March 1, 1932. E. D. WATT 1,847,854

APPARATUS FOR FORMING CONCRETE PILES

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FIG.1.

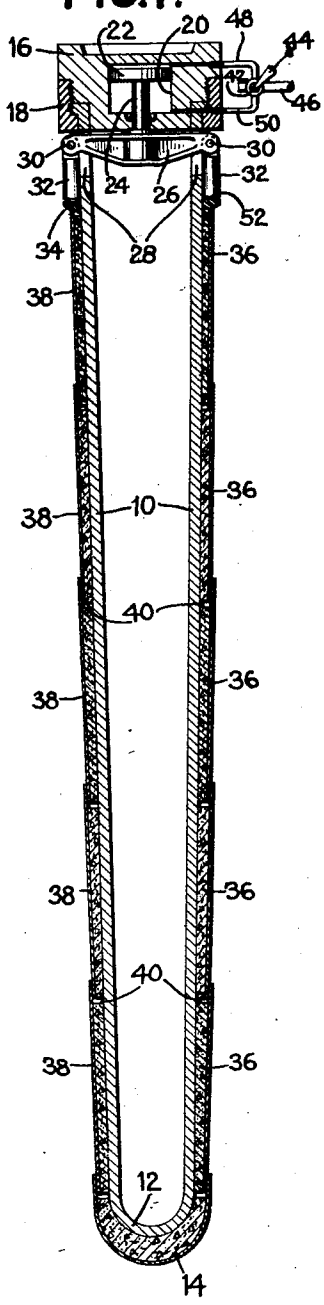


FIG.2.

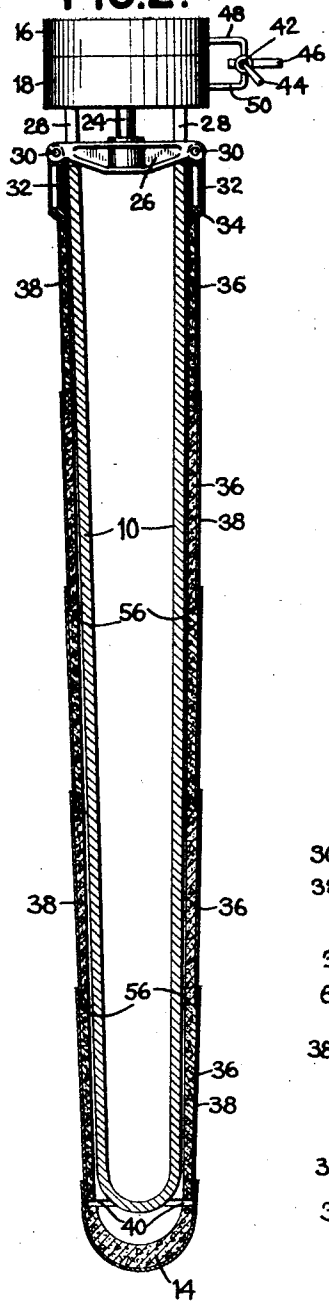


FIG.3.

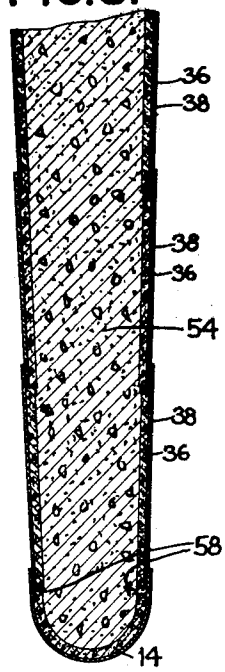
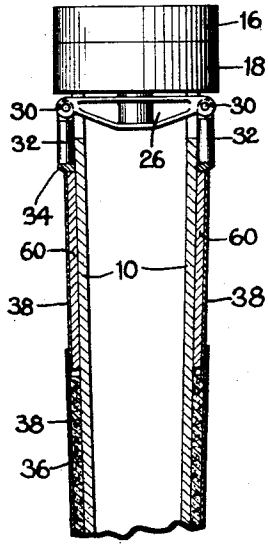


FIG.4.



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FIG.5.

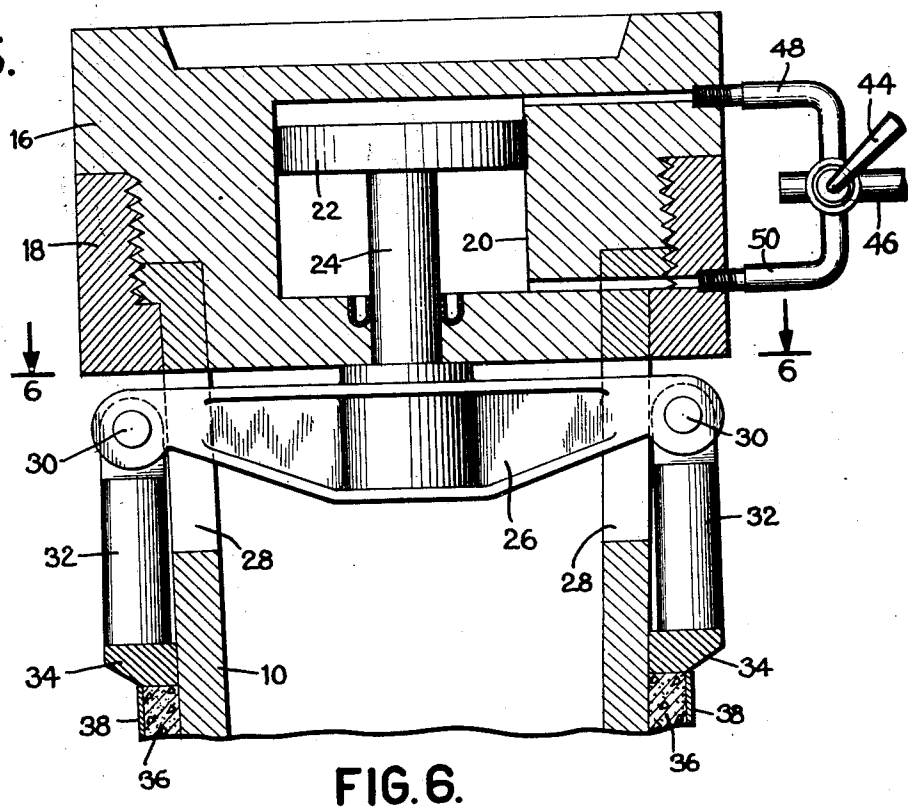
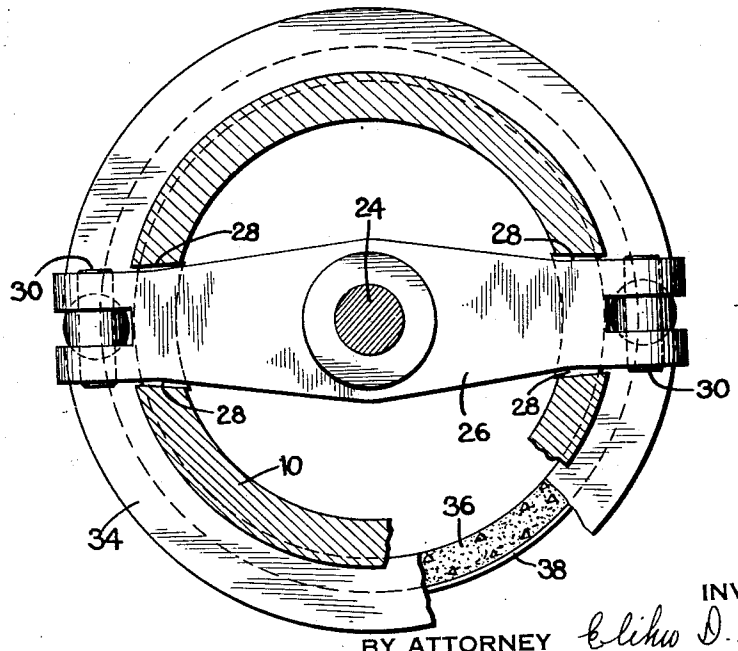


FIG.6.



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APPARATUS FOR FORMING CONCRETE PILES

Application filed August 20, 1930. Serial No. 476,682.

This invention pertains to the formation of concrete piles of the type wherein a hollow shell is first sunk into the ground by means of a tapered driving core, after which the core is withdrawn, and finally the shell is filled with plastic concrete to complete the pile.

During the driving of shell and core, the core usually becomes very tightly wedged into the shell, and it has been customary, therefore, to make the core collapsible in order that it may readily be withdrawn from the shell. So far as I am aware, it has never been possible prior to the present invention to use a non-collapsible core on account of the impossibility of withdrawing it after driving.

The principal object of the present invention, therefore, is to disclose ways and means for withdrawing a solid core without at the same time pulling the shell out of the ground with the core. This is accomplished by applying downwardly to the shell a reaction equal to the upward pull required to raise the core. In the preferred form herein disclosed, hydraulic pressure is applied downwardly on the shell and upwardly on the core until they are free from each other, after which the core may be lifted out by the usual hoisting means.

Some of the advantages of the solid (non-collapsible) core are: it is cheaper in first cost, the cost of upkeep is comparatively light, it stands heavier and harder driving, it is more resistant to bending when boulders and obstructions are encountered, having no breaks in its surface it completely fills the shell thus providing no openings for sand or water to enter should there be leaks at the joints between shell sections.

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

Fig. 1 shows in vertical cross-section the driving core, shells, driving head and release apparatus.

Fig. 2 is substantially the same as Fig. 1 but with the operative parts in different position.

Fig. 3 is a view of the lower portion of a finished pile.

Fig. 4 is a detail view showing a modification used when the core is longer than the shell being driven.

Fig. 5 is an enlarged cross-section of the driving head and parts associated therewith.

Fig. 6 is a view on the line 6—6 of Fig. 5.

Referring to the drawings, 10 represents a tapered, solid driving core which for reduction in cost and convenience in handling is made hollow. It is provided with a semi-spherical lower end 12 to accommodate a driving shoe 14, and an upper end comprising a driving head 16 to which the core is attached by screw collar 18. In the head is a vertical cylinder 20 containing a piston 22 having a downwardly projecting piston rod 24 upon the lower end of which is attached a cross-head 26, guided for vertical movement in slots 28 cut in the upper end of the core. Depending from the ends of the cross-head, on pins 30, are links 32, the lower ends of which are adapted to rest on a ring 34 surrounding the core and, in turn, resting on the top of the shell, which is shown as consisting of a stack of concrete shell sections surrounding the core from shoe 14 to ring 34. Each shell comprises an annular concrete lining 36 surrounded by a thin steel casing 38 having an upper end extended to overlap the lower end of the shell above it. Each shell section tightly fits the tapered core and when the core and shell are driven into the ground by blows or other pressure applied to head 16, the driving effect is transmitted to the shell sections by virtue of their tapered relationship with the core.

It is usually advisable when the shell sections are of concrete, to avoid end contacts between shell sections during driving in order to prevent crushing of the ends of the sections as might be the case if too much driving effect were transmitted vertically from section to section. The sections are, therefore, fitted to the core with slight clearance spaces therebetween, as at 40. These spaces if open are either closed during the withdrawal of the

core, as will appear, of if not closed are filled with plastic concrete when the shell is filled therewith.

A suitable valve 42 having a handle 44 controls admission of fluid under pressure from pipe 46 to top or bottom of cylinder 20 through pipe 48 or 50, respectively.

Fig. 1 shows the shell and core ready for driving, with piston 22 at the top of its stroke to maintain some clearance, as at 52, between links 32 and ring 34.

After the driving is completed, valve 42 is opened to admit fluid under pressure above piston 22 and to exhaust fluid from below the piston, thereby pushing downwardly by means of cross-head 26, links 32 and ring 34 on the stack of shell sections, and upwardly on the driving core by pressure transmitted thereto by head 16 against which the pressure fluid acts directly on the upper head of cylinder 20. Since the force of the thrust and the reaction thereto must be equal, it follows that the shell sections are pushed downwardly with the same force as the core is pushed upwardly, the result being that the core is freed from the shell as shown in Fig. 2, after which the core is hoisted from the shell and the shell is filled with plastic concrete 54 to form with the shell sections a monolithic pile structure as in Fig. 3.

When pressure is applied downwardly to the pile sections during the core releasing operation the first effect is to close any open clearance spaces 40 between shell sections, as at 56 (Figs. 2 and 3). Any spaces not closed are filled by concrete as at 58 (Fig. 3) when the shell is filled.

In case a long core must be used for driving a comparatively short shell, a spacer shell section 60, preferably of metal, is inserted between ring 34 and the top of the shell, as shown in Fig. 4.

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

I claim—

1. Apparatus for forming concrete piles comprising a tapered one-piece driving core constructed to accommodate thereon a pile shell adapted to remain in the ground and be filled with concrete, in combination with means for applying force to said core to remove it from the shell, and means for transmitting the reaction of said force to the shell to hold it in the ground.

2. Apparatus for forming concrete piles comprising a tapered one-piece driving core constructed to accommodate thereon a pile shell adapted to remain in the ground and be filled with concrete, in combination with means for applying vertical force upwardly to said core to remove it from the shell after driving, and means for transmitting the reaction of said force downwardly to said shell to hold it in the ground.

3. The invention set forth in claim 2 in which said force applying means comprises a fluid-operable device mounted on said core.

4. The invention set forth in claim 2 in which said force applying means comprises a fluid-operable device mounted on said core and adapted to thrust upwardly on said core and downwardly on the shell.

5. Apparatus for forming concrete piles comprising a tapered one-piece driving core having a driving head thereon and constructed to receive a pile shell which is adapted to remain in the ground and be filled with concrete, in combination with a vertically movable fluid-operable piston in said head, means interconnecting said piston and said shell, and means for admitting fluid under pressure between said piston and said head whereby said head and core are pushed upwardly and said shell is pushed downwardly, substantially as described.

6. The invention set forth in claim 5 in which said interconnecting means comprises a piston, a cross-head attached to said piston, and links depending from the ends of said cross-head.

7. The invention set forth in claim 5 in which said interconnecting means comprises a piston, a cross-head attached to said piston, links depending from the ends of said cross-head, and a ring between the upper end of said shell and the lower ends of said links.

8. The invention set forth in claim 2 in which said transmitting means includes a temporary spacer shell section between said pile shell and said force applying means, substantially as described.

9. Apparatus for forming concrete piles comprising a tapered one-piece driving core constructed to accommodate thereon a stack of pile shell sections spaced apart at their adjacent ends, said stack of shells adapted to be driven into the ground by the core and there remain to be filled with concrete, in combination with means for applying force to said core to remove it from the shell sections, and means for transmitting the reaction of said force to said shell sections at one end thereof, whereby said sections are first moved relative to one another to close said spaces and then to free the core from said sections.

10. Apparatus for forming concrete piles comprising a tapered one-piece driving core constructed to accommodate thereon a stack of pile shell sections spaced apart at their adjacent ends, said stack of shells adapted to be driven into the ground by the core and there remain to be filled with concrete, in combination with means for applying force longitudinally to said core to remove it from the shell sections, and means for transmitting the reaction of said force in an opposite direction to said shell sections at one end thereof,

whereby said sections are first moved relative to one another to close said spaces and then to free the core from said sections.

11. Apparatus for forming concrete piles comprising a tapered one-piece driving core adapted to receive thereon a pile shell, in combination with means for applying force to the core to remove it from the shell comprising a driving head attached to the core and having a cylinder axially arranged therein, a piston operating in said cylinder, and means connected with the piston for engaging the upper end of said pile shell, together with a source of fluid pressure connected to the cylinder whereby a force may be applied to the driving head to lift the core from the shell against the reaction of said means contacting with the pile shell.

12. Apparatus for forming concrete piles comprising a tapered one-piece driving core adapted to receive thereon a pile shell, in combination with means for applying force to said core to remove it from the shell which comprises a driving head attached to the core, a fluid piston operating within the head, said core being slotted, a cross head connected to the piston and operating in the slot of the core, and means carried by the cross head and engaged with and adapted to exert a reactionary force on the upper end of the pile shell.

In testimony whereof I hereto affix my signature.

ELIHU D. WATT.