

H. BAETZ.
METHOD OF FORMING SEA WALLS, &c.
APPLICATION FILED AUG. 19, 1911.

1,048,791.

Patented Dec. 31, 1912.

2 SHEETS—SHEET 1.

FIG 5

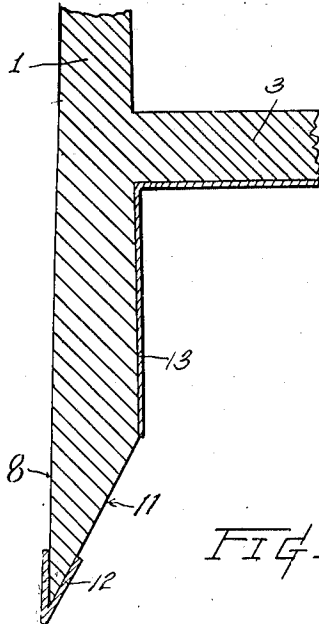
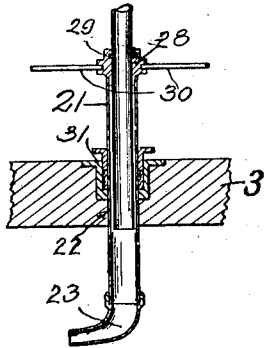
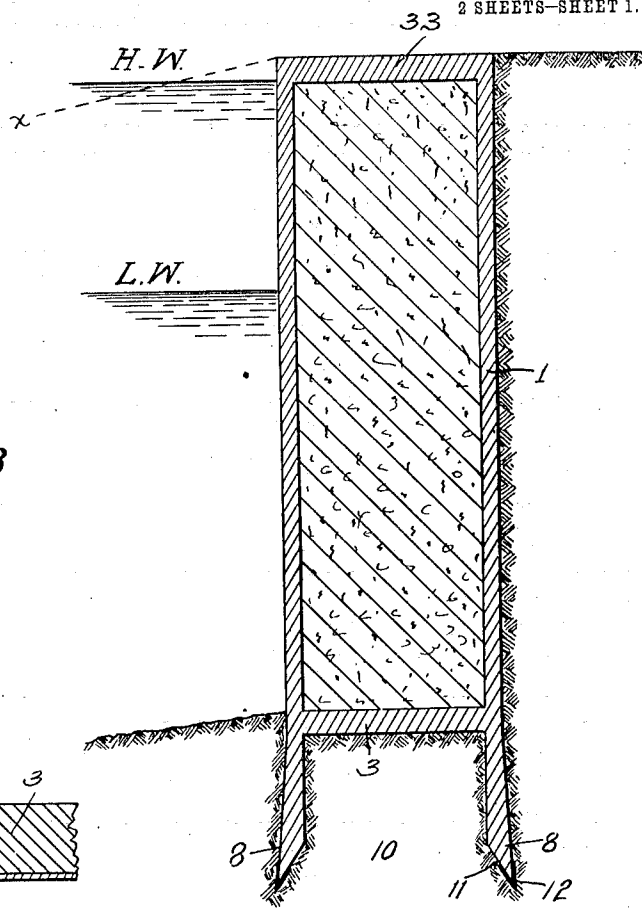


FIG-6

WITNESSES:

F. G. Matheny
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FIG-1



INVENTOR :

Henry Baetz

BY

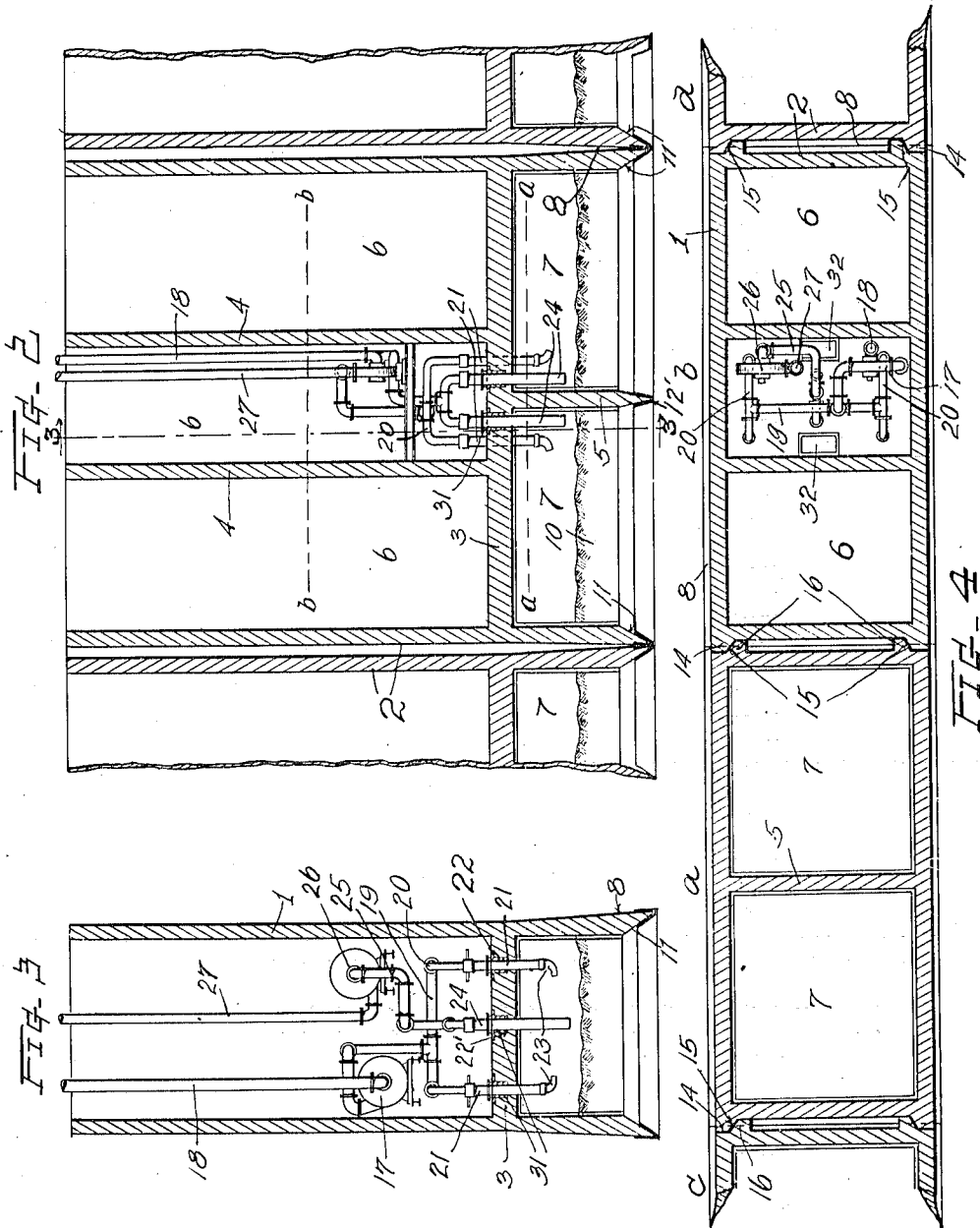
Pierre Barnes
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2 SHEETS-SHEET 2.



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HENRY BAETZ, OF SEATTLE, WASHINGTON.

METHOD OF FORMING SEA-WALLS, &c.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HENRY BAETZ, a citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Methods of Forming Sea-Walls, &c., of which the following is a specification.

This invention relates to improvements in the construction of sea walls and to novel methods of establishing the same in selected operative positions.

The object of the invention is the provision of a wall suitable for harbor embankments, docks, jetties and the like, that may be instituted with solid foundations well below the water level without recourse to the expensive and inconvenient expedients of coffer-dams and caissons.

The invention consists in the novel construction of a wall-unit and method of sinking the same and in combination with like units in longitudinal relation.

In the accompanying drawings, wherein like reference numerals denote similar parts in the several views, Figure 1 is a cross sectional view of an embankment-wall showing somewhat diagrammatically an embodiment of my invention in a completed state. Fig. 2 is a fragmentary view in vertical longitudinal section of the same in process of emplacement. Fig. 3 is a cross sectional view on line 3—3 of Fig. 2. Fig. 4 is a view in horizontal section, the unit *a* being on line *a—*a** and the unit *b* on line *b—*b** of Fig. 2. Fig. 5 is a detail fragmentary view partly in section of the water delivery devices shown in the preceding views, and Fig. 6 is a sectional view showing a detail of construction of the sub-chamber.

To carry out my invention, I employ a structure comprising individual wall-units of substantially similar construction formed of concrete suitably reinforced by steel rods or the like to afford a well-knit construction proportioned and adapted to the particular situation in which employed. Modifications in structural detail may obviously be made within the scope of the appended claims without departing from the spirit of the invention or sacrificing its advantages.

In the embodiment of the invention illustrated herewith the reference numeral 1 designates the longitudinal vertical side walls and 2 the transverse end walls of the respec-

tive units *a*, *b*, *c*, *d*, etc. The quadrangular space inclosed within said walls is divided by a horizontal partition 3 into upper and lower compartments which are in turn subdivided respectively by vertical transversely arranged party-walls 4 and 5 into suitably disposed cells 6 and 7. Said lower compartment is desirably provided with one medial party-wall 5 forming two symmetrically proportioned cells 7 herein specifically designated as "sub-chambers." The lower extremities of said walls 1 and 2 forming the exterior walls of the sub-chambers are extended outwardly, as at 8, at an angle from their vertical planes affording a batter to provide a somewhat broader base for the structure and to provide an extended advance peripheral edge to penetrate the bed 10 and relieve the wall surface thereabove of excessive amounts of friction in the progressive sinking of the structure. Such lower edges are inwardly beveled at 11 and may desirably be each provided with a V-shaped metal shoe 12 for protection against fracture or other damage. The lower edge of the party-wall 5 may likewise be beveled from both sides and protected with a V-shaped shoe 12'. The interior surface of the side and top walls of each said sub-chamber should be protected against severe abrasive hydraulic force by the provision of a sheathing 13 of sheet metal, or the like.

The upper compartment is, as before explained, subdivided by party-walls 4 into a plurality of cells 6. In the present instance two such party walls are employed dividing the space above the partition 3 transversely into three parts. The middle cell herein denominated the "pumping chamber" is positioned to overlie a portion of both the sub-chambers, and the adjacent cells, termed "filling chambers" occupy the remainder of the space above said partition. At opposite ends each said unit is provided with inter-fitting devices by means of which the several units are sunk and maintained in proper alinement. The side walls 1 of each unit are protruded at one end to provide vertical guides 14 with sloping faces 15 inclined toward the recess therebetween; the opposite end of each unit is provided with vertical tongues 16 spaced inwardly from the side walls and formed with inclined faces opposing said faces 15 of an adjacent unit.

Power operated pumping apparatus is

provided for carrying out the invention and may be located upon adjacent land or in whole or in part within the several units. For the purposes of this application, said devices are shown installed within the afore-

said pumping chamber and it will be understood that the installation shown somewhat diagrammatically may be varied to properly meet the exigencies of each case.

The reference numeral 17 denotes a pump of the centrifugal type operated by electrical motor or other means not shown in the views. Said pump obtains a supply of water through the pipe 18 from a source exteriorly of the chamber and the same is forced outwardly from the pump to pipe-branches 19 conveying water to sub-branches 20 telescopically connected with downwardly directed heads 21 which protrude through apertures 22 in the partitions 3 into the respective sub-chambers therebelow. Four of said heads are shown of which two enter each of said sub-chambers.

As outlined water is pumped into the respective sub-chambers through the nozzles 23 and the same may be induced outwardly therefrom through the extensible suction pipe 24 extending through an aperture in each said chamber into the pipe 25 whence it is conducted axially of the centrifugal sand and gravel pump 26 and forced thereby upwardly through the conduit 27 to a suitable receptacle (not shown) exteriorly of the unit-structures. Each said sub-branch 20 through which the water is conveyed to the sub-chambers is extended downwardly as into the respective aperture 22 in the partition 3 (see Fig. 5). The head 21 slidable in said aperture extends exteriorly of said sub-branch and is provided with a collar 28 and contained gasket 29 at its upper end affording water-tight connection therebetween. 30 are handles upon said collar through which the head may be raised or lowered upon the sub-branch and rotated to deflect the nozzle in any direction desired.

31 denotes a stuffing box and gland within the apertures 22 to prevent leakage of water thereat. Suitable valves (not shown) may be included in each of several nozzle and suction pipe connections so that control of flow in each member is obtainable by the operator.

In carrying out my invention, I construct a wall-unit as described at any suitable location and convey it in its integrity to the selected position where it is to be installed. Providing the bed wherein the unit is to be sunk is submerged the exterior walls 1 and 2 are formed of sufficient height to extend above the water-level. The method and structure herein described are intended for sinking in a bed of relatively penetrable sedimentary material such as silt, or sand, commonly forming the beds of streams and

waterways and free in most part from rock or other refractory obstructions.

When the structure is erected in its initial position the weight thereof will cause the edges to sink somewhat into the relatively soft bed about as shown in Figs. 2 and 3, the mud being forced upwardly into the sub-chambers and seal the latter from access to the atmosphere. Water is then pumped in through the nozzles 23 to fill the sub-chambers and suction is applied thereto through the pipes 24 which withdraws water and the contained air therefrom until the latter is exhausted and displaced by water and thereafter the pumps force out water and suspended solid matter from the chamber as the latter is stirred up by the water jets emitted from the aforesaid nozzles. The force of the jets and violent agitation of the contained water have a rapid erosive effect upon the subjacent earthy material and as the same is dislodged and conveyed out of the sub-chamber the unit structure progressively settles downwardly by its gravity into the bore thus formed until a predetermined depth for the foundations is approximated. The water and mud material is pumped into a suitable receptacle (not shown) exteriorly of the structure where the water may be drained off and the solids may be deposited in the cells 6 styled "filling chambers." As the material is displaced it is filled into the compartments therefor and gives added weight to the structure as it sinks into the surrounding bed.

It will be obvious that in the manipulation of the pumping apparatus and other appliances provided that the nozzles may be revolved and raised or lowered to direct the force of water in any direction desired. In this manner the structure may be sunk in a perfectly erect condition by varying the direction of the jets to increase or retard the cutting action at any point and thus rendering the operator capable of guiding the sinking operations to a practicable degree of accuracy.

In practice where the wall to be built has considerable height, it may not be advisable to construct the vertical walls originally before installation to their final extent but to add to the same from time to time during the downward progress of the work. To this end the vertical steel reinforcing rods may be left protruding upwardly above the original lower section and superposed forms may be built about the walls and concrete filled therein in the usual manner.

During the progress of the sinking operations if obstructions to the work should be met rendering it necessary to investigate conditions within the sub-chambers or remove material too large to pass through the pipes 24 the flow of water into the latter may be stopped as by closing valves in-

cluded in the nozzle connections and after withdrawing the major part of the contained water by means of the pump 26 the latter may be discontinued and connections made with an air compressor (not shown) to increase atmospheric pressure therein to prevent the undue influx of seepage after the well-known practice of caisson-work. Similarly, access is had by the operator to each sub-chamber through the partition 3 by means of a man-hole 32 suitably provided with an air-tight cover. According to like practice the pumping chamber may be provided with air-locks to regulate air-pressure and permitting safe access within the sub-chambers.

Upon the wall-unit being sunk in its selected position it may be completed as follows: The pumping and other apparatus may be removed from the pumping chamber and the unoccupied space within the sub-chambers filled with earthy material to cause the partition 3 to bear upon its bottom thereon. The filling chambers and the pumping chambers may likewise be filled and a concrete slab or floor 33 may be formed across the top.

All of the foregoing description of the operation relates to a single unit of a wall. It will be understood that it is intended to be employed with other equivalent units in continuous endwise relation as required in embankments and the like. The units are installed in operative position one after another. The adjacent ends provided with interfitting and guiding devices, as described, secure the same in alinement and in continuous contact with each other. It will be noted that the protruding lower edges of the opposing end walls 2 are arranged to meet to prevent the intrusion of silt between the several units.

Referring to Fig. 1, wherein a completed wall is shown in section, it will be noted that the land side has been filled in with earth and the water side dredged to a suitable depth below low tide of water indicated by L. W. while H. W. represents maximum high tide and its relation to the wall. The dotted line *x* in the view denotes the original slope of the shore before the structure was instituted and the water side dredged. The construction is practicable and safe under all conditions during the operation of sinking and also under the final static and possible moving loads.

The operation of sinking is rapid and may be conducted with relatively small consumption of power or labor.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is—

1. A method of building sea-walls consisting in forming a hollow wall section with a transverse horizontal partition there-

in to afford a sub-chamber opening downwardly and a filling chamber opening upwardly, pumping water into said sub-chamber and withdrawing same with accompanying earth, depositing said earth in said filling chamber as the structure is progressively sunk, and finally causing the sub-chamber to be completely filled with earth.

2. A method of building sea-walls, consisting in forming a plurality of longitudinal hollow wall-sections of homogeneous construction, sinking them in alined adjacent order by withdrawing the earth from beneath their foundations, and filling the sections with said earth.

3. A sea-wall comprised of a plurality of sections severally consisting of longitudinal side walls, transverse end walls provided with exterior guide devices for engagement with adjacent sections, a horizontally arranged partition connecting said walls and affording a water-chamber therebeneath opening downwardly, and a filling chamber thereabove.

4. A sea-wall comprised of a plurality of wall units severally consisting of a homogeneous structure provided with longitudinal side walls and transverse end walls provided with exterior guide devices for alined engagement with adjacent sections, a horizontally arranged partition connecting said walls and affording a chamber therebeneath openable downwardly with access to the foundation bed.

5. A sea-wall comprised of a plurality of wall units severally consisting of a homogeneous structure provided with longitudinal side walls and transverse end walls provided with exterior guide devices for alined engagement with adjacent sections, a horizontally arranged partition connecting said walls and affording a chamber therebeneath opening downwardly with access to the foundation bed, means to introduce water under pressure within said chamber, and means to withdraw water and accompanying earthy material from said chamber.

6. The method of establishing sea-walls or the like, consisting of providing a hollow structure divided by a horizontal partition into upper and lower compartments, said lower compartment opening downwardly toward the foundation bed, injecting water under pressure within said lower compartment, and withdrawing said water and accompanying earth removed from the foundation bed within the lower compartment to undermine the walls of the structure to cause the latter to sink within said bed, and filling said upper compartments with said earth.

7. In a sea-wall or embankment, a section of homogeneous construction consisting of vertical walls, a transverse horizontal partition connecting said walls, and one or

more vertically arranged party-walls above said horizontal partition dividing the superstructure into a plurality of chambers.

5 8. The method of establishing sea-walls and the like, which consists in sinking into an excavation as it is deepened a structure having a water-chamber at its lower end, said excavation being made by pumping water to fill said chamber and simultaneously withdrawing water from said chamber with accompanying earth.

10 9. The method of establishing sea-walls and the like, which consists in sinking into

an excavation as it is deepened a structure having a water chamber at its lower end 15 and a filling chamber thereabove, said excavation being made by pumping water to fill said water-chamber and simultaneously withdrawing water from said chamber with accompanying earth, and depositing said 20 earth in said filling chamber.

HENRY BAETZ.

Witnesses:

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