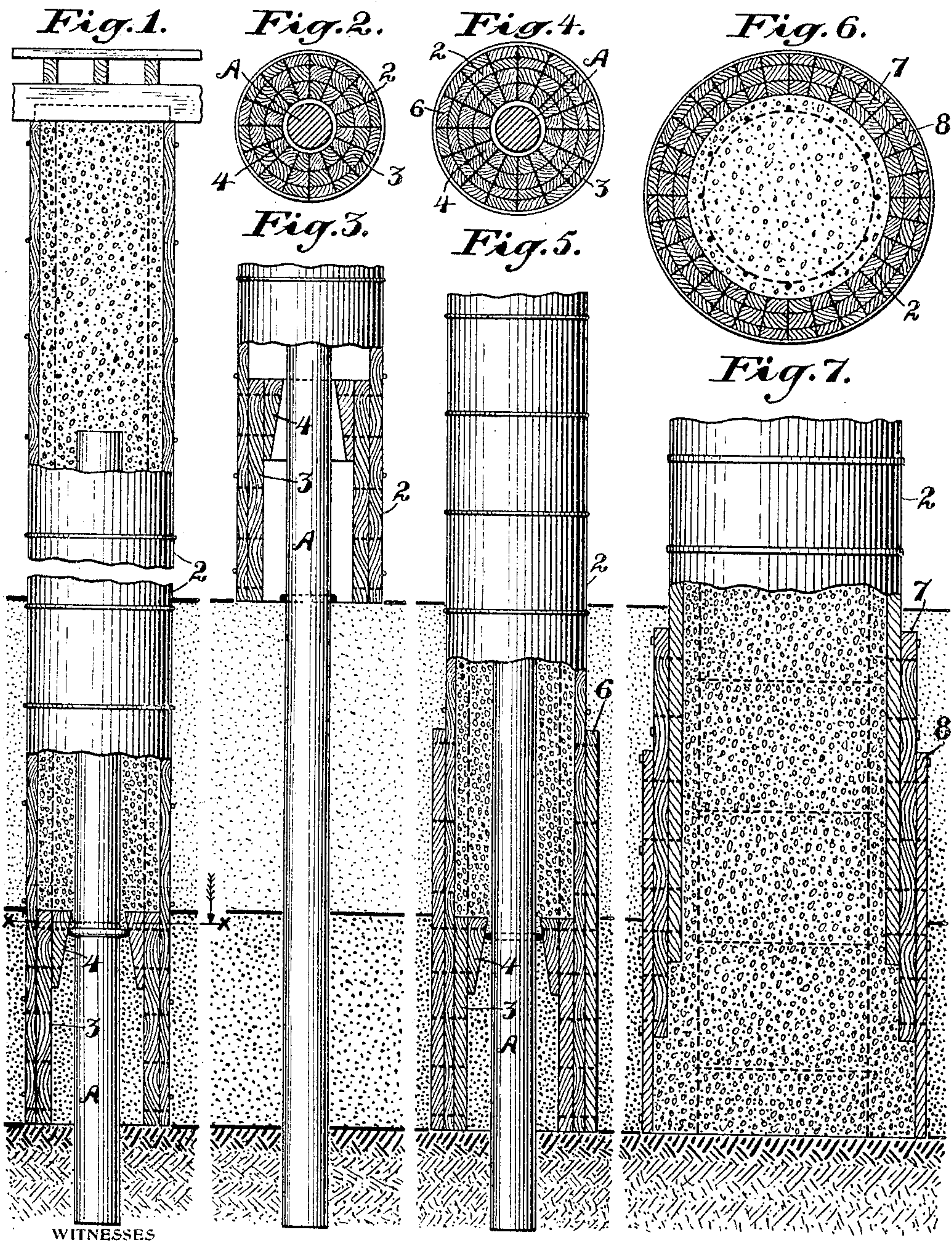


920,061.

Patented Apr. 27, 1909.



*J. C. Friedner*  
*Witness*

INVENTOR  
*Howard C. Holmes*  
 BY *Geo. H. Strong*  
 ATTORNEY.



# UNITED STATES PATENT OFFICE.

HOWARD C. HOLMES, OF SAN FRANCISCO, CALIFORNIA.

## PILE STRUCTURE.

No. 920,061.

Specification of Letters Patent.

Patented April 27, 1909.

Application filed July 20, 1908. Serial No. 444,411.

*To all whom it may concern:*

Be it known that I, HOWARD C. HOLMES, 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 Structures, of which the following is a specification.

My invention relates to improvements in pile and similar devices, such as may be employed to provide a foundation for the support of wharves, and like or equivalent structures.

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

Figure 1 is an elevation and partial section with the parts in final position. Fig. 2 is a horizontal section through  $x-x$  of Fig. 1. Fig. 3 is a view showing the position of cylinder before driving. Figs. 4, 5, 6 and 7 are modifications of the device.

Where piles are driven in mud, and especially where the mud is deep and soft, dependence must be had upon what is termed "skin friction", or that quality of the mud which causes it to adhere so continually to the surface as to form in a great measure a sufficient support for the piles, and the structure carried thereby.

It is the object of my present invention to take advantage of this skin friction, and to increase its effectiveness.

A represents a pile which may be driven into the mud or earth at any point where its services are desired. Around this pile is fitted a casing 2 which is adapted to receive a filling of concrete. This casing may be made of any well known, suitable, or desired material. It may be made as here shown of wooden staves, bound together by hoops, and it has a sufficiently large interior diameter to leave a considerable space around the pile to receive a filling of concrete. Within the casing 2 I form cylinders 3 and 4 also constructed of wooden staves, and securely fastened to the main cylinder with carriage bolts. These cylinders are of such length as to extend from the bottom of the outer casing upwardly. In the present case they are shown as extending from the solid bottom up to the line of the stiff mud of the submerged surface. The cylinder 4 is preferably made as shown of wedge-shaped staves, converging from the bottom upwardly so that its interior has a diameter but slightly

larger than that of the interior pile. The pile having been driven to the proper depth, the casing is then driven or forced down until its lower end rests upon the solid bottom. The interior cylinder 4 acts during the driving to force the soft mud down, and thus leave the space above these interior cylinders substantially free for the subsequent filling of concrete, and without the necessity of pumping, hydraulicing or otherwise removing this interior mud. In order to insure this action, I have found a very suitable means is to fit a gasket of some description, either of old rope, oakum tule or other pliable fabric, closely around the pile, and allow it to drop until it rests on the mud. The wooden cylinder then being placed over the pile, and driven to the solid foundation, will force the mud out, and as the part 4 is but slightly larger than the pile, it forms a guide to hold the pile substantially concentric with the cylinder. When the cylinder enters the mud the gasket, if used, is forced up into the space between the pile and the cylinder 4, and will close the entrance to the same, and the interior mud is thus forced downward with the cylinder, leaving the portion above the opening free from the mud. The shoulder of the cylinder 3 forms a resting-place for the interior filling of concrete, and transmits the load of said concrete to the hard bottom, and also to the main cylinder to which the interior one is attached.

In some cases and in order to provide an additional skin friction, by reason of a larger base, I may increase the end section of the wooden cylinder, by bolting on to the outside of the cylinders 2, supplemental exterior wooden cylinders 6, of larger diameter, and providing a correspondingly increased superficial area to give the proper sustaining power, and strength to resist collapsing pressure.

As shown in Fig. 6, I increase the end section of the interior of the wooden cylinder as follows: Supplemental cylinders 7 and 8 of greater or less thickness and proper length, are bolted on to the exterior of the main cylinder 2; these extending successively below the bottom of said cylinder, and providing the successively increasing areas, as plainly shown in the figure. This increases the base of the reinforcing filling, where the foundation is such as to require it; and in any event, provides a greatly increased stability for the structure.



It will be understood that various modifications of the devices herein shown may be made without materially altering the character of the invention, the essential features of which are substantially set forth above.

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

1. A structure consisting of a driven pile, a cylinder of larger diameter adapted to be sunk around the pile, shorter cylinders fixed around the lower interior portion of the main cylinder, said shorter cylinders being concentrically arranged and adapted to extend from the solid bottom up to the line of the soft mud of the submerged surface, and adapted through the driving of the first-named cylinder, to force the soft mud down and thus leave a space above the other cylinders, and a filling of concrete or equivalent plastic material which will harden, surrounding the pile.

2. A structure consisting of a driven pile, an inclosing casing of larger diameter adapted to be sunk around the pile to rest upon the solid bottom, other cylinders concentric with the main cylinder and with each other and fixed within the bottom of the main cylinder, extending upwardly therefrom, closing the space between the cylinder and the pile, and acting as a plunger to force the soft mud downward when the cylinder is sunk.

3. In a structure of the character described, a driven pile, a cylinder of larger diameter adapted to be sunk around the pile, other cylinders concentric with each other and with the main cylinder and extending from the bottom of the main cylinder upwardly, having the upper periphery closely fitting the body of the pile, and acting to force the soft mud downwardly when the cylinder is sunk to position, said interior cylinders forming shoulders, and a filling of concrete surrounding the pile within the cylinder and resting upon said shoulders.

4. In a structure of the character described, a driven pile, an exterior inclosing cylinder of larger diameter adapted to be sunk around the pile, with interior lining cylinders in the lower part, the upper ends of said interior cylinders forming an upwardly convergent guide to center the pile and casing, and supports, and a body of concrete surrounding the pile within the casing, and resting upon said shoulders.

5. In a structure of the character described, a driven pile, an inclosing cylinder of larger diameter adapted to be sunk around the pile, interior lining cylinders extending from the bottom upwardly, the upper por-

tion forming an upwardly convergent channel around the pile, a flexible gasket adapted to fit said channel when the casing is sunk to position, and to force the mud out of the casing.

6. In a structure of the character described, a driven pile, an exterior inclosing casing of larger diameter, said casing adapted to be sunk around the pile to the solid bottom, interior cylinders fixed to the lower part of the casing and decreasing upwardly, forming a guide to center the casing around the pile, a shelf or support and a filling of concrete surrounding the pile within the casing and resting upon the shelf formed by the interior linings.

7. In a structure of the character described, a driven pile, an exterior casing adapted to be sunk around the pile to a solid bottom, interior linings fixed within said casing and extending upwardly from the bottom, forming a centering device for the pile and casing, and a shelf support for the body of concrete surrounding the pile, and an exterior casing bolted to the lower part of the main casing and extending from the solid bottom upwardly into the soft superposed mud.

8. In a structure of the character described, a driven pile, an inclosing casing of larger diameter sunk around the pile and adapted to receive a filling of concrete, a plurality of exterior cylinders fixed to the inner cylinder and successively increasing the surface area downwardly to the hard bottom upon which the cylinder rests.

9. In a structure of the character described, a cylinder of large diameter, a plurality of other cylinders surrounding the lower part of the main cylinder, and successively extending downwardly below its end exterior to said cylinder, and resting upon the hard bottom, and the whole forming a receptacle for a filling of concrete with a base of large diameter.

10. In a structure of the character described, a main cylindrical casing, a plurality of exterior casings extending downwardly from the lower part and successively increasing in diameter, and closely fitting the casing and each other, and a filling of concrete therefor.

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

HOWARD C. HOLMES.

Witnesses:

GEO. H. STRONG,  
M. V. COLLINS.