April 28, 1953 J. H. THORNLEY 2,636,355

EXTRA LENGTH CONCRETE PILE

Filed July 15, 1949 2 SHEETS—SHEET 1

Fig. 1.

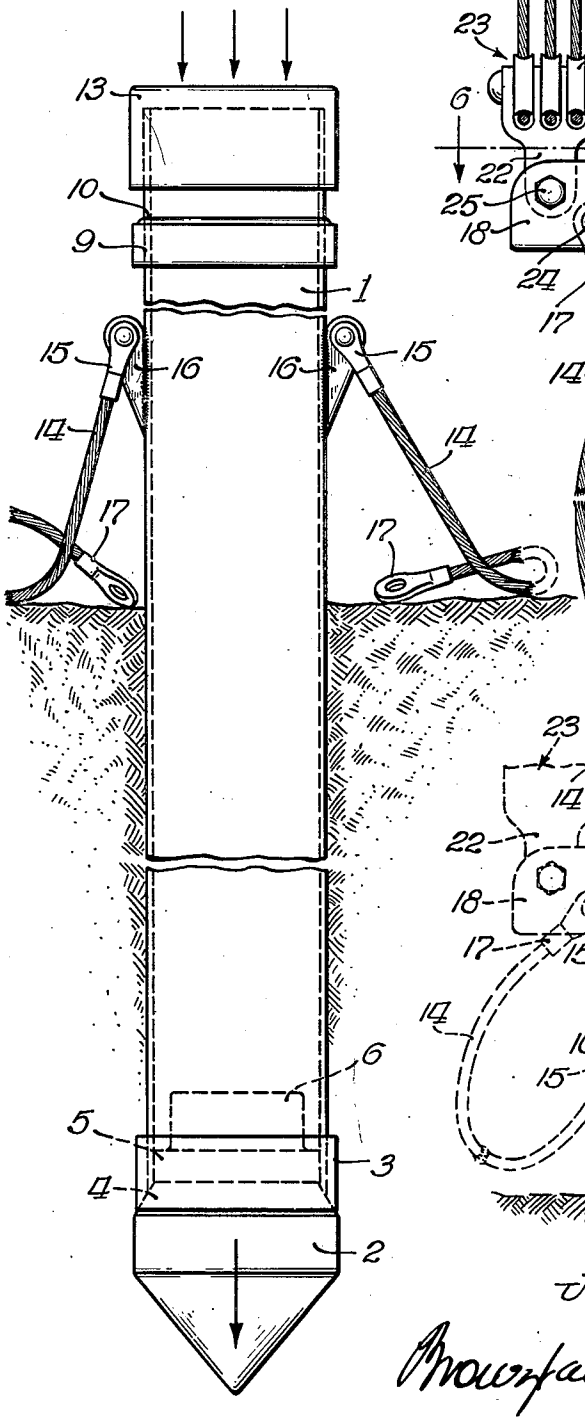
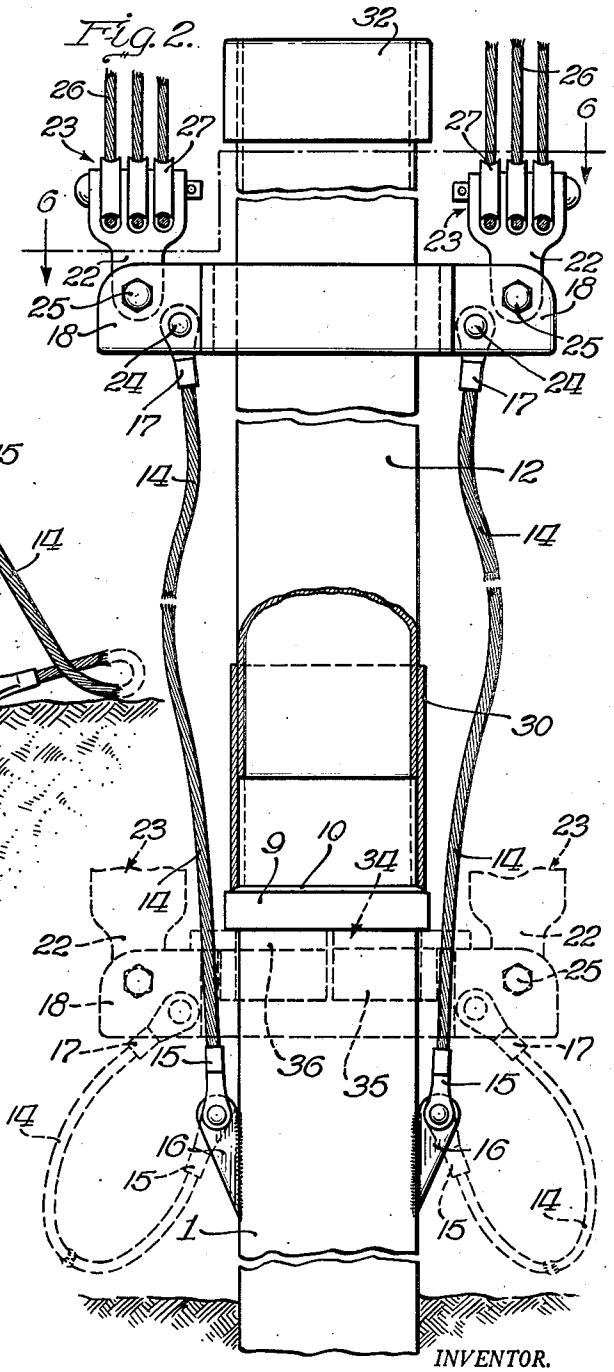


Fig. 2.



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Fig. 3.

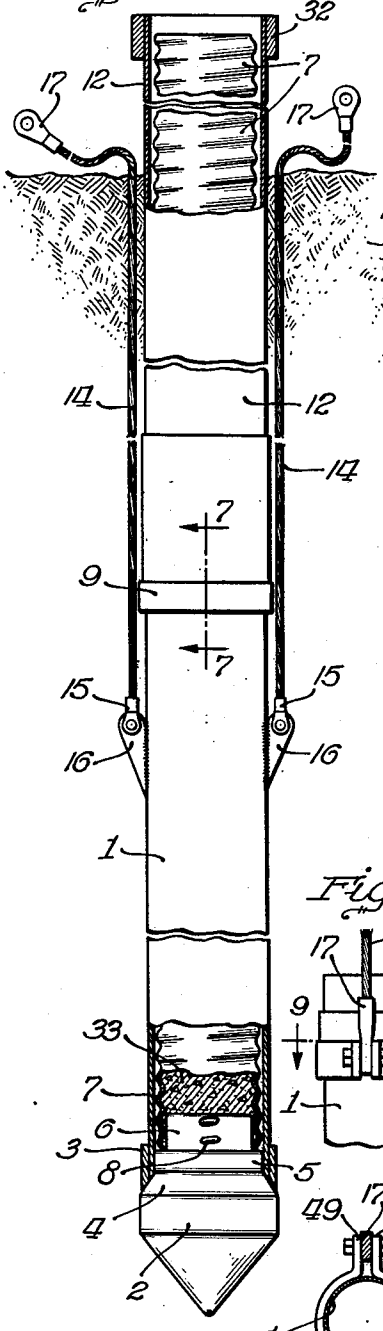


Fig. 4.

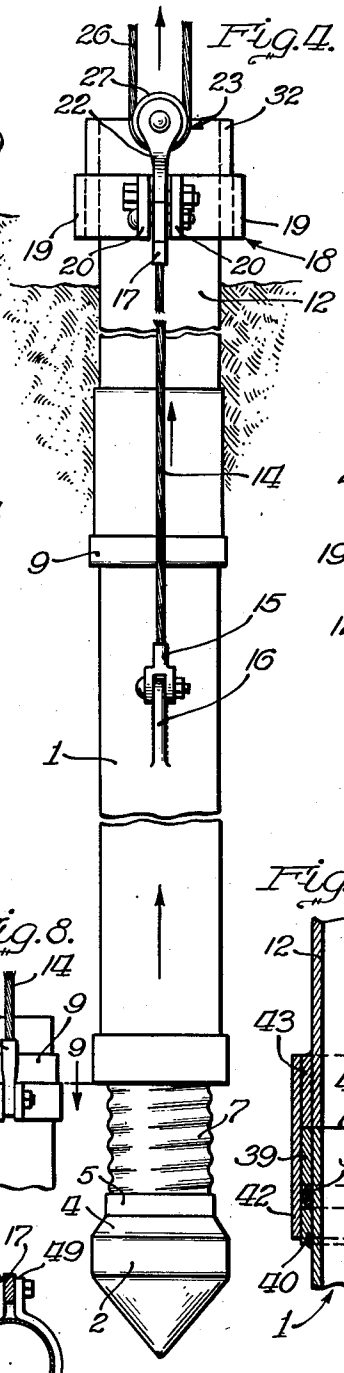


Fig. 5.

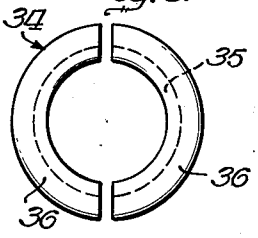


Fig. 6.

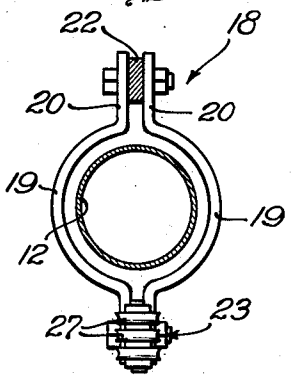


Fig. 8.

Fig. 9.

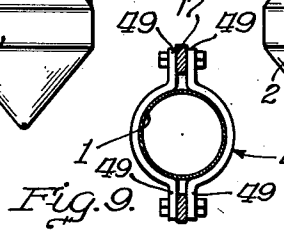


Fig. 7.

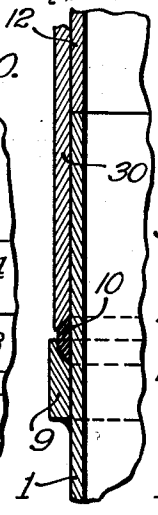
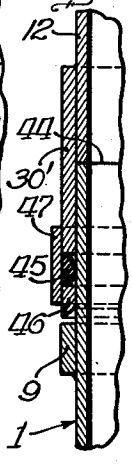


Fig. 10.

Fig. 11.



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Patented Apr. 28, 1953 2,636,355

UNITED STATES PATENT OFFICE

2,636,355

EXTRA LENGTH CONCRETE PILE

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Application July 15, 1949, Serial No. 104,917

5 Claims. (Cl. 61—78)

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My invention lies in the foundation art and is concerned with concrete piles.

It sometimes becomes necessary to install piles of a length greater than the length of the leads or ways on the pile driver derrick of the operator. Heretofore this need has been met by driving a sectional pile, such as a composite wood and concrete or a steel and concrete pile, but so far as I am aware, no one has heretofore devised a workable way by which a unitary, cast-in-place pile of a length substantially greater than the length of the derrick leads employed to install it could be constructed. For example, the derrick with which I have operated has leads of a length of approximately 75 feet. That is quite usual in the art. However, when the situation arises where a continuous concrete pile is to be projected, for example, to a depth of 125 feet, or in fact anything above the length of the ways of the derrick or pile driver, a problem is presented which the art has heretofore not solved.

The present invention permits of the installation of extra length unitary concrete piles, that is, piles of a length in excess of the length of the leads or ways of the pile driver.

According to my invention, the pile casing is divided into sections which are telescopically coupled for driving, so that after the first section is driven down to substantially ground level, the second section is then erected on the first, with only a slip fit, and driving is continued through the second section to project the casing to the desired depth. Thereupon the hole which is produced by the sinking of the pile casing is filled with concrete which contacts either directly the inside of the pile casing or which may be contained within a thin shell lowered in the pile casing according to a practice well known in the art. After the pile casing is thus filled with the cement for the pile, the casing must be pulled, since it is an expensive piece of apparatus, the cost of which is too great to permit it to be employed as a part of the pile structure.

I have conceived the possibility of providing a pulling harness for extracting both of the pile casing sections simultaneously to the point where the lower section is revealed and then extracting the latter separately. In the preferred form of the device, I attach the lower ends of tension members which may be cables, chains, or even rods, to the upper end of the lower section, and allow these strands to be carried down into the soil with the driving of the lower section below the surface of the soil. Then when the upper and lower sections have been driven down to the

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desired depth, I employ a harness, which, in the preferred form, has a yoke at the upper end for connecting to the cables which in turn are connected to the upper end of the lower section, to pull both sections simultaneously. No pull can be exerted upon the upper end of the upper section effective upon the lower section as the two sections are joined only by a slip fit or telescopic joint. Then after the sections are pulled up to bring the upper end of the lower section above ground, the lifting yoke is connected to said lower section as by means of a split collar and the lower section is pulled out of the ground. This harness may in detail vary considerably, but it involves essentially the idea of an attachment of the strands to the lower casing section, and the carrying of the lower ends of said strands down with driving of the lower section to permit the said lower section later to be extracted, after filling part or all of the casing with concrete.

The harness is coupled initially only to the upper end of the lower section. Thereby both sections may be pulled up simultaneously while maintained in tight telescopic relation with each other. After both sections have been pulled up to the point where the upper section can be removed, then the hitch is shortened for pulling the lower section. Where a light sheet metal shell is employed, it is generally advisable to fill only the lower part of the casing with cement, and then pull up the casing far enough to get the upper section above ground, and to allow the said upper casing section to be removed from the harness. Then, assuming the light shell is used inside the casing section, a further filling of cement may be introduced to fill a part of the shell above the part which is then supported by the soil closing against it below the lower end of the lower casing section. Then the hitch is shortened by dropping the yoke below the fixed collar at the upper end of the lower casing section, inserting the split collar, and thereby connecting the yoke to the fixed collar to pull up the lower casing section. It is desirable to have the telescopic joint sealed in the course of driving, since the entry of mud or water prior to placing the concrete filling is objectionable.

Now in order to acquaint those skilled in the art, I shall describe, in connection with the accompanying drawings, a specific embodiment of my invention, and the mode of constructing and using the same.

In the drawings, in which like reference numerals refer to like parts:

Figure 1 is a side elevational view of the lower casing section being driven into the earth;

Figure 2 shows the top section aligned and telescopically connected to the bottom section for driving of both sections down into the ground. This figure shows in dotted lines how the harness is connected by a shortened hitch to the upper end of the lower section;

Figure 3 is a side elevational view of the pile, partly in section, with the two casing sections driven to the full depth, the inner light shell put in place and partly filled with concrete, and the casing sections ready to be pulled;

Figure 4 shows the parts at 90° to the view of Figure 3 with the harness in place, and the casing sections partly pulled to reveal the lower end of the partly finished pile;

Figure 5 is a top plan view of the split collar by which the yoke engages the reenforcing ring at the top of the lower section for the shortened hitch.

Figure 6 is a section taken on the line 6, 6 of Figure 2;

Figure 7 is a fragmentary, sectional view of the telescopic joint taken on the line 7, 7 of Figure 3;

Figure 8 is a side elevational view of a modified form of anchorage for the lower ends of the cables;

Figure 9 is a cross sectional view taken on the line 9, 9 of Figure 8;

Figure 10 is a fragmentary, sectional view similar to Figure 7, showing a modified form of telescopic joint between the sections; and

Figure 11 is a section of a further modification of the seal at the telescopic joint between casing sections.

In constructing a continuous concrete pile of a length in excess of the ways of the pile driver derrick, I provide a plurality of casing sections, in this case two. Assume that it is desirable to project a pile to a depth of 105 feet, and that the leads of the pile driver permit only a 75 foot length to be handled. I thereupon provide the pile casings in two lengths, the first of which may be a uniform 75 foot length, and the second or variable length section may be cut to the desired length of 30 feet to make up the total of 105 feet for the particular example. The first pile casing section shown at 1 (see particularly Figure 1) is placed over a concrete button or point 2, which is driven into the ground by a driving force applied to the upper end of the lower pile section 1. A conventional steam hammer may be used. The lower end of the tubular casing section 1 is reenforced by a ring 3 which preferably is shaped to seat upon the shoulder 4 of the concrete button. The button has a guiding stem 5 which fits fairly closely within the inner bore of the sleeve 1, and it has an attaching stem 6 to which a spiral sheet metal shell 7 shown in Figures 3 and 4 may be connected as by threading the same in place, suitable projections or interrupted threads 8 being provided to permit this connection to be made. This connection is preferably sealed to exclude mud or water from the shell 7.

The section 1 has a ring or collar 9 attached to its outside surface, as shown in Figures 1 and 7, this collar 9 having a recess in which there is seated a gasket 10 of rubber or the like to maintain a tight joint between the said lower casing section 1 and the upper casing section 12.

For driving the section 1, a driving cap 13, or a driving mandrel not shown, may be employed, to project the casing section closed by the button 2 down to a point where the upper end of the said section is only a short distance above the ground.

For certain conditions of the soil, instead of using a concrete button to close the lower end of the casing section, the section 1 may be driven with a mandrel which fills the opening, and the upper section may be driven likewise using a mandrel of suitable length.

The lower casing section is provided with a pair of strands 14, 14, in this case stranded wire cables having suitable yokes 15, 15 at their lower ends pinned to ears 16, 16 that are welded to the outside of the casing wall to make a permanent fixed connection for the attachment of the said cables 14, 14. At their upper ends, the cables 14 have connectors 17, 17 which are connected to a yoke 18 shown in Figures 2, 3 and 6. These may be of fixed length as shown or may have turnbuckles to adjust the length.

The yoke 18 consists of two flat bars bent into arcuate portions 19, 19 in the center, and extending ears 20, 20 at each end of the arcuate portion. These ears 20, 20 are spaced apart to receive the cable lugs or connectors 15, 15, and also to receive the ears or lugs 22, 22 of pulley blocks which form the lower end of block and tackle lifting means for pulling up upon the yoke 18. The cable ears or connectors 15, 15 are connected to the yoke 18 by pins or bolts 24, 24 which pass through the ears 20, 20, and likewise the ears 22 of the pulley blocks 23 are secured by pins 25, 25, which also pass through the ears 20, 20 of the yoke. As the reeved cables 26 are contracted and pull upon the pulleys 27, 27 the yoke is raised upwardly. This tends to tighten up the cables 14, 14 attached to the lower casing section, as will be described in detail later.

The upper casing section 12 is aligned endwise and telescopically connected with the lower casing section 1 as shown in Figure 2. The ends of the two casing sections are abutted and kept in alignment by means of a sleeve 30 which is attached as by welding to the upper casing section 12 and which extends over the outside of the top of the lower casing section 1 and has its end flared or tapered out so as to engage the rubber gasket 10 carried in the groove in the ring 9 of the lower casing section. The relative positions of the sleeve 30 and the ring 9 may be reversed if desired. Driving force is applied to the driving ring 32 at the upper end of the upper casing section 12, so as to drive both sections further into the ground to substantially the position indicated in Figure 3. In Figure 3, the cable ears or connectors 15, 15 are shown as detached from the yoke. In driving the casing sections it is desirable to leave the cable strands 14, 14 free to be drawn down into the ground, as shown in Figure 3. The strands 14 may remain connected to the yoke 18 while the sections are being driven if desired.

The inside diameter of the body of the yoke is large enough to pass the driving ring 32 of the upper section and the joining sleeve 30 of the lower end of the upper section, and hence the yoke may be dropped over the driving ring 32 when the parts are in the position shown in Figure 3, and the cable connectors 15 then connected to the yoke 18 by means of the pins 24, 24 for pulling of the section when that is in order. Obviously, the yoke may be laid on the ground near by during driving of the lower section, either coupled or not coupled to the cables 14, 14, as may be desired. If the cables 14, 14 should be left connected to the yoke, the yoke may then be

disposed in the position shown in Figure 2 during the driving of the upper and lower sections together. In other words, since the parts are readily connectable and detachable, the procedure may be varied to suit the convenience of the operator. However, as soon as the casing sections have been driven down to the position shown in Figure 3, it is then in order to begin to fill the casing sections with concrete. Where the inner light shell 7 is to be employed, it is then made up in the right length and fastened in place as shown in Figure 3 and filled with concrete, as indicated at 33. It is filled for a distance of only approximately 50 feet, so as not to put too great hydrostatic pressure upon this light shell. Thereupon the casing sections 1 and 12 may be drawn upwardly, as shown part way in Figure 4. At this time the yoke 18 fits loosely about the upper casing section 12. As the reeved cables 26 are drawn upwardly, the yoke 18 pulls the strands 14—14 up, bringing with it the lower casing section 1, and it in turn brings up with it the upper casing section which rests upon it. The contact seal 10 tends to remain tight because of the pressure of the lower section 1 against the upper section 12. This pulling of the cables 26 on the pulley blocks 23 and the raising of the yoke 18 with the connected section 1 and the upper section 12 resting on section 1 is continued until all of the upper section 12 and a few feet of the lower section 1 are above the ground surface. The top section 12 is then removed.

The pulling yoke 13 is then dropped down to a point below the ring or fixed collar 9 on the upper end of the lower section 1, as shown in dotted lines in Figure 2. Then the halves of the split collar 35 of Figure 5 are inserted in the yoke 18 with the cylindrical parts 35 of the collar 34 disposed inside the yoke 18 and the flange 36 of the split collar resting upon the top edge of the yoke 18. As the yoke 18 is raised, the split collar 34 engages under the ring 9, and further upward movement of the yoke 18 pulls the lower section of the casing out of the ground. This pulls the lower casing section up to a point where it is under the hammer and ready for sinking the next pile.

As shown in Figures 1 to 4 and 7, the seal between the two casing sections is largely a contact seal produced by engagement of the end of the sleeves 30 with the rubber ring 10 when the two parts are in end to end relation, as during driving. However, as shown in Figures 10 and 11, the seal may be disposed in the form of a wiping ring which will maintain a fluid-tight joint even though some separating movement of the telescopic joint has occurred.

When the harness has been used to pull the casing up to the point of freeing the upper section 12, the harness may be slacked off and the upper section 12 lifted out of the yoke 18. Then the remainder of the concrete may be filled in to fill up the shell 7 while the lower section 1 is extracted. Where the concrete is to be disposed directly on the inside of the casing, progressive filling will not be required.

In Figure 10, I have shown the rubber gasket 38, which is seated in a groove formed between the driving ring 39 and an auxiliary ring 40 secured upon the outside surface of the pipe forming the lower section 1. The said gasket ring 38 has its outer circular surface in the form of a ridge which engages the inside of the sleeve 42. The sleeve 42 is mounted on a filler ring 43 upon the lower end of the upper casing section 12. The end walls of the pipe of casing sections 1 and 12 abut and are guided and held in that relation by the overlapping of the sleeve 42 with the driving ring 39 on the lower section 1.

It can be seen that a slight separation of the sections 1 and 2 at their meeting places 44 may be permitted without loss of a fluid tight joint by virtue of the continued engagement of the rubber sealing ring 38 with the sleeve 42.

A similar arrangement is shown in Figure 11 in which the annular sealing ring 45 seats in a groove with a ridged or V-shaped face facing inwardly to engage the external cylindrical wall of the section 1 above the ring 9. The groove in which the sealing ring 45 is seated is formed between the sleeve 30' attached to the lower end of the upper section 12, and an auxiliary ring 46 which is held in spaced relationship with the sleeve 30' by a short sleeve 47 which spans the gap between the lower end of the sleeve 30' and the auxiliary ring 46.

Instead of hitching the strands 14 to the permanently attached ears 16, 16, these strands may be connected to a split clamp or yoke 48, consisting of two bars disposed edgewise, each having the body portion bent into arcuate cylindrical form to engage the outer surface of the pipe of the casing section 1. The ends of these bars are bent into the form of parallel ears which clamp the cable lugs 17, 17 between them by means of suitable bolts or the like. In other words, a yoke 48, similar to the yoke 18, except that it fits the wall of the pipe section closely and engages under the attached ring 9, may be used for pulling the lower casing section.

It will be seen that in this method of installing a pile the casing sections are joined and aligned merely by a slip fit, so that they may be readily separated upon being pulled out of the ground, yet this slip fit is ample connection for driving the sections into the ground. In order to be able to pull the lower section, connection with it is retained through the flexible tension connections 14, 14, which may be cable, chains, or even rods if desired. The pulling of the lower section 1 is then accomplished through the hitching of the yoke 18 by means of the split collar 34 to the ring 9, the tension connections 14—14 which have remained connected to the section throughout the driving operation being relaxed and idle. Thus, by first pulling both sections up to release the short upper section, and then shortening the hitch to connect the lifting yoke below the top of the lower section, a pile of a length greater than the length of tubing that could be handled as one piece by the derrick leads, may readily be installed. The longer bottom section is then in place on the derrick leads under the hammer ready for driving of the same for the next pile.

I do not intend to be limited to the specific details shown and described, except as the same are made essential in the following claims, since those skilled in the art will adapt the invention to their own particular requirements.

I claim:

1. Means for installing an extra length pile comprising a drive casing made up of two unitary pipe sections having a slip joint for holding them in alignment in endwise abutting relation, and flexible cables connected to the upper end of the lower section said cables being of a length approximately equal to the length of the upper pipe section and said cables being adapted to be drawn down into the ground with the lower pipe section.

2. The combination of claim 1 with a yoke

member attached to the strands for pulling up both sections, said yoke member embracing the drive casing and means for connecting the yoke member to the upper end of the lower casing section independently of the cables whereby to provide a shortened hitch to said lower section.

3. A lower drive casing section and raising means therefor comprising a unitary pipe section having a button engaging and reenforcing band at its lower end, a fixed collar near its upper end, cable attaching lugs fastened to the upper end of said section and spaced a substantial distance below the collar to permit the engagement of a yoke under said collar and flexible pulling cables pivotally attached to said lugs, said cables having eyes at their upper ends for pin connection with a pulling yoke.

4. Means for installing a concrete pile which is of substantially greater length than the effective height of the derrick by which the pile is to be installed, comprising a lower section of unitary tubular pile casing adapted to be closed at its lower end during driving, said section being of a length not in excess of the said effective height of the derrick, said lower section being adapted to be driven into the ground untill only the upper end thereof is exposed substantially at ground level, and an upper section of unitary tubular pile casing suitable for driving into the ground and being of a length not in excess of the said effective height of the derrick, said upper section being adapted to be placed axially on top of

the exposed end of the first section and both sections then driven to the desired depth, said lower section having a plurality of cables attached to the upper end thereof, said cables being drawn down into the earth as said lower section is driven below ground, said cables being of a length approximately equal to the length of the upper section, whereby the upper ends of said cables remain exposed when the two sections have been driven together to the desired depth.

5. In combination with the means of claim 4, a yoke connected to the upper ends of said cables, said yoke being adapted to be pulled upwardly by the derrick to raise the two pile casing sections together until the upper pile casing section is above ground and can be removed from the lower section, and a split collar for clutching together the yoke and the upper end of the lower pile casing section for pulling the lower pile casing section out of the ground independently of said cables.

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