H. F. KNAPP.

Method for deepening Bars of Rivers.

No. 195,896. Patented Oct. 9, 1877.

Fig. 1.

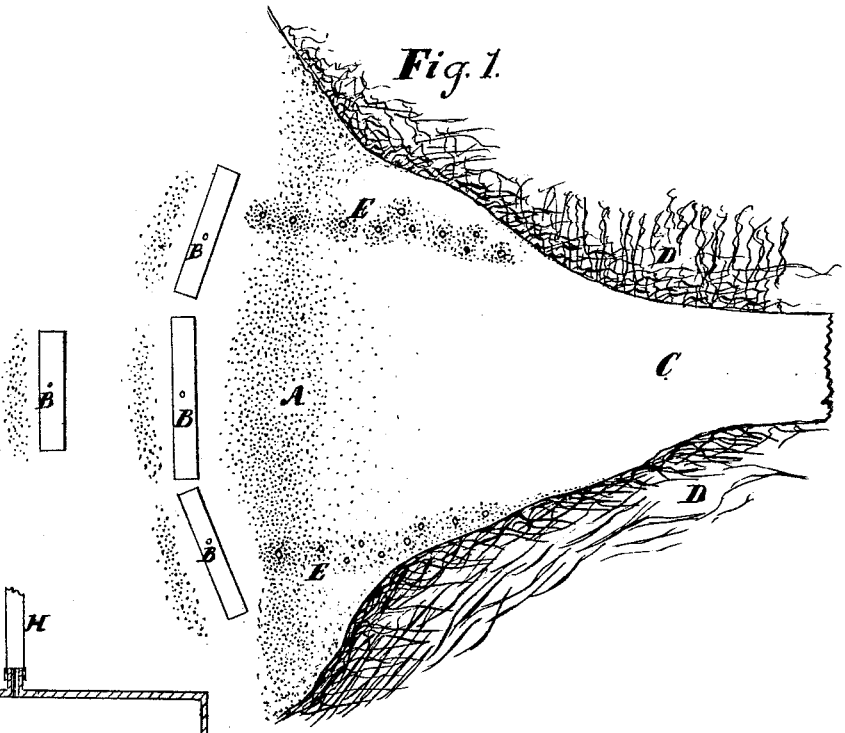


Fig. 3.

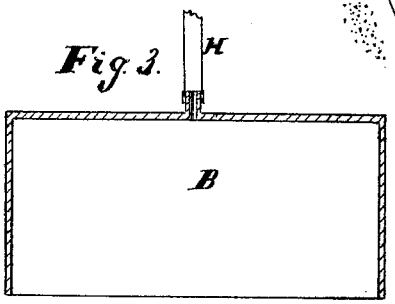


Fig. 4.

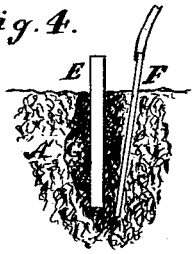
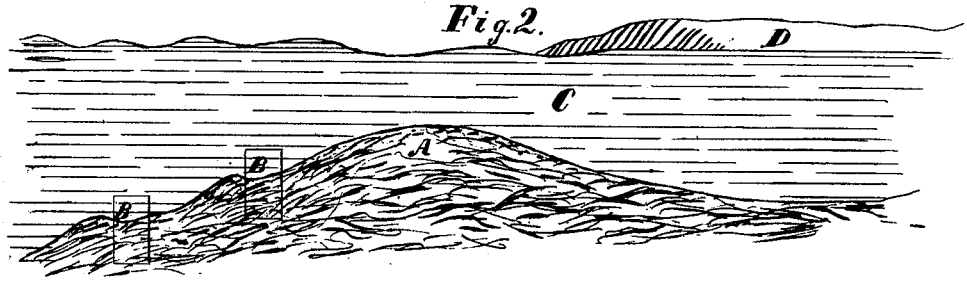


Fig. 2.



Witnesses
D. C. Lattimer
Geo. H. Stetson

Inventor
Henry F. Knapp

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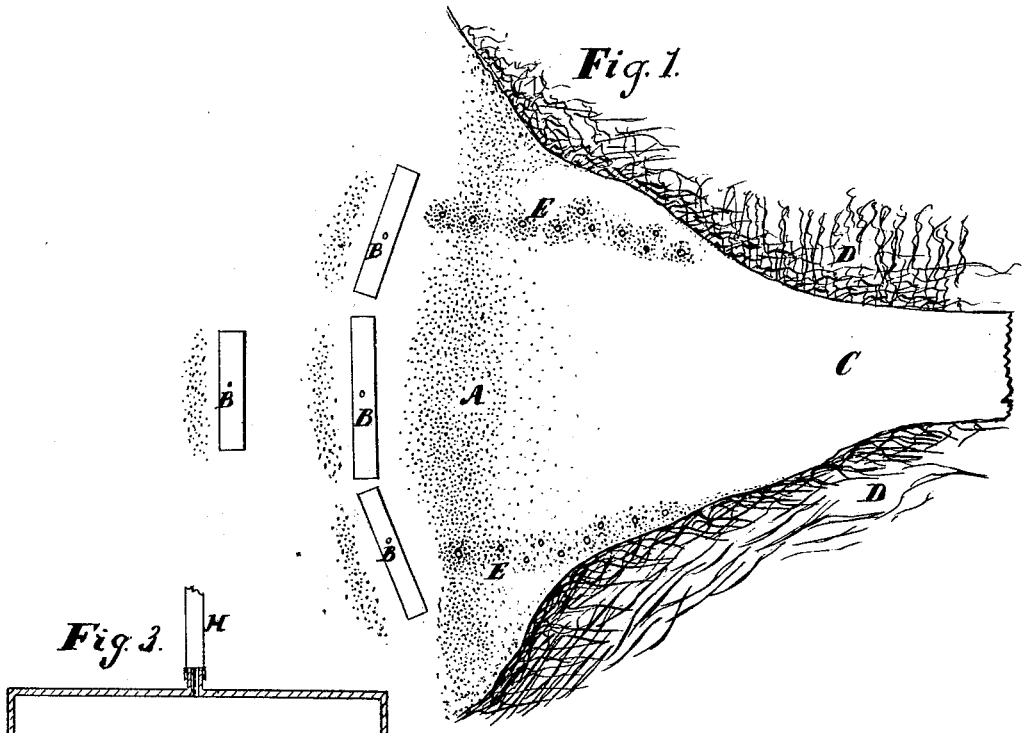

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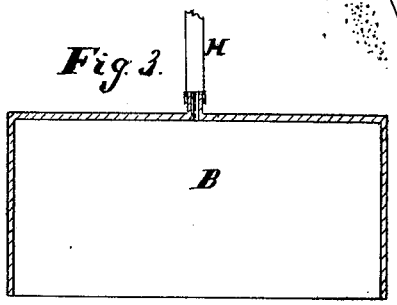

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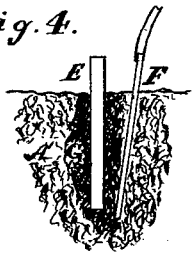

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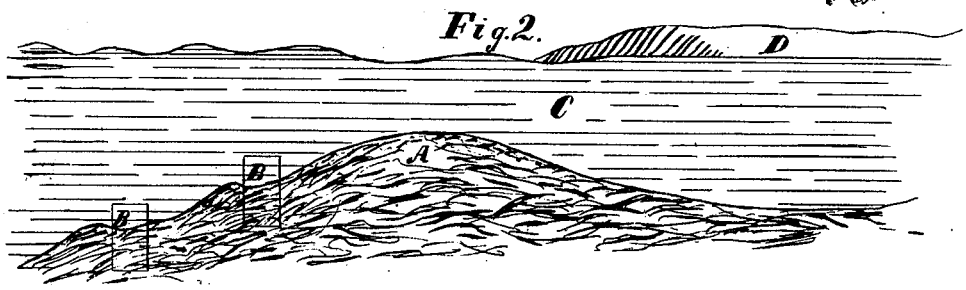

D. C. Saltmarsh
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UNITED STATES PATENT OFFICE.

HENRY F. KNAPP, OF NEW YORK, N. Y.

IMPROVEMENT IN METHODS FOR DEEPENING BARS OF RIVERS.

Specification forming part of Letters Patent No. **195,896,** dated October 9, 1877; application filed April 6, 1875.

To all whom it may concern:

Be it known that I, HENRY F. KNAPP, of the city, county, and State of New York, have invented an Improved Process and Means for Deepening the Bars of Rivers, of which the following is a specification:

This invention relates to modes of arranging one or more lines of walls along the outside of a bar, and across the direction of the flow of the river into the sea, the top of which walls is on a lower level than the top of the bar, in order to give clearance to any vessels passing in and out of the river.

The invention consists in novel means of constructing these walls or obstructions so that they may be movable and adjustable, to meet the gradual extension of the river into the sea; and it also consists in a novel manner of securing piles by injecting liquid cement into the sand or mud around them, in order to preserve them from being washed away by the sea, the said piles being for the purpose of confining the channel of the river, so as to deepen it as well as to secure it against the cross-wash of the sea.

As the bars of alluvial rivers are continually being formed farther out into the sea, the utility of a permanent wall would be but temporary; so I have arranged an adjustable wall that may be changed from place to place with facility, as occasion may require.

To this end I employ a rigid open-bottom caisson, which is lowered onto the bottom, and the water being pumped out of it, the superincumbent pressure forces it to sink into the sand to a proper depth, so that it will remain secure against the wash of the sea, much of it remaining above the sand or mud, so that it will act as a barrier against the run or wash of the sea onto the bar, to which action of the sea their formation is due.

In the accompanying drawing, which forms part of this specification, Figure 1 represents a plan view of river, bar, walls, &c.; Fig. 2, a longitudinal sectional view of same; Fig. 3, a vertical sectional view of adjustable caisson, on an enlarged scale. Fig. 4 represents a sectional view of manner of cementing piles in the sand or mud.

Similar letters of reference indicate corresponding parts in all the figures.

A represents the bar of a river running between the banks or shores D. The velocity of the current of the river always tends to cut away this bar; but the action of the sea always tends to maintain it by washing upon it solid matter. To stop this action of the sea, the walls or obstructions B are arranged across the mouth of the river on the outside of its bar, extending several feet above the plane of the sandy bottom, so as to present a barrier, which, being effected, leaves the current of the river to erode the bar without counteraction.

To effect this obstruction, and do it economically, I employ open-bottom movable and adjustable caissons B, which are sunk into the mud or sand by exhausting their contents, and when occasion requires them to be changed to another position, air is forced into them, which raises them bodily out of the sand to the surface of the water, where they may be floated off and reset. These operations on the caissons are effected by tube H and any ordinary pump.

For the purpose of confining, and thereby increasing, the current of the river, the more effectually to erode the bar, I sink a line of piles, E, along its length, at such places as may be necessary, and to protect them against the force of the sea or river current cutting them out, I inject a quantity of liquid cement into the sand or mud around them by means of tube F, Fig. 4, in connection with a pump, which hardens the sand into concrete, G, and firmly holds the piles against any wash.

These piles act the double purpose of protecting the channel, especially against a cross-wash of the sea, and also facilitate the formation of the banks of the river, by inducing deposits of solid matter, whereby the *debouchement* of the river is narrowed, and increased current effected in the mid-section of the river, the better to erode the bar. The open-bottom caissons B may also be used along the length of the river to narrow its channel, and if it is desired to make them permanent, liquid cement may be ejected into the sand in them through valves in their top, in order to form a solid compact mass within them, and thus form a solid and permanent bank for the river. The same may be done with the obstructions

across the bar, if desired to form them permanently.

What is here claimed, and desired to be secured by Letters Patent, is—

1. The process herein described of arranging obstructions across the mouth of a river, on the outside of its bar, in order to prevent the sea washing up sand, &c., on the bar.

2. The process of injecting a cement, in a semi-fluid state, into the sand or mud around piles, for the purpose of more firmly securing them.

HENRY F. KNAPP.

In presence of—
THEODORE WRIGHT,
EDMUND WALDORF.