No. 646,553. Patented Apr. 3, 1900.

H. C. HOLMES.

WHARF CONSTRUCTION.

(Application filed Dec. 21, 1899.)

(No Model.)

Fig. 1.

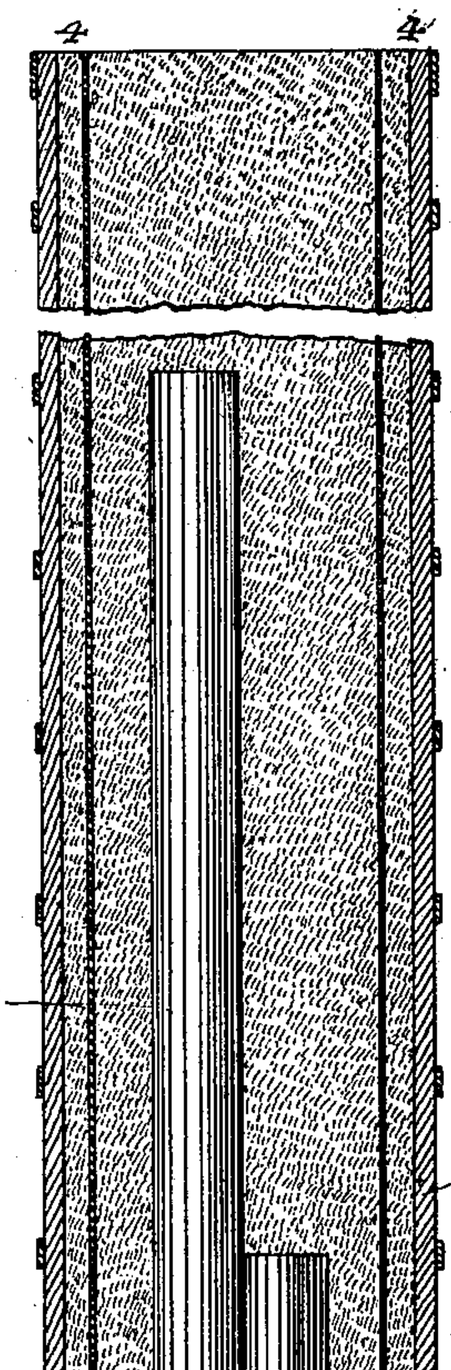


Fig. 2.

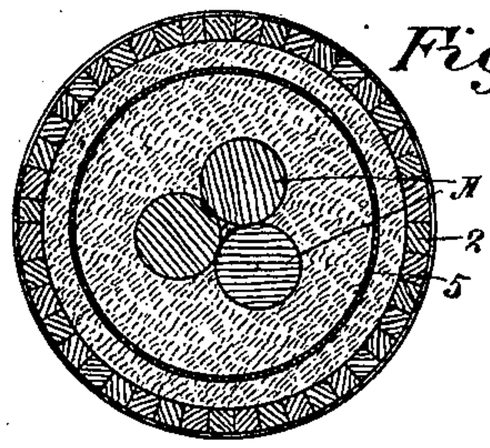


Fig. 5.

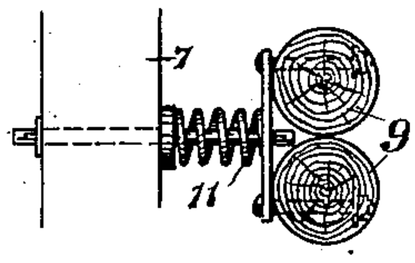


Fig. 3.

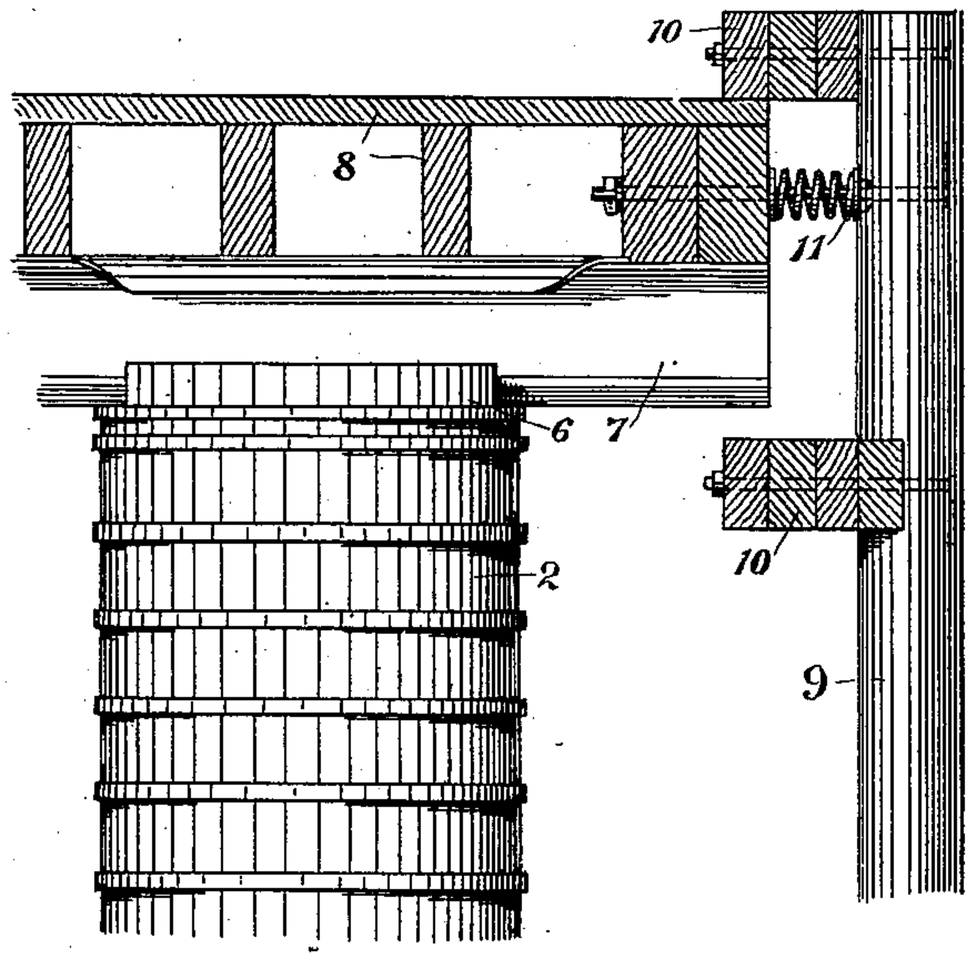
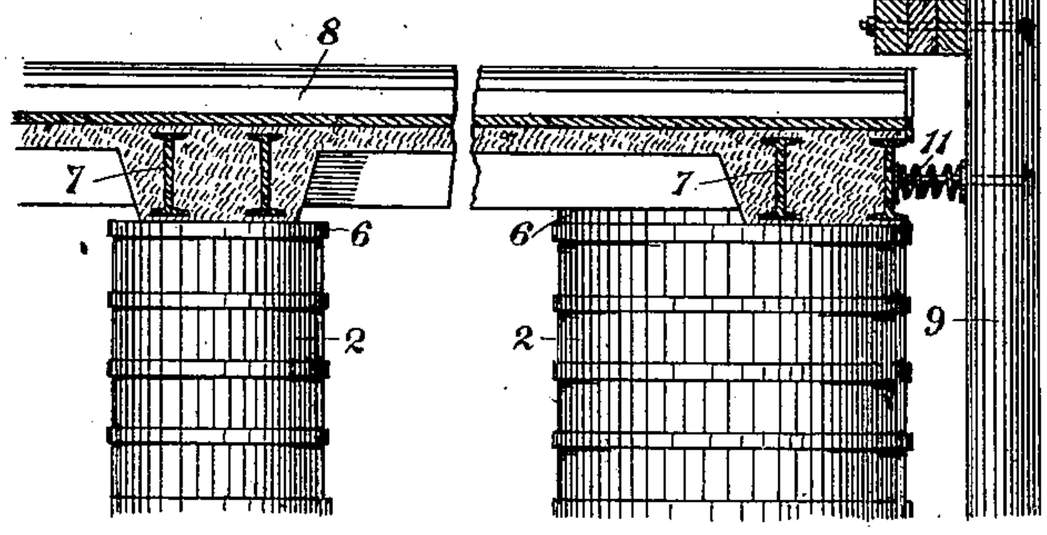


Fig. 4.



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UNITED STATES PATENT OFFICE.

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

WHARF CONSTRUCTION.

SPECIFICATION forming part of Letters Patent No. 646,553, dated April 3, 1900.

Application filed December 21, 1899. Serial No. 741,105. (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, State of California, have invented an Improvement in Wharf Constructions; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to improvements in the construction of wharves and like structures; and its objects are to provide a stronger and more permanent foundation than can be had by the use of single piles as usually driven and to provide a means for protecting the wharf from the shocks caused by vessels or other floating objects striking against it.

It consists in novel details of construction, which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a vertical section through one of the cylinders. Fig. 2 is a horizontal section of the same on line *y y* of Fig. 1. Fig. 3 shows a corner of the finished wharf with wooden superstructure and fender. Fig. 4 is a similar view showing concrete flooring. Fig. 5 is a plan view of fender-piles and spring.

In the usual construction of wharves and like structures it is customary to drive piles made of wood or iron singly in lines, which piles may be variously protected in their isolated condition, and upon the foundation thus formed is fixed a superstructure of caps with stringers and a covering which forms the floor of the wharf. In my invention I first drive piles A, of suitable length, in clusters of three, which are driven as closely together as possible, and these clusters of piles are suitably spaced and driven in the proper lines to produce the required length and breadth of the finished structure. As the expense of piles, especially when long, is very considerable, I drive these piles to different depths, and thus economize on the length of the piles. The first pile may be driven, for instance, with its top fifteen feet below the city-base or wharf-level. The next will be driven ten feet below, and the third five feet below said base. I do not limit myself to these particular differences; but the object is to drive the piles so that the the upper ends are at different levels below the city-base. This has two advantages—first, I am enabled to use shorter piles, of which the upper ends are at successively-lower levels, and, secondly, the bond which is formed by the surrounding structure, as hereinafter described, will be more solid and complete. These piles being driven as shown at A, the clusters of piles are then surrounded by cylinders 2, which may be made of iron, steel, or of wooden staves, bound together by hoops, so as to provide an interior diameter sufficiently larger than that of the clusters of piles to receive the proper filling of concrete or equivalent protective and strengthening material. Thus if the piles A are fourteen inches in diameter the interior diameter of the inclosing cylinders may be approximately four feet. These cylinders are made of sufficient length to enable them to be sunk around the clusters of piles, so that the latter are essentially in the middle of the cylinders. The mud is then pumped or otherwise removed from the interior of the cylinders until the bottom is at a depth of at least two feet below the surface of the mud on the outside. Burlap bags 3 are then filled to about half their capacity with properly-mixed concrete made with broken stone or cement and the bags sewed up. Before placing the bags in the cylinders cement is put into the water in the cylinders, they having been pumped out, and this cement is thoroughly mixed with the water which is left in the cylinders. The partially-filled sacks are then introduced and sufficient additional quantities of cement are used during the process to assure the complete filling of the voids between the sacks. The sacks 3 are thoroughly tamped, and after the filling is brought to the proper height it is allowed to stand sufficiently long to set, as forty-eight hours. The remainder of the cylinders is then filled with loose concrete, the cylinders being properly stayed and kept in position, and the concrete is filled into the cylinders, inclosing and covering the tops of the piles up to the top of the cylinder, as shown at 4.

As a further bond and strengthener of the structure, I embed in the concrete at a point intermediate between the piles and the inner peripheries of the cylinders some form of expanded metal, wire screen, or other metal

structure 5 into and through which the concrete may pass, so that this structure will be thoroughly embedded within the concrete. This surrounding cylinder of open-mesh metal will preferably lie about three or four inches from the outer periphery of the concrete cylinder which has been built up within the outer inclosing cylinder. The concrete thus fills into the interstices between the piles and covers the top of the two lowermost, respectively, as the filling proceeds, thus increasing the body of concrete in proportion as the pile-bodies are diminished by reason of one being shorter than the other, and the filling is finally continued above the top of the uppermost pile, as stated. This construction provides for strong and well-protected supports for the wharf and overcomes the objection to the use of single piles, which it is not practicable to coat after they have been driven, and no previously-applied coating will stand the shocks of driving piles. Whenever the outer inclosing cylinders are destroyed, the body of concrete which remains is of sufficient size to thoroughly protect the piles within, and it cannot be cracked or broken by any of the ordinary forces or strains to which the wharf is subjected. This portion of the structure being completed, caps 6 are fixed upon the top after it is properly leveled, and stringers 7 are laid across these caps. The wharf-planking 8 is then laid upon the stringers.

It will be manifest that the floor structure of the wharf may also be made by the use of steel I-beams embedded in or coated with concrete and a floor-surface made of concrete of sufficient thickness, with a final top coating of asphaltum or similar surfacing material.

In order to protect the structure thus formed from the strains which are caused by vessels striking heavily against the wharf and other similar actions, fender-piles 9 are driven around the outside of the wharf and at some distance away from it, say 12 inches, more or less. Timbers or ribbing 10 are bolted to these fender-piles below the wharf structure, and similar timbers are bolted to the fender-piles above the floor or surface of the wharf, these timbers being independent of the wharf and movable with relation thereto in unison with any movements which may be imparted to the fender-piles. These upper connecting-timbers serve in the place of the chocks or guard-timbers, which are usually bolted directly upon the top of the floor-planks of the wharf around the edges thereof; but in the present case, being connected with the fender-piles and independent of the wharf, they are movable over the latter for such short movements as may be imparted to them and their supporting-piles whenever vessels strike against the fenders. In order to increase the elasticity of this fender structure, heavy coiled or equivalent springs 11 are fixed between the fender-piles and the wharf structure, so that they will be compressed by pressure against the fenders and will be extended whenever the pressure is released, thus adding their elasticity to that of the fender-piles to return the surrounding structure to its normal position after pressure upon it has been relieved. These springs may be kept in place by long bolts passing through the piles and through the stringers or some suitable portion of the wharf structure, and it will be manifest that by reason of the connection of this surrounding fender structure any pressure upon one part of it will be to a great extent communicated so as to be resisted by all portions and the wharf thoroughly protected from injurious pressure and shocks.

While the cylinders which inclose the piles and concrete may be of any convenient material, I prefer to make them of heavy wooden staves hooped or bound together, because the skin friction of this large wood surface embedded in the mud adds greatly to its ability to support the wharf structure.

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

1. In a wharf or like structure, supports consisting of piles of different lengths and driven in clusters whereby their upper ends are at different distances below the wharf-level, inclosing cylinders fitting over each cluster and sunk into the mud and a filling of concrete intermediate between the cylinders and the piles and covering the heads of the latter.

2. In a wharf or like structure, supports consisting of piles driven with their upper ends at different distances below the wharf-level, inclosing cylinders of larger interior diameter than the circumference of the clusters, a filling of concrete intermediate between the piles and the interior of the cylinders, and a structure of expanded metal or like mesh embedded in the concrete and surrounding the piles.

3. In a wharf or like structure, supports consisting of piles driven in clusters with an exterior inclosing cylinder extending from below the mud to a point above the tops of the piles, a foundation formed of concrete inclosed in bags and tamped into the bottom of the cylinders, a filling of concrete extending from said foundation upwardly to a point above the tops of the piles and within the exterior cylinders and a bond of expanded metal or like mesh embedded in the concrete.

4. In a wharf or like structure, a support consisting of piles of different lengths driven in clusters, whereby their upper ends are at different distances below the wharf-level, an exterior cylinder extending from the mud to a point above the piles, a body of concrete filled into the cylinders and inclosing and covering the piles, and caps, stringers and flooring of the wharf supported upon the pillars thus formed.

5. In a wharf or like structure, pillars or supports formed of piles driven in clusters, a surrounding body of concrete and exterior inclosing cylinders, caps, stringers and flooring

supported thereon, fender-piles driven at a distance outside of the wharf-line and springs interposed between the upper ends of said piles and the wharf.

6. In combination with a wharf of a line of fender-piles driven exterior to and at a distance from the edge of the wharf ribs or timbers bolted to and connecting said fender-piles above and below the wharf and independent thereof, and springs intermediate between the fender-piles and the edge of the wharf substantially as described.

7. In a wharf or like structure, supports consisting of piles of different lengths driven in clusters whereby their upper ends are at different distances below the wharf-level said piles embedded in concrete, and an inclosing wooden cylinder, the lower end of which is embedded in the mud.

8. An improved wharf comprising supporting-piles driven in clusters and embedded in concrete, and an inclosing wooden cylinder sunk around the piles, and having its lower end embedded in the mud.

In witness whereof I have hereunto set my hand.

HOWARD C. HOLMES.

Witnesses:
S. H. NOURSE,
JESSIE C. BRODIE.