

Engineering, Civil & Mechanical.

THE JETTY WORKS OF THE MISSISSIPPI.

Of all the engineering works ever executed in the United States, none are to be compared in respect to boldness of conception and in the magnitude of the results proceeding therefrom, with the jetty works for improving the navigation of the Mississippi river, planned and successfully executed by Capt. James B. Eads. In view of the exciting discussion which the suggestion of Capt. Eads called forth in the engineering fraternity, and the strong opposition which it aroused among influential professional officials, the prosecution of the work to a successful termination in the face of peculiar obstacles, and in spite of the condemnation of the first professional authorities of the country, has won for its originator the unqualified admiration of his fellow-engineers, and a national renown.

We present in the following a brief history of the origin and character of this important work, with engravings showing the outlet of the jetties for which we are under obligations to the *Leffel Mechanical News*. The great commercial interests involved in the maintenance of a deep, permanent channel from the Mississippi into the Gulf of Mexico, will be familiar to every reader. The great river drains twenty States and Territories, embracing an area of 757,000 acres of the richest agricultural districts of the country. It traverses the four great belts of wheat, corn, cotton and sugar, to say nothing of the minor products, the tobacco of the central South, the lumber of the far North, and the live stock and minerals of all sections. The importance, therefore, not only to the rich and growing States through which it passes, but to the nation at large, that this magnificent waterway of the continent should be maintained in a condition suitable for the cheap, rapid, and uninterrupted conveyance seaward of the immense agricultural and other products of the rich countries which it drains, had long been recognized before the plan of Capt. Eads was presented. To understand the case properly, it will be necessary to give a brief statement of the condition of the mouth of the Mississippi previous to the construction of the jetties.

Like all great rivers, the Mississippi carries down with it to its mouth immense quantities of silt, or mud, robbed from the land which its tributaries drain. The quantity of solid matter conveyed by the river varies according to season, being greatest during the spring, when the melting snow and ice of the North swell the volume of the tributaries and the main river to enormous proportions, causing frequent and disastrous flooding of the adjacent low lands. This year it will be remembered, the inundations were especially severe. At such time the velocity of flow of the river is much greater than at ordinary periods, and consequently its power of transporting silt, or sediment is correspondingly increased. Taking the average of one year with another, it has been estimated that the Mississippi annually pours into the Gulf nineteen and a half trillion cubic feet of water. This water carries from a half to three cubic inches of sediment along with every cubic foot of water. The aggregate of this solid matter is about 800,000,000,000 pounds per annum, a quantity sufficient to make every year a square mile of land 268 feet deep. As the river approaches the comparatively sluggish waters of the Gulf, its velocity of flow is diminished, and a portion of its sediment is deposited. The river here becomes a broad and shallow stream, entering the Gulf through half a dozen or more passes bordered by mud banks of its own creation, and which are gradually being extended further and further out towards the deep waters of the Gulf. From this it will be seen that the river is constantly making land at its mouth and extending itself seaward. About 12 miles from its mouth, it divides into three branches, which run down like narrow tongues into the Gulf; on each side they are bordered by low, muddy banks, and between them the Gulf extends up in shallow embayments. At the Gulf extremity of these passes, the silt deposited from the sluggish current of the river forms a bar that is constantly being extended outward. The depth of the river gradually decreases as it approaches the Gulf. At New Orleans, the river averages over 100 feet in depth and about $\frac{1}{2}$ of a mile in width; this depth continues to the head of the passes where the river widens suddenly to a mile and a half, and shoals up to a depth of about 30 feet. At the mouth of the south pass, where the jetty works have been constructed, the depth of water over the bar at low tide was only 12 or 13 feet.

From these facts the reader will perceive that the navigation of the great river was seriously impeded by the shallow water at the Gulf entrance, making it impassable save to vessels of light draft and small tonnage. It was to remedy this state of things,

and to create a channel deep enough and wide enough to enable vessels of the largest tonnage to pass freely up and down the river, that the jetty works were projected; and this the jetties have thus far succeeded in doing.

The following statement will explain the nature of these improvements. The plan of the work is remarkably simple. The object sought to be accomplished was the removal of the point where the sediment of the river was formerly deposited—namely, in the shallow water at the entrance of the pass, further out into the deep water of the Gulf, where filling up again by natural causes will be an indefinitely remote possibility. To accomplish this object, Capt. Eads, against the judgment of some of the most eminent government engineers, proposed the adoption of a system of jetties, which had been found so successful in the cases of the mouth of the Danube and other rivers of Europe. This system involved the extension of the banks of the pass, to carry the stream far enough out, by the creation of artificial walls within which the waters of the river would be confined, the said walls being so proportioned in width, to the quantity of water escaping, as to produce an increased velocity of current, and thus force the stream to scour out for itself a deep channel.

After much discussion, the plans presented by Capt. Eads, were approved by Congress, and he was authorized to proceed with the work under conditions, which, in consideration of the professional opposition to his plans, reflect the highest credit upon his engineering skill and foresight. By the terms of the contract entered into between the government and Capt. Eads and his associates, the work was to be undertaken at the sole risk of the last named. No payments were to be made by the government until certain stipulated depths of water had been secured and maintained for a certain period. The act of Congress provided that when a depth of 20 feet had been secured, a certain payment should be made, and so on up to 30 feet; that twelve months after each of the prescribed depths had been secured, a further payment should be made, provided that the same had been maintained during that time; and that a certain annual payment should be made during twenty years for maintaining the works after their construction, and for extending them if necessary, so as to keep the channel at the required depth.

Upon these terms the work was undertaken. Extensive lines of jetties were constructed along the course of the moving waters, to act as artificial banks to the river to prevent it from expanding and diffusing itself as it enters the sea. The greatest difficulties to be overcome were to devise means for erecting these artificial walls, and making them secure and permanent upon the exceedingly unstable foundation of soft sediment, into which any works of stone would speedily sink and disappear. Piles alone or cribs, however firmly placed would soon be undermined and swept away by the scour of the accelerated current.

To meet these difficulties, Capt. Eads constructed the artificial walls of the river with broad, flat mattresses of willow brush, securely lashed together and anchored to an interior row of piles. The preliminary work was the driving of piles along and inside of the line of the proposed structure. While this was going on, great mattresses of willow brush were constructed, firmly locked together with cross-ties and pins. These mattresses were towed into position adjoining the piles and fastened to them. Within twelve or twenty-four hours, the deposit of sediment from the current so completely filled the interstices of the mattresses as to sink them. Each mattress was not only fastened to others adjacent to it, and to the piles, but was also anchored to its place by a layer of stone. This simple plan was found to work most satisfactorily. It was found that the sediment continued to gather in upon the mattresses until they became more solid and enduring than any part of the natural bank. The wall of mattresses was found to perfectly protect the piles from the scour of the current, while the latter in turn served to hold the mattresses in place. When built up to a sufficient height, the structure was crowned with a firm stone paving, and the outer ends of the wall, where they were exposed to the sea, were constructed of broader and stronger mattresses supporting solid and durable works.

The extent and location of the jetties are as follows: The lines of the jetties are 1,000 feet apart. The length of the east jetty, from the land's end to the jetty head, is about 12,500 feet. For most of its length this jetty is constructed on a lateral shoal, where the depth averaged about 6 or 7 feet. The west jetty, on account of the further extension of the river bank on that side, begins about 4,000 feet further down than the east one, and extends parallel to it out to the same point. At its beginning it was constructed in much deeper water than was the east jetty; the depth, however, gradually shoaled to the crest of the bar, where it was some 6 or 7 feet. In addition to the jetties, the improvements of Capt. Eads comprise two auxiliary works—the