L. L. BROWN.

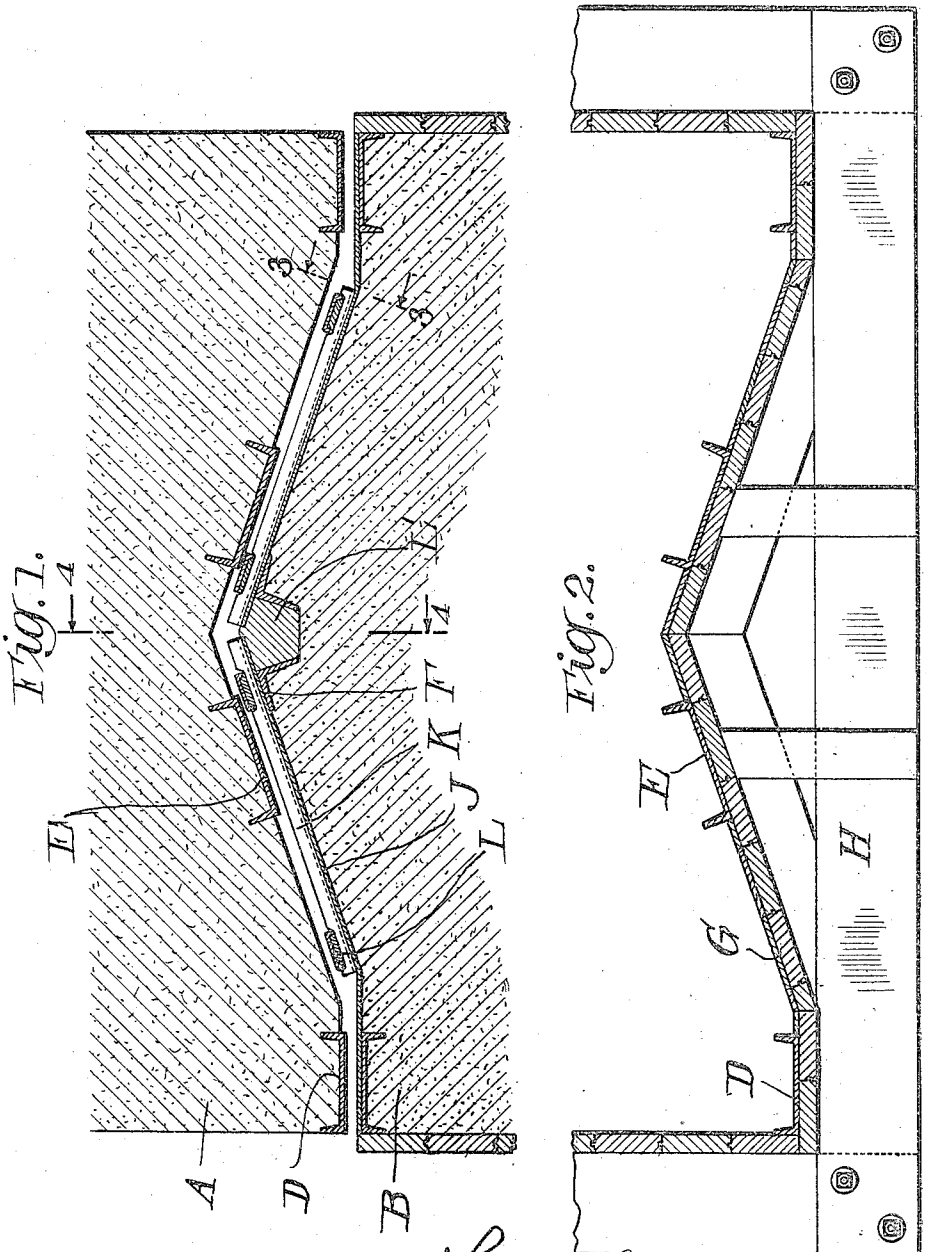
APPARATUS AND METHOD FOR BUILDING A CONTINUOUS WALL OF CAISSONS.

APPLICATION FILED APR. 23, 1915.

1,255,702.

Patented Feb. 5, 1918.

4 SHEETS—SHEET 1.




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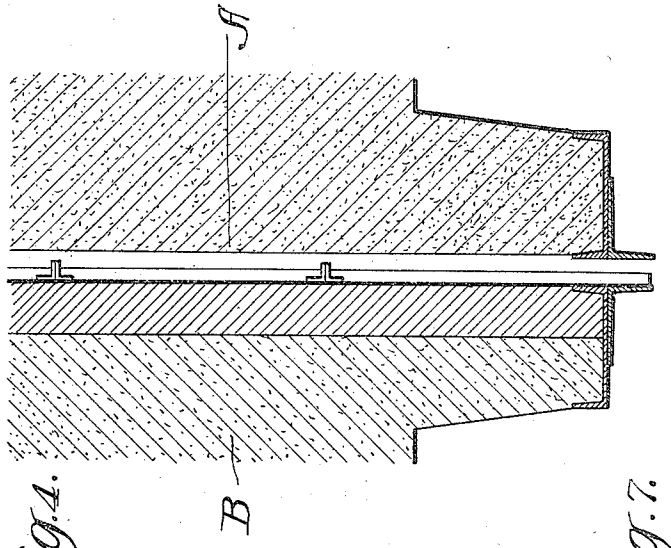



Fig. 4.

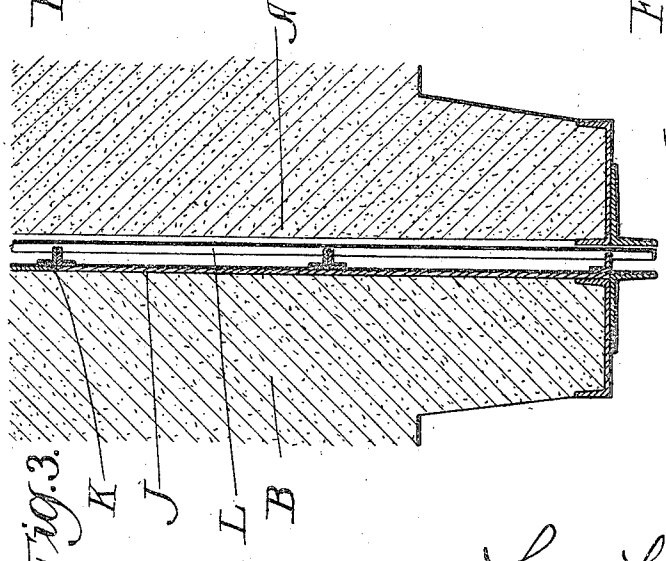



Fig. 3.

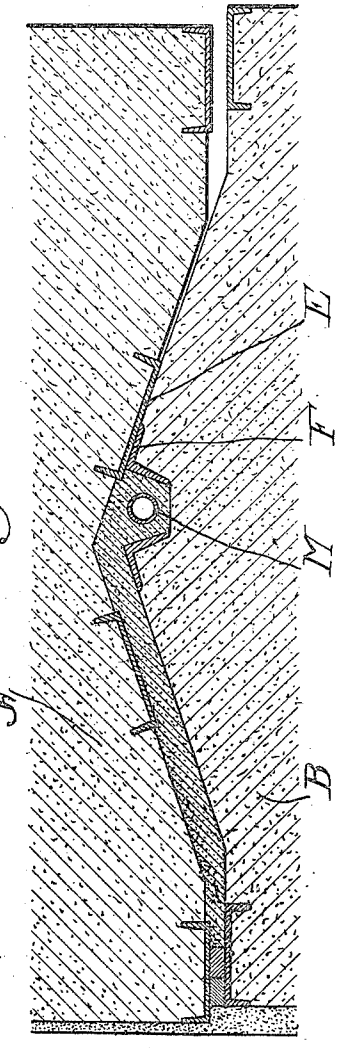



Fig. 7.

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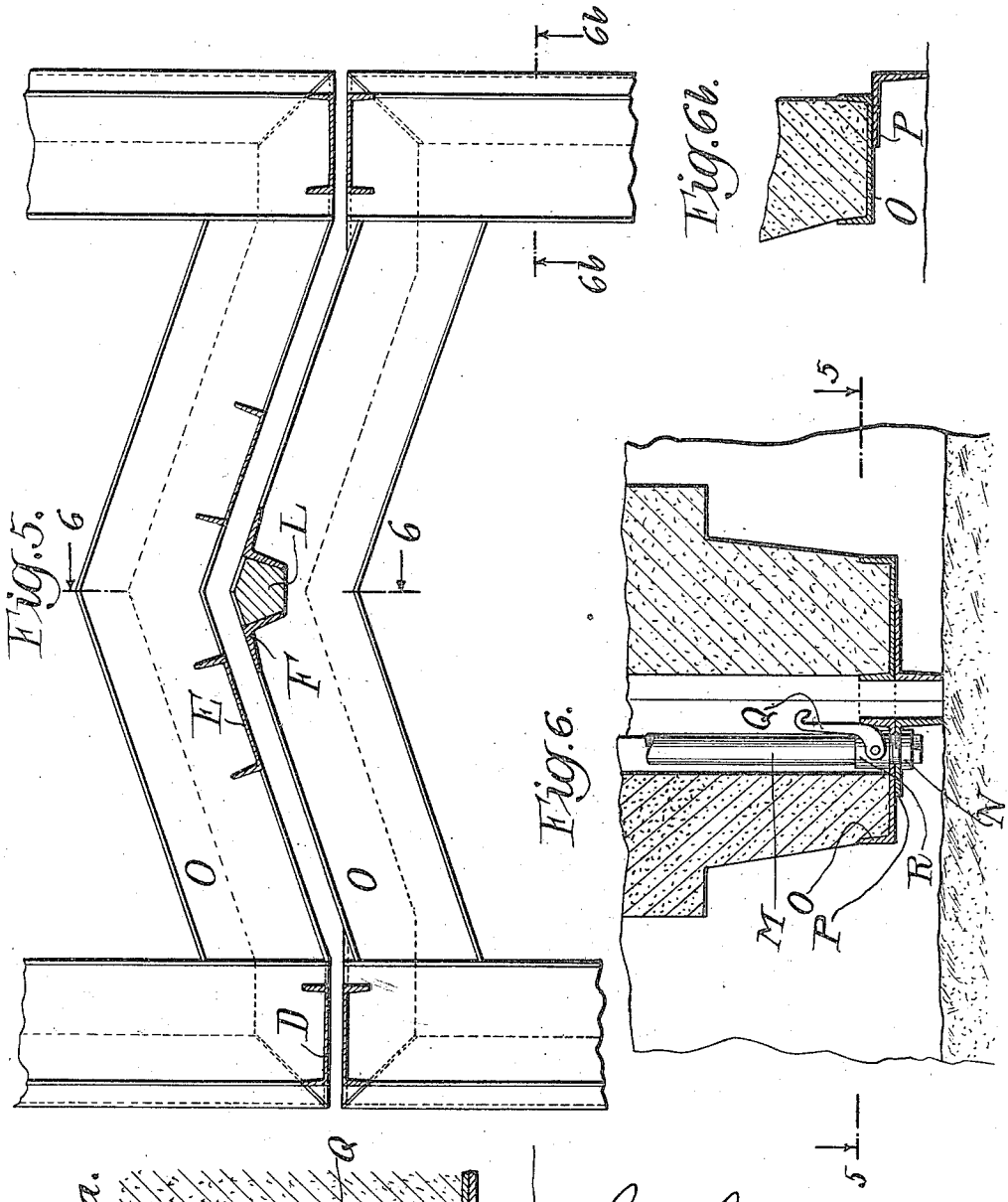
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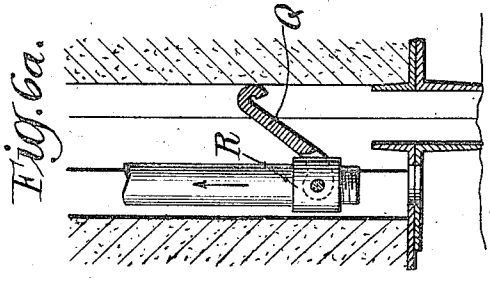
4 SHEETS—SHEET 3.










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4 SHEETS—SHEET 4.

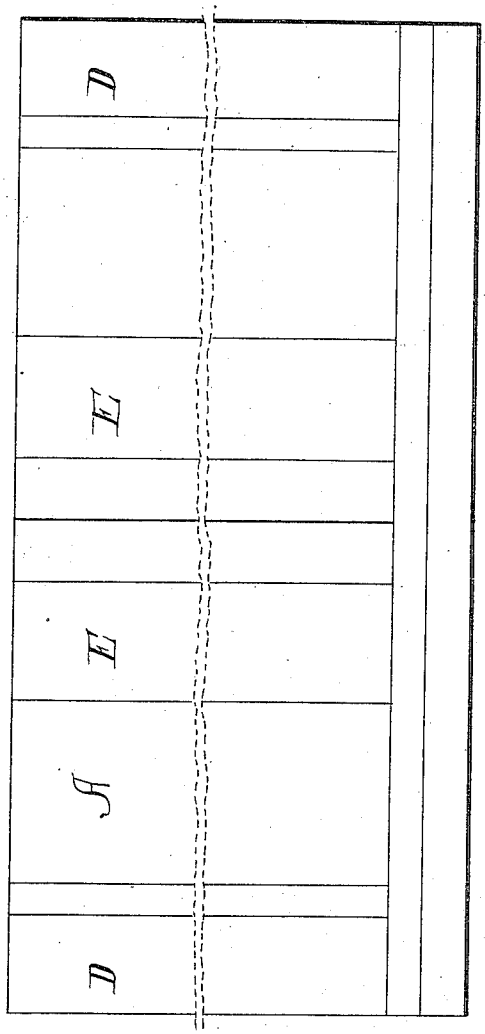



Fig. 8.

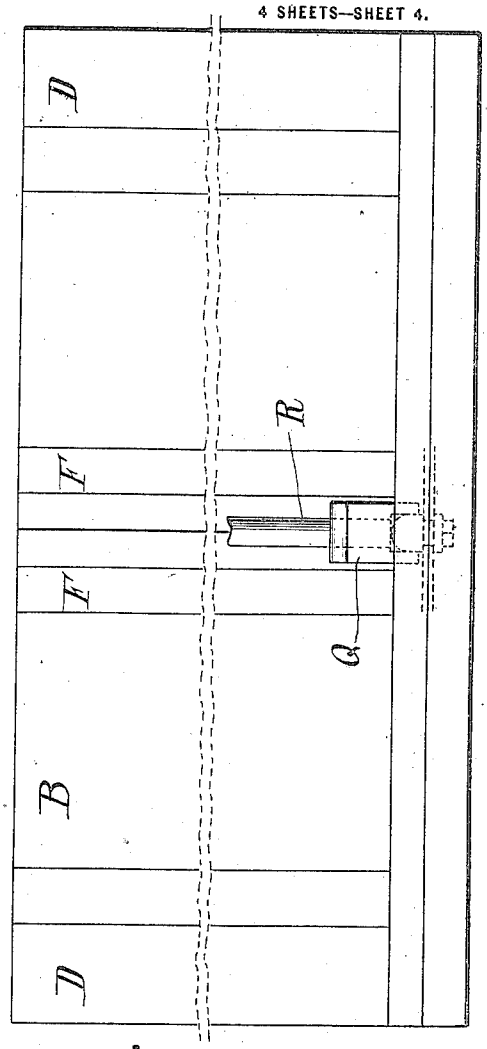



Fig. 9.

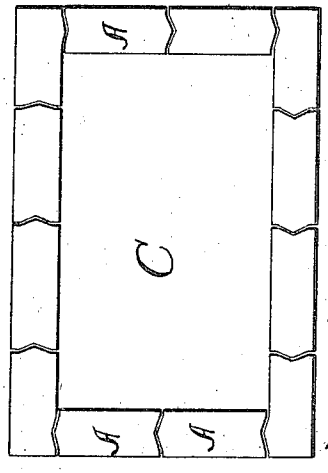



Fig. 10.

Louis L. Brown, INVENTOR

BY

D. Anthony Usina, ATTORNEY

# UNITED STATES PATENT OFFICE.

LOUIS L. BROWN, OF NEW YORK, N. Y., ASSIGNOR TO THE FOUNDATION COMPANY, A CORPORATION OF NEW YORK.

## APPARATUS AND METHOD FOR BUILDING A CONTINUOUS WALL OF CAISSONS.

1,255,702. Specification of Letters Patent. Patented Feb. 5, 1918.

Application filed April 23, 1915. Serial No. 23,337.

*To all whom it may concern:*

Be it known that I, LOUIS L. BROWN, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Apparatus and Methods for Building Continuous Walls of Caissons, of which the following is a specification.

For building foundations by means of caissons it is often desirable to make a continuous wall of such caissons around the lot and then to excavate within the lot for the basements or cellars of the building. It has been found difficult to form a water-tight connection between the adjacent caissons, or the piers which are formed from such caissons by filling them with concrete. A substantially water-tight connection is necessary, however, so as to exclude water from the excavation within the lot. This invention provides a method and apparatus by which this can be done with comparatively little difficulty and without danger to the workmen.

The accompanying drawings illustrate a method and apparatus embodying the invention.

Figure 1 is a horizontal section through the adjacent ends of two caissons or piers, the form in which one was molded having been removed;

Fig. 2 is a similar section showing the manner of molding the end of a caisson such as shown in the upper part of Fig. 1;

Fig. 3 is a vertical section on the line 3—3 of Fig. 1;

Fig. 4 is a vertical section on the line 4—4 of Fig. 1;

Fig. 5 is a plan of the adjacent portions of the cutting edges of two caissons with certain uprights shown in section omitting the concrete body for the sake of clearness, being approximately a section on the line 5—5 of Fig. 6 before applying the grouting pipe;

Fig. 6 is a section on the line 6—6 of Fig. 5 after molding the concrete and applying the grouting pipe and commencing sinking operations;

Fig. $6^a$ is a section showing the same parts during the raising of the grouting pipe;

Fig. $6^b$ is a vertical section on the line $6^b$—$6^b$ of Fig. 5;

Fig. 7 is a horizontal section showing the grouting of the joint space after the caissons have been sunk;

Figs. 8 and 9 are respectively elevations of a grooved joint face and a tongued joint face of the caissons;

Fig. 10 is a plan of a building lot with a surrounding wall of caissons joined in accordance with this invention.

Referring now to the embodiment of the invention illustrated, Fig. 1 shows the adjacent end portions of two caissons or piers A and B, the end of the caisson A being formed with a wide angular groove and the end of the caisson B with a correspondingly shaped tongue entering such groove. The caisson A may have both ends grooved and fitted against caissons with tongued ends, or all the caissons may be identical, having a groove at one end and a tongue at the other, each tongue entering the groove of the next. Fig. 10 shows a building lot surrounded by caissons, designated A and joined together in accordance with this invention, the center C of the lot being excavated.

The caissons may be made in various known ways. As illustrated, they are all concrete caissons or piers made substantially in the manner indicated in the Moran Patent No. 759,388 with steel cutting edges and with concrete extending upward therefrom forming the working chamber and the body above and having substantially naked faces of concrete throughout their height, the working chamber and shaft-opening being afterward filled with concrete to form the pier.

In sinking these caissons it is not always possible to sink them accurately to the line desired. They sometimes shift a few inches out of line endwise or sidewise so that although a space of a few inches is left between adjoining caissons one is apt to get out of line and to bear against the next. The friction of naked concrete surfaces on each other would be considerable. In order to minimize this friction I provide anti-friction plates on the joint faces in such positions that an endwise or a sidewise movement of one caisson relatively to the next will cause these anti-friction plates to engage with each other rather than the naked concrete and the sinking of the caissons will be eased. These anti-friction plates consist of steel channels D embedded

in the normal portions of the joint faces (that is, the portions at right angles to the side faces) and serving at the same time to reinforce the corners of the concrete, similar channels E embedded in the oblique faces of the groove and steel angles F embedded in the oblique faces of the tongue. In case of an endwise movement of one caisson toward the next the anti-friction plates D, which are normal to the length of the caisson and the general direction of the wall, will bear against each other. In case of a lateral movement of one of the caissons one or the other of the angles F, whose faces are at an angle to the normal end faces of the caisson, will bear against one of the channels E as shown in Fig. 7. In either case they bear against each other along determined narrow anti-friction faces. These faces are preferably greased to further reduce friction. In going down with one caisson alongside of another already sunk the workmen in the second caisson can, if they find the second caisson shifting toward or bearing against the first, excavate beyond the cutting edge sufficiently to expose the bearing face of the first caisson and grease the bearing face of the latter, the caissons being preferably sunk as close to each other as is practicable.

The form for the grooved joint face is shown in Fig. 2 and comprises vertical planks or boards G fitting the intended contour of the concrete and held by outside braces H. With the form of this sort the caisson A will be built up to the desired height above the ground. When the next caisson B is built there is not sufficient room between it and the caisson A for the same style of form and a thinner removable form must be used. For this purpose I provide a form of suitably shaped sheet metal plates J with braces or horizontal stiffeners K on the outside face and vertical supports L. These can be set up in the narrow space between the two joint faces and, after the concrete in caisson B has been molded and set, can be withdrawn upward. Three caissons in line should be built in this way and leveled carefully above ground. Numbers 1 and 3 should be built up to a convenient height to act as guides for number 2 which will be sunk first. Then number 4 should be built up and number 3 sunk; numbers 2 and 4 serving as guides therefor. The sinking may proceed in this way around the entire lot.

In molding the caissons I provide at the apex of the angular tongue (or a similar provision may be made at the apex of the groove) a strip or form L of timber flaring outward. For example, this timber may be placed between the angles F. After forming the concrete body this timber is removed, which may be easily done by first knocking it outward slightly, and in the recess thus left there is inserted a pipe M, say a two inch pipe, which passes through a hole left at this point in the cutting edge of the caisson, the pipe having its lower end screw threaded and covered with a cap N which holds it in place and also prevents dirt from entering it in the subsequent sinking operation. The cutting edge comprises a broad steel channel O from which the concrete springs and an angle P mounted on the lower face thereof. These steel parts are shaped the same in plan as the concrete body above, as indicated in Fig. 5. The anti-friction plates are mounted thereon with their outer faces flush with the outer face of the cutting edge. The rivets, splice plates and other devices used for fastening the parts together are omitted for the sake of clearness, these being well understood and being of any usual or suitable design.

After sinking two adjoining caissons down to bed rock or to the desired grade the cap is removed from the lower end of the grout pipe M and grout is forced down through this pipe by means of a force pump. The pipe is withdrawn gradually as the grout is forced down in sufficient quantity to make the joint tight, so that the grout is distributed thoroughly from bottom to top into the space between the caissons. In Fig. 7, for example, where we suppose the caisson B to have shifted to the right in sinking the anti-friction plates E and F at the right hand side will make contact and prevent substantial outflow of grout in that direction. The space at the left, however, will be of increased width by reason of the lateral shift of the caisson B and will receive a solid broad body of grout or of grout and earth compacted and mixed together which will not only be substantially water-tight, but will be strong enough to transmit from one caisson to the other the lateral pressures which are encountered from the outside body of earth when the lot is excavated. The tongue and groove formation of the caissons, together with the key of grout which is interposed at one side of the tongue and the actual contact which occurs at the other side, prevents any lateral movement of one caisson relatively to the other and thus causes the caissons to constitute in fact a continuous wall to resist and distribute throughout its length the lateral pressure referred to.

The placing of the grout may be facilitated by the method described in my prior application No. 836,933 filed May 7th, 1914, and I have illustrated a device for working in this way. This device is a sort of plow or harrow consisting of a blade Q pivoted to the ring R on the lower end of the pipe and adapted to collapse against the pipe during the sinking of the caisson. After the caisson

is sunk, as the pipe is raised the plow swings outward to or approximately to the face of the opposite caisson and loosens the earth through which it passes and displaces such earth to some extent sidewise, thus facilitating the entrance of the grout from the end of the pipe into the space between the caissons and insuring a good key of grout at this point.

When the lot is excavated the inner vertical edges of the joints become accessible. The earth therein may then be excavated and the joint sealed perfectly by filling with concrete or brick and facing with waterproof cement or in any other usual or suitable way.

Though I have described with great particularity of detail a certain specific embodiment of my invention, yet it is not to be understood therefrom that the invention is restricted to the particular embodiment disclosed. Various modifications may be made by those skilled in the art without departure from the invention as defined in the following claims.

What I claim is—

1. The method of making a wall of concrete piers sunk in the earth which consists in sinking caissons having bodies of concrete alongside of each other while permitting relative horizontal displacement thereof, one of said caissons being formed with a groove and the other with a tongue entering said groove, and providing said caissons with anti-friction plates adapted to bear against each other in sinking one caisson alongside of the other.

2. The method of making a wall of concrete piers sunk in the earth which consists in building caissons having bodies of concrete provided with anti-friction plates on their ends and sinking said caissons, while permitting relative horizontal displacement thereof with the anti-friction plates on one registering with those on the other, so that in case of displacement of the caissons they will contact along said plates.

3. The method of making a wall of concrete piers sunk in the earth which consists in sinking caissons having bodies of concrete alongside of each other while permitting relative horizontal displacement thereof, one of said caissons being formed with a groove, and the other with a tongue entering said groove and providing anti-friction plates on said tongue and groove respectively registering in a lateral direction with each other so that in case of lateral displacement of the caissons at least one of the plates on said tongue will contact with one of the plates on said groove.

4. The method of making a wall of concrete piers sunk in the earth which consists in sinking caissons having bodies of concrete in the earth alongside of each other while permitting relative horizontal displacement thereof, one of said caissons being formed with an exposed groove in one side of its concrete body and the other with an exposed tongue on one side of its concrete body entering said groove partially so as to leave a slight space between the caissons and subsequently filling said space with joint material to make a continuous structure.

5. The method of making a wall of concrete piers sunk in the earth which consists in building caissons having bodies of concrete with their ends adjacent to each other, molding a vertical groove in an end face of one of the caissons, removing the form for said groove and substituting a pipe in said groove, sinking the caissons with freedom for relative horizontal displacement, forcing grout or the like down said pipe and lifting said pipe gradually, so as to form a wall of grout extending from the end of one caisson across to the next.

6. A wall comprising caissons having bodies of concrete sunk in the earth alongside of each other, one of said caissons having an exposed groove in one end face of its concrete body and the next caisson having an exposed tongue on one end face of its concrete body partially entering said groove so as to leave a slight space between the two caisson bodies, the caissons being spaced apart with freedom for horizontal displacement in sinking and having their adjacent faces provided with anti-friction plates to prevent interference with the descent in case such horizontal displacement brings one against the other, and a filling of joint material in said space.

7. A wall comprising caissons having bodies of concrete sunk in the earth alongside of each other, one of said caissons having one end face of its concrete body formed with an exposed groove and with relatively narrow marginal portions extending in the normal direction and the next caisson having one end face of its concrete body formed with wider marginal portions opposite said relatively narrow marginal portions and with an exposed tongue partially entering said groove so as to leave a slight space between the two caisson bodies, the caissons being spaced apart to permit free horizontal displacement in sinking and having their adjacent faces provided with anti-friction plates to prevent interference with the descent in case such horizontal displacement brings one against the other and a filling of joint material in said space.

In witness whereof, I have hereunto signed my name.

LOUIS L. BROWN.

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