

SYSTEM AND METHOD FOR SECURING, MOVING AND PLACING A PILE OR HEAVY ELONGATED OBJECT

TECHNICAL FIELD

[0001] The present invention relates generally to equipment used in construction, and, more specifically, to a system and method for securing, moving and placing a heavy elongated object such as a reinforced concrete (RC) pile.

BACKGROUND

[0002] A pile is a vertical structural element typically made of concrete that is common in the construction and building industry. It is driven into the ground to establish a foundation or to provide structural support for a building or other structure. Reinforced concrete (RC) piles are large and heavy, typically twelve meters in length and weighing up to five tons. Accordingly, heavy machinery and tools are needed to lift, carry, maneuver and place RC piles.

[0003] Traditional methods of working with RC piles are generally unsafe, labor intensive and inefficient. Hoisting concrete piles using a crane and cables is a normal practice. Cables are hooked through reinforced steel lifting eyes of square piles or into c-hooks in the ends of spun piles. The piles are suspended from a cable or a network of cables where they are free to yaw and sway, presenting the threat of damage and injury.

[0004] Forklifts can also be used to lift and move RC piles which are also unsafe. The piles are seated on a cantilever arm and are free to slide and shift. The danger presented by the sudden shift or roll of a pile is especially problematic in construction sites that have irregular surfaces, inclines or terraces.

[0005] Regardless of whether a crane or a forklift is used, moving and setting RC piles requires the coordinated effort of several skilled workers. A typical project entails dedicating a minimum of seven workers to lift, move and place RC piles. One must operate a crane while another observes the load and watches for hazards or people. A lifting supervisor must also be present to coordinate the operation along with four riggers to hook and unhook the wire slings on the RC piles. Regardless of precautions, unforeseen hazards can cause RC piles to suddenly shift or move causing damage or injury.

[0006] Attempts have been made toward improving these methods. For example, a heavy object gripping device attached to a loader is described in U.S. Pat. No. 4266819. Hydraulically operated grapple arms press an object into a frame. The apparatus can be used for moving logs or poles in a warehouse setting. Similarly, U.S. Pat. No. 5184934 discloses a gripping device for use in combination with a front-end loader for lifting and transporting objects, particularly slabs of concrete. However, neither device is capable of safely gripping and moving heavy, elongated objects such as RC piles. Further, these devices are not useful on inclines or uneven surfaces and cannot be used to rotate or place objects.

[0007] Because traditional methods of moving and placing RC piles have limitations, there is a need for an improved system and method that overcomes these shortcomings. Specifically, there is a need for a system that can firmly grip an RC pile, safely move it, rotate it 90 degrees and release it. The system should be reliable, inexpensive to operate and require less coordination and manpower than conventional methods.

SUMMARY

[0008] The invention recognizes that exists a long felt need for a system and method of moving, lifting, rotating and placing heavy elongated objects such as RC piles in a

safe and controlled manner.

[0009] The following summary is provided to facilitate an understanding of some of the innovative features unique to the disclosed embodiment and is not intended to be a full description. A full appreciation of the various aspects of the embodiments disclosed herein can be gained by taking into consideration the entire specification, claims, drawings and abstract as a whole.

[0010] We describe a system for gripping, moving, rotating and placing an elongated object comprised of a chassis with a pair of gripping members, a hydraulic geared motor driven gearbox and a connecting member. Each "gripping member" includes a load backrest, an upper clamping jaw and one or more lower fork tines. Each upper clamping jaw is movable along a point of attachment (i.e. slipper housing or mechanical guide) to the chassis for grasping and releasing objects. In an alternative embodiment, each clamping jaw can have a pivotal connection to the load backrest.

[0011] Each gripping member is moveable along the length of the chassis to accommodate elongated objects of different lengths. The hydraulic geared motor driven gearbox joins the chassis to the connecting member and permits rotation about a plane parallel to the chassis. In an alternative embodiment, a planetary gearbox joins the chassis to the connecting member and permits rotation about a plane parallel to the chassis.

[0012] The connecting member can be a bucket, jib or arm attachment connected to an arm or boom of a crane or other vehicle. The connecting member can pitch and roll to maintain an RC pile in a substantially horizontal position. The load backrest or a portion of the load backrest can be moveable to assist in loading and unloading an elongated object. A side clamping cylinder can also be used to assist with loading and unloading an elongated object. Further, the chassis can be rotated to adjust the level of the lower fork tines.

[0013] The elongated object can be, among other things, a reinforced concrete pile, a pole, a pipe, a slab, a pallet, a post, a beam or a panel. The upper clamping jaw can be driven by a motor, a hydraulic pump or hydraulic cylinder. The connecting member can also be driven by a motor, a hydraulic pump or hydraulic cylinder. Further, the configuration of the gripping members can be adjusted by a motor, a hydraulic pump or hydraulic cylinder. The gripping members can include one or more retractable side clamping cylinders that provide compressive force to hold an elongated object. The retractable side clamping cylinders can also provide compressive force to push an elongated object away from the load backrest.

[0014] We also describe a method for gripping, moving, rotating and placing an elongated object vertically into the ground, comprising the steps of (1) adjusting the distance between a pair of securing means based on the length of the elongated object, (2) placing the securing means near or against the elongated object so that lower fork tines are beneath it, (3) closing the upper clamping jaws on the securing means until the elongated object is firmly held, (4) lifting the elongated object with a crane joined to the gripping members through a chassis, (5) moving the elongated object to the required position, (6) rotating the elongated object to a desired angle using a hydraulic geared motor driven gearbox that connects the securing means to the chassis and (7) releasing the elongated object by retracting the upper clamping jaws away from the elongated object.

[0015] The method can include the step of releasing the elongated object from the securing means using one or more side clamping cylinders after the clamping jaws are raised. The pitch angle of the fork tines can also be used to load or release an elongated object from the gripping members.

[0016] Further, we describe a system for use in combination with a crane or similar vehicle for gripping, moving, rotating and placing an elongated object such as a reinforced concrete pile into the ground. The system includes a chassis with a pair of

gripping members. Each gripping member includes a load backrest, an upper clamping jaw and one or more lower fork tines. The system also includes a connecting member and a hydraulic geared motor driven gearbox.

[0017] Each gripping member includes a clamping cylinder and clamping cylinder mounting to open and close the upper clamping jaw. The hydraulic geared motor driven gearbox joins the chassis to the connecting member and permits rotation of the chassis and attached gripping members. Each gripping member is moveable along the length of the chassis to accommodate elongated objects of different lengths.

[0018] The connecting member can pitch, yaw or roll at the point of attachment to the arm or boom of a crane. The load backrest can include a side clamping cylinder to press an elongated object against a retainer or beveled edge on the lower surface of the upper clamping jaw. The chassis can pitch or yaw to adjust the level of the angle of the lower fork tines.

INTRODUCTION

[0019] A first aspect of the invention is a construction clamp (securing means, gripping member or gripper) composed of a load backrest, an upper clamping jaw and one or more lower fork tines wherein the upper clamping jaw is movable along a point of attachment (i.e. slipper housing or mechanical guide) of the chassis for clenching objects.

[0020] A second aspect of the invention is a construction clamp that firmly grips one or more elongated objects using a side clamping cylinder and a retainer or beveled edged on the clamping jaw.

[0021] A third aspect of the invention is system for rotating and placing an elongated object such as an RC pile. The system includes a chassis, a hydraulic geared motor

driven gearbox and a connecting member. The hydraulic geared motor driven gearbox permits rotation of the chassis at the point of attachment to the connecting member.

[0022] A fourth aspect of the invention is an apparatus for gripping, moving, rotating and placing an elongated object such as an RC pile that can be attached to the distal end of a crane arm.

[0023] A fifth aspect of the invention is a chassis that can be connected to the distal end of a crane arm. The chassis includes two clamps or gripping members whose distance apart from each other is adjustable. The chassis is rotatable about a point of attachment to the distal end of a crane arm.

[0024] A sixth aspect of the invention is a method of gripping, moving, rotating and placing an elongated object vertically into the ground composed of the steps of (1) adjusting the distance between a pair of securing means according to the length of the elongated object, (2) placing the securing means near or against the elongated object so that lower fork tines are beneath it, (3) closing the upper clamping jaws on the securing means until the elongated object is firmly held, (4) lifting the elongated object with a crane joined to the gripping members through a chassis, (5) moving the elongated object to the desired location, (6) rotating the elongated object to a desired angle using a hydraulic geared motor driven gearbox that connects the securing means to the chassis and (7) releasing the elongated object by retracting the upper clamping jaws away from the elongated object.

BRIEF DESCRIPTION OF THE FIGURES

[0025] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

[0026] **FIG. 1** is a perspective view of a crane using the invention to hold an elongated

object or RC pile in a horizontal position.

[0027] FIG. 2 is a side view of a crane using the invention to hold an elongated object or RC pile in a vertical position.

[0028] FIG. 3A is a front view of the invention with the gripping members in a retracted position.

[0029] FIG. 3B is a front view of the invention with the gripping members in an extended position.

[0030] FIG. 4 is a side view of the invention and illustrates the use of the side clamping cylinder to embrace an elongated object or RC pile.

[0031] FIG. 5 is a side view of the invention and illustrates the pitch angle that can be used to assist in loading and unloading a pile or elongated object.

[0032] FIG. 6A is a perspective view of the front of the invention with the gripping members in an extended position.

[0033] FIG. 6B is a perspective view of the back of the invention with the gripping members in an extended position.

[0034] FIG. 7A is a front view of a gripping member.

[0035] FIG. 7B is a side view of a gripping member.

[0036] FIG. 8A is a perspective view of the invention with the gripping members clenching an elongated object.

[0037] FIG. 8B is a side view of the invention with the gripping members clenching an elongated object.

[0038] FIG. 9A is a perspective view of the invention with the gripping members clenching multiple elongated objects.

[0039] FIG. 9B is a side view of the invention with the gripping members clenching multiple elongated objects.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

[0040] While the invention is primarily described for use with piles in construction, it is understood that the invention is not so limited and can be used to assist in moving, placing and manipulating pallets, beams, bricks, boards, panels, posts, poles and other objects. Other applications include, for example, but not limited to, using the invention in shipping, storage, assembly and in factory and warehouse settings.

[0041] Reference in this specification to "one embodiment/aspect" or "an embodiment/aspect" means that a particular feature, structure, or characteristic described in connection with the embodiment/aspect is included in at least one embodiment/aspect of the disclosure. The use of the phrase "in one embodiment/aspect" or "in another embodiment/aspect" in various places in the specification are not necessarily all referring to the same embodiment/aspect, nor are separate or alternative embodiments/aspects mutually exclusive of other embodiments/aspects. Moreover, various features are described which may be exhibited by some embodiments/aspects and not by others. Similarly, various requirements are described which may be requirements for some embodiments/aspects but not other embodiments/aspects. Embodiment and aspect can be in certain instances be used interchangeably.

[0042] The terms used in this specification generally have their ordinary meanings in

the art, within the context of the disclosure, and in the specific context where each term is used. Certain terms that are used to describe the disclosure are discussed below, or elsewhere in the specification, to provide additional guidance to the practitioner regarding the description of the disclosure. For convenience, certain terms may be highlighted, for example using italics and/or quotation marks: The use of highlighting has no influence on the scope and meaning of a term; the scope and meaning of a term is the same, in the same context, whether or not it is highlighted. It will be appreciated that the same thing can be said in more than one way.

[0043] Consequently, alternative language and synonyms may be used for any one or more of the terms discussed herein. Nor is any special significance to be placed upon whether or not a term is elaborated or discussed herein. Synonyms for certain terms are provided. A recital of one or more synonyms does not exclude the use of other synonyms. The use of examples anywhere in this specification including examples of any terms discussed herein is illustrative only, and is not intended to further limit the scope and meaning of the disclosure or of any exemplified term. Likewise, the disclosure is not limited to various embodiments given in this specification.

[0044] Without intent to further limit the scope of the disclosure, examples of instruments, apparatus, methods and their related results according to the embodiments of the present disclosure are given below. Note that titles or subtitles may be used in the examples for convenience of a reader, which in no way should limit the scope of the disclosure. Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure pertains. In the case of conflict, the present document, including definitions, will control.

[0045] The term “boom” refers to the lifting arm of lifting component of a crane.

[0046] The term “crane” refers to a big machine with a long arm that can be used for

lifting and moving heavy things. A crane is generally equipped with a hoist rope, wire ropes or chains, and sheaves that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places.

[0047] The term “hydraulic cylinder” or “linear hydraulic motor” refers to a mechanical actuator that is used to give a unidirectional force through a unidirectional stroke.

[0048] The term “jib” or “operating arm” refers to the part of the crane that carries the load and may be further characterized as the long horizontal jib (working arm) or the short counter-jib.

[0049] The term “jib crane” refers to a type of crane where a horizontal member (jib or boom), supporting a moveable hoist, is fixed to a wall or to a floor-mounted pillar. The jib may be fixed or swing through an arc to give additional lateral movement.

[0050] The term “pile” refers to a long slender column usually of timber, steel, or reinforced concrete driven into the ground to carry a vertical load.

[0051] The term “pile driver” refers to a mechanical device used to drive piles into soil to provide foundation support for buildings or other structures.

[0052] The term “pitch” refers to the angle of steepness of a slope.

[0053] The term “hydraulic motor” refers to a mechanical actuator that converts hydraulic pressure and flow into torque and angular displacement (rotation). The hydraulic motor can be considered the rotary counterpart of the hydraulic cylinder.

[0054] The term “tine” refers to a slender, pointed, projecting part, such as the pointed end of a fork. Forklift tines, are typically two metal lengths, hanging on the front of the forklift carriage. They allow a forklift to lift, carry and lower a load or object.

[0055] It will be appreciated that terms such as "front," "back," "top," "bottom," "side," "short," "long," "up," "down," and "below" used herein are merely for ease of description and refer to the orientation of the components as shown in the figures. It should be understood that any orientation of the components described herein is within the scope of the present invention.

[0056] Other technical terms used herein have their ordinary meaning in the art that they are used, as exemplified by a variety of technical dictionaries.

Description of Preferred Embodiments

[0057] The invention provides a system and method for securing, moving and placing a heavy elongated object such as a concrete pile. A conventional mobile construction vessel such as a construction crane can be used with the invention. A crawler crane of sufficient size and capacity is preferred. However, the vessel can be a forklift or other vehicle capable of supporting a crane arm and preferably, fitted with electronics and controls to allow an operator to utilize the capabilities of the invention from a cabin or control seat. The size and mass of the piles should be considered in determining the vessel type and capacity.

[0058] A conventional crane is depicted in FIG. 1 which includes a main boom **104** connected to a crane arm **103**. A bucket (not shown) is typically connected to the crane arm and each component is controlled through a hydraulic assembly.

[0059] The system can be attached to a crane arm **103** of the crane as shown. The bucket (or other attachment) is removed and the connecting member **105** is joined to the crane arm **103**. A hydraulic arm can be attached to the connecting member. Minor mechanical and electrical modifications can be made to secure the invention to the

crane arm and permit an operator to control it from the cab of the crane. Such adjustments and modifications are commonly used in the field.

[0060] In a preferred embodiment, the invention includes a chassis **107**, a hydraulic geared motor driven gearbox **106** and a connecting member **105**. The chassis **107** includes two gripping members **108**, each of which include a backrest, an upper clamping jaw and one or more lower forks or fork tines. The gripping members can also each include a side clamping jaw and retainer.

[0061] FIG.1 illustrates a perspective view of a crane using the invention to lift an RC pile. In this embodiment, the main boom **104** is connected to a crane arm or jib arm **103**. The crane arm **103** is joined with the connecting member **105**. The connecting member connects the hydraulic geared motor driven gearbox **106** to the crane arm **103**. The two gripping members **108** can be extended and retracted from the body of the chassis **107**. Because of the length of the RC pile, a wide configuration between the gripping members is preferred for stability. In an alternative embodiment, the hydraulic geared motor driven gearbox **106** can be replaced with a planetary gearbox.

[0062] RC piles are usually stored and stacked in a horizontal position as illustrated in FIG. 1. The crane can use the invention to operate like a conventional forklift to pick up and place RC pile horizontally. In typical use, the invention is employed to grasp the RC pile and move it while maintaining it in a horizontal position. After grasping the RC pile, the crane operator drives the crane to a location to place it. The RC pile can then be placed in a horizontal or vertical configuration. To place the RC pile vertically, it is lifted using the crane arm **103** and the main boom **104**. It is then rotated into a vertical position using the hydraulic geared motor driven gearbox **106**.

[0063] FIG. 2 depicts a side view of a crane using the invention to hold an RC pile in a vertical position. In such circumstance, the crane operator has likely rotated the RC pile so that it can be placed vertically at the site of a building foundation. The connecting

member **105** joins the hydraulic geared motor driven gearbox **106** with the crane arm **103**. Here, the gripping members **108** are extended from the chassis **107**. The individual components can be controlled through hydraulic assemblies.

[0064] FIG. 3A depicts a front view of the invention in a retracted state. Both the upper hydraulic chassis extender **109** and the lower hydraulic chassis extender **110** remain in retracted positions. Components of the gripping members include the load backrest **115**, the lower fork tine **111**, the side clamping cylinder **114** and the upper clamping jaw **113**. The upper clamping jaw **113** is controlled with a hydraulic cylinder.

[0065] FIG. 3B depicts another version of the invention in an extended state. Both the upper hydraulic chassis extender **109** and the lower hydraulic chassis extender **110** are in extended positions so that the gripping members are furthest from the center point of the chassis. The lower fork tine **111**, side clamping cylinder **114**, upper clamping jaw **113** and hydraulic cylinder are also depicted.

[0066] FIG. 4 depicts a side view of the invention holding an RC pile **110**. The crane arm **103** is attached to the connecting member **105**. The range of movement at this point of attachment assists with loading and unloading an RC pile. The hydraulic geared motor driven gearbox **106** joins the chassis **107** with the connecting member **105**. The upper clamping jaw **113**, lower fork tines **111**, and side clamping cylinder **114** secure the RC pile. In an alternative embodiment, the hydraulic geared motor driven gearbox **106** can be replaced with a planetary gearbox.

[0067] FIG. 5 depicts a side view of the invention wherein an RC pile **110** is being loaded or unloaded. A hydraulic cylinder **116** between the crane arm and the connecting member **105** can be used to adjust the pitch or angle of the chassis and forks. This is particularly useful in loading and unloading RC piles as well as keeping an RC pile level while moving it along graded or uneven terrain. The upper clamping jaw **113** and side clamping cylinder **114** are in open or released states.

[0068] FIG. 6A is a perspective view of another embodiment of the invention. The front of the chassis **107** and other components are illustrated in greater detail. The extendable arm **117** is adjusted by the action of the arm extension cylinder **116** that is joined with the arm bracket **118**.

[0069] Here, the gripping members **108** include a clamping cylinder mounting **132** and clamping cylinder **130** that opens and closes the clamping jaw. As shown, the clamping jaw opens and closes by moving vertically along a mechanical guide referred to as the slipper housing **131**. The clamping cylinder mounting **132** connects the clamping cylinder **130** with the base of the gripping member. The side clamping cylinder **114** and side clamping jaw **115** are also illustrated.

[0070] FIG. 6B is a perspective view of the rear of the chassis **107**, connecting member **105** and other components in greater detail. The gripping members **108** are in an extended position. The connecting member **105** includes a material handler pivot **121** and pitch cylinder pivot **122** which can be joined to a crane arm. The hydraulic planetary gear motor **119** drives inner rotating gears which can rotate the system clockwise and counter-clockwise. In a preferred embodiment, two independent hydraulic gear motors **119** (hydraulic motor directly coupled to a planetary gear box, with an output shaft) are fitted with a pinion spur gear on each output shaft. These motors are fitted 180 degrees apart from one another. The pinion gears drive a center ring spur gear. The ring gear is fitted and bolted down to the chassis. The center ring gear is driven when the two pinion gears turn in the same direction. The yaw cylinder **120** and yaw center **123** allow for the adjustment of the angle or “pitch” of the fork system to aid in loading and unloading.

[0071] FIG. 7A depicts the front side of a gripping member in greater detail. A side view of a gripping member is illustrated in FIG. 7B. The solid lines depict the gripping member in an open configuration. The hatched lines depict it in a closed configuration.

The clamping cylinder mounting **132** and clamping cylinder **130** open and close the clamping jaw **113**. The load bracket includes the slipper housing **131** which connects the clamping cylinder mounting **132** to the body of the gripping member. The retainer **129**, side clamping cylinder **114** and side clamping jaw **115** are also depicted.

[0072] Each gripping member can be designed to provide suitable pressure and adequate surface area to hold and transfer heavy objects such as RC piles. The side clamping cylinder **114** and side clamping jaw **115** provide further stability by pressing the pile against the retainer **129** or a beveled edge. Each upper clamping jaw is movable along the slipper housing **131**, a mechanical guide on to the backrest of the chassis.

[0073] As described, the gripping members can be used for moving and manipulating various elongated objects such as poles or piles. The gripping members are well suited for use with the rotational capabilities of the invention. With the adequate pressure and surface area from the upper clamping jaws, a pile can be held firmly so that it does not slip when it is rotated into a vertical position. This allows a pile to be picked up or grasped from or horizontal position and rotated then set or positioned into the ground. The pile can also be held in a vertical position to be hammered or forced into the ground with a different device.

[0074] FIG. 8A is a perspective view of the invention with the gripping members **108** clenching a single elongated object such as an RC pile. FIG. 8B is a side view of the invention with the gripping members clenching an RC pile. The clamping jaws **113** are in a closed position, putting downward pressure onto the RC pile. The retainer **129** and side clamping jaw **115** enclose the RC pile so that it is held firmly in position. The clamping cylinder mounting **132**, clamping cylinder **130** and side clamping cylinder **114** are also illustrated.

[0075] FIG. 9A is a perspective view of the invention with the gripping members **108**

clenching multiple elongated objects. FIG. 9B is a side view of the invention that illustrates individual components in greater detail. As shown, the gripping members can be used to clench multiple elongated objects. The clamping jaws **113** are in a closed position, putting downward pressure onto the elongated objects. The retainer **129** and side clamping jaw **115** enclose the elongated objects so that they are held firmly in position. The clamping cylinder mounting **132**, side clamping cylinder **114** and clamping cylinder **130** are also illustrated.

Working Example – Pick and Placement of an RC Pile

[0076] RC piles are typically delivered and stored at a building or construction site in stock piles. The RC piles are laid horizontally and stacked upon one another. Thereafter, the RC piles must be moved individually and placed upright in a specific area, usually around the circumference of a building foundation.

[0077] Conventional methods of moving and placing RC piles involve a crane or a forklift. This requires a series of steps with several workers to safely move the RC pile. Thereafter, the pile must be released from the crane or forklift to be hoisted into position. This is a complicated process that involves several “riggers” along with the use of the crane. An object of the invention is to lift and place an (RC) pile in a controlled, safe and efficient manner while avoiding the time, expense and resources required for conventional methods. The invention can be provided in different sizes and modified for use with various sizes and types of cranes.

[0078] In this example, a standard crawler crane is used. A crane crawler is preferred because the tracks (crawlers) provide stability and mobility. The size of the crane and system can be determined based on the size and mass of the RC piles. The system is attached to a jib arm of the crane using a connecting member or similar device. The bucket is removed and the attachment member is joined to the jib arm. A hydraulic arm

is attached to the connecting member. Minor mechanical and electrical adjustments are made to adapt the invention to the crane and allow an operator to control it from the cabin of the crane.

Loading an RC Pile

[0079] A crane operator drives the crane to a pile or a stack of piles. Based on the length of the pile, the operator can adjust the distance between the gripping members. The gripping members can be extended on a horizontal plane (away from the center of the chassis body) to accommodate the size and length of a typical RC pile. One or more switches or levers can be used to operate the gripping members and other components of the invention. In a preferred embodiment, the crane operator has access to all controls in the cab of a crane.

[0080] When picking up and securing a load or pile, the gripping members are usually fully extended. Thereafter, the operator can adjust the angle or “pitch” of the fork tines to pick up the pile as demonstrated in FIG. 5. The fork tines can be inserted under the pile by moving the crane forward or by changing the position of the crane arm or main boom. Once loaded on the fork tines, the angle of the fork tines can be readjusted and the upper clamping jaw can be lowered to grip the pile. The side clamping cylinder can also be used to further secure the pile by pressing the back of the pile forward, against the retainer or lip of the upper clamping jaw. This is demonstrated in FIG. 4.

Moving an RC Pile

[0081] Once loaded, the crane operator can deliver the crane to the desired location to place the pile. Because the RC pile is firmly held by the gripping members, it can be safely moved up hills or terraces or over uneven terrain. In a preferred mode of use, pressure is exerted against the RC pile from four directions (both sides, top and bottom). The invention can maintain the pile in a level, horizontal position through the use of the hydraulic arm and hydraulic geared motor driven gearbox.

Placing an RC Pile

[0082] The RC pile can be unloaded and placed in a horizontal position. To do so, the operator lowers the crane arm and releases the pressure from the upper clamping jaw. The pitch angle of the chassis and lower fork tines can be adjusted as described above. The side clamping cylinder and side clamping jaw can be used to push the RC pile away from or out of the gripping member.

[0083] The RC pile can also be unloaded and placed in a vertical position. To do so, the operator lifts the pile using the main boom and crane arm so that the RC pile can be rotated without contacting the ground. The hydraulic geared motor driven gearbox (or planetary gearbox) is activated to rotate the chassis along with the RC pile. This allows the operator to hold the pile in a vertical configuration as depicted in FIG. 2. The operator can then make fine adjustments to the location before releasing the pile. The RC pile can be lowered using the main boom and crane arm. The operator releases the pile by withdrawing the upper clamping jaw and the side clamping cylinder. Doing so releases pressure against the RC pile allowing it to slide into a hole or crevice.

[0084] The invention can also be used in conjunction with a pile driver (not shown) to keep the pile properly placed and oriented. The pile is maintained in a vertical position and the pressure is released by retracting the clamping jaw and the side clamping cylinder. Thereafter, the pile driver can be employed to force the pile downward.

[0085] It will be appreciated that variations of the above disclosed and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. For example, different designs of the invention have been described. One uses a hydraulic brace extender to close the upper clamping jaw against an elongated object. The alternative design uses a clamping cylinder mounting and clamping cylinder to open and close the upper clamping jaw. We have also described designs that have either a hydraulic geared motor driven gearbox or a

planetary gearbox to rotate the chassis. Also, various presently unforeseen or unanticipated alternatives, modifications, variations or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

[0086] Although we have attempted to comprehensively describe the embodiments in detail to cover all possible aspects, those skilled in the art would recognize that other versions of the disclosure are also possible. For example, although we describe the use of the invention for moving and placing a pile, the invention can be used for inserting other structures such as poles, pilings and beams.

What is claimed is:

1. A system for use in combination with a crane for gripping, moving, rotating and placing an elongated object, said system comprising:
 - a) a chassis with a pair of gripping members, each gripping member comprised of:
 - i. a load backrest;
 - ii. an upper clamping jaw;
 - iii. one or more lower fork tines;
 - b) a hydraulic geared motor driven gearbox;
 - c) a connecting member for connecting the hydraulic geared motor driven gearbox to an arm of the crane;

wherein each gripping member is moveable along the length of the chassis by an extendable arm adjustable by the action of a hydraulic cylinder, to accommodate elongated objects of different lengths;

wherein the load backrest includes a side clamping cylinder to press the elongated object against a retainer or beveled edge on the upper clamping jaw;

wherein said hydraulic geared motor driven gearbox joins the chassis to the connecting member and permits rotation of the chassis and attached gripping members;

and

wherein the upper clamping jaw opens and closes by sliding along a slipper housing on the load backrest.
2. The system of claim 1, wherein each upper clamping jaw has a pivotal connection with the load backrest and a hydraulic actuating means for opening and closing.
3. The system of claim 1, wherein the gripping member includes a clamping cylinder and a clamping cylinder mounting to open and close the upper clamping jaw.
4. The system of claim 1, wherein the connecting member is a bucket, jib or arm

attachment connected to an arm or boom of the crane.

5. The system of claim 1, wherein the connecting member can pitch, yaw or roll at the point of attachment to the arm or boom of a crane.
6. The system of claim 1, wherein the chassis can pitch or yaw to adjust an angle between a plane where centers of the lower fork tines lie and a horizontal plane.
7. The system of claim 1, wherein the elongated object is a reinforced concrete pile, a pole, a pipe, a slab, a pallet, a post, a beam or a panel.
8. The system of claim 1, wherein the upper clamping jaw is opened and closed with a motor, a hydraulic pump or hydraulic cylinder.
9. The system of claim 1, wherein each gripping members is movable along the length of the chassis using a motor, a hydraulic pump or hydraulic cylinder.
10. A method of gripping, moving, rotating and placing an elongated object vertically into the ground, comprising the steps:
 - providing a crane with an attached chassis, wherein said chassis includes a pair of gripping members;
 - adjusting the distance between the pair of gripping members by an extendable arm adjustable by the action of a hydraulic cylinder, to accommodate the length of an elongated object;
 - placing the gripping members near or against the elongated object so that lower fork tines are beneath it;
 - closing upper clamping jaws on the gripping members until the elongated object

is grasped between the upper clamping jaws and lower fork tines, wherein the upper clamping jaw opens and closes by sliding along a slipper housing on the load backrest;

further securing the elongated object using one or more side clamping cylinders to press it against a retainer or beveled edge on upper clamping jaws;

lifting the elongated object with the crane joined to the chassis through a connecting member;

moving the elongated object to the desired location;

raising the elongated object with crane arms;

rotating the elongated object to a desired angle using a hydraulic geared motor driven gearbox between the chassis and the connecting member;

lowering the elongated object using the crane arms and

releasing the elongated object by retracting the upper clamping jaws and side clamping cylinders.

11. The method of claim 10, further comprising the step of adjusting the pitch angle of the fork tines to load or release an elongated object from the gripping members.
12. The method of claim 10, wherein the elongated object is a reinforced concrete pile, a pole, a pipe, a slab, a pallet, a post, a beam or a panel.
13. A system for use in combination with a crane or other vehicle for gripping, moving, rotating and placing an elongated object such as a reinforced concrete pile, said system comprising:
 - a chassis with a pair of gripping members, each gripping member composed of a load backrest, an upper clamping jaw and one or more lower fork tines;
 - a connecting member and
 - a planetary gearbox,
 - wherein each gripping member includes a clamping cylinder and clamping cylinder mounting to open and close the upper clamping jaw, wherein the upper clamping jaw opens and closes by sliding along a slipper housing on the load backrest;
 - wherein said planetary gearbox joins the chassis to the connecting member

and permits rotation of the chassis and attached gripping members; and

wherein each gripping member is moveable along the length of the chassis by an extendable arm adjustable by the action of a hydraulic cylinder, to accommodate elongated objects of different lengths.

14. The system of claim 13, wherein the connecting member can pitch, yaw or roll at the point of attachment to the arm or boom of a crane.
15. The system of claim 13, wherein the load backrest includes a side clamping cylinder to press an elongated object against a retainer or beveled edge on the lower surface of the upper clamping jaw.
16. The system of claim 13, wherein the chassis can pitch or yaw to adjust an angle between a plane where centers of the lower fork tines lie and a horizontal plane.