

METHOD FOR CONSTRUCTING BUTTRESS-TYPE RETAINING WALL ON THE SEA USING BUOYANCY AND RETAINING WALL ASSEMBLY THEREFOR

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CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

10 This application claims the benefit of Korean Patent Application No. 10-2020-0001471 filed on January 06, 2020, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND OF THE INVENTION

15 1. Field of the Invention

The present invention relates to a technology for constructing a marine structure, and more particularly, to a technology for constructing a buttress-type retaining wall on the sea.

20 2. Description of the Related Art

In general, a caisson, which is a reinforced concrete structure generally weighing several thousand tons, is used for the construction of berthing facilities such as quay walls. Since the caisson can provide its own buoyancy, the caisson is launched by using buoyancy to a construction site, is moved, and then sunken by supplying water therein. A buttress-type retaining wall can structurally function like the caisson, but because the buttress-type retaining wall cannot provide buoyancy like the caisson, the buttress-type retaining wall cannot be launched on its own, so that the buttress-type retaining wall is manufactured in a small scale and installed using a marine crane.

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[Prior-art document]

[Patent document]

(Patent document 1) Korean Patent Registration No. 10-1806855
entitled "Modular revetment structure and construction method" (registered on
5 January 18, 2018)

SUMMARY OF THE INVENTION

The present invention provides a method for constructing a buttress-type
retaining wall on the sea using buoyancy and a retaining wall assembly
10 therefor.

According to an aspect of the present invention, there is provided a
method for constructing a buttress-type retaining wall on the sea using
buoyancy, the method including preparing a buttress-type retaining wall, the
buttress-type retaining wall

15 including a base portion and a wall portion extending upward from the base
portion and a plurality of support wing walls extending upward from the base
portion, connected to the wall portion and sequentially arranged along a width
direction of the wall portion, preparing a buoyancy tank, the buoyancy tank being
coupled to the buttress-type retaining wall to be constructed and providing
20 buoyancy, coupling the buttress-type retaining wall to be constructed to the
buoyancy tank on the sea so as to form a retaining wall assembly, and
transporting the retaining wall assembly to a construction site of the buttress-
type retaining wall to be constructed on the sea, wherein, in the coupling the
buoyancy tank is detachably coupled to the buttress-type retaining wall by a
25 coupling unit.

According to another aspect of the present invention, there is provided a
retaining wall assembly for constructing a buttress-type retaining wall on the
sea using buoyancy, the retaining wall assembly including a buttress-type
retaining wall including a base portion, a wall portion extending upward from
30 the base portion, and a plurality of support wing walls extending upward from
the base portion, connected to the wall portion and sequentially arranged along
a width direction of the wall portion, a buoyancy tank coupled to the buttress-

type retaining wall and providing buoyancy, and a coupling unit detachably coupling the buttress-type retaining wall and the buoyancy tank.

BRIEF DESCRIPTION OF THE DRAWINGS

5 The above and other features and advantages of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

10 FIG. 1 is a flowchart schematically illustrating a method for constructing a buttress-type retaining wall on the sea using buoyancy according to an embodiment of the present invention;

 FIG. 2 is a perspective view illustrating a buttress-type retaining wall prepared in an operation of preparing the buttress-type retaining wall shown in FIG. 1;

15 FIG. 3 is a perspective view illustrating a buoyancy tank prepared in an operation of preparing the buoyancy tank shown in FIG. 1;

 FIGS. 4 through 6 are views illustrating a state in which a coupling operation shown in FIG. 1 is performed;

20 FIG. 7 is a perspective view illustrating a retaining wall assembly formed by coupling the buttress-type retaining wall and the buoyancy tank by performing the coupling operation shown in FIG. 1;

 FIG. 8 is a view showing a state in which the retaining wall assembly is floated by buoyancy so as to perform the operation of transporting the assembly shown in FIG. 1;

25 FIG. 9 is a view showing a state in which the operation of sinking the assembly shown in FIG. 1 is performed and thus the retaining wall assembly is seated at a construction site; and

 FIG. 10 is a view showing a state in which the dismantling operation shown in FIG. 1 is performed and thus the buoyancy tank is separated from the buttress-type retaining wall.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, the configuration and operation of embodiments of the present invention will be described in detail with reference to the attached drawings.

5 FIG. 1 is a flowchart schematically illustrating a method for constructing a buttress-type retaining wall on the sea using buoyancy according to an embodiment of the present invention. Referring to FIG. 1, the method for constructing a buttress-type retaining wall on the sea using buoyancy according to an embodiment of the present invention includes an operation of preparing a
10 buttress-type retaining wall (S11) in which a buttress-type retaining wall to be constructed is prepared, an operation of preparing a buoyancy tank (S12) in which the buoyancy tank to be coupled to the buttress-type retaining wall to be constructed is prepared, a coupling operation (S20) in which the buttress-type retaining wall to be constructed and the buoyancy tank are coupled to each
15 other so as to form a retaining wall assembly, an operation of transporting an assembly (S30) in which the retaining wall assembly formed through the coupling operation (S20) is transported to a construction site on the sea, an operation of sinking the assembly (S40) in which the retaining wall assembly transported to the installation site on the sea through the assembly transporting
20 operation (S30) is sunken, and a dismantling operation (S50) in which the buoyancy tank is separated from the retaining wall assembly sunken at the construction site through the operation of sinking the assembly (S40).

In the operation of preparing the buttress-type retaining wall (S11), the buttress-type retaining wall to be constructed is manufactured and prepared.
25 In the present embodiment, it will be described that the buttress-type retaining wall to be constructed is manufactured on land. FIG. 2 is a view illustrating an example of the buttress-type retaining wall to be constructed prepared through the operation of preparing the buttress-type retaining wall (S11). Referring to FIG. 2, a buttress-type retaining wall 110 to be constructed includes a plate-
30 shaped base portion 111, a wall portion 120 formed by extending upward from the base portion 111, and a plurality of support wing walls 145 formed by extending upward from the base portion 111.

The base portion 111 has a flat plate-like shape arranged horizontally, and the wall portion 120 and the plurality of support wing walls 145 are arranged on a top surface of the base portion 111.

The wall portion 120 is formed by extending vertically upward from the base portion 111. The wall portion 120 is positioned adjacent to a front end 112 from among the front end 112 and a rear end 113 of the base portion 111 in the base portion 111. The plurality of support wing walls 140 are connected to a rear wall surface 125 facing the rear end 113 of the base portion 111 in the wall portion 120. At an upper end of the wall portion 120, upper couplers 130 are positioned at a plurality of points connected to the plurality of support wing walls 145. Coupling holes are formed in the upper couplers 130.

Each of the plurality of support wing walls 145 is formed to be erected upward from the base portion 111. The plurality of support wing walls 145 are arranged between the wall portion 120 and the rear end 113 of the base portion 111 and are sequentially spaced apart from one another substantially at equal intervals along a width direction of the wall portion 120. Each of the plurality of support wing walls 145 has a shape extending from the wall portion 120 toward the rear end 113 of the base portion 111 and has substantially a triangular shape in which the height of the support wing wall 145 decreases toward the rear end 113 of the base portion 111. Lower couplers 140 are positioned at a lower end of some of the support wing walls 145 from among the plurality of support wing walls 145. Coupling holes are formed in the lower couplers 140.

In the operation of preparing the buoyancy tank (S12), a buoyancy tank to be coupled to the buttress-type retaining wall 110 to be constructed prepared through the operation of preparing the buttress-type retaining wall (S11) is prepared. FIG. 3 shows an example of the buoyancy tank prepared through the operation of preparing the buoyancy tank (S12). In the present embodiment, it will be described that the buoyancy tank prepared through the operation of preparing the buoyancy tank (S12) is manufactured in a floating dock (or dry dock). However, the present invention is not limited thereto. Referring to FIG. 3, a buoyancy tank 150 is a hollow structure that provides an inner space 150a and has an open upper portion, and includes a plurality of

partition walls 160 formed in the inner space 150a and supporting the buoyancy tank 150 structurally. Also, the buoyancy tank 150 is formed with a plurality of slit portions 165 in which each of the plurality of support wing walls 145 provided in the buttress-type retaining wall 110 is inserted and can be accommodated. In addition, the buoyancy tank 150 includes a plurality of upper coupling devices 155 detachably coupled to each of the plurality of upper couplers 130 embedded in the buttress-type retaining wall 10, and a plurality of lower coupling devices (see 157 of FIG. 7) detachably coupled to each of the plurality of lower couplers 140 embedded in the buttress-type retaining wall 110. Corresponding couplers 130 and 140 and coupling devices 155 and 157 constitute a coupling unit.

In the coupling operation (S20), the buttress-type retaining wall (see 110 of FIG. 2) to be constructed prepared through the operation of preparing the buttress-type retaining wall (S11) and the buoyancy tank (see 150 of FIG. 3) prepared through the operation of preparing the buoyancy tank (S12) are coupled to each other. FIGS. 4, 5, and 6 show a process in which the buttress-type retaining wall 110 to be constructed and the buoyancy tank 150 are coupled to each other through the coupling operation (S20). First, referring to FIG. 4, the buoyancy tank 150 manufactured in the floating dock 170 (or dry dock) is floating by its own buoyancy. Subsequently, the buoyancy tank 150 is moved from the floating dock 170 and is temporarily moored. At this time, the launch of the buoyancy tank 150 may be accomplished by draining the water filled in the buoyancy tank 150 or filling the floating dock 170 with water. Next, the buttress-type retaining wall 110 manufactured on land is transported to the floating dock 170 by a transport equipment such as an individual pushing caisson carrier vehicle (IP-CCV), and then shipped to the floating dock 170. Next, the buoyancy tank 150 is moved to the floating dock 170 in which the buttress-type retaining wall 110 is loaded by a tugboat, and is located at a coupling position with the buttress-type retaining wall 110, as shown in FIG. 5. Although not shown in detail in FIG. 6, in this case, each of the plurality of support wing walls 145 formed in the buttress-type retaining wall 110 is partially inserted into each of the plurality of slit portions 165 formed in

the buoyancy tank 150. In this state, water is supplied to the buoyancy tank 150 so that the buoyancy tank 150 sinks and the coupling devices 155 and 157 (for example, hydraulic jacks) are coupled to the corresponding couplers 130 and 140, so that the retaining wall assembly 100 as shown in FIGS. 6 and 7 is formed in the floating dock 170. The upward and downward movement of the buoyancy tank 150 with respect to the buttress-type retaining wall 110 is restricted by the combination of the upper couplers 130 and the upper coupling device 155, and the forward and backward movement of the buoyancy tank 150 with respect to the buttress-type retaining wall 110 is restricted by the combination of the lower couplers 140 and the lower coupling device 157, and the support wing portions 145 formed on the buttress-type retaining wall 110 are inserted into the slit portions 165 formed in the buoyancy tank 150, so that the movement of the buoyancy tank 150 with respect to the buttress-type retaining wall 110 in a width direction is restricted. The coupling devices 155 and 157 are provided with moving bars, and the moving bars are fitted into the coupling holes formed in the couplers 130 and 140, so that the coupling devices 155 and 157 and the couplers 130 and 140 are coupled to one another.

In the operation of transporting the assembly (S30), the retaining wall assembly 100 formed through the coupling operation (S20) is transported to a construction site of the buttress-type retaining wall 110 to be constructed on the sea. The operation of transporting the assembly (S30) may be performed by towing the retaining wall assembly 100 floating on the water to the construction site using the tugboat, as shown in FIG. 8. In a state in which the retaining wall assembly 100 shown in FIG. 6 is sunken, water filled in the buoyancy tank 150 is drained so that the buoyancy of the retaining wall assembly 100 increases, and the retaining wall assembly 100 can float on the water, as shown in FIG. 8.

In the operation of sinking the assembly (S40), the retaining wall assembly 100 transported to the construction site of the buttress-type retaining wall 110 to be constructed through the operation of transporting the assembly (S30) is sunken. In a state in which the retaining wall assembly 100 is floating

on the water at the construction site, the operation of sinking the assembly (S40) is performed by filling water in the inner space 150a of the buoyancy tank 150 and by increasing the weight of the retaining wall assembly 100. FIG. 9 shows a constructed state in which the retaining wall assembly 100 is sunken at the construction site.

In the dismantling operation (S50), the buoyancy tank 150 is separated from the retaining wall assembly 100 sunken at the construction site through the operation of sinking the assembly (S40). The dismantling operation (S50) is performed by separating the plurality of coupling devices 155 and 157 from the plurality of couplers 130 and 140 coupled thereto in correspondence and removing water filled in the inner space 150a of the buoyancy tank 150. The buoyancy tank 150 separated from the buttress-type retaining wall 110 through the disassembly operation (S50) is raised by buoyancy, as shown in FIG. 10, and is then towed by the tugboat and recycled.

According to the present invention, all of the objects of the present invention described above can be achieved. Specifically, a buttress-type retaining wall is detachably coupled and moves to a construction site after launching using a reusable buoyancy tank, so that it is easy to construct the buttress-type retaining wall having a large size on the sea and the buttress-type retaining wall in which the amount of materials is reduced compared to the existing caisson, is used and thus construction cost can be reduced.

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

What is claimed is:

1. A method for constructing a buttress-type retaining wall on the sea using buoyancy, the method comprising:

5 preparing a buttress-type retaining wall, the buttress-type retaining wall comprising a base portion and a wall portion extending upward from the base portion and a plurality of support wing walls extending upward from the base portion, connected to the wall portion and sequentially arranged along a width direction of the wall portion;

10 preparing a buoyancy tank, the buoyancy tank being coupled to the buttress-type retaining wall to be constructed and providing buoyancy;

coupling the buttress-type retaining wall to be constructed to the buoyancy tank on the sea so as to form a retaining wall assembly; and

15 transporting the retaining wall assembly to a construction site of the buttress-type retaining wall to be constructed on the sea,

wherein, in the coupling the buoyancy tank is detachably coupled to the buttress-type retaining wall by a coupling unit.

20 2. The method of claim 1, wherein a plurality of slit portions are formed in the buoyancy tank, and in the coupling, each of the plurality of support wing walls is inserted into each of the plurality of slit portions.

25 3. The method of claim 2, wherein the buoyancy tank in a state of being located above the plurality of support wing walls descends by water supplied to the inner space of the buoyancy tank so that each of the plurality of support wing walls is inserted into each of the plurality of support slit portions.

30 4. The method of claim 1, wherein the coupling unit comprises a plurality of couplers installed at the buttress-type retaining wall, and a plurality of coupling devices detachably coupled to each of the plurality of couplers and installed at the buoyancy tank.

5. The method of claim 4, wherein the couplers are embedded in the buttress-type retaining wall, and the coupling devices comprise moving bars insertable into coupling holes formed in the couplers.

5 6. The method of claim 1, further comprising sinking the retaining wall assembly by supplying water to the buoyancy tank in a state in which the retaining wall assembly is transported to the construction site through the transporting of the assembly.

10 7. The method of claim 6, further comprising dismantling the buoyancy tank from the retaining wall assembly sunken at the construction site through the sinking of the retaining wall assembly, wherein the dismantling is performed by draining water from the buoyancy tank in a state in which the coupling unit is dismantled.

15 8. The method of claim 1, wherein the coupling is performed in a floating dock or dry dock.

20 9. A method for constructing a buttress-type retaining wall on the sea using buoyancy, the method comprising:

preparing a buttress-type retaining wall, the buttress-type retaining wall comprising a base portion and a wall portion extending upward from the base portion and a plurality of support wing walls extending upward from the base portion, connected to the wall portion and sequentially arranged along a width direction of the wall portion;

25 preparing a buoyancy tank, the buoyancy tank being coupled to the buttress-type retaining wall to be constructed and providing buoyancy;

coupling the buttress-type retaining wall to be constructed to the buoyancy tank on the sea so as to form a retaining wall assembly;

30 transporting the retaining wall assembly to a construction site of the buttress-type retaining wall to be constructed on the sea; and

sinking the retaining wall assembly by supplying water to the buoyancy tank in a state in which the retaining wall assembly is transported to the construction site through the transporting of the assembly; and

dismantling the buoyancy tank from the retaining wall assembly sunken at the construction site through the sinking of the assembly.

10. A retaining wall assembly for constructing a buttress-type retaining wall on the sea using buoyancy, the retaining wall assembly comprising:

a buttress-type retaining wall comprising a base portion, a wall portion extending upward from the base portion, and a plurality of support wing walls extending upward from the base portion, connected to the wall portion and sequentially arranged along a width direction of the wall portion;

a buoyancy tank coupled to the buttress-type retaining wall and providing buoyancy; and

a coupling unit detachably coupling the buttress-type retaining wall and the buoyancy tank.

11. The retaining wall assembly of claim 10, wherein the buoyancy tank is formed with a plurality of slit portions into which each of the plurality of support wing walls is inserted.

12. The retaining wall assembly of claim 10, wherein the coupling unit comprises a plurality of couplers installed at the buttress-type retaining wall, and a plurality of coupling devices detachably coupled to each of the plurality of couplers and installed at the buoyancy tank.

13. The retaining wall assembly of claim 12, wherein the couplers are embedded in the buttress-type retaining wall, and the coupling devices comprise moving bars insertable into coupling holes formed in the couplers.