

SPECIFICATION

Title of Invention: PILE RAPID LOADING TESTING DEVICE

TECHNICAL FIELD

[0001] The present invention relates to a pile rapid load test device for checking a bearing capacity of a pile based on an axial pushing force for a pile, which is exerted on a pile head by a weight that is caused to fall onto the pile head protruding from a ground surface, enabling extremely safe and quick lifting of the weight that has fallen onto the pile head to its initial height.

BACKGROUND ARTS

[0002] As a method of checking a bearing capacity of a pile, a static load test that is carried out under the same conditions as those for a pile to be actually used has been widely known. However, the static load test requires installation of, for example, a reaction-force resisting body (reaction-force pile) or a loading beam. Thus, when a large load is to be loaded, in particular, the test becomes extensive, leading to extension of a construction period and an increase in costs. In addition, the static load test has problems such as taking a long time for testing.

[0003] Accordingly, a pile rapid load test for checking a bearing capacity by causing a weight to fall onto a pile head to be actually used so as to apply an axial pushing force to a pile has been attracting attention.

[0004] In Patent document 1, for example, a weight, weight

catching devices, and a lifting device are described. The weight is caused to fall onto a pile head. The weight catching devices catch the weight that has fallen onto and bounced off the pile head. The lifting device lifts up the weight that has fallen onto the pile head to its initial height. In particular, as means for lifting up the weight that has fallen onto the pile head, for example, a jack, a winch, or a crane is used.

[0005] When the weight that has fallen onto the pile head is to be lifted up to the initial height by using, for example, a jack, the following work has hitherto been repeated. Specifically, the weight is hung from a threaded rod. The jack that is holding the threaded rod is extended or retracted to lift up the threaded rod together with the weight by one-stroke length of a piston rod. A temporary fixing nut that is threadably engaged with a male thread portion of the threaded rod is tightened to temporarily fix the threaded rod. Then, the piston rod is returned to an initial position. After that, the jack is extended or retracted again to lift up the threaded rod together with the weight.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0006]

Patent document 1: Japanese Patent No. 6613430

Patent document 2: Japanese Unexamined Patent Application Publication No. 2005-68802

Patent document 3: Japanese Unexamined Patent Application Publication No. 2002-303570

Patent document 4: Japanese Patent No. 6693778

NON-PATENT DOCUMENT

[0007]

Non-patent document 1: "SUPER JACK SYSTEM" 2010/08/06 Social Infrastructure Division JFE CIVIL RECRUITING [Search January 14, 2021] <https://www.jfe-civil.com/infra/tokkou/>

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0008] With the related-art method of lifting up the weight that has fallen onto the pile head to the initial height by using the jack, however, the jack that lifts up the weight is installed on a significantly high frame that is set up around the pile head. An operation of the jack and the work for temporarily fixing the lifting rod from which the weight is hung are manually carried out by a worker on an aerial work platform for each time. Thus, the work is inefficient with extremely low workability.

[0009] In particular, the weight that is used for the pile rapid load test weighs, for example, as much as 200 tons and thus is extremely heavy. Further, the work for lifting up the weight in small steps of several tens of centimeters generally to a height of 3 meters to 4 meters takes a long time. Thus, the work that has to be performed is extremely inefficient.

[0010] Further, a worker manually performs the above-mentioned work at a high altitude. Thus, performing the work involves high risk. In addition, some trouble may occur during the work, resulting in forced interruption of the test.

[0011] There has been known a jack-type lifting machine that automatically lifts up a suspended load by using a lifting jack having both of an upward movement function and a downward movement function. For example, a step rod, a full thread rod, a wire, a prestressed concrete (PC) steel wire strand, or a step bar is used as a lifting member for lifting the suspended load. In any case, the lifting member is lifted up together with the suspended load by a fixed amount in each step by using the jack. Finally, the suspended load is automatically lifted up to an aimed height.

[0012] For example, there has been known a super jack system technology that enables not only lifting by using the jack having both of the upward movement function and the downward movement function but also lifting of a heavy load, which has been considered to be difficult to achieve (Non-patent document 1).

[0013] The super jack system is a jack system that moves a step rod having nodes upward and downward through extension and retraction of the jack to thereby move the heavy load upward or downward. The super jack system is mainly used for demolition work and construction work for building structures (Patent document 4).

[0014] The present invention has been made to solve the problems described above, and has an object to provide a pile rapid load test device that uses, in particular, the above-mentioned super jack system technology to enable extremely safe and quick lifting of a weight that has fallen onto a pile head to its initial height.

MEANS FOR SOLVING THE PROBLEMS

[0015] The present invention relates to a pile rapid load test device for checking a bearing capacity of a pile based on an axial pushing force exerted on a pile head by a weight that is caused to fall onto the pile head actually protruding from a ground surface, the pile rapid load test device including: a frame body installed upright in a vicinity of the pile head; a weight lifting jack, which is installed above the frame body, and is configured to lift up the weight that has fallen onto the pile head to an initial height through intermediation of a weight lifting rod; a weight holding chuck, which allows the weight to be hung at an end portion of the weight lifting rod so that the weight is separable therefrom; and guide devices configured to guide the weight, wherein the weight lifting jack includes: a jack main body configured to lift up the weight; and an upper chuck and a lower chuck, which are provided above and below the jack main body, respectively, and are each configured to hold and release the weight lifting rod, wherein, when the weight lifting jack lifts up the weight, the upper chuck holds the weight lifting rod and the lower chuck releases the weight lifting rod, and wherein, when the upper chuck releases the weight lifting rod and is moved downward along with retraction of the weight lifting jack, the lower chuck holds the weight lifting rod. In particular, the extension and retraction of the jack main body of the weight lifting jack and the holding and release of the weight lifting rod by and from the upper chuck and the lower chuck are alternately repeated. As a result, the weight that has fallen onto the pile head can be extremely safely and quickly lifted up to the initial height.

[0016] Further, a plurality of node portions are formed on an outer periphery of the weight lifting rod at equal

intervals in an axial direction of the weight lifting rod. As a result, the weight lifting rod can reliably be held by the upper chuck and the lower chuck, enabling safe and reliable lifting of the weight that has fallen onto the pile head to its initial height.

[0017] Further, the pile rapid load test device includes a weight catching device that catches the weight that has bounced off the pile head in midair. As a result, repetitive bouncing of the weight can be prevented. Further, the weight lifting jack and the weight holding chuck can be operated safely by a remote device.

EFFECTS OF THE INVENTION

[0018] According to the present invention, in particular, the extension and retraction of the jack main body of the weight lifting jack and the holding and release of the weight lifting rod by and from the upper chuck and the lower chuck are alternately repeated. As a result, the weight that has fallen onto the pile head can be extremely efficiently and quickly lifted up to the initial height.

[0019] Further, the weight lifting jack is automatically operated through a remote operation. As a result, the occurrence of trouble can be prevented as much as possible. Further, the weight can be lifted up extremely safely to its initial height.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. 1 is a front view for illustrating a pile rapid load test device according to one embodiment when a

weight is hung at a lower end portion of a weight lifting rod through intermediation of a weight chuck.

FIG. 2 is a sectional view of the pile rapid load test device illustrated in FIG. 1, taken along the line A-A.

FIG. 3 is a side view of the weight hung at the lower end portion of the weight lifting rod through intermediation of the weight chuck.

FIG. 4 is an enlarged view of a weight lifting jack.

FIG. 5 is an explanatory view of an operation of the weight lifting jack, which is an enlarged sectional view for illustrating an operation in which an upper chuck holds the weight lifting rod and a jack main body is extended to lift up the weight through intermediation of the weight lifting rod.

FIG. 6 is an explanatory view of an operation of the weight lifting jack, which is an enlarged sectional view for illustrating an operation in which the upper chuck releases the weight lifting rod and is moved downward along the weight lifting rod through retraction of the jack main body.

FIG. 7 is an explanatory view of an operation of the weight lifting jack, which is an enlarged sectional view for illustrating an operation in which the upper chuck holds the weight lifting rod and the weight lifting rod is moved downward through the retraction of the jack main body.

FIG. 8 is an explanatory view of an operation of the weight lifting jack, which is an enlarged sectional view for illustrating an operation in which the upper chuck releases the weight lifting rod and is moved upward along the weight lifting rod through extension of the jack main body.

FIG. 9 is an exploded perspective view for illustrating

one example of a weight catching device.

FIG. 10(a) to FIG. 10(c) are longitudinal sectional views for illustrating an operation of the weight catching device illustrated in FIG. 9.

FIG. 11(a) to FIG. 11(c) are views for illustrating a modification example of the weight catching device, in which FIG. 11(a) is a longitudinal sectional view, FIG. 11(b) is a plan view, and FIG. 11(c) is a longitudinal sectional view for illustrating an operation thereof.

MODE FOR EMBODYING THE INVENTION

[0021] FIG. 1 to FIGS. 11 are illustrations of a pile rapid load test device according to one embodiment of the present invention. In FIG. 1 to FIGS. 11, a frame body 1 of a pile rapid load test device is installed so as to surround a pile head A actually protruding from a ground surface.

[0022] A base 2 is provided above the frame body 1. A weight lifting rod 4 is vertically provided to the base 2 so as to extend toward the pile head A. Further, a weight 3 to be caused to fall onto the weight head A is hung at a distal end portion of the weight lifting rod 4.

[0023] Further, a weight lifting jack 5 configured to lift up the weight 3 to a height from which the weight 3 is caused to fall through intermediation of the weight lifting rod 4 is installed onto the base 2.

[0024] The weight 3 is formed by combining a plurality of blocks into one and is configured so that its total weight can be adjusted by increasing and decreasing a quantity of blocks.

[0025] The weight lifting rod 4 is installed above the

pile head A so as to be located in an extension line from the pile head A and vertically pass through the weight lifting jack 5. In addition, the weight lifting rod 4 is supported by the base 2 so as to be movable in a vertical direction by the weight lifting jack 5.

[0026] Further, node portions 6 are formed on an outer periphery of the weight lifting rod 4 at equal intervals in an axial direction of the weight lifting rod 4. An outer peripheral surface of each of the node portions 6 includes a tapered surface 6a having a truncated conical shape with a diameter gradually decreasing from a lower end portion toward an upper end.

[0027] Further, a chuck 7 that releasably holds the weight 3 is mounted to a lower end portion of the weight lifting rod 4. When the weight 3 is held by the chuck 7, the weight 3 is hung at the lower end portion of the weight lifting rod 4 so as to be separable therefrom.

[0028] The chuck 7 is configured to be actuated, for example, hydraulically so as to releasably hold the weight 3. The chuck 7 allows the weight 3 to be hung at the lower end portion of the weight lifting rod 4 and allows the weight 3 to be separated from the lower end portion of the weight lifting rod 4 to cause the weight 3 to fall onto the pile head A through a wireless or wired remote operation.

[0029] The weight lifting jack 5 includes a jack main body 8, an upper chuck 9, and a lower chuck 10. When the weight lifting jack 5 is extended and retracted in the vertical direction, the jack main body 8 lifts up the weight 3 through intermediation of the weight lifting rod 4 to an initial height from which the weight 3 is caused to fall. The upper chuck 9

and the lower chuck 10 are provided above and below the jack main body 8 and are each configured to hold and release the weight lifting rod 4.

[0030] The upper chuck 9 is configured to hold the weight lifting rod 4 to be moved upward together with the weight lifting rod 4 when a piston rod 8a of the jack main body 8 is extended to lift up the weight 3 through intermediation of the weight lifting rod 4 (see FIG. 5).

[0031] Further, the upper chuck 9 is configured to hold the weight lifting rod 4 to be moved downward together with the weight lifting rod 4 when the piston rod 8a of the jack main body 8 is retracted to move the weight lifting rod 4 downward (see FIG. 7).

[0032] Further, the upper chuck 9 is configured to release the weight lifting rod 4 and be moved upward along the weight lifting rod 4 through the extension of the piston rod 8a of the jack main body 8 under a state in which the lower chuck 10 is holding the weight lifting rod 4 (see FIG. 8). Further, the upper chuck 9 is configured to be moved downward along the weight lifting rod 4 through the retraction of the piston rod 8a under a state in which the lower chuck 10 is holding the weight lifting rod 4 (see FIG. 6).

[0033] The lower chuck 10 is configured to release the weight lifting rod 4 when the upper chuck 9 holds the weight lifting rod 4 and the weight 3 is lifted up through intermediation of the weight lifting rod 4 through the extension of the piston rod 8a of the jack main body 8 (see FIG. 3).

[0034] Further, the lower chuck 10 is configured to hold the weight lifting rod 4 when the upper chuck 9 holds the

weight lifting rod 4 and the weight lifting rod 4 is moved downward through the retraction of the piston rod 8a of the jack main body 8 (see FIG. 5) and when the upper chuck 9 releases the weight lifting rod 4 and is moved upward along the weight lifting rod 4 through the extension of the piston rod 8a of the jack main body 8 (see FIG. 8).

[0035] The upper chuck 9 and the lower chuck 10 are now more specifically described. The upper chuck 9 includes a chuck main body 9a, an engagement key 9b, a jack 9c, and a spring 9d. The chuck main body 9a is formed hollow. The engagement key 9b is provided inside the chuck main body 9a so as to be movable upward and downward in an axial direction of the weight lifting rod 4, and holds and releases a lower part of the node portion 6 of the weight lifting rod 4. The jack 9c is provided inside the chuck main body 9a so as to be extendable and retractable upward and downward in the axial direction of the weight lifting rod 4, and pushes the engagement key 9b upward in the axial direction of the weight lifting rod 4. The spring 9d constantly pushes the engagement key 9b downward in the axial direction of the weight lifting rod 4.

[0036] Further, an intermediate rib 9e is formed on an inner side of the chuck main body 9a. The jack 9c and the spring 9d are provided below and above the intermediate rib 9e, respectively. Further, a tapered surface 9f having an inverted truncated conical shape that is inclined toward the weight lifting rod 4 is formed on a contact surface between the intermediate rib 9e and the engagement key 9b. The weight lifting rod 4 vertically passes through loose holes formed in central portions of the chuck main body 9a, the jack 9c, and the engagement key 9b.

[0037] With the configuration described above, the spring 9d constantly pushes the engagement key 9b downward in the axial direction of the weight lifting rod 4. As a result, the engagement key 9b is slid toward the weight lifting rod 4 along the tapered surface 9f of the intermediate rib 9e and is engaged with the lower part of the node portion 6 of the weight lifting rod 4. Specifically, the upper chuck 9 holds the lower part of the node portion 6 of the weight lifting rod 4 (see FIG. 5). As a result, when the piston rod 8a of the jack main body 8 is extended, the weight 3 can be lifted up by one-stroke length of the piston rod 8a through intermediation of the weight lifting rod 4.

[0038] Further, when the jack 9c pushes the engagement key 9b upward in the axial direction of the weight lifting rod 4, the engagement key 9b is slid in a direction opposite to the weight lifting rod 4 while being pushed upward and is disengaged from the lower part of the node portion 6 of the weight lifting rod 4. Specifically, the engagement key 9b releases the weight lifting rod 4. Thus, the upper chuck 9 is moved downward along the weight lifting rod 4 to the initial position along with the retraction of the piston rod 8a of the jack main body 8 (see FIG. 6).

[0039] At this time, the lower chuck 10 described later is holding the weight lifting rod 4. Thus, the weight lifting rod 4 is not moved downward together with the upper chuck 9.

[0040] Subsequently, an operation in which the engagement key 9b holds the weight lifting rod 4 and the piston rod 8a of the jack main body 8 is extended to lift up the weight 3 through intermediation of the weight lifting rod 4 (see FIG. 5) and an operation in which the engagement key 9b releases the weight lifting rod 4 and the piston rod 8a of the jack

main body 8 is retracted to move the upper chuck 9 downward along the weight lifting rod 4 (see FIG. 6) are repeated. As a result, the weight 3 that has fallen onto the pile head A can be lifted up to the initial height from which the weight 3 has been caused to fall.

[0041] The lower chuck 10 includes a chuck main body 10a, an engagement key 10b, a jack 10c, and a spring 10d. The chuck main body 10a is formed hollow. The engagement key 10b is provided inside the chuck main body 10a so as to be movable upward and downward in the axial direction of the weight lifting rod 4, and holds and releases the weight lifting rod 4. The jack 10c is provided inside the chuck main body 10a so as to be extendable and retractable upward and downward in the axial direction of the weight lifting rod 4, and pushes the engagement key 10b upward in the axial direction of the weight lifting rod 4. The spring 10d constantly pushes the engagement key 10b downward in the axial direction of the weight lifting rod 4.

[0042] Further, an intermediate rib 10e is formed on an inner side of the chuck main body 10a. The jack 10c and the spring 10d are provided below and above the intermediate rib 10e, respectively. Further, a tapered surface 10f having an inverted truncated conical shape that is inclined toward the weight lifting rod 4 is formed on a contact surface between the intermediate rib 10e and the engagement key 10b. The weight lifting rod 4 vertically passes through loose holes formed in central portions of the chuck main body 10a, the jack 10c, and the engagement key 10b.

[0043] With the configuration described above, the spring 10d constantly pushes the engagement key 10b downward in the axial direction of the weight lifting rod 4. As a result, the

engagement key 10b is slid along the tapered surface 10f of the intermediate rib 10e toward the weight lifting rod 4 and is engaged with the lower part of the node portion 6 of the weight lifting rod 4. Specifically, the lower chuck 10 holds the lower part of the node portion 6 of the weight lifting rod 4.

[0044] As a result, the upper chuck 9 releases the hanging rod 4 and thus can be moved upward (see FIG. 6) and downward (see FIG. 8) along the weight lifting rod 4 through the extension and retraction of the piston rod 8a of the jack main body 8.

[0045] Further, when the jack 10c pushes the engagement key 10b upward in the axial direction of the weight lifting rod 4, the engagement key 10b is slid in the direction opposite to the weight lifting rod 4 while being pushed upward to thereby release the weight lifting rod 4.

[0046] As a result, the upper chuck 9 holds the weight lifting rod 4 and is moved downward together with the weight lifting rod 4 through the retraction of the piston rod 8a of the jack main body 8 (see FIG. 7). Specifically, the weight lifting rod 4 can be moved downward by one-stroke length of the piston rod 8a of the jack main body 8.

[0047] Subsequently, an operation in which the engagement key 9b holds the weight lifting rod 4 and the weight lifting rod 4 is moved downward through the retraction of the piston rod 8a of the jack main body 8 under a state in which the weight lifting rod 4 is released by the lower chuck 10 (see FIG. 7) and an operation in which the engagement key 9b releases the weight lifting rod 4 and the upper chuck 9 is moved upward along the weight lifting rod 4 through the

extension of the piston rod 8a of the jack main body 8 under a state in which the lower chuck 10 is holding the weight lifting rod 4 (see FIG. 6) are repeated. As a result, the weight lifting rod 4 can be moved downward to a position of the weight 3, which has fallen onto the pile head A.

[0048] Reference symbol 11 represents guide devices that guide the weight 3 while the weight 3 is falling toward the pile head A and while the weight 3 that has fallen onto the pile head A is being lifted up to the initial height. Each of the guide devices 11 includes a guide rail 11a and a guide roller 11b. The guide rails 11a are installed on inner sides of support columns 1b of the frame body 1. The guide rollers 11b are provided to the weight 3 and the weight chuck 7 and travel on the guide rails 11a.

[0049] Further, reference symbol 12 represents weight catching devices that catch the weight 3 in midair when the weight 3 that has fallen onto the pile head A bounces off, so as to prevent repetitive bouncing of the weight 3. Each of the weight catching devices 12 includes a weight catching holder 13, a permanent electromagnetic holder 14, and a weight fall prevention stopper 15. The weight catching devices 12 are mounted to a gate-shaped frame 16 installed on an upper end portion of the frame body 1.

[0050] The weight catching holder 13 and the permanent electromagnetic holder 14 are installed on an upper frame 1a of the frame body 1 and an upper frame 16a of the gate-shaped frame 16, respectively. The weight fall prevention stopper 15 is provided between the weight catching holder 13 and the permanent electromagnetic holder 14.

[0051] Further, the weight catching holder 13, the

permanent electromagnetic holder 14, and the weight fall prevention stopper 15 are arranged in the same vertical line. At the same time, a weight catching rod 17 described later vertically passes through central portions of the weight catching holder 13, the permanent electromagnetic holder 14, and the weight fall prevention stopper 15 so that the weight fall prevention stopper 15 can be freely moved upward and downward along the weight catching rod 17 between the weight catching holder 13 and the permanent electromagnetic holder 14.

[0052] Further, a recessed portion 13a having an inner side with which the weight fall prevention stopper 15 is to be brought into contact is formed at an upper end of the weight catching holder 13. The recessed portion 13a is formed to have an inverted truncated conical shape with an outer diameter that is maximum at an upper end portion and gradually decreases toward a lower end. The recessed portion 13a has a loose hole 13b formed in a bottom portion, through which the weight catching rod 17 passes.

[0053] The weight fall prevention stopper 15 includes a plurality of spherical bodies 18 and a spherical-body holder 19 that holds the spherical bodies 18. The spherical-body holder 19 has an inverted truncated conical shape with an outer diameter that is maximum at an upper end portion and gradually decreases toward a lower end, which conforms with the shape of the recessed portion 13a of the spherical-body holder 19.

[0054] Further, a loose hole 19a through which the weight catching rod 17 passes is formed in a central portion of the spherical-body holder 19. A plurality of spherical-body receiving portions 19c are formed between the loose hole 19a and an outer peripheral surface 19b at equal intervals in a

circumferential direction and an up-and-down direction of the spherical-body holder main body 19. The spherical-body receiving portions 19c each have an inwardly curved inner peripheral surface.

[0055] Each of the spherical-body receiving portions 19c is open on the loose hole 19a side and on the outer peripheral surface 19b side. The spherical bodies 18 are received in the spherical-body receiving portions 19c, respectively. Each of the spherical bodies 18 is freely rotatable inside a corresponding one of the spherical-body receiving portions 19c and is freely movable toward the loose hole 19a and the outer peripheral surface 19b. Further, each of the spherical bodies 18 is formed to have such a size that allows a part of the spherical body 18 to protrude from one of the opening on the loose hole 19a side and the opening on the outer peripheral surface 19b side without fail.

[0056] The permanent electromagnetic holder 14 has a loose hole 14a in a central portion, through which the weight catching rod 17 passes. Further, the permanent electromagnetic holder 14 includes a shock-absorbing member such as a coil spring or an anti-vibration rubber, which relaxes impact that is generated when the weight 3 falls. The permanent electromagnetic holder 14 is provided to the upper frame 16a of the gate-shaped frame 16.

[0057] Further, the permanent electromagnetic holder 14 attracts the weight fall prevention stopper 15 only when being energized to generate a magnetic force. An energizing operation is performed through a remote operation using a wired or wireless rectifier (not shown) for a permanent electromagnetic holder or automatic control.

[0058] A plurality of weight catching rods 17 are arranged at equal intervals around the weight lifting rod 4. A lower end portion of each of the weight catching rods 17 is connected to a peripheral edge portion of an upper end of the weight 3. Further, an upper end side of each of the weight catching rods 17 continuously passes through the loose hole 13a of the weight catching holder 13, a loose hole 15a of the weight fall prevention stopper 15, and the loose hole 14a of the permanent electromagnetic holder 14 of the weight catching device 12.

[0059] With the configuration described above, when the weight 3 hung at the distal end portion of the weight lifting rod 4 bounces off the pile head A after falling onto the pile head A, the energization of the permanent electromagnetic holder 14 is interrupted. Then, the weight fall prevention stopper 15 is separated from the permanent electromagnetic holder 14 and falls along the weight catching rod 17 into the recessed portion 13a of the weight catching holder 13.

[0060] Simultaneously with contact of the weight fall prevention stopper 15 with the recessed portion 13a of the weight catching holder 13 as a result of the fall, the spherical bodies 18 are strongly pushed by an inner peripheral surface of the recessed portion 13a of the weight catching holder 13 toward the loose hole 15a. As a result, the spherical bodies 18 partially protrude into the loose hole 15a and firmly hold the weight catching rod 17 together to thereby prevent the repetitive bouncing of the weight 3.

[0061] The permanent electromagnetic holder 14 that attracts the weight fall prevention stopper 15 is mounted to the upper frame 16a of the gate-shaped frame 16 through intermediation of a shock-absorbing member such as a coil spring or an anti-vibration rubber. Thus, the weight 3 does

not accidentally fall due to, for example, impact generated when the weight falls.

[0062] FIG. 11(a) to FIG. 11(c) are illustrations of a modification example of the weight fall prevention stopper. A piece holder 20 has a plurality of slits 20c. The slits 20c are formed between a loose hole 20a and an outer peripheral surface 20b of the piece holder 20 at equal intervals in a circumferential direction of the piece holder 20. A wedge-shaped piece 21 is inserted into each of the slits 20c.

[0063] With the configuration described above, when the permanent electromagnetic holder 14 generates a magnetic force, the weight fall prevention stopper 15 is attracted to the permanent electromagnetic holder 14. When the energization of the permanent electromagnetic holder 14 is interrupted, the weight fall prevention stopper 15 falls into the recessed portion 13a of the weight catching holder 13. Then, the wedge-shaped pieces 21 are strongly pushed by an inner peripheral surface of the recessed portion 13a toward the loose hole 20a. As a result, end portions of the wedge-shaped pieces 20 protrude into the loose hole 20a to firmly hold the weight catching rod 17 that has bounced together with the weight 3 to thereby prevent the repetitive bouncing of the weight 3.

INDUSTRIAL AVAILABILITY

[0064] The present invention enables extremely safe and quick lifting of the weight that has fallen onto the pile head to the initial height in a pile rapid load test for checking the bearing capacity of the pile based on the axial pushing force exerted on the pile head by the weight that has fallen onto the pile head actually protruding from the ground surface.

EXPLANATION OF REFERENCE NUMERALS

[0065] 1 frame body

1a upper frame

1b support column

2 upper base

3 weight

4 weight lifting rod

5 weight lifting jack

6 node portion

6a taper

7 weight chuck

8 jack main body

8a piston rod

9 upper chuck

9a chuck main body

9b engagement key

9c jack

9d spring

9e intermediate rib

9f taper

10 lower chuck

10a chuck main body

10b engagement key

10c	jack
10d	spring
10e	intermediate rib
10f	taper
11	weight guide device
11a	guide rail
11b	guide roller
12	weight catching device
13	weight catching holder
13a	recessed portion
13b	loose hole
14	permanent electromagnetic holder
14a	loose hole
15	weight fall prevention stopper
15a	loose hole
16	gate-shaped frame
16a	upper frame
17	weight catching rod
18	spherical body
19	spherical-body holder
19a	loose hole
20	piece holder
20a	loose hole
21	wedge-shaped piece

CLAIMS

[Claim 1] A pile rapid load test device for checking a bearing capacity of a pile based on an axial pushing force exerted on a pile head by a weight that is caused to fall onto the pile head, the pile rapid load test device comprising:

a frame body installed upright in a vicinity of the pile head;

a weight lifting jack, which is installed above the frame body, and is configured to lift up the weight that has fallen onto the pile head to an initial height through intermediation of a weight lifting rod;

a weight holding chuck, which allows the weight to be hung at an end portion of the weight lifting rod so that the weight is separable therefrom; and

guide devices configured to guide the weight,

wherein the weight lifting jack includes:

a jack main body configured to lift up the weight;
and

an upper chuck and a lower chuck, which are provided above and below the jack main body, respectively, and are each configured to hold and release the weight lifting rod,

wherein, when the weight lifting jack lifts up the weight, the upper chuck holds the weight lifting rod and the lower chuck releases the weight lifting rod, and

wherein, when the upper chuck releases the weight lifting rod and is moved downward along with retraction of the weight lifting jack, the lower chuck holds the weight lifting rod.

[Claim 2] The pile rapid load test device according to claim 1, further comprising a weight catching device configured to catch the weight bouncing off the pile head in midair.

[Claim 3] The pile rapid load test device according to claim 1, wherein a plurality of node portions are formed on an outer periphery of the weight lifting rod at equal intervals in an axial direction of the weight lifting rod.

[Claim 4] The pile rapid load test device according to claim 3, further comprising a weight catching device configured to catch the weight bouncing off the pile head in midair.

[Claim 5] The pile head load test device according to any one of claims 1 to 4, further comprising a remote device configured to remotely operate the weight lifting jack and the weight holding chuck.