Jan. 30, 1951 T. OGNIBENE 2,539,670

METHOD FOR THE CONSTRUCTION OF A CUTOFF WALL

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FIG. 1.

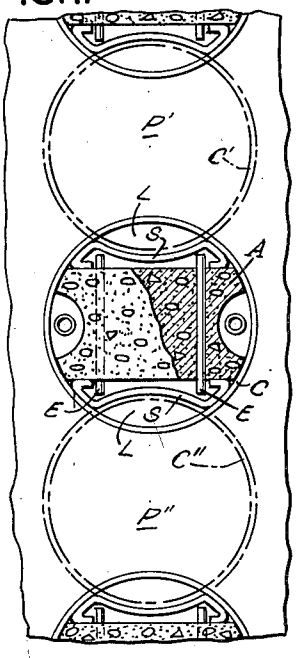


FIG. 2.

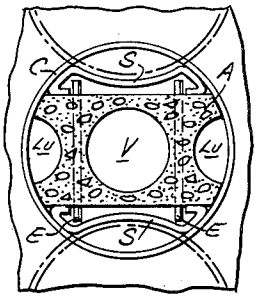


FIG. 3.

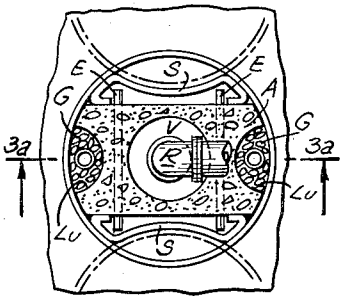


FIG. 4.

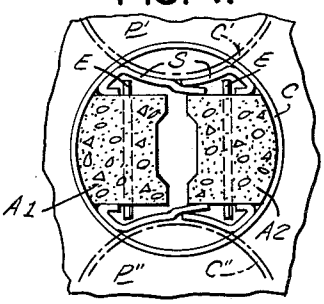


FIG. 5.

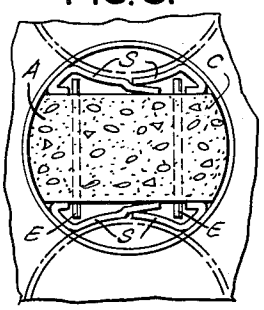


FIG. 3a.

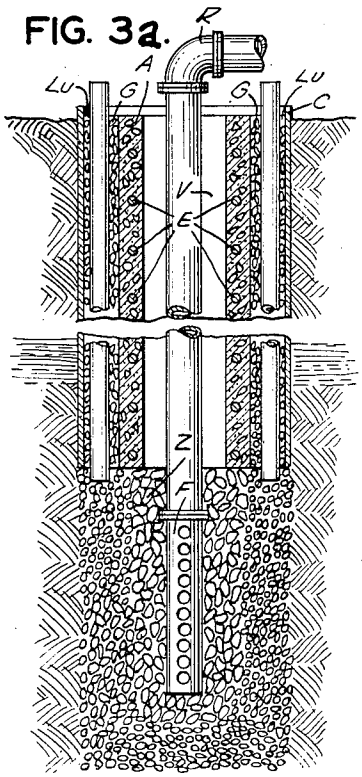


FIG. 6

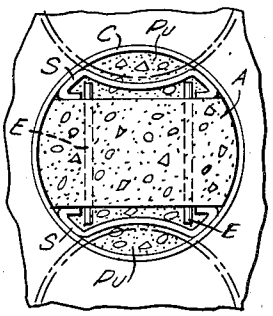
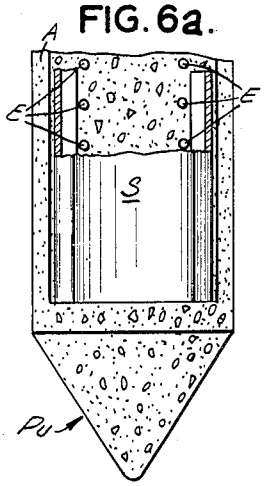


FIG. 6a.



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FIG. 8.

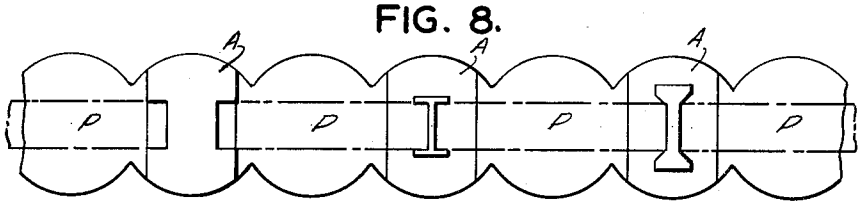


FIG. 8a.

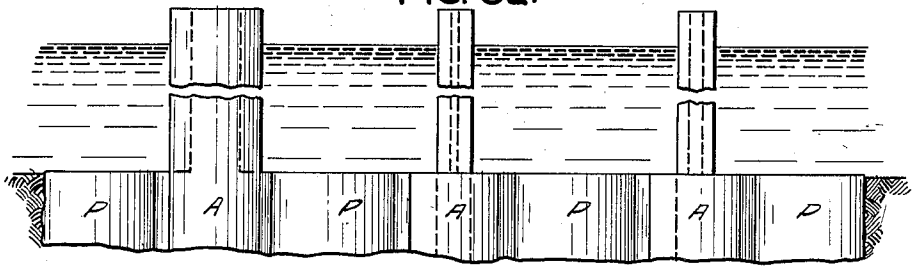


FIG. 7.

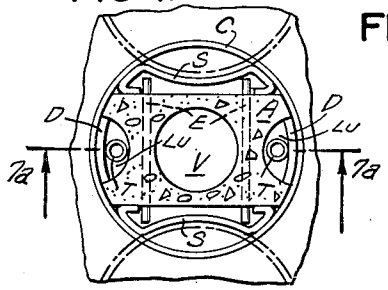


FIG. 9.

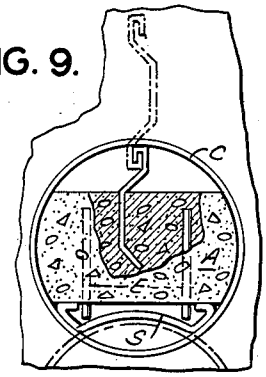


FIG. 10.

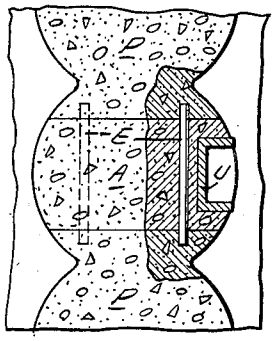


FIG. 7a.

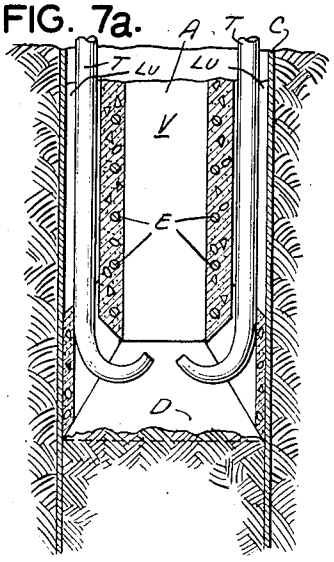


FIG. 11.

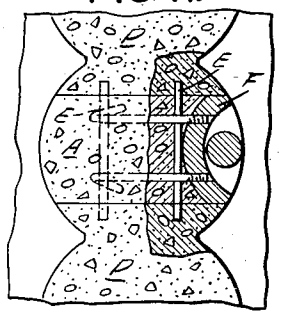
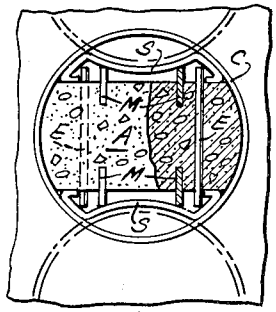


FIG. 12.



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UNITED STATES PATENT OFFICE

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METHOD FOR THE CONSTRUCTION OF A CUTOFF WALL

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Application September 5, 1946, Serial No. 694,950
In Italy September 25, 1945

8 Claims. (Cl. 61—31)

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The present invention relates to the construction of a cut-off wall for a dam structure or a sheet-piling or the like.

An object of the present invention is to provide a cut-off wall built by a series of contiguous piles or pillars tightly interconnected with each other by mechanical means so as to form a watertight structure.

Another object of the present invention is to provide a cut-off wall wherein an element or elements used for building up of the cut-off wall can be used for the arrangement of a filtering system within the cut-off wall during the construction thereof.

A further object of the present invention is to provide a cut-off wall which may be readily connected with sheet-piling.

With the above and other objects of the invention in view, the invention consists in the novel method, construction, arrangement and combination of various elements and parts, as set forth in the claims hereof, certain embodiments of the same being described in the specification and being illustrated in the accompanying drawings forming part of this specification, wherein:

Fig. 1 is a top plan view, partly in section, of a prefabricated pillar arranged between the positions of two piles to be cast-in-place for the construction of a cut-off wall in accordance with the invention,

Fig. 2 is a top plan view of a different embodiment of a prefabricated pillar according to the invention,

Fig. 3 is a top plan view similar to that shown in Fig. 2, wherein, however, filler material is placed into recesses of the prefabricated pillar,

Fig. 3*a* is a vertical sectional view taken on line *a*—*a* of Fig. 3,

Fig. 4 is a top plan view of a further embodiment of a prefabricated pillar according to the invention,

Fig. 5 is a top plan view of still another embodiment of a prefabricated pillar according to the invention,

Fig. 6 is a top plan view, partly in section, of a further embodiment of a prefabricated pillar according to the invention,

Fig. 6*a* is a side elevational view of the lower portion of a prefabricated pillar as shown in Fig. 6,

Fig. 7 is a top plan view of another embodiment of a prefabricated pillar according to the invention,

Fig. 7*a* is a vertical sectional view taken on line *b*—*b* of Fig. 7,

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Fig. 8 is a top plan view of a series of prefabricated pillars in a section of a cut-off wall according to the invention, said pillars being provided with means for connection with sheet-piling,

Fig. 8*a* is a side elevational view of the arrangement of prefabricated pillars shown in Fig. 8, and

Figs. 9–12 are top plan views, partly in section, of various different embodiments of prefabricated pillars according to the invention.

Referring now to Fig. 1 illustrating the invention in its simplest form, A generally indicates a reinforced prefabricated pillar which is inserted into a tube or pipe C previously driven into the ground in any suitable manner. The prefabricated pillar A is provided with a series of stirrups E embedded into the material, preferably concrete, of the pillar A. Said stirrups E extend transversely of the longitudinal axis of the pillar A and their ends project from the pillar at opposite sides thereof. The projecting ends of the stirrups E are protected by removable shields S of steel. The shields S are curved in such a manner that, after removal of the tube C enclosing the pillar A, they may serve as guides for the tubes C′ and C″ when the latter are driven into the ground, preparatory to the casting of the adjacent piles P′ and P″. Moreover, owing to said curved shape of the shields S, the tubes C′ and C″ subsequently driven into the ground may intersect the space previously occupied by the tube C, so that overlapping portions L having a cross-section of the shape of a lens are formed.

When concrete is poured into a tube C′ or C″, for example into the tube C′ for preparing a pile P′ of concrete or reinforced concrete, the tube C′ and the shield S adjacent to said tube C′ are withdrawn at the same time, so that the concrete leaving the tube C′ at the lower end thereof may perfectly and fully envelop the stirrups E and may perfectly and fully engage the side surface of the prefabricated pillar A from which the stirrups project so as to form an integrated structure including the prefabricated pillar A and the cast-in-place pile P′. Thus, a fully watertight connection is obtained between the prefabricated pillars and cast-in-place piles used for the integrate structure of the cut-off wall.

The prefabricated pillar A may be made in the shape of a full or hollow or tubular body.

In the embodiment shown in Fig. 2, a hollow prefabricated pillar A is used. Said hollow pillar A is provided with a center bore V and has two longitudinal recesses L*u* of substantially semi-

circular cross section at opposite side surfaces thereof. Apparently, the hollow shape of a pillar A may be chosen for reducing the weight thereof. Said hollow shape, however, may also serve another useful purpose.

As shown in Figs. 3 and 3*a*, a suction pipe R forming a part of a filtering system is inserted into the center bore of the pillar A. The lower end of said suction pipe R communicates with a filter tube F embedded into a filter bed Z prepared below the pillar A. Thus, it is possible to lower the underground water level without the use of a special filter well drilled outside the cut-off wall.

The longitudinal recesses L*u* of semi-circular cross-section likewise contributing to a reduction of the weight of the prefabricated pillar A may also be used for the formation of two additional filter columns. As shown in Fig. 3*a*, during the withdrawal of the tube C filtering material G is filled into said two recesses L*u*, whereby two filter columns are formed connecting the upper underground water strata with the lower underground water stratum, the water of which is sucked by the filtering system communicating with the filter bed Z arranged below the pillar A. Thus, the filter columns may be effectively used for a drainage of the ground. If desired, one or more pipes may be placed into the filter columns which may be used for pressing grout or other packing material into the filtering material so as to obtain an increased water-tightness of the cut-off wall and to fill intervening spaces between the cut-off wall and the ground or an adjacent structure.

As shown in Fig. 4, a prefabricated pillar according to the invention may be made of two separate symmetrical parts A_1 and A_2, which may be displaced relative to each other in a direction perpendicular to the longitudinal axis of the pillar. In such a case, each protecting shield S is likewise made of two separate pieces. After the withdrawal of the tube C enclosing the pillar portions A_1 and A_2, said two portions are moved away from each other by any suitable means to such an extent, that their outer round surfaces occupy at least the same position previously occupied by the outer surface of the round tube C. The concrete subsequently filled into the tubes C', C'' for casting the piles P', P'' will also penetrate into the space thus formed between the portions A_1 and A_2 of the pillar.

According to Fig. 5, the protecting shields S may also be made of two relatively movable parts, so that, after the withdrawal of the tube enclosing the pillar A, the protecting shields may be extended in width, whereby their outer edges previously contacting or nearly contacting the inside of the tube now occupy the position previously occupied by the outer surface of the tube.

The prefabricated pillar may be inserted into the ground or may be driven into the ground by means of a pile-driver without the use of a tube, if necessary in combination with a flushing process.

According to the embodiment illustrated by Figs. 6 and 6*a*, a point P*u* facilitating the driving of the pillar into the ground is arranged at the lower end of the pillar A. Said point P*u* also serves to protect the shields S which in turn protect the projecting ends of the stirrups E.

According to the embodiment shown in Figs. 7 and 7*a*, the pillar A equipped with stirrups E and protecting shields S has a cutting shoe D at its lower end, by means of which the penetration into the ground may be facilitated. Flushing pipes T are inserted into the recesses L*u*. Material disintegrated and loosened by the liquid ejected from the flushing pipes may be removed through the center bore V of the pillar A.

The prefabricated pillars may be of greater length than the piles cast-in-place. For example, when a cut-off wall according to the invention is used in submarine construction, the cast-in-place piles P may reach only up to the bottom of a river or the like while the pillars A may reach beyond the bottom of the river and may even extend above the level of the water as illustrated by Figs. 8 and 8*a*. If desired, the pillars A may be extended by means of beams of steel or concrete anchored in or connected to the body of the pillar proper. The extensions of the pillars A may constitute elements of the cut-off structure and may be used for the construction of a watertight sheeting of a cofferdam.

The prefabricated pillar may be provided with means for a ready connection with a sheet-piling of steel. According to Fig. 9, for example, a section of a sheet-pile cut along its length is partially embedded into the body of the pillar A, so that its flanged part projects therefrom and renders possible an easy connection with the flange of a normal sheet-pile of the same profile.

As shown in Fig. 10, a U-shaped beam U may be inserted into and connected with the body of the prefabricated pillar A, if desired, so as to form a channel or groove of a cofferdam.

Furthermore, any other suitable profile iron, for example a profile iron F of the shape shown in Fig. 11, may be inserted into and connected with the body of the prefabricated pillar A so as to form such a channel or groove.

According to the embodiment shown in Fig. 12, the prefabricated pillar A carries also flat iron sheets M in addition to the stirrups E. Said flat iron sheets extending in the longitudinal direction of the pillar A are partially embedded into the material of the pillar and project partially from the same sides of the pillar as the stirrups E. The flat iron sheets, likewise, protected by the shields S, serve to improve the watertightness of the cut-off wall.

Furthermore, the prefabricated pillar may be provided with lateral and/or central grooves or ribs extending longitudinally of the pillar at the sides from which the ends of the stirrups project. Said grooves or ribs are arranged for engagement with the shields so as to prevent same from an undesired lateral displacement which might be caused by the driving in of an adjacent tube, whereby the watertightness of the finished cut-off wall may be further increased.

What I claim is:

1. A method for the construction of a cut-off wall comprising the steps of driving a first tube into the ground, placing a prefabricated pillar into said first tube, placing removable shields into said first tube at sides of said pillar, withdrawing said first tube, driving a second tube into the ground in such a manner that it intersects the space previously occupied by said first tube and is adjacent such a shield, pouring concrete into said second tube, and withdrawing substantially simultaneously said second tube and the adjacent shield during the pouring of concrete into said second tube.

2. A method for the construction of a cut-off wall comprising the steps of driving a first tube into the ground, placing a prefabricated pillar into said first tube, said prefabricated pillar having elements projecting from sides thereof, plac-

ing removable shields into said first tube at the sides of said pillar with said projecting elements so as to cover same by said shields driving a second tube into the ground in such a manner that it intersects the space previously occupied by said first tube and is adjacent such a shield, pouring concrete into said second tube, and withdrawing substantially simultaneously said second tube and the adjacent shield during the pouring of concrete into said second tube.

3. A method for the construction of a cut-off wall comprising the steps of driving a first tube into the ground, placing the assembly of a prefabricated pillar having elements projecting from sides thereof and of shields covering said projecting elements and being slidably engaged with said pillar into said first tube, withdrawing said first tube, driving a second tube into the ground in such a manner that it intersects the space previously occupied by said first tube and is adjacent such a shield, pouring concrete into said second tube, and withdrawing substantially simultaneously said second tube and the adjacent shield during the pouring of concrete into said second tube.

4. A method for the construction of a cut-off wall comprising the steps of driving a first tube into the ground, placing a prefabricated pillar including two individual component parts into said first tube, placing removable shields into said first tube at sides of said pillar, withdrawing said first tube, spreading said component parts of said pillar apart from each other so as to provide for a space between same, driving a second tube into the ground in such a manner that it intersects the space previously occupied by said first tube and is adjacent such a shield, pouring concrete into said second tube, and withdrawing substantially simultaneously said second tube and the adjacent shield during the pouring of concrete into said second tube.

5. A method for the construction of a cut-off wall comprising the steps of driving a first tube into the ground, providing a filter bed in the lower portion of said first tube, placing a prefabricated hollow pillar into said first tube on top of said filter bed, inserting a filtering pipe of a filtering system into said hollow pillar in communication with said filter bed, placing removable shields into said first tube at sides of said pillar, withdrawing said first tube, driving a second tube into the ground in such a manner that it intersects the space previously occupied by said first tube and is adjacent such a shield, pouring concrete into said second tube, and withdrawing

substantially simultaneously said second tube and the adjacent shield during the pouring of concrete into said second tube.

6. A method for the construction of a cut-off wall as claimed in claim 5, wherein a prefabricated hollow pillar having recesses at sides free from said shields is placed into said first tube, inserting filtering material into said recesses so as to build filter columns connecting with said filter bed.

7. A method for the construction of a cut-off wall comprising the steps of driving a first tube into the ground, providing a filter bed in the lower portion of said first tube, placing the assembly of a prefabricated hollow pillar having elements projecting from sides thereof and of shields covering said projecting elements and being slidably engaged with said pillar into said first tube on top of said filter bed, inserting a filtering pipe of a filtering system into said hollow pillar in communication with said filter bed, withdrawing said first tube, driving a second tube into the ground in such a manner that it intersects the space previously occupied by said first tube and is adjacent such a shield, pouring concrete into said second tube, and withdrawing substantially simultaneously said second tube and the adjacent shield during the pouring of concrete into said second tube.

8. A method for the construction of a cut-off wall as claimed in claim 7, wherein a prefabricated hollow pillar having recesses at sides free from said shields is placed into said first tube inserting filtering material into said recesses so as to build filter columns connecting with said filter bed.

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