

March 9, 1965

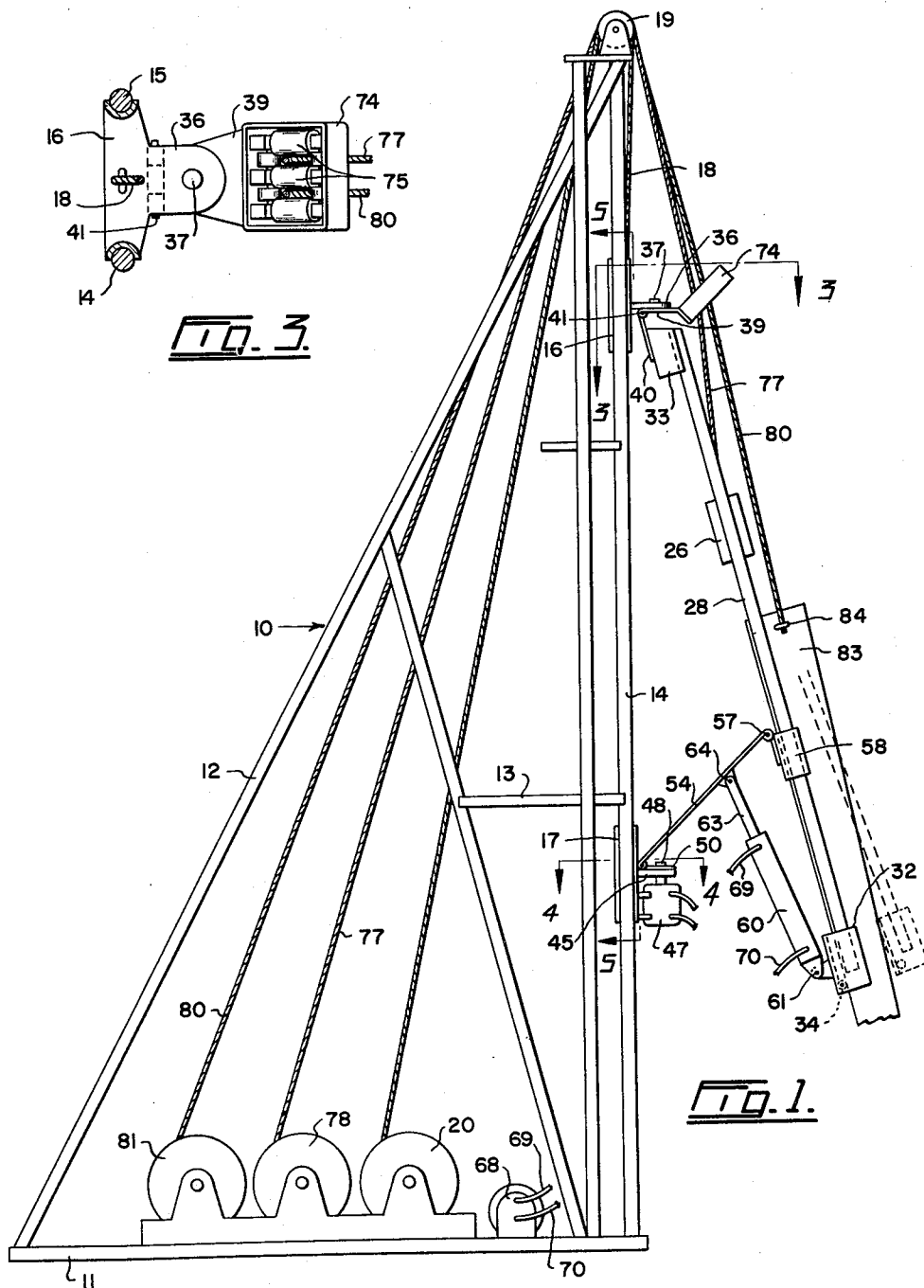
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3,172,484

PILE DRIVING APPARATUS

Filed May 20, 1963

2 Sheets-Sheet 1



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FILE DRIVING APPARATUS

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2 Sheets-Sheet 2

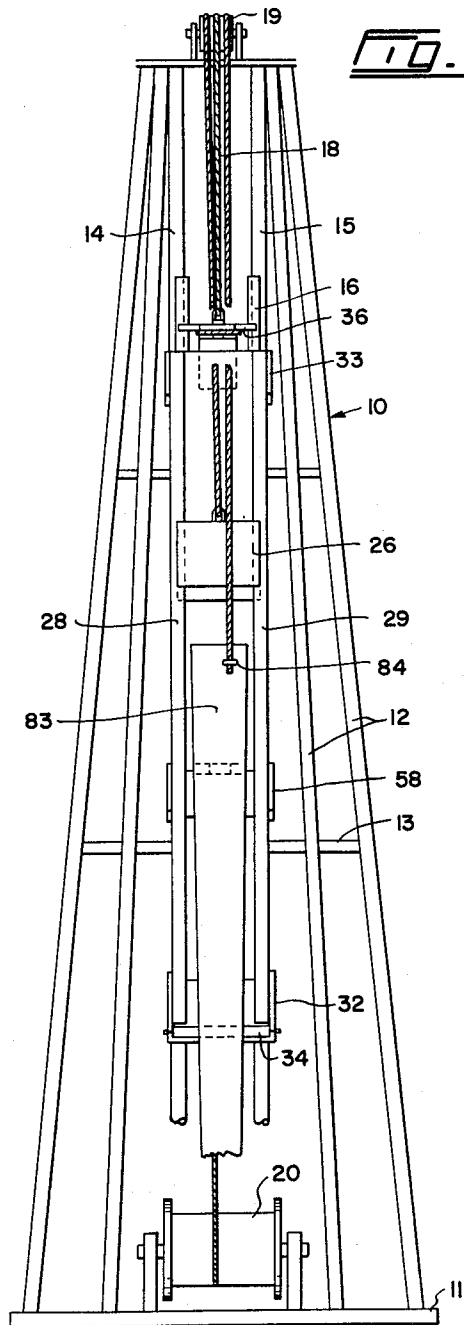


Fig. 2.

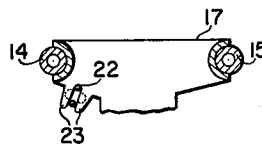


Fig. 6.

Fig. 4.

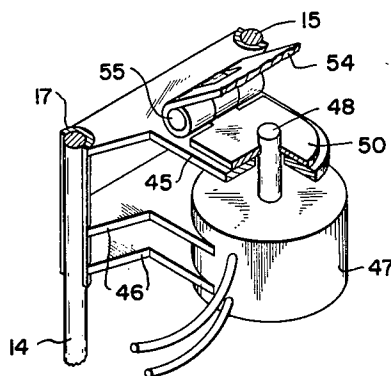
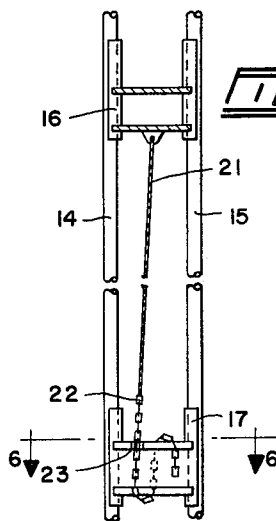


Fig. 5.



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PILE DRIVING APPARATUS

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13 Claims. (Cl. 173-43)

The present invention relates to an improved pile driving apparatus.

With pile drivers of the prior art, where it has been required to drive a number of piles at different angles and/or at different distances from the frame of the pile driver, this has necessitated frequent shifts in the position of the frame, and the need for shifts in positioning of the apparatus has slowed the pile driving work. Furthermore, the prior art machines could not drive piles at an angle to the vertical without special attachments and special operating techniques which were cumbersome, not accurate and very time consuming.

I have now found that the work of driving a number of piles in a given area can be greatly speeded and facilitated through the provision of a novel pile driving apparatus wherein the guides in which the pile driving hammer runs may be raised or lowered upon the supporting frame, may be angularly adjusted vertically relative to the vertical members of the frame, and may be caused to swing through an arcuate path in front of the frame. Not only can this apparatus be used to drive vertical or inclined piles in front of or to either side of the machine, but it may be used as a live boom crane, which is a distinct advantage around many types of construction in which piles are involved.

The pile driving apparatus of this invention may be generally defined as comprising a vertical support, an upper mounting plate slidably mounted on said support, a lower mounting plate slidably mounted on the support, means for simultaneously raising and lowering said mounting plates and holding them at a desired level, an elongated hammer guide, a hammer slidably mounted on said guide, a first strut connecting the upper ends of said hammer guide to said upper mounting plate, said first strut being rotatable about a first vertical axis which is fixed relative to said upper mounting plate, a second strut connected at one of its ends to said lower mounting plate and at its other end to said hammer guide at a point intermediate the end thereof, and means for adjusting the angular relationship between said second strut and said guide, said second strut being rotatable about a second vertical axis which is fixed relative to said lower mounting plate.

In the accompanying drawings which illustrate one presently preferred embodiment of the invention,

FIGURE 1 is a side elevation,

FIGURE 2 is a front elevation,

FIGURE 3 is a cross section on an enlarged scale taken along the line 3-3 in FIGURE 1,

FIGURE 4 is a cross section on an enlarged scale taken along the line 4-4 in FIGURE 1,

FIGURE 5 is a fragmentary vertical section taken on the line 5-5 of FIGURE 1, and

FIGURE 6 is an enlarged cross section taken on the line 6-6 of FIGURE 5.

The illustrated embodiment has a frame generally indicated by reference numeral 10 and made up of a base 11, uprights 12, and cross bars 13. The uprights include a vertical support in the form of two spaced vertical posts 14 and 15. An upper mounting plate 16 and a lower mounting plate 17 are slidably mounted between the support posts 14 and 15. The upper mounting plate 16 may be raised or lowered by means of a cable 18 trained over a three way sheave 19 and wound upon a drum 20. A

second cable 21 serves to suspend the lower mounting plate 17 from the upper mounting plate 16, see FIGURE 5. For example, cable 21 may be fixedly connected to plate 16 and have a section of chain 22 connected to its lower end. When one of the links of the chain is fitted between jaws 23 fixedly mounted on plate 17, the chain is connected to the latter plate. Suitable means may be provided releasably to retain the chain link in jaws 23, or said chain may be wound around plate 17, as shown in FIGURE 5, in order to prevent the link from accidentally coming out of the jaws. The effective length of the cable 21 can be adjusted by means of chain 22 and jaws 23 whereby to adjust the spacing between the upper and lower mounting plates. It will be appreciated that once the setting of cable 21 has been made, the upper and lower plates will move as a unit with a fixed interval between them whenever drum 20 is rotated.

A hammer 26 is carried in conventional fashion by an elongated guide, which in this example consists of a pair of spaced parallel hammer guides 28 and 29, the spacing of the guides being maintained by transverse members 32 and 33 located at the opposite ends of the guides. If desired, a transversely extending roller 34 may be mounted on the outer portion of member 32.

A bracket 36 extends horizontally from the upper mounting bracket 16. A stub shaft 37 extends vertically downwardly from the plate 36 to which it is fixed, and a second plate 39 is mounted so as to abut the plate 36 and yet be rotatable with respect thereto, the plate 39 being rotatable about the stub shaft 37. A strut 40 is pivotally connected to the plate 39 at 41, and the other end of strut 40 is rigidly secured to the transverse member 33 which connects the upper ends of the hammer guides 28 and 29 to one another.

The lower mounting plate 17 is provided with a horizontal plate 45 similar to the plate 36 attached to the upper mounting plate 16. Also mounted upon the lower mounting plate 17, in this case by brackets 46 (see FIGURE 4) is a motor 47 having a drive shaft 48, the drive shaft being vertically disposed and passing freely upwardly through the plate 45. A plate 50 is mounted in abutting relationship with the upper surface of the plate 45 and is rigidly connected to the drive shaft 48 so as to be rotatable with said shaft whenever the latter is rotated by means of the motor 47. A second strut 54 (see FIGURES 1 and 4), is hingedly connected at its lower end to the plate 50 by means of a pin 55. The opposite end of the second strut 54 is pivotally connected by means of a pin 57 to a transverse member 58 which is fixedly mounted upon the two hammer guides 28 and 29.

Suitable means is provided for swinging hammer guides 28 and 29 inwardly and outwardly relative to support posts 14 and 15. In this example, the lower end of a hydraulic jack 60 is pivotally connected, as indicated at 61, to the transverse member 32 which interconnects the lower ends of the hammer guides 28 and 29. The outer end of piston rod 63 of the hydraulic jack 60 is pivotally connected, as indicated at 64, to the second strut 54 at a point intermediate its ends. By supplying hydraulic fluid from a pump 68 along the lines 69 and 70 to the hydraulic jack 60, the angular relationship of the hammer guide 28 and 29 to the vertical members 14 and 15 may be adjusted. Thus, for example, retraction or extension of the piston rod 63 of the hydraulic jack 60 will cause the hammer guide to swing inwardly or outwardly respectively, to decrease or increase the angularity of the hammer guide members 28 and 29 with respect to the vertical support members 14 and 15. As the piston rod extends, mounting plate 17 slides up support members 14 and 15 and strut 54 moves towards a horizontal position, thereby swinging guides 28 and 29 outwardly. Cable 21 permits this movement of plate 17 in an upward direction, and it may be

adjusted to a length to permit the guides to swing into a vertical position when piston rod 63 is retracted, or the cable length may be adjusted to set a predetermined minimum angle to the guides on retraction of the piston rod.

The plate 39 carries a fairlead 74 which, as best seen in FIGURE 3, is provided with three fairing guides 75. A cable 77 is wound on a drum 78 and it is trained over sheave 19 and through two of the fairing guides 75 and connected to the hammer 26. Another cable 80 is wound upon a drum 81 and is passed over the sheave 19 and through two of the fairing guides 75, and its free end is attached to the top of the pile 83 which is to be driven, as indicated at 84.

The apparatus of the invention would be used as follows in driving a pile. By using the cable 80, the pile 83, connected at 84 to the cable 80, is drawn between the hammer guides 28 and 29 so as to occupy the position laying along the guides shown in FIGURES 1 and 2. The hammer guides are brought to the desired vertical position for initial driving by raising or lowering of the mounting plates 16 and 17 by means of the cable 18. The desired angle for driving of the pile is obtained by operation of the hydraulic jack 60 and/or the motor 47 to (a) adjust the angular relationship between the hammer guides 28 and 29 and the vertical members 14 and 15 and/or (b) to rotate the plates 50 and 39 carrying the struts 54 and 40, respectively, to induce rotation about the vertical axes of the pin 37 and the drive shaft 48, whereby the hammer guides 28 and 29 may be swung in an arcuate path in front of the portion of the frame made up of the vertical members 14 and 15. Thus, the pile may be driven from a position in front of the apparatus or to either side thereof.

When the pile 83 has thus been brought into the exactly desired position for driving, the cable 80 is slackened off the pile 83, and the pile is driven in conventional manner through operation of the hammer 26 by means of the cable 77. If the pile is to be driven a substantial distance it would be found advantageous to lower the mounting plates 16 and 17, thereby lowering the hammer guide 28 and 29, as progress is made in the driving of the pile.

The apparatus specifically disclosed in the foregoing specification and the accompanying drawings was disclosed by way of example only, and various modifications will occur to those skilled in the art. Thus, for example, the cable 21 which is employed to adjust the distance below mounting plate 16 of mounting plate 17 could be replaced by a hydraulic jack connected to one of the mounting plates and having a piston rod which is connected to the other mounting plate. Furthermore, the hydraulic jack 60 could be dispensed with altogether by adjusting the angular relationship of the guides to the vertical members 14 and 15 simply by relatively adjusting the distance between the two mounting plates.

This pile driver may be used as a live boom crane. In this case, cable 80 is used to lift any load and, if necessary, draw it up on to guides 28 and 29. The outer or lower ends of these guides are swung inwardly and outwardly relative to support members 14 and 15 by means of jack 60, and laterally from side to side by means of motor 47. Furthermore, guides 28 and 29 are raised and lowered by cable 18, and the maximum reach of these guides is adjusted by shifting mounting plate 17 up or down relative to mounting plate 16 through decreasing or increasing the effective length of cable 21. Thus, guides 28 and 29 can reach out from the supports through a lateral arc of about 180°. Cable 80 rides over roller 34 when it is used to lift or deposit a load.

This ability to function as a crane is a distinct advantage for this pile driver. Pile drivers are usually used where great loads, such as heavy timbers, have to be moved about, as in the construction of docks. This pile driver eliminates the necessity of having a separate crane for this purpose or of having to shift heavy loads by hand.

What I claim as my invention is:

1. Pile driving apparatus comprising a vertical support, an upper mounting plate slidably mounted on said support, a lower mounting plate slidably mounted on the support, means carried by the support for simultaneously raising and lowering said mounting plates and holding them at a desired level, an elongated hammer guide, a hammer slidably mounted on said guide, a first strut rotatably connecting the upper end of said hammer guide to said upper mounting plate, said first strut being rotatable about a first vertical axis which is fixed relative to said upper mounting plate, a second strut rotatably connected at one of its ends to said lower mounting plate and connected at its other end to said hammer guide at a point intermediate the ends thereof, and means connected to the second strut for adjusting the angular relationship between said second strut and said vertical support, said second strut being rotatable about a second vertical axis which is fixed relative to said lower mounting plate.

2. Pile driving apparatus as defined in claim 1 including means connected to said upper and lower mounting plates for adjusting the spacing between said plates.

3. Pile driving apparatus as defined in claim 1 including drive means connected to one of said struts for rotating said struts about said vertical axes to swing the hammer guide therewith.

4. Pile driving apparatus as defined in claim 1 in which said other end of said second strut is fixedly connected to said hammer guide, and in which said means for adjusting the angular relationship between said second strut and said vertical support comprises a hydraulic jack pivotally connected to said second strut at a point intermediate the ends thereof and pivotally connected to said hammer guide at a point spaced below said second strut.

5. Pile driving apparatus as defined in claim 1 in which said first and second vertical axes are coaxial.

6. Pile driving apparatus comprising a vertical support, an upper mounting plate slidably mounted on said support, a lower mounting plate slidably mounted on the support, means carried by the support for simultaneously raising and lowering said mounting plates and holding them at a desired level, an elongated hammer guide, first means hingedly connecting an upper end of said guide to the upper mounting plate for swinging movement towards and away from the support, second means hingedly connecting the lower mounting plate to the hammer guide adjacent a lower end thereof, said second means being adapted to move the hammer guide towards and away from the support, and means connected to said second means for operating said second means selectively to move the hammer guide towards and away from the support.

7. Pile driving apparatus as defined in claim 6 including a hammer slidably mounted on the hammer guide.

8. Pile driving apparatus as defined in claim 6 including means connected to the upper and lower mounting plates for adjusting the spacing between said plates.

9. Pile driving apparatus comprising a vertical support, an upper mounting plate slidably mounted on said support, a lower mounting plate slidably mounted on the support, means carried by the support for simultaneously raising and lowering said mounting plates and holding them at a desired level, an elongated hammer guide, first means hingedly connecting an upper end of said guide to the upper mounting plate for swinging movement towards and away from the support and around a vertical axis, second means swingably and hingedly connecting the lower mounting plate to the hammer guide adjacent a lower end thereof, said second means being adapted to move the hammer guide towards and away from the support and around a vertical axis, means connected to said second means for operating said second means selectively to move the hammer guide towards and away from the support, and additional means for operating said second means to swing the hammer guide around the two above-mentioned vertical axes.

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10. Pile driving apparatus as defined in claim 9 including a hammer slidably mounted on the hammer guide.

11. Pile driving apparatus as defined in claim 9 including means connected to the upper and lower mounting plates for adjusting the spacing between said plates.

12. Pile driving apparatus comprising a support structure which includes a pair of spaced vertical posts, an upper mounting plate slidably mounted between said posts, a lower mounting plate slidably mounted between said posts, means carried by the support structure for simultaneously raising and lowering said mounting plates and holding them at a desired level, a pair of spaced parallel hammer guides held in spaced relation to one another by a plurality of transverse members, a hammer slidably mounted in said hammer guides, a first strut rotatably connecting the upper ends of said hammer guides to said upper mounting plate, said first strut being rotatable about a first vertical axis which is fixed relative to said upper mounting plate, a second strut rotatably connected at one of its ends to said lower mounting plate

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and connected at its other end to said hammer guides at points intermediate their ends, and means connected to the second strut for adjusting the angular relationship between said second strut and said vertical posts, said second strut being rotatable about a second vertical axis which is fixed relative to said lower mounting plate.

13. Pile driving apparatus as defined in claim 12 including means carried by the supporting structure for drawing a pile on to the hammer guides beneath the hammer slidably mounted thereon.

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