A. N. Spooner,
CONSTRUCTION OF PIERS AND THE LIKE.
APPLICATION FILED MAR. 14, 1906.

PATENTED DEC. 25, 1906.

Fig. 1.
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3 SHEETS—SHEET 3.
To all whom it may concern:

Be it known that I, ALLEN N. SPONNER, a citizen of the United States, residing at the city of New York, in the borough of Manhattan and State of New York, have invented certain new and useful Improvements in Construction of Piers and the Like, of which the following is a full, clear, and exact description.

My invention relates to the construction of masonry and concrete piers, foundations, sea-walls, and the like where the main part of the construction has to be done beneath the surface of the water. The principal object of the invention is to provide a very simple and comparatively inexpensive method of laying foundation structures of the above character and one which is particularly applicable to places where there are heavy seas or strong tides, so that the work of construction is difficult or impossible by the ordinary methods.

A further object of the invention is to devise a crib composed entirely of ordinary piping, bolts, planks, and foundry-castings capable of being assembled into place without any machinery or difficult manipulation and largely above the surface of the water by the ordinary unskilled labor available.

With these and other objects in view my invention consists in the steps, sequence, and order of operations hereinafter set forth and also in the construction, combination, location, and arrangement of parts, all as will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is an end elevation of a partly-completed foundation structure and crib embodying the principles of my invention. Fig. 2 is a front elevation of the same. Fig. 3 is a detail view illustrating the joints and connections of the parts which I employ in practice. Fig. 4 is a similar view showing other details.

Piers, walls, and foundations below the surface of the water are frequently constructed of concrete or cement, which is supplied in liquid or plastic form and allowed to harden in place. In order to form the concrete into the structure desired, a mold is of course necessary, and for this purpose it is customary to use caissons, coffer-dams, and other apparatus. Caissons for this purpose are very expensive and if employed as a mold for the concrete or grout cannot be subsequently detached and used again for any other purpose.

A still more serious objection to caissons is found with their usage in rough water, since the great surface exposed to the tides and waves renders it extremely difficult to keep them in place initially with sufficient security. Coffer-dams are extensively employed for comparatively shallow water, but it is evident that in cases where there are strong tides or rough water or where the water is comparatively deep the coffer-dam is inapplicable.

In carrying out my present invention I make use of a sectional crib in which there is almost no surface exposed to the action of the tide and waves until the masonry work is substantially completed, and therefore able to supply all the necessary strength. I further secure the greater part of the assembling and construction work above the surface of the water, so that a minimum amount of work is imposed upon the divers, whose services are of course difficult and expensive, particularly in rough or deep water.

Referring now to the figures of the drawings, in which like parts are designated by the same reference-signs, I denote the bed of a river, harbor, or other situation where it is desired to construct a foundation. The loose silt and mud is first carefully cleaned away, so as to expose the hard-pan or rock beneath. This being accomplished, a quantity of concrete is obtained and packed closely around the outlines of the foundation by the divers in bags, as indicated at 2. Under these circumstances the concrete soon hardens and the bags remain or weld themselves together into a good firm foundation. The central part 3 is then grouted in and the operation repeated with bags and grouting until the sea-bottom is levelled around the place desired, the rocks or hard-pan having, of course, an uneven or jagged contour ordinarily in the natural state. When a level floor or surface is provided in this or any other way, I proceed with what constitutes more particularly the features of my invention.

I do not claim the features by which the level surface is secured, it being possible to use any desired method.

Upon the level surface (designated at 4) I lay a pair of parallel pipe-sections 5, and loosely disposed upon these I provide collars 6, which may be ordinary couplings reamed out to a sufficient size to loosely pass upon the pipe-sections 5. 7 denotes short studs or

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pipes threaded into the collars 6 and which constitute tenons for the vertical structure hereinafter described. These pipes are laid in position for line and level with their loose collars approximately spaced, and the studs 7, which are shown in an upright position in the drawings, are temporarily allowed to remain in repose, thereby obviating a rotary motion in the pipe during the preparation of its position; but this being accomplished these studs 7 are regulated by a diver, as shown in Fig. 1, and temporarily held in position by a thumb set-screw (No. 27) in the side of the loose collar or fitting when in readiness to receive and connect with the main supports or uprights.

The main supports or uprights of the crib are indicated at 8 and also comprise sections of ordinary iron pipe about four inches in diameter in practice. The diameter of these sections is great enough to pass over and inclose the upstanding studs 7, so that the uprights become firmly connected to the studs in this way. I prefer to make the uprights in single lengths where this is possible; but if the water is very deep two pipe-sections may be spliced together to produce a single upright. Fig. 1 shows a convenient means for splicing the uprights in this way, employing a simple rod 9 of a size adapted to be closely received into the pipes and having a pin 10 to fix its position therein. In any case, whether single sections or a pair of spliced sections are employed, a plurality of uprights are formed which project upward vertically or with an inward batter, as desired, above the water-level. The direction of these uprights determines the outline of the completed masonry structure. In practice I make use of distance-rods 11 at the upper ends of the uprights, also composed of pipe, and loosely inserted into the horizontal passages of four-way couplings, which are temporarily held in place thereon by thumb-screws 28, the couplings being secured at the tops of the respective uprights. I provide plugs in said couplings which are connected by tie-rods 13, screwed onto the plugs by ordinary machine-screws 14. The particular arrangement by which the upper ends of the uprights is determined is relatively unimportant, the parts being fixed together in any desired way.

Having obtained a skeleton structure of this form, I proceed with the formation of the cribs and masonry work proper, and it is evident that the skeleton framework above described presents very little surface to the action of the waves and tide and in practice so little surface as to be unaffected thereby during any ordinary conditions. I now obtain a supply of ordinary milled planking about three or four planks. 'in which are particularly illustrated in Figs. 3 and 4. The lumber is sawed into predetermined lengths, depending on the separation of the uprights 8, and the relation is such that when the castings are assembled with the planks a wall element is formed with eyes 70 to surround and engage said uprights. The particular form of the castings employed is subject to considerable variation, it being merely essential to provide the eyes at the ends of the planks to inclose the uprights. The construction shown has special advantages, and I prefer to use it in practice. I make use of three styles of castings, (designated as A, B, and C in the figures.) The castings A are oblong plates 15, the central parts 16 of which are curved or deflected out of the rectilinear outline. The castings B are similar to A in all respects, except that they are shortened or cut off at one end for a purpose which will later appear. The castings C are quite similar to A, except that they have a lateral lug or member 18. The various castings have bolt-holes 17, in which are received bolts 19 for securing the plates together or to the plank element, as hereinafter described. This detail construction is of course merely a practical and preferred form, and I do not desire to be limited or restricted thereto. It is of course possible to use wrought iron or steel plates or other materials of widely-varying forms and still secure the features of my invention.

The masonry construction is commenced by assembling a pair of the plates A at opposite ends of a plank element 20, the curved parts of the plates fitting around the uprights 8 and resting temporarily on the pins 21, inserted for this purpose. Other castings A or B are also bolted to the planks, so as to lie opposite the first-positioned plates, whereby the pipe-uprights are slidably inclosed on both sides by the plates. This completes one element of the crib-wall which is being formed. Another element may be organized in the same way and superposed upon the first and in this way a tier constructed of three or four planks. All this is accomplished above the surface of the water and in the open air at the upper parts of the upright structure.

Having formed the tier of three or four planks, I organize another tier between the next adjacent uprights. The plates A extending on both sides of the uprights and having bolt-holes at both ends permit the formation of a wall of elements of any desired length extending between the successive uprights. This being completed for a certain distance, about four or five lengths in practice, the end elements are fitted with plates of the form C in the relation shown in Fig. 4. Spacing-blocks may be inserted at intervals between the plates, whereby I can withdraw the pins 21, whenupon the group of elements forming a small wall-section will...
slide down the uprights and into the water and continue in their downward fall until they strike the sea-bottom or the foundation-pipes 5.

Two walls being made along the uprights along the sea-bottom, the diver is supplied with plank-sections 22 in properly-cut lengths, and these are attached to the legs 18 of the plates C by bolts or other fastening means. Thus a crib is constructed on the sea-bottom or surface 4 in which concrete or gravel may be dropped in buckets or fed through a tube or deposited in any way. In practice it is convenient to lower the concrete in buckets, and it is evident that the open nature of the uprights not only avoids the damaging effect of the waves and sea, but permits the lowering of the concrete-buckets wherever they are required. In this way the foundation of the pier or wall is built up to a certain height from the bottom and for a certain length, depending on the number of elements that have been assembled together. I shall term the portion thus completed a "division" of the complete structure.

After the completion of one division, as above described, another division may be made either on top of or alongside the first. If it is desired to construct the second division alongside the first, a number of planks or elements are assembled upon the uppermost part of the incomplete structure. The second wall-section is thus formed as the first was made if the end plates 28 are immediately adjoining the completed division are saved off slightly shorter than the normal length, as clearly illustrated in Fig. 3. In this way the end of the wall-section is in a position to be attached to that of the completed division by bolting the end-planks of the new wall-section to the end-plates C of the completed division beneath the water. The shortened plates Bi lie opposite the plates C in this relation, so as not to interfere with the easy assembling of the old and new sections. In this way two wall-sections are made which are virtually prolongations of the wall-sections originally placed. The diver now removes the end elements 22 of the completed division and assembles them on the new crib or division, which is therewith filled with concrete in exactly the same way as the first.

Thus the construction proceeds, division by division, along the sea or river bottom without any large amount of structural work at the water-level exposed to the tide and waves. When the work is about at this stage, I find it advantageous to incorporate chains or stay-rods 24 in the concrete of the various divisions and extending outward through the side walls thereof. The ends of such stays or rods have eyebolts 25, which are passed through what I shall term "stay-beams" 26, consisting of short stiff pieces of planking, which are thereby bolted rigidly upon the sides of the completed division and project upward parallel with the wall to be formed. The purpose of these stay-beams thus bolted to the completed structure is to form a rigid support for the plank elements subsequently positioned and prevent their folding under the considerable outward pressure of the concrete massing.

The construction of the wall is proceeded with division by division until it approaches 75 the surface of the water. By this time, however, the lower divisions are hardened together into a solid monolith, which is beyond the power of any waves or sides to displace. The resulting construction is therefore a comparatively simple matter and is readily proceeded with till the work is completed.

An important feature of my invention lies in the removability of substantially all the structural work employed, which is thereby made available for subsequent use. The uprights bi are free to be drawn upward, being loosely guided by the eye of the various elements. It is evident that the nature of the said connections 7 and 10 does not impede such upward withdrawal. After this the various elements of the planking may be stripped off, so that nothing is left except the foundation-pipes 5, 6, and 7, which are by this time so embedded in cement that they cannot be removed.

What I claim is—

1. The method of constructing piers, sea-walls, foundations and the like, which consists in erecting a skeleton structure composed of uprights, guiding sections into position on the sea-bottom by said uprights by sliding them longitudinally downward thereon, whereby a crib is formed, laying the masonry-work in said crib, whereby a division of the wall is made, and repeating said process, division by division, and after the structure emerges above the water-surface, the masonry-work of longitudinally-adjacent divisions being merged into a continuous monolithic uninterrupted by said uprights.

2. The method of constructing piers, sea-walls, foundations and the like, which consists in erecting uprights on the sea-bottom, whereby a skeleton structure is formed, guiding wall-sections into place on the sea-bottom by sliding them longitudinally downward on said uprights, adding end wall-sections thereto, filling the crib thus formed with grout or concrete, whereby a wall-division is produced, and repeating said process until the wall emerges above the water-surface.

3. The method of constructing piers, sea-walls, foundations and the like which consists in leveling the sea-bottom, erecting uprights thereon, forming wall-sections on said uprights above the water-surface, said sections being composed of connected elements, dropping the completed section to the sea.
bottom upon the uprights, adding walls to form a crib, and filling the crib with material to form a wall.

4. The method of constructing piers, sea-walls, foundations and the like, which consists in leveling the sea-bottom, placing pipe-sections thereon with upstanding studs, slipping uprights upon said studs, assembling wall-sections on said uprights, lowering said wall-sections to the sea-bottom, adding walls to form a crib, and filling the crib with material to form a wall.

In witness whereof I subscribe my signature in the presence of two witnesses.

Witnesses:

ALLEN N. SPOONER.

ALFRED W. PROCTOR,

WM. M. STOCKBRIDGE.