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APPARATUS AND METHOD FOR DRIVING PILE SHELLS

Filed Aug. 20, 1930

2 Sheets-Sheet 1

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FIG.2.

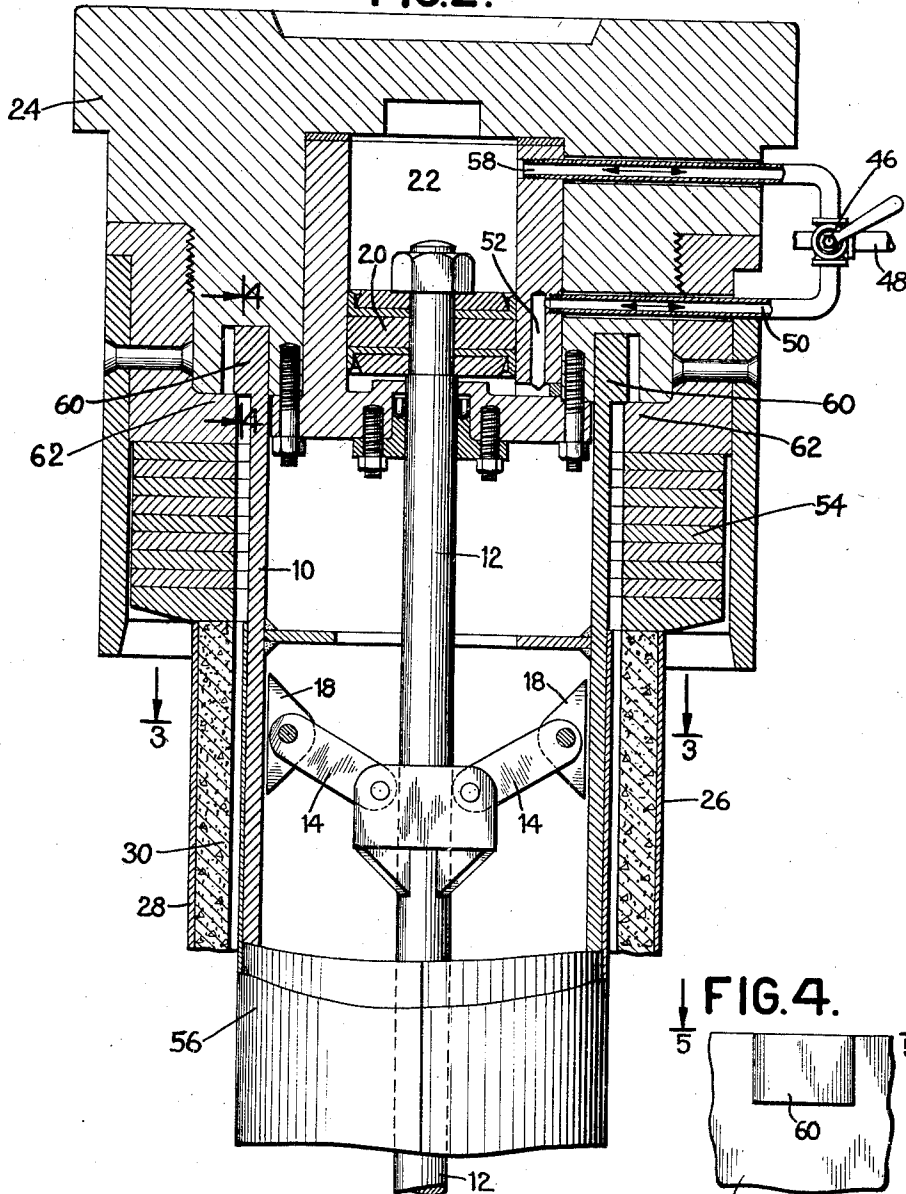
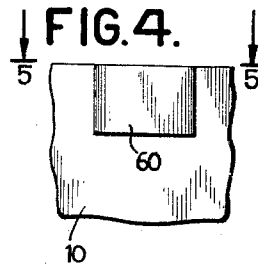
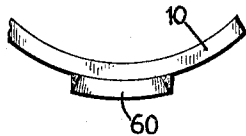


FIG.5.



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APPARATUS AND METHOD FOR DRIVING PILE SHELLS

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This invention pertains to concrete piles, with particular reference to apparatus and methods for driving thin non-taper concrete shells, preparatory to filling them with concrete to form a monolithic pile structure.

In order to save transportation and handling costs it is desirable to make the shells as thin as possible. This is comparatively easy to do if tapered shells are used on a tapered core, but if non-taper shells are to be carried down into the earth by driving at the top, as has heretofore been the practice with shells of that type, it has been found that the shells must be of considerable thickness. The principal object of this invention is to disclose ways and means for driving straight sided (non-taper) shells largely by friction applied to the interior walls of the shells, whereby the thickness of the shells may be reduced to only a fraction of that required for top end driving. For example a shell having walls from 2 to 2½ inches thick may, under the method herein disclosed, be replaced by a shell of the same outer diameter but having a wall thickness of only about ¾ inch.

One of the steps of the invention is to expand a driving core against the inner surface of the shells to hold pressure against the shells during the driving operation. The principal driving effect is thus communicated to the shells by friction between core and shells. It is sometimes advisable to insert a thin sheet of compressible and preferably resilient material, which may be rubber sheeting, between core and shell in order to obtain more uniform distribution of pressure than is obtained by direct contact of core and shell.

Further and other objects and advantages will be apparent from the specification and claims, and from the accompanying drawings which illustrate what is now considered the preferred embodiment of the invention.

Fig. 1 shows in cross-section a stack of shells ready for driving, with the core in place but not expanded.

Fig. 2 is an enlarged cross-section of the upper shell, core, core-expanding device, driving head, etc.

Fig. 3 is a cross-section on the line 3—3 of Fig. 2.

Fig. 4 is a detail on the line 4—4 of Fig. 2.

Fig. 5 is a view on the line 5—5 of Fig. 4.

Figs. 6 and 7 are enlarged detail cross-sections of a shell having a corrugated outer surface but reinforced in somewhat different manners.

For the purpose of illustration the expandible core is shown as comprising a pair of semi-annular leaves 10, a vertical central stem 12, numerous pairs of toggle links 14 interconnecting collars 16 on the stem to lugs 18 on the leaves, and a double acting plunger 20 on the upper end of stem 12, movable vertically in a cylinder 22 in driving head 24.

When it is desired to sink a pile, the core while collapsed is encased in a stack of comparatively short shell sections 26, as shown in Fig. 1. Each shell in its preferred form comprises a thin outer metallic casing 28 lined with a thin layer of concrete 30. The upper end of each casing 28 extends upwardly beyond the concrete lining 30, to overlap the lower end of the shell section above it in order to prevent entrance of dirt between sections. In order to insure clarity of illustration the thicknesses of the shells and their component parts have been increased in the drawings, out of proportion to the operative parts of the apparatus, and the usual reinforcing wires have been omitted in Figs. 1 and 2.

The steel casings may be plain as in Figs. 1 and 2 or may be corrugated as at 32 in Figs. 6 and 7. Each shell is usually reinforced by wire rings 34 or 36 embedded in the concrete. Under certain circumstances vertical reinforcing wires 38 are added between the wire rings and outer casing as shown in Fig. 7. These vertical wires serve to prevent longitudinal stretching of the shell section as may happen, for instance, if the lower end of the section has better frictional contact with the core than has the upper end of the section.

The lower end of the core and shell assembly is equipped with a driving shoe 40 of metal or concrete upon which the core rests at 42 and the stack of shell sections rests at 44. A thin casing 46 of the shoe overlaps the bottom of the lowest pile section.

It will be noted that a set of core toggles is located near the top and another set near the bottom of each shell section in order to obtain fairly uniform pressure throughout the length of each section.

After the parts are assembled as in Fig. 1, four-way valve 46 is opened to admit fluid under pressure from pipe 48, through passages 50, 52 to the under side of plunger 20, whereupon stem 12 is raised and toggles 14 are straightened, thus forcing core leaves 10 into contact with the inner surfaces of the shell sections. The assembly is then ready for driving by blows or pressure applied in the usual manner on head 24.

A cushion such as rope or rubber belting 54 may be placed between the driving head and the top of upper shell section 26 if desired, in order to apply a slight top-driving effect to the stack of shells to prevent slippage thereof relative to the core, in case the frictional engagement between core and shell be not quite sufficient to overcome the ground resistance.

To insure more perfect frictional engagement between core and shell, a thin layer of compressible material 56 may be placed between core and shell.

After the shell is driven to desired depth, valve 46 is turned to exhaust the fluid from below piston 20 and to admit fluid under pressure through passage 52 into cylinder 22 above plunger 20, whereby the plunger is pushed down, toggles 14 are broken, and the core is collapsed so that it may be removed from the shells preparatory to filling the driven stack of shells with concrete to form therewith a monolithic pile.

Lugs 60 on the upper ends of leaves 10 overlap ring 62 attached to drive head 24 in such manner as to permit lateral movement of the leaves.

It is to be understood that the invention is not limited to the specific details herein illustrated and described but may be used in other ways without departure from its spirit as defined in the following claims.

We claim—

1. Apparatus for driving multi-section annular pile shells having cylindrical inner surfaces, comprising in combination, an expansible driving core, means independent of the driving operation for expanding said core into frictional driving engagement with the cylindrical surface of the shell sections, and means for maintaining said core in said expanded condition during the driving of said core and shell.

2. The invention set forth in claim 1 in which said expanding means includes a fluid operable plunger.

3. The invention set forth in claim 1 in which said expanding and maintaining means includes a fluid operable plunger.

4. Apparatus for driving annular pile shells having cylindrical inner surfaces, comprising in combination, an expansible driving core adapted to accommodate a stack of said shells therearound, and means independent of the driving operation for expanding said core into frictional engagement with all the shells of said stack, means for maintaining engagement of the core and stack of shells during the driving of both into the ground, and means for releasing said engagement after the driving is completed.

5. The invention set forth in claim 4 in which means is also provided for applying downward vertical pressure on top of said shells while said engaging means is being forced into the ground, whereby the driving effect on said shells is contributed partly by force applied to the tops of the shells and partly by friction of the shell walls with the engaging means.

6. Apparatus for driving annular pile shells having cylindrical inner surfaces, comprising in combination, an expansible driving core having a driving head, means independent of the driving head for expanding said core into frictional engagement with the cylindrical surface of the shells, means for maintaining said core in said expanded condition during the driving of said core and shells, and a cushion interconnecting said driving head with the top of the uppermost shell whereby a cushioned driving effect is imparted to said shell during the driving of the core and shells.

7. Apparatus for driving cylindrical pile shells comprising, in combination, an expansible driving core, a driving head connected therewith, and means associated with the head but movable independently thereof for expanding said core into driving engagement with the shell.

8. Apparatus for driving cylindrical pile shells comprising, in combination, an expansible driving core, a driving head associated therewith, means for expanding the core into driving engagement with the shell and a power device in said head movable independent of the head and connected with said expanding means.

9. Apparatus for driving pile shells comprising, in combination, a driving core embodying an axial stem, a plurality of leaves surrounding the stem and toggle links interconnecting said stem and leaves, a driving head, and a power device arranged in but movable independently of the head for actuating said stem to expand the leaves into driving contact with the shell or withdraw said leaves from contact with the shell.

10. Apparatus for driving pile shells comprising, in combination, a driving core embodying an axial stem, a plurality of leaves surrounding the stem, and toggle links interconnecting said stem and leaves, a driving

head, a power cylinder carried in said head and connected with a source of fluid pressure, and a piston on the stem and operating in said cylinder to expand the leaves into driving contact with said shell or withdraw said leaves from contact with the shell.

11. Apparatus for driving multiple section annular pile shells having a cylindrical inner surface comprising, in combination, an expansible driving core adapted to accommodate a stack of shells therearound, means for expanding the core into frictional engagement with all of the shells of the stack, a driving head on the core, and means interposed between the driving head and the upper shell section for assisting the frictional driving of the shell by the core by a compressional action on the top of the shell whereby the shell is driven solely by a compressional action on the top and a frictional engagement with the side walls thereof.

12. The method of driving cylindrical multiple section pile shells which comprises exerting a frictional force laterally on the inner walls of said shell and a compressive force on the upper end of said shell.

In testimony whereof we hereto affix our signatures.

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