

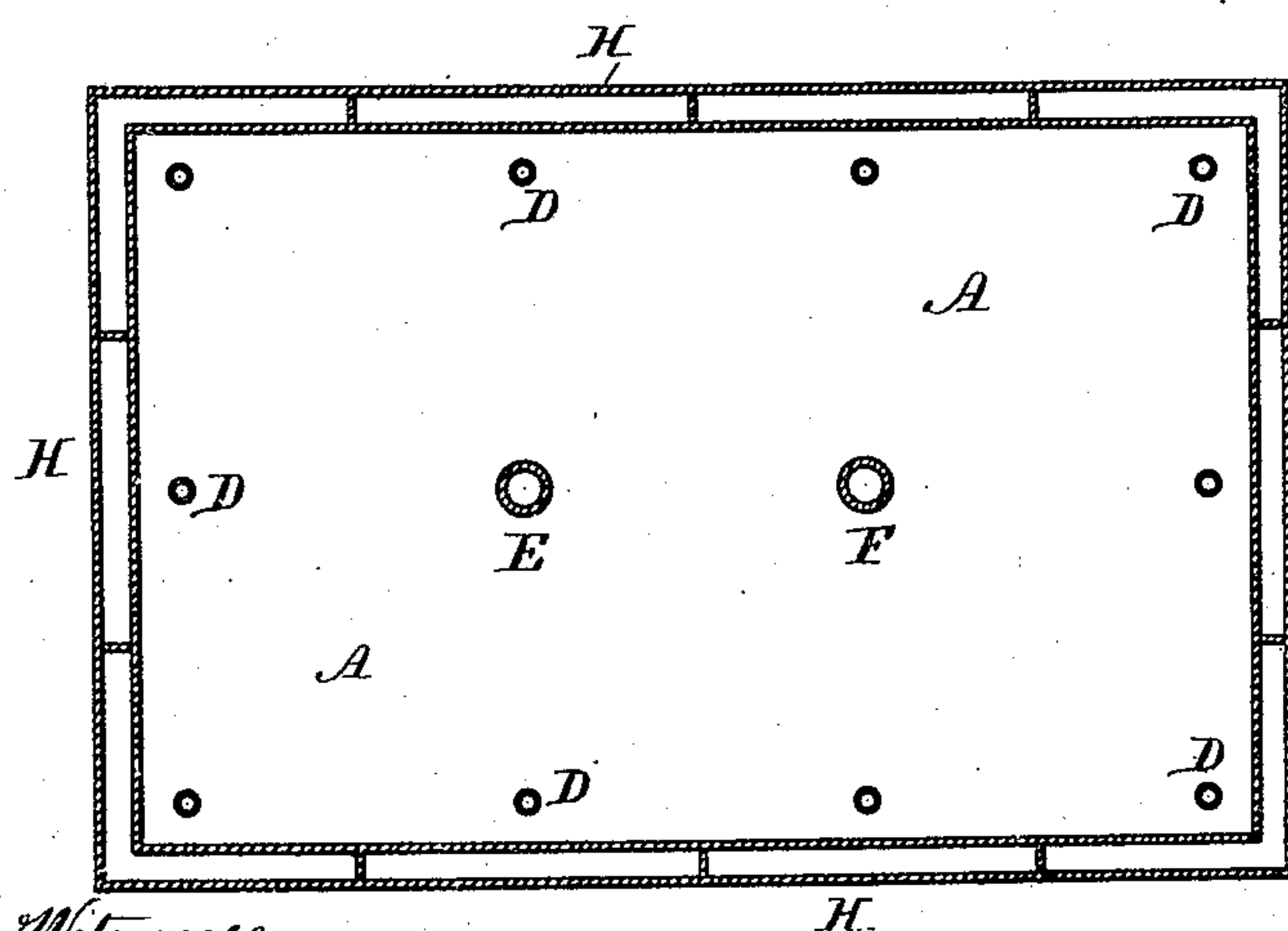
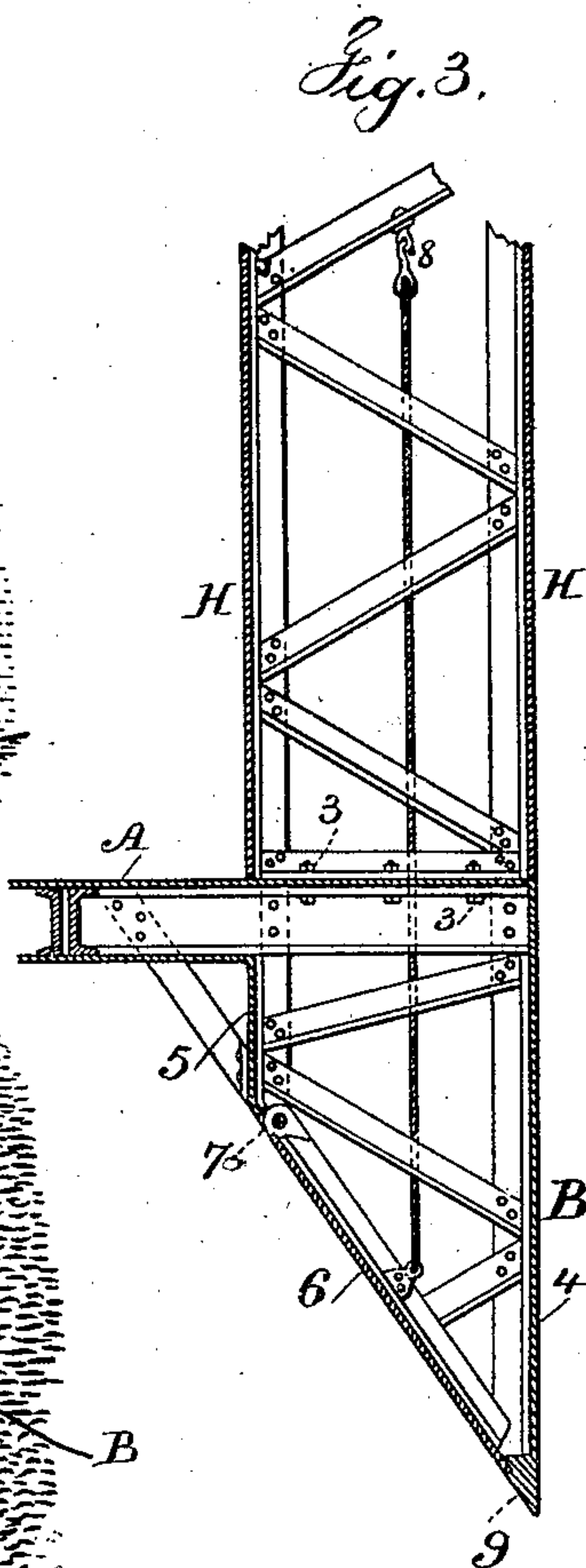
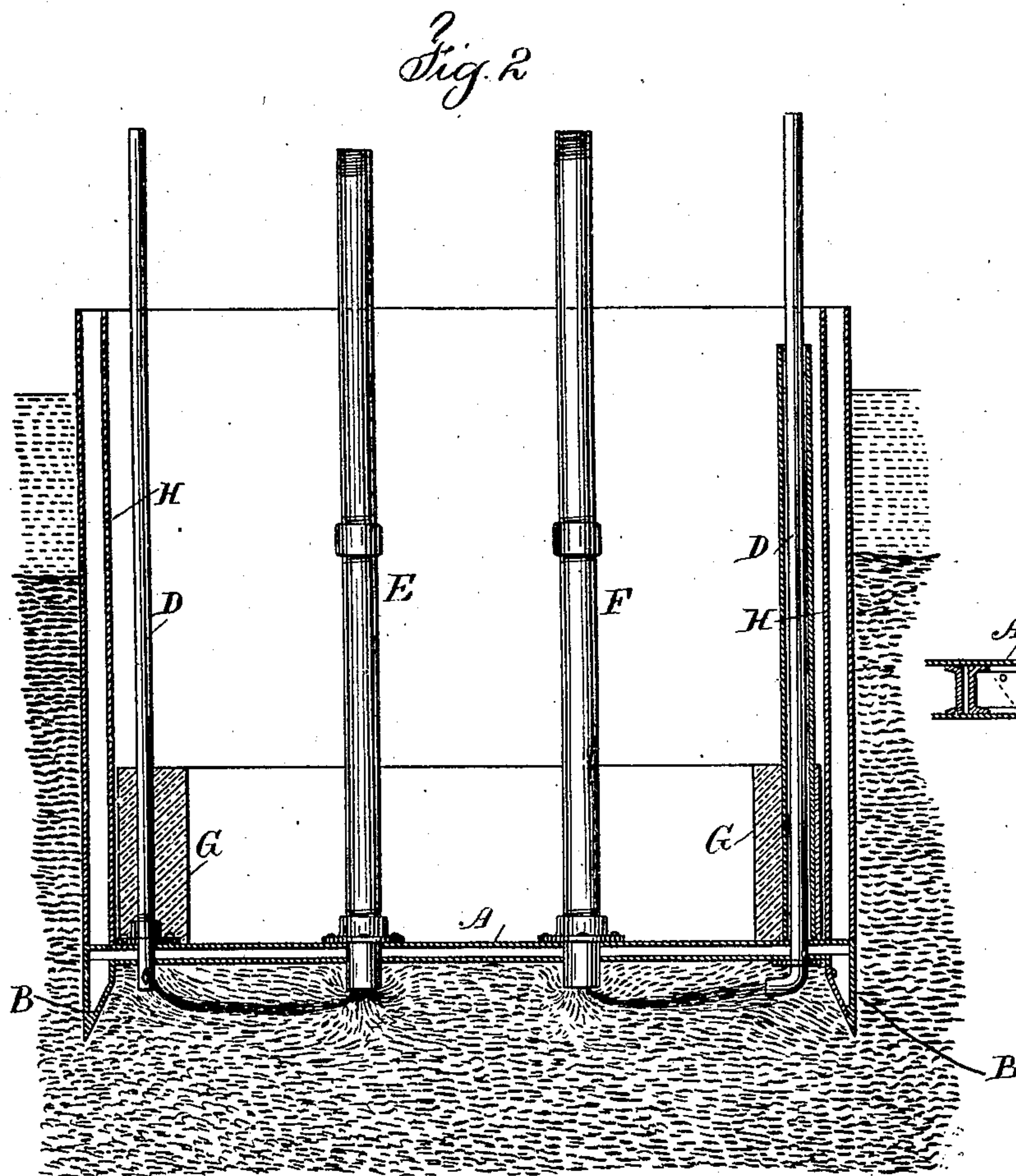
(No Model.)

R. L. HARRIS.

# METHOD OF AND APPARATUS FOR CONSTRUCTING FOUNDATIONS.

No. 538,073.

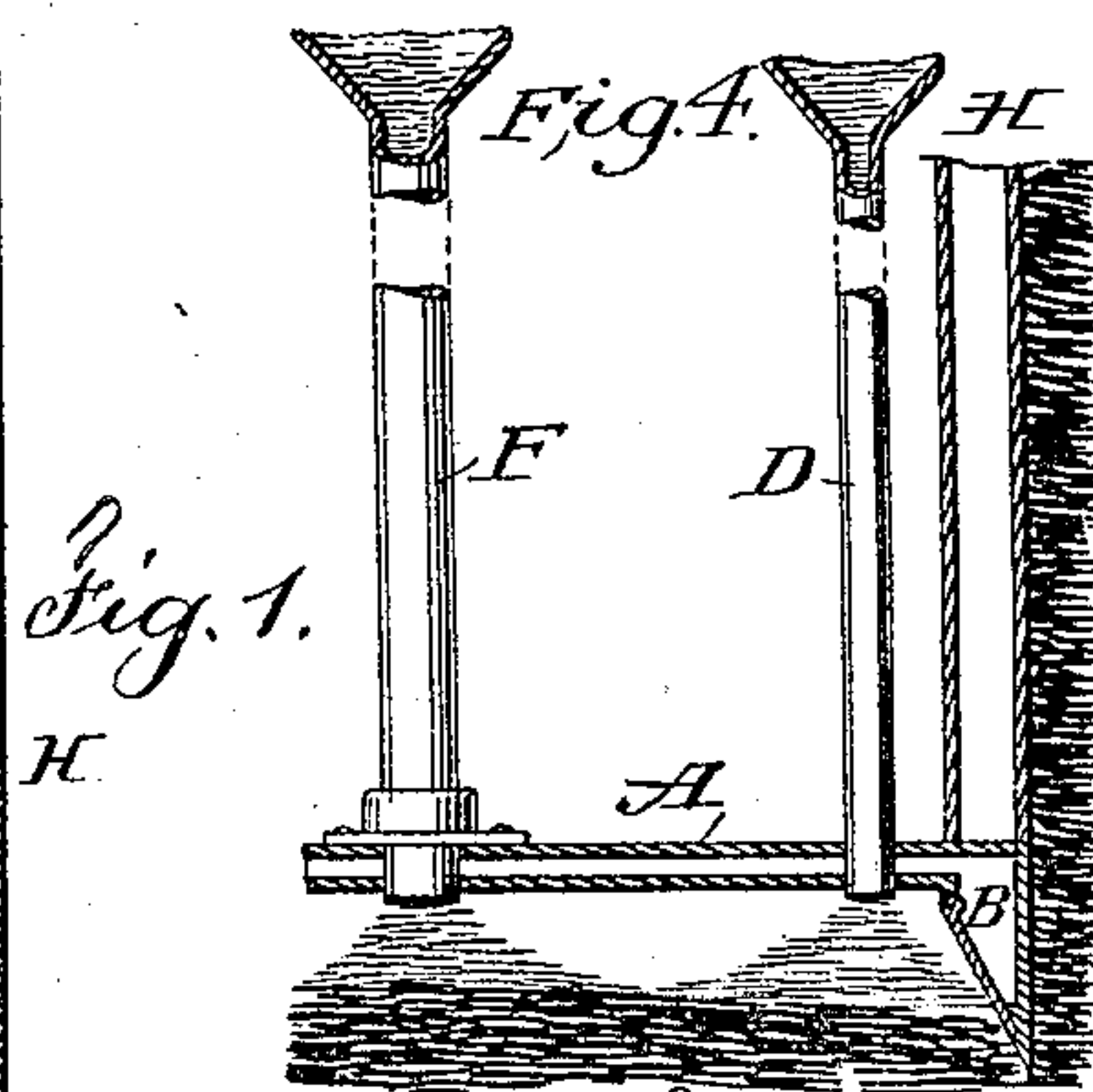
Patented Apr. 23, 1895.



Witnesses

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# UNITED STATES PATENT OFFICE.

ROBERT L. HARRIS, OF NEW YORK, N. Y.

## METHOD OF AND APPARATUS FOR CONSTRUCTING FOUNDATIONS

SPECIFICATION forming part of Letters Patent No. 538,073, dated April 23, 1895.

Application filed June 15, 1894. Serial No. 514,896. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT L. HARRIS, a citizen of the United States, residing in the city, county, and State of New York, have invented an Improvement in Methods of and Apparatus for Constructing Foundations, of which the following is a specification.

Caissons have been made use of in putting down foundations for piers, bridges and buildings, such caissons having a deck and downwardly projecting edges that pass into the soil as the caisson settles, and the material inclosed between the downwardly projecting edges and beneath the deck has been excavated by hand, and the water has been partially excluded by atmosphere under pressure confined below the deck and between the downwardly projecting sides, and in some instances the material that has been excavated has been discharged upwardly through a suitable pipe or conduit by the accumulated air pressure, but it is often dangerous for men to work in this space and exposed to the heavy atmospheric pressure.

In Letters Patent No. 464,771, granted to me December 8, 1891, a method is set forth of obtaining circulation between separate pipes and consolidating loose materials by passing water through the materials from one pipe to another and then introducing cementing material.

The present invention relates to a method of removing the material from beneath a caisson so as to allow the same to sink, by which I am enabled to make use of the method set forth in the aforesaid patent for establishing a circulation of water between one pipe and another for the loosening and removal of sand, mud or other substance and thereby excavate the material beneath the caisson without the necessity of sending men into such space; and after the caisson has been sunk to the desired depth, cementing material may be filled into the same by introducing such cementing material through the pipes before mentioned, thus avoiding the danger to life where men have been heretofore employed beneath such caissons and under an excessive atmospheric pressure, and at the same time lessening the expense of removing the materials beneath such caisson and allowing the same to be sunk to any desired depth.

In the drawings, Figure 1 is a plan, and Fig. 2 a vertical section through a caisson being sunk by my improved method. Fig. 3 is a section on a larger scale representing the downwardly projecting side of the caisson; and Fig. 4 is a diagram illustrative of the introduction of cement.

The deck A of the caisson or roof is of any desired size or shape, and it is to be built in such a manner as to obtain the necessary strength and stiffness according to the size and the circumstances under which it is made use of. The downwardly projecting edges B are usually V-shaped, the outer surfaces being substantially vertical so that a cutting edge is formed at the bottom of the respective sides, and the inner inclined surfaces of these downwardly projecting edges act to deflect and press toward the middle of the caisson the sand, mud or other material as the caisson descends.

I pass down through the deck A at suitable distances apart pipes shown at D E F, and these pipes are advantageously arranged so that usually the pipes D are near the edges of the caisson, and the pipes E F are near the middle portions of the caisson, and the pipes D may be down-take, and the pipes E F are usually up-take, all of these pipes passing through the deck of the caisson and opening below the same; and it is now to be understood that water is to be forced down the pipes D and either exhausted or allowed to flow up through the pipes E F, and in so doing channels are established between the respective pipes and below the deck of the caisson, and according to the material that is acted upon, so more or less water will be required to be forced down the pipes D and to rise up through the pipes E and F and convey with the water the solid materials from beneath the caisson and thus excavate below the caisson and allow it to sink from time to time as the materials are removed from below the same, according to the character of the subsoil, so that the water will be passed down either of the pipes and the materials will pass up through either of the other pipes.

The down-take pipes D may simply open beneath the deck vertically or be slotted near their ends to direct the stream of water laterally, or they may be provided with elbows or



nozzles either stationary or adapted to be rotated so as to project the issuing jets of water upon the material to be softened and to pass up the up-take pipes, and the currents of water are to be projected or act in such a manner as to remove the material below the caisson with uniformity to maintain the deck of the caisson in the proper level condition, and such caisson is to be suitably loaded so as to cause it to sink by gravity, or any desired force may be applied in addition.

Under some circumstances the superstructure will be built upon the caisson and will form the weight that is made use of in carrying the caisson down, and the superstructure may be built with a wall G of brickwork or other material which will leave the interior of the structure above the roof of the caisson sufficiently hollow for the necessary work to be performed, and this wall may be made use of in keeping out the surrounding water in structures that pass down below the level of the water in the soil, or that may be above the soil in submarine structures, such wall being laid up water-tight; but usually a shell or inclosing crib will be provided, as at H, which rises above the deck of the caisson and is sufficiently strong to resist external pressure, and the same may be bolted or secured to the caisson as at 3, so as to be disconnected and removed if desired after the caisson has been sunk to the required depth and the superstructure has been built thereon.

Where the soil or material into which the caisson is to be sunk is liable to contain logs, bowlders or other obstructing material, it is advantageous to make the downwardly projecting edges B hollow and of suitable steel or iron frames, as represented in Fig. 3, with exterior and interior skins 4 and 5 so as to produce hollow chambers that may be filled with water to obtain additional weight in causing the caisson to sink by gravity, and upon the inclined inner surfaces of the downwardly projecting edges B, doors or flaps 6 are provided at suitable distances apart or so as to extend all around the caisson, such doors being hinged at their upper edges 7 so as to open inwardly and downwardly of the caisson, and they may be secured by hooks or other fastenings 9. These doors usually remain shut in consequence of the pressure against them from below the caisson and they will rest against the framework within the edges, but in case a log or similar obstruction may be met with beneath the cutting edge 9 of the caisson, (the fact may be ascertained in any usual manner such for instance as the passing down of a rod or plate outside the edge of the caisson,) and when the obstruction is located, the particular chamber to which the obstruction is adjacent may be closed and water forced into the chamber after unfastening the door and the door forced open by an increased pressure of water so that a suitable cutting or drilling tool may be passed from above through the opening between the lower edge of the door and the cut-

ting edge 9 so as to drill, chop, disintegrate or otherwise break up the obstruction and allow the same to pass into the cavity beneath the caisson and be removed in any suitable manner if necessary.

It will be understood that by the before described improvements the earthy materials can be washed out from beneath the caisson and delivered upwardly even though bowlders, logs or other loose materials may accumulate beneath the caisson or be driven down by the same as the caisson sinks. When the desired depth has been reached, cementing materials may be introduced through the respective pipes D E F until the entire space beneath the caisson is filled in and consolidated. It is of course to be understood that the cementing materials introduced through one pipe will displace the water beneath the caisson, and that this water will pass upwardly through the up-take pipes so as to give opportunity for filling in the entire space beneath the caisson with cementing material. In cases however where the sand, gravel or other materials beneath the caisson are sufficiently solid and compact for supporting the superincumbent weight, it is only necessary to allow the caisson to settle until the proper depth has been reached, the materials beneath the caisson filling up the space below the deck in consequence of the weight upon the deck causing the materials to firmly consolidate.

In sinking the caisson, should any obstruction be met with, either beneath the cutting edge or at any place beneath the deck, the location of the same having been determined, a jet of water may be directed toward such obstruction so as to loosen the earthy materials around the same and allow such obstruction to settle by gravity from time to time as the caisson descends, but should the same be found to obstruct the work, it may be broken or removed as aforesaid or in any convenient manner according to the character of the obstruction.

In sinking a caisson if the surrounding materials are of a binding character, such for instance as a stratum of quicksand, and such exterior materials interfere with the proper sinking of the caisson, the up-take pipes may be closed, and the water forced into the down-take pipes will gradually find its way upwardly between the exterior surface of the shell and the surrounding earthy material so as to lessen the binding force thereof and allow the caisson to sink.

This invention is especially available in sinking foundations for light-houses, bridge piers and similar structures where great depth is often necessary, but it may be employed to advantage in the erection of buildings, because by sinking a caisson in the manner before mentioned with a shell or by building up the superstructure as the caisson sinks, the adjacent materials are supported and a sufficient pressure may be maintained beneath the caisson to prevent exterior materials passing be-



low the cutting edges of the caisson, and thereby the settling of surrounding buildings may be effectually prevented.

The walls or deck of the caisson may be single or of two or more thicknesses, and of wood, iron, steel or other suitable material, and the cutting edges may be made in any desired shape.

I claim as my invention—

10 1. The method herein specified of making foundations for buildings and other structures, consisting in placing a caisson with downwardly projecting edges in the position required for the foundation, providing numerous pipes passing through the deck of  
15 such caisson and directing currents of water through one or more of such pipes and through the earthy materials below the deck of the caisson to commingle with such earthy materials and force the same up one or more of the  
20 other pipes by the accumulated pressure below such caisson thereby providing for the removal of the earthy materials as required beneath any portion of such caisson without requiring air pressure or air locks, substantially  
25 as set forth.

2. A caisson having downwardly projecting edges and a closed deck adapted to receive the foundation of a building or other structure, in combination with numerous water  
30 pipes passing through such deck and opening

near the under side of such deck, such pipes being adapted to pass and direct water through the earthy materials to commingle with the same and to discharge the same upwardly through other of such pipes, substantially as set forth. 35

3. The method herein specified of forming foundations for buildings and other structures, consisting in removing the earthy materials from beneath the caisson by the circulation of water, and then filling in the space below the deck of the caisson by cementing material introduced through pipes, substantially  
40 as set forth.

4. A caisson having a deck and a downwardly projecting edge made of a metallic framework and a substantially vertical exterior skin and an inclined interior skin below the deck and one or more doors in the inclined  
45 part of the interior skin and hinged at their upper edges so as to be capable of being opened downwardly at their lower edges near the cutting edge of the caisson to give access from  
50 between the skins to any obstruction which may be encountered by the caisson as it sinks, substantially as set forth. 55

Signed by me this 13th day of June, 1894.

ROBERT L. HARRIS.

Witnesses:

GEO. T. PINCKNEY,

A. M. OLIVER.