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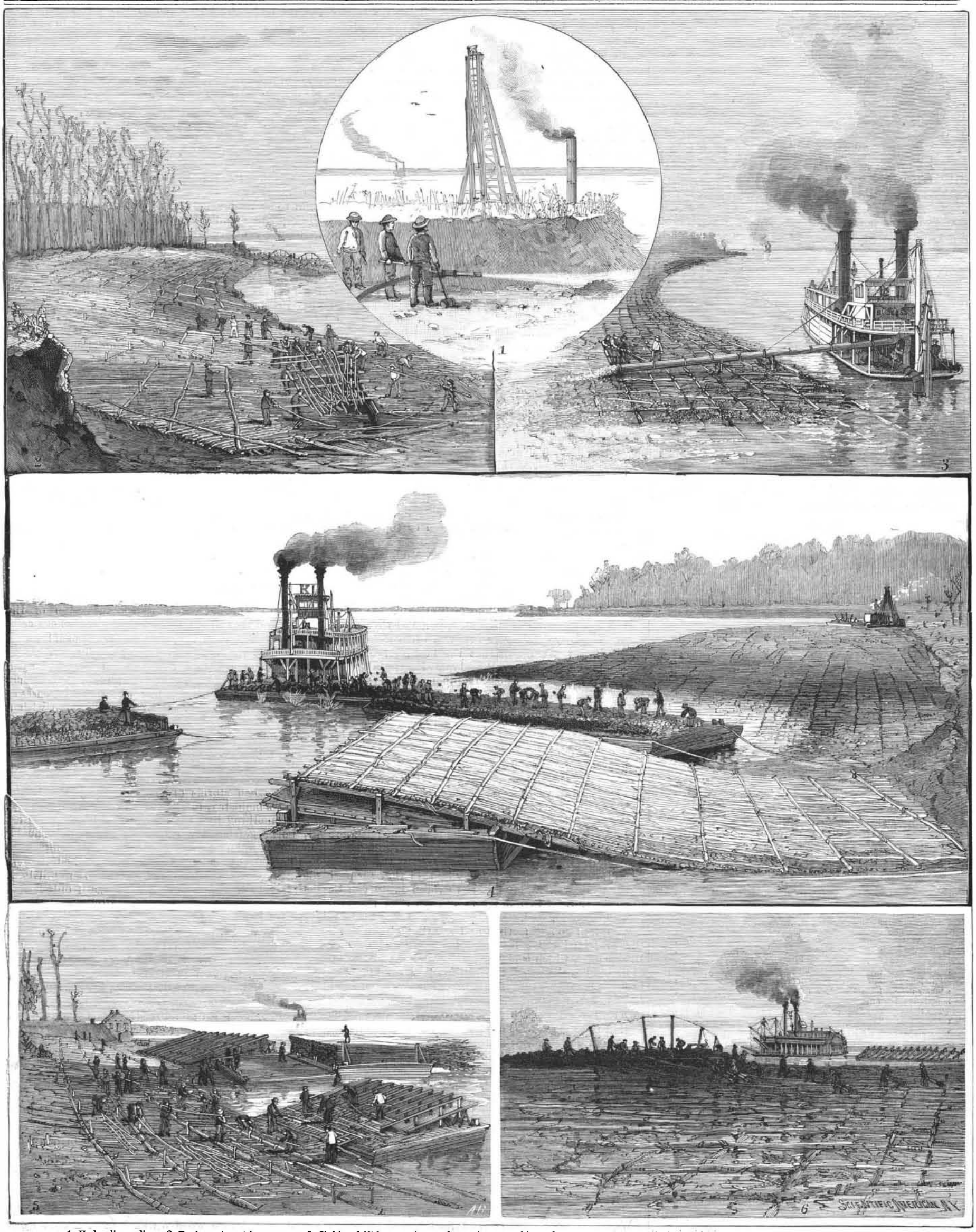

1. Hydraulic grading. 2. Bank revetment in progress. 3. Sinking drift by pumping sandu pon it. 4. Sinking sub-aqueous mat. 5. Load of brush and weaving barge. 6. Ballasting sub-aqueous mat.

U. S. GOVERNMENT IMPROVEMENTS ON THE MISSISSIPPI RIVER AT PLUM POINT, ABOUT FIFTY MILES ABOVE MEMPHIS.—[See p. 405.]

MISSISSIPPI RIVER IMPROVEMENTS.

For many years the question of the practical feasibility of confining the Mississippi River within fixed channels has been a most important one, not only as it affected the improvement of navigation over this great inland water course, but also from the necessity of protecting great properties along its banks, which have been frequently endangered by its fitful changes. In 1873, for instance, the banks of the river fronting the city of Memphis, Tenn., commenced rapidly caving in, the encroachment of the river destroying extensive sites and endangering costly structures, such as warehouses, elevators, cotton compresses, etc. In 1876 the bank had receded 350 feet, and was continuing to cave in at the rate of 100 feet per annum, thus promising to quickly destroy what had before been the finest harbor on the river above New Orleans, accessible to the largest vessels.

For a long time the national government has made annual appropriations for various improvements of the river, the most of the work so done having been originally for the construction and repair of levees, but in 1879 Congress passed an act organizing the Mississippi River Commission, to take more comprehensive action in regard to the whole matter, and of this commission Major-Gen. Q. A. Gillmore, of the engineer corps of the U. S. army, was president up to the time of his death, April 7, 1888. The general plan of work adopted by the commission contemplated the reduction of the low water width of the river below the mouth of the Ohio to about 3,000 feet by means of permeable dikes, behind which artificial banks should be formed by deposit, and the preservation of the natural curves of the river by reveting caving banks, together with the construction of levees.

Our first page illustrations represent the progress of this work at a portion of the river styled Plum Point Reach, about fifty miles above Memphis, Tenn. The river here takes a great bend into the Arkansas shore, and for a distance of some eighteen miles its channel was constantly changing, while numerous bars were formed, very seriously interfering with navigation. Previous to the commencement of these improvements the river at this point was frequently unnavigable for vessels of more than 4½ feet draught, while now, at the low water stage, it is navigable for vessels drawing 8½ to 9 feet. The work has been substantially completed about three years, requiring only slight repairs from year to year, while the natural current is evidently wearing the channel steadily deeper and making changes therein less likely to occur hereafter.

The principal form of protection for the banks shown in our views consists in firmly anchoring mats of light timber and brush, to extend from below to quite high water mark, these mats being connected, by the manner in which they are woven on board and moved to place, to form a continuous protection to the portion of the bank they cover. A break anywhere in this mat covering would soon be found by the current when the water rises, and great care is, therefore, taken to make this matting cover continuous before the weight of stone or other material which is to hold it down is put in place.

The general manner of conducting operations is pretty thoroughly indicated by our illustrations, although the details vary in different localities. The hydraulic grading shown in Fig. 1, and one manner of sinking mat by pumping sand upon it, as shown in Fig. 3, indicate some of the recent improvements in methods of conducting the work, the whole plant for carrying on which is owned by the government. Fig. 2 shows the weaving of the mat in place upon the bank. Fig. 5 shows the weaving barge, with a load of brush in convenient proximity thereto, the weaving being done on a special frame set at an angle against the bank, the mat as made, shown in Fig. 4, being moved down into position on a bed formed by longitudinal timbers and stakes, the mat being afterward ballasted by loose stones and the pumping of sand upon it. The progress of this ballasting and placing of the mat is shown in Figs. 5 and 6.

The results of the work done at this point on the Mississippi have been so satisfactory as to lead to the more steady prosecution of similar plans for improving other sections of the river. The point at which these improvements were made was notoriously the worst one below Cairo, yet during last year, a season of very low water, no trouble was found in navigating this section. The high water of the year was above the thirty-foot stage for fifteen days, yet all overflow was prevented for a distance of nearly thirty miles. In the similar work done for the protection of Memphis harbor, the success has been equally pronounced. This work was not completed until the fall of 1887, and much of that which was done at first proved inefficient, but with the later methods adopted it is said that not a stick or a stone can be seen to be displaced, and not a foot of earth has been lost behind the revetment. So great is the confidence of those doing business there in the permanence of the water front as now established, that manufacturing and warehousing concerns ave lately erected extensive and costly additions to their buildings on the river bank, and the elevator and compress companies have built out on piles driven through the revetment, so as to recover a considerable portion of their lost space.

The cost of such work has been greatly reduced since the government commenced these improvements. What originally involved an expenditure of some $30 per foot of bank was, in the last portion of the work, done for about $12 per foot of bank. The cost of a subaqueous mat 150 feet wide constitutes about one-half the expense, but some of the mats used have been 250 to 300 feet wide. This is said to be the heaviest and most costly work of its kind ever put down, and the engineers claim that it will certainly protect any alluvial bank on the Mississippi River.

The work above described has been ably conducted under the supervision of Capt. Smith S. Leach and Capt. Wm. T. Rossell, of the corps of engineers, U. S. army.

The Mississippi River Commission consists of Col. C. B. Comstock, Lieut. Charles R. Suter, and Maj. O. H. Ernst, of the U. S. Engineer Corps; Mr. Henry Mitchell, of the Coast and Geodetic Survey; Messrs. B. M. Harrod and S. W. Ferguson, civil engineers, and Mr. Robert S. Taylor.

Notes on Telea Polyphemus.

I collected two cocoons of this beautiful moth last fall. As they happened to be free from parasites, I was fortunate enough to observe the very interesting manner in which they came forth. April 30, about noon, the end of one cocoon was noticed to be soft and moist. Every minute or two the moth could be seen struggling to push its way through the softened cocoon. In about ten minutes from the time it was first noticed, the moth burst through, and, drawing its enormous body out, it began to run hurriedly around to find a place suitable for the position necessary to the growth of its wings. Climbing up the window frame, it attached itself to the wood by the sharp hooks on each foot, and there, with its body hanging downward, it waited for its wings to grow.

When it first came forth, its wings, were less than an inch in length, but they grew so rapidly that in fifteen minutes they were longer than its body; in twenty minutes they were of full length, but were still very soft.

The reason for the insect being so anxious to get the right position immediately after emerging from the cocoon is that if the wings are cramped or held in a wrong position, they harden thus and prevent it from flying.

The other moth came forth about half an hour after the first one. I covered it with a low glass cover for about fifteen minutes. It kept running around and turning over on its back in the vain attempt to assume an upright position. Removing the cover, I allowed it to climb an upright stick, when it immediately became quiet. Its wings, which had been slowly expanding, now began to develop as rapidly as in the first one, but its forced imprisonment had ruined its beauty. The hind wings were creased and crumpled so that it could not fly.

During the development of the wings I could see the pulsations in the body as the blood was forced into the tubes of the wings. WALTER A. LYNN.

Silo Presses and Ensilage.

The following is a description of a silo press erected at the Agricultural Experiment Station at Minneapolis, Minn. There are two presses located in the barn, each 16 ft. square and 21 ft. in height. They are so arranged that the top of each is on a level with the thrashing floor of the barn and the bottom is on a level with the basement stables, thus facilitating the feeding of the animals. To a height of 11 feet are walls of stone, 18 inches in thickness, above which the walls are wood. The bed is of concrete, composed of one part Louisville cement, two parts sand, with enough water and gravel added to make a stiff mortar. The floor has a slope of one inch to the center, where is located a well 2 feet in diameter and 4 feet deep, filled with gravel and stones, the bottom being left open. The walls are boarded up with matched flooring, a space being left between that and the main wall for ventilation. Two thicknesses of tarred paper is tacked on to this lining, and over the paper another covering of matched flooring nailed on vertically. This gives an air-tight, water-tight, and frost-proof silo, and one which is constructed to facilitate filling and feeding, and is admirably adapted for preserving the ensilage.

For the greater preservation of the wood, the partition walls are only carried within an inch and a half of the floor, and before filling the silo a strip of tarred paper is folded and nailed to a strip of board at the bottom, one-half of the tarred paper lying on the floor and being held firmly in place when the silo is filled by the ensilage. This makes an air-tight joint when the press is filled, and when it is empty the paper is raised or removed, and a free circulation of air is established, which purifies the chamber and dries and preserves the board partitions. This method of construction, with the use of an air chamber, has proved satisfactory, and in spite of very severe winters has prevented the contents from freezing.

It is well to bear in mind in constructing a silo that it is only a preserving can on a large scale, and the same rules should be observed in both cases. The timber used may be rough, but it is necessary to make a liberal use of tarred building paper. The walls of the silo must always be vertical, that the contents may readily settle by gravity. They must also be strong enough to withstand a strong lateral pressure. It is absolutely essential that the bottoms and walls be air and water tight. It is preferable to divide the space intended for the silo into three equal compartments, so that they may be filled alternately to a depth of four or five feet and then allowed to ferment, the heat rising to 100 or 140 degrees before the section is again filled. The silo in practical use should not be too large, as it is advantageous to remove an inch or more from the surface daily, the ensilage thus being always found sweet and pure and before any mould can gather thereon.

The report of the Department of Agriculture also issues the following directions on the preparation and treatment of ensilage: Although any plant or vegetable fit for cattle food when green may be preserved for an indefinite period in the silo, Indian corn is considered the cheapest and best for ensilage. Such varieties of the corn should be planted as will reach maturity in an ordinary season in the section of the country in which it is to be raised. Plant in rows wide enough to admit of easy cultivation and just thick enough to allow each stalk to form a well developed ear. The crop should be gathered when the grain is fully formed, but in the doughy state, at which period it contains the greatest amount of digestible matter. Corn partially dried is equally desirable for the silo. The corn should be cut in about one-half inch lengths.

In filling the silo, care should be taken to spread it evenly as put in, to pack the corners and sides firmly, to cover the top with a layer of boards or plank. Spread over this a double layer of tarred paper, and then a layer of rough boards, and on the whole a moderate weight of from fifty to one hundred pounds to the square foot. The weighting material may be anything convenient, sand, gravel, or dirt in barrels, stone, fire wood, farm implements, for storage and the like.

Pits should not be opened until fermentation has ceased and the mass has cooled, which will be in from six to eight weeks from the time of filling.

In feeding from the silo, it is better to feed day by day from the top in uniform layers, rather than from top to bottom, as by this method the surface is not exposed long enough to the air to become sour.

Ensilage can be grown and preserved much cheaper than root crops, by the ordinary farmer, and will successfully take their place in feeding value.

Corn ensilage is not a complete feeding ration, as it is deficient in protein, and this must be supplied by some by-fodder, as bran, shorts, or oil cake.

The best results of feeding ensilage are obtained by using it in combination with dry fodder, the best of which is clover hay.

Ensilage furnishes a succulent and easily digested food, greatly relished by all animals during the winter months, when their diet would otherwise be confined to a regime of dry provender. The cheapness and ease with which the silo can be constructed, the certainty with which, when properly constructed, it will preserve the feed from injury, the low cost of raising the crop, and the great yield per acre as compared with hay crops, and the value as a cattle food, render this the cheapest provender a stockman can raise.

Such are the directions given by this report and such are the deductions arrived at.

The Biggest Girders Yet.

In the new addition to the American Museum of Natural History will be used the largest box or riveted girders ever used in the construction of a building, says the New York *Times*. These girders were designed by J. Cleveland Cady, the architect, to support the floors and partitions, and thus obviate the use of pillars or columns, the object being to give unobstructed floor room for the display of specimens. There are twenty-eight of these girders, measuring about sixty-two feet in length, and weighing 40,000 pounds each. They were landed on the North River front of the city in the neighborhood of Fiftieth Street, and the possibilities of modern trucking have been taxed in vain to transport them to their destination at Manhattan Square.

The longest and strongest trucks to be found were brought into requisition, and with twelve horses harnessed to each truck the attempt began. One truck collapsed in Fifty-seventh Street near Tenth Avenue, another at Seventy-seventh Street and Ninth Avenue, while a third, which was fortunate enough to reach the square without mishap, buried its wheels to their hubs and stuck fast as soon as it left the pavement of the street. The contractors have therefore found it necessary to construct a tramway across the square from Ninth Avenue to the building for the transportation of the girders.