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METHOD OF SEALING CAISSONS AND ERECTING CONCRETE PILES.

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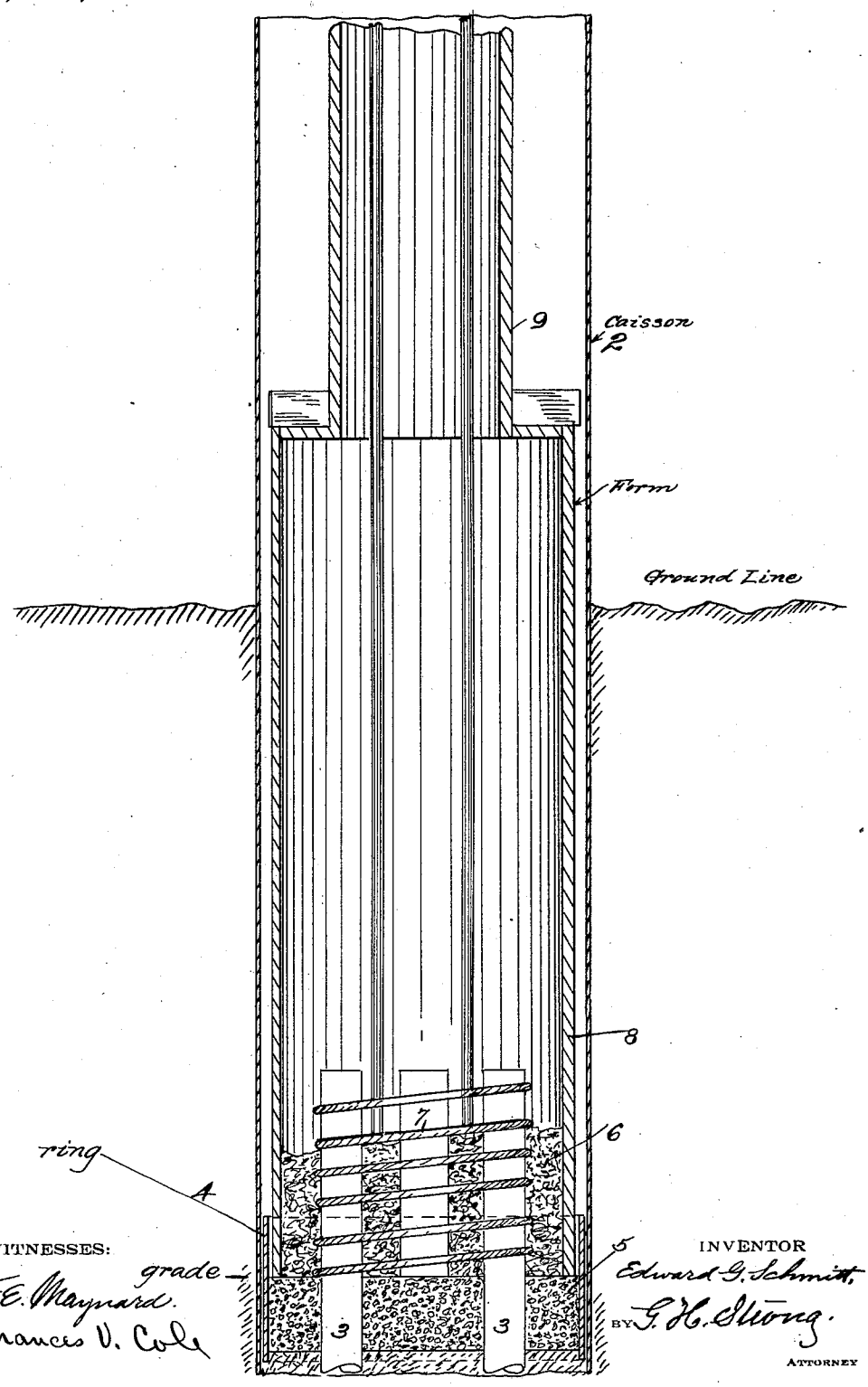

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METHOD OF SEALING CAISSONS AND ERECTING CONCRETE PILES.

1,097,369. Specification of Letters Patent. Patented May 19, 1914.

Application filed September 3, 1913. Serial No. 787,981.

To all whom it may concern:

Be it known that I, EDWARD G. SCHMITT, 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 Methods of Sealing Caissons and Erecting Concrete Piles, of which the following is a specification.

This invention relates to an improved method and apparatus for the erection of concrete piles in removable caissons.

The object of the present invention is to provide an improved, simplified, reliable and safe process by which the construction of subaqueous concrete piers may be practised at less expense and with a saving of time in the operation of preparing the caisson and enabling the early re-use of the removable caisson by rotation in the erection of other concrete piles. This early re-use of the caisson is obtained as a result of the present invention by reason of the reliability of the preliminary steps consisting of obtaining a safe seal at the bottom of the caisson and permitting an early resumption of the erection of the pile.

One method of building concrete piers is to first drive a heavy steel caisson or cylinder until its bottom edge is down to, or a little lower than, the bottom of the concrete called for in the specifications. Excavation with an orange peel dredge is carried on either between periods of driving or when driving is finished. The inside of the caisson is excavated low enough to allow for the rising of the bottom, due to the driving of the foundation piles, and to make room for sealing the caisson below the grade line. The bottom is leveled as much as practicable. Loose rock is sometimes put in the bottom of the caisson to a depth of three or four feet. Part of the water is then bailed out and the foundation piles are driven in. The remainder of the water is then removed. If the bottom of the caisson appears liable to hold, the heads of the piles are next sawed off about five feet above grade and galvanized wire rope is then wrapped around the cluster of piles and wooden cylinders are placed in position as forms for the concrete; but if the ground at the bottom of the caisson appears liable to blow in, the lower one of the two concrete forms is first lowered into position and about two feet of concrete is spread inside to seal it. After it is considered properly sealed, the sawing off of the piles, wrapping of same, and placing of the upper concrete form is accomplished as previously described. Specifications usually demand that the water inside of the caisson be kept below the top of the concrete in the forms as concrete is being poured. Twenty-four hours must elapse before the caisson is pulled and placed in position for the next pier. The disadvantages of this method are as follows: 1. Excavation has to be deeper to allow for the amount of crushed rock used, and also to allow for the added swelling of the ground at the bottom, due to the increased pressure caused by the removal of the water from the inside of the caisson. 2. Cost of rock and handling of same. 3. Loose rock does not prevent leakage of water and often is useless in preventing bottoms from blowing in, especially where the bottom is composed of sand. 4. Trouble in securing form-base against floating when the caisson is full of water. 5. Added danger of bottom blowing in when the water is removed from the caisson to facilitate the driving of the piles. 6. Caisson is liable to blow up when men are sawing off and wrapping piles. 7. Extra expense due to necessity of then digging down to grade with shovels and delaying a crew of six or seven men probably four or five hours at the least. 8. Complete failure in some cases to get the concrete down to grade according to specifications. 9. Continual use of steam ejectors and other pumping apparatus in an effort to hold down the water in the caisson. 10. Sealing with concrete inside of the lower form does not prevent water and sand from coming through between the form and the caisson. 11. Loss due to irregularity of operation.

In my proposed method for erecting concrete piles with subaqueous bases I employ a substantial removable caisson or cylinder of the desired diameter and which is lowered or driven into position, with its lower end at about grade or a little below; then excavate the soil from within the caisson to a depth a little below grade; then drive in the wooden or other foot piles so that their heads project, according to specifications, above the grade line. After this I lower and arrange an annulus or metal band, of a diameter slightly less than the inside diameter of the caisson, and force the lower edge of the annulus into the soil at the bottom of

the caisson; the length of the annulus being sufficient to provide for a sufficient depth of seal below the grade line.

After the annulus has been positioned within the bottom of the caisson, a seal is formed within the annulus of suitable depth, with its top surface approximately at grade. The seal is composed of cementitious mixture which may be lowered into position within the annulus by suitable means as by buckets, and is then allowed to firmly set, after which the caisson may be exhausted of water so that workmen can move with safety within the bottom of the caisson which is thoroughly sealed by the substantially solidified concrete seal and the erection of the concrete pile may proceed according to specifications.

Having reference to the accompanying drawing:—The figure is a diagrammatic representation of a concrete pile constructed in accordance with the practice of my method.

The erection of subaqueous piles for supporting piers, foundations and other structures is now commonly practised by utilizing a cylinder or caisson 2, of suitable cross section and length, which is lowered into the specified position and driven so that its lower end enters the subaqueous soil, after which the soil is excavated well below grade. After that the concrete pile is erected according to specifications. As hereinbefore set forth, considerable time is lost and danger risked and not altogether satisfactory results are incurred because of the unreliability of a good seal being obtained at the base of the caisson preliminary to the erection of the pile.

In my process the cylinder is adjustable in position with its end sufficiently below grade and within the positioned caisson the wooden or other foot piles 3 are driven into the soil at the bottom of the caisson and such material as may be exuded by the embedded foot piles 3 is removed to a sufficient depth. Then I lower a ring or annulus 4, preferably of metal and of slightly less diameter than the cylinder 2, into position adjacent to the foot of the cylinder and remove the soil within the annulus 4 until a suitable depth has been reached as to the annulus 4. Into the excavated chamber of the annulus 4 I then place cementitious material, which may be lowered into the annulus by any suitable means, such as a drop bucket, with a trap bottom, filling the annulus 4 to a suitable depth and bringing its top surface to grade, after which the cementitious material is allowed to set. This important step in the process of erecting the concrete pile results in the production of a seal within the bottom of the caisson 2 and yet is independent thereof so that the caisson can be readily lifted away for re-use in another position. The caisson 2 has a slidable fit or relation with the exterior surface of the annulus 4 in which the seal 5 of cementitious material is made. Further, the solid cement seal becomes a substantial base for the erection of the concrete pile and is also a safe and dependable seal capable of withstanding the pressure of the water and soil from below, so that the liability of blowing in of the soil at the bottom of the caisson is eliminated. This results in avoiding risk and saving the time and labor lost when a blow-in occurs, in addition to forming a more permanent and desirable footing than is produced by the old and well-known methods in general practice.

After the seal 5 has been produced by my process, the water in the caisson, above the seal, is exhausted and the erection of the concrete pile 6 may proceed according to specification which usually requires that the tops of the foot piles 3 be sawed off and made uniform and then wired, as at 7, with a reinforcing member, and the lower section 8 of the concrete mold or form is positioned within the caisson 2 and the super-mold or form 9 is also erected, subsequent to which the concrete is charged to fill the molds.

It will be seen that by the use of a substantial, metallic ring or annulus 4 this can be lowered into position at the bottom of the caisson with greater ease, reliability and speed than can be done when a wooden mold or member is lowered to position as is the common practice, because the weight of the metallic ring naturally aids in its lowering and positioning in contradistinction to the natural buoyancy and resistance when a wooden mold is being used.

This process results in producing a seal 5 of great strength, as stated, which is thoroughly reliable and impervious, and as soon as it has been allowed to set the water in the caisson can be exhausted; the very small leak which might occur, as between the circumference of the annulus 4 and the inner surface of the removable caisson 2, being easily kept down by a small pump, thus enabling the lowering of the wooden concrete molds into a substantially dry caisson and also permitting the men to work with greater freedom in the dry chamber.

It is understood that the ring may be of any length and its upper portion used as the form for the lower part of the concrete pier.

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

1. The method of preparing a caisson for the erection of subaqueous hydraulic piles which consists of arranging a portable caisson or cylinder with its lower end embedded in the subaqueous soil, excavating said soil from within the caisson, driving anchoring

piles into the soil at the base of the caisson, and then forming a hydraulic cement seal about said piles and adjacent to and within the foot of the caisson and from which said caisson is freely removable.

2. The method of producing a blow-in resisting seal in subaqueous caissons which consists in arranging a caisson cylinder with its lower end embedded in the subaqueous soil, excavating said soil from within the cylinder down to a predetermined level, driving anchoring piles in the soil within the foot of the cylinder, lowering a ring slidably fitting the interior of the cylinder into the soil at the foot thereof, grading the soil in the ring, then charging the ring with a suitable thickness of hydraulic cement on top of the subaqueous soil, and allowing the cement to set.

3. A caisson for the construction of subaqueous hydraulic piers, comprising a portable caisson tube adapted to be embedded at one end in the subaqueous soil, a ring having a sliding fit with the interior of the tube and adapted to be positioned adjacent to the foot thereof when the latter is embedded, and a seal of hydraulic cement of suitable thickness, transversely, filling the ring and above which the water may be removed from the tube.

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

EDWARD G. SCHMITT.

Witnesses:
JOHN H. HERRING,
IRVINE SINNETT.