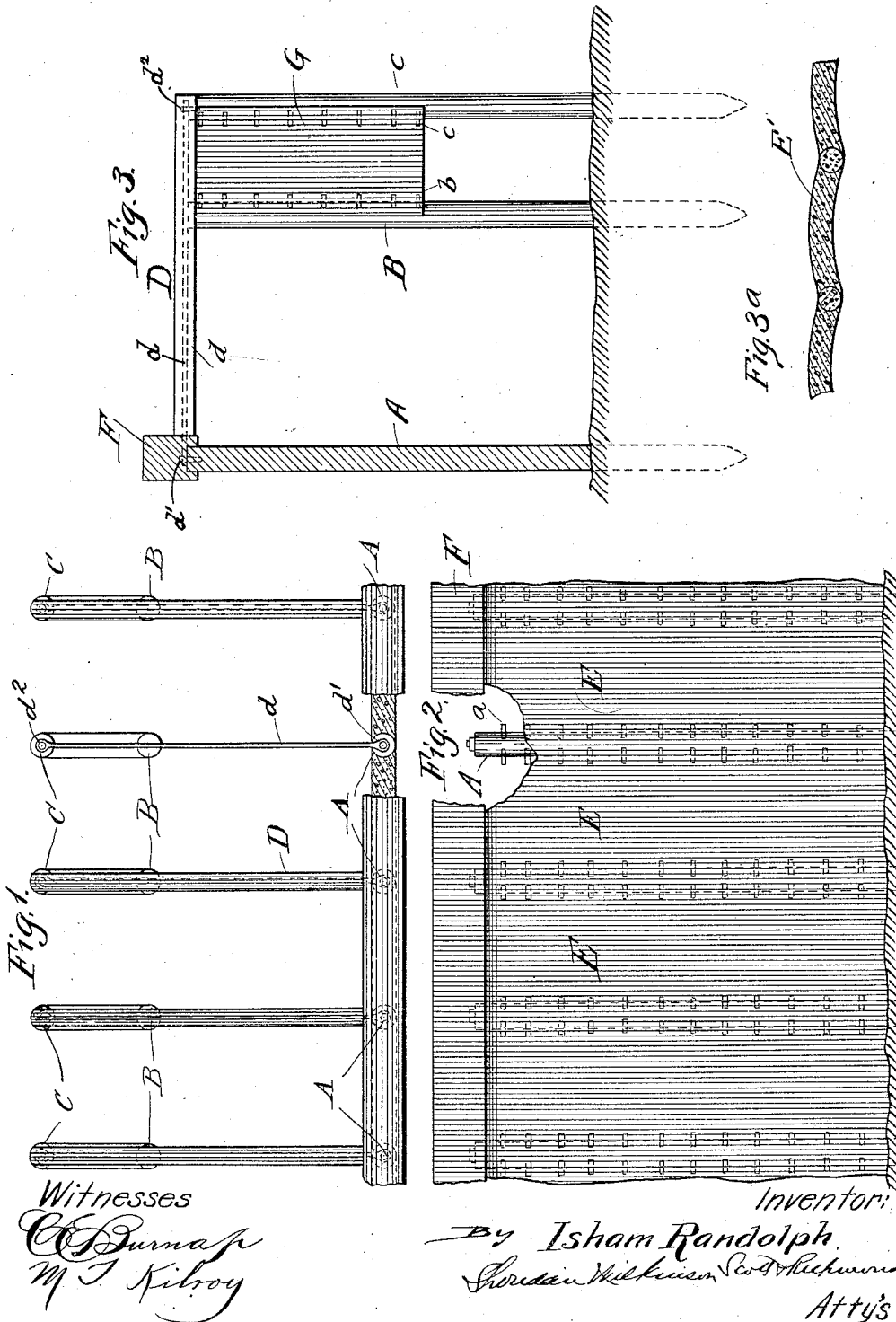


I. RANDOLPH.
METHOD OF CONSTRUCTING WALLS OF CONCRETE.
APPLICATION FILED JAN. 11, 1910.

1,047,987.

Patented Dec. 24, 1912.

3 SHEETS—SHEET 1.

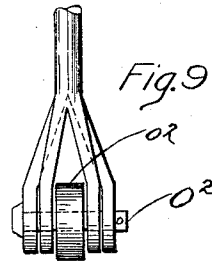
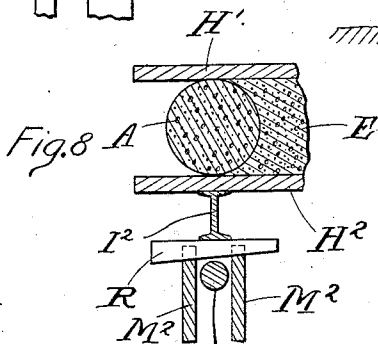
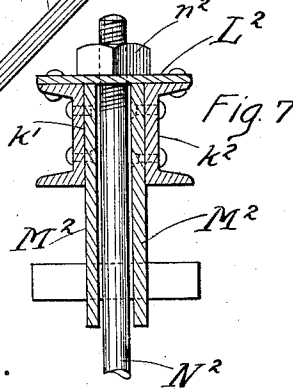
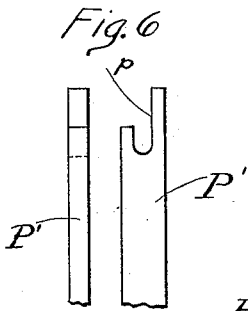
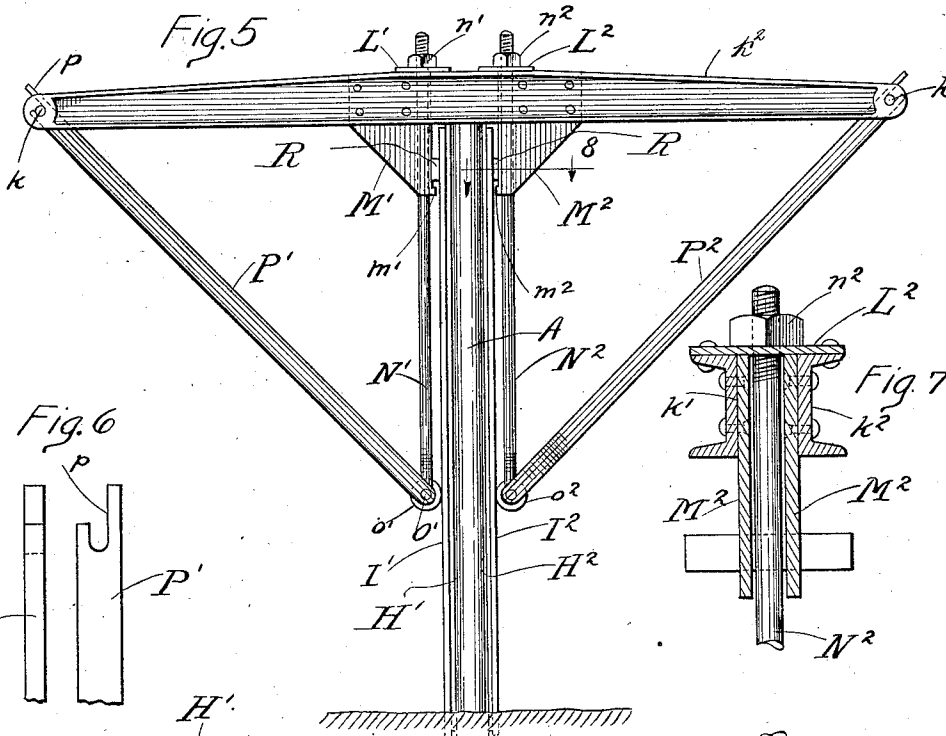
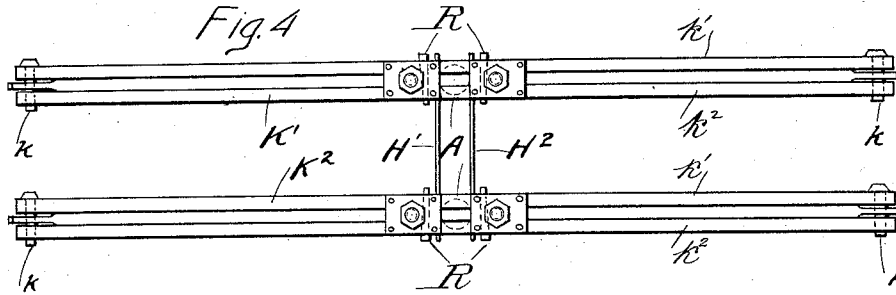


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3 SHEETS—SHEET 2.



Witnesses:
C. D. Burnap
M. J. Kilroy

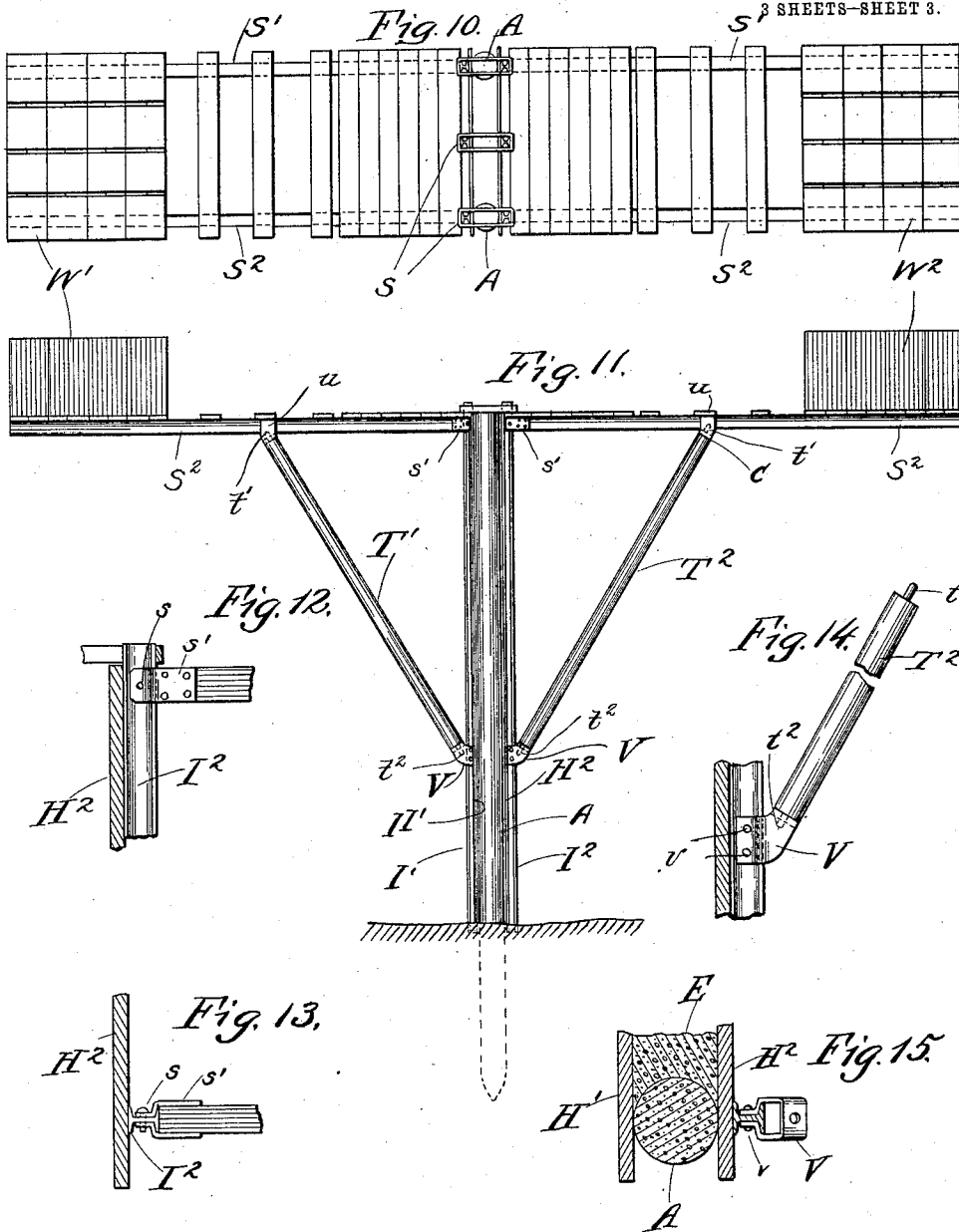
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3 SHEETS-SHEET 3.



Witnesses
C. Durnap
M. J. Gibroy

Inventor:
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UNITED STATES PATENT OFFICE.

ISHAM RANDOLPH, OF RIVERSIDE, ILLINOIS.

METHOD OF CONSTRUCTING WALLS OF CONCRETE.

1,047,987.

Specification of Letters Patent.

Patented Dec. 24, 1912.

Application filed January 11, 1910. Serial No. 537,518.

To all whom it may concern:

Be it known that I, ISHAM RANDOLPH, a citizen of the United States, residing at Riverside, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Methods of Constructing Walls of Concrete, of which the following is a specification.

My invention relates in general to concrete structures, and more particularly to an improved method of building concrete walls, especially dock walls, or other walls which must be built in or under water.

While concrete has in recent years been used quite extensively in building various structures, yet it has heretofore been impracticable to build dock or other walls in or under water of concrete, owing to the difficulties incident to removably supporting the necessary forms for receiving the plastic concrete. The cost of constructing the temporary forms incident to the use of concrete, for constructing dock or other walls in or under water, has heretofore been almost prohibitive when compared with the cost of constructing such walls of other materials.

The primary object of my invention is to provide an improved method of building dock and other structures of concrete, by the practice of which the difficulties and great expense heretofore necessarily involved in building such structures of concrete may be so greatly reduced as to render the use of concrete for such structures not only practicable but economical.

My invention will be more fully described hereinafter with reference to the accompanying drawings, in which I have illustrated a dock structure built by the practice of my improved process, and in which I have illustrated two forms of apparatus, by the use of which my improved process may be practised.

In the drawings—Figure 1 is a plan view of a dock structure, parts being omitted and broken away for the sake of clearness; Fig. 2, an elevational view of the outer surface of the dock wall shown in Fig. 1; Fig. 3, a vertical section of the dock structure shown in Figs. 1 and 2; Fig. 3^a, a plan view of a modification; Fig. 4, a plan view of one form of my improved apparatus for se-

curely supporting the forms in position to receive the plastic concrete; Fig. 5, an elevational view looking upwardly with respect to Fig. 4; Fig. 6, side and edge elevations of the upper end of one of the compression members; Fig. 7, an enlarged sectional detail of the upper end of one of the tension members, showing its engagement with the cross girder; Fig. 8, a sectional view on line 8, Fig. 5; Fig. 9, a detail view, showing the connection of the tension and compression members and roller for applying an inward pressure to the outer surface of the adjacent form; Fig. 10, a plan view of a modified apparatus for use in practising my improved process; Fig. 11, an elevational view looking upwardly with respect to Fig. 10; Figs. 12 and 13, elevational and plan views, showing the connection of one of the weight supporting levers with the adjacent vertical stiffener; and Figs. 14 and 15, elevational and transverse sectional views of the means for supporting the lower end of one of the compression members.

Similar reference characters are used to designate similar parts in the several figures of the drawings.

Reference letters A, A designate piles, posts, or columns of reinforced concrete which are driven, planted or otherwise securely placed in alinement at predetermined distances apart. These piles are located within a plane corresponding to the plane of the dock or other wall which is to be constructed.

Reference letters B, B indicate a series of anchoring piles or posts which are driven or planted in alinement with the piles A. C, C indicate a second row of anchoring piles or posts which are driven or planted adjacent to the several anchoring piles B, B and in planes with them intersecting at right angles the plane of the proposed wall.

The upper ends of the piles A are connected with the upper ends of the anchoring piles C by rods *d* which engage at one end with pins *d'* or other means for connecting the same with the respective piles A, and at their other ends by means of pins *d*₂, or other fastening means, with the corresponding anchoring piles C.

E, E indicate panels of concrete which are

formed in the spaces between the adjacent piles A. In order that these panels may be more securely united at their opposite ends to the adjacent piles A, the latter are provided with laterally projecting pins a , a which are embedded in the plastic concrete when the panels E, E are formed.

If desired, the panels intermediate of the piles A, A may be curved inwardly as illustrated in Fig. 3^a, thereby producing an arch capable of strengthening the panels to more strongly resist the pressure of the material against their inner surfaces. When the panels are curved inwardly, as indicated at E' in Fig. 3^a, they will be of sufficient strength to render unnecessary any reinforcement of the concrete, even though in practice it may be found desirable to reinforce the panels when made with plain surfaces, as shown in Figs. 1 and 2. A cap F of concrete, which also, if desired, may be reinforced, is then formed along the tops of the piles A and intermediate panels E, such cap being also rigidly connected with the reinforced concrete ties D which connect the piles A with the respective anchoring piles.

In order that the anchoring piles may possess the requisite stiffness to resist any tendency of the wall composed of the piles A and intermediate panels E to be forced outwardly, I preferably form panels G of reinforced concrete between the aligned pairs of anchoring piles B and C. The piles B and C are or may be provided with lateral projecting pins b and c which are embedded in the plastic cement interposed between piles in forming the respective panels G.

A dock platform may be supported upon the reinforced anchoring tie beams D, or the space on the inside of the wall composed of the piles A and intermediate panels E may be filled in so as to form a surface of the desired height with respect to the cap F, to permit the convenient use of the dock.

In order that the forms may be held in place on the opposite sides of the spaces between the piles A, A, it is necessary that they should be subjected to inward pressure sufficient to resist the outward pressure of the plastic concrete of which the panels are formed. Heretofore such inward pressure has been applied to the forms by either tying them together or by struts interposed between them and the ground. In constructing dock or other walls in or under water, such means for applying the requisite inward pressure to the forms are impracticable and are rendered unnecessary by my improved process of construction. I provide means supported above the line of spaced piles A for exerting a horizontal pressure upon the forms located on the opposite sides of the spaces between the piles A.

In Figs. 4 to 8, I have shown the preferred

method of exerting the requisite inward pressure upon the forms, and in said figures reference characters H' and H² indicate slabs or forms of sufficient width to overlap adjacent piles A, A and of slightly greater depth than the distance between the tops of the piles and the surface into which they extend. These slabs are preferably made of metal, and in order that they may possess sufficient rigidity, vertical stiffeners I' and I² are provided which may conveniently consist of I-beams. Upon the tops of the adjacent piles A, A, on the opposite sides of the space between which the slabs H' and H² have been placed, are supported cross girders K' and K², respectively. Each of these girders is, preferably, formed of spaced channel beams k' and k^2 , the outer ends of which are connected by bolts k , k , and which are rigidly connected by plates L' and L² overlying and riveted to the top flanges of the channel beams at points adjacent the opposite sides of the centers of the girders. Gusset plates M' and M² are arranged in pairs riveted to the webs of the channel beams k' , k^2 at points underlying the tie plates L' and L². Tension members, such, for instance, as rods N', N² extend through the plates L' and L², and lie between the gusset plates in the respective pairs M' and M². The ends of the tension rods N' and N² which project above the cross girders are provided with means for exerting an upward pull, such, for instance, as nuts n' and n^2 engaging screw threads on the tension rods, and resting upon the tie plates L' and L². The lower end of the tension rod N' is pivotally connected by a pin O' with the lower end of a compression strut P', the upper end of such strut being bifurcated, as shown at p , and provided with a seat which rests against the pin k which connects the ends of the channel beams k' and k^2 of the cross girder. A roller o' is preferably journaled upon the pivot pin O' and rests against the adjacent surface of the vertical stiffening I-beam I'. A similar compression strut P² is pivotally connected to the lower end of the tension rod N² and engages at its outer upper end with the connecting pin k of the channel beams at the adjacent end of the cross girder.

In order that the tops of the slabs H' and H² may be securely retained against the opposite surfaces of the spaced piles A, A, wedges R are driven between the vertical inner surfaces of the gusset plates M' and M² and the outer surfaces of the vertical I-beam stiffeners I' and I². Inwardly projecting lugs m' and m^2 are, preferably, provided at the lower edges of the gusset plates to serve as stops for the wedges.

After the cross girders have been placed in position upon the adjacent piles with the rollers o' and o^2 engaging the outer surfaces

of the respective I-beams I' and I^2 , an upward pull is exerted upon the tension rods, thereby forcing the rollers o' and o^2 tightly against the vertical I-beams in a substantially horizontal direction, owing to the compression struts P' and P^2 being interposed between the lower ends of the tension members and outer ends of the cross girders.

After the cross girders and cooperating parts have been arranged as above described, the plastic concrete is placed within the space intermediate of the adjacent piles and between the slabs H' and H^2 . After the concrete has hardened, the cross girders, vertical I-beams, and slabs are removed and are placed in position upon the two other adjacent piles A, A for use in making a panel between such piles.

The slabs H', H^2 may be made of sufficient rigidity to render unnecessary the use of I-beam stiffeners I' and I^2 , in which case it may be necessary to only use one cross girder, such as K' or K^2 , located intermediate of the adjacent piles A, A , in lieu of having two cross girders located in substantial alinement with the two adjacent piles, as shown in Fig. 4.

In Figs. 10 to 15, inclusive, I have illustrated another apparatus for retaining the forms in position on the opposite sides of the spaces between adjacent piles, while concrete columns are being formed. In these figures, levers S' and S^2 project laterally from the upper ends of the I-beam stiffeners I' and I^2 , and are secured at their inner ends to the I-beams in any suitable manner, as by means of plates s' , which are located on opposite sides of the inner end of each lever, and converge so as to closely engage the opposite sides of the web of the adjacent I-beam, a removable pin s being provided for passing through registering holes in the I-beam web and overlying portions of the brackets. Suitable retaining means, such, for instance, as loops S , are provided for connecting the I-beams in each of the alined pairs, as shown in Fig. 10. Compression struts T' and T^2 are interposed between the levers S' and S^2 and the vertical I-beams, such struts being removably connected to the levers and I-beams by any suitable fastening devices, such as by providing a pin t' at the upper end of each of the struts engaging within an opening in a bracket u secured to the corresponding lever S' or S^2 . The lower end of each of the struts is shown as provided with a pin t^2 which engages within an opening in a bracket V secured to the adjacent I-beam, by means of a rivet or pin v extending through alined holes in the I-beam web and overlying portions of the bracket V .

Weights W' and W^2 are placed upon the outer ends of the platforms formed upon the pairs of levers S' and S^2 . It is obvious that the weights, acting through the compression

struts T' and T^2 , exert a horizontal pressure upon the I-beams and consequently upon the slabs H' and H^2 , such pressure being sufficient to counteract the outward pressure of the plastic concrete between the slabs.

When the concrete has hardened between adjacent piles A and A , the levers, cooperating parts, I-beam stiffeners, and slabs, are removed and placed in position to permit the insertion of plastic concrete between two other piles A, A .

From the foregoing description, it will be observed that I have invented an improved process for constructing docks and other walls of concrete, and that by the practice of the same it is possible to construct walls in or under water of concrete, reinforced if desired, inasmuch as it is possible to exert upon the slabs or forms between which the plastic concrete is placed an inward horizontal pressure applied from above, through instrumentalities which may be readily placed in position and as readily removed after the hardening of the concrete.

I claim:

1. In a concrete wall, the combination with a series of concrete piles located in alinement at predetermined distances apart, of concrete panels intermediate of and united to adjacent piles, a plurality of concrete anchoring piles in planes at right angles but spaced apart from the plane of the wall, and reinforced concrete tie beams connecting the wall with the anchoring piles.

2. In a concrete wall, the combination with a plurality of piles located in alinement at predetermined distances apart, of concrete panels intermediate of and molded on to adjacent piles, a plurality of concrete anchoring piles located in planes at right angles to but spaced apart from the plane of the wall, a concrete panel intermediate of and molded on to adjacent anchoring piles, and reinforced concrete tie beams extending from said wall to the corresponding anchoring piles.

3. The method of constructing walls of concrete, which consists in locating piles at predetermined distances apart, placing forms on the opposite sides of the spaces between adjacent piles, filling the spaces intermediate the adjacent piles and between the forms with plastic concrete, and resisting the outward pressure exerted on the forms by the inclosed mass of the plastic concrete by an inward pressure applied to the exterior of the forms.

4. The method of constructing walls of concrete, which consists in locating piles at predetermined distances apart, placing forms on the opposite sides of the spaces between adjacent piles, filling the spaces intermediate the adjacent piles and between the forms with plastic concrete, and resisting the outward pressure exerted on the forms by the

inclosed mass of the plastic concrete by applying a downward and inward diagonal force to the exterior of the forms.

5 5. The method of constructing walls of concrete, which consists in locating piles at predetermined distances apart, placing disconnected and removable slabs on opposite sides of the spaces between adjacent piles, filling the spaces intermediate the adjacent
10 piles and between said slabs with plastic concrete, and resisting the outward pressure

exerted on the slabs by the inclosed mass of the plastic concrete by resolving forces applied from above the piles into horizontal forces acting inwardly on the exterior of the 15 slabs.

In testimony whereof, I have subscribed my name.

ISHAM RANDOLPH.

Witnesses:

HENRY A. PARKS,

FLORENCE A. FLORELL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
