SKETCH

OF

AMERICAN ENGINEERING.

CHAPTER I.

HARBOURS.

Natural facilities for the formation of Harbours on the American Coast—Tides—Construction of Quays, and Jetties—Cranes—Graving Docks—Screw Docks—Hydraulic Docks—Landing Slips, &c.—New York—Boston—Philadelphia—Baltimore—Charleston—New Orleans—Quebec—Montreal—Halifax.

THE eastern and southern coasts of North America are indented by numerous bays and sheltered sounds, which afford natural facilities for the formation of harbours more commodious than any which works of art alone, however costly, could possibly supply, and to an extent of which, perhaps, no other quarter of the globe can boast. The noble rivers with which this country abounds, and its inland lakes, which, for expanse, deserve the name of seas, are subjects of great interest to the general traveller; but to the civil-engineer, who is more alive to the importance of deep water and good shelter in the formation of harbours, and who,

at every step in the exercise of his profession, feels the difficulty, and is made aware of the expense, which attend the attainment of these indispensable qualities by artificial means, the natural harbours of the continent of North America afford a most interesting and instructive subject of contemplation.

The original founders of the sea-port towns on this coast appear to have been very judicious in their selection of situations for forming their settlements. The towns, if not placed at the mouths of fine navigable rivers, in most cases possess the advantages of sheltered anchorages, with deep water, and accommodation for all classes of vessels. The chief object in founding most of the towns seems to have been the formation of a port for shipping, or the cultivation of a valuable adjacent tract of country watered by a navigable river; in which latter case the harbours do not always possess the same natural advantages, but stand in need of works for their improvement, which would involve a greater expenditure of capital, and occupy more time in their execution, than a country, as yet new in the arts, has been disposed to bestow upon them. Viewing the harbours of America generally, however, no one can fail to be struck with their importance, and, in connection with its inland navigation, convinced of their mighty effect in advancing the prosperity of that enterprising country.

The largest ports of North America are Quebec, Halifax, and Montreal, in the British dominions, and

Boston, New York, Philadelphia, Baltimore, Charleston, and New Orleans, in the United States. Besides these ports, there are many towns on the coast, of later origin, having less trade and importance, but nevertheless possessing splendid natural facilities for the formation of harbours.

I was fortunate enough to visit many of the American ports, and in most of them, I found that accommodation for vessels of great burden had been obtained in so satisfactory a manner, and at so small an expense, as could not fail to strike with astonishment all who have seen the enormously costly docks of London and Liverpool, and the stupendous asylum harbours of Plymouth, Kingstown, and Cherbourg. I have little hesitation in saying, that the smallest of the post-office packet stations in the Irish Sea has required a much larger expenditure of capital, than the Americans have invested in the formation of harbour accommodation for trading vessels along a line of coast of no less than 4000 miles, extending from the Gulf of St Lawrence to the Mississippi.

The American packet-ships trading between New York and the ports of London, Liverpool, and Havre, are generally allowed to be the finest class of merchant-vessels at present navigating the ocean; and for their accommodation we find in England the splendid docks of London and Liverpool, and in France the docks of Havre. An European naturally concludes that a berthage no less commodious and costly

awaits their arrival in the ports to which they sail; but great will be his astonishment when, on reaching New York, the same fine vessel which lately graced the solid stone-docks of Europe, is moored by bow and stern to a wooden quay; and, on leaving the vessel, he will not fail to miss the shade of a covered verandah enclosed within high walls, the characteristic of a British dockyard, and will have any thing but pleasant sensations when he is ushered forth upon a hastily constructed wooden jetty, which, in certain states of the weather, is deeply covered with mud, and generally affords a footpath far from agreeable.

This state of things strikes a foreigner, on first landing in America, in a very forcible manner. The high, and in some cases superfluous, finish, which the Americans bestow on many of their vessels employed in trading with this country, lead those who do not know the contrary to expect a corresponding degree of comfort, and an equal display of workmanship, in the works of art connected with their ports; and it strikes one at first sight as a strange inconsistency, that all the works connected with the formation of the harbours in America should be of so rude and temporary a description, that, but for the sheltered situations in which they are placed, and other circumstances of a no less favourable nature, the structures would be unfit to serve the ends for which they were intended. But, when we come to inquire into the reasons for this difference between the construction of the European and

American harbours, they soon become apparent and satisfactory. The difficulties and expense encountered in the formation of most European harbours, have arisen chiefly from the necessity of constructing works of a sufficient strength to withstand the violence of a raging sea to which they are in general exposed, or in obtaining a sufficient depth of water, by the construction of docks or other means, to enable the vessels frequenting them to lie afloat at all times of tide. In Britain, these difficulties in a great measure arise from the narrowness of our country, which necessarily contains but a small extent of inland waters, whose quantity and currents, when compared with the bays and rivers on the American coast, are agents too unimportant and feeble to produce, without recourse to artificial means, the depth or shelter required in a good harbour. The Americans, on the contrary, among the numerous large bays and sounds by which their coasts are indented, have the choice of situations for their harbours, perfectly defended from the surge of the ocean, and requiring no works, like the breakwaters of Plymouth and Cherbourg, for their protection; and the basins formed and scoured by their large navigable rivers afford, without resorting to the construction of docks like those of Liverpool, London, Leith, or Dundee, natural havens, where their largest vessels lie afloat at all times of tide within a few paces of their warehouse doors.

The kind of workmanship which has been adopted

in the formation of the American harbours is almost the same in every situation; and the harbours generally bear a strong resemblance to each other in the arrangements of the quays, and even in their localities. This renders a detailed description of the works of more than one harbour unnecessary; and, for the purpose of giving an idea of an American harbour, I would select that of New York, because it undoubtedly ranks as the first port in America, and is, in fact, the second commercial city in the world, the aggregate tonnage of the vessels belonging to the port being exceeded only by that of London.

The island of Manhattan, in the state of New York, is about fifteen miles in length, and from one to three miles in breadth. The city of New York is situate on the southern extremity of this island, in north latitude 40° 42′, and west longitude 74° 2′ from Greenwich. It was founded by the Dutch in the year 1612, and it now contains a population of about 300,000 inhabitants, and measures about ten miles in circumference. On the east, the shore of Manhattan Island is washed by the sound which separates it from Long Island, and on the west by the estuary of the river Hudson, which, as far up as Albany, is more properly an arm of the sea than a river, the stream itself being small and contemptible. These waters, which have received from the Americans the appellation of the East and North Rivers, meet at the southern extremity of the island of Manhattan, and at their junc-

tion form the spacious bay and harbour of New York, the great emporium of the western hemisphere.

The Bay of New York, which extends about nine miles in length and five miles in breadth, has a communication with the Atlantic Ocean through a strait of about two miles in breadth, between Statten Island and Long Island. This strait is called "The Narrows;" and on either shore stands a fort for protecting the entrance to the harbour. This magnificent bay, which is completely sheltered from the stormy Atlantic by Long Island, forms a noble deep-water basin, and offers a spacious and safe anchorage for shipping to almost any extent, while the quays which encompass the town on its eastern, western, and southern sides, afford the necessary facilities for loading and discharging cargoes. The shipping in the harbour of New York, therefore, without the erection of breakwaters or covering-piers, is, in all states of the wind, protected from the roll of the Atlantic. Without the aid of docks, or even dredging, vessels of the largest class lie afloat during low water of spring-tides, moored to the quays which bound the seaward sides of the city; and, by the erection of wooden jetties, the inhabitants are enabled, at a very small expenditure, to enlarge the accommodation of their port, and adapt it to their increasing trade.

The situation of New York is peculiarly favourable for the extensive trade of which it has become the seat, by the nearness of its harbour to the ocean; the

quays being only about eighteen miles from the shore of Sandy Hook, which is washed by the waters of the Atlantic. This naturally makes the communication more direct and easy, as a very short time elapses between making land and mooring at the quay; and all the anxiety which is experienced after falling in with the European land, in a coasting navigation of several days, before the mariner terminates his cares by docking his vessel in Liverpool or London, or in any other port of Great Britain, is thus avoided. I may mention, in illustration, that I left the quays of New York at half-past eleven on the forenoon of the 8th of July 1837, in the "Francois Premier" packet-ship, Captain Pell, for Havre, with a very light breeze from the north-west; and, at seven o'clock on the evening of the same day, our vessel was gliding through the Atlantic with nothing in sight but sky and water. This case is strongly contrasted with what took place on my outward passage, on which occasion I left Liverpool, under no less advantageous circumstances, on the 12th of March of the same year, in the "Sheffield" packet-ship, Captain Allen; but we did not clear the Irish land till two days after our leaving port.

The perpendicular rise of tide in the harbour of New York is only about five feet. The tidal wave, however, increases in its progress northwards along the coast, till at length, in the Bay of Fundy, it attains the maximum height of 90 feet. Towards the

south, on the contrary, its rise is very much decreased; and, in the Gulf of Mexico, is reduced to eighteen inches, while on the shores of some of the West India Islands it is quite imperceptible.

A bar extends from Sandy Hook to the shore of Long Island, across the entrance to the harbour. Over this there is a depth of twenty-one feet at low water, which is sufficient to float the largest class of merchant-vessels.

The wharfs erected for the accommodation of the shipping of New York are formed entirely of timber and earth, in a very rude and simple manner. A row of wooden piles, driven close to each other into the bed of the river, forms the face-work of the quay, which is projected from the shore as far as is necessary to obtain a depth of water sufficient to float the largest class of vessels at all times of the tide. The situation of New York, in this respect, is very favourable, as deep water is very generally obtained at the distance of from forty to fifty feet from the margin of the water. The piles, of which the face-work of the piers is composed, are driven perpendicularly into the ground, and are secured in their place by horizontal wale-pieces or stretchers, bolted on the face of the quay, and running throughout its whole extent. Diagonal braces are also bolted on the inside of the piles, and beams of wood are connected to the face-work, and extend behind it to the shore, in which they are firmly embedded. These beams act both as struts and ties,

serving to counteract the tendency of lateral pressure, whether acting externally or internally, to derange the line of quay. The void between the perpendicular piles, which form the face-work and the sloping bank rising from the margin of the water, is generally filled up with earth, obtained in the operation of levelling sites and excavating foundations for the dwellings and warehouses of the city. This hearting of earth is carried to the height of about five feet above high water of spring-tides, at which level the heads of the piles, forming the face-work, are cut off, and the whole roadway or surface of the quay is then planked over. The planking used in forming the roadway of the quay is, in some cases, left quite exposed; but, in general, where there is a great thoroughfare, the surface of the quays is pitched with round water-worn stones, and corresponds, in appearance and level, with the adjacent streets. The following cross section of one of the wharfs, will shew more clearly the manner in which they are constructed.