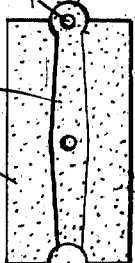
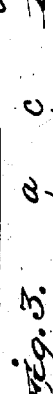
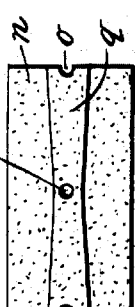
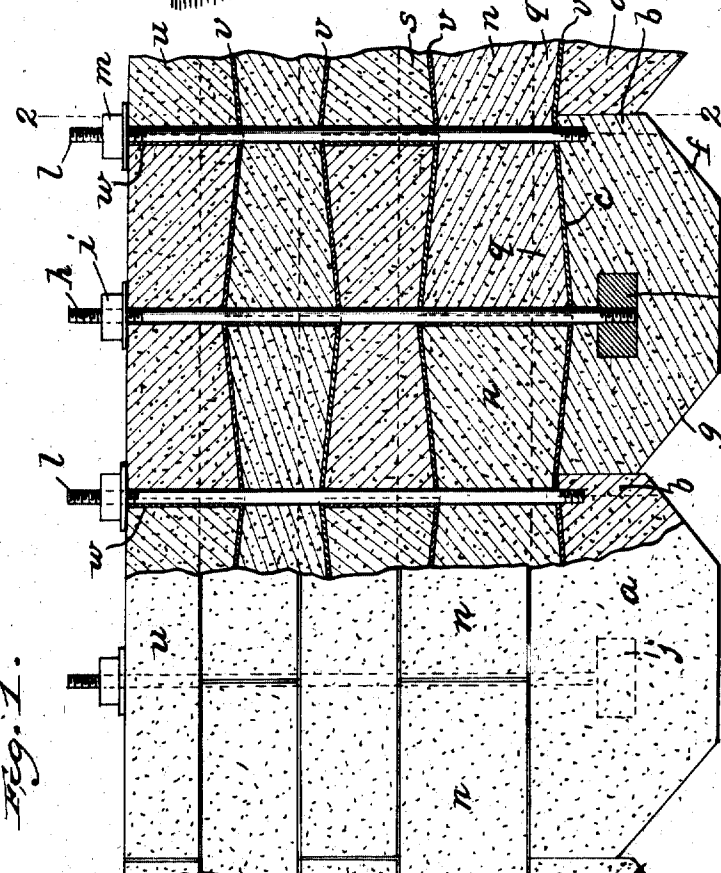
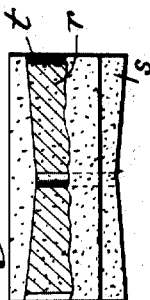
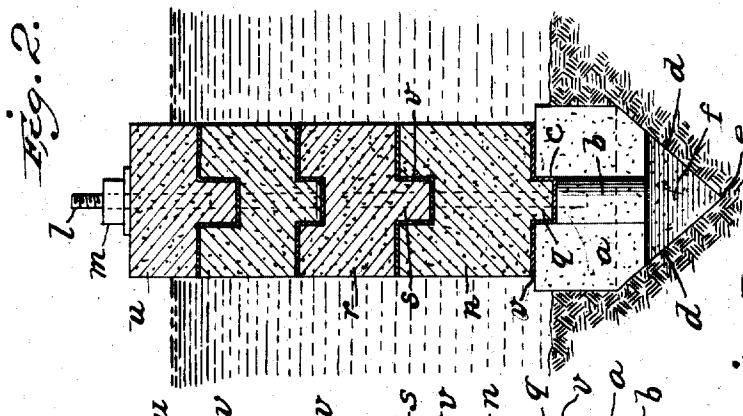


1,002,161.

Fig. 2.



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[Signature]

1,002,161.

Patented Aug. 29, 1911.

2-SHEETS-SHEET 2.

Fig. 6.

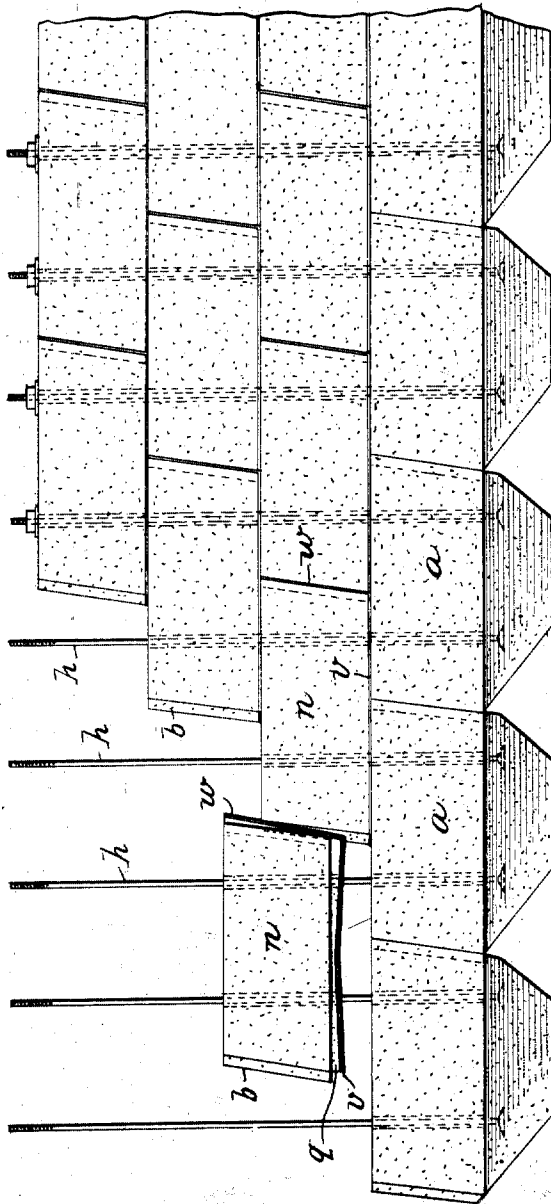
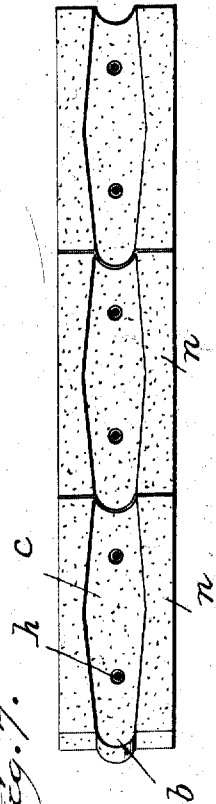


Fig. 7.



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GEORGE W. LAMBERT, OF RICHMOND, VIRGINIA.

SEA-WALL CONSTRUCTION.

1,002,161.

Specification of Letters Patent. Patented Aug. 29, 1911.

Application filed October 7, 1910. Serial No. 585,860.

To all whom it may concern:

Be it known that I, GEORGE W. LAMBERT, a citizen of the United States, and a resident of Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Sea-Wall Constructions, of which the following is a full and clear specification, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation partly in section of a portion of a wall constructed in accordance with one form of my invention; Fig. 2 a vertical sectional view thereof on the line 2—2 of Fig. 1; and Figs. 3, 4 and 5 detail views of one of the interlocking body blocks of the wall; and Figs. 6 and 7 views of a slightly modified form.

The object of this invention is to provide a wall structure which may be used for sea-walls, wharves, dry-docks, coffer-dams and other marine purposes where either a temporary or a permanent wall of a substantial nature and practically water proof construction is advantageous, as more fully hereinafter set forth.

For the bottom course of my improved wall structure I employ a series of blocks *a*, molded into shape from suitable concrete or other plastic material and preferably reinforced in a suitable manner. The blocks abut end to end and are interlocked by forming a vertical rib *b* at one end and a correspondingly shaped groove at its opposite end. The top face of each block is provided with a groove *c* extending its full length centrally of the block, this groove having its bottom inclining from both ends of the block toward the middle and having its side walls square or vertical. The longitudinal lower corners of each block are beveled off to form inclined sides *d* which converge to a central lower edge *e*, and the two lower end corners are also beveled off to form inclined faces *f* and *g*, the latter having a greater area than the former.

Each of the foundation blocks *a* has rigidly attached to it a central upstanding rod *h* which extends to a point above the top of the wall and is threaded and provided with a suitable clamp nut *i*. The manner of attaching this rod to the foundation block is preferably by threading its end into an anchor block *j* which is em-

bedded in the block in the course of molding, so that the rod shall have a substantial and rigid connection to the block. In the upper end of each of the ribs *b* is formed a hole *k* in which is inserted the lower end of a guide rod *l*, which also extends to a point above the top of the wall and is preferably provided with a clamp nut *m*. The lower end of this guide rod *l* is preferably fastened rigidly to the block by screw threads or otherwise, but this guide rod *l* is not designed to be attached to the rod during the molding of the block, it being preferable to attach this rod during the operation of building the wall, as more fully hereinafter set forth.

The layer or row of blocks *n* which is laid upon the foundation blocks are laid so as to break joints with the foundation layer the ends of these blocks being vertically grooved at *o* to partly surround the rods *h* and being provided with a central hole *p* for the passage of the guide rod *l*, these blocks being each threaded on one of the guide rods. As stated each of these blocks *n* breaks one of the end joints between one of the foundation blocks and its vertical end wall terminates mid-way the length of one of the foundation blocks. Centrally on the bottom of each of the blocks *n* is formed a depending rib *q* extending the full length of the block and shaped so as to fit the adjoining ends of the grooves *c* in the foundation blocks, that is, this rib is widened from its middle toward its ends and is deepened from each end toward its middle.

The courses or layers *r* above the second course *n* are laid in the same manner as the course *n*, namely to break joints with the course next below. The course immediately above the course *n* is threaded on the anchored rods *h* and their ends are grooved to engage the guide rods *l*, and centrally on the bottom of each of these blocks is formed a longitudinal rib *s* which increases in depth and width from its middle toward its ends, this peculiarly formed rib fitting into similarly shaped grooves in the upper faces of the halves of the lower blocks which it overlaps. The ends of these blocks *r* are each vertically grooved at *t* to engage the rods *l*. Each of the courses *r* is constructed alike except that the blocks in each alter-

nate course are threaded on the different sets of rods *h* and *l*, as shown in Fig. 1.

The top course of blocks *u* is constructed similarly to the courses *r* except that the upper faces of the blocks are desirably made flat. Between each course is laid a packing *v* consisting of a suitable sheet material such as fiber board, paste-board, wood, wood or paper pulp, or other fibrous material which shall be capable of forming a sort of cushion between the blocks and also be capable of expansion when soaked in water. I preferably, during the erection of the wall, insert one of these sheets under each block as it is lowered into place and rely upon the weight of the block to shape the packing of the rib and groove formation, the fit of the rib and groove being sufficiently free or loose to thus permit the interposition of this thin sheet of packing. If it be desired to pack around the rods, the sheets may be sufficiently extended at their ends to extend to the upper surface of the block when bent upwardly and pressed against the rods, as shown at *w*. These upwardly extending portions *w* of the packing sheets may be at one or both ends of the rods, as may be desired, but it is not believed that it would be necessary to pack the central holes in the blocks. It is obvious that all the blocks may be reinforced in any well known manner, and also that the rods may be jointed and may be in the form of tubes or piping.

It will be observed that a wall constructed in accordance with my invention will be practically a monolithic structure since each of the blocks is tied rigidly to the structure against movement or dislodgment in all directions, this being especially due to the peculiar form of the interlocking wedge-shaped grooves and ribs and it being especially desirable that the vertical walls or edges of all the ribs and grooves shall be at right angles to the horizontal faces of the blocks. It will be further observed that when the packing sheets are soaked with water they will expand sufficiently to fill in the spaces and crevices between the blocks and will thus make the wall sufficiently water tight for all practical purposes, and when the wall is to be used for some permanent structure it will be obvious that the fibrous expansible packing can be replaced by a suitable plastic or other kind of packing or cement which will endure submerging in sea water. When the expansible packing or filling is used it will be seen that the wall is rendered sufficiently elastic to permit heavy tamping to drive it solidly to a foundation, and this tamping may be done either during the erection of the wall or after the top layer course of blocks is laid in place. When the wall is completed the slight expansion that takes place in the packing material tightens up all the

joints throughout the wall and thus solidifies the wall and tends to close all the joints, as is obvious.

In erecting or building this wall the method pursued will be somewhat varied according to the size of the wall and the nature of the work. In general, the foundation blocks will be put in place first, one after another, and then courses of upper blocks may be lowered into position. The foundation blocks are lowered into position by means of the rods *h* and they will of course be so mounted or supported on the bottom of the sea or other body of water that they shall have a firm solid foundation. The beveled formation will assist in forcing these blocks to a solid foundation, and they may be tamped or driven into position or a suitable trench may be excavated in the bottom for their reception. The beveled side edges of the blocks have the further function of preventing lateral shifting of the blocks, the end bevel *g* being larger in area than the bevel *f* at the other end of the block, and as the block is driven or forced down into the mud or sand, will tend by a sort of cam action to jam each block endwisely hard against the preceding block. In some cases it may be necessary for a diver to assist in positioning the foundation blocks. In the drawing these blocks are shown as only partly embedded in the bottom but it will be understood that where the soft mud is on the bottom in a very thick layer, the blocks may be embedded entirely in it, the level of the mud coming up to a point on the superposed blocks; and in other cases it may be impossible to embed the foundation blocks by reason of a rocky or coral bottom and in such cases the foundation blocks may be anchored in any suitable manner such as by the use of masses of concrete. Of course in those cases where the mud or silt is deeper than the foundation block, it will be necessary to place the blocks of the second course upon the foundation before they are forced into the mud or silt.

After the foundation is thus erected the superposed blocks with their packings may be readily lowered into place, the rods serving to guide the blocks into interlocking relation and the weight of the blocks serving to properly shape the packing sheets. The rods *h* are not only employed as guide rods for thus guiding the blocks into their final position but serve also as a means of suspending and lowering the foundation blocks; while the rods *l* are attached to the foundation blocks after they are properly positioned and anchored and therefore only serve as guides in lowering the blocks to place. It will be understood of course that suitable vessels or barges and derricks and other mechanism will be essential to the proper manipulation of the blocks and the rods. In

some cases it may be desirable to make the foundation blocks buoyant so that they may be floated and be sunk into place by the weight of one or more blocks piled upon them. It will be observed that a wall constructed as described herein may be employed for a great variety of marine purposes. It will be especially desirable for building a coffer-dam or the like around a sunken vessel, since when a wall of the type described is thus built entirely around the vessel it will have sufficient strength and stability to permit the water to be pumped out of the inclosure and thus expose the vessel on all sides so that the vessel may be repaired in the same manner as when it is in a dry-dock and be floated again by admitting the water in the inclosure after it is repaired. In such cases the wall will be but a temporary structure and may be readily dismantled and removed after the vessel is floated.

In the form of wall shown in Figs. 6 and 7, I employ two of the anchoring rods *k* for each of the foundation blocks, locating one at each end of the block; this is advantageous in that it leaves the middle of each foundation block free for handling and thus facilitates the positioning of the blocks. This arrangement of two anchoring rods enables the rods *l* to be done away with as these rods *l* are merely for assisting in guiding the superposed blocks into position. In this form the two anchor rods, it will be observed, assist more effectually in tying the blocks together longitudinally as well as vertically. In this form of the wall I show the ends of the blocks all inclined in the same direction so that the superposed blocks may be lowered into position with less danger of knocking off the corners of the blocks. These inclined ends also serve to better hold the packing in place while being lowered into position, as shown in Fig. 6, in which view one of the blocks is shown in the act of being lowered into position. These inclined ends also cause a sort of jamming or keying of the blocks together, as is obvious.

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

1. A wall structure consisting of a series of superposed courses of blocks, the blocks of one course breaking joints with the blocks of the adjacent courses and each block being longitudinally grooved on its upper surface and provided with a longitudinal rib on its under surface, said ribs and grooves being correspondingly shaped and located so as to interlock, said ribs and grooves having a wedge-shaped or tapered formation, for the purpose set forth.

2. A wall structure consisting of a series of superposed courses of blocks, the blocks of one course breaking joints with the

blocks of the adjacent courses and each block being longitudinally grooved on its upper surface and provided with a longitudinal rib on its under surface, said ribs and grooves being correspondingly shaped and located so as to interlock, said ribs and grooves having a wedge-shaped or tapered formation, and a packing material between the adjacent faces of said blocks.

3. In a wall construction for the purpose set forth, a course of foundation blocks each being beveled along its lower corners inwardly forming a longitudinal entering edge, an upstanding rod carried by each block, a series of courses of blocks laid upon a foundation of blocks and threaded upon said rods, and means for clamping the upper courses of blocks in place.

4. In a wall construction for the purpose set forth, a course of foundation blocks, a pair of rods attached to each block and extending to a point above the water level, a series of courses of blocks threaded on said rods and resting on said foundation blocks, these blocks being provided with means for interlocking them together and each course breaking joints with its adjacent courses and the end walls of the block being all inclined in the same direction, for the purpose set forth.

5. In a wall construction for the purpose set forth, a course of foundation blocks, rods connected to said blocks, and extending to a point above the water level, a series of courses of blocks threaded on said rods and resting on said foundation blocks, the blocks being provided with means for interlocking them together, and each of the foundation blocks beveled to a longitudinal entering edge and having its lower corners beveled off downwardly, one of these beveled surfaces having a greater area than the other.

6. A wall structure consisting of a series of superposed courses of blocks, the blocks of one course breaking joints with the blocks of the adjacent courses and each block being longitudinally grooved on its upper surface and provided with a longitudinal rib on its under surface, said ribs and grooves being correspondingly shaped and located so as to interlock, said ribs and grooves having a wedge-shaped or tapered formation, said grooves tapering from the middle of the block to its ends and said ribs tapering from the ends of the block toward its middle, the sides of the ribs and grooves being vertical.

7. The method herein described of building a marine wall *in situ*, consisting in employing a series of foundation blocks each having an upstanding rod long enough to reach above the water level and each being beveled off downwardly to form an entering edge, lowering said blocks by means of said rods into the body of water and forcing the sharpened bottom edges of the blocks to a

foundation in the bottom of the body of water, and then after said blocks are thus anchored on the bottom positioning the superposed blocks by successively threading the same down said upstanding rods, and finally locking all the blocks in place upon the foundation blocks.

In testimony whereof I hereunto affix my signature in the presence of two witnesses this 6 day of October 1910.

GEORGE W. LAMBERT.

Witnesses:

W. L. ROYALL,
CLIFF. GODSEY.