F. O. RAY.

SEA WALL.

APPLICATION FILED MAY 29, 1907. RENEWED SEPT. 10, 1908.

901,040. Patented Oct. 13, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

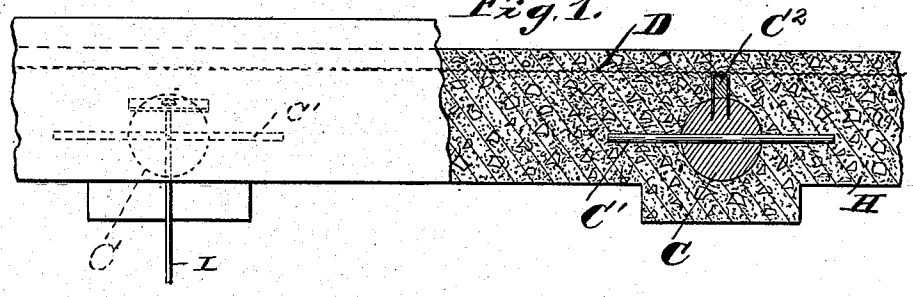
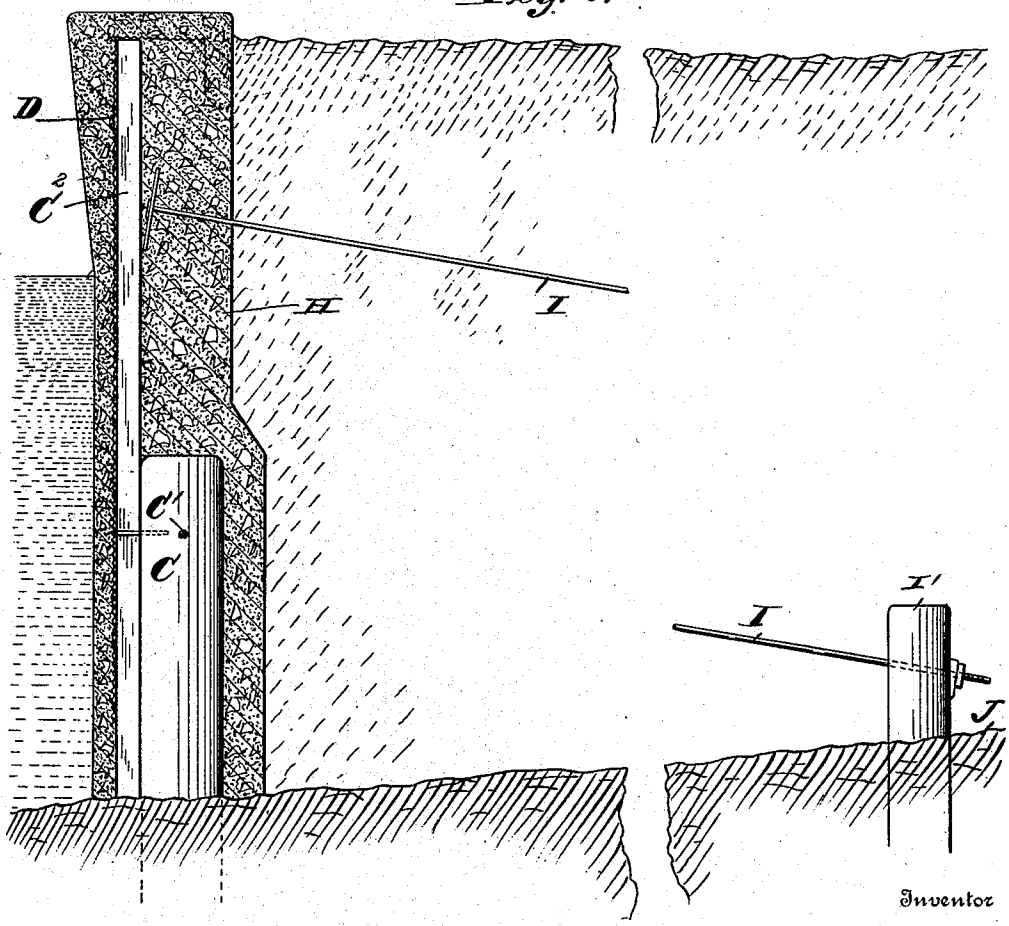


Fig. 2.



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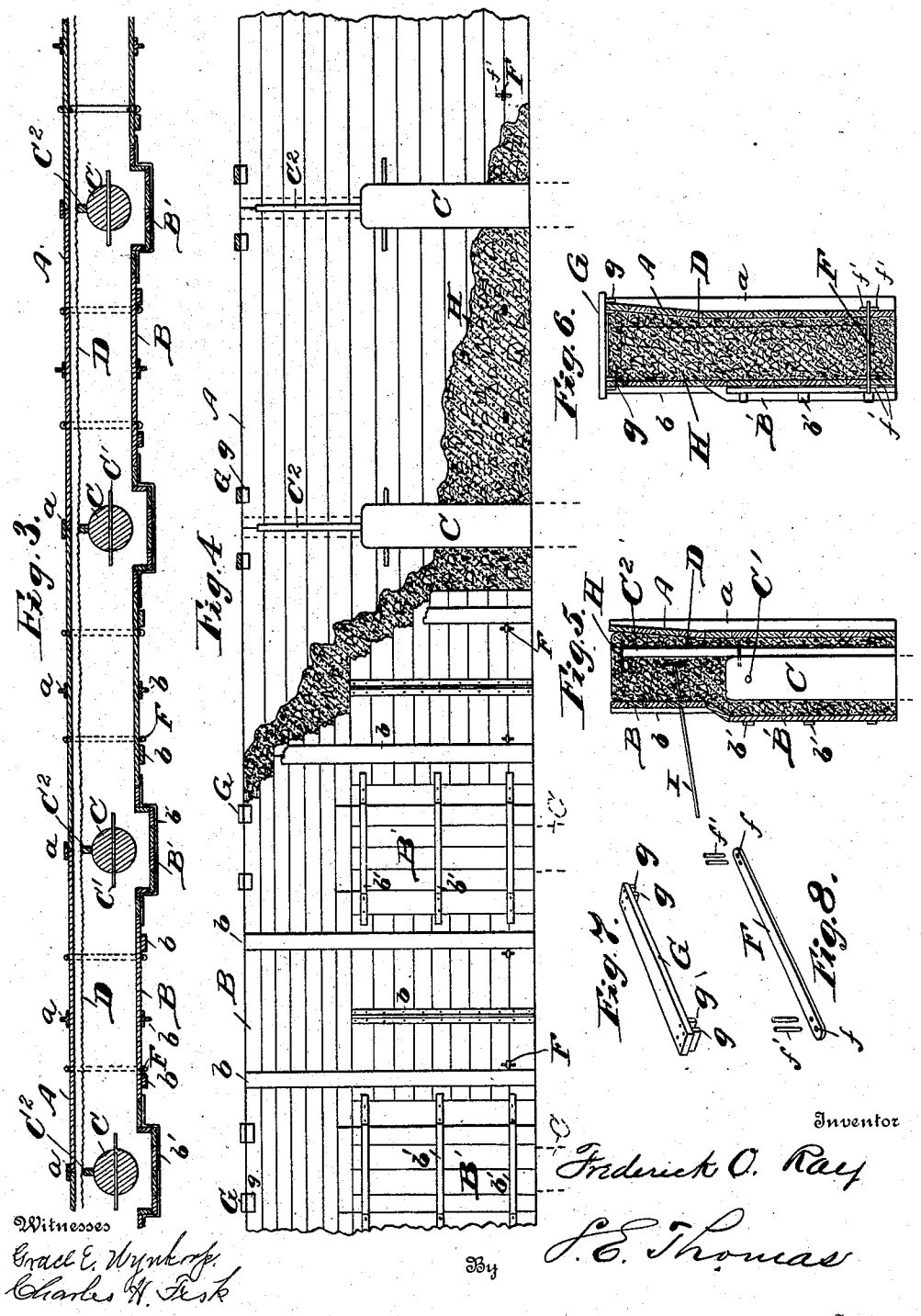
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UNITED STATES PATENT OFFICE.

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SEA-WALL.

No. 901,040. Specification of Letters Patent. Patented Oct. 13, 1908.

Application filed May 29, 1907, Serial No. 376,287. Renewed September 10, 1908. Serial No. 452,451.

To all whom it may concern:

Be it known that I, FREDERICK O. RAY, citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Sea-Walls, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to an improvement in sea walls and the method of constructing same shown in the accompanying drawings and more particularly pointed out in the claims.

In the drawings: Figure 1 is a plan view of a portion of the wall with parts broken away and in section to more clearly show its construction. Fig. 2 is a cross-sectional view through the wall showing it in position,—a portion of the guy cable being broken away to accommodate the view to the size of the sheet. Fig. 3 is a horizontal sectional view through the mold and piles showing the projecting dowel pins embedded in the latter and the manner of spacing and supporting the walls forming the mold to receive the concrete filling. Fig. 4 is an elevation of the mold for forming the sea wall, showing one of the walls of the mold broken away to disclose the concrete filling, the piles and the opposite wall of the mold. Fig. 5 is a cross-sectional view through the mold and wall showing the means for supporting the concrete reinforcement above the piles. Fig. 6 is a cross-sectional view through the mold showing the means employed to secure its walls in fixed relation, the mold being shown filled with concrete. Fig. 7 is a perspective view of the cross member employed to support the walls of the mold at the top. Fig. 8 is a perspective view of the cross member for supporting the walls of the mold at the bottom and which is left embedded in the concrete.

The object of this invention is the construction of a sea wall to protect the bank against erosion by means which are simple, effective and inexpensive.

Heretofore it has been customary to protect the bank by sheet piling, cobble stone or like material and also by the erection of a stone or concrete wall. When this latter method has been attempted it is customary to build a coffer-dam in the water inclosing the proposed site of the sea wall or pier while excavating for the foundation and building of the wall and to protect the workmen while employed on the undertaking. This is expensive and while the resulting wall is entirely satisfactory when properly built, the cost makes it impracticable in many cases.

I have referred to this invention as an improvement in sea walls and the method of constructing same but as will be readily understood it is equally well adapted for the construction of piers, breakwaters and other similar hydraulic engineering work.

Referring now to the letters of reference shown on the drawings, A is the outer wall forming the mold, constructed of wood, and formed in sections of suitable length, the height being that of the proposed sea-wall from the datum-line or water bed to that of the predetermined height of the wall above water level. B is the inner wall of the mold also formed in sections similar in construction to the part A but preferably provided with offset portions B′ to accommodate the piles C, the ends of which project above the river bed but preferably not above the water level.

a and *b* are battens, secured to the sections A and B respectively, those on one end of each section overlapping the next thereby alining the sections and forming a continuous wall.

b′ are metal straps secured to the offset portions B′ and to the section B to secure the offset portions to the main wall.

C′ are projecting dowel pins driven through the piles C and when surrounded and embedded in the cement wall serve to bind the latter with the piles.

C² are uprights or scantlings secured to the piles, serving to support the concrete reinforcement D attached thereto.

F are bars having two sets of holes *f* near their ends to receive the dowel pins *f′*, the ends of the bars projecting through openings provided in the walls A and B of the mold. The pins *f′* being inserted in the bar F on either side of each of the walls A and B hold the walls in fixed relation at their base.

G are bars provided with cleats *g* at each end to receive between them the upper ends of the walls A and B, thereby serving in con-

junction with the bars F to hold the side walls of the mold parallel with each other and in fixed relation.

H is the concrete filling, and I are guy rods suitably anchored in the concrete and to guy posts I' driven in the bank J.

Having indicated the several parts by reference letters, I will now describe the manner of constructing the wall.

The piles C are first driven into the river or lake bed at predetermined intervals, the top being left to project above the bed of the stream but preferably not above the water level thereof. To the piles are then engaged the scantlings C^2 to which are attached the concrete reinforcement D. The walls A and B forming the sections of the mold are then linked together by the bars F and G, and being in a vertical plane, or on edge, are floated in position above the piles, the mold is then weighted sufficiently so to cause it to sink until its lower edge rests upon the river bed. The tops of the piles now project up within the walls of the mold, which may then be staked or otherwise secured to prevent any lateral movement of the mold but this is not usually required. Concrete or cement filling is now introduced between the walls of the mold and, when properly set, the sections forming the mold are removed and floated to a point near the end of the finished concrete wall when it is again anchored and the filling introduced as before until the entire sea wall or pier is completed.

In carrying on the work I prefer that the concrete filling should be introduced into the mold so as to taper off near the end of the mold in the manner indicated in Fig. 4 with the tops of the piles projecting above the filling in order that when the mold is moved along and fresh concrete introduced that the bond may be perfect between the old wall and the new.

In constructing the mold I prefer to line its inside above the water level with sheet metal in order that the resulting wall may present a smoother and more finished appearance than would be possible to obtain with wood.

In removing the mold from the wall the dowel pins *f* driven in the bar F on the outside of the walls of the mold are first removed, the walls are then pried off the ends of the bars F which are left embedded in the concrete wall.

It will be apparent that before the mold is floated into position over the next set of piles that another set of bars F with the proper dowel pins must be employed to properly space and secure the walls of the mold.

Having thus described my invention, what I claim is:—

1. A sea wall formed of concrete or cement, piles partially driven in a water bed, their projecting ends wholly inclosed within the concrete wall to present a continuous unbroken surface, substantially as described.

2. A sea wall formed of concrete, piles partially driven in a water bed, a reinforcing fabric secured to their projecting ends, the projecting ends of said piles and the fabric being wholly inclosed within the concrete wall so as to present a continuous undivided surface, substantially as described.

3. In a sea wall formed of concrete, piles driven in a water bed their ends projecting above the bottom but below the water level, upstanding timbers secured to the piles, a concrete reinforcing fabric secured to said timbers, the construction being such that the concrete incloses the fabric, their supporting timbers and the projecting ends of the piles, forming a continuous wall, substantially as described.

4. A continuous sea wall formed of concrete, piles driven in a water bed, their projecting ends embedded in the concrete wall, and projecting dowel pins driven in the piles and embedded in the concrete wall, substantially as described.

5. A sea wall formed of concrete, piles driven in a water bed, their projecting ends inclosed within the concrete wall, said wall formed with an abutment adjacent to each pile to inclose the latter, forming a continuous wall, substantially as described.

6. The herein described method of forming a sea wall consisting of first driving piles in the water bed at predetermined intervals, their upper ends projecting above the water bed, then partially inclosing the top of said piles by temporary removable walls spaced to admit concrete around, above and between said piles, then introducing cement or concrete between said temporary walls and afterwards removing said temporary walls when the concrete is set, substantially as described.

In testimony whereof, I sign this specification in the presence of two witnesses.

FREDERICK O. RAY

Witnesses:
SAMUEL E. THOMAS,
GRACE E. WYNKOOP.