No. 772,100. PATENTED OCT. 11, 1904.

H. C. HOLMES.

PILE AND WHARF SUPPORTING STRUCTURE.

APPLICATION FILED APR. 20, 1904.

NO MODEL.

FIG. 3.

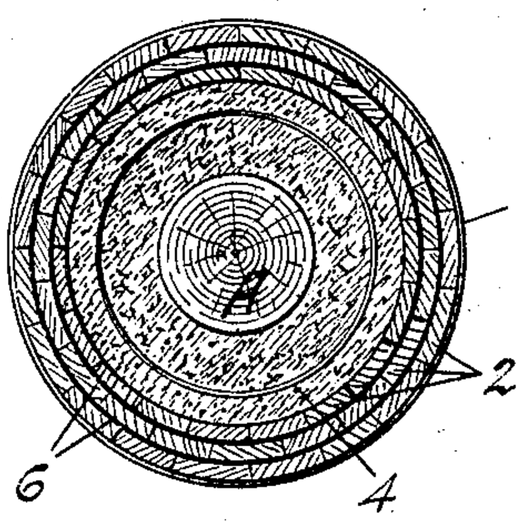

FIG. 4.

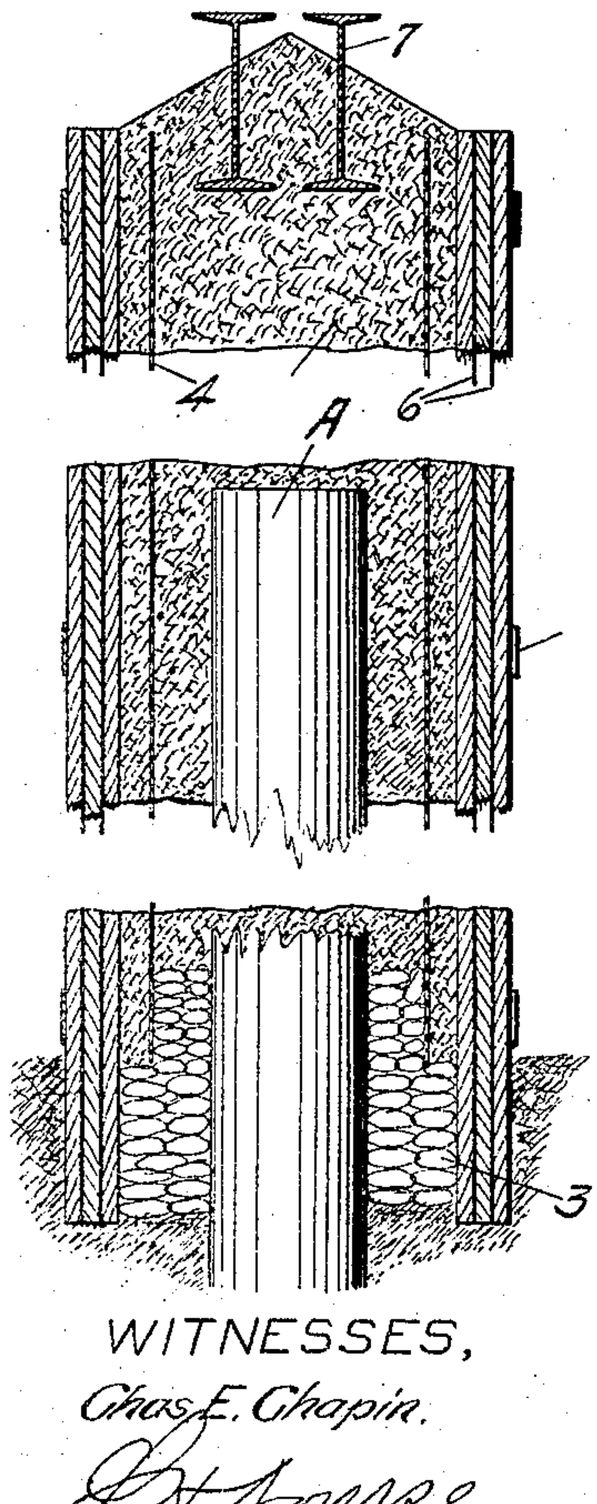

FIG. 1.

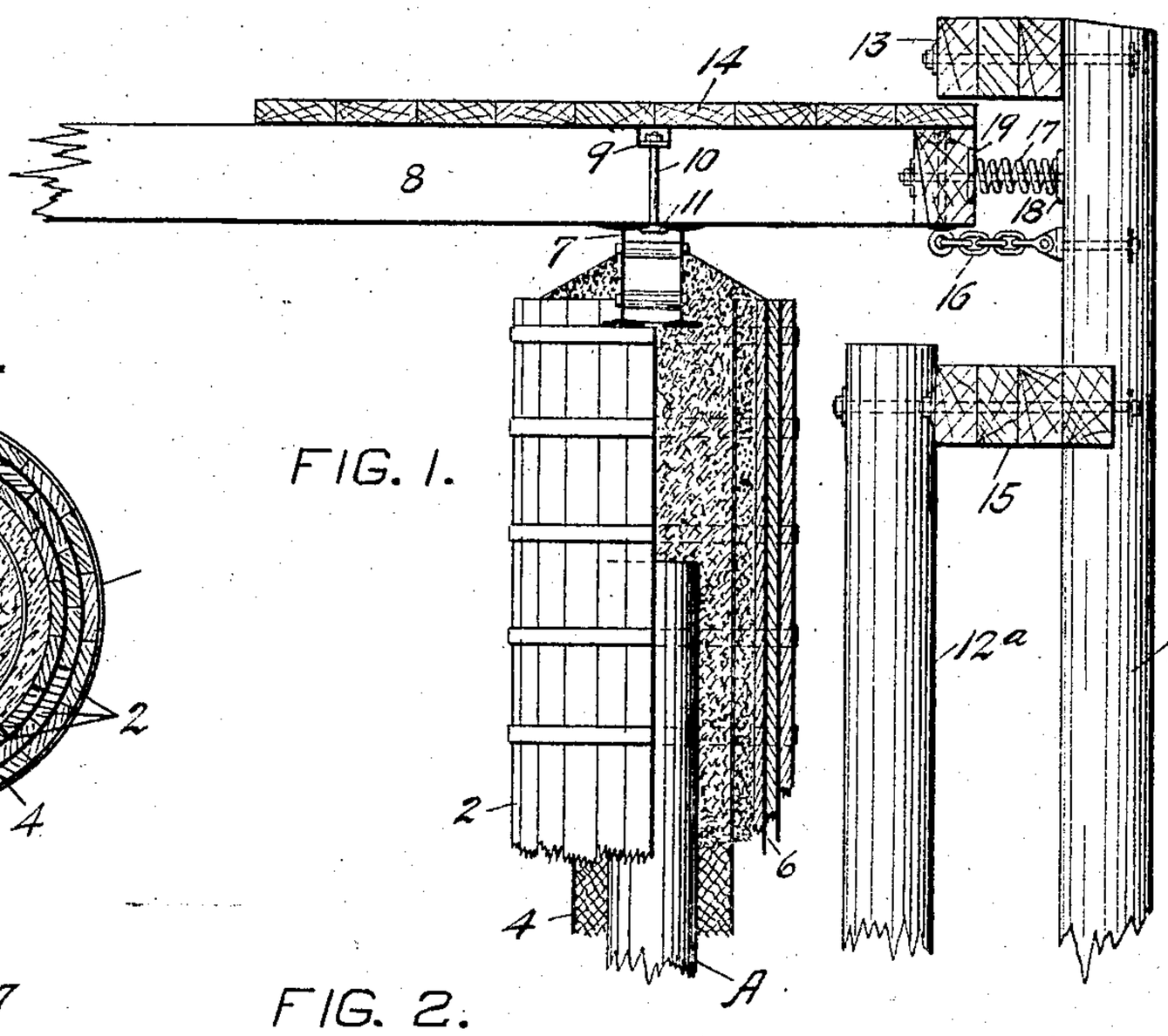

FIG. 2.

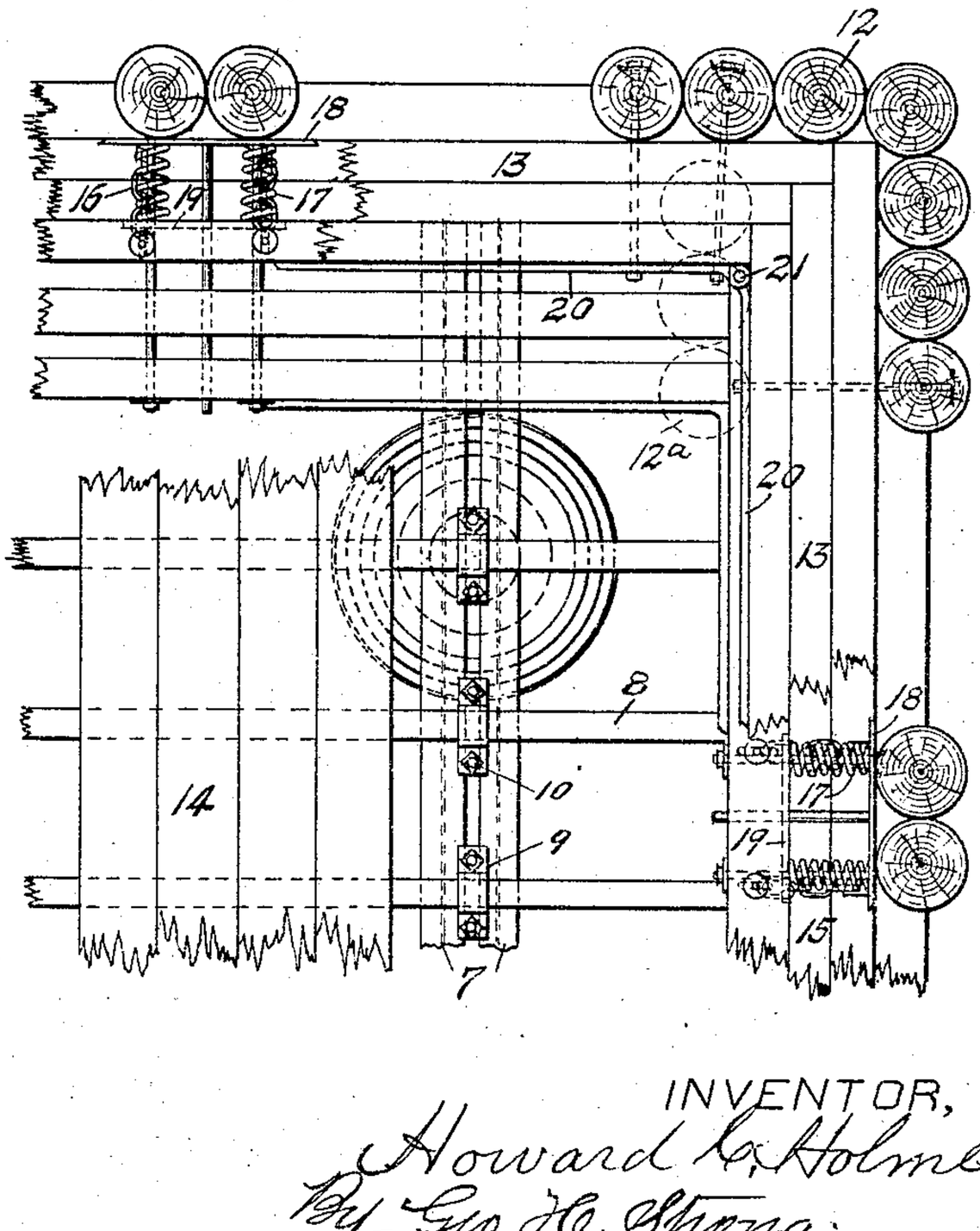

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PHOTO-LITHOGRAPHED BY SACKETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 772,100. Patented October 11, 1904.

UNITED STATES PATENT OFFICE.

HOWARD C. HOLMES, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-HALF TO CARL UHLIG, OF SAN FRANCISCO, CALIFORNIA.

PILE AND WHARF SUPPORTING STRUCTURE.

SPECIFICATION forming part of Letters Patent No. 772,100, dated October 11, 1904.

Application filed April 20, 1904. Serial No. 204,054. (No model.)

To all whom it may concern:

Be it known that I, HOWARD C. HOLMES, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Pile and Wharf Supporting Structures, of which the following is a specification.

My invention relates to improvements in the construction of wharves and like structures.

In the accompanying drawings, Figure 1 is transverse section. Fig. 2 is a plan view of wharf-corner. Fig. 3 is a horizontal section of concrete cylinder. Fig. 4 is a vertical section of same.

In a former patent, No. 646,553, issued to me April 3, 1900, I have described a wharf construction in which clusters of piles are driven so that their upper ends are at different levels, and these clusters are surrounded by an exterior casing with an intermediate filling of concrete and a strengthening bond of expanded metal, wire screen, or other metal structure and a means by which the wharf or floor built upon said substructure is protected from injury by fender-piles connected directly with the wharf and having intermediate elastic springs.

My present invention is designed as an improvement upon my former construction.

Where piles are driven in deep soft mud, it is found that a plurality or cluster of piles united together, as in my former patent, afford a better support than ordinary single piles, because the increased surface presented to the mud greatly increases the skin friction or adhesion between the mud and the piles, and this skin friction in such cases is found sufficient to support heavy structures without the piles sinking farther into the mud even although no solid bottom is reached.

My present invention is designed more particularly to be used where more or less hard ground or solid bottom can be found and in which it is not necessary to use a cluster of piles, but in which I use a single pile driven into the bottom and the surrounding inclosing casing with the filling of concrete and metal bond will answer the purpose required.

As shown in the drawings, A is a pile of suitable length and diameter, which is driven into the mud or earth at a point where its services are needed. Around this pile is a casing 2, consisting of wooden staves bound together by hoops and of sufficiently large interior diameter to leave a considerable space around the interior pile, as described in my former patent. This cylinder is of such length that it may be sunk around the pile with the lower end submerged in the mud on the outside. A filling of concrete is then prepared by pumping out a considerable portion of the water within the cylinder, the mud around the outside preventing any additional inflow, and the space thus formed is filled with concrete, which is mixed with water, or by partially filling burlap sacks 3 and packing them firmly within the cylinder. These sacks are preferably tamped in place and a filling of concrete introduced between and above them until the said filling has been brought to the proper height, when it is allowed to stand sufficiently long to set. The concrete filling is preferably brought to a point sufficiently high to cover the tops of the piles or to the top of the exterior casing. The strength of this filling may be increased by means of a bond consisting of some form of expanded metal, wire screen, or other metal structure 4, which may be embedded in the concrete as the filling proceeds, as in my former patent. In this manner a compound structure is produced comprising the single pile extending down into the mud bottom and the inclosing cylinder with its filling of concrete, the latter forming a shoulder which rests upon the mud and acts as an additional support dependent upon the area of the base of this enlarged concrete inclosure.

The inclosing cylinder may be made of a single set of staves bound together by hoops, as specified in my former patent; but in the present case I prefer to make them of laminated form—that is to say, of two or more concentric series of staves with interposed layers of ship-felt, tarred paper, or equiva-

lent material. In Figs. 1, 2, 3, 4 I have represented three such series, (indicated by the numeral 2.) The interposed material between the series of staves is represented by 6. The object of this laminated structure is to take advantage of the fact that marine insects will not cross open spaces or cracks. This form of casing may be used with cluster piles as well as with single piles. The superstructure, which rests upon these piles, may consist of I-beams 7, which I have here shown as placed closely together, and the wharf-stringers 8 extend transversely across these I-beams and are held in place by means of yokes 9, passing over the top of the stringers, and the extensions have holes made to receive bolts 10, the lower ends of which have T-heads, as shown at 11. The lower ends of these bolts lie between the flanges of the I-beams 7, and the T-heads extending beneath these flanges prevent the bolts from being withdrawn and allow nuts to be screwed upon the upper ends of the bolts, thus clamping the yokes and the stringers firmly into place.

In order to prevent a wharf structure of this character from being injured by exterior pressure, such as by vessels striking the wharf, I have shown fender-piles 12 12^a, the piles 12 extending up above the level of the wharf and having timbers 13 bolted to them and extending just above the wharf-planking 14. Beneath the I-beams of the wharf other timbers 15 are bolted through the piles 12 12^a, the latter piles being sufficiently shorter, so that they do not extend quite up to the bottom of the wharf. Any pressure against the exterior of these fender-piles will cause them to sway in and out, and the timbers 13 and 15 are movable without actual pressure upon the wharf. To limit the outward movement of these piles, I have shown chain or flexible connections 16, the outer ends of which are shackled or otherwise connected with the pile, and the inner ends are connected with eyebolts secured to the wharf structure, as shown. This flexible connection allows of a variety of independent movements of the piles 12 12^a without danger of breaking the connection, which if dependent upon rigid bolts might be injured by transverse strains.

Between the outer fender-piles 12 and the stringers or other portion of the wharf structure are strong springs 17. These springs may be in the form of heavy car-springs or other equivalent construction, and their inner ends rest against the wharf-timbers, while the outer ends abut against and are connected with plates, as at 18, by means of bolts interior to the springs. The inner ends of the springs may also rest against similar plates 19, fixed to the wharf structure, so that the springs 17 and plates 18 and 19 are only allowed movement due to the compression and extension of the springs.

The piles 12, resting against the outer surface of the plates 18, may slide upon these plates in the direction of their length, and the bolts will not be subject to bending or breaking, as in the case where the bolts which pass through the springs are fixed directly in the piles. The object of this will be understood by noting the corner of the wharf where the pressure of a ship or other contacting body may be applied against either side.

In order to connect the timbers attached to the fender-piles at the corner so that they will all yield and move in unison whenever pressure is brought upon either side, I have shown heavy plates 20 fixed to the fender-timbers, and these plates are united at their meeting angles by hinges, as at 21, so that while these hinges maintain the connection between the timbers they will yield and allow any distortion of the frame caused by pressure upon either side of the structure, and the sliding of the fender-piles upon the plates 18 of the meeting side will allow of this movement without any danger of breaking or distorting the bolts which support these plates and the springs.

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

1. In a wharf or like structure, supports each consisting of a single pile driven into the mud bottom, an inclosing casing of larger diameter concentric with and surrounding each single pile and having its lower end embedded in the mud, a filling of concrete between the pile and the casing, and a metal bond of expanded metal or like structure embedded in the concrete.

2. In a wharf or like structure, supports each consisting of a single pile driven into the mud bottom, an inclosing wooden casing of larger diameter concentric with and surrounding each single pile and having its lower end embedded in the mud, a filling of concrete between the pile and the casing, and a metal bond of expanded metal or like structure embedded in the concrete.

3. An inclosing casing for a pile consisting of a plurality of layers of wooden staves fastened together and having interposed between two such adjacent layers ship-felt, tarred paper or similar material.

4. In a wharf or like structure, supports consisting of piles driven into the mud bottom, inclosing casings of larger diameter surrounding the driven piles and consisting of a plurality of layers of wooden staves fastened together, and a filling of concrete between the piles and the interior surface of the casing.

5. In a wharf or like structure, supports each consisting of a single pile driven into the mud bottom, inclosing casings of larger diameter surrounding the single driven piles and consisting of a plurality of concentric layers of wooden staves fastened together, a filling of concrete between the piles and the interior

surface of the casing, and a metal bond of expanded metal or like structure embedded in the concrete.

6. In a wharf or like structure, supports formed of driven piles, an inclosing casing of larger diameter with a filling of concrete surrounding the upper part of each pile, a superstructure consisting of I-beams in pairs resting upon the piles, stringers laid transversely upon the I-beams, and means for securing the stringers to the beams, said means consisting of yokes crossing the beams, and bolts passing through said yokes, said bolts having T-heads adapted to interlock with the upper flanges of the I-beams.

7. A wharf structure comprising piles driven singly, each having a surrounding casing and filling of concrete, a flooring supported upon said piles, independent rows of fender-piles driven exterior to and at a distance from the rigid portion of the wharf, flexible connections between said piles and the wharf and springs interposed between the piles and the wharf.

8. The combination with a wharf of lines of fender-piles driven exterior to and at a distance from the edge of the wharf, timbers bolted to said piles above and below the wharf and independent thereof, springs fixed in pairs to the wharf structure, plates to which the outer ends of the springs are secured, against which the fender-piles are independently movable, and flexible ties connecting the fender-piles to the wharf-timbers.

9. In a wharf or like structure, supporting-piles, fender-piles driven exterior to and at a distance from the edge of the wharf or like structure, springs fixed to the wharf or like structure, having exterior plates against which the fender-piles are movable, longitudinal timbers bolted to the fender-piles, and movable in unison therewith and hinge-plates fixed to said timbers at the corners formed by meeting angles.

10. Fender-piles driven exterior to and inclosing the angles of a wharf structure, timbers bolted to said piles and movable in unison therewith and independent of the wharf and flexible hinged connections uniting the meeting angles of said timbers.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

HOWARD C. HOLMES.

Witnesses:
HENRY C. DROGER,
S. H. NOURSE.