JOURNAL
OF
THE FRANKLIN INSTITUTE
OF THE STATE OF PENNSYLVANIA,
FOR THE
PROMOTION OF THE MECHANIC ARTS.

JANUARY, 1860.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

The Bar at the Mouth of the Mississippi River.

By D. S. HOWARD, Civ. & Marine Eng.

THE vast importance of this impediment to the trade of one of the greatest commercial thoroughfares in the world, together with the other incalculable evils arising out of the freshets of this river alone, is well calculated to demand from an enlightened people a remedy, which may also be applied to numerous similar obstructions to navigation in other streams that have existed ever since the world began, and will ever exist until the subject shall have received the attention due to it.

There is no improvement within the reach of science of the same importance, that has so baffled the research of scientific men as that of rivers and harbors. Still, there is no reason to despair, for "necessity is the mother of invention," and we may look upon the bar at the mouth of the Mississippi, as a near relative to necessity, if not the real parent of some invention that will free the world, not only of bars at the mouths of rivers, but from various other obstructions above, as far as the current will admit of navigation without locks.

The invention, in fact, has already been made; but, in a republican government like ours, where a majority of the whole people have to sanction the policies adopted by the government, it is necessary that every subject of so much importance as this, should be thoroughly discussed before any great deviation can be made from the beaten track,

however unsuccessful we may hitherto have been in it. It, therefore, behooves us all to search among the established facts of the case for a true remedy.

If the remedy be found in any invention already made, let the arguments be put forth sustaining it by every advocate for the improvement of our country, the advancement of commerce, and justice to the bold originator of the plan, that it may be applied before the governments of Europe, or some power not dependent upon the people to sanction their policies, adopt the honor as well as the profit of a project so important to the world at large.

The newspapers are already bringing out Napoleon III. as the projector of "artificial lakes for the improvement of the Loire and other rivers of France," and, at the same time, say that "it has been suggested for the improvement of the Ohio," without mentioning the name of the man who suggested it.

We may here observe a prevailing disposition in human nature to make royalty the centre of greatness in the useful arts and sciences, as well as those of politics and war, by clothing it with the happy thoughts and suggestions of the more humble searchers after scientific truths. This would seem to be among the moral evils, but, if so, it is one out of which great good is often produced.

The weakest ruler knows enough of human nature to expect the clamorous applause of the weak and designing part of his people, for all the great designs he may be instrumental in carrying out, whether he be the originator of them or not; but that portion of mankind whose applause is of any value are ready to do justice to the real projector also. Many great projects are thus carried out through the influence of concentrated political power that might never have come to light by any other means, until the originators were beyond the reach of benefit from them.

Napoleon III., in adopting this plan, would manifest more discernment, more magnitude of purpose, and more ability to become great among a scientific people, than is common to heads of governments of any kind.

We have the facts and figures before us, from a source we have a right to respect as the best authority, countenanced by the highest scientific ability in that department of the nation, which show beyond peradventure that one of the main tributaries of the Mississippi may be placed under perfect control by the expenditure of a small sum of money compared to the amount of property (saying nothing about the lives) lost at every great freshet. These figures also show that the perfect control over the freshets of the Ohio river, would have kept the waters within the levees on the lower Mississippi, through the two last great freshets, which would have saved enough to have made a good beginning towards improving all of the other principal tributaries and securing the whole system of rivers against any serious damage from flood forever, besides the untold amount of benefit from the improvement of their navigation.

There is always good water over the bar at the mouth of the river

at any and all times when the river is confined within its banks. It is only when the freshets of the numerous tributaries act sufficiently in unison to cause an overflow of the levees, that the deposit at the mouth becomes troublesome. This fact, alone, shows conclusively that the whole evil is due to the additional amount of sediment produced by the freshets; and, though lateral outlets could be produced sufficient to relieve the levees and enable them to confine the remainder of the water, the navigation would still be obstructed. The only benefit of the lateral outlets would be the saving of swamp lands.

Another important fact is, that nature has provided better for the true remedy of *all* the evils arising out of the overflow of the Mississippi than of most other rivers. All who have explored its head waters bear testimony to it. The facilities for reservoirs are seldom surpassed. The country is filled with lakes and ponds.

The question has been raised (and strange to say by professed engineers, who, however, are opposed to the reservoir system,) against the usefulness of reservoirs without the expense of constant attendance to regulate them. It is true that a limited number may be made more useful if attended to and drawn off at proper times, but common observation might teach us the usefulness of reservoirs without attendance, by comparing such rivers as have natural reservoirs with those that have not, as the upper Mississippi with the upper Missouri. The one heads in numerous rice-lakes and swamps, and the other in the narrow valleys of the Rocky Mountains. The one is a gentle, pure, crystal stream until joined by some of its turbulent tributaries, and the other is a wild, furious stream, subject to be influenced by every rain or season of melting snow, causing freshets that change the current of the stream and wash away the banks, tearing up trees, and furnishing materials for bars, rafts, snags, and sawyers; and, when acting in concert with other similar streams in the same great basin, produce the great freshets that overflow the levees on the lower Mississippi, causing great destruction of property, enough at every such freshet, if properly applied, to establish the fact at least, that the reservoir system is the only true system for the improvement of rivers.

We may also compare the magnificent St. Lawrence with any other river of the opposite character; there is not one of the three hundred thousand square miles of this great basin that would not warrant cultivation so far as the climate is concerned. There are no parched deserts or inundated swamp lands to reclaim. Although there are many turbulent little streams among the head waters of this noble river, the natural reservoirs are so extensive and their surfaces bear such a proportion to the width of their outlets, that any rush of water from any combination of causes, is swallowed up without causing any sudden rise in the river below.

It is wholly unnecessary to include in estimates of the reservoir system a large item of expense for attendance after the reservoirs are built if the work be properly and permanently done. The outlets of each reservoir should have a width proportional to the amount of water to be discharged, and the height of the dam, which should never be

overflowed; then, the greater the proportion which the area of the surface of the reservoir bears to that of the water-shed, the nearer perfect will be the regimen of the river below.

One of the beauties of the reservoir system is, that any amount of money, however small, if properly expended, creates an immediate corresponding permanent benefit, which is well calculated to encourage the completion of the system.

It is no part of my purpose here to set forth the numerous advantages of the reservoirs in a country where the streams below require them. We have only to turn the American mind from speculations of far less importance, by showing the possibility of complete success, at a moderate comparative cost.

It would seem to be an easy matter of calculation to determine the comparative cost of retaining the surplus waters of the Mississippi near its source in spacious reservoirs, and confining them by levees less than one mile apart, and over a thousand miles long, each.

Where natural reservoirs do not exist among the numerous tributaries to the Mississippi, it is not being over-trustful to rely upon a diversified country containing a million or more of square miles, the extent of the great water shed of this river, to afford facilities for reservoirs better than the bed of the lower part of the river, where there are no materials but mud and perishable timber afforded for structures which, when constructed, are not only liable to be worn away by the various freaks of the current at different stages of the flood, but are subject to destruction at any time by the numerous animals that burrow in the banks near the surface of the water.

The amount of dike required to keep the surplus waters of any river back, if built along the banks of the upper streams without regard to the best locations for reservoirs, would bear the same proportion to the levees inversely, as the land overflowed by the dikes, to the surface of the stream enclosed by the levees. This brings the subject fairly before us. To all who have had occasion to observe the features of rivers and river basins, it is conclusive, that in no case can it cost as much to retain the surplus waters of any river or that amount which overflows the banks, by reservoirs above, as by levees below. It is also evident that locations may be selected somewhere within the great basin of any principal stream, that will not only reduce the expense of dams and dikes, but lessen materially the land to be overflowed.

It is well known that the land along rivers which empty into the ocean is valuable in proportion to its proximity to the coast generally, both on account of the quality of the soil, and the convenience of getting its products to market. The climate is also different, in favor of the lower waters, unless where nature, in a seeming desire to give us a useful hint, has supplied the country at the source of some few streams, such as the Oswego river in New York, the river Trent in Canada, and some of the other principal tributaries to the St. Lawrence, which bear incontrovertible testimony to the correctness of the policy of sacrificing the land necessary at or near the source, for the benefit of that and other property nearer the mouth of a river.

From a careful consideration of the admitted facts of the case, it is evident that nothing short of the reservoir system will ever be perfectly satisfactory to the aggregate interest in the Mississippi river. In the meantime something must be done for the commercial interests immediately.

In February last, the New Orleans Chamber of Commerce reported that five millions and a half of dollars worth of property was held in check, at one time, by the bar at the mouth of the river. I am confident this is no exaggeration, as I counted sixty-seven three-masted vessels at anchor near the bar, inside and out, and aground on it, at the South-west Pass, on the morning of the twenty-fourth of the same month, the most of which were undoubtedly detained by the vast accumulation of sediment. The river was then overflowing its banks and levees at near the highest point ever reached.

The only means for immediate relief are dredging and scouring. Dredging was resorted to in 1839, by Capt. A. Talcott, one of the ablest engineers ever in the U. S. service, under very unfavorable circumstances; but, had he possessed the advantages of the improved machinery now in use, he would have been eminently successful, as he usually is in all of his undertakings, more especially in the improvement of rivers and harbors.

In a very able report to the Chamber of Commerce of New Orleans by A. J. Duncan, in February last, a plan of dredging and scraping is recommended, such as has been tried with some success, but it would seem that a more economical use of power might be made by raising the material and depositing it on each side of a three hundred feet channel, which could be done without lighters by improved machinery already tested: the cost of outfit would be no more than that for dredging and scraping, and the cost of working much less. By these means the current in the channel would be increased by the deposit on the side; while, with wings recommended by Mr. Duncan so constructed as to increase the current near the bottom, and a proper construction of the lower machinery of the dredge for stirring up the mud, as much would be carried off by the current as when the drag and scraper are used, with much less power, besides what is raised and deposited outside the three hundred feet.

The possibility of depositing the excavated material one hundred and fifty feet from where it is raised without lighters, might be questioned were it not that machines are now in operation in similar and less favorable material, which is readily discharged by a spout inclined less than an inch to the foot.

If it should be objectionable to make any deposit on the sides of the channel, a machine should be constructed capable of carrying within itself one hundred cubic yards or more, with the lower machinery calculated for stirring up the mud while excavating, which may be gauged to load itself while passing from deep water above to deep water below, where the load would be discharged and the dredge returned by means of a propeller screw, worked by the same power.

On this plan, it is estimated that with an outfit of \$50,000 and an

expense of \$175 per day of 24 hours, 8000 cubic yards could be removed daily from the bar and deposited in the Gulf, which would admit of a liberal allowance for contingencies, and bring the whole cost below \$100,000 for removing 900,000 cubic yards within six months, the amount required from the South-west Pass and Pass-à-l'Outra; making twenty feet depth, with a width of three hundred feet in each channel.

Corpus Christi, Texas, June, 1859.

Steam Engineering in 1859. Steam Generation (Continued).*

(Continued from Vol. xxxviii, page 366.)

In our last number we referred briefly to the present efficiency of boilers used on land, and pointed out the wide margin still left for improvement; and as it is neither the intention nor object of these general observations to enter minutely into constructive details, we propose now, as briefly, to say a few words respecting the present efficiency of marine boilers.

When steam was first applied to the propulsion of ships, it was generated in large boilers with capacious internal flues, the pressure per sq. in. seldom exceeding 4 or 5 lbs. The advantages of this class of boilers are the ready access to all portions of the internal surface for cleaning, and their consequent durability, extending frequently to 8 and 10 years; their disadvantages are their weight, both of iron and water, and the great space they occupy in the ship. They have been, and still are, much used for tug-boats, and a few may be found in some of our largest first-class steamships.

To remedy the great weight and bulk of the flued boiler, the multi-tubular system was introduced, and it has now almost completely supplanted all other kinds of boilers for steamships, and although the particular arrangement of the present marine boiler may not be the best, it has nevertheless stood the test of a lengthened trial, and to a certain extent can be fully relied on.

To those practically acquainted with the construction of the boilers now in general use in our naval and merchant steam fleets, we shall be understood in describing them as those in which we have first the furnace, then the flame-box as a continuation thereof, then the tubes or flues returning over the furnace to the smoke-box; and, lastly, the uptake leading from the smoke-box to the chimney, and all, excepting the chimney, enclosed in the outer shell. This is the kind of boiler now generally adopted on board ship; in some cases, as in the *Great Eastern*, there are furnaces at each end of the boiler, leading into one flame-box, and having two sets of return tubes, leading to one or two chimneys as may be preferred. This arrangement, well proportioned, can be made the most effective of any, the only drawback being the necessity of having two stoke-holes—a matter of some importance in a small ship.

Adhering to the rule we have hitherto observed to avoid discussing exceptional cases, we will only allude in passing to the existence of two

*From the Lond. Artizan, July, 1859.