No. 828,761. PATENTED AUG. 14, 1906.

D. E. MORAN & J. W. DOTY.

CAISSON.

APPLICATION FILED SEPT. 1, 1905.

2 SHEETS—SHEET 1.

FIG. 1.

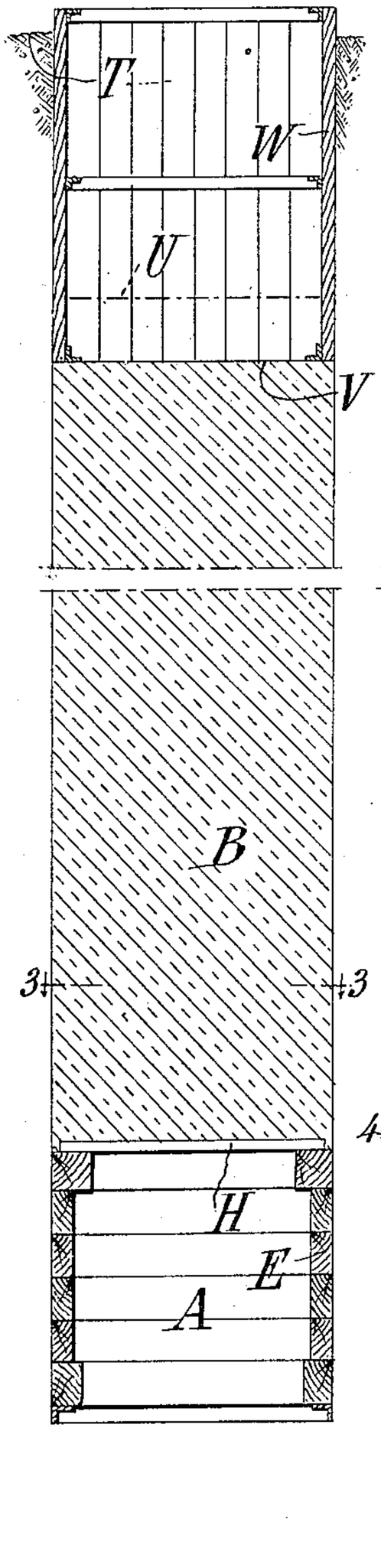


FIG. 2.

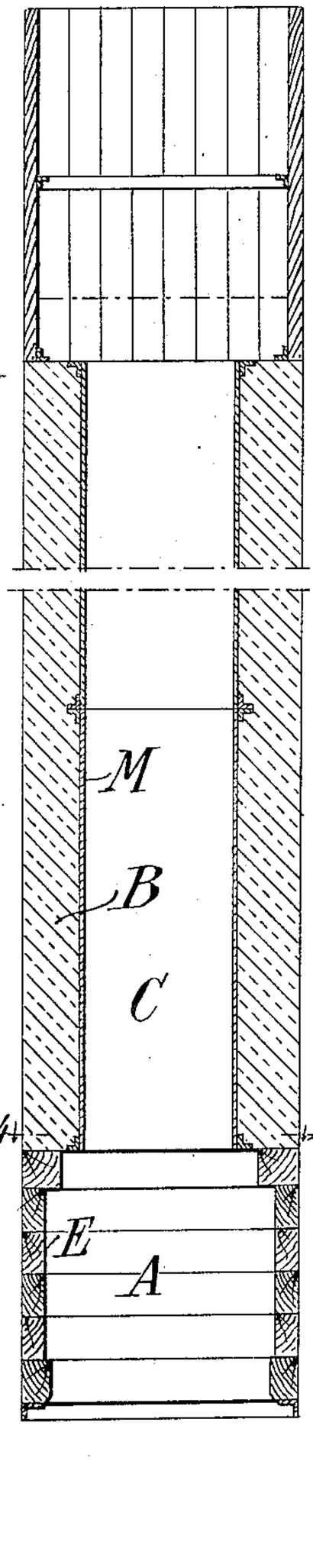


FIG. 3.

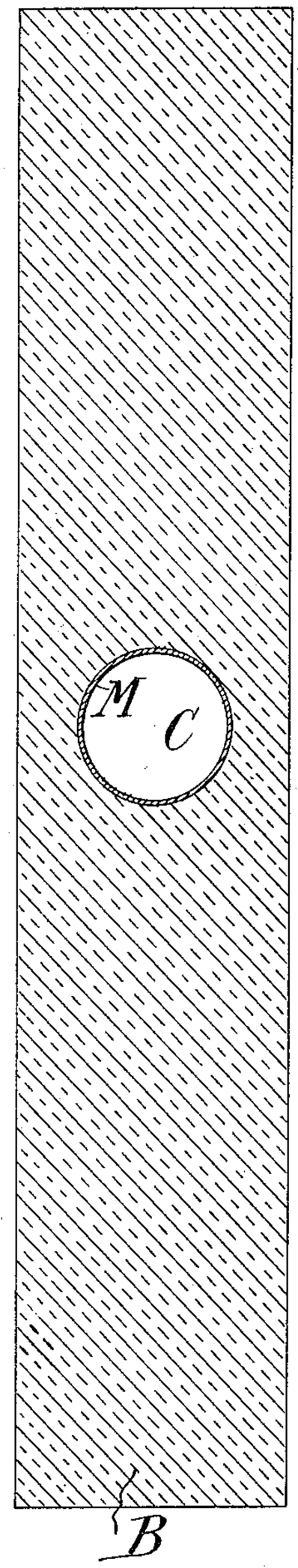
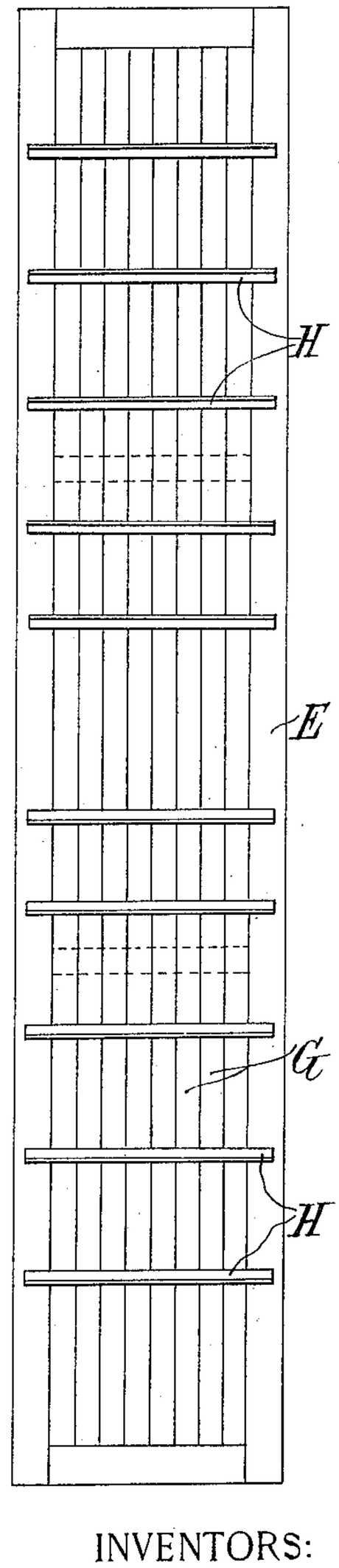


FIG. 4.



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Rene' Bruine

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2 SHEETS—SHEET 2.

FIG. 5.

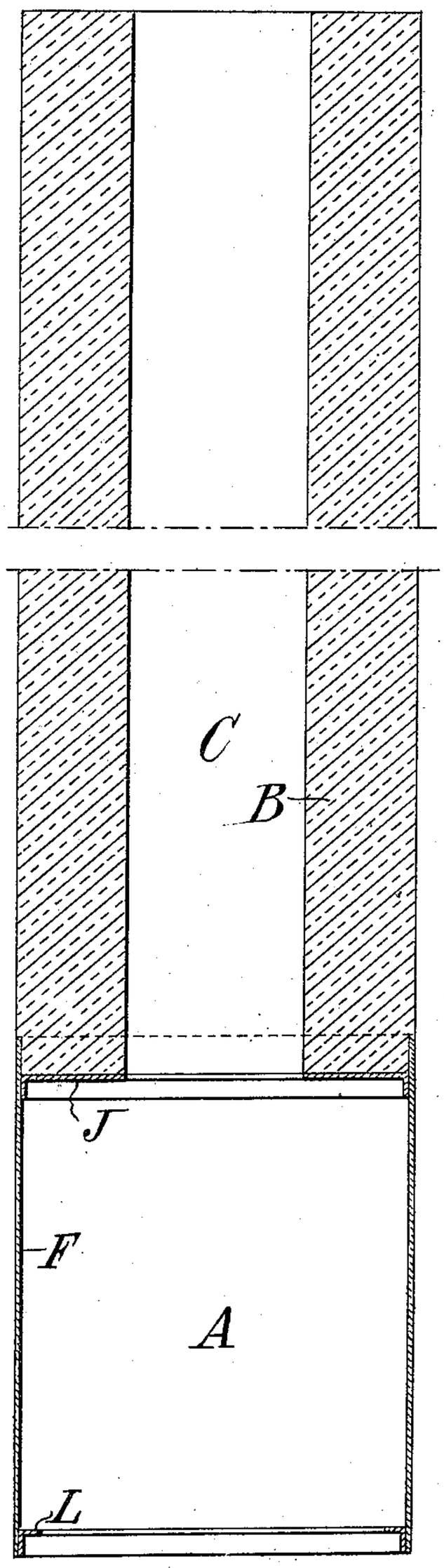


FIG. 6.

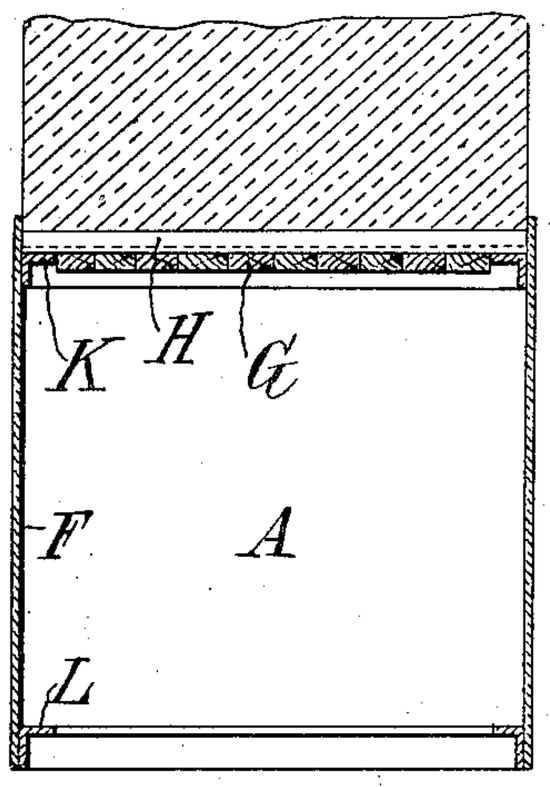


FIG. 7.

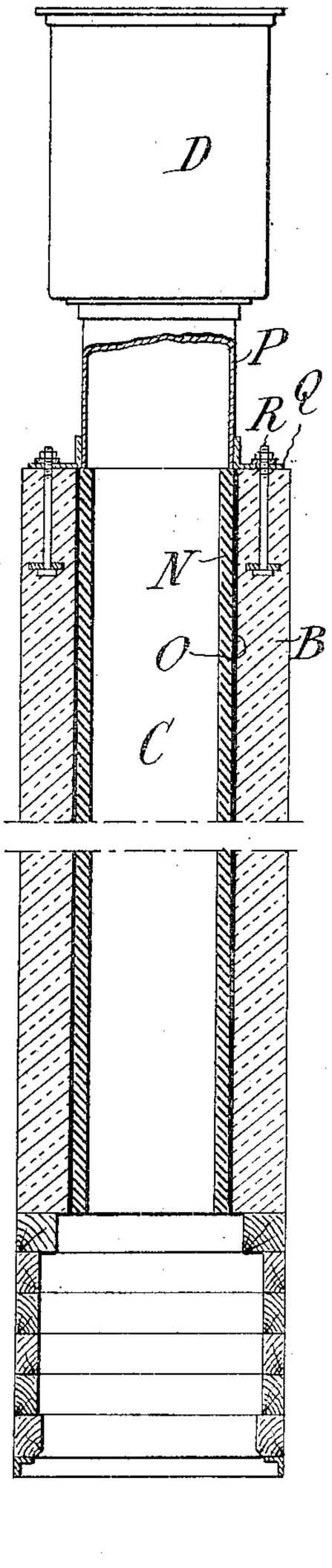


FIG. 8.

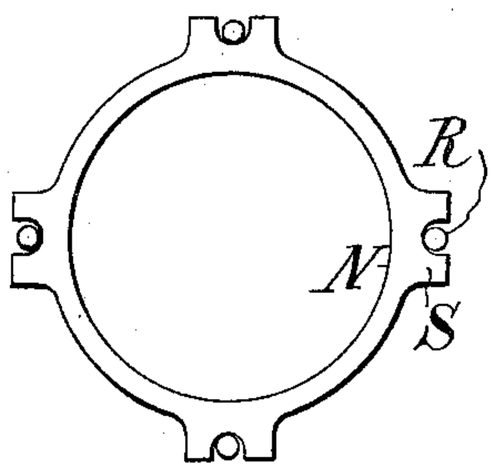
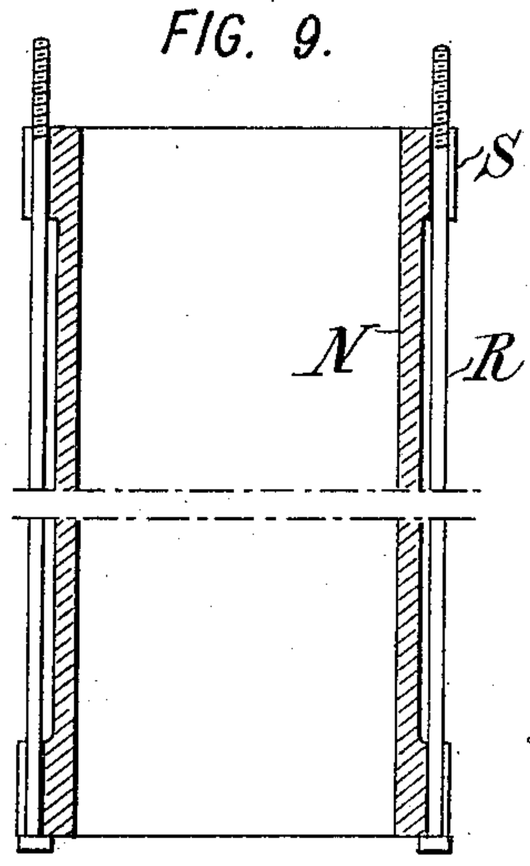


FIG. 9.



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UNITED STATES PATENT OFFICE.

DANIEL E. MORAN, OF MENDHAM, NEW JERSEY, AND JOHN W. DOTY, OF NEW YORK, N. Y.

CAISSON.

No. 828,761. Specification of Letters Patent. Patented Aug. 14, 1906.

Application filed September 1, 1905. Serial No. 276,767.

To all whom it may concern:

Be it known that we, DANIEL E. MORAN, a citizen of the United States, residing at Mendham, in the county of Morris and State of New Jersey, and JOHN W. DOTY, a subject of the King of Great Britain, residing in the borough of Brooklyn, county of Kings, city and State of New York, have jointly invented certain new and useful Improvements in Caissons, of which the following is a specification.

In Patents Nos. 759,388 and 759,389, of May 10, 1904, there are described certain improvements in pneumatic caissons, such as are ordinarily used in making foundations for buildings, whereby the caisson is constructed substantially entirely of concrete without the usual coffer-dam or shell of steel or timber and in such a way as to form nearly the whole of the pier at once instead of first sinking a caisson and coffer-dam and subsequently filling these with concrete to form the pier.

The present invention relates to certain features of improvement in the structure and in the method of putting it together and sinking it, by which the same results may be secured in a more practical way. Certain features are also presented here which are independent of the subjects of the above patents.

An important feature is in the making of the body alone of concrete or equivalent plastic material, this body being being built upon a working-chamber of non-plastic material—such, for example, as steel or timber. In this way the working-chamber can be very readily transported in sections and put together on the job and sunk as a whole, while the body portion can be built up of concrete in place little by little or in large units as the working-chamber is sunk. Timber or steel is also preferable for the working-chamber, in that these materials have sufficient tensile strength to resist the flexing strains to which the working-chamber is sometimes subjected, while it is doubtful if concrete would have sufficient strength under extreme conditions unless made extremely heavy. The formation and sinking of this caisson is therefore rather the formation and sinking of all of the pier (except for the space within the working-chamber and the shaft) at the first operation than the forming of a shaft with a coffer-dam to hold back the earth and subsequently filling in this coffer-dam to form the pier, as in the process now generally used. The concrete body is supported by suitable means extending across between the walls of the chamber, which supporting means may be permanent or may be partly or entirely temporary, so as to ultimately leave the concrete to form part of or the entire roof of the chamber. Certain other improvements are referred to in detail hereinafter.

The accompanying drawings illustrate embodiments of the invention.

Figures 1 and 2 are transverse sections at a point outside of the shaft and through the center of the shaft, respectively, illustrating a timber working-chamber. Fig. 3 is a horizontal section through the body of the caisson. Fig. 4 is a plan of a working-chamber with a support for the concrete, partly temporary and partly permanent. Fig. 5 is a transverse section of a caisson with a steel chamber. Fig. 6 is a similar section showing a slightly-different style of steel chamber. Fig. 7 is a central section illustrating variations in detail. Figs. 8 and 9 are a plan and diametral section, respectively, illustrating a shaft-lining of special construction.

Referring to the embodiments of the invention illustrated, the working-chamber A is made sufficiently large to accommodate workmen, as usual, who work under a pressure of air depending upon the depth of excavation. The body B, of concrete, is of the same horizontal dimensions as the working-chamber, and a shaft C passes through the body, whereby during the sinking of the caisson men and materials pass to and from the working-chamber, and compressed air is usually transmitted to the working-chamber from an air-lock D, Fig. 7, located at the upper end. The pneumatic operations involved in the sinking of the caisson are well understood, and the details of the pneumatic apparatus are therefore not illustrated.

The working-chamber, which is designated in each case by the latter A, may be constructed with side walls E of timber, Figs. 1, 2, and 7, or with side walls consisting of steel plates F, Figs. 5 and 6. A consideration of the length and depth of the working-chamber, an actual example of which is shown in Figs. 1 to 4, will make it clear that it may be subjected to severe flexing stresses in a vertical directions and will show the advantage of

using non-plastic material therefor, which by its resistance to tensile or flexible stresses is superior for this purpose to plastic material. Timber or steel can also be more conveniently put together and handled. Using, therefore, a material better adapted for the construction and operation of the working-chamber we nevertheless preserve the advantage of sinking nearly the entire pier at once, and we avoid the use of an expensive and objectionable coffer-dam throughout the height of the pier by building a body of concrete extending from the working-chamber to the top of the pier. The concrete may be built in blocks and laid directly on the working-chamber; but preferably it is built in place upon a floor supported from the walls of the working-chamber. Whether or not this floor shall be permanent or partly or entirely temporary depends chiefly upon the dimensions. For the comparatively large working-chamber of Figs. 1 to 4 we propose to support a temporary floor, (shown in Fig. 6,) consisting of planks or boards G, attached to the under sides of angles or similarly-shaped ribs H, the latter in turn being supported upon the upper edges of the walls E. The concrete body B is then molded directly thereon, and after it has set the temporary floor G is withdrawn, leaving the ribs H embedded in the base of the concrete, as in Fig. 1, and giving support to the latter in the open space between the walls of the chamber. This construction has the advantage that the concrete body forms the roof of the working-chamber and unites strongly to the filling of concrete which is ultimately introduced into the chamber, forming substantially a monolith with such filling and eliminating whatever weakness is introduced by the usual interposition of a roof between the filling of concrete in the chamber and the concrete of the pier immediately above the chamber. On the other hand, and especially for small caissons, it is very convenient to provide a permanent support—such, for example, as the head J, Fig. 5, of sheet metal, constituting, in effect, a broad flange projecting from the side walls of the chamber, or, as in Fig. 6, the steel plate side walls F may be provided with flanges K, which support ribs H and floor-boards G similar to those of Fig. 1.

The steel construction lends itself most admirably to convenience and rapidity. The depth of the working-chamber is in nearly all cases the same, and plates of corresponding width and of standard lengths with angles L for stiffening the cutting edge and angles K for supporting the concrete body, either already attached or ready for immediate attachment to said plates, can be carried in stock and can always be obtained quickly and cheaply, and a chamber of any desired horizontal dimensions can be very quickly put together from such plates and angles, thus saving the expense and expensive delays now generally incurred in securing special steel shapes and dimensions for caisson-work.

The shaft-lining may be of the usual steel tubes M, Fig. 2, or may be omitted entirely, as in Fig. 5, a coating of impervious paint being applied, if necessary, to prevent too rapid escape of air. Preferably, however, the lining is made of tubes N, Fig. 7, of molded concrete or other plastic material, which being hardened before erection serves as a permanent form about which to build up the concrete body and which being harder than the concrete body is better adapted to resist the wear to which the lining of the shaft is subjected by blows from the bucket. We propose to provide also a layer O of impervious material—such, for example, as a coat of tar-paint or the like upon the outside of the concrete lining N—this being put in place, of course, before the surrounding concrete is built up. By this construction the tube of impervious material O is entirely protected from blows by the bucket. The lining, whether it be a steel tube M or a concrete tube N, is preferably supported upon the floor until the concrete around it has set, (or permanently where a permanent floor, such as J, is employed.)

In sinking the caisson the working-chamber will be built upon the desired location; the concrete-supporting floor put in place, and the permanent lining or a temporary internal form and also the external mold-boards or form erected a suitable distance above the top of the working-chamber. The concrete body will then be built up to the top of the mold or form and allowed to set, when the mold-boards may be removed, the caisson sunk a certain distance, and the concrete again built up as before. It is understood that for the purpose of sinking the caisson an air-lock D must be connected to the top of the shaft C. This air-lock may be connected by a section of pipe P, having a flange Q, held down by bolts R, embedded in the concrete body B during the building up of the latter. The lock is disconnected each time that a new section of concrete is built up and is replaced upon the new section before the work of excavation can proceed.

Since the concrete tubes N, constituting the shaft-lining, are hard and strong at the time that they are set in place, and since they will ordinarily be of standard lengths, so as to extend the shaft always a good distance upward above the next lower length, it may be more convenient to connect the bolts R to the tubes N, the latter being provided with lugs S, Figs. 8 and 9, into which the bolts R may be conveniently set. The manner of connecting the bolts R to the tubes N is of course subject to a wide variation. It is important to have the lock held down strongly

and reliably against the upward pressure of the air therein.

In some cases the footings or lower portions of the walls of the building rest upon the piers at a point below the level of the ground or even of the main excavation. For example, the level of the ground may be at T, Fig. 1, and it may be required that the piers terminate at the level U, at which point the building proper begins. In such case after reaching a point V a little below the final upper end of the pier a coffer-dam W is erected of any usual or suitable construction and supported upon the finished body of the caisson. The whole is then sunk as one continuous structure to the position indicated in Fig. 1. The air-lock is then removed and the chamber A and shaft C filled with concrete in the usual manner and the entire pier finished to the level U.

The coffer-dam W may be of any material and construction which will permit it to serve merely as a retaining-wall for the surrounding earth and to be withdrawn when such earth shall be subsequently excavated to approximately the upper end of the concrete pier.

Though we have described with great particularity of detail certain embodiments of our invention, yet it is not to be understood therefrom that the invention is limited to the particular embodiments disclosed. Various modifications thereof in detail and in the arrangement and combination of the parts may be made by those skilled in the art without departure from the invention.

What we claim is—

1. The method of forming a caisson, which consists in building a working-chamber with sides of non-plastic material and without a roof, and applying a body of concrete thereto to form the roof.

2. The method of forming a caisson, which consists in building a working-chamber without a roof, supporting a floor from the walls of said chamber, and building a body of concrete upon said floor.

3. The method of forming a caisson, which consists in building a working-chamber without a roof, supporting a temporary floor from the walls of said chamber, building a body of concrete on said temporary floor, and withdrawing said temporary floor.

4. The method of forming a caisson, which consists in building a working-chamber without a roof, supporting a temporary floor from the walls of said chamber, building a body of concrete on said temporary floor within external side mold-boards, and withdrawing said floor and side boards.

5. The method of forming a caisson, which consists in building a working-chamber without a roof, supporting metal ribs from the walls of said chamber, supporting a temporary floor from said ribs, building a body of concrete on said temporary floor, and withdrawing said temporary floor, leaving said ribs in place to give support to the concrete.

6. The method of forming a caisson, which consists in building a working-chamber with a body of concrete thereon extending upward to a point below the level of the ground, and applying to the upper end of said body a coffer-dam W adapted to act merely as a retaining-wall and to be withdrawn when the earth is excavated to approximately the upper end of the body of concrete.

7. The method of forming and sinking in the earth a combined caisson and concrete pier to form a foundation for buildings or the like, which consists in building a working-chamber, supporting a floor from the walls of said chamber, supporting a shaft-lining in place, molding in place a body of concrete around said shaft-lining, and then sinking the combined caisson and pier.

8. The method of forming and sinking in the earth a combined caisson and concrete pier to form a foundation for buildings or the like, which consists in building a working-chamber, supporting a floor from the walls of said chamber, supporting a shaft-lining of molded plastic material in place, and molding in place a body of concrete around said shaft-lining, and then sinking the combined caisson and pier.

9. The method of forming a caisson, which consists in building a working-chamber, supporting a floor from the walls of said chamber, supporting a shaft-lining of molded plastic material in place, applying a layer of substantially impervious material to the outside of said shaft-lining, and building a body of concrete around said shaft-lining.

10. A combined caisson and concrete pier adapted to be sunk through earth to form a foundation for buildings and the like and having a working-chamber of non-plastic material and a body of concrete molded in place thereon, said concrete forming the roof of said chamber.

11. A caisson having a working-chamber, and having a body of concrete, in combination with a coffer-dam W applied to the upper end of said body adapted to act merely as a retaining-wall and to be withdrawn when the earth surrounding it is excavated.

12. A caisson having a working-chamber comprising wall-plates F having flanges K, members H extending across said chamber at intervals, and a body of concrete supported by said flanges K and members H.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

DANIEL E. MORAN.
JOHN W. DOTY.

Witnesses:
EDWIN F. KELLOGG,
JAS. C. LOGAN.

Disclaimer in Letters Patent No. 828,761.

DISCLAIMER.

828,761.—*Daniel E. Moran*, Mendham, N. J., and *John W. Doty*, New York, N. Y. Caisson. Patent dated August 14, 1906. Disclaimer filed January 19, 1915, by *The Foundation Company*, assignee, by mesne assignments.

Enters this disclaimer as follows:

"Where the specification and claims refer to 'caissons' or 'a caisson' or 'piers or 'a pier' your petitioner disclaims all caissons or piers except pneumatic caissons and caissons or piers sunk on land for forming foundations for buildings on land."

[*Official Gazette, January 26, 1915.*]