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HIGH-SERVICE WATER TOWER, BROOKLYN.

A large section of the city of Brooklyn, near the main entrance to and along the southwestern boundary of Prospect Park, is on pretty high ground, and on this account an important distributing reservoir was located here many years ago. The water level of this reservoir is 198 feet above tide water, and its service has been of an entirely satisfactory character for the area it was intended to supply with water, for at the time the reservoir was constructed the high ground in the neighborhood of the park was almost entirely unoccupied, and the level of the built-up section of the city was so much lower that a good water pressure for house service was easily maintained. In but few large cities, however, has there been such a steady and substantial growth as has been characteristic of Brooklyn for several years past, and the entire region lying directly around the reservoir, with still higher portions along the park border, is now being occupied as a residence section, a great part of it being already covered by handsome brownstone structures. The site is a commanding one, as from "Reservoir Hill" the view takes in the larger portion of the two cities of New York and Brooklyn, as well as New York Bay and the Narrows, out to the Atlantic Ocean, and its value is greatly enhanced by the fact that a large portion of this high land borders upon one of the most beautiful parks in the world, the main entrance to which forms the subject of our illustration.

The new high-service water tower now being completed, and which forms a prominent feature of the picture, is designed to supply the water for house service for this neighborhood, the pressure afforded by the old reservoir being insufficient to cause the water to flow above the first or second stories in buildings occupying the highest sites. The tower is located at one corner of the old reservoir, and is built of Connecticut red granite. It has an extreme height of 166

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THE NEW HIGH-SERVICE WATER TOWER, BROOKLYN, N. Y., AND PROSPECT PARK PLAZA.

HIGH-SERVICE WATER TOWER, BROOKLYN.

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feet above the street level, the tower extending 58 feet above the top of the tank or water reservoir it contains. The manner in which the reservoir is supported in the tower is shown by the sectional view on this page. The height of the tank is 75 feet, with an inside diameter of 16 feet. It is built up of fifteen rings of boiler iron of varying thickness, the two rings nearest the bottom being half an inch thick, the two next above $\frac{7}{16}$ of an inch, then three rings of $\frac{3}{8}$ of an inch each, three of $\frac{5}{16}$, and five of $\frac{1}{4}$ of a inch each. The iron is of a high grade, and has a tensile strength of 52,000 to 55,000 pounds. The tank is supported upon a flooring of steel girders resting upon masonry piers, the bottom of the tank being 34 feet 7 inches above the foundation.

The flow of water to and from the tank is indicated by the arrows, and the inlet and outlet pipes are each 20 inches in diameter. A short section of pipe connects these pipes, so that water may be pumped directly into the service main without being passed into the reservoir if desired. Within the reservoir is arranged an overflow pipe, adapted to discharge into the old reservoir. The top of the overflow pipe is 12 inches below the top of the reservoir, and in it are arranged four reducing disks or diaphragms, to break the force of the fall of the water in the pipe. The pipe is 10 inches in diameter, and the reducing disks have each a central opening of 6 inches. Fig. 2 shows one of these disks in position, Figs. 2, 3 and 4 also showing the manner of supporting and holding the overflow pipe in place. A spiral staircase, 2 feet 10 inches wide, leads around the tank to an outlook room above, in the top portion of the tower, from which a view of wide extent is afforded.

The pumping plant is to consist of two Davidson high-service pumps, each capable of pumping one and a half million gallons a day. It is expected that the entire cost of this improvement will be about $100,000.

The beautiful memorial arch which forms so prominent a feature of the picture is now very near completion. It has been erected by the city "To the Defenders of the Union, 1861-1865," as indicated by an inscription upon an entablature below the frieze, and is built of light granite. It is 80 feet long, 71 feet high, and 45 feet wide. The top will be reached by stairs in each abutment.

Locomotive Performances.

Almost every one is familiar with the remarkable run recently made by a Schenectady locomotive hauling a special train on the New York Central Railroad, when the distance of 439½ miles from New York to Buffalo was made at an average speed of nearly 60 miles per hour, and which was the precursor of the Empire State express, which makes the regular run at an average speed of over 52 miles per hour.

More recently we have accounts of an interesting record made by a well known writer on two runs between New York and Albany, on which a large number of indicator cards were taken. The weight of the train was about 270 tons. The steam pressure varied from 160 to 170 pounds. From an inspection of about a dozen cards, the indicated horse power varied from 551 horse power at 44 miles to 1,120 horse power at 78·9 miles. At 60 miles per hour the train resistance is stated to have been 15 pounds per ton and at 70 miles 17·10 pounds per ton. About seven pounds of water were evaporated per pound of coal.

A remarkable statement concerning this performance was made by Mr. Sinclair, which, while almost incredible, will, if borne out by an analysis of facts, prove to be something of a surprise to those who make their prophecies of the electric economies by comparative statements.

In the description of these tests it is stated that the whole trip shows an indicated horse power per hour for an average expenditure of only about 3⅛ pounds of coal per hour. This is far better than many stationary engines.

On the New Jersey Central road one schedule time is 86¼ miles in 89 minutes, which is made where there are a number of necessary slackings. On May 13 the time was taken of the speed of a Baldwin compound locomotive for a considerable period of time on one of the regular runs. Ten continuous miles were made in 452½ seconds, and five were made in 222 seconds. The fastest time taken was 44 seconds and the slowest noted was 47.

On February 26 a similar compound passenger locomotive running on the same road broke all steam records by running a mile in 39¼ seconds, or at the rate of nearly 92 miles per hour.

At this speed the indicator cards showed 930 horse power, and the drivers, which are 78 inches in diameter, were making 395 revolutions per minute.

In making these very high-speed runs there is not much attempt at maximum economy of coal consumption, the necessity being to generate steam as fast as required by the cylinder, but, on taking an average of five trips, I find that there was evaporated 7·19 pounds of water per pound of coal used and 9·41 pounds of water evaporated per pound of coal consumed. The total weight of the train varied from 213 to 241 tons.

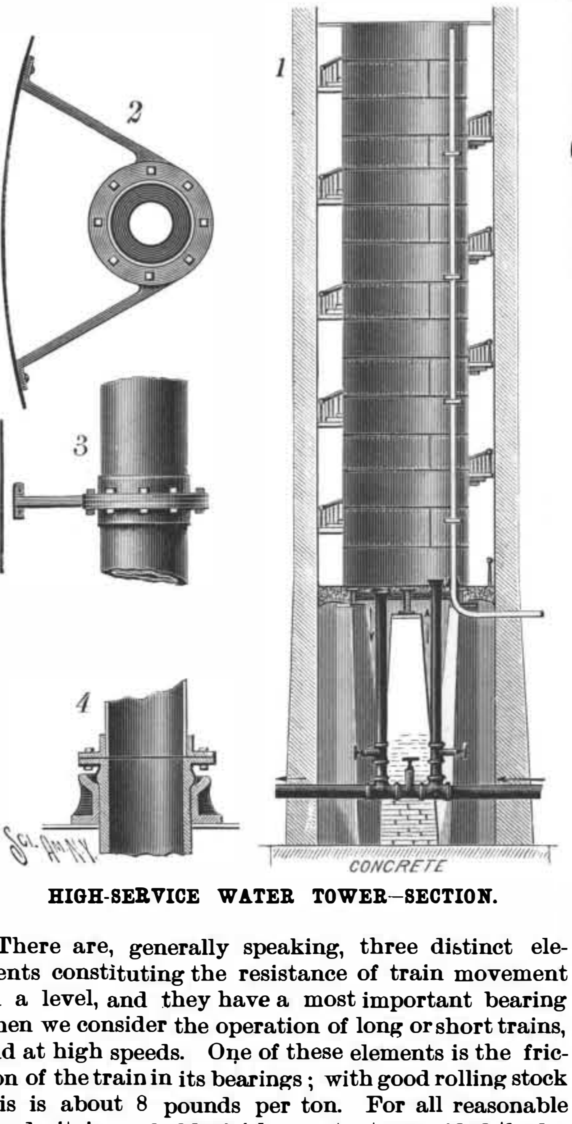
Some time ago I made a very careful analysis of the work done in the elevated roads in New York City, with a view of determining the coal consumption and the duty performed by the locomotives. At the time this investigation was made, now nearly seven years ago, there were in use on the Third Avenue division 63 trains at one time, running at very close intervals. The weight of the train was from 80 to 90 tons; the speed was often as high as 20 to 25 miles an hour; stops were made every third of a mile; in short, the duty demanded of the engines was exceedingly severe.

The maximum indicated horse power of the locomotives was found to average about 163 horse power, although on occasions these locomotives have been worked up to 185 horse power. Work was divided approximately as follows:

Acceleration in starting, 59 per cent; lifting, 24·3 per cent; and traction, 16·7 per cent. The average horse power exerted was 70·3 horse power, considerably less than one-half of the maximum.

The work on the line was so distributed that there was an almost constant total duty of about 4,500 horse power. The locomotives were on duty twenty hours, but used steam only six hours, and including all losses when standing still and the amount of steam used in braking, there was a horse power developed for about 6·2 pounds of coal per hour.

I believe that these figures are entirely reliable, and they show a remarkable performance when we consider the class of duty.



HIGH-SERVICE WATER TOWER—SECTION.

There are, generally speaking, three distinct elements constituting the resistance of train movement on a level, and they have a most important bearing when we consider the operation of long or short trains, and at high speeds. One of these elements is the friction of the train in its bearings; with good rolling stock this is about 8 pounds per ton. For all reasonable speeds it is probably fairly constant, provided the lubrication is good. Another element is that of air resistance, which varies with the shape of the forward end of the train, the condition of the air, the direction of the wind, and the velocity of movement. The third I may call the train-lifting or rail-bending effort, which depends upon the weight and swiftness of the train and solidity of the roadbed.

Dr. Dudley stated that on the New York Central system he found that trains of about 250 tons, when running at a speed of a mile a minute, had a resistance of from 10 to 12 pounds per ton, but that on short trains of two or three cars the resistance sometimes ran as high as 35 or 40 pounds per ton.

This is probably due not to any change in the friction of the bearings, but to the fact that the air resistance enters as a much higher component of the total.

It at once emphasizes the fact that the operation of short trains at high speeds must, no matter how good the track or how favorable all other circumstances, be with a train resistance higher than required by long and well-vestibuled trains.

Mr. Dudley further stated, in speaking of the influence of stiff rails, that the difference in power required on the Chicago Limited when running on an 80 and a 65 pound rail was from 75 to 100 horse power per mile, that is, somewhere between 10 to 12 per cent of the power actually developed, and he estimates that with a 105 pound rail, which is nearly twice as stiff as the 80 pound rail, there would probably be saved another hundred horse power per mile, making a total saving of a quarter by less than doubling the weight of the rail. In his opinion it is perfectly safe to run a steam engine 120 miles an hour on this heavy rail.

Almost all the locomotive work of the United States has been done up to the present with simple engines. Their weight and capacity has been increased, their steam pressure raised until the standard is now about 140 pounds. Within recent years, however, the compound locomotive has come into use, and there is a comparatively large number of them in daily service. The steam pressure has gone up to 180 pounds as a standard, working sometimes as high as 200 pounds, but these are by no means the limits of steam pressure.

On the Paris, Lyons, and Mediterranean Railway the standard for steam pressure for compound locomotives is 250 pounds. The compound locomotive has still its battle to fight, but I think he would be a rash man who would say that the days of still higher steam pressure are not to come and that the triple expansion locomotive will never exist.—*Frank J. Sprague.*

Paving Estimates.

Estimates per square yard for the different kinds of paving for Pacific Avenue, in Tacoma, are as follows:

WOOD.

Size of blocks, nine inches long, three inches wide and six inches deep. If concrete is used for foundation it would be six inches thick, and in the proportion of one part of cement to four parts of sand and six parts broken rock. Estimate for one square yard of wood blocks:

Concrete, six inches thick, at $9 per cubic yard	$1.50
Sand, one inch thick, at $1 per cubic yard	3
Six inch block, fifty-four feet B. M., at $10 per M	54
Labor, 2 cents per square foot	18
Total cost	$2.25

BRICK ON CONCRETE, PER SQUARE YARD.

Concrete, six inches thick, at $9 per cubic yard	$1.50
Sand, one inch thick, at $1	3
Brick on edge (8x5x4), eighty-one brick per square yard, at $14	1.13
Labor, 2 cents per square foot	18
Total cost	$2.84

DOUBLE BRICK PAVEMENT, PER SQUARE YARD.

Gravel, eight inches thick, at $1 per cubic yard	$0.22
Brick, laid flat, forty-one brick, at $14	57
Sand, two inches thick, at $1 per cubic yard	6
Brick on edge, eighty-one brick, at $14	1.13
Labor, per square yard	25
Total cost	$2.23

BITUMINOUS ROCK.

Concrete	$1.54
Bitumen laid in place	1.20
Total cost	$2.74

Florida Moss.

The valuable moss of Florida, says Mr. Harry Bomford, abounds in the hammocks and back lands. It is gathered chiefly by negroes. In its natural state it hangs in festoons from the limbs of trees in strands from one to five feet in length. The moss is gathered by pulling it from the trees with long poles, or by cutting the trees down and then removing it. The moss is buried in the earth for about a month, after which it is dug up and is dried and shaken and sold to the local moss dealers for $1 per hundred pounds. It is then run through a machine called a gin, which is nothing more than a cylinder covered with three-inch spikes revolving between a roll of similar stationary spikes. The action of these spikes is to knock out some of the dirt and trash, but it does not complete the job. It is then shaken over a rack formed of parallel bars, after which it is pressed into bales of about 200 pounds each. Some of the moss mills do all this work by hand, except the ginning. The moss, after having gone through the above process, brings from $2.50 to $3 per hundred pounds.

If, instead of allowing it to remain in the earth for one month, it is left there for three months, the entire bark of the moss is pulled off and there remains a beautiful black fiber almost exactly like hair. The hair moss brings from $5 to $7 per hundred pounds.

Mr. Bomford suggests the treatment of this moss as a good field for invention. He thinks a machine could be made which would take off the bark, leaving the fiber, without the necessity of burying the moss for so long a time in the earth.

Universal Cement.

250·0 sugar placed in a flask are dissolved in 750·0 water by aid of a water bath, 65·0 slaked lime added and the mixture warmed for three days at 70-75° C., agitating repeatedly. After cooling, the supernatant liquid is poured off clear; 200·0 are diluted with 200·0 water and 550·0 finest glue allowed to swell in it for three hours, when it is heated until perfect solution takes place; after restoring the original weight by adding water, 50·0 acetic acid (96 per cent) and 1·0 pure carbolic acid finish the preparation.