A. H. DAVIS.

METHOD OF CONCRETING PILES.

APPLICATION FILED NOV. 14, 1910.

1,025,112. **Patented Apr. 30, 1912.**

3 SHEETS—SHEET 1.

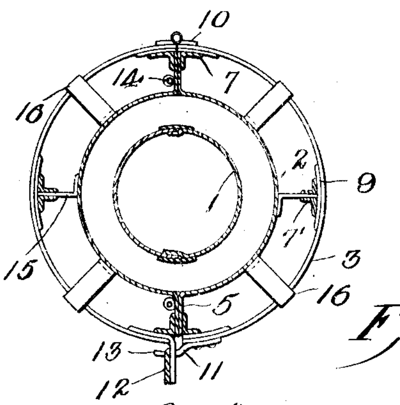


Fig. 2.

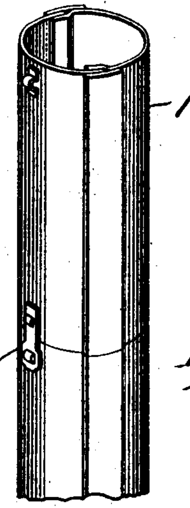


Fig. 3.

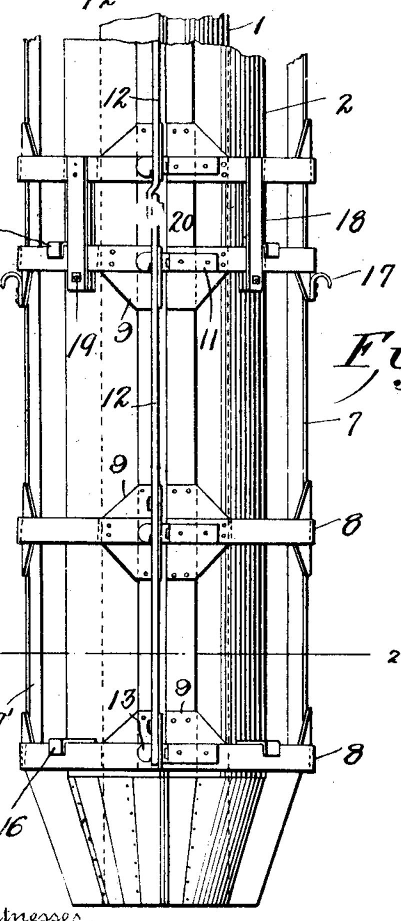
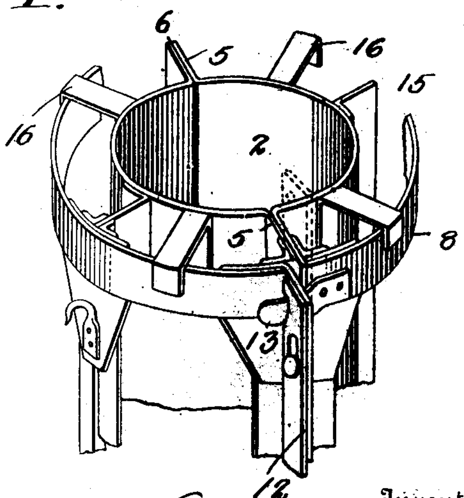


Fig. 1.

Fig. 4.



Witnesses
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his Attorney

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3 SHEETS—SHEET 2.

Fig. 6.

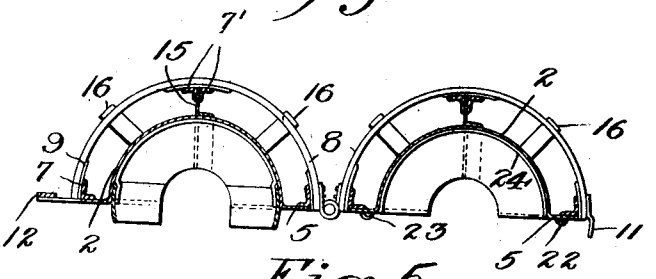


Fig. 7.

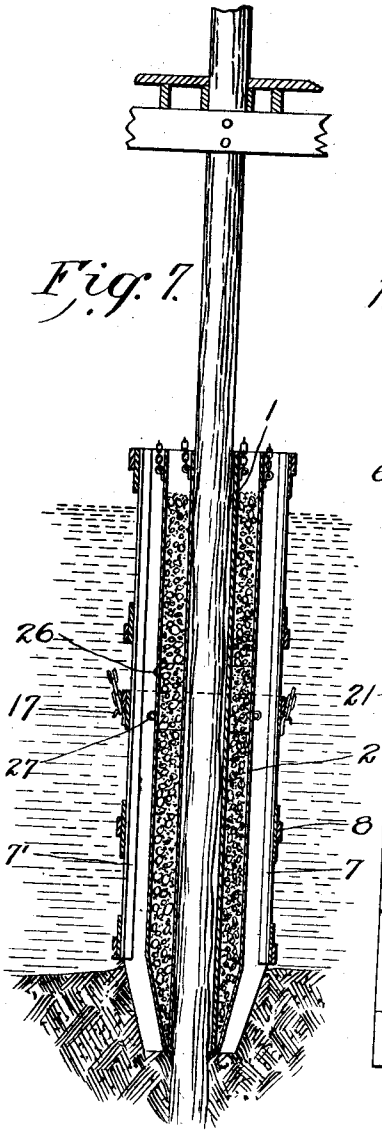


Fig. 5.

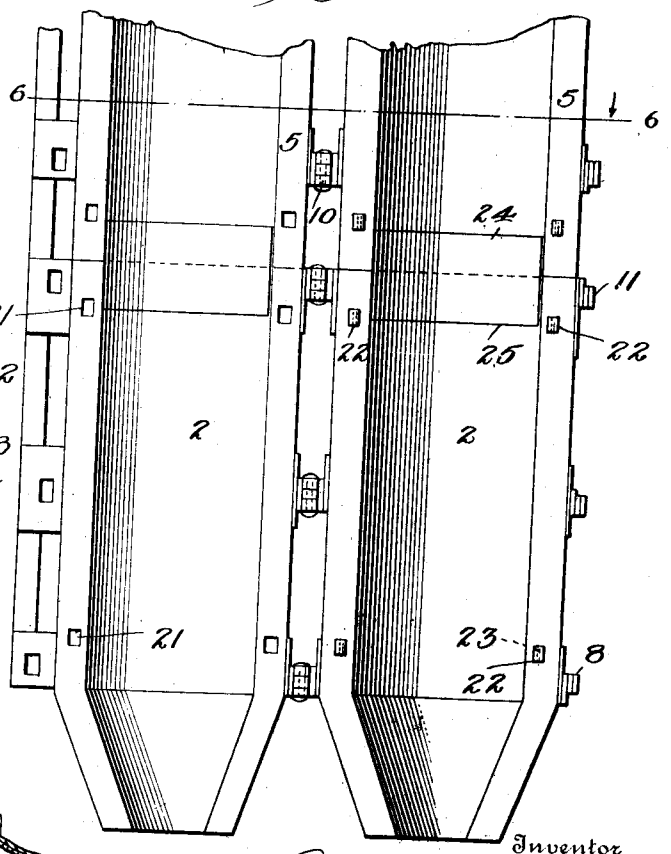
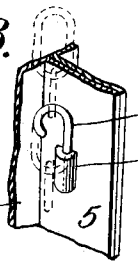


Fig. 8.



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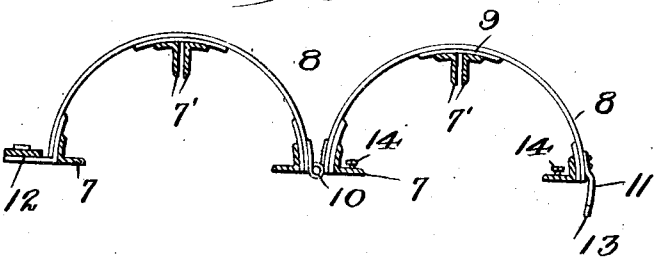
3 SHEETS—SHEET 3.

Fig. 10.



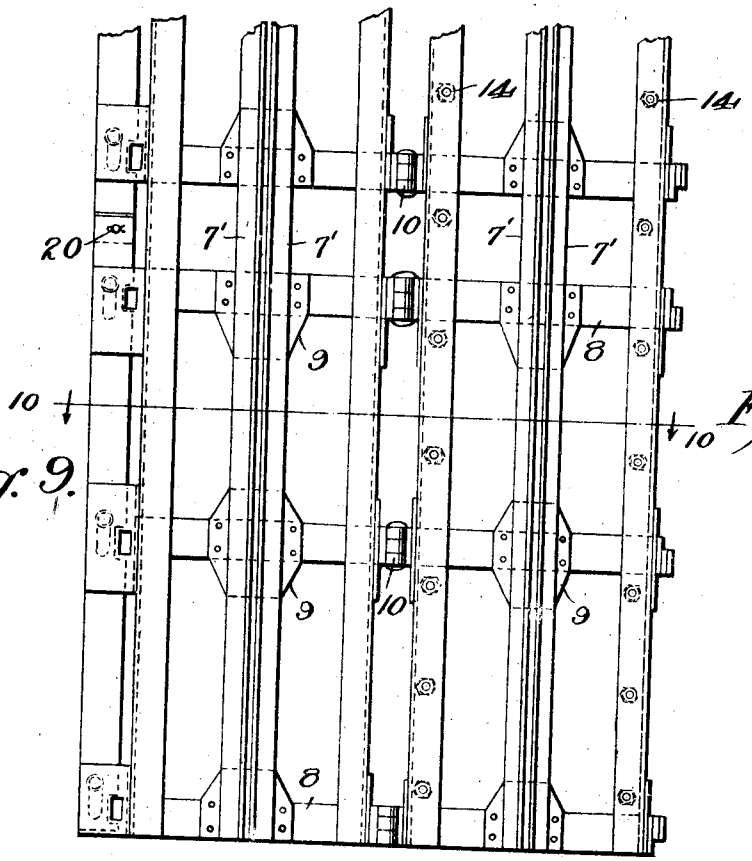


Fig. 9.

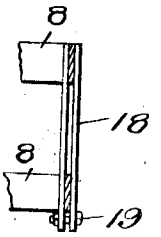


Fig. 11.

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UNITED STATES PATENT OFFICE.

ALFRED H. DAVIS, OF ST. PETERSBURG, FLORIDA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO INTERNATIONAL CONCRETE PILING CO., INC., OF JAMESTOWN, NEW YORK, A CORPORATION OF NEW YORK.

METHOD OF CONCRETING PILES.

1,025,112. Specification of Letters Patent. Patented Apr. 30, 1912.

Original application filed August 15, 1910, Serial No. 577,365. Divided and this application filed November 14, 1910. Serial No. 592,149.

To all whom it may concern:

Be it known that I, ALFRED H. DAVIS, a citizen of the United States, residing at St. Petersburg, in the county of Hillsboro and State of Florida, have invented certain new and useful Improvements in Methods of Concreting Piles, of which the following is a specification.

This invention relates to an improved process in casting concrete jackets around piling or other structure: the present application being a division of an application for Letters Patent of the United States, filed by me on August 15, 1910, for method and apparatus for concreting piles, serially numbered 577,365.

One of the principal objects of this invention is to facilitate and lessen the cost of labor in forming a protective covering of concrete, upon submerged or partially submerged piles or other structure, after they have been put in place, and principally to enable the concrete covering to be carried down to the bottom of the supporting structure in its proper consistency, and there permitted to set without the intermingling therewith of the surrounding water.

Another object of my invention is the method of providing a receptacle or mold in which the concrete is placed, after having been mixed to the proper consistency by the addition of fresh water, as contra-distinguished from the methods employed wherein the mixture, of cement and gravel is placed in dry form in receptacles and sunk into place, depending on the sea water to effect the chemical action and combination between the ingredients of the mixture, the advantages of which will hereinafter more fully appear.

My said invention further relates to a process of covering each section of the mold forms with a coating of non-adhesive compound, which facilitates the removal of the molds after the concrete has become partially set, as well as imparting a smooth exterior surface to the concrete jacket.

My said invention further relates to methods of placing the mold forms around the pile above the tide, immersing the mold into the water surrounding the pile and maintaining a zone around the pile below the tide comparatively devoid of water while the concrete is put in place.

A further object of this invention is to provide methods whereby the mold casings with their reinforcing frames which have been carried down below the surface of the tide, may be unlatched and detachably removed from the concrete structure by operative means located above the level of the tide.

In order to more fully describe my said invention, reference will be had to the accompanying drawings wherein I have illustrated an apparatus suitable for the practice of the invention.

Figure 1, represents in vertical section, a form mold applied in my invention, the same being shown closed and locked ready to receive the concrete mixture: Fig. 2, represents a transverse section of a reinforcing frame, a tubular mold and an inner-tube used in creating a dry zone around the pile. Fig. 3, is a perspective view of sections of an inner tube showing means for joining the two half sections and means for locking the longitudinal sections together. Fig. 4, is a perspective view, with parts broken away, of the reinforcing frame with the tubular mold in position therein. Fig. 5, is a vertical transverse section produced through the first mold section showing the taper funnel shaped bottom. Fig. 6, represents a transverse section produced through the hinged reinforcing frame with the tubular mold in half sections. Fig. 7, is a sectional elevation taken centrally through a pile, disclosing the application of the method of concreting piles. Fig. 8, is an enlarged view of the locking means whereby the flanged edges of the tubular mold are coupled together, by which means are provided for excluding the surrounding water. Fig. 9, is a vertical central sectional view of the reinforcing frame opened and Fig. 10, is a sectional view of the same taken on the plane indicated by line 10—10, on Fig. 9. Fig. 11, is an enlarged view of one of the clevises by which the sections of the reinforcing frame are joined together, providing means of lowering the concrete below the tide level.

Like parts are represented by similar characters of reference in the several views.

For the purposes of forming a concrete jacket around a pile I provide one or more jacket-forming units, each of which is comprised in the case shown, of an inner tube immediately surrounding the pile or object to be concrete-jacketed; of a tubular mold section surrounding the inner tube and adapted to receive and contain the concrete; and of a reinforcing and supporting frame adapted to clasp around the tubular mold section for supporting and reinforcing the same during the operation of forming the concrete jacket. The sectional inner tube consists of two half sections by means of which each section is bisected vertically and placed around the pile. The contiguous vertical edges of the two half sections are provided with a tongue and groove joint, and for the purpose of making this joint tight, I place in the groove of the joint a layer of suitable compressible packing, such as oakum or other material, well known in the art and used for making joints water tight. When the two halves of a section of inner tube have been placed in position around a pile, I provide for joining the next section thereto by telescoping the intersecting joints or divisions of one section with the section below, and to provide means for securely holding the sections together, for the purpose hereinafter explained I provide a hasp and staple 4, shown in Fig. 3. By this means it is possible to construct around a standing pile or other similar structure, a tube of any desired length, water tight, and detachable. Around this inner tube is placed the tubular mold section 2, consisting of two half sections bisected vertically as shown in Fig. 5. For the purpose of providing a water tight joint, the contiguous edges of the tubular mold form are made with extended flanges 5, between which are placed suitable gaskets 6, designed to be compressed by methods hereinafter described, into making a water tight seam in the joint between the two halves of the tubular mold sections. For the purpose of gripping these flanged lips to a greater degree, and thus insuring a water tight joint, I provide set-screws 14, tapped through one of the inwardly extended faces of the angle irons at suitable intervals, and by means of "setting up" these screws I am enabled to compress the gaskets 6, placed between flanged lips 5, thereby making the intersecting joints of the tubular mold sections water tight.

For the purpose of handling the supporting frame and swinging the same into position around the pile or other structure above to be cement jacketed I provide hooks 17, securely attached to the supporting frame. To hooks 17, are attached suitable chain or other supporting devices leading upward to the superstructure above the piling from which the apparatus is supported and lowered.

In Fig. 1, is shown the first or lower section of a supporting frame, the upper terminals of which section end at the annular shaped hoop 8, above the supporting hooks 17. Above this annular shaped hoop is shown the beginning of another section of the supporting frame, and is shown intersected and locked to the lower section by the clevises 18, which are bolted at their upper ends to the annular hoop of the engaging section, and are arranged to slip over the upper annular hoop of the lower section and are locked by the bolt 19 passing therethrough as shown in an enlarged detailed view in Fig. 11.

For providing a suitable detachable joint for the latch bar 12, at intersections of the supporting frames, I provide an off set joint for bringing the two sections of the latch bar in proper alinement and couple the same with a bolt 20.

In providing a suitable tubular mold section that can be placed around a standing pile I arrange for each section of the tubular mold form to be made in two half sections divided vertically the lower extremities of the first or anchor section being contracted or reduced to funnel shape at its lower end. To provide a suitable means for making the intersecting edges of the two half sections water tight, I provide outwardly extending flanges through which I have provided suitable apertures 21, in the one half section, adapted to engage the protruding studs 22, placed in the other half section, so that when the tubular mold form is closed, the studs 22, pass through the apertures 21, and the cotter pins 23, are placed through the holes provided therefor, in the stud 22, thus securely locking the two half sections of the tubular mold form together. For the purposes of creating a water tight joint where the one tubular mold section rests upon and engages the next lower tubular mold section, I provide a suitable lining or apron which is securely fastened to the inner side of the tubular mold sections at line 24, Fig. 5, arranged to telescope into the next lower section to a depth of line 25, shown in Fig. 5. This lining or apron may be made of any suitable material preferably of heavy water proof canvas or other fabric, designed to close in against the inner surface of the tubular section next below by the compressing force of the weight of the concrete mixture. For the purpose of further uniting and maintaining the superposed sections of the tubular mold casing in alinement, I provide a hasp 26, shown in Fig. 7, on the one section, adapted to engage a staple 27, on the other section, through which is inserted a suitable cotter pin. By this means the tubular casing sections are

held together, and may be supported from the superstructure by suitable chains or other means, attached to the staples 27, shown in Fig. 7.

Having thus described the various parts of my apparatus necessary to carry out my invention, the application of the same is as follows: When a concrete covering is about to be placed around a pile or other support and without removing the planking of the dock or superstructure, upon which the work is to be done, the reinforcing and supporting frame is opened and placed in a horizontal position as shown in Fig. 9. Into this supporting frame is placed the tubular mold section shown in Fig. 5, which has been selected as of the proper diameter sufficient to give the required thickness of the concrete jacket for the particular pile it is to be applied to. To the inner surface of the tubular mold section, I apply a non-adhesive mixture compressed of red lead and common brown soap, which facilitates severing the tubular mold sections from the concrete jacket after it has received its initial set, and also imparts a smoothness to the exterior surface of the concrete jackets. The tubular mold sections are held in proper place in the frame by the supporting hooks 16, engaging the top and bottom hoops of the supporting frame. The angle irons 15, are also brought into engagement with the slot provided for in the space between the angle irons 7′ 7′, receiving a bearing therein against the supporting frame as shown in Fig. 4. The supporting frame, together with the tubular mold forms therein is then closed together and properly latched. In this form it is supported from any cross timber or part of the superstructure by means of chains or other suitable supports, depending therefrom, attached to the hooks 17. The frame in its suspended position, together with the tubular mold form therein is then opened and swung into position around the pile above the water line, and the supporting frame is then closed and latched, and the cotter pins 23, are slipped through the holes into studs 22, thus fastening the edges of the half sections of the tubular mold casing. The set screws for compressing the gaskets 6, are then properly "set up" making the joints water tight. I then place the two halves of a section of the inner tube around the pile, allowing the same to slip down over the pile until the lower edge of the inner tube engages the funnel shaped bottom of the tubular mold section as shown in the dotted lines in Fig. 1, provision being made for placing a gasket on the lower end of the inner tube, where it engages in contact with the funnel shaped end of the tubular mold casing, the weight of the inner tube creating a sufficient bearing upon the gasket to make a water tight joint between the inner tube and the funnel shaped sides of the tubular mold casing. I then place in the annular space formed by the tube, and the tubular mold casing, a proper quantity of broken stone or gravel to make a proper foundation upon which the first application of concrete is placed. The annular space between the inner tube and the tubular mold casing, is then filled from above the water line with a concrete mixture of proper consistency. The supporting frame with the inner tube and the tubular mold casing resting therein, are then lowered until the top of the mold casing is a few inches above the water line. I then place another section of the inner tube around the pile with a telescopic joint connecting the same with the like section already in place. I then repeat the process of placing another section of the tubular mold form into another section of the supporting frame and clasping the same around the pile, lowering the supporting frame section until the clevises 18, engage the uppermost annular shaped hoop 8, of the section of the supporting frame already in place, at the same time permitting the inner lining or fabric attached to the lower edge of the tubular mold section, to telescope inside of the lower mold section already in place, I then attach and fasten the two supporting frame sections together by inserting the bolts 19, through the lower extremities of the clevises, and couple up the two sections of the latch bar 12, by inserting the bolt 20, therethrough. To securely attach the two section of the tubular mold casing, I place the hasp 26, over the evelet or staple 27, and insert a cotter pin through the apertures in the staple, thus securely connecting the one section of the tubular mold casing with the section next above. An application of cement or concrete mixture is then applied to the annular space until by such application the concrete has risen to a point above the fabric apron, and properly compressing the same against the inner sides of the next section of the tubular mold form below, thus making a water tight joint between the two mold sections so jointed as aforesaid. The whole apparatus is then again lowered and the process of applying the mold section is repeated and the concrete is continued until the lower or anchor section composing the funnel shaped tubing, reaches the bottom and is embedded sufficiently into the mud or gravel into which the pile is driven to shut off any sea water getting in from below, after which the concreting may be continued to any desired point above the water line. After the required height of the concrete jacket has been provided, the inner tube is immediately withdrawn, allowing the concrete in its plastic condition to

settle around the pile without altering to any appreciable extent its proper consistency, and forcing in its settling operation, any water that may have existed in the space between the inner tube and the pile, upwardly and out through and over the top of the concrete. As the inner tube is withdrawn, and the concrete settles and fills up any depressions or worm eaten cavities in the pile, sufficient concrete mixture is added at the top to always keep the level of the concrete above the water line as the tube is being withdrawn, thus providing against any disintegration of the concrete mixture. After the concrete mixture thus applied has established its initial set the reinforcing and supporting frame 3, may be removed, the tubular mold form 2, being left in position until such time as the concrete thus formed around the pile has attained sufficient age and hardness to resist the action of the water in agitation caused by tides, currents, and undertow. After this state has been reached, the cotter pins 23, are withdrawn, by suitable chains connected therewith extending upward to a point above the water line. To provide for the drawing of one of these cotter pins at a time and thus drawing the various pins in *seriatim*, I arrange my draw chains connected to the cotter pins in such manner that there is a little slack chain between the fastening of the chain to the one pin and the fastening of the chain to the pin next below, so that in drawing the uppermost pin no tension is put on the next succeeding pin below, until sufficient movement of the chains has disengaged each upper pin before the drawing of the pin next below commences.

Since the present invention resides in the method of covering piles with concrete as hereinafter set forth in the claims, other modifications in the mold structure and apparatus may be made without departure from the scope thereof and it may also be practiced in the employment of other and different forms of molds and apparatus.

The apparatus herein shown and described is made the subject of a separate application No. 577,365, for Letters Patent.

What I do claim as my invention is:

1. The method which consists in creating around a pile within the water surrounding the same, an annular zone devoid of water, filling said zone with concrete, and isolating said concrete from the pile during the filling process.

2. The method of coating a submerged pile with concrete, which consists of creating a dry zone around a pile below the level of the tide, placing a filling of properly mixed concrete within said zone, isolating said concrete from the pile, and excluding the surrounding water from intermingling with said concrete while it is undergoing the setting process.

3. The method of casting a concrete jacket around a pile which consists of creating a dry zone within an annular mold placed below the tide, filling said zone with concrete of proper consistency, isolating said concrete from the surrounding sea water during its setting stage, and withdrawing said mold.

4. The method of forming concrete jackets around a pile which consists of creating a dry zone around a submerged pile filling said zone with concrete, isolating the concrete from the pile while lowering it to the ground foundation, allowing the concrete to come in contact with the pile, and maintaining said zone isolated from the surrounding sea water during the initial set of the concrete.

5. Method of casting concrete jackets around a pile below the surface of the water, consisting of creating a zone around the pile devoid of water below the level of the tide, placing concrete properly mixed within said zone, isolating the concrete from the pile, lowering the concrete to the ground foundation into which the pile is driven, allowing the concrete while in plastic condition to come in contact with the pile, and allowing a setting thereof without the intermingling therewith of the surrounding sea water.

6. The method of forming concrete jackets around a pile or other similar structure, wholly or partially submerged, which consists of screening an area or zone below the level of the water around a pile from the surrounding water, by means of tubular casings, coating the interior of said casing with non-adhesive compound filling said area or zone with properly mixed concrete, and lowering the tubular casings with the concrete therein to ground foundation into which the pile is driven.

7. Method of coating the exterior surface of a pile with concrete, which consists in placing an inner casing around a pile, placing an outer casing of greater diameter around said inner casing, excluding water from the annular space formed between said inner casing and outer casing, filling the annular space so formed with properly mixed concrete, lowering the inner and outer casing to the ground foundation into which the pile is driven, and withdrawing the inner casing thereby permitting the concrete while in a plastic condition, to close up the void preëxisting between inner casing and outer surface of the pile.

8. A method of forming a concrete jacket around a pile or analogous structure, which consists in supporting a section of tubular casings encircling a pile maintaining the top of said casing above the water line, filling the annular space in said casings with

properly mixed concrete, placing another section of tubular casing on the one so filled, lowering the sections so placed and filled, to the ground foundation into which the pile is driven, and removing the inner casings therefrom, permitting the concrete in its plastic condition to adjust itself around the exterior surface of the pile hermetically sealing the same.

9. The method of forming concrete casings around piles which consists of creating within the surrounding sea water, an annular dry zone within a mold, filling said mold with concrete and isolating said concrete from the pile and surrounding sea water while the mold with concrete therein is lowered to the bottom of the pile.

10. The method of forming concrete casings around piles, which consists of creating within the surrounding sea water an annular dry zone within a mold, filling said mold with concrete, isolating said concrete from the pile and surrounding water while the mold with concrete therein, is lowered to the bottom of the pile, and removing the mold after the concrete has received its initial set.

11. The method of forming concrete casings around piles, which consists of creating within the surrounding sea water an annular dry zone isolated from the surface of the pile and the surrounding sea water, filling said zone with concrete, and extending said zone with the concrete therein to the bottom of the pile.

12. The method of forming concrete casings around piles, which consists of creating within the surrounding sea water an annular zone isolated from the surface of the pile and surrounding sea water, filling said zone with concrete, extending said zone with the concrete therein to the bottom of the pile, and bringing the concrete in contact with the surface of the pile while isolated from the surrounding sea water.

13. The method of forming concrete casings around piles, which consists of creating within the surrounding sea water an annular dry zone within a mold, filling said mold with concrete, isolating said concrete from the pile and surrounding sea water, lowering said mold with concrete therein to the bottom of the pile, bringing the concrete in contact with the surface of the pile, and maintaining the concrete isolated from the surrounding sea water while undergoing its initial set.

14. The method of forming concrete jackets around a pile or other similar structure, wholly or partially submerged, which consists of screening an area or zone below the level of the water around a pile from the surrounding water, by means of tubular casings, coating the interior of said casing with non-adhesive compound, filling said area or zone with properly mixed concrete, lowering the tubular casing with concrete therein to the ground foundation into which the pile is driven, and removing said casing after the concrete has received its initial set.

15. A method of forming concrete jackets around a pile or analogous structure, which consists in supporting a section of tubular casings around a pile, maintaining the top of said casings above the water line, filling the annular space in said casings with properly mixed concrete, placing another section of tubular casings on the one so filled, lowering the section so placed and filled to the ground foundation into which the pile is driven, removing the inner casing therefrom permitting the concrete in its plastic condition to adjust itself around the exterior surface of the pile hermetically sealing the same, and removing the exterior casing after the concrete has received its initial set.

In testimony whereof I have affixed my signature in presence of two witnesses.

ALFRED H. DAVIS.

Witnesses:

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A. P. AVERY.