Feb. 6, 1962 T. MARMION 3,019,608

APPARATUS FOR BALANCING AND HOLDING PILE-DRIVING HAMMERS ON SHEET PILING

Filed Dec. 13, 1957 2 Sheets-Sheet 1

FIG. 1.

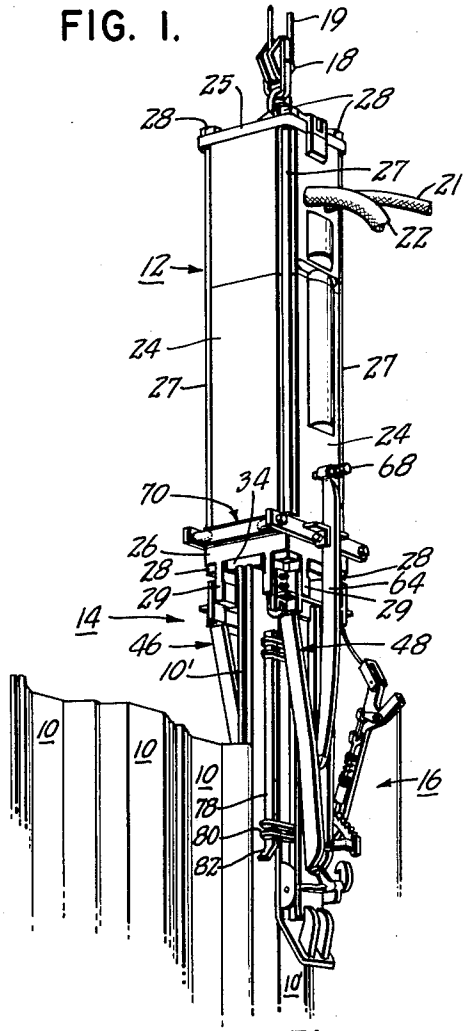


FIG. 2.

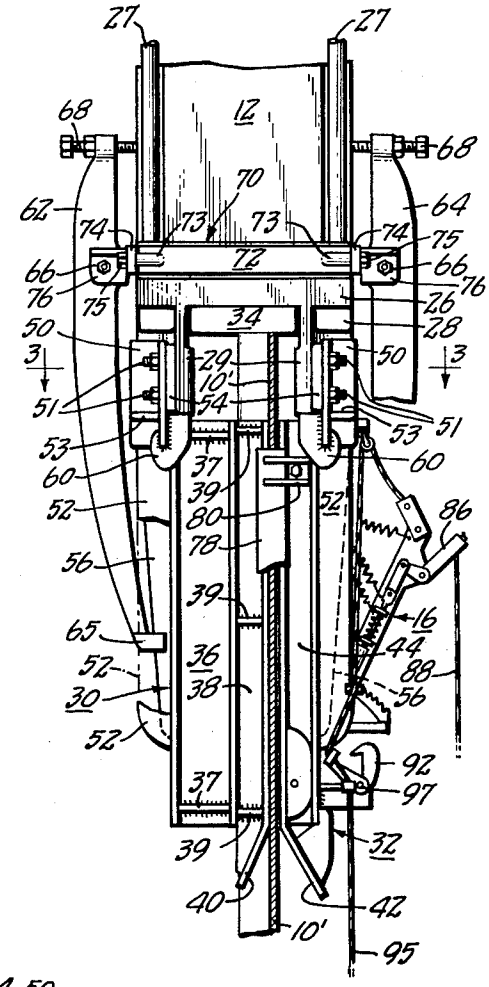


FIG. 3.

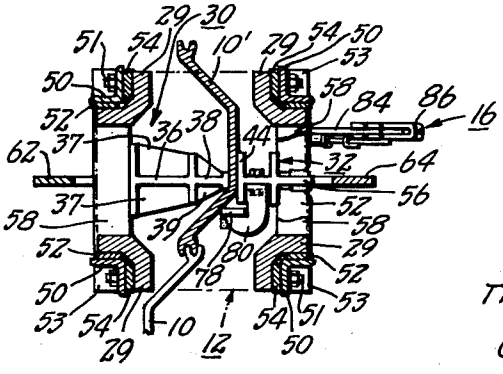
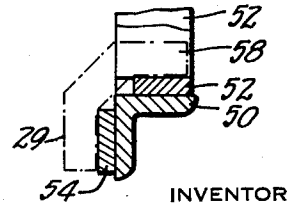


FIG. 3A.



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Feb. 6, 1962 T. MARMION 3,019,608

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Filed Dec. 13, 1957 2 Sheets-Sheet 2

FIG. 4.

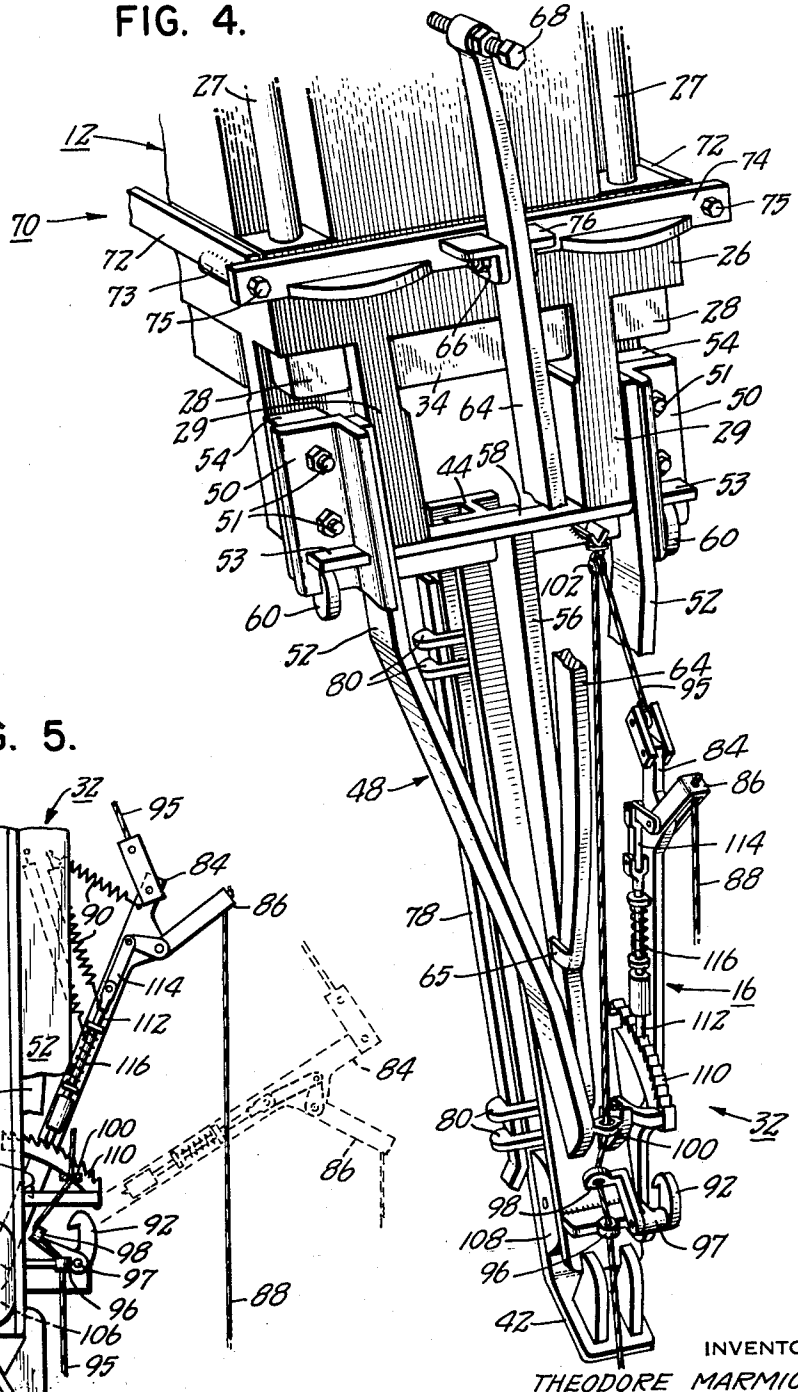


FIG. 5.

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APPARATUS FOR BALANCING AND HOLDING PILE-DRIVING HAMMERS ON SHEET PILING

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13 Claims. (Cl. 61—63)

This invention relates to balancing apparatus for pile-driving hammers when used to drive sheet piling, and particularly to balancing apparatus enabling the pile driving hammers to be held in accurately aligned position on the upper ends of sheet piles as they are being driven.

Sheet piles are used to form bulkheads or retaining walls for holding back water, muck, or shifting soil and are driven down through the earth in interlocking edge-to-edge relationship. As is indicated in FIGURES 1 and 3, the sheet piles 10 usually have a contoured cross-sectional shape so as to increase their longitudinal stiffness and ability to hold back the pressure of water or shifting soil without buckling. For example, sheet piles are commercially available having arched cross-sectional shapes, such as shown in FIGURES 1 and 3, and also having Z or N-configurations. In some cases the arch is almost flat, a so-called "straight web" sheet pile, and in other cases the arch is relatively much deeper than that illustrated in FIGURE 3. In order to interlock with each other as they are driven down, the edges of sheet piles have claw-shaped beads extending along their length, forming a fairly watertight joint between adjacent piles, when they have been driven.

As is well known, a great deal of difficulty is experienced in driving sheet piles utilizing the methods and apparatus which were available prior to this present invention. These difficulties have been well known in the pile-driving industry for many, many years and have resulted in large expenditures of effort and high costs whenever it was necessary to drive sheet piles through hard strata of earth. The expense of driving sheet piling is particularly high when utilizing prior practice to drive sheet piles in or near to a body of water by means of a pile-driving rig mounted on a barge. By its very nature, sheet piling is particularly useful for construction and repair in and around bodies of water, for building docks, piers, warves, bridges, tunnels, channels, various foundations and sea walls, and barge-mounted driving rigs are commonly used for these purposes. The methods and apparatus of the present invention overcome these prior difficulties and enable sheet piling to be driven approximately four times, or often more, faster than with prior practice, resulting in markedly reduced costs under all circumstances of which I am aware, and usually considerably more saving results in the case of barge-mounted rigs.

A pile-driving hammer of the double-acting type includes an outer frame with a movable anvil block at the bottom which is rested on the top of the pile. Within the hammer is a relatively heavy ram and a piston for raising the ram and then for driving it down against the anvil block. Compressed air or steam may be used to operate the piston, and because the force of the piston is added to the weight of the ram, it accelerates the ram down to strike hard against the anvil with repeated heavy blows. For example, 145 blows per minute are delivered using a medium large double-acting hammer such as is illustrated in FIGURE 1, which weighs slightly more than 7,000 pounds, and each impact delivers 8,750 foot-pounds which is supposed to be transferred through the anvil to the pile being driven.

In driving ordinary piling, such as round logs and H-shaped steel beams it is customary to use "leads" to guide the hammer as it moves downwardly during the

repeated blows on the pile. These leads are a pair of spaced parallel vertical tracks extending down along opposite sides of the hammer and maintaining the hammer in accurately aligned position directly over the pile.

When driving sheet piling, it is usually virtually impossible to use leads for guiding the hammer because all of the sheet piles are usually interengaged and started down into the earth before any one of them is fully driven. This initial driving of all of the piles is for the purpose of obtaining the proper spacing and mutual supporting action of the interlocked piles before they are driven down into their final positions. As a result, the started piles form a high barrier or a high enclosure which completely interferes with the placement or operation of leads for the hammer.

Prior to the present invention, the customary practice in driving sheet piling was to suspend the double-acting hammer by a pulley and hoisting cable from the end of a derrick boom. The boom was swung into position over the pile to be driven, and the hoisting cable was payed out by the derrick operator until the anvil just rested on top of the sheet pile. If the derrick operator payed out a slight amount too much, the cable would slacken and allow the top of the hammer to tip to one side or the other. As a result, the blows of the hammer were delivered at an angle to the top of the sheet pile. This angular impact tended to knock the piling over and often bounced the anvil completely off from the pile. Only a small fraction of the available impact was used. Most of it was dissipated in bouncing the anvil and jerking on the hoisting cable. If the derrick operator kept the hoisting cable slightly too tight, the anvil barely rested on the pile. As a result, when the ram hit the anvil, only a small fraction of the impact was delivered to the pile. Most of the impact was received by the retainers at the bottom of the hammer which prevent the anvil and ram from plunging out.

In normal lead-guided operation when the anvil is resting squarely on a pile with the full weight of the hammer on the anvil, then the pile absorbs the full impact and the resistance of the pile stops the anvil and ram before they hit the retainers. But when the cable is slightly too tight in driving sheet piling, the retainers themselves are battered, rapidly damaging the hammer and wasting most of the impact in jerking down on the hoisting cable.

It will be appreciated that this prior practice required a very exacting control over the hoisting cable in order to suspend the hammer partially resting on the sheet piling and in order to pay out the cable gradually and precisely synchronized with the downward movement of the pile being driven. This was very difficult under the best of conditions and a large amount of time was wasted in jockeying the boom back and forth and in re-adjusting the cable length. Even under the best conditions, a major portion of the impact energy over a period of time usually was dissipated by jerking on the hoisting cable. In hard strata, an unduly long period of time was required for driving each pile.

When the rig was mounted on a barge, subject to tide, wave motion, plus the swirls and eddies of river current and with the boom swaying back and forth and pitching up and down in an erratic way due to combined motions of the water and resulting from gusts of wind blowing on the derrick, it was a long drawn-out, frustrating job to drive each sheet pile.

The problem of driving sheet piling has been well known for many, many years and has cost governmental agencies, municipalities and private contractors millions of dollars over this period of time, which this invention will now save. Although various solutions for the difficulties of driving sheet piling have been proposed, they

have not been practicable under most conditions, so that the cable-balancing procedure described above is the one which has customarily widely been used prior to my invention.

In accordance with the methods and apparatus of the present invention the double-acting hammer is self-balanced on top of the sheet piling so as to prevent movement sideways or forward or backward with respect to the pile, with substantially the full weight of the hammer being rested on the anvil and the driving force always applied in proper alignment down along the length of sheet piling. As the sheet piling is driven down, the hammer automatically follows it down while delivering the full force of the blows in rapid uninterrupted sequence. In the illustrative embodiment of my invention described herein, the whole hammer is rigidly locked in position on top of the sheet pile at the beginning of the main driving operation and is released from the pile after the pile has been driven down to refusal. The hammer is then readily locked onto the next pile and it is then smoothly and easily driven down into place. The result is an increase of more than four times in the number of piles which can be driven compared with the same hammer under customary prior practice in hard strata and an even greater increase in production when a barge-mounted rig is used.

Among the many advantages of this invention are those resulting from the fact that the piling is enabled to be driven in one smooth continuous operation. As is well known in the art of pile driving, when the driving motion is interrupted, the earth tends to settle inwardly against the sides of the pile so that when the driving begins again, the resistance offered by the settling condition is much greater than that which would occur if the driving operation were carried out continuously. If the interruption occurs when the pile is most of the way down, the resistance often builds up so that it is impossible to finish driving the pile all the way down to ledge rock or bed rock as may be desired so as to provide a good seal against passage of water. Regardless of whether or not the pile refused to go all the way down, the increased resistance resulting from the interruptions of prior operations caused further wear and tear on the hammer and also badly battered up the upper end of the pile. By virtue of the methods and apparatus of the present invention, a continuous driving operation takes place. The pile goes down smoother, faster, and farther with less battering or distortion than customary under prior practice.

A more complete understanding of the invention can be had by reference to the following description of an illustrative embodiment considered together with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a series of sheet piles **10** which have been driven down into final position with a self-balancing double-acting hammer embodying the invention being shown in operation driving the next one;

FIGURE 2 is an elevational view of the lower end of the hammer, on somewhat larger scale, showing the two legs of the self-balancing apparatus extending down along opposite faces of the sheet pile. The web of the sheet pile is seen edgewise in cross section extending up to the anvil, and the locking mechanism engages the pile so as to hold the whole hammer down with the anvil always in firm engagement with the pile;

FIGURE 3 is a plan cross-sectional view taken along the line 3—3 of FIGURE 2 looking down and showing the lateral guide member engaging the bend of the sheet piling so as to prevent the hammer from tipping sideways;

FIGURE 3A is a cross-sectional view on enlarged scale showing the engagement between the hammer leg and the top of the yoke of the balancing apparatus;

FIGURE 4 is a perspective view on further enlarged scale showing the lower portion of the hammer, the front locking leg of the balancing apparatus and the clamping mechanism; and

FIGURE 5 is a partial elevational view, similar to the lower part of FIGURE 2, but on enlarged scale to show the operation of the clamping mechanism in detail.

Referring to FIGURE 1, the upper ends of a series of arch-shaped sheet piles **10** are shown in interlocked driven position, and a double-acting hammer **12** utilizing self-balancing apparatus, generally indicated at **14**, and clamping mechanism **16**, embodying the invention, is driving the next sheet pile **10'**. The hammer is held at the top by a pulley **18** and a hoisting cable **19**, but in operation the cable **19** is maintained in slackened condition so that substantially the full weight of the hammer rests on top of the pile **10'**. Supply and exhaust hoses are shown at **21** and **22** conveying steam or compressed air for reciprocating the piston and ram within the hammer. The hammer itself includes the cylinder side walls **24**, a top head **25** and a bottom head **26**. Four tie rods **27** extend down along the four corners of the hammer with nuts **29** on each end so as to hold the top and bottom heads in position. Four pre-drilled angular brackets or short hammer legs **29** extend down from the four corners of the bottom head **26** and are customarily used for attaching various anvils so as to accommodate different kinds of piling.

This hammer **12**, which is shown as exemplary of the type of double-acting hammer with which the self-balancing and locking mechanism **14** and **16** can be used to advantage for driving sheet piles, is a commercially available model weighing about 7000 pounds. However, it will be appreciated that the apparatus of the present invention can be used to advantage with other pile-driving hammers.

In order to balance the hammer **12** on the pile **10'** and to lock the whole hammer down firmly on the sheet piling, the self-balancing apparatus **14** and locking mechanism **16** are provided. The self-balancing apparatus **14** includes a main backer leg **30**, as shown most clearly in FIGURES 2 and 3, and a front locking leg **32**, as shown most clearly in FIGURES 2, 4 and 5. There is a narrow spacing extending up between the backer and front legs **30** and **32** and the web of the sheet pile fits up into this space with the backer and front legs engaging opposite faces of the pile **10'**.

For purposes of providing rigid support to prevent the hammer from swaying back and forth on the sheet piling and for purposes of engaging into a concave portion of the sheet pile **10'**, the backer leg **30** is shown as being deeper than the front locking leg **32** and extends inwardly a greater distance beneath the anvil **34**. This backer leg **30** includes a main H-section column **36** whose flanges are braced by gussets **37** welded in place with an inner narrow T-shaped rail **38** held onto the inner flange of the column **36** by means of triangular gussets **39**. As seen in FIGURE 3, this narrow rail **38** of the backer leg forms a long abutment seating snugly into the concave side of one corner of the web of the sheet pile **10'**.

To form a funnel entrance for guiding the web of the sheet pile up into the narrow space between the backer leg **30** and the locking leg **32**, the lower end of the rail **38** is bent out at a slope **40** from the opposed inclined lower end **42** of the H-shaped column **44** of the front locking leg.

A pair of identical front and rear V-shaped yokes **46** and **48** secure the backer leg **30** and the front locking leg **32**, respectively, to the four short hammer legs **29**. The lower end of each yoke is welded to the outer flange of the respective H-column **36** or **44** near its lower end, and short portions of the upper ends of the V-shaped yokes are bent into parallel relationship and secured to right-angle mounting brackets **50** which are bolted to the hammer legs by bolts **51**.

Because these yokes are identical, the front yoke **48** as shown in FIGURE 4, for the front balancing leg **32**,

will be described in detail, and it will be understood that similar comments apply to the rear yoke 46 for the backer leg. The yokes include a pair of stiff diagonal braces 52 having their upper ends bent parallel and spaced apart approximately the same distance as the legs 29 on one side of the bottom head 26 of the hammer. The right-angle mounting brackets 50 have one flange welded onto these parallel portions of the braces 52 and have their other flanges projecting outwardly in coplanar relationship and including pairs of bolt holes for mounting on the hammer legs 29. Small gusset pieces 53 are used to stiffen the brackets 50. Shim blocks 54 are inserted between the brackets 54 and the hammer legs, and the thickness of these shim blocks is easily changed so as to accommodate the balancing apparatus to different sizes of hammers or different bottom heads 26.

As seen in FIGURES 1 and 4 the outer corners of these diagonal braces 52 are rounded at their lower ends and welded to the outer flange of the H-column 44 spaced apart a slight distance so as to straddle a tapered track 56, whose purpose is explained further below. These tracks 56 extend up along the outside of the front leg and of the backer leg.

It will be noted in FIGURES 3 and 3A from a comparison of the cross sectional showing of the upper parallel portions of the yoke braces 52 with their lower portions, that clearance is provided for the diagonal concave corners of the hammer legs 29 by cutting away a strip along the inner edges of the parallel portions of the braces where they overlap the respective hammer legs. This is also seen in perspective in FIGURE 4 in the upper portion of the left brace 52.

As seen in FIGURE 4, a shelf brace 58 extends across between the upper portions of the yoke braces. This shelf brace has an upper horizontal flange extending across just beneath the lower ends of the hammer legs, forming a shelf on which they can stand. As its center, this shelf brace 58 has its lower vertical flange fastened rigidly to the wide upper end of the tapered track 56, providing additional strength. In order to provide additional support for the other corners of the respective hammer legs, as shown in FIGURE 2, J-shaped stops 60 are welded around the lower edges of the mounting brackets just beneath the stiffening pieces 53. The stem of each J-shaped stop projects up underneath the adjacent hammer leg 29 in position to support the shim 54 as well as the hammer leg (please see FIG. 2).

In order to strengthen the backer and front legs, to adjust the vertical alignment of the hammer 12 over the balancing mechanism, and to increase the clamping force on the sheet piling, an identical rear and front adjusting lever 62 and 64, respectively, are provided. The lower end of each lever has a U-shaped shoe 65 riding on the track 56. An intermediate portion of each lever is swingably mounted by a pivot 66 on the lower portion of the hammer, just above the bottom head 26. At the top end of the lever is a jack screw 68 and an associated lock nut. By virtue of the fact that the jack screws of these adjustable levers bear against opposite sides of the hammer, it is possible to adjust the longitudinal axis of the hammer relative to the web of the sheet pile so as to obtain the desired alignment. It is usually desirable to adjust both levers so that their U-shoes press firmly against the respective tracks 56. By tightening up further on both jack screws, the lower ends of the backer and front legs are urged together so that they maintain the clamping mechanism 16 firmly engaged.

In order to fasten the pivots 66 onto the hammer, a harness 70 girdles the hammer just above the bottom head 26. This harness includes a pair of identical side tie straps 72 with threaded studs 73 welded on so as to project from each end. A pair of pivot straps 74 are held by nuts 75 engaging these studs so as to extend across the front and rear walls of the hammer. The pivots 66 are secured to the straps 74 by hinge brackets 76.

In order to prevent the balancing mechanism from shifting laterally, there is provided as shown in FIGURE 3, a removable lateral support guide bar 78 which has a face extending at an angle to and offset from the inner parallel faces of the backer and front legs so as to engage an offset portion of the sheet pile. In this embodiment of my invention, the guide bar 78 is at right angles to the inner face of the front leg. This bar is held by a pair of brackets 80 which are bolted onto the web of the H-column 44 of the front balancing leg. This lateral guide bar is shown bearing against the arched side of the sheet pile. It will be understood that this guide bar can readily be unbolted and replaced with one having a different offset and angle for accommodating different shapes of sheet piles. As shown in FIGURE 1, the lower end of this guide bar is bent out at 82 to form a funnel-like mouth for receiving the sheet pile as the hammer is lowered down into position prior to clamping.

The clamping mechanism 16 includes a swingable arm 84 having a ratchet release lever 86 near its free end. In operation, after the balancing mechanism is astride the top of the sheet pile, a cocking rope 88 attached to the end of the release lever is pulled down. This swings the arm 84 down to the dotted-line position shown in FIGURE 5, stretching a group of springs 90. A hook 92 engages a detent 94 on the side of the arm 84 so as to hold it in its cocked position with the springs 90 stretched to a fairly high tension. When the operator sees that the anvil 34 is resting squarely on the top of the pile, he pulls on the trigger wire 95, releasing the arm. This wire runs up through a first fixed eye 96 near the pivot 97 for the hook latch 92, and then it runs over at an angle through an eye at the end of a trigger lever 98 secured to the hook latch. The wire then runs back at an angle through a second fixed eye 100 which is secured to a short cross piece (not shown) between the lower ends of the braces 52. It runs on up through a pulley 102 suspended from the center edge of the shelf brace 58 and continues over to the end of the arm 84 where it is attached. A yank on this trigger wire tends to straighten the offset portion of the wire between the eyes 96 and 100, thus urging the trigger lever 98 upwardly and outwardly so as to release the latch.

The released clamping arm 84 swings up as it is pulled by the springs and by the pull of the trigger wire. As the arm swings up about its pivot 104, a knurled eccentric cam 106, which is secured to the lower end of the arm moves in through a slot in the inner flange of the H-column of the front arm. The knurled surface of this cam clamps up against the web of the sheet pile 10' holding it firmly against the backer leg 30. The pivot 104 is held by the web of the H-column 44 and by a plate 108 spanning across between its flanges.

In order to hold the clamp engaged, a ratchet mechanism is provided including an arcuate rack 110 engaged by a pawl rod 112. A linkage 114 couples the pawl rod to the release lever 86 and a spring 116 urges the point of the pawl down into the teeth of the rack.

From the foregoing description, it will be understood that the methods and apparatus of the present invention described above are well suited for balancing a double acting hammer in accurate alignment on top of a sheet pile and for clamping the whole hammer assembly to the sheet pile, thus providing the many advantages set forth. Because certain possible changes may be made in the various features of this balancing apparatus without departing from the scope of my invention, it is to be understood that all the specific examples set forth or shown in the accompanying drawings are to be interpreted as illustrative of my invention, for in certain instances, some of the features of the invention may be used without a corresponding use of other features, all without departing from the scope of the invention.

I claim:

1. Apparatus for conveniently driving sheet piling of the type having an arch shape as seen in end view thereby forming a vertically extending offset portion when the sheet piling is standing on end, said apparatus comprising a pile driving hammer, self-balancing and clamping mechanism secured to the hammer for holding the hammer on top of the sheet pile being driven including a pair of opposed legs depending from the hammer and providing first and second closely spaced opposed guide surfaces extending down along opposite faces of the sheet pile and maintaining the axis of the hammer aligned with respect to these guiding surfaces so as to prevent backward or forward tipping motion of the hammer with respect to the axis of the sheet pile, a guide member providing a third guide surface extending down along a substantial length of the offset portion of the sheet pile so as to prevent lateral motion of the hammer with respect to the axis of the pile, a clamping device included in said mechanism for applying clamping force on the faces of the piling between said first and second guide surfaces, thereby to lock the hammer onto the pile while driving the pile downwardly, and releasing means for removing said clamping force and withdrawing said hammer after the pile has been driven.

2. Self-balancing and clamping apparatus for balancing a pile driving hammer on top of a sheet pile being driven and for clamping the hammer thereto comprising a backer leg member projecting down from the hammer and adapted to slide down along one face of the sheet pile, a front leg member in closely spaced parallel relationship with said backer leg member adapted to slide down along the opposite face of the sheet pile, mounting means securing said two leg members to the hammer, and a releasable clamping mechanism mounted on one of said leg members including a pivot axis extending parallel with the adjacent face of the sheet pile, an eccentric cam element adapted to rotate about said pivot axis, and a clamping arm connected to said eccentric cam element for rotating said cam element about said axis for applying a clamping force to the adjacent face of the sheet pile.

3. Self-balancing apparatus for balancing a pile driving hammer on top of sheet piling comprising mounting means adapted to be secured to the hammer, a backer leg member projecting down from the mounting and adapted to slide down along one face of a sheet pile, a front leg member also secured to said mounting means and being in closely spaced parallel relationship with said backer leg member and adapted to slide down along the opposite face of the sheet pile, at least one lateral adjusting mechanism including a lever having a lower end adjacent to one of said leg members and an upper end adjacent to the hammer, said adjusting mechanism including adjustable element co-operating with said lever for adjusting the longitudinal position of the axis of said hammer with respect to said one leg member and a releasable clamping mechanism mounted on one of said leg members, said one leg member having an opening therein, and said clamping mechanism having a clamping element movable inwardly through said opening toward the other leg member adapted to clamp a sheet pile between said leg members.

4. Self-balancing apparatus as claimed in claim 3 and wherein said adjustable element is a jack screw carried by one end of said lever, and fastening means securing an intermediate portion of the lever to a lower end portion of the hammer.

5. Self-balancing apparatus as claimed in claim 3 and including a fulcrum mounting for said lever, said fulcrum mounting being coupled to an intermediate portion of said lever near to said mounting means, and a jack screw carried by one end of said lever for urging one end of the lever outwardly while urging the other end of the lever inwardly about said fulcrum mounting.

6. Self-balancing and clamping apparatus for balancing a pile driving hammer on top of a sheet pile being driven by the hammer and for clamping the hammer thereto comprising mounting means adapted to be secured to the hammer, a first leg member projecting down from the mounting means and adapted to slide down along one side of a sheet pile, a second leg member projecting down from the mounting means in closely spaced parallel relationship with said first leg member and adapted to slide down along another side of the sheet pile, and releasable securing mechanism carried by said mounting means for releasably securing the sheet pile between said leg members, said releasable securing mechanism including a pivoted lever and a cam operated by said lever for applying a clamping force to said sheet pile.

7. Self-balancing and clamping apparatus for balancing a pile driving hammer on top of a sheet pile being driven by the hammer and for clamping the hammer thereto comprising mounting means adapted to be secured to the hammer, a first leg member projecting down from the mounting means and adapted to slide down along one side of a sheet pile, a second leg member projecting down from the mounting means in closely spaced parallel relationship with said first leg member and adapted to slide down along another side of the sheet pile, releasable securing mechanism carried by said mounting means for releasably securing the sheet pile between said leg members, and at least one lateral adjusting mechanism having a lever with a lower end adjacent to one of said leg members and an upper end adjacent to the hammer, said adjusting mechanism also including an adjustable element co-operating with the lever for adjusting the attitude of the axis of said hammer with respect to said one leg member.

8. Self-balancing apparatus as claimed in claim 7 and wherein said lever is carried on a pivot, and said adjustable element is a jack screw is carried on an upper end portion of said lever for pressing the upper end of the lever outwardly about said pivot.

9. Balancing apparatus for use with a double-acting hammer of the type having a bottom head with four depending hammer legs extending down from the bottom head and adapted for balancing the hammer on the upper edge of a sheet pile and for clamping the hammer thereto, said balancing apparatus comprising four mounting brackets adapted to be secured to the four hammer legs, a pair of V-shaped yokes extending down from respective pairs of said mounting brackets, a pair of balancing legs having their upper ends secured to said mounting brackets and being secured to the vertex of said V-shaped yokes near their lower ends, a lateral guide bar releasably secured to one of said balancing legs and having an offset surface angularly disposed with respect to the spaced parallel balancing legs, a pair of adjustable levers, a pair of pivot mountings for said levers in an intermediate portion thereof, the lower ends of said levers engaging the lower portions of said balancing legs respectively, jack screw means at the upper ends of said levers adapted to engage opposite walls of the hammer, clamping mechanism secured to one of said balancing legs having a portion movable into the space between said balancing legs, thereby to balance the hammer in vertical alignment on the sheet pile and to clamp it firmly thereto.

10. Apparatus as claimed in claim 9 including a harness adapted to girdle the hammer, said pivot mountings securing said levers to opposite sides of said harness.

11. Self-balancing and clamping apparatus for use with pile driving hammers when driving sheet piling having an arch-shape when seen in end view, said arch shape providing a vertically extending offset portion of the sheet piling when the piling is standing upright, said apparatus comprising fastening means adapted to be secured to the hammer, a pair of opposed legs extending down below said fastening means on opposite sides of

the driving anvil of said hammer, said opposed legs providing a space therebetween for receiving the end of the sheet piling with said legs being adapted to bear against opposite faces of the sheet piling for preventing backward or forward tipping motion of the hammer on the end of the sheet piling, a guide member adjacent to one of said legs and laterally offset from the other of said legs and extending across the space between said legs and overlapping one side of the other of said legs in spaced relationship therewith for engaging the outer surface of said laterally offset portion of the sheet piling for confining said laterally offset portion between said guide member and the other of said legs for preventing lateral motion of the hammer with respect to the axis of the sheet piling, the space between said legs being open and unobstructed on the opposite side from the position of said guide member for accommodating sheet piles of various shapes, and releasable clamping means for clamping the sheet piling between said legs.

12. Apparatus for use with a pile-driving hammer having a driving anvil for conveniently driving a sheet pile of the type having a first vertically extending area offset from a second vertically extending area, said apparatus comprising a pair of legs adapted to depend from the hammer on opposite sides of the anvil, the inner faces of said legs defining first and second closely spaced opposed guide surfaces extending down along opposite sides of the first area of the sheet pile, lateral support guide means defining a third guide surface at an angle to and offset laterally from the first and second opposed guide surfaces and overlapping the plane of the space between said first and second opposed guide surfaces and extending down along a substantial length of the second area of the sheet pile for aligning and holding the axis of the hammer with respect to the longitudinal axis of the sheet pile with the anvil positioned to deliver driving impulses to the sheet pile, a clamp connected to one of said legs and having releasable clamping mechanism for applying a clamping force to the sheet pile, and manually operable actuating means connected to said clamping mechanism, whereby said clamping mechanism is operated to clamp the hammer in position during a driving operation and is released for withdrawing the hammer after completion of the driving operation.

13. Self-balancing apparatus adapted for use with a pile-driving hammer having a driving anvil, said balancing apparatus being adapted for driving sheet piling of the type having a shaped web defining a concave side and a convex side as seen in end view, said apparatus comprising a backer leg and a front leg extending down from the hammer beneath opposite sides of the driving anvil, said backer leg and said front leg being substantially parallel and defining a narrow space therebetween for receiving an end portion of the sheet piling, said backer leg extending inwardly beneath the driving anvil a greater distance than the front leg and thereby being adapted to fit into the concave side of the sheet piling, said front leg being adapted to engage the convex side of the sheet piling, and a lateral support guide element offset from the backer leg and overlapping the narrow space between the backer and front leg for engaging the convex side of the sheet piling.

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2,122,835	Deros	July 5, 1938
2,554,146	Johns	May 22, 1951
2,562,039	Johansen et al.	July 24, 1951