J. WENMAEKERS.

Sectional Coffer-Dams.

No. 154,935. Patented Sept. 8, 1874.

Fig: 1.

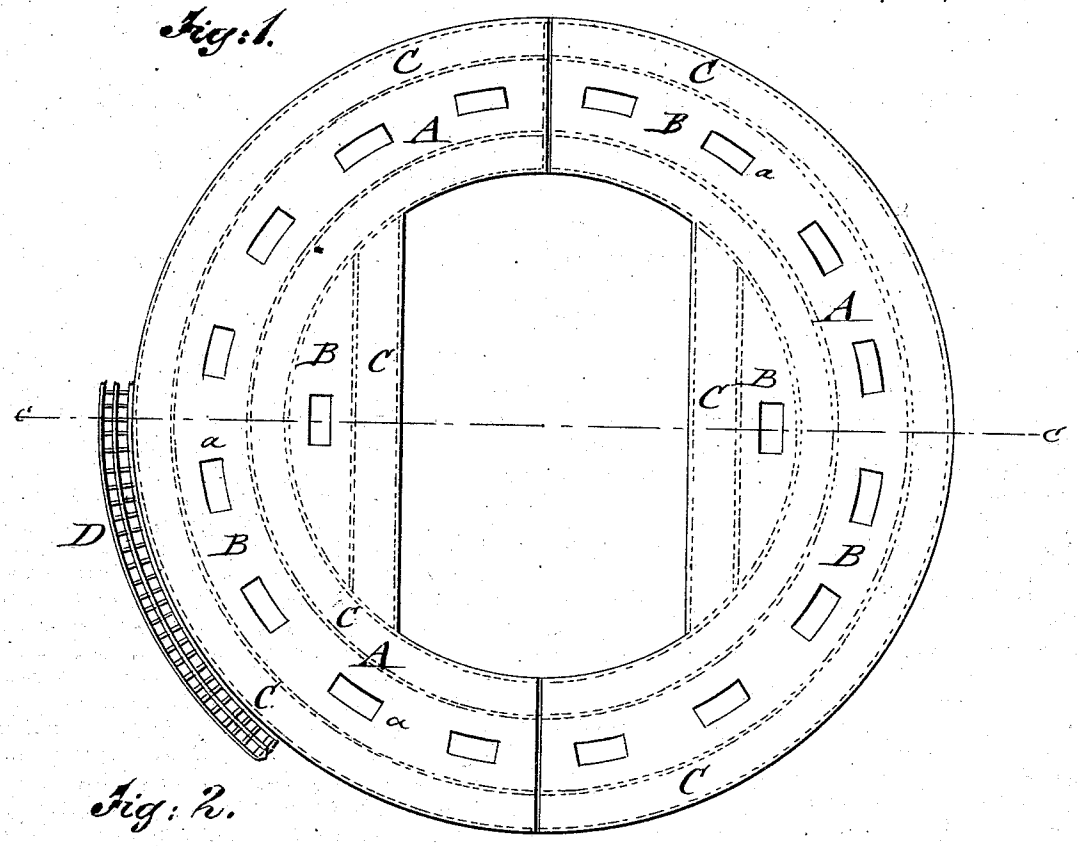
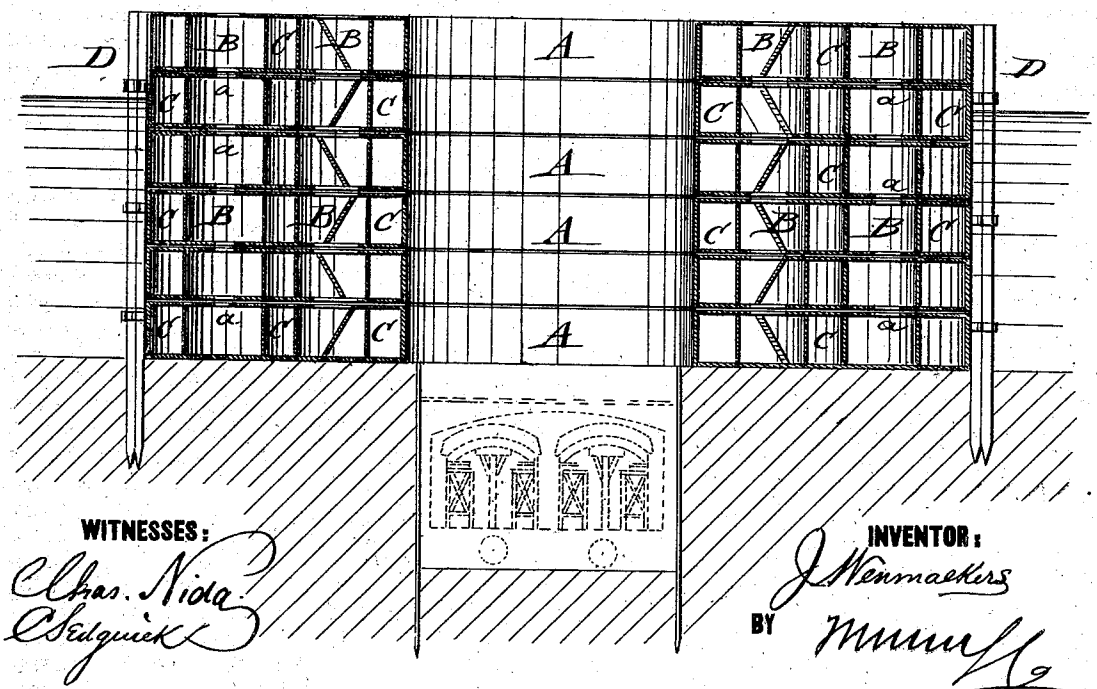


Fig: 2.



WITNESSES:

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UNITED STATES PATENT OFFICE.

JEROME WENMAEKERS, OF BRUSSELS, BELGIUM.

IMPROVEMENT IN SECTIONAL COFFER-DAMS.

Specification forming part of Letters Patent No. **154,935**, dated September 8, 1874; application filed July 3, 1874.

To all whom it may concern:

Be it known that I, JEROME WENMAEKERS, of Brussels, Belgium, have invented a new and Improved Method of Building Submarine Structures, of which the following is a specification:

In the accompanying drawing, Figure 1 represents a top view of my apparatus for building submarine structures; and Fig. 2, a vertical central section of the same on the line *c c*, Fig. 1.

Similar letters of reference indicate corresponding parts.

My invention relates to an apparatus and a system for building quays, piers, sea-walls, tunnels, and similar structures under water, so that they may be completed with less difficulty, at considerable lower cost, and in less time than heretofore. My invention consists of a series of hollow compartment-sections, constructed of wood, iron, and other material, and of semicircular, polygonal, or other shape, so as to form, when lowered to the bottom and raised to a suitable height above the level of the water, a coffer-dam around a central open space, which is used for building after the water is pumped out. The connected sections are suitably ballasted when lowered, in part filled with water, and secured to the bottom by piles driven through guide rings or bands at the outer circumference of the dam.

In the drawing, A represents one of my compartment-sections, of which a certain number, according to the depth of the water, are placed in tiers one above the other. The bottom of the river, lake, &c., is leveled to a certain degree, for giving a stable base for the lowermost section A, which may be of semicircular shape, as indicated in the drawing, or of polygonal, oval, or other suitable form, according to that of the structure to be built. The sections A are constructed of wooden top and bottom parts, with vertical dividing-walls of iron, by which compartments are formed for the various purposes. They may also be made entirely of iron or any other material, as many tiers, one above the other, being required so that the uppermost sections rise to such height above the water-level that even in rough weather no water may be thrown from the outer part to the inside of the sections. By the connection of two semicircular or of four quadrantal sections, A, a central space is formed, which is of a size corresponding to the structures to be built. The sections A are conveyed by means of two vessels, which are connected with a suitable arched trestle-work, to the place of work, and ballasted in compartments B, either with sand, hewed stones, or other material required for building. Some of these compartments B may also be fitted up as quarters for the workmen employed. The ballast-compartments B of all the sections are connected by openings and doors *a*, through which the ballast is readily introduced, and hoisted for use by windlass or other apparatus. The sections A are closed at the ends and screwed together, rubber packing being interposed at the inner and outer edges, for producing a perfectly water-tight joint of each tier. The ballasting of the sections gradually lowers them below the level of the water. The next sections are then conveyed by the arched vessels, jointed thereon, and ballasted, and so on until the lower sections reach bottom, and the whole is firmly seated thereon. The adjoining parts of the sections, as well as the adjoining tiers, are rigidly and tightly connected, so that a perfectly secure and water-proof coffer-dam with central part is formed in the water. The compartments C at the inner and outer circumference of the sections, and intermediately between the ballast-compartments, are connected by vertical pipes, so that, when the whole dam is seated on the bottom, water may be introduced, by means of suitable engines in the ballast-compartments, into the water-chambers of the lowermost tier, and thence to all the water-chambers of the whole dam. This increases the strength and stability of the whole, and imparts a resistance sufficient to meet any storms, floods, or strong currents of the water. The dimensions of the sections, especially the height, should not go beyond a certain limit, a height of from six to eight feet being most advantageous for most purposes, as thereby the sections may be fully within control of the mechanical appliances, and not too unwieldy and difficult to handle. For the purpose of preventing the washing off of the bed of the river, &c., below the coffer-dam thus con-

structed, a double series of piles, D, is driven along the circumference, the piles being guided by means of staples or bands attached to the sections. The piles are driven to a depth of about four feet below the bottom, and thereby the structure secured against any danger or accident, being of such great weight and strength that it may serve as a pier for all the vessels carrying the supplies of building material to the same, and taking off the earth dug out from the same. The body of water in the center of the structure is next pumped out by the engines, and then the digging out of the earth commenced in the center space. The quay or other structures are then built in the same manner as on the land, the necessary hoisting apparatus being moved on lateral bridge-connections and rails, in the usual manner. After a quay or tunnel section equal to the inner length of the coffer-dam is completed, the water is pumped out of the compartments C, which assists in raising the whole from the ground. The piles are then withdrawn, the upward pressure of the dam greatly expediting their detachment, which allows the whole structure to float, so as to be readily governed and towed to the place adjoining the one finished. The dam is then lowered again by admitting water to the compartments, and the work continued in the manner above described. Submarine tunnels for railroad purposes across rivers or inlets of the sea may in this manner be constructed within shorter time, at greatly less cost, than bridges, without forming obstructions to the shipping. The current repairs of submarine structures are also less than those of structures erected above water. The main cost consists in the first construction of the apparatus, which can be used over again by being taken to pieces, and conveyed to the place of work. Obstructions to navigation may also be advantageously removed by my system with the greatest facility, expedition, and safety.

I am aware that caissons or coffer-dams for making submarine excavations and structures have been constructed of two shells, so as to be filled with water for sinking the apparatus, and to be floated by removing the water. The caisson devised by me differs materially from the ordinary form of water-ballasted caisson, as I propose to use the various sections composing the same as receivers for dry ballast and building materials.

The sections of my caisson are designed to be filled in part with ballast in the form of stones and materials used in the construction of the submarine structure. It is thus possible to sink the sections without resorting to water-ballast, and by making the caisson of a series of superposed sections placed in tiers, any desired height of caisson may be built.

As the building materials are removed from the storage compartments in the sections composing the caisson the latter is lightened, and only then is it necessary to supply the place of the removed ballast by introducing water into the compartments designed for its reception. It will, of course, be obvious that a certain amount of ballast must generally remain in the lower sections, so as to serve, in connection with the water-ballast, as a medium for retaining the caisson in position.

The firm retention of the caisson is further insured by the external surrounding piles, which pass through loops or keepers on the various sections, and serve to hold the same together, in connection with their own weight and that of the ballast.

In order to float the caisson, all that is necessary is to remove the water-ballast, either in whole or to such an extent as may be deemed necessary, and then the upward pressure of the caisson will tend to loosen the piles, thus freeing the caissons for the object stated.

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

1. A caisson or coffer-dam composed of a series of hollow superposed sections, each tier made in two or more parts, having compartments for the reception of dry ballast, building materials, water-ballast, &c., substantially as herein described.

2. The hollow compartment-section provided with interior ballast-compartments, and intermediate and circumferential water-compartments, substantially as specified.

JEROME WENMAEKERS.

Witnesses:

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