating surface ever given to a passenger locomotive, and it is only exceeded by the largest freight locomotives in the world, the Pittsburg, Bessemer and Lake Erie consolidations having 3,805 square feet.

It certainly looks as though the designer's expectation that the boiler will supply 200 pounds of steam in any quantities that the cylinders may call for will be easily realized.

As the cylinders are 21 inches in diameter by 26 inches stroke, it will be understood that when they are working up to full power an unusual amount of adhesion will be required, and to meet this emergency the engine is fitted with what is known as an adjusta-



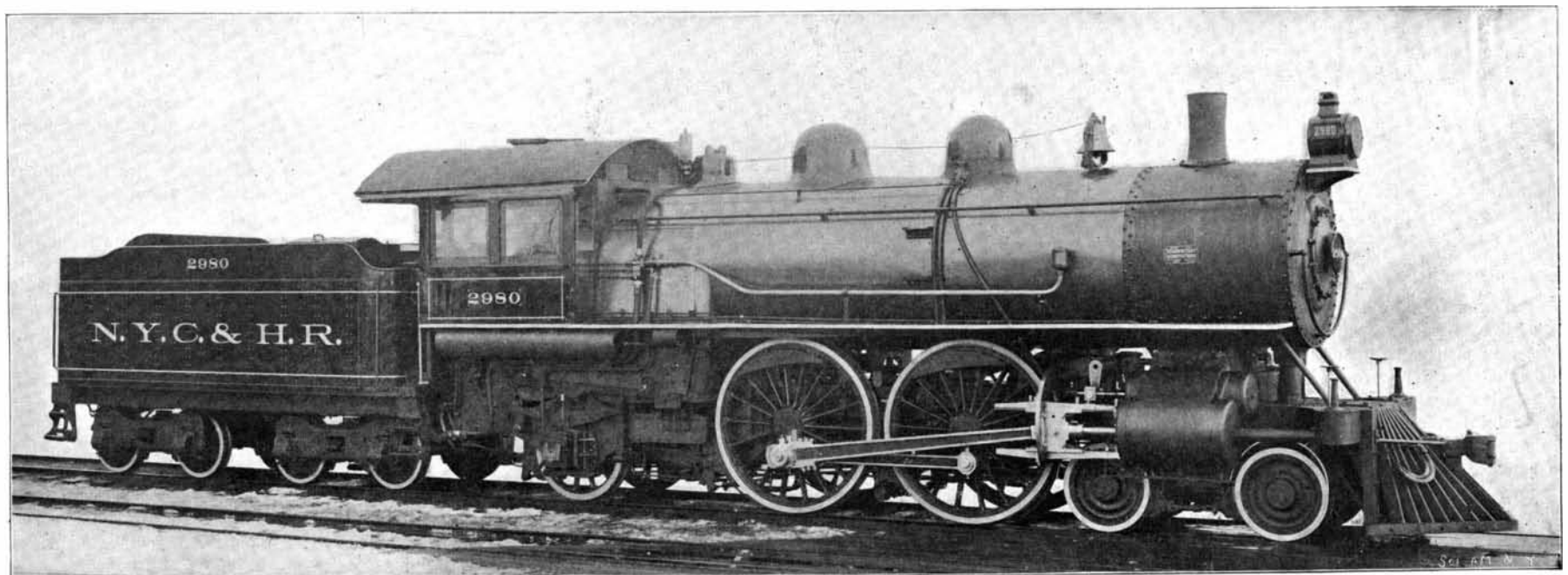
OLD BOONTON FORGE—A PRE-REVOLUTIONARY FOUNDRY WHERE CANNON BALLS WERE CAST FOR THE CONTINENTAL ARMY.

after it leaves the reservoir before it reaches the Jersey City mains, the trip being made through a series of pipes and conduits. It will pass twice under the Passaic River, and once under the Hackensack. The construction of reservoirs and aqueducts for the water will when completed have occupied little more than two years. The work has a number of unusual features, but none are more interesting than the fact that it is the only reservoir so far as known that has for its site a Revolutionary battleground.

MOST POWERFUL EXPRESS LOCOMOTIVE IN THE WORLD.

It is now nearly a decade since the New York Central and Hudson River Railroad Company introduced into its service a powerful express locomotive which, at the time, was probably the most efficient engine of its type in the world. We refer to the locomotive known as No. 999, a typical eight-wheeled, American locomotive, which, in those days, was distinguished from other American locomotives in service by the great size of its drivers, which were 7 feet in diameter, its large heating surface of 1,900 square feet, and a boiler pressure of 190 pounds to the square inch. This engine and its somewhat modified successors have been doing excellent work in hauling the Empire State Express and the fastest, long-distance trains of this railroad.

The rapid increase in the weight of trains, coupled with the utter impossibility of reducing the speed



Cylinders, 21 inches by 26 inches. Drivers, 79 inches diameter. Weight of Engine, 176,000 pounds. Total Heating Surface, 3,505 square feet. Steam Pressure, 200 pounds. Tractive Effort, 25,350 pounds.

THE MOST POWERFUL EXPRESS LOCOMOTIVE IN THE WORLD.

ble equalizer fulcrum. This consists of a pair of levers operated by air cylinders, which are so arranged that when air is admitted to the cylinders and the levers are depressed, the fulcrum is shifted and a part of the engine load which ordinarily rests upon the engine truck and trailing wheels is thrown on to the drivers, thereby increasing their adhesion. The normal distribution of the weight of the engine, which in working order is 176,000 pounds, is 95,000 pounds on the drivers, 42,600 pounds on the truck, and 38,400 pounds on the trailers. On approaching a grade, or in starting, or when any supreme effort is to be made, the adjustable fulcrum is shifted and the weight distribution becomes 104,800 pounds on the drivers, 37,000 pounds on the truck, and 34,200 pounds on the trailing wheels. The normal traction, reckoned at 85 per cent of the full steam pressure is 23,725 pounds; but when the device just described is thrown into action the tractive effort is raised to 25,350 pounds. The valves are of the piston type, 12 inches in diameter with inside admission; the engines are of the simple type and the drivers are 79 inches in diameter. The tender has a tank capacity of 50,000 gallons of water and a coal capacity of 10 tons.

Altogether we must confess to a great liking for this beginning-of-the-century locomotive. It is strictly in line with the trend of developments in American locomotive designing, and as far as its contour and general appearance is concerned it is exceedingly handsome and impressive. The only criticism which we could make on this score is that the smokestack, though probably quite sufficient for its legitimate purpose, looks dwarfed and insignificant in comparison with the vast bulk of the engine. Our thanks are due to the Schenectady Locomotive Works for the photograph from which our engraving is made.

THE PITCH LAKE AND THE ASPHALT INDUSTRY OF TRINIDAD.

The island of Trinidad, which is the largest of the British West Indies, is 30 by 50 miles and lies in 10 degrees north latitude, 62 degrees 0 minute west longitude, and is separated from Venezuela by the Gulf of Paria and the narrow channels connecting it with the Caribbean Sea to the north and the broad Atlantic to the east, the island being apparently broken off from the mainland.

This island contains numerous asphaltic deposits. The largest and most interesting of this section, as well as of the world, is the one known as the "Pitch Lake." This is situated on the gulf coast or northern side of the western portion of the island, and lies inland about one mile. The topography of this portion of the island is irregular and rolling, and in the immediate vicinity of the Pitch Lake it is extremely simple, with the ground sloping gradually up from the sea to the Pitch Lake, which lies on the brow of a hill forming the end of a low ridge extending into the interior.

The lake lies at an elevation of 136 feet above the sea and covers an area of 114 acres, nearly circular in form, and lies on top of this hill in a basin-like depression that presents most convincing evidence of being the broad-mouthed crater of a volcano. The existence of mud volcanoes in this portion of the island and one small one about a mile to the south-east of the lake lends to the theory that this is the crater of an extinct mud volcano into which the asphalt has broken and filled it to the brim, and possibly at some prehistoric time has broken over the combing of the crater and flowed down toward the sea, filling on its way the hollows and pockets in the irregular surface and mixing with the dirt and other impurities on its way, forming what is known as land asphalt deposits. The rim of this crater is from 3 to 6 feet higher than the general level of the lake, the highest of the inner slopes of which are covered with a thin layer of sun-dried or dead pitch that seems to indicate that the entire mass has at some prehistoric time subsided. Borings show that the bottom of the lake is funnel shaped, as it is possible to bore through the mass and into the clay at a considerable distance in from the rim, but as the center is approached it has been so far impossible to get through it; a depth of 140 feet has been reached with no perceptible change in the nature of the material, and the deposit tapers from a thin sheet at the rim to the bottomless center.

To the west of the lake, on the gulf coast, bold cliffs of bright red and yellow porcelaine with veins of porcelain jasper, strata of loose sandstone saturated with asphaltic oil are to be found for a distance of 4 or 5 miles along the coast. Two oil springs occur in this vicinity, one about 200 feet from the beach and about 40 feet above the sea; the other bubbles up from beneath the gulf at a similar distance out from the shore and spreads out over the surface of the water. Attempts were made at one time to separate the petroleum from the product of the former deposit, a company being formed for this purpose, but they were unsuccessful and soon gave it up.

The surface of the lake is not a continuous sheet, but is traversed by a series of crevasses or channels,

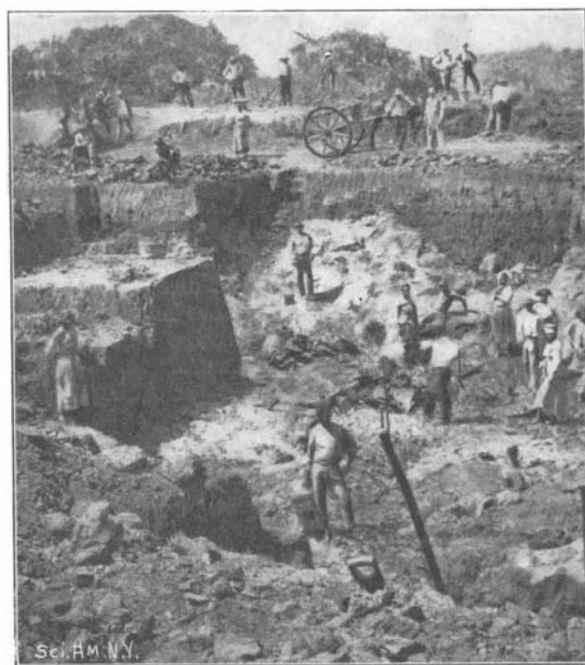
which are connected into one system, that are always filled with water, and at times during the rainy season become 12 or 15 feet deep. These channels divide the entire surface into a great number of flat topped, slightly convex areas, many of which are nearly circular, and which resemble flattened cones. These areas each present a surface of concentric wrinkles, caused by the gradual sliding of the surface from the higher center toward the channels of water. The movement of these areas from the center outward is probably caused by a blow-hole or fissure in the underlying sandstone being directly under the center through which the pitch and gases are slowly issuing. Blow-holes that are much more defined occur in many places in the surrounding vicinity at distances varying from a few hundred feet to a mile from the lake. They



DIGGING AND LOADING ASPHALT ON THE LAKE.

are at times active, and small quantities of semi-liquid sticky pitch are forced up and build up small cones of 6 or 8 feet in diameter that spread out on the surface and form miniature pitch lakes, the pitch soon becoming hard by the evaporation of the volatile oils, leaving a small mass of pitch that is very largely mixed with the earth that it has gathered in its passage in what appears to be a small tube leading down to a larger deposit below, the surface of the ground being in most instances higher than the level of the surface of the lake.

The largest and most active of these cones is at the center of the crater, where semi-liquid pitch and gases are constantly bubbling up. This appears to be the main source of inflow and builds up a convex area of considerably larger proportions than its neighbors and is the highest portion of the entire surface, and is soft enough at the center so that a man will slowly sink



DIGGING LAND ASPHALT.

into it and would probably, in time, be engulfed. The gases that are emitted are sulphureted hydrogen, and give off a vile sulphurous odor and are inflammable, the bubbles burning with a slight explosion as a lighted match is held to them.

The water filling the channels is clear rain water, and nearly always holds in solution considerable sulphur absorbed from the pitch; in places this becomes of a decided acid reaction and will turn litmus paper. These mineral properties lead the native negroes to believe that it possesses medical virtues, and they come from some distance to bathe themselves in this veritable "Siloam."

Notwithstanding the mineral nature and the exceedingly high temperature of this water, which at times during the middle of the day is 140 degrees F., a peculiar kind of fish thrives here and grows to 8

and 10 inches in length. This water is also used for laundry purposes, and during the dry season the natives come from long distances, bringing their soiled clothing in bundles on their heads to wash in these pools of clear warm water.

The pitch is excavated for shipment by digging it up with a pick-ax, into pieces weighing 20 or 30 pounds, in patches of about 30 or 40 feet square, to a depth of 3 or 4 feet. As soon as work ceases on one of these excavations it begins to obliterate itself and come back to the original level. There is a slight closing in of the sides and a general rising up of the bottom, caused by the surrounding pressure and a slightly softer mass underneath the crust-like surface, and four or five hours of midday sun will bring it back to practically the same level, and as many days will obliterate all trace of it. There is no evidence of a higher temperature or of internal heat, and the plasticity is probably due to the oily matter it contains. The excavations and the movement caused by the inflow of pitch and gases cause the entire mass to be constantly moving in an irregular manner, and a line of stakes set across the lake with a surveyor's transit will in a few days be 8 or 10 feet out of line.

Numerous patches of vegetation, consisting in some cases of trees 5 or 6 inches in diameter at the butt, subsist on soil which has been accumulated in the crevasses. These islands, too, share in this general movement.

Statistics show that a lowering of 6 inches over the entire surface of the lake corresponds to the removal of about 100,000 tons, which is the approximate annual shipment.

An American company has a lease of this lake from the British government and is engaged in shipping the pitch to all parts of the world, to be used principally for paving purposes. Previous to 1894 it was dug out and loaded into carts and hauled to the beach, and from there lightered out to the ships lying at anchor in an open roadstead, but during that year a pier 1,700 feet long was built out into the gulf and an extensive loading plant was installed. The accompanying illustrations will help to give the reader some idea of this plant, which consists of a surface tramway running from a terminal power station, on the hard ground bordering the lake, run by an endless wire rope forming a loop around the center of the lake 4,000 feet long. Trains of three flat cars, carrying two iron tubs holding 1,000 pounds of pitch each and controlled by a gripman on each train, traverse this loop, stopping at the excavations to be loaded. At the terminal station these loaded tubs are exchanged for empty ones on a hydraulic lift that transfers them to an aerial tramway, which is also driven by an endless wire rope, and carried on steel towers down over the hill and out to the extreme end of the pier, where it is dumped direct into the hold of the ships laying alongside, the empty tubs returning on the other side of the loop. The surface tramway to the lake and the aerial tramway to the pier are coupled up to the same engine and the loaded tubs going down the aerial tramway by gravity help to run the entire system and a small engine developing about 20 horse power runs the entire plant. Each tub is weighed (and checked by a customs officer for the purpose of fixing the export duty collected by the government) on a scale block in the overhead track in the terminal station before being gripped to the hauling wire. About 175 tubs pass over this scale per hour, making about 80 tons per hour, or 800 tons per day, and employing a working force of 150 men. This plant was a revelation to the people of the island, and was a source of great surprise to them that it was a success, as they looked upon it as a wild scheme and predicted dire failure.

The labor employed is entirely of native negroes, who are not all that could be wished for. These people are ordinarily very contented and happy, with no thought of the morrow, and unless they are hungry they will laugh at a threat to discharge them. They require very little clothing, any temporary shelter will answer for a sleeping place, and they can subsist on sugar cane and fruit that grows in abundance about the island. They are very independent and extremely lazy, and clever only in dishonesty.

The management consists of five Americans. The dwellings of the manager and his staff and the office are built on the pier at a distance of 1,000 feet from the shore. The prevalence of malarial fevers in this portion of the island makes it impossible for a person accustomed to the northern latitudes to live on shore at night time without becoming impregnated with this dread disease that is omnipresent in tropical countries.

A coasting steamer that runs about the island calls at the pier three times a week, bringing local mails and supplies from Port of Spain, the principal city of the island, and at intervals of two weeks the steamers from New York and London visit the island, bringing mails from the outside world.

The site of the ancient Cyrene is being excavated by a Danish archaeological expedition.