

PILE HAVING LID FOR OPENING AND SHUTTING USING HINGE

CROSS-REFERENCE TO RELATED APPLICATION

Pursuant to 35 U.S.C. § 119(a), this application claims the benefit of
5 earlier filing date and right of priority to Korean Application No. 10-2010-0042868,
filed on May 7, 2010, the contents of which is incorporated by reference herein in
its entirety.

BACKGROUND OF THE INVENTION

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1. Field of the Invention

The present disclosure relates to civil engineering works, and particularly,
to a structure of a pile.

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2. Background of the Invention

A pile construction method for forming the foundation structure on the
ground, may largely include a method for inserting a factory-manufactured pile by
piling, and a method for installing a bar in a punched hole and installing concrete
in-situ.

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In case of the former piling method, as a pile, may be used a steel pipe
having a hollow tubular shape and provided with openings on upper and lower
ends thereof, or a pretensioned spun high strength concrete (PHC) pile. In such
structure, soil is introduced through the opening of the lower end of the pile, and
the soil is not introduced any longer due to consolidation occurring from the lower
25 part of the ground (that is, the lower end of the pile is blocked (reliably

immobilized)). Accordingly, a stable foundation structure can be implemented.

The piling method has advantages that the construction is convenient and the structure is stable. However, the piling method has a disadvantage that severe noise due to piling occurs under construction.

5 In order to solve such problems, has been developed a pile construction method for punching and then piling, in which a punched hole is formed in the ground, the punched hole is partially filled with grout, a factory-manufactured pile is inserted thereinto, and then piling is performed within the range of about 1m.

10 However, the punching and then piling construction method (partial piling method) also has the following soil mechanics problems.

Firstly, since the pile having the opening at the lower end thereof is piled within the range of about 1m, the bottom of the pile is not blocked. This may cause a stable foundation structure not to be implemented.

15 Secondly, at the time of a design, a fore end supporting force (P) of a pile is obtained by multiplying a sectional area of the bottom of a pile (A) by a point (lower end) resistance of soil (Q) ($P = A \times Q$). Here, a point resistance of a pile having not been piled, is set to be less than that of a pile having been piled, by about 30%, due to the aforementioned reasons. Therefore, in case of applying the punching and then piling construction method (partial piling method), the number
20 of piles should be increased. This may increase the construction costs.

Thirdly, an additional guide means is not required when performing partial piling with respect to a factory-manufactured pile. This may cause the pile to be inclined in a punched hole, or may cause the pile to be displaced.

25 SUMMARY OF THE INVENTION

Therefore, an aspect of the detailed description is to provide a pile having a lid for opening and shutting using a hinge, capable of having a stable foundation structure by sufficiently obtaining a fore end supporting force (by having the bottom of the pile completely-blocked), even when being applied to a punching and then piling construction method (partial piling method), and capable of reducing construction costs.

To achieve these and other advantages and in accordance with the purpose of this specification, as embodied and broadly described herein, there is provided a pile having a lid for opening and shutting using a hinge, the pile comprising: a pile body 100 having a pipe shape; an opening plate 200 installed to open and shut an opening of a lower end of the pile body 100; a central body hinge portion 110 formed on a front end of a bottom surface of the pile body 100; a central connection member 310 having one end connected to the central body hinge portion 110; a central opening plate hinge portion 210 to which another end of the central connection member 310 is connected, and formed behind the center of gravity of the opening plate 200; a pair of side body hinge portions 120 formed at two side ends of a bottom surface of the pile body 100; a pair of side connection members 320 having one ends connected to the side body hinge portions 120, respectively; and a pair of side opening plate hinge portions 220 to which another ends of the side connection members 320 are connected, and formed behind the central opening plate hinge portion 210 of the opening plate 200, wherein the opening plate 200 is open and shut by a hinge driving of the central connection member 310 and the side connection members 320.

Preferably, the central opening plate hinge portion 210 and the side opening plate hinge portions 220 may be formed at positions where a front end of

the opening plate 200 is inclined towards the front side, in a state where the front end of the opening plate 200 is towards the lower side as the opening plate 200 is open.

Preferably, the central opening plate hinge portion 210 may be positioned
5 in the opening of the lower end of the pile body 100, in a state where the opening plate 200 is shut.

Preferably, a central hinge portion insertion hole 230 for inserting the central body hinge portion 110 in a state where the opening plate 200 is shut, may be formed at the opening plate 200.

10 The central connection portion 310 may include a head portion 311 having one end connected to the central body hinge portion 110; an inclined portion 312 having one end connected to another end of the head portion 311, and upward inclined; and a tail portion 313 having one end connected to another end of the inclined portion 312, having another end connected to the central opening plate
15 hinge portion 210, and downward inclined, wherein the head portion 311 and the inclined portion 312 are partially inserted into the central hinge portion insertion hole 230 in a state where the opening plate 200 is shut.

Preferably, a pair of side hinge portion insertion holes 240 for inserting the pair of side body hinge portions 120 in a state where the opening plate 200 is shut,
20 may be formed at the opening plate 200.

Preferably, each of the central connection member 310 and the pair of side connection members 320 may have a length long enough for a rear end of the opening plate 200 and a lower end of the pile body 100 not to collide with each other, when the rear end of the opening plate 200 is upward driven as the opening
25 plate 200 is open.

Preferably, the pile may further comprise a stopper 400 installed at the opening plate 200, the stopper configured to fix the opening plate 200 by being inserted into a stopper insertion portion 314 formed at another end of the central connection member 310, by being downward driven by its weight, in a state where
5 a front end of the opening plate 200 is towards the lower side as the opening plate 200 is open, and the stopper configured to shut (close) the opening plate 200 by being separated from the stopper insertion portion 314 by being upward driven when the front end of the opening plate contacts a bottom surface of a punched hole.

10 Preferably, the stopper 400 may be provided with a locking portion 410 configured to lock the stopper 400 to the stopper insertion portion 314, for prevention of downward separation of the stopper 400 having been inserted into the stopper insertion portion 314.

Preferably, an area increasing portion 420 for increasing a contact area
15 between the stopper 400 and the bottom surface of the punched hole, may be formed at a front end of the stopper 400.

Preferably, the stopper 400 may include a body portion 430 inserted into the stopper insertion portion 314; and an extension portion 440 having a thinner structure than the body portion 430, and extending toward the fore end of the
20 stopper 400.

Preferably, a hinge portion avoiding portion 441 may be formed at the extension portion 440, such that the stopper 400 and the central body hinge portion 110 do not collide with each other in a state where the opening plate 200 is shut.

25 Preferably, the opening plate 200 may have a width greater than that of

the pile body 100.

Preferably, the opening plate 200 may have a conical structure that a central part thereof downward protrudes.

A ring-shape mounting member 100a may be coupled to a peripheral part of a lower end of the pile body 100. And, the opening plate 200, the central body hinge portion 110, and the side body hinge portions 120 may be mounted to the ring-shape mounting member 100a.

The present invention may have the following advantages.

Firstly, the present invention can have a stable foundation structure by sufficiently obtaining a fore end supporting force (by having the bottom of the pile completely-blocked), even when being applied to a punching and then piling construction method (partial piling method).

Secondly, the present invention can reduce construction costs.

Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments and together with the description

serve to explain the principles of the invention.

In the drawings:

FIGS. 1 to 10 are views showing a pile having a lid for opening and shutting using a hinge according to the present invention, in which

5 FIGS. 1 to 3 are views showing an operation in a first embodiment;

FIG. 4 is a view showing a first usage state in a second embodiment;

FIG. 5 is a view showing a second usage state in a second embodiment;

FIG. 6 is a cross-sectional view of a third embodiment;

FIG. 7 is a view showing a first usage state in a fourth embodiment;

10 FIG. 8 is a view showing a second usage state in a fourth embodiment;

and

FIG. 9 is a front view of a stopper.

DETAILED DESCRIPTION OF THE INVENTION

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Description will now be given in detail of the exemplary embodiments, with reference to the accompanying drawings. For the sake of brief description with reference to the drawings, the same or equivalent components will be provided with the same reference numbers, and description thereof will not be repeated.

20 Hereinafter, preferred embodiments of the present invention will be explained in more details with reference to the attached drawings.

As shown in FIG. 1, a pile having a lid for opening and shutting using a hinge comprises: a pile body 100 having a pipe shape; an opening plate 200 installed to open and shut an opening of a lower end of the pile body 100; a
25 central body hinge portion 110 formed on a front end of a bottom surface of the

pile body 100; a central connection member 310 having one end connected to the central body hinge portion 110; a central opening plate hinge portion 210 to which another end of the central connection member 310 is connected, and formed behind the center of gravity of the opening plate 200; a pair of side body hinge portions 120 formed at two side ends of a bottom surface of the pile body 100; a pair of side connection members 320 having one ends connected to the side body hinge portions 120, respectively; and a pair of side opening plate hinge portions 220 to which another ends of the side connection members 320 are connected, and formed behind the central opening plate hinge portion 210 of the opening plate 200.

In such a hinge structure, the opening plate 200 is open and shut by a hinge driving of the central connection member 310 and the side connection members 320.

That is, when the pile body 100 is inserted into a punched hole, the opening plate 200 is open (refer to FIG. 1). On the other hand, when the pile body 100 reaches the bottom of the punched hole, the opening plate 200 is shut (refer to FIGS. 2 and 3).

Such configuration has the following advantages.

Firstly, when the pile body 100 is inserted into the punched hole, the opening plate 200 is open. Accordingly, the pile body 100 is floated by buoyancy of a grout or other fluid which exists at the punched hole. This can allow the insertion operation to be smoothly performed. When the pile body reaches the bottom of the punched hole, the opening plate 200 is shut. Accordingly, the bottom of the pile is blocked, and thus a fore end supporting force can be obtained even by partial piling.

Therefore, the present invention is effective in that a fore end supporting force can be sufficiently obtained, even when being applied to a punching and then piling method (the bottom of the pile is completely blocked). This can allow a stable foundation structure to be implemented, and can reduce the construction costs.

Secondly, the opening of the lower end of the pile is open and shut in a state where the opening plate 200 has a circular shape. Therefore, the occurrence of a problem due to a transformation of the opening plate 200, can be reduced.

Thirdly, an opening driving structure is implemented by 4 hinges when viewed from the side. Accordingly, the shape of the opening plate 200 can be freely changed, and the pile can be less damaged when being placed near the punched hole, or when being lifted up from a desired position.

Hereinafter, the pile having a lid for opening and shutting using a hinge according to the present invention will be explained in more detail.

If the pile body 100 is formed of a steel pipe, the aforementioned member may be mounted to the lower end of the steel pipe. However, if the pipe body 100 is formed of a concrete pipe such as a PHC pile, a ring-shaped mounting member 100a is preferably coupled to a peripheral part of the lower end of the pile body 100 by bolts, etc. And, the opening plate 200, the central body hinge portion 110, and the side body hinge portions 120 are preferably mounted to the ring-shape mounting member 100a.

In this case, only the ring-shape mounting member 100a is manufactured from a factory, and the ring-shape mounting member 100a is mounted to the lower end of a general concrete pile in-situ.

The opening plate 200 is inserted into the punched hole in a state of

hanging down by its weight. For a smooth upward driving (closing driving) implemented as the lower end of the opening plate 200 contacts the bottom surface of the punched hole, the opening plate 200 should be inserted into the punched hole in a state where the front end thereof is inclined towards the front side (refer to FIGS. 1 and 2).

To this end, the central opening plate hinge portion 210 and the side opening plate hinge portions 220 are preferably formed at positions where the front end of the opening plate 200 is inclined towards the front side, in a state where the front end of the opening plate 200 is towards the lower side as the opening plate 200 is open (refer to FIGS. 4 and 5).

The central opening plate hinge portion 210 is formed behind the center of gravity of the opening plate 200. In order to prevent collision in the structure, the central opening plate hinge portion 210 is preferably positioned in the opening of the lower end of the pile body 100, in a state where the opening plate 200 is shut (refer to FIGS. 4 and 5).

The central body hinge portion 110 downward protrudes more than the pile body 100. In order to prevent the central body hinge portion and the opening plate 200 from colliding with each other, a central hinge portion insertion hole 230 for inserting the central body hinge portion 110 in a state where the opening plate 200 is shut, is formed at the opening plate 200 (refer to FIGS. 4 to 6).

If the pile of the present invention is formed of a concrete pile, the pile body 100 and the central connection member 310 may collide with each other in a state where the opening plate 200 is shut.

In order to prevent such problem, the central connection portion 310 preferably includes a head portion 311 having one end connected to the central

body hinge portion 110; an inclined portion 312 having one end connected to another end of the head portion 311, and upward inclined; and a tail portion 313 having one end connected to another end of the inclined portion 312, having another end connected to the central opening plate hinge portion 210, and
5 downward inclined (refer to FIG. 6).

In this case, as the head portion 311 and the inclined portion 312 are partially inserted into the central hinge portion insertion hole 230 in a state where the opening plate 200 is shut, the central connection portion 310 can be prevented from colliding with the concrete pile body 100.

10 As the pair of side body hinge portions 120 are mounted to the outside of the pile body 100, the pile body 100 can be prevented from colliding with other members. In order to completely prevent collision, a pair of side hinge portion insertion holes 240 for inserting the pair of side body portions 120 in a state where the opening plate 200 is shut, are preferably formed at the opening plate 200
15 (refer to FIGS. 4 and 5).

The central connection member 310 and the pair of side connection members 320 are configured to open and shut the opening plate 200 by being coupled to the aforementioned hinge portions. For a smooth open and shut operation, each of the central connection member 310 and the pair of side
20 connection members 320 has a length long enough for the rear end of the opening plate 200 and the lower end of the pile body 100 not to collide with each other, when the rear end of the opening plate 200 is upward driven as the opening plate 200 is open (refer to FIGS. 4 and 5).

The object of the present invention can be achieved by the
25 aforementioned structure. However, in the above structure, an unpredicted

situation may occur when the pile is inserted into the punched hole, as the opening plate 200 is freely driven by the hinge portions.

To prevent such problem, the pile of the present invention preferably comprises a stopper 400 for fixing the opening plate 200 which is in an open state
5 when the pile is inserted into the punched hole (refer to FIGS. 7 and 8).

The stopper 400 is inserted into a stopper insertion portion 314 formed at another end of the central connection member 310, by being downward driven by its weight, when the front end of the opening plate 200 is towards the lower side as the opening plate 200 is open. As a result, the opening plate 200 is fixed (refer
10 to FIG. 7).

Then, once the fore end of the opening plate 200 contacts the bottom surface of the punched hole, the stopper 400 is upward driven to be separated from the stopper insertion portion 314. As a result, the opening plate 200 is shut (refer to FIG. 8).

The stopper 400 merely needs to be installed at the opening plate 200 so
15 as to perform the sliding operation. As shown in FIGS. 7 and 8, the stopper insertion portion 314 is configured to fix the central connection member 310 by the stopper 400 at a desired position (open position of the opening plate). And, the stopper insertion portion 314 is configured to allow the central connection member
20 310 to be freely hinge-driven as the stopper 400 is separated therefrom, at a time point when the opening plate contacts the bottom surface of the punched hole.

Preferably, the stopper 400 is provided with a locking portion 410 configured to lock the stopper 400 to the stopper insertion portion 314, for prevention of downward separation of the stopper 400 having been inserted into
25 the stopper insertion portion 314 (refer to FIG. 7).

Once the fore end (lower end in drawing) of the stopper 400 contacts the bottom surface of the punched hole, the stopper 400 is upward driven with respect to the opening plate 200, to thereby be separated from the stopper insertion portion 314. In order to smoothly perform such operation, an area increasing portion 420 for increasing a contact area between the stopper 400 and the bottom surface of the punched hole, is preferably formed at the front end of the stopper 400, in a disc shape, etc.

For smooth insertion and separation into/from the stopper insertion portion 314, the stopper 400 preferably includes a body portion 430 inserted into the stopper insertion portion 314; and an extension portion 440 having a thinner structure than the body portion 430, and extending toward the front end of the stopper 400 (refer to FIGS. 7 and 8).

When the opening plate 200 is shut, the stopper 400 and the central body hinge portion 110 may collide with each other. To prevent such problem, a hinge portion avoiding portion 441 is preferably formed at the extension portion 440, in a structure of a groove or a through hole (refer to FIG. 9).

If the width of the opening plate 200 which is to form the bottom plate of the pile after the construction is greater than that of the pile body 100, the above opening and shutting operation is more smoothly performed. Further, as the area of the fore end (shoe) of the pile increases, a greater fore end supporting force can be obtained. This can increase the stability of the foundation structure, and reduce the number of piles. As a result, the construction costs can be reduced.

Further, if the opening plate 200 has a conical structure that a central part thereof downward protrudes, the opening plate 200 can be more stably open (by downward moving when the pile is inserted into the punched hole (FIGS. 7 and 8).

The foregoing embodiments and advantages are merely exemplary and are not to be considered as limiting the present disclosure. The present teachings can be readily applied to other types of apparatuses. This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, 5 modifications, and variations will be apparent to those skilled in the art. The features, structures, methods, and other characteristics of the exemplary embodiments described herein may be combined in various ways to obtain additional and/or alternative exemplary embodiments.

As the present features may be embodied in several forms without 10 departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be considered broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or 15 equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. A pile having a lid for opening and shutting using a hinge, the pile comprising:

5 a pile body 100 having a pipe shape;
 an opening plate 200 installed to open and shut an opening of a lower end of the pile body 100;

 a central body hinge portion 110 formed on a front end of a bottom surface of the pile body 100;

10 a central connection member 310 having one end connected to the central body hinge portion 110;

 a central opening plate hinge portion 210 to which another end of the central connection member 310 is connected, and formed behind the center of gravity of the opening plate 200;

15 a pair of side body hinge portions 120 formed at two side ends of a bottom surface of the pile body 100;

 a pair of side connection members 320 having one ends connected to the side body hinge portions 120, respectively; and

 a pair of side opening plate hinge portions 220 to which another ends of
20 the side connection members 320 are connected, and formed behind the central opening plate hinge portion 210 of the opening plate 200,

 wherein the opening plate 200 is open and shut by a hinge driving of the central connection member 310 and the side connection members 320.

25 2. The pile of claim 1, wherein the central opening plate hinge portion 210

and the side opening plate hinge portions 220 are formed at positions where a front end of the opening plate 200 is inclined towards the front side, in a state where the front end of the opening plate 200 is towards a lower side as the opening plate 200 is open.

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3. The pile of claim 2, wherein the central opening plate hinge portion 210 is positioned in the opening of the lower end of the pile body 100, in a state where the opening plate 200 is shut.

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4. The pile of claim 1, wherein a central hinge portion insertion hole 230 for inserting the central body hinge portion 110 in a state where the opening plate 200 is shut, is formed at the opening plate 200.

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5. The pile of claim 4, wherein the central connection portion 310 includes:
a head portion 311 having one end connected to the central body hinge portion 110;

an inclined portion 312 having one end connected to another end of the head portion 311, and upward inclined; and

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a tail portion 313 having one end connected to another end of the inclined portion 312, having another end connected to the central opening plate hinge portion 210, and downward inclined,

wherein the head portion 311 and the inclined portion 312 are partially inserted into the central hinge portion insertion hole 230 in a state where the opening plate 200 is shut.

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6. The pile of claim 4, wherein a pair of side hinge portion insertion holes 240 for inserting the pair of side body hinge portions 120 in a state where the opening plate 200 is shut, are formed at the opening plate 200.

5 7. The pile of claim 1, wherein each of the central connection member 310 and the pair of side connection members 320 has a length long enough for a rear end of the opening plate 200 and a lower end of the pile body 100 not to collide with each other, when the rear end of the opening plate 200 is upward driven as the opening plate 200 is open.

10 8. The pile of claim 1, further comprising a stopper 400 installed at the opening plate 200, the stopper configured to fix the opening plate 200 by being inserted into a stopper insertion portion 314 formed at another end of the central connection member 310, by being downward driven by its weight, in a state where
15 a front end of the opening plate 200 is towards a lower side as the opening plate 200 is open, and configured to shut the opening plate 200 by being separated from the stopper insertion portion 314 by being upward driven when a front end of the opening plate contacts a bottom surface of a punched hole.

20 9. The pile of claim 8, wherein the stopper 400 is provided with a locking portion 410 configured to lock the stopper 400 to the stopper insertion portion 314, for prevention of downward separation of the stopper 400 having been inserted into the stopper insertion portion 314.

25 10. The pile of claim 9, wherein an area increasing portion 420 for

increasing a contact area between the stopper 400 and the bottom surface of the punched hole, is formed at a front end of the stopper 400.

11. The pile of claim 10, wherein the stopper 400 includes:

5 a body portion 430 inserted into the stopper insertion portion 314; and
 an extension portion 440 having a thinner structure than the body portion 430, and extending toward a fore end of the stopper 400.

12. The pile of claim 11, wherein a hinge portion avoiding portion 441 is
10 formed at the extension portion 440, such that the stopper 400 and the central body hinge portion 110 do not collide with each other in a state where the opening plate 200 is shut.

13. The pile of claim 1, wherein the opening plate 200 has a width greater
15 than that of the pile body 100.

14. The pile of claim 1, wherein the opening plate 200 has a conical structure that a central part thereof downward protrudes.

20 15. The pile of one of claims 1 to 14, wherein a ring-shape mounting member 100a is coupled to a peripheral part of a lower end of the pile body 100, and

 wherein the opening plate 200, the central body hinge portion 110, and the side body hinge portions 120 are mounted to the ring-shape mounting member
25 100a.