

REPLACED SHEETS SG

☒ Description : paged 1 to paged 7
☒ Claim(s) : paged 8 to paged 13
☒ Drawing(s) : paged 13 to paged 13
☒ Abstract : paged 9 to paged 1

1

BACKGROUND OF THE INVENTIONPILING RIG

The present invention relates to a piling rig, and, more particularly, to a piling rig which is capable of driving a pile in marine construction.

DESCRIPTION OF THE PRIOR ART

Conventionally, pile driving in marine construction is carried out using a piling rig mounted on a piling barge and having a leader boom which is fixed thereon in a substantially vertical position. The leader boom has a hydraulic hammer for exerting an impact on a top end of a pile charged to the leader boom, whereby the pile is driven into the seabed. Usually, a stack of piles is transported by a second barge. Wire slings are fastened to one of the piles and a spreader bar is attached to the wire slings. The pile is lifted by picking up the spreader bar by a crane mounted on the second barge. While the hydraulic hammer is positioned at a top of the leader boom, the pile is charged to the leader boom in a vertical position by maneuvering the crane. After the pile has been charged to the leader beam, it is held by a cramp mounted thereon and the pile is ready to be driven into the seabed by the hydraulic hammer.

In marine construction, pre-stressed concrete piles, each of which having a substantially long span, are often used. When such pre-stressed concrete piles are to be used for construction, they must be handled with due caution because exerting a bending moment on such a pile is critical. As mentioned above, in order to charge the pile to the leader boom in a substantially vertical position, one end of the pile brought to the piling barge must be raised by the crane while the other end is resting on the barge, whereby a bending moment is exerted



on the pile that may cause cracking or breakage of the pile. Therefore, in order to avoid such cracking or breakage of the pile, the charging operation requires a highly skilled operator and it is a time consuming operation.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a piling rig that prevents damages to a pile during the charging operation and which enables to reduce overall time required to charge each pile to the leader boom.

The above and other objects of the present invention can be accomplished by a piling rig carried on a barge comprising a leader boom adapted for pivotal movement with respect to said barge, and means for rotating the leader boom between a substantially horizontal position and an upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position to the upright position and hammer means for driving the pile.

In a preferred aspect of the present invention, a piling rig carried on a barge, comprises a sub-frame adapted for pivotal movement with respect to said barge and laid in a substantially horizontal position thereon, a leader boom laid on said sub-frame and adapted for pivotal movement with respect to the sub-frame, a first power cylinder for rotating said sub-frame to move said leader boom laid thereon between said substantially horizontal position and an intermediate position that is between said substantially horizontal position and an upright position, a second power cylinder for rotating said leader boom with respect to said sub-frame between said intermediate position and said upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof



from the substantially horizontal position to the upright position and hammer means for driving the pile.

In a further preferred aspect of the present invention, a piling rig further comprises a skid beam carrying said leader boom thereon and being movable to an outwardly extended position from said barge.

The above and other objects and features of the present invention will become apparent from the following description made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic side view of a piling rig mounted on a piling barge according to the present invention.

Figure 2 is a side view of the piling rig where a pile is charged to a leader boom.

Figure 3 is a side view of the piling rig showing deployment operation of a sub-frame.

Figure 4 is a side view of the piling rig showing deployment operation of a leader boom.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 is a schematic side view of a piling rig mounted on a piling barge according to the present invention.

Referring now to Figure 1, a piling rig constructed in accordance with the present invention is identified by a reference numeral 2 and installed on a piling barge 4 whose stem and stern are shown on the left and right hand sides as viewed in Figure 1, respectively. A skid beam 6 is mounted on the piling barge 4 and is movable fore to an outwardly extended position from the stem thereof. The piling rig 2 is provided with a sub-frame 8 pivotally connected at a pivot point 10 to



the skid beam 6 at its fore end. The sub-frame 8 is initially laid on the skid beam 6 in a substantially horizontal position. A first power cylinder 12 is pivotally connected between the sub-frame 8 and the skid beam 6 to rotate the sub-frame 8 about the pivot point 10 from the substantially horizontal position to an inclined intermediate angular position in a counterclockwise direction as viewed in Figure 3. A leader boom 14 is laid on the sub-frame 8 initially in a horizontal position and is pivotally connected at its one end to the sub-frame 8 at a pivot point 16. A second power cylinder 18 is pivotally connected between the sub-frame 8 and the leader boom 14 to rotate the leader boom 14 about the pivot point 16 with respect to the sub-frame 8 from the inclined intermediate angular position to a upright position in a counterclockwise direction as viewed in Figure 4. A hydraulic hammer 20 is provided for exerting an impact on a pile to be driven and is slidably mounted on the leader boom 14. Winches 24 are provided to move the hydraulic hammer 20 upwardly along the leader boom 14 via wires 28 attached thereto. The hydraulic hammer 20 has a hammer cap 22 adapted to hold the end of the pile charged to the leader beam 14. Prior to the charging of the pile to the leader boom 14, the hydraulic hammer 20 is positioned at an aft end of the leader boom 14 as shown in Figure 1. The leader boom 14 is further provided with a clamp 26 to secure the pile charged thereto during the rotation thereof from the substantially horizontal position and the upright position.

Figure 2 is a side view of the piling rig where a pile is charged to the leader boom 14.

The charging operation of a pile to the leader boom 14 is carried out as follows. A stack of piles are usually transported on a second barge (not shown) and wire slings (not shown) are fastened to one of the piles carried thereon. A spreader bar (not shown) is attached to



the wire slings and the pile is lifted in a horizontal position by picking up the spreader bar by a crane (ADD A REFERENCE NUMBER) mounted on the leader boom 14. Then, it is moved toward the piling rig 2 on the piling barge 4 by maneuvering the crane (ADD A REFERENCE NUMBER). The pile 30 is placed horizontally on the leader boom 14 and a first end of the pile 30 is inserted into the cap portion 22 of the hydraulic hammer 20 as shown in Figure 2. Then, the second end of the pile 30 is tightly secured to the leader boom 14 by the clamp 18. The winches 24 are released to permit the hydraulic hammer 20 to move freely with the pile 30 when moved along the leader boom 14 as mentioned below.

Figure 3 is a side view of the piling rig showing deployment operation of a sub-frame. Figure 4 is a side view of the piling rig showing deployment operation of a leader boom.

After the pile 30 has been charged to the leader boom 14 as shown in Figure 2, the sub-frame 8 is rotated about the pivot point 10 by actuation of the first power cylinder 12, whereby the leader beam 12 laid thereon is rotated therewith. The sub-frame 8 is rotated to the inclined intermediate angular position about the pivot point 10. When the sub-frame 8 is rotated to the intermediate position, the second power cylinder 18 is actuated, whereby the leader boom 14 is rotated from the inclined intermediate angular position toward the upright position about the pivot point 16 with respect to the sub-frame 8. The actuation of the second power cylinder 18 is stopped when the leader boom 14 has reached to the upright position at a predetermined angle at which the pile 30 should be driven into the seabed. The angle is normally selected to be, between +30 degrees and -30 degrees with respect to a vertical axis.

When the piling rig 2 is fully deployed to the upright position at the predetermined angular position, it is fixed thereat. Then, the skid



beam 6 is moved fore with respect to the piling barge 4 so that the pile 30 is located at the position where it should be driven into. Then, the clamp 18 is loosened to allow the pile 30 to slide down along the leader beam 12 due to its own weight as shown in Figure 4. As mentioned above, it should be noted that the winches 24 are released to permit the free movement of the hydraulic hammer 20 with the pile 30. Then, an impact is exerted on the pile 30 at its top end by actuation of the hydraulic hammer 20 which causes to drive the pile 30 into the seabed at the predetermined angle. Such driving operation is continued until the pile 30 is driven into the seabed to the predetermined depth.

When driving of the pile 30 is completed, the winches 24 are actuated. The hydraulic hammer 20 is raised thereby via the wires 28 to the top end of the leader boom 14, whereby the pile 30 is released from the cap portion 22 of the hydraulic hammer 20. Then, the leader boom 14 and the sub-frame 8 are rotated back to the horizontal position by reverse operation of the deployment operation mentioned above. The charging operation of a pile 30 and the driving thereof are repeated for each pile 30 as mentioned above.

In this preferred embodiment, since the piling rig 2 can be pivoted to a horizontal position and the pile 30 can be charged thereto in the horizontal position, no bending moment is exerted on the pile 30 during the charging operation and therefore, a damage to the pile 30 can be avoided.

Further more, in the preferred embodiment, since the leader boom 14 is rotated to the upright position via the sub-frame 8, short and less powerful power cylinders 10, 14 can be used.

Further more, in this preferred embodiment, because the skid beam 6 on which the piling rig 2 is mounted is utilized, the entire piling rig



2 can be moved fore with respect ⁷ to the piling barge 4. Therefore, the location of the pile 30 to be driven can be adjusted to the predetermined location without moving the piling barge 4 itself.

Further more, in the preferred embodiment, since the leader boom 14 can be deployed to the upright position at a predetermined angle, the pile 30 can be easily driven into the seabed at the predetermined angle.

The present invention has thus been shown and described with reference to specific embodiments. However, it should be noted that the present invention is in no way limited to the details of the described arrangements but changes and modifications may be made without departing from the scope of the appended claims.

For example, although, in the above preferred embodiment, the piling rig 2 is mounted on the piling barge 4. In case of using the piling rig 2 on the ground, it may be mounted on a vehicle such as a truck.

Further more, in the preferred embodiment, the piling rig 2 is comprised of one sub-frame 8, it may be comprised of a plurality of sub-frames which allow to raise the leader boom 14 in several stages. In such a case, shorter and less powerful power cylinders can be utilized.

Further, the pivot points 10 and 16 of the sub-frame 8 and the leader boom 14 are located at the ends thereof. However, as far as the leader boom 14 can be deployed to the upright position, the pivot points does not need to be located at their ends and can be located, for example, in the middle thereof.

According to the present invention, it provides a piling rig that prevents damages to a pile during the charging operation and enables to reduce overall time required to charge each pile to the leader boom.





Claims:

1. A piling rig carried on a barge, comprising: a leader boom adapted for pivotal movement with respect to said barge, and means for rotating the leader boom between a substantially horizontal position and an upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position to the upright position and hammer means for driving the pile.
2. A piling rig carried on a barge, comprising: a sub-frame adapted for pivotal movement with respect to said barge and laid in a substantially horizontal position thereon, a leader boom laid on said sub-frame and adapted for pivotal movement with respect to the sub-frame, a first power cylinder for rotating said sub-frame and said leader boom laid thereon between said substantially horizontal position and an intermediate position that is between said substantially horizontal position and an upright position, a second power cylinder for rotating said leader boom with respect to said sub-frame between said intermediate position and said upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position to the upright position and hammer means for driving the pile.
3. A piling rig in accordance with Claim 1 or 2, further comprising a skid beam carrying said leader boom thereon and being movable to an outwardly extended position from said barge.

ABSTRACT OF THE DISCLOSURE

A piling rig carried on a barge comprises a leader boom adapted for pivotal movement with respect to said barge, and means for rotating the leader boom between a substantially horizontal position and an upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position to the upright position and hammer means for driving the pile.

According to the present invention, it provides a piling rig that prevents damages to a pile during the charging operation and enables to reduce overall time required to charge each pile to the leader boom.

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FIG. 1

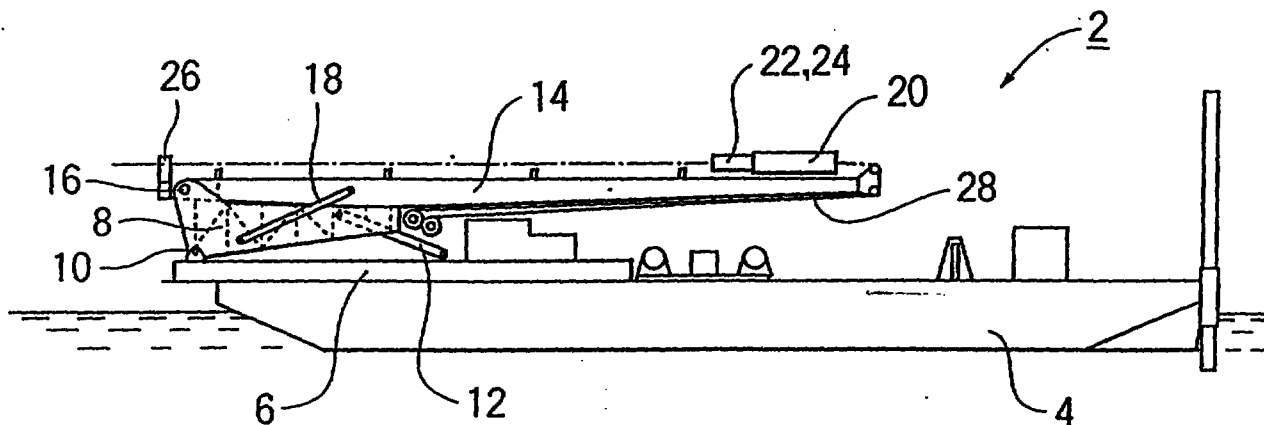
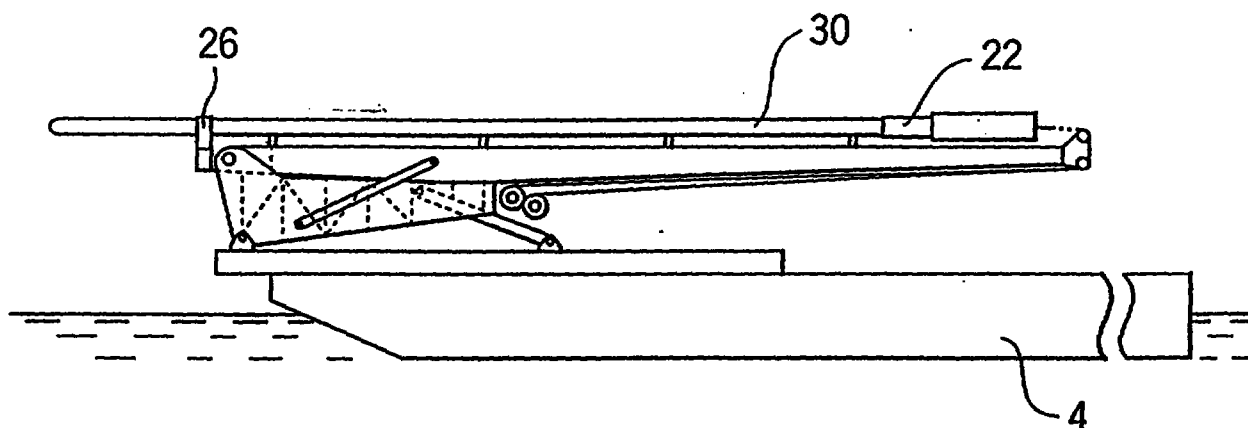


FIG. 2



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FIG. 3

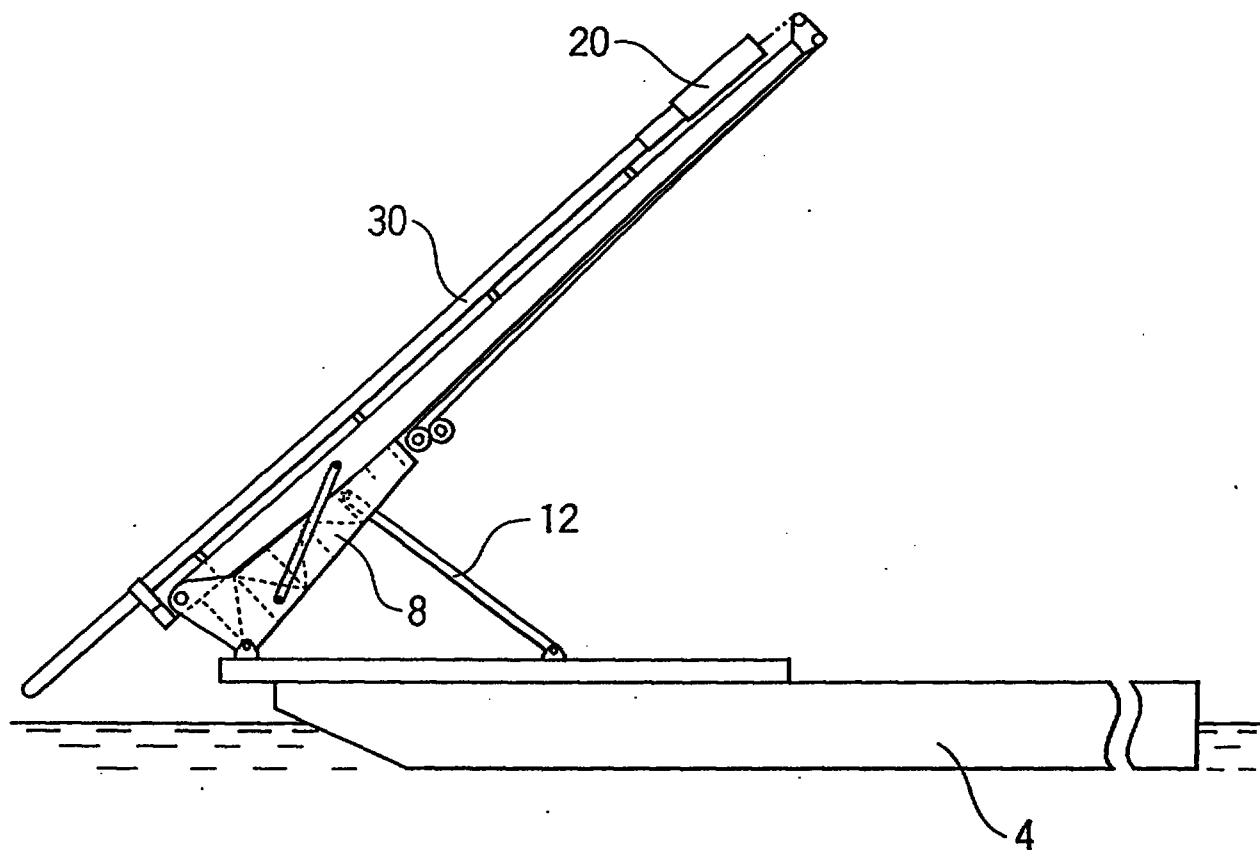
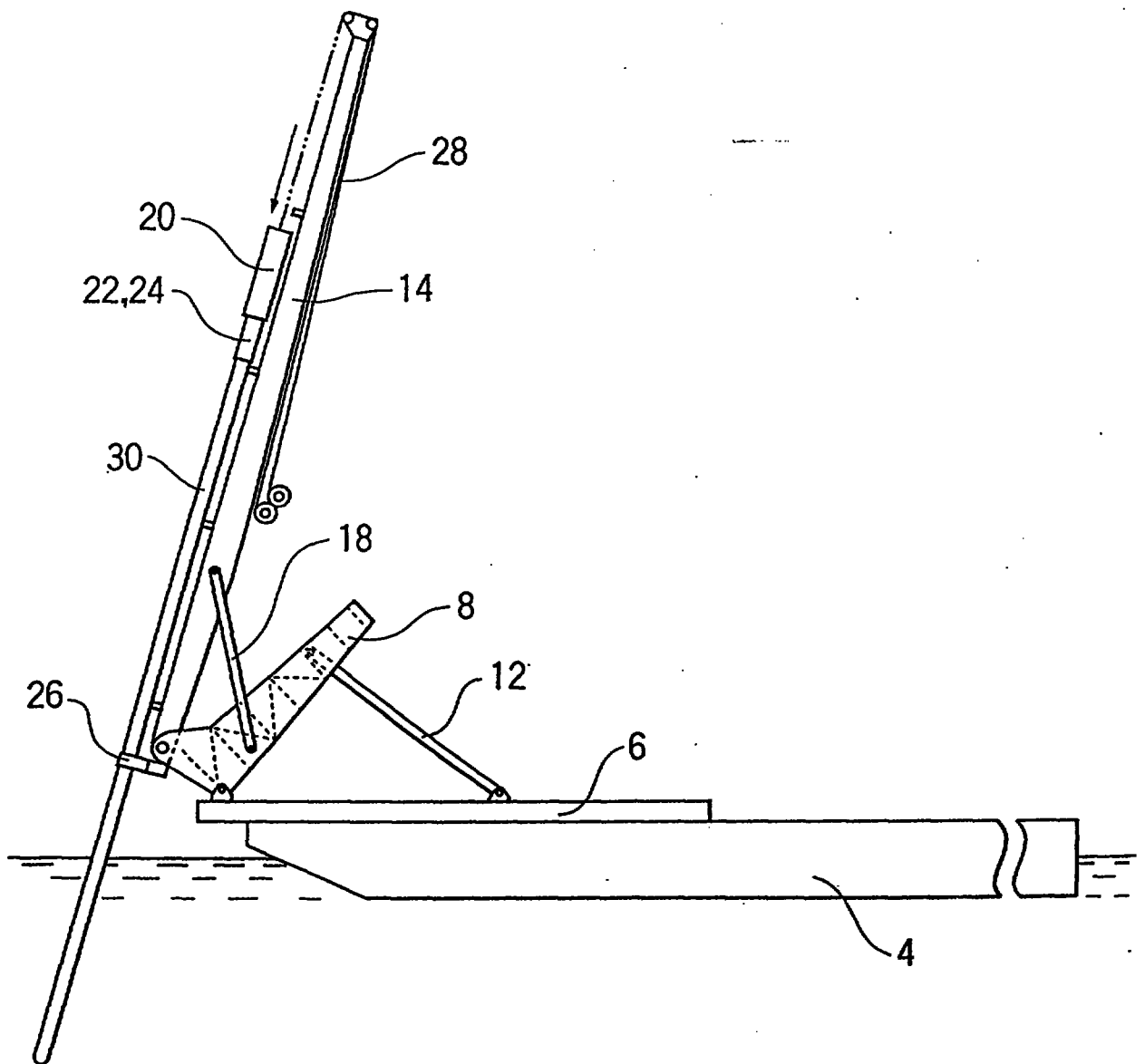


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BACKGROUND OF THE INVENTION

PILING RIG

The present invention relates to a piling rig, and, more particularly, to a piling rig which is capable of driving a pile in marine construction.

DESCRIPTION OF THE PRIOR ART

Conventionally, pile driving in marine construction is carried out using a piling rig mounted on a piling barge and having a leader boom which is fixed thereon in a substantially vertical position. The leader boom has a hydraulic hammer for exerting an impact on a top end of a pile charged to the leader boom, whereby the pile is driven into the seabed. Usually, a stack of piles is transported by a second barge. Wire slings are fastened to one of the piles and a spreader bar is attached to the wire slings. The pile is lifted by picking up the spreader bar by a crane mounted on the second barge. While the hydraulic hammer is positioned at a top of the leader boom, the pile is charged to the leader boom in a vertical position by maneuvering the crane. After the pile has been charged to the leader beam, it is held by a cramp mounted thereon and the pile is ready to be driven into the seabed by the hydraulic hammer.

In marine construction, pre-stressed concrete piles, each of which having a substantially long span, are often used. When such pre-stressed concrete piles are to be used for construction, they must be handled with due caution because exerting a bending moment on such a pile is critical. As mentioned above, in order to charge the pile to the leader boom in a substantially vertical position, one end of the pile brought to the piling barge must be raised by the crane while the other end is resting on the barge, whereby a bending moment is exerted

REPLACEMENT SHEETS SG
☒ Description : paged 1 to paged 7
☒ Claim(s) : paged 8 to paged 13
☒ Drawing(s) : paged 13 to paged 313
☒ Abstract : paged 9 to paged 1

DATE OF RECEIPT 23/9/97

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Date: 23 SEP 1997



on the pile that may cause cracking or breakage of the pile. Therefore, in order to avoid such cracking or breakage of the pile, the charging operation requires a highly skilled operator and it is a time consuming operation.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a piling rig that prevents damages to a pile during the charging operation and which enables to reduce overall time required to charge each pile to the leader boom.

The above and other objects of the present invention can be accomplished by a piling rig carried on a barge comprising a leader boom adapted for pivotal movement with respect to said barge, and means for rotating the leader boom between a substantially horizontal position and an upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position to the upright position and hammer means for driving the pile.

In a preferred aspect of the present invention, a piling rig carried on a barge, comprises a sub-frame adapted for pivotal movement with respect to said barge and laid in a substantially horizontal position thereon, a leader boom laid on said sub-frame and adapted for pivotal movement with respect to the sub-frame, a first power cylinder for rotating said sub-frame to move said leader boom laid thereon between said substantially horizontal position and an intermediate position that is between said substantially horizontal position and an upright position, a second power cylinder for rotating said leader boom with respect to said sub-frame between said intermediate position and said upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof

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Date: 23 SEP 1997

from the substantially horizontal position to the upright position and hammer means for driving the pile.

In a further preferred aspect of the present invention, a piling rig further comprises a skid beam carrying said leader boom thereon and being movable to an outwardly extended position from said barge.

The above and other objects and features of the present invention will become apparent from the following description made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic side view of a piling rig mounted on a piling barge according to the present invention.

Figure 2 is a side view of the piling rig where a pile is charged to a leader boom.

Figure 3 is a side view of the piling rig showing deployment operation of a sub-frame.

Figure 4 is a side view of the piling rig showing deployment operation of a leader boom.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 is a schematic side view of a piling rig mounted on a piling barge according to the present invention.

Referring now to Figure 1, a piling rig constructed in accordance with the present invention is identified by a reference numeral 2 and installed on a piling barge 4 whose stem and stern are shown on the left and right hand sides as viewed in Figure 1, respectively. A skid beam 6 is mounted on the piling barge 4 and is movable fore to an outwardly extended position from the stem thereof. The piling rig 2 is provided with a sub-frame 8 pivotally connected at a pivot point 10 to

This is the replacement sheet

Date: 23 SEP 1997

4

the skid beam 6 at its fore end. The sub-frame 8 is initially laid on the skid beam 6 in a substantially horizontal position. A first power cylinder 12 is pivotally connected between the sub-frame 8 and the skid beam 6 to rotate the sub-frame 8 about the pivot point 10 from the substantially horizontal position to an inclined intermediate angular position in a counterclockwise direction as viewed in Figure 3. A leader boom 14 is laid on the sub-frame 8 initially in a horizontal position and is pivotally connected at its one end to the sub-frame 8 at a pivot point 16. A second power cylinder 18 is pivotally connected between the sub-frame 8 and the leader boom 14 to rotate the leader boom 14 about the pivot point 16 with respect to the sub-frame 8 from the inclined intermediate angular position to a upright position in a counterclockwise direction as viewed in Figure 4. A hydraulic hammer 20 is provided for exerting an impact on a pile to be driven and is slidably mounted on the leader boom 14. Winches 24 are provided to move the hydraulic hammer 20 upwardly along the leader boom 14 via wires 28 attached thereto. The hydraulic hammer 20 has a hammer cap 22 adapted to hold the end of the pile charged to the leader beam 14. Prior to the charging of the pile to the leader boom 14, the hydraulic hammer 20 is positioned at an aft end of the leader boom 14 as shown in Figure 1. The leader boom 14 is further provided with a clamp 26 to secure the pile charged thereto during the rotation thereof from the substantially horizontal position and the upright position.

Figure 2 is a side view of the piling rig where a pile is charged to the leader boom 14.

The charging operation of a pile to the leader boom 14 is carried out as follows. A stack of piles are usually transported on a second barge (not shown) and wire slings (not shown) are fastened to one of the piles carried thereon. A spreader bar (not shown) is attached to

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Date: 23 SEP 1997

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5

the wire slings and the pile is lifted in a horizontal position by picking up the spreader bar by a crane (ADD A REFERENCE NUMBER) mounted on the leader boom 14. Then, it is moved toward the piling rig 2 on the piling barge 4 by maneuvering the crane (ADD A REFERENCE NUMBER). The pile 30 is placed horizontally on the leader boom 14 and a first end of the pile 30 is inserted into the cap portion 22 of the hydraulic hammer 20 as shown in Figure 2. Then, the second end of the pile 30 is tightly secured to the leader boom 14 by the clamp 18. The winches 24 are released to permit the hydraulic hammer 20 to move freely with the pile 30 when moved along the leader boom 14 as mentioned below.

Figure 3 is a side view of the piling rig showing deployment operation of a sub-frame. Figure 4 is a side view of the piling rig showing deployment operation of a leader boom.

After the pile 30 has been charged to the leader boom 14 as shown in Figure 2, the sub-frame 8 is rotated about the pivot point 10 by actuation of the first power cylinder 12, whereby the leader beam 12 laid thereon is rotated therewith. The sub-frame 8 is rotated to the inclined intermediate angular position about the pivot point 10. When the sub-frame 8 is rotated to the intermediate position, the second power cylinder 18 is actuated, whereby the leader boom 14 is rotated from the inclined intermediate angular position toward the upright position about the pivot point 16 with respect to the sub-frame 8. The actuation of the second power cylinder 18 is stopped when the leader boom 14 has reached to the upright position at a predetermined angle at which the pile 30 should be driven into the seabed. The angle is normally selected to be, between +30 degrees and -30 degrees with respect to a vertical axis.

When the piling rig 2 is fully deployed to the upright position at the predetermined angular position, it is fixed thereat. Then, the skid

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Date: 23 SEP 1997



beam 6 is moved fore with respect to the piling barge 4 so that the pile 30 is located at the position where it should be driven into. Then, the clamp 18 is loosened to allow the pile 30 to slide down along the leader beam 12 due to its own weight as shown in Figure 4. As mentioned above, it should be noted that the winches 24 are released to permit the free movement of the hydraulic hammer 20 with the pile 30. Then, an impact is exerted on the pile 30 at its top end by actuation of the hydraulic hammer 20 which causes to drive the pile 30 into the seabed at the predetermined angle. Such driving operation is continued until the pile 30 is driven into the seabed to the predetermined depth.

When driving of the pile 30 is completed, the winches 24 are actuated. The hydraulic hammer 20 is raised thereby via the wires 28 to the top end of the leader boom 14, whereby the pile 30 is released from the cap portion 22 of the hydraulic hammer 20. Then, the leader boom 14 and the sub-frame 8 are rotated back to the horizontal position by reverse operation of the deployment operation mentioned above. The charging operation of a pile 30 and the driving thereof are repeated for each pile 30 as mentioned above.

In this preferred embodiment, since the piling rig 2 can be pivoted to a horizontal position and the pile 30 can be charged thereto in the horizontal position, no bending moment is exerted on the pile 30 during the charging operation and therefore, a damage to the pile 30 can be avoided.

Further more, in the preferred embodiment, since the leader boom 14 is rotated to the upright position via the sub-frame 8, short and less powerful power cylinders 10, 14 can be used.

Further more, in this preferred embodiment, because the skid beam 6 on which the piling rig 2 is mounted is utilized, the entire piling rig

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Date: 23 SEP 1997

2 can be moved fore with respect ⁷ to the piling barge 4. Therefore, the location of the pile 30 to be driven can be adjusted to the predetermined location without moving the piling barge 4 itself.

Further more, in the preferred embodiment, since the leader boom 14 can be deployed to the upright position at a predetermined angle, the pile 30 can be easily driven into the seabed at the predetermined angle.

The present invention has thus been shown and described with reference to specific embodiments. However, it should be noted that the present invention is in no way limited to the details of the described arrangements but changes and modifications may be made without departing from the scope of the appended claims.

For example, although, in the above preferred embodiment, the piling rig 2 is mounted on the piling barge 4. In case of using the piling rig 2 on the ground, it may be mounted on a vehicle such as a truck.

Further more, in the preferred embodiment, the piling rig 2 is comprised of one sub-frame 8, it may be comprised of a plurality of sub-frames which allow to raise the leader boom 14 in several stages. In such a case, shorter and less powerful power cylinders can be utilized.

Further, the pivot points 10 and 16 of the sub-frame 8 and the leader boom 14 are located at the ends thereof. However, as far as the leader boom 14 can be deployed to the upright position, the pivot points does not need to be located at their ends and can be located, for example, in the middle thereof.

According to the present invention, it provides a piling rig that prevents damages to a pile during the charging operation and enables to reduce overall time required to charge each pile to the leader boom.

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Date: 23 SEP 1997



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Claims:

1. A piling rig carried on a barge, comprising: a leader boom adapted for pivotal movement with respect to said barge, and means for rotating the leader boom between a substantially horizontal position and an upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position to the upright position and hammer means for driving the pile.
2. A piling rig carried on a barge, comprising: a sub-frame adapted for pivotal movement with respect to said barge and laid in a substantially horizontal position thereon, a leader boom laid on said sub-frame and adapted for pivotal movement with respect to the sub-frame, a first power cylinder for rotating said sub-frame and said leader boom laid thereon between said substantially horizontal position and an intermediate position that is between said substantially horizontal position and an upright position, a second power cylinder for rotating said leader boom with respect to said sub-frame between said intermediate position and said upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position to the upright position and hammer means for driving the pile.
3. A piling rig in accordance with Claim 1 or 2, further comprising a skid beam carrying said leader boom thereon and being movable to an outwardly extended position from said barge.

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Date: 23 SEP 1997

PILING RIGABSTRACT OF THE DISCLOSURE

A piling rig carried on a barge comprises a leader boom adapted for pivotal movement with respect to said barge, and means for rotating the leader boom between a substantially horizontal position and an upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position to the upright position and hammer means for driving the pile.

According to the present invention, it provides a piling rig that prevents damages to a pile during the charging operation and enables to reduce overall time required to charge each pile to the leader boom.

(Figure 1)

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Date: 23 SEP 1997

FIG. 1

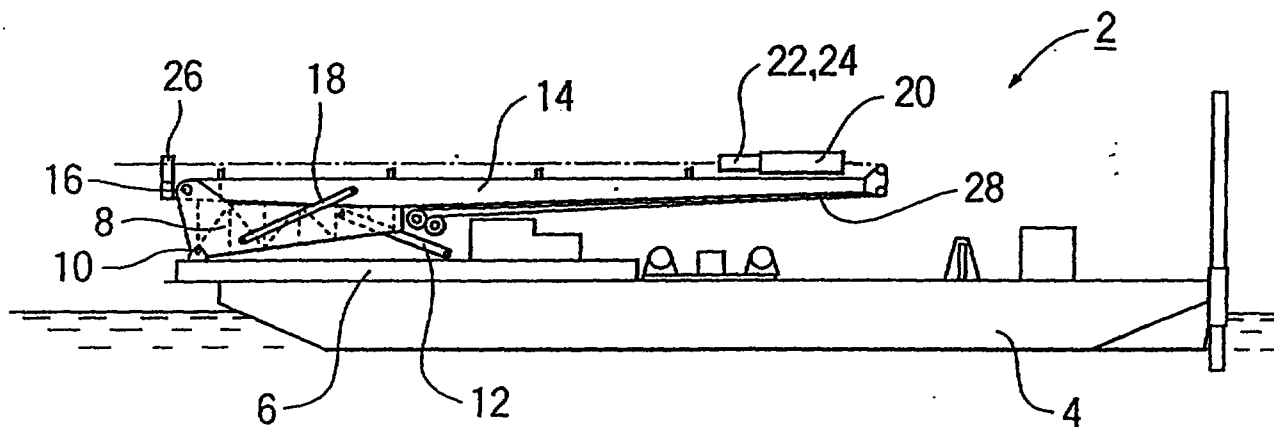
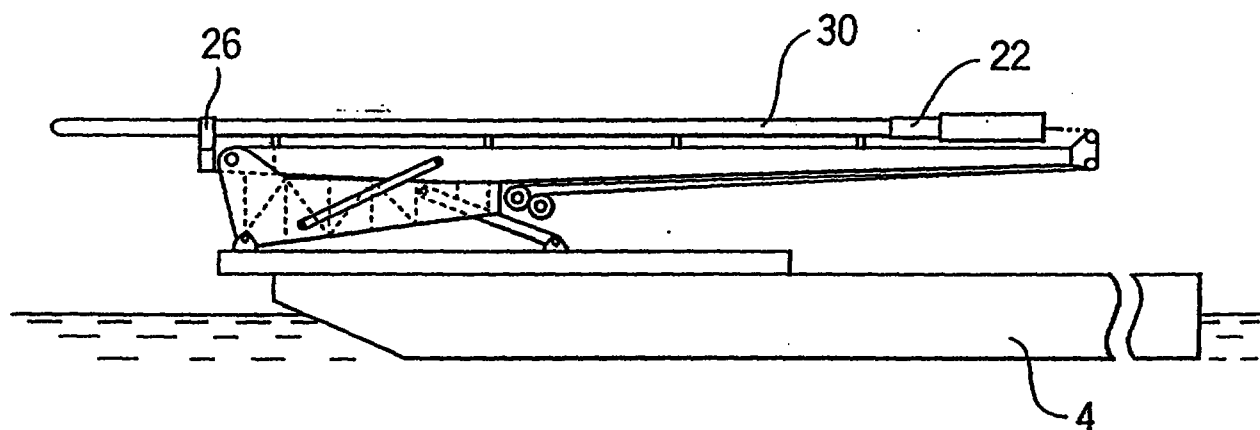


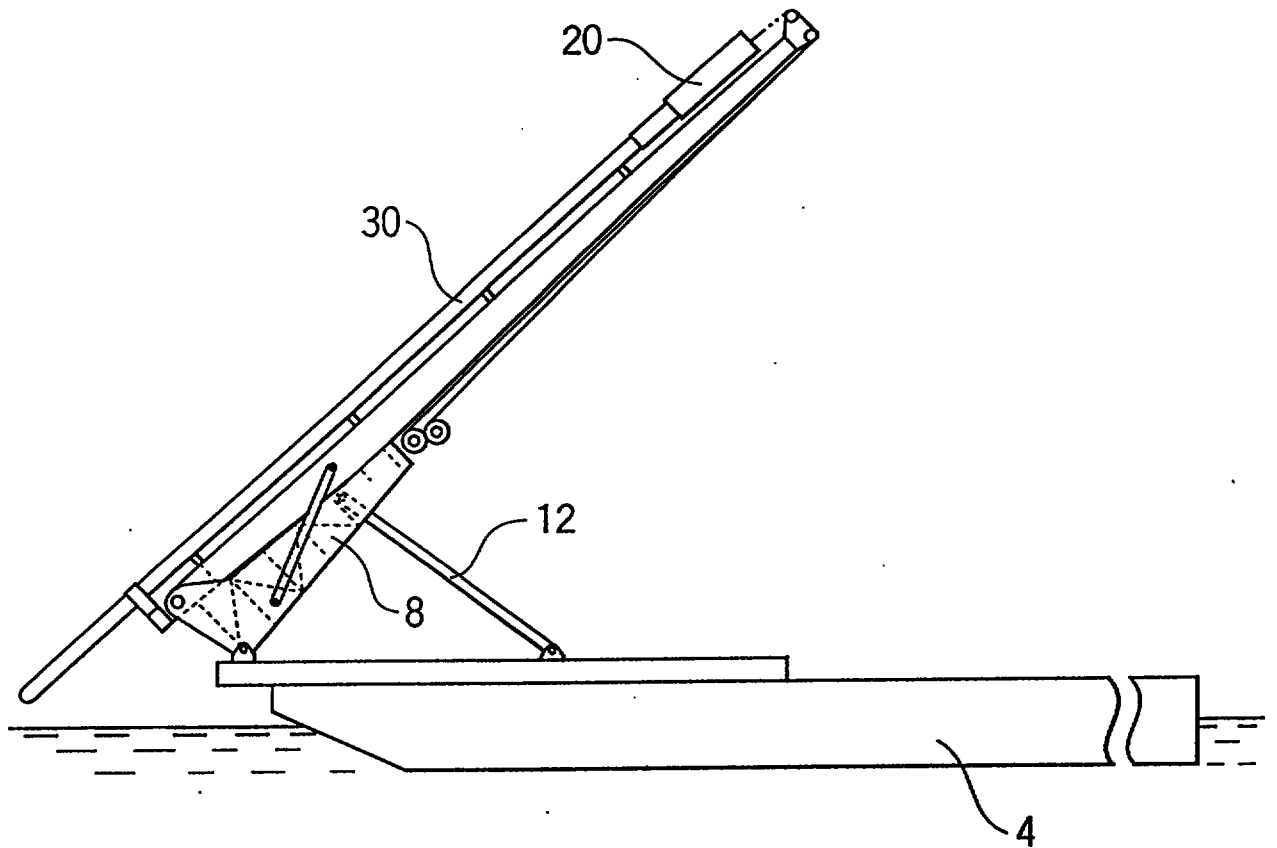
FIG. 2



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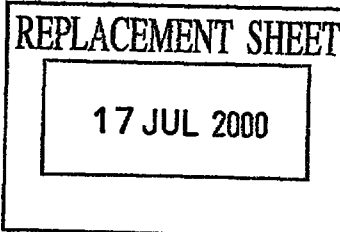
Date: 23 SEP 1997

FIG. 3



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Date: 23 SEP 1997

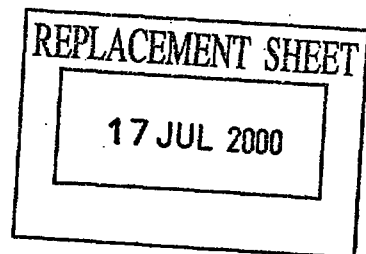
BACKGROUND OF THE INVENTIONPILING RIG

The present invention relates to a piling rig, and, more particularly, to a piling rig which is capable of driving a pile in marine construction.

DESCRIPTION OF THE PRIOR ART

Conventionally, pile driving in marine construction is carried out using a piling rig mounted on a piling barge and having a leader boom which is fixed thereon in a substantially vertical position. The leader boom has a hydraulic hammer for exerting an impact on a top end of a pile charged to the leader boom, whereby the pile is driven into the seabed. Usually, a stack of piles is transported by a second barge. Wire slings are fastened to one of the piles and a spreader bar is attached to the wire slings. The pile is lifted by picking up the spreader bar by a crane mounted on the second barge. While the hydraulic hammer is positioned at a top of the leader boom, the pile is charged to the leader boom in a vertical position by maneuvering the crane. After the pile has been charged to the leader beam, it is held by a clamp mounted thereon and the pile is ready to be driven into the seabed by the hydraulic hammer.

In marine construction, pre-stressed concrete piles, each of which having a substantially long span, are often used. When such pre-stressed concrete piles are to be used for construction, they must be handled with due caution because ^{not} exerting a bending moment on such a pile is critical. As mentioned above, in order to charge the pile to the leader boom in a substantially vertical position, one end of the pile brought to the piling barge must be raised by the crane while the other end is resting on the barge, whereby a bending moment is exerted



the wire slings and the pile is lifted in a horizontal position by picking up the spreader bar by a crane (not shown) mounted on the leader boom 14. Then, it is moved toward the piling rig 2 on the piling barge 4 by maneuvering the crane (not shown). The pile 30 is placed horizontally on the leader boom 14 and a first end of the pile 30 is inserted into the cap portion 22 of the hydraulic hammer 20 as shown in Figure 2. Then, the second end of the pile 30 is tightly secured to the leader boom 14 by the clamp 26. The winches 24 are released to permit the hydraulic hammer 20 to move freely with the pile 30 when moved along the leader boom 14 as mentioned below.

Figure 3 is a side view of the piling rig showing deployment operation of a sub-frame. Figure 4 is a side view of the piling rig showing deployment operation of a leader boom.

After the pile 30 has been charged to the leader boom 14 as shown in Figure 2, the sub-frame 8 is rotated about the pivot point 10 by actuation of the first power cylinder 12, whereby the leader beam 12 laid thereon is rotated therewith. The sub-frame 8 is rotated to the inclined intermediate angular position about the pivot point 10. When the sub-frame 8 is rotated to the intermediate position, the second power cylinder 18 is actuated, whereby the leader boom 14 is rotated from the inclined intermediate angular position toward the upright position about the pivot point 16 with respect to the sub-frame 8. The actuation of the second power cylinder 18 is stopped when the leader boom 14 has reached to the upright position at a predetermined angle at which the pile 30 should be driven into the seabed. The angle is normally selected to be, between +30 degrees and -30 degrees with respect to a vertical axis.

When the piling rig 2 is fully deployed to the upright position at the predetermined angular position, it is fixed thereat. Then, the skid

17 JUL 2000

6

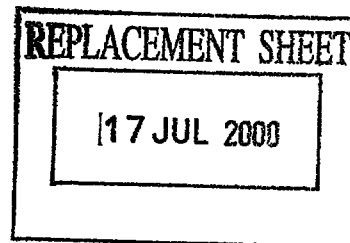
beam 6 is moved fore with respect to the piling barge 4 so that the pile 30 is located at the position where it should be driven into. Then, the clamp 26 is loosened to allow the pile 30 to slide down along the leader beam 12 due to its own weight as shown in Figure 4. As mentioned above, it should be noted that the winches 24 are released to permit the free movement of the hydraulic hammer 20 with the pile 30. Then, an impact is exerted on the pile 30 at its top end by actuation of the hydraulic hammer 20 which causes the pile 30 to be driven into the seabed at the predetermined angle. Such driving operation is continued until the pile 30 is driven into the seabed to the predetermined depth.

When driving of the pile 30 is completed, the winches 24 are actuated. The hydraulic hammer 20 is raised thereby via the wires 28 to the top end of the leader boom 14, whereby the pile 30 is released from the cap portion 22 of the hydraulic hammer 20. Then, the leader boom 14 and the sub-frame 8 are rotated back to the horizontal position by reverse operation of the deployment operation mentioned above. The charging operation of a pile 30 and the driving thereof are repeated for each pile 30 as mentioned above.

In this preferred embodiment, since the piling rig 2 can be pivoted to a horizontal position and the pile 30 can be charged thereto in the horizontal position, no bending moment is exerted on the pile 30 during the charging operation and therefore, a damage to the pile 30 can be avoided.

Further more, in the preferred embodiment, since the leader boom 14 is rotated to the upright position via the sub-frame 8, short and less powerful power cylinders 12, 18 can be used.

Further more, in this preferred embodiment, because the skid beam 6 on which the piling rig 2 is mounted is utilized, the entire piling rig



Claims:

1. A piling rig carried on a barge, comprising: a leader boom adapted for pivotal movement with respect to said barge, and means for rotating the leader boom between a substantially horizontal position and an upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position and for releasing the pile to slide under its own weight along the leader boom and hammer means for driving the pile.
2. A piling rig carried on a barge, comprising: a sub-frame adapted for pivotal movement with respect to said barge and laid in a substantially horizontal position thereon, a leader boom laid on said sub-frame and adapted for pivotal movement with respect to the sub-frame, a first power cylinder for rotating said sub-frame and said leader boom laid thereon between said substantially horizontal position and an intermediate position that is between said substantially horizontal position and an upright position, a second power cylinder for rotating said leader boom with respect to said sub-frame between said intermediate position and said upright position, said leader boom being provided with clamping means for securing a pile charged thereto during the rotation thereof from the substantially horizontal position and for releasing the pile to slide under its own weight along the leader boom and hammer means for driving the pile.
3. A piling rig in accordance with Claim 1 or 2, further comprising a skid beam carrying said leader boom thereon and being movable to an outwardly extended position from said barge.