

No. 806,755.

PATENTED DEC. 5, 1905.

F. SHUMAN.
PILE FOR PIERS OR PIER CASINGS.

APPLICATION FILED AUG. 20, 1905.

3 SHEETS—SHEET 1.

Fig. 1.

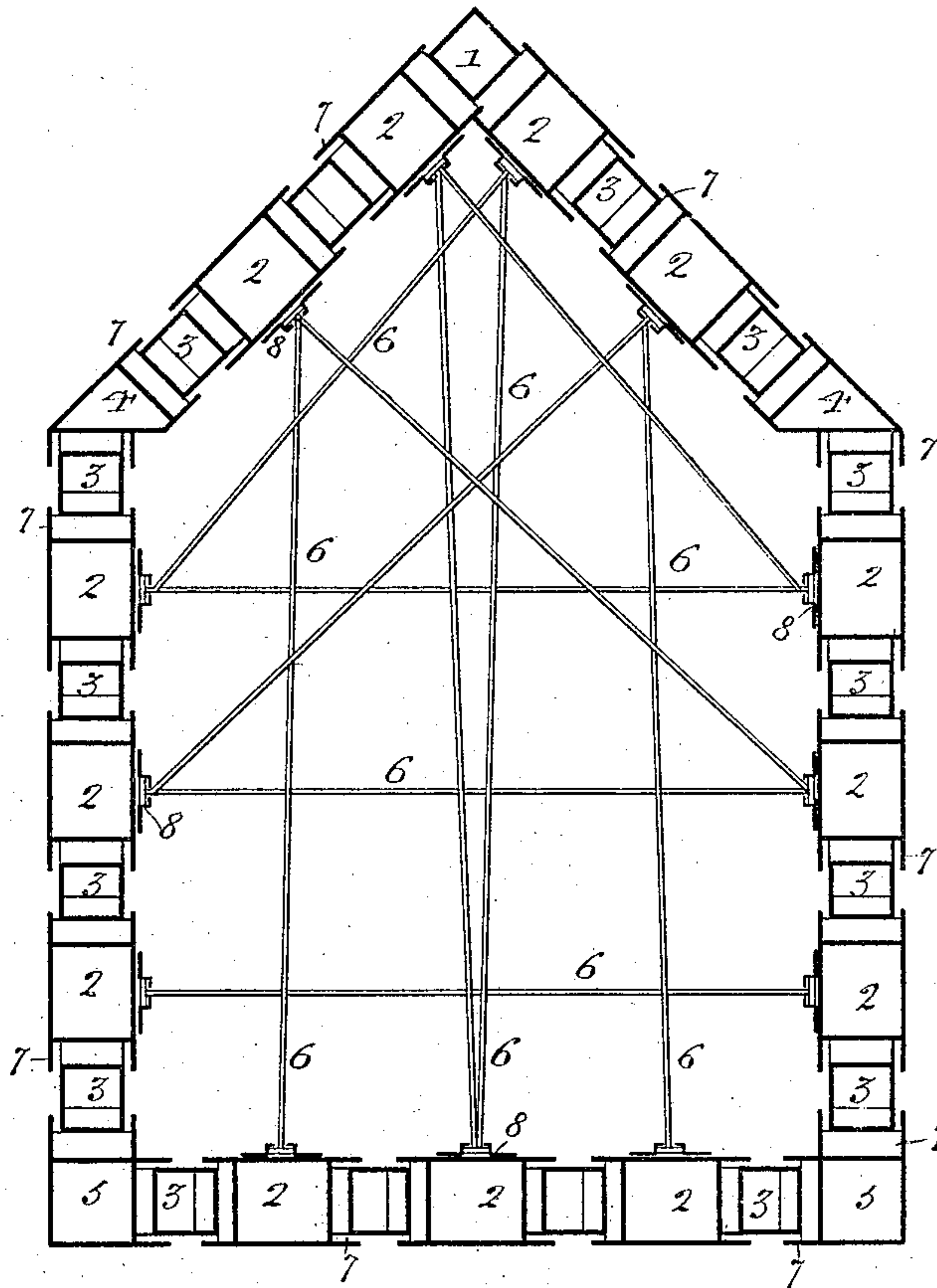
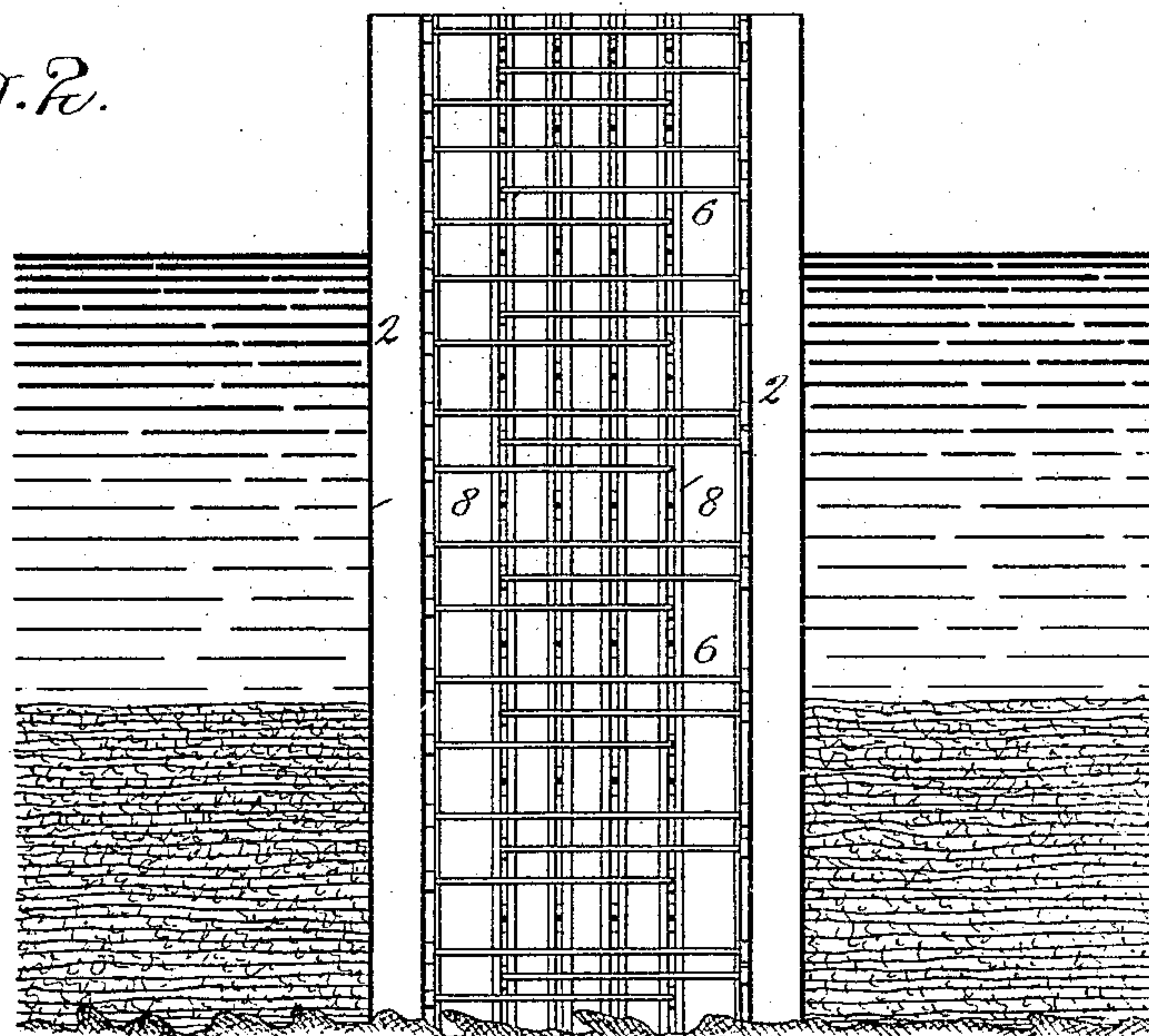


Fig. 2.



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By his Attorneys

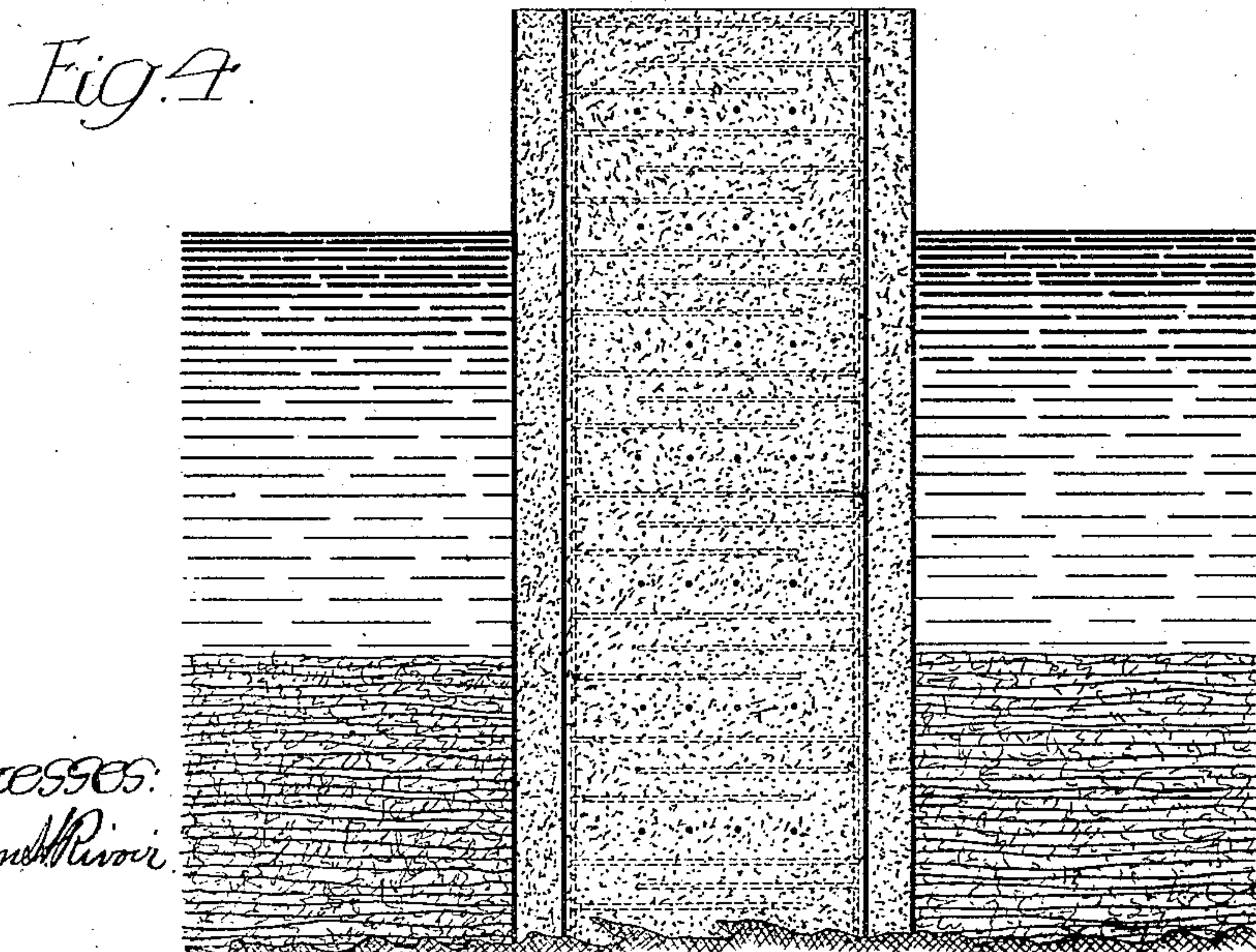
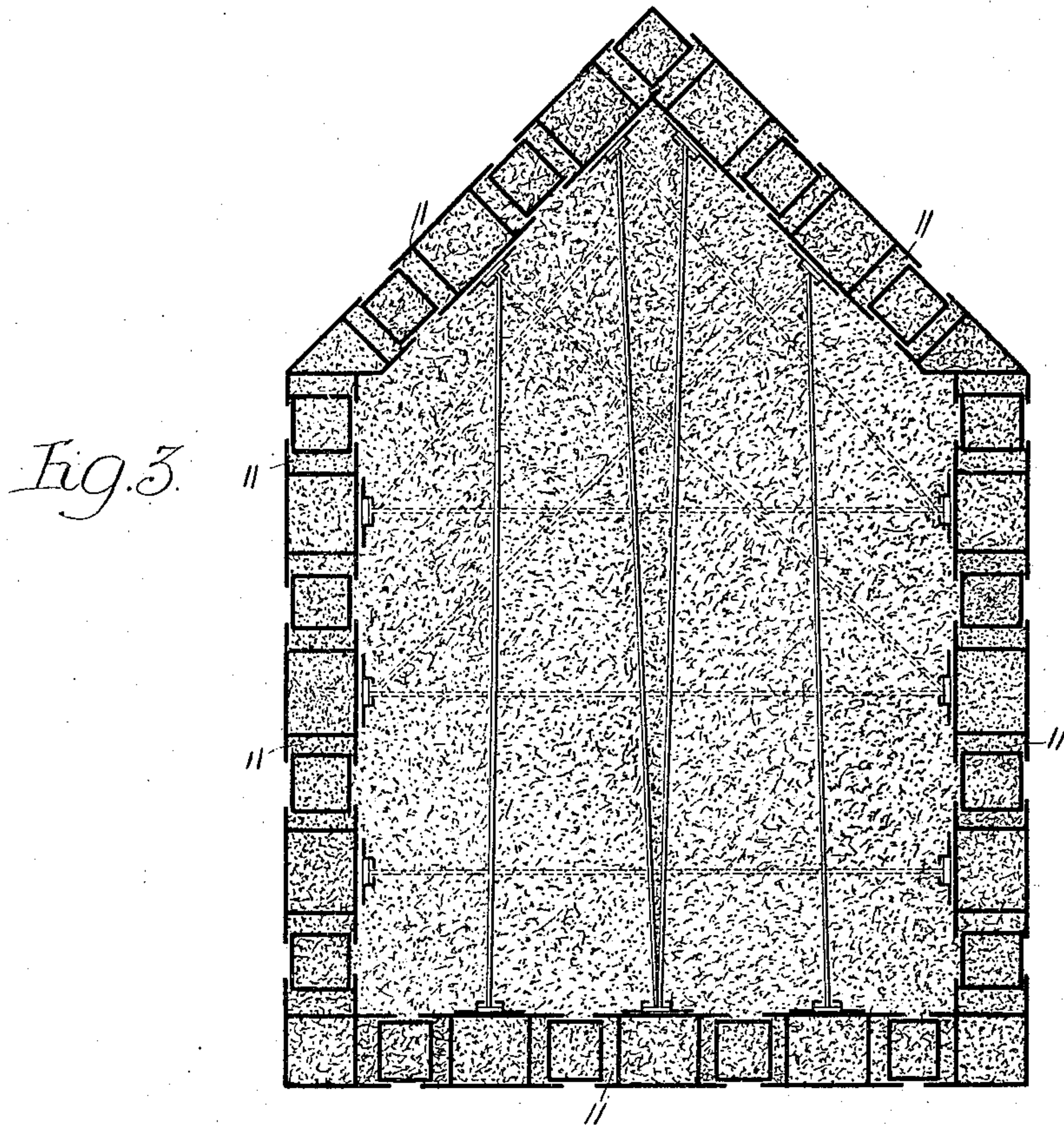
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 7.

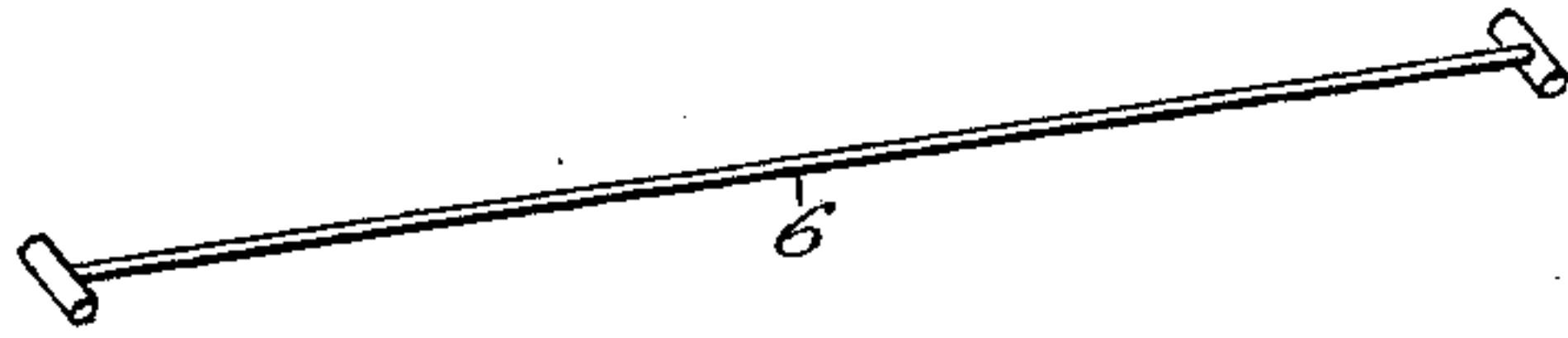


Fig. 8.

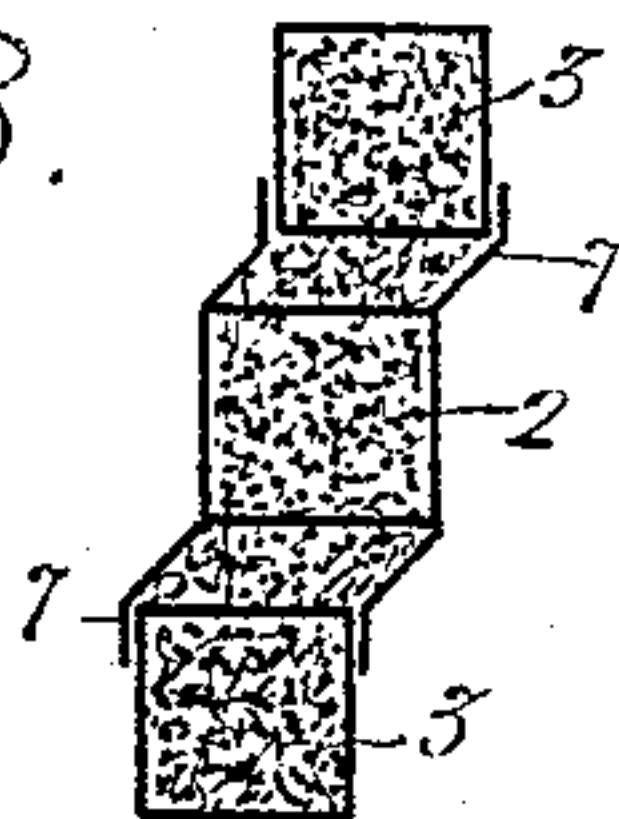


Fig. 6.

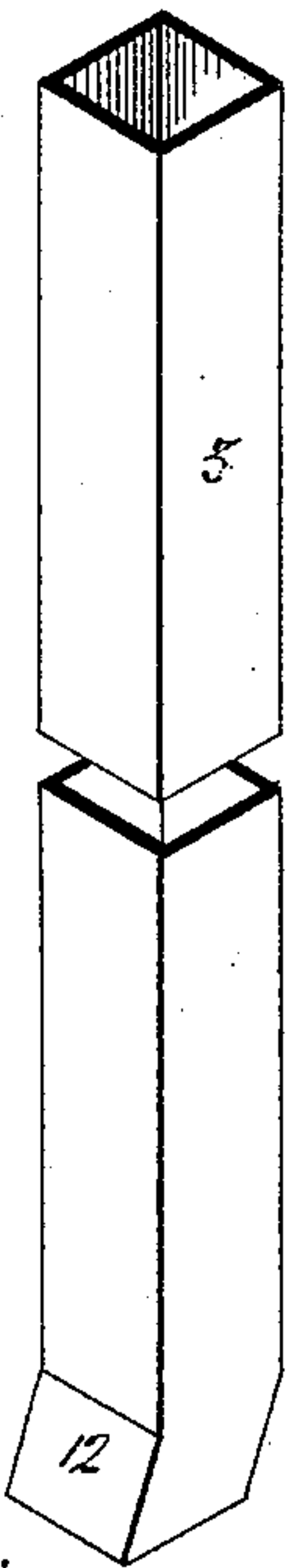
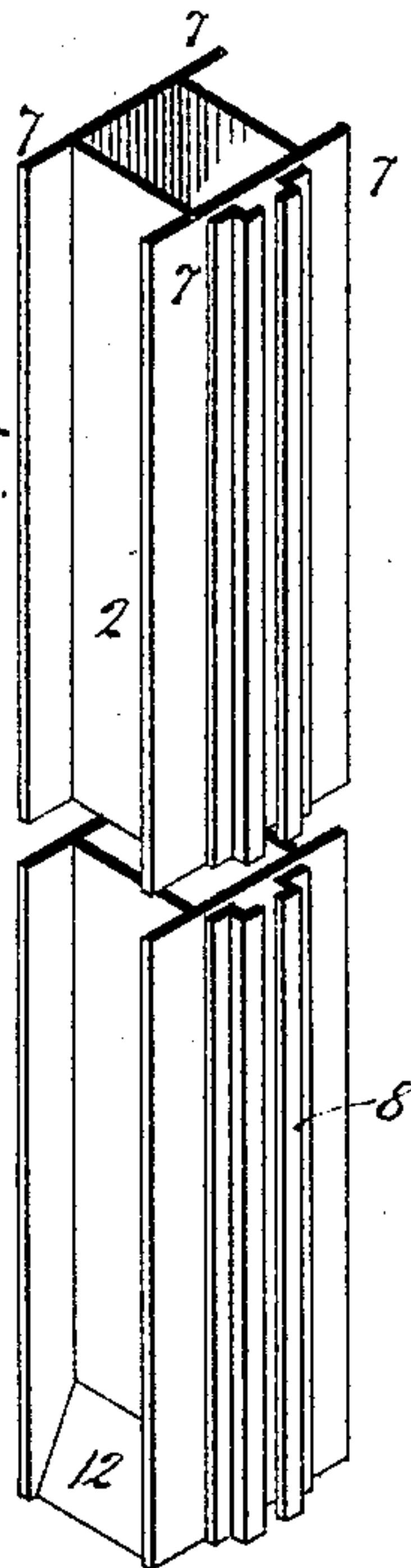


Fig. 5.



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UNITED STATES PATENT OFFICE.

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PILE FOR PIERS OR PIER-CASINGS.

No. 806,755.

Specification of Letters Patent.

Patented Dec. 5, 1905.

Original application filed April 21, 1904, Serial No. 204,238. Divided and this application filed August 20, 1904. Serial No. 221,547.

To all whom it may concern.

Be it known that I, FRANK SHUMAN, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Piles for Piers or Pier-Casings, (the same being a division of my application, Serial No. 204,238, filed April 21, 1904,) of which the following is a specification.

My invention consists of a pile intended for use in the construction of a pier or pier-casing for bridges or other structures, said pile being so constructed that the pier can be built upon bed-rock or other stable foundation at any desired depth without the necessity of using a caisson, air-lock, or pressure-chamber, and, if desired, without the necessity of sending any workmen below the water-level, the method of construction, moreover, being much cheaper and more expeditious than methods now in use and the resulting pier being of exceptional strength.

In the accompanying drawings, Figure 1 is a sectional plan view of a pier-casing constructed in accordance with my invention before the concrete or other filling has been introduced. Fig. 2 is a vertical sectional view of the same on a smaller scale. Figs. 3 and 4 are views similar to Figs. 1 and 2, but illustrating the completed pier. Figs. 5 and 6 are perspective views illustrating the piles used in constructing the pier-casing. Fig. 7 is a perspective view of one of the brace-rods, and Fig. 8 is a view illustrating a special form of pile.

In Fig. 1 of the drawings, 1, 2, 3, 4, and 5 represent different forms of metal tubes which may be employed in the construction of a pier in accordance with my invention, the tubes 1 and 3 being simple rectangular structures, the tubes 2 being rectangular in cross-section, but having projecting edge flanges on opposite sides, the tubes 4 being of triangular cross-section and having projecting edge flanges on two of their sides, and the tubes 5 being of rectangular cross-section and having projecting edge flanges on two of the sides which are at a right angle to each other. These metallic tubes may be of any desired length, depending upon the depth of the bed-rock or other permanent foundation beneath the water-level, and they are driven or sunk side by side through the mud or other soil overlying the bed-rock or foundation either by means of an ordinary pile-driver or by means of a water-jet or in any other available manner, the fact that the tubes are open at the bottom

facilitating such driving or sinking, although in carrying out my invention piles closed at the bottom may be used in place of such tubes, if desired.

The pier is started by first driving or sinking the tube 1 at the upstream point of the desired pier, and after the same has been driven tubes 2 and 3 are driven or sunk in alternation on each side of the same and on diverging lines until the necessary width for the finished pier has been approached, whereupon the triangular tubes 4 are driven, preparatory to the formation of the sides of the pier-inclosure by driving in alternation tubes 3 and 2, and when the desired length of the pier-inclosure has been attained the said inclosure is completed by filling up the end of the same by driving tubes 3 and 2 in alternation, as shown in Fig. 1. By means of the projecting sides or edge flanges 7 of the various tubes they are closely interlocked and held in proper alinement one with another during the driving operation and after the inclosure has been completed. If the pier is to be of simple rectangular cross-section, the special forms of tube or pile shown at 1 and 4 will not be required. After each tube has been driven or sunk to the proper foundation the soil or other material within the tube may be removed by jetting or in any other available manner, and each tube may then be filled from the foundation to the top with concrete, as shown in Figs. 3 and 4, or, if desired, the soil or other material through which the tube is sunk or driven to foundation may be permitted to remain in the tube, and the concrete may be filled in on top of the same, the water in either case being displaced upwardly as the level of concrete rises in the tube. The soil or other material within the pier-casing thus formed may now be removed down to bed-rock or other foundation by a suitable suction or other dredge without removing the water, so that said casing is not subjected to any external pressure tending to collapse the same, and after such material has been thus removed the various portions of the pier-casing may be tied together by suitable transverse longitudinal and diagonal rods 6, as shown in Figs. 1 and 2, these rods being readily introduced into place and secured to the desired tubes of the pier-casing without any under-water work by providing said tubes on their inner sides with grooved guides 8 for the reception of T-heads at the opposite ends of the tie-rods, so that said tie-rods can be dropped into proper

position from the top of the casing structure, suitable filling-blocks being introduced in order to properly separate vertically the successively-introduced sets of tie-rods or the T-heads of the latter being of a proper length for that purpose. The interior of the pier-casing is now filled with concrete suitably rammed, the water being gradually displaced as the concrete accumulates and stones and rubble-work being, if desired, thrown in with the concrete and such bolts or other connections being embedded in the latter as may be necessary to securely fasten the cap or superstructure to the pier. The pier thus constructed is practically a very strongly reinforced concrete monolith extending down to the bed-rock or other foundation and securely anchored thereto. Binding-cavities may be formed in the bed-rock by blasting or in any other manner adapted to the purpose if such cavities are not originally presented by the bed-rock and are considered necessary in order to firmly unite the pier therewith. The pier can be constructed without the use of any temporary caisson or any system of air-locking or pressure chambers and under perfectly normal conditions and without any risk, since it is not necessary for the workmen to go below the surface of the water at any time.

The economy of the construction will be evident when it is borne in mind that all of the tubes which constitute the pier-casing can be easily and quickly constructed at any bridge-works and that tubes of any desired length can be easily driven by any of the larger barge pile-driving machines, as the lower edges of the tubes offer very little resistance to such driving of the same. The strength of a pier constructed in this manner and provided with an outer reinforced casing securely tied to the central concrete body of the pier must, as will be evident, be much greater than that of any masonry pier, particularly when used as an ice-breaker. In the latter case the nose or point of the pier may be armored with timber or other desirable material.

Many of the advantages of my invention will be obtained if after constructing the pier-casing in the manner described the water is pumped out of the same and the material down to bed-rock or other foundation then removed in the same manner as now adopted in connection with piers of limited depth, such as can be constructed within an ordinary sheet-pile coffer-dam. In this case it becomes necessary to make the pier-casing water-tight, and for this purpose the spaces between the tubes may be filled with concrete, as shown at 11, these spaces as the piles are being driven being kept free from mud or soil by reason of the fact that each pile has each of its sides beveled at the bottom, as shown at 12, so that the downwardly-projecting beveled flange of that side of the pile which adjoins the previously-driven pile is as

each pile is driven caused to bear against said previously-driven pile, thus preventing the entrance of mud or soil into the space between the two piles. The casing having been rendered water-tight, the sides of the casing are braced by means of struts introduced in the same manner as the tie-bars 6 or by means of timber struts or braces, and the water is then pumped out and the material excavated down to the bed-rock or other foundation, the interior of the casing being then filled with concrete or with masonry work, as desired. In this case the struts or braces may be introduced as the water is being pumped out or the soil or other material is being removed down to bed-rock, and brackets or short guides may be used for connecting said struts or braces to the tubes or hollow piles of the casing instead of the long guides shown in Figs. 1 and 2. The struts or braces are removed as the concrete is filled in, or in the case of metallic struts or braces they may, if desired, be permitted to remain, so as to serve as a means of tying the casing to the concrete body of the pier. Even when this method is adopted all of the work can be done in the open air and without risk attending the use of caissons, airlocks, and pressure-chambers.

The flange 7 can, if desired, be bent so as to accommodate itself to tubes which are not in direct alinement one with another, as shown in Fig. 8.

In some cases it may not be necessary to fill with concrete the tubes of which the pier-casing is composed, although in most cases such filling of the tubes will be desirable in order to impart to said casing the desired strength and rigidity, and, if desired, any suitable form of metallic reinforce may be embedded in the concrete masses with which the tubes are filled.

In the case of long piers or wharf structures extending from the solid ground or from a bulkhead out into the water it may not be necessary to close the inner end of the pier-casing in the manner described, the opposite sides of the pier-casing abutting against the bulkhead or against the solid ground forming the bank or shore from which the pier projects, nor is it necessary in every case to use metallic tubes or hollow piles in carrying out my invention, as in some cases said tubes or hollow piles may be composed of planks or timbers properly secured together.

Although I prefer in carrying out my invention to fill with concrete or other material the tubes or hollow piles of which the pier-casing is composed before excavating the material within the casing, such filling of the tubes or hollow piles of the casing may, if desired, be deferred until such excavation has been completed, and the tubes or hollow piles may be filled with concrete at the same time that the space within the casing is being thus filled, or the filling of the tubes or hollow piles

of the casing may be deferred until after the latter has been filled with concrete.

Some of the features of my invention can also be adopted in the formation of coffer-dams which are intended to be removed after the pier has been constructed with the same, tubes open at the lower end being much superior to piles for such purpose, because if started straight they are free from that liability to deviation from a straight course which frequently causes trouble in building coffer-dams from ordinary sheet-piling.

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

15 1. A tube or pile for a pier-casing, having means for interlocking it with an adjoining tube or pile, and having on one side a longitudinal guide for the enlarged head of a tie or brace rod.

20 2. A tube or pile for a pier-casing having on one of its sides near the bottom a projecting flange for closing at the bottom the space between said pile and an adjoining pile.

25 3. A tube or pile for a pier-casing having one of its sides deflected at or near the bottom so as to close at the bottom the space between said pile and an adjoining pile.

4. A tube or pile for a pier-casing having

one of its sides deflected diagonally at or near the bottom, so as to close at the bottom the space between the said pile and an adjoining pile. 30

5. A tube or pile for a pier-casing having projecting flanges for overlapping an adjoining pile and having, on the side next to said pile, a projecting flange for closing at the bottom the space between the two piles. 35

6. A tube or pile for a pier-casing having projecting flanges for overlapping an adjoining pile, and having that side next to said adjoining pile deflected at or near the bottom so as to close at the bottom the space between the two piles. 40

7. A tube or pile for a pier-casing having projecting flanges for overlapping an adjoining pile, and having that side next to said adjoining pile deflected diagonally at or near the bottom so as to close at the bottom the space between the two piles. 45

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses. 50

FRANK SHUMAN.

Witnesses:

WALTER CHISM,
JOS. H. KLEIN.