

Plate IV.—Root. Cross-sections, sand fence, and curtain construction.

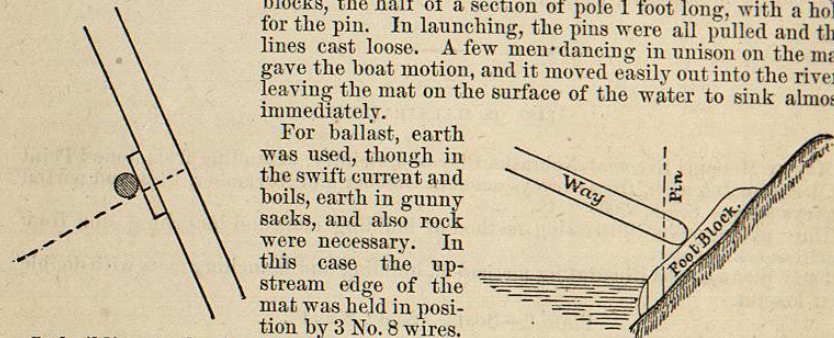
- Fig. 1. Plan of root (Eastport), 1878-'9. Scale, $\frac{1}{1200}$.
 Fig. 2. Characteristic sections below root. Scale, $\frac{1}{500}$, H and V.
 Figs. 3, 4, 5, and 6. Construction of sand fence and section showing effect. Scale, $\frac{1}{11}$.
 Fig. 7 a and b. Adopted plan of making curtains.
 Figs. 8 and 9 a and b. Tools used for same.
 Fig. 14. General plan of curtain.
 Fig. 10. First plan of curtain tried.
 Fig. 11. Shuttle used.
 Fig. 12. Second plan tried.
 Fig. 13 a and b. Method of twisting in the brush.

NOTES ON THE ILLUSTRATIONS.

Plate I.—The *Spider*.—The hull is 62½ feet by 18 feet, by 3 feet 4 inches over all, with rakes of 4 on 1. Her deck is caulked. The gunwales are made of 5-inch timber secured with through bolts. There are 5 longitudinal bulkheads, the center one being solid of 2-inch plank, the two on either side being open, of 4 inches by 4 inches, braced with long plank. She is strongly cross-braced. The spars or ways were supported on trunnion blocks at the center line, and were 8 feet 9 inches apart, and originally 41 feet long. These were lengthened 6 feet in 1879, and guards 4 feet wide added to the boat, which made her more convenient. Forty-two ½-inch pins were placed in gaspette sockets, 6 feet apart. She was always accompanied by a tool-boat, 10 feet by 30 feet.

In building a mat the ends of the spars were rested on foot-blocks on shore, and the two end spars were secured by heavy iron pins, which held the boat firmly in position. Usually the four upper lines of poles were supported on soaped skids or launching-blocks, the half of a section of pole 1 foot long, with a hole for the pin. In launching, the pins were all pulled and the lines cast loose. A few men dancing in unison on the mat gave the boat motion, and it moved easily out into the river, leaving the mat on the surface of the water to sink almost immediately.

For ballast, earth was used, though in the swift current and boils, earth in gunny sacks, and also rock were necessary. In this case the upstream edge of the mat was held in position by 3 No. 8 wires.



In building such a boat for a pole mat the ways should be placed 8 feet apart and the pins 6 feet apart in the way. There is no necessity of mounting the ways on trunnions, as they can be more cheaply and better secured to the gunwales, leaving the middle of the boat free. The *Spider* has been worked with her ways rigid nearly half the time.

The slope of the ways should be about 3½ to 4 to 1, and their surface oak. A single boat will carry rigid ways of three times her beam in length, with a mat of ordinary thickness (8 inches to 12 inches), weighing 6 to 8 pounds per square foot, and weighted 2 to 5 pounds per square foot. The ordinary weight required for effective sinking is 2 to 4 pounds.

A mat can be made of any width by using a double boat, or can be made with brush alone by giving the ways a slope of about 3 to 1 and placing them about 5 feet apart. Light balloon framing would answer for this purpose.

The *Peanut*.—This arrangement consisted of 2 boats, each 7 feet by 14 feet by 2 feet, connected by a tumbling-beam 43 feet over all. The skids were 28 feet long. The manner of operating is apparent from the drawings and photographs. This system is not to be approved of, as the size of mats which can be constructed is quite limited. The pulling of long skids is unsatisfactory, and strong currents cannot be contended with. The use of the *Peanut* has been discontinued.

O 8.

IMPROVEMENT OF MISSOURI RIVER OPPOSITE SAINT JOSEPH, MISSOURI.

In the project submitted to you July 5, 1878, it was proposed to expend the appropriation of \$50,000 made by act approved June 18, 1878, in extending a revetment of brush mattresses above and below the dikes built by the bridge company on the north side of the Kansas peninsula opposite Saint Joseph, Mo., the work proposed being a continuation of that done during the preceding season. This project having received your approval, work was begun August 8, and with the exception of the month of January was prosecuted continuously till the end of February, 1879, Assistant Frank Hotchkiss being in charge. Work was resumed April 19, and is still in progress, Assistant D. W. Church being in charge, with Assistant T. L. Rowland as local engineer.

During the season 10,240 feet of bank was protected, the mattresses extending from 3 or 4 feet above low-water about 40 feet out in the stream. The upper portion of the bank was graded down and protected with a layer of stone backed in the more exposed localities by layers of fascines or loose brush from 10 to 12 inches thick.

The work has stood very well as a whole; such damage as has occurred is traceable to the eddies formed by the old dikes. These are now a decided nuisance, and will be got rid of as soon as possible. All damaged portions of the revetment have been repaired, and it is intended, as soon as the June flood subsides, to begin a revetment 2,024 feet in length on the left bank extending upstream from the east abutment of the Saint Joseph bridge. This work is rendered necessary by the heavy erosion which has been going on there. Later in the season it is expected to remove a portion or all of dike No. 3, which has given us the most trouble. These operations will exhaust the current appropriation. A survey made last fall developed the fact that there are changes going on above Saint Joseph that threaten to destroy or nullify all that has been done so far. Opposite Amazonia, 20 miles above Saint Joseph, is a long peninsula, which is now being rapidly eroded on both sides. Its width by recent measurement is only 547 feet at the narrowest point, and a cut-off will undoubtedly be formed there inside of a year. This will shorten the course of the river some 4½ miles, and will probably start a heavy cutting on the north side of the point above Saint Joseph, known as French Bottom. The shore here is already cutting badly, and with the changes likely to occur above will soon be broken through. The consequences of such an event would be disastrous in the extreme, and should be prevented at all hazards. It is estimated that 9,000 feet of revetment will be needed at this point, costing \$50,000. The present revetment on the Kansas point should also be extended upstream 4,000 feet, the cost of which will be \$25,000; its extension below, with repairs and additions to the present work, will cost \$9,000, making a total estimate of \$84,000, which can profitably be expended in one season.

The work is situated in the collection-district of New Orleans, and the nearest port of delivery is Omaha, Nebr. The nearest fort is at Leavenworth, Kans. Amount of revenue collected at Omaha, Nebr., during fiscal year ending June 30, 1879, was \$2,355.38.

Money statement.

July 1, 1878, amount available.....	\$50,000 00	
Amount appropriated by act approved March 3, 1879.....	9,000 00	\$59,000 00
July 1, 1879, amount expended during fiscal year.....	47,507 87	
July 1, 1879, outstanding liabilities.....	1,423 47	48,931 34
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July 1, 1879, amount available.....		10,068 66
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Amount (estimated) required for completion of existing project.....	84,000 00	
Amount that can be profitably expended in fiscal year ending June 30, 1881.	84,000 00	

O 9.

IMPROVEMENT OF MISSOURI RIVER AT NEBRASKA CITY, NEBRASKA,
AND EASTPORT, IOWA.

At the date of the last annual report a resurvey was in progress at this locality. Upon its completion a report and plan of operations was submitted to you under date of September 18, 1878, and having received your approval, work was begun in the latter part of September, Assistant L. E. Cooley being in charge, and continued until December 20, when the cold weather compelled the discontinuance of field operations. Work was resumed April 12, 1879, and is still in progress. The plan proposed for this locality contemplates a complete rectification of the river-channel for some distance above Nebraska City with the view of ultimately forcing it out of Eastport Bend and directing it into its old channel along the front of Nebraska City. It is expected torevet the shores wherever exposed to erosion in Eastport Bend, Copeland Bend, and Civil Bend, above Wyoming. The rectification of the channel is to be accomplished by inducing deposits of sand by floating brush-dikes or other means, ultimately building up these deposits and securing them by revetment. Work during last season was confined to the revetments which were carried on in Eastport Bend, at the head of Nebraska City Island, and near the foot of Civil Bend, a total length of 10,374 feet. All this work stood well except that in Eastport Bend, the most important of all. During the spring and June rises this work was attacked by the river with such extreme violence that there was great danger of losing the whole work. By dint of the most strenuous exertions, working part of the time both night and day, the constantly recurring damages to the revetment were made good, so that the bank has been held and is now deemed to be safe. To understand the difficult nature of the problem presented here it is necessary to consider that at high-water the banks are under water to a depth of 3 or 4 feet, and the current velocity is as great as 7 or 8 miles an hour. The erosion of the banks for several years past has been at the rate of about 1,100 feet per annum. When this was stopped by our revetment, a tremendous scour was set up, carrying the bed of the river 30 or 40 feet below its normal position; in fact, the scour undoubtedly extended to the solid rock underlying the valley. Into this trough the mattresses gradually slid and the work could only be maintained by building new ones inside and overlapping them and by constantly increasing their width. The mattresses put in in 1878 were about 50 feet wide and extended up to low-water mark. They are now 120 feet wide and upwards in width and extend up to the top of the bank and even beyond, to provide against

