THE BOSTON SEWER SYSTEM AND MAIN DRAINAGE WORKS.

The city of Boston, Mass., has recently built and now has in full operation an extensive system of sewage and drainage works that merit an important attention in sanitary engineering. A summary account of these works has already been published by us. But as they include engineering work of the highest order, and as a number of perplexing problems are successfully solved in their construction, they appear to merit a fuller account.

By referring to the map of the city which accom-

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THE BOSTON WETER SYSTEM AND MAIN DRAINAGE WORKS
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Boston shows the interesting sewer. When it was constructed so as to be off the drain into the waters of the bay of all ordinary drainage, the old ustedes were completely closed. They are preserved, and, by means of dams or gates, are arranged to discharge all over the certain amount.

The amount is made great enough to allow for all ordinary use and for the heavier rain storms. In ease of heavy falls of rain, the overflows come into the most convenient part of the water to run directly away into the bay.

From the city the transit lines run outside, and reach eventually a low, nearly level piece of land called the "elf pasture." Over this a causeway, marked A, on the map, has been built. Under its roadway the sewer must be for about a mile. At the end of this line the pumping station is established. Up to this point in the main and intercepting sewers, deeded to the city of Boston and environs, and the places are included. The diameter of the main line varies from 7 to 24, with an increment of 1 in 2.50. The bottom of the delivery end at the pumping station is 14 feet below low water level.

The pumping station, of which we give an exterior and interior view, is a fine structure. It is built of granite, and its architectural features are worthy of the highest recommendation. Its general plan includes two wings, with a connecting building. One wing is devoted to coal storage, and from within it to the large chimney. The capacity of the coal bins is 1,200 tons.

In the connecting building the boilers, four in number, are placed. Each pair is of 150 horse power, and can supply all the steam required in ordinary working. The boilers are built of steel, each has 351 square feet grate surface and 1,250 square feet heating surface, giving a ratio of 3.1. Economical tests of efficiency were made in the spring of 1885, showing an economical power of 10.136, of water per pound of dry coal from water of the actual existing temperature, which is approximately the average efficiency of about nine pounds. During these tests the boiler water temperature was reduced to 12,300,000 pounds per hour. The water of the pumping engine was reduced to 9,600,000 pounds per hour. The water of the pumping engine was reduced to 12,300,000 pounds per hour. The water of the pumping engine was reduced to 9,600,000 pounds per hour. The water of the pumping engine was reduced to 12,300,000 pounds per hour.

In the other wing are situated the pumping engines. These are divided into high duty and low duty engines. Each engine has two cylinders, one high pressure and one low pressure. The low pressure steam engine is situated at one extremity, the high pressure cylinder at the other extremity of the walking beam. The steam is very even deposition of the main working parts of the engine. The walking beam is pivoted at the ends. Of each end there are two, each engine having two cylinders.

On the first page of this paper are the great high duty pumping engines, designed by Mr. E. D. Leavitt, Jr. They are impressive structures, and present an imposing appearance as the great flywheels of the engines are turned by the engine, and the engines quietly do their duty and dispose of the drainage from nearly twenty square miles of territory.

They are compound beam engines. The pumping cylinders, of which there are two, are directly below and in line with the high and low pressure steam cylinders. The high pressure steam cylinder is situated at one extremity, the high pressure cylinder at the other extremity of the walking beam. The steam is very even deposition of the main working parts of the engine. The walking beam is pivoted at the ends. Of each end there are two, each engine having two cylinders.

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The chain feeder and movable scraper.

BOSTON DRAINAGE SYSTEM—DEPOSIT SEWERS.

The low duty engines are used when a heavy rain sends a large volume of drainage to the station. The fulcrum of the lever is by the high duty engines.

The sewer is pumped out of the delivery sewer, first being screened through a large pipe. The water is collected in a large tank, mixed with a small quantity of water, and then pumped over the hill and through the boilers.

The sewer is pumped into the station, first being screened through a large pipe. The water is collected in a large tank, mixed with a small quantity of water, and then pumped over the hill and through the boilers.

BOSTON DRAINAGE SYSTEM PUMPING STATION BUILDING.

The sewer is pumped into the station, first being screened through a large pipe. The water is collected in a large tank, mixed with a small quantity of water, and then pumped over the hill and through the boilers.

BOSTON DRAINAGE SYSTEM—GATE HOUSE AT MOON ISLAND.
down. A chain holds the gate upright against the pressure of the water. This machine is put in position at the end of the sewer nearest the pumps and the sewage is turned in. It rolls over the gate and also to some extent around and under it, pressing the scraper forward at the same time. The pressure and scouring action of the water work and force the deposit forward until it reaches the outlet tank. To replace the scraper, the weights are removed and it is floated back.

The current through the outlet pipe is sufficient to carry a half brick with it, and sicks can even be carried by it around the bends. The sludge is delivered to a tank. As much water comes with it, this, after settling, is permitted to flow on and into the sewer again, beyond the deposit line. The sludge is taken out to sea in a large, and dumped into the water.

In 1899 the maximum daily amount pumped was 113,457,377 gallons, the average daily amount was 30,582,728 gallons. The cost of labor, fuel, repairs, and general expenses, no interest or depreciation being included, was for 1899, $79,185.31. The lift varies from 35 to 45 feet, and the cost per million gallons lifted one foot is put at $0.039, or about six cents. Some seven or eight cubic yards of sludge are collected daily from the deposit sewers. The sewage, now almost clean water, is carried through a 2½ foot sewer, 5,160 feet long, across Dorchester Bay, then through a terminal flume, 11 feet high and 12 feet wide and about 6000 feet long, to the reservoirs on Moon Island. Here it is collected and impounded. These reservoirs cover 5 acres. Their floor is 1 foot below high water mark, and their walls are 10 feet high. Their capacity is 25,000,000 gallons. About one hour after high tide, the outlet gates are opened, the nearly clean drainage rushes out, and in forty minutes they are emptied. The drainage is then allowed to accumulate for another tide.

The gates are worked by a long shaft, nearly 600 feet long, that carries level one wheels in pairs, one pair for each gate. By setting these, the shaft, though revolving in one direction, can be made to either open or shut the valves. The shaft is driven by a turbine wheel, which is turned itself by the drainage water.

A portion of which is diverted for this purpose. A steam plant is provided, also for use when the turbine is shut up. The bottoms of the reservoirs are shaped so as to favor perfect drainage. To flush them, drainage is allowed simultaneously to enter at one corner and flow out at the other. This scour's them perfectly, leaving the masonry bare and clean. Samples of the fluid collected here are as clear as rain water, except for a slight deposit.

The sluice has quite a strong odor, however. The men in charge make no complaint, and their health seems perfect. The same brine flowing from Squamata to Moon Island, and which we have referred to as only temporary, is carried by a new embankment. When this shall have settled and reached a definite level, a permanent masonry structure will be built and the system will then be complete.

NEWS comes from Prescott, Arizona, of the discovery of a wonderfully rich ledge of gold-bearing rock 20 inches wide, on the Hassayampa River. The assay shows $100,000 per ton. The pieces of the rock, when broken, hang together by the gold in them.