(No Model.)

J. C. GOODRIDGE, Jr.

METHOD OF LAYING CONCRETE UNDER WATER.

No. 358,853. Patented Mar. 8, 1887.

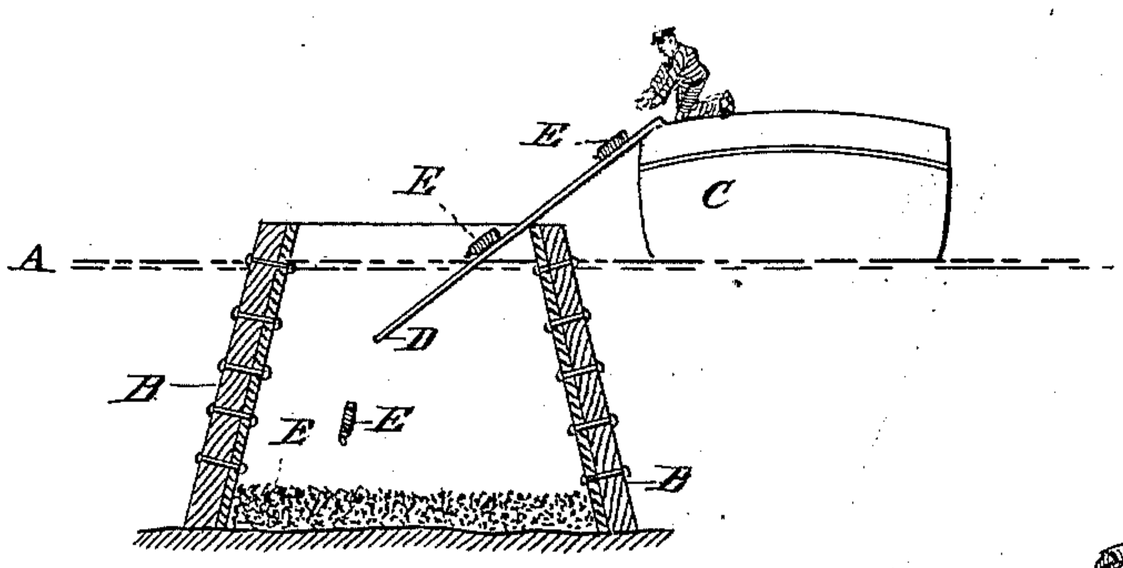

Fig. 1.

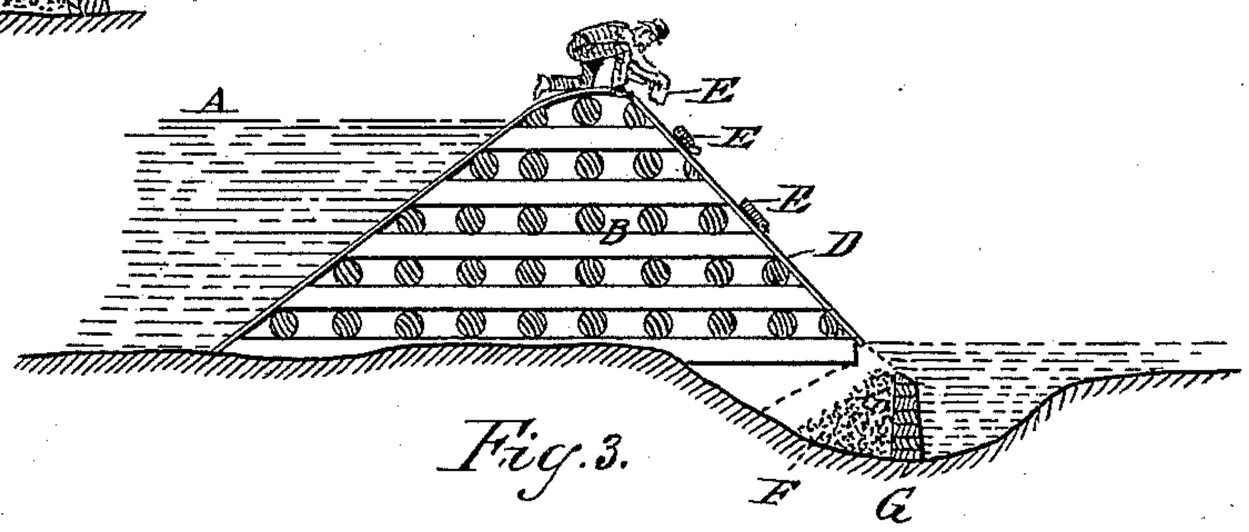

Fig. 3.

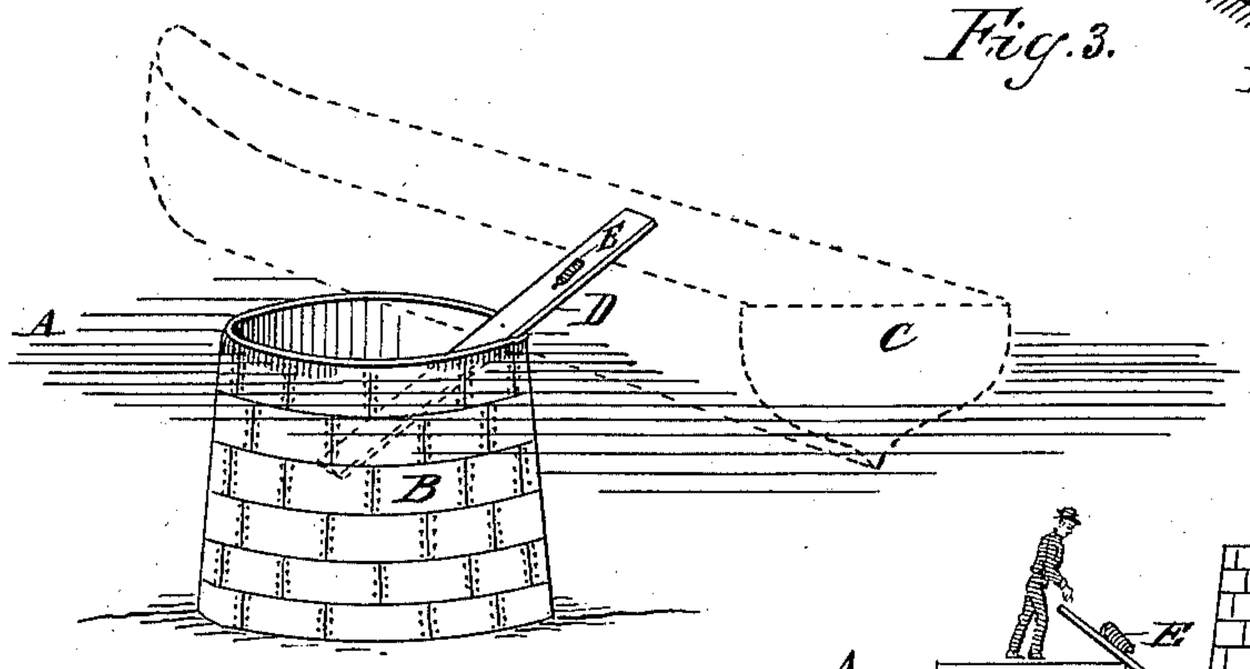

Fig. 2.

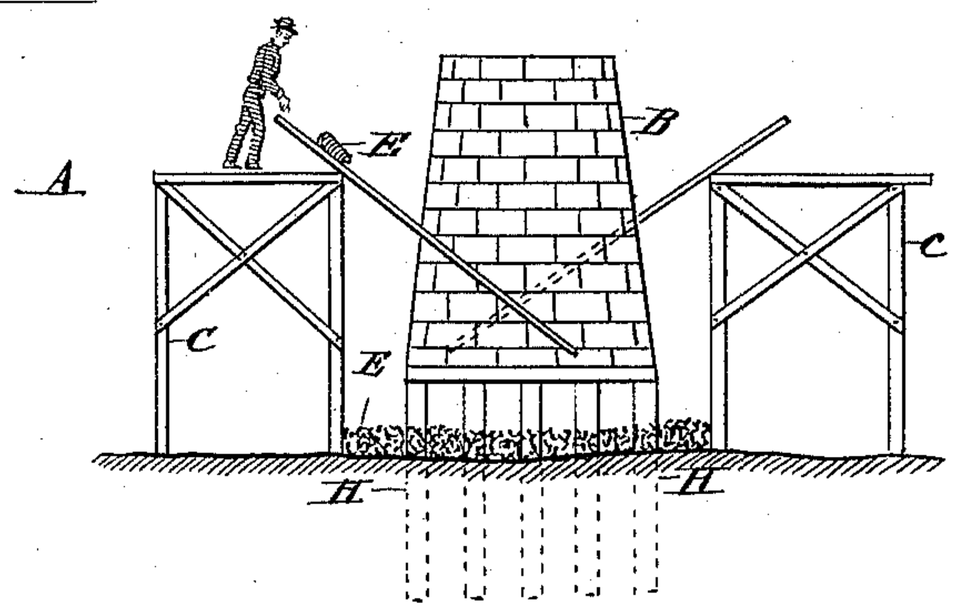

Fig. 4.

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METHOD OF LAYING CONCRETE UNDER WATER.

SPECIFICATION forming part of Letters Patent No. 358,853, dated March 8, 1887.

Application filed November 4, 1886. Serial No. 217,972. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. GOODRIDGE, Jr., of the city of New York, in the county of New York and State of New York, have invented a new and useful Improvement in the Method of Laying Concrete under Water, of which the following is a specification, reference being had to the accompanying drawings.

Laying concrete under water is attended with many difficulties. The most important of these is the separation of its constituent particles by their descent through the water, due to the well-known principle that bodies of different sizes, though of the same specific gravity, fall through liquids at different rates of speed.

When concrete falls through water, the largest stones are deposited first, the next smaller next, and so on until the cement is deposited near the top. Last of all, the various impurities held in suspension by the water are deposited, which may at the end of a day's labor cover the work with a slippery slimy mass several inches thick, known as "laitence," a mass without adhesion or cohesion, which prevents all bond between the layers, and may subsequently be washed away by the action of water, so as to endanger the structure. In short, unless the concrete is protected during its passage through the water, all skill in proportioning its ingredients, or care in incorporating them is rendered abortive. Experiment has shown that but a very slight fall through water, even less than one foot, will do this.

Various methods have been tried to overcome this well-recognized difficulty, among which may be mentioned the tremie or skip. This requires powerful mechanical appliances to lift and move it, and the first charge is not only lost, but lies in the place to be filled as an inert mass. Boxes of various patterns, generally with gates at the bottom, have been used; but here the box must be as far above the bottom when emptied as at least half the width of the gates, and thus wash is not entirely avoided. Bags formed of various kinds of cloth have also been tried; but these do not lie in close apposition to each other, the interstices are large and numerous, and they remain a series of separate blocks, not combined to form a monolithic structure, as is most desirable in submarine construction, where the stability of the blocks against the action of waves and currents depends upon their size. The matter of leakage, oftentimes of great importance, is very imperfectly prevented by this process, while the employment of a diver is necessary.

The object of my invention is to provide a method which shall insure the passage of the concrete through the water without wash, and at the same time deposit it when required in such manner as to form a homogeneous monolithic and water-tight mass.

Any of the bétons or concretes now in use may be employed for this purpose. The mixture is placed in paper bags of convenient size, holding anywhere from one to five or more cubic feet. The filled bags are then slid down a properly-directed incline into place. During the downward passage of the bag the paper becomes saturated with water, and the moment the bag comes in contact with the bottom, or the material already laid, it bursts from the change in shape of its plastic contents, and the béton or concrete is deposited in place in its most efficient condition, and ready to unite with the contents of preceding or succeeding bags to form a single monolithic mass.

The drawings forming part of this specification show my method as applied to various forms of subaqueous work.

Figure 1 shows the filling of a jetty or similar structure, in which A represents the water level, B the jetty, C a float of any description, D the incline, and E E the bags of concrete sliding down the incline to fill the jetty.

Fig. 2 shows filling the shell or mold for a round pier, A being the water-level, B the shell or mold, C the float, D the incline, E E the bags, all as in the previous figure.

Fig. 3 shows my method as applied to the repair of a dam or breakwater which has been partly undermined at F, in which A represents the water-level, B the dam or breakwater, D the incline or inclined surfaces answering the same purpose, and E E E the bags of concrete sliding downward, and guided into place by the mold G.

Fig. 4 represents my method as applied to forming or replacing the foundation of a solid

pier. A represents the water line, B the pier, C floats or staging, D the incline directed downward and alongside the faces of the pier and adjusted as to locality from time to time during the progress of the work as the necessities of the case require, E the bags of concrete, and H the piles or grillage upon which the pier rests.

The incline should pass into the water, and may in some cases go nearly to the bottom, lest the paper bag should burst on striking the water surface of the water, or before it has deposited its contents in the desired locality. It should be adjusted from time to time, so as to deposit the bags in the position desired, since the surface of the béton or concrete should not be disturbed after the envelope has burst. Béton or concrete so laid becomes a monolithic mass. The remains of the bags are mixed in with the béton or concrete as pulp, or float away. The remains of these envelopes may be themselves of advantage, since in filling the mold prepared for the béton or concrete the water is forced out, and the paper working into any cracks or crevices plugs them up and prevents the leakage of the cement. The tops of the bags need not to be tied, but may be folded or twisted, so as to serve as a vane or rudder to prevent the bag turning over in its descent.

If desired, a float can be tied to the mouth end of the envelope, by which a portion of it can be retrieved after it has burst.

The ordinary paper bags—such as flour or other like materials are often put up in—will ordinarily answer for my method; but if the bags must be dropped a great distance paper of heavier quality, or move heavily sized, or partially waterproofed, may be employed, the object being to so proportion the durability of the envelope to the depth of the stratum of water through which it must pass that its cohesion will be almost but not quite destroyed when it reaches the bottom.

Care should be taken that the surface of the incline is sufficiently smooth not to prematurely rupture the envelope by friction. If any difficulty is experienced from this cause, the bags may be placed upon a sled or equivalent device, or an endless belt may be used for this purpose, or the bags may be placed in buckets attached to a belt so arranged as to be adjusted from time to time with reference to the position at which the béton or concrete should be lodged.

It is evident that any other material which is affected by water in substantially the same manner as paper may be employed as a substitute in the construction of the within-described envelopes.

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

The within-described method of laying béton or concrete under water, consisting of first inclosing the béton or concrete in paper bags or other soluble envelopes, and then lodging the bags or envelopes so filled in the desired position under water, in such a manner that the bag or envelope shall not be ruptured until after or at the time it and its contents are in place.

In testimony that I claim the foregoing improvement in the method of laying concrete under water as above described, I have hereunto set my hand this 21st day of June, 1886.

JOHN C. GOODRIDGE, JR.

Witnesses:

M. A. GOODRIDGE,

C. L. ROLLINS.