Dec. 6, 1932. H. R. SMITH 1,890,268

METHOD AND APPARATUS FOR FORMING COMPOSITE PILES

Filed June 20, 1931 2 Sheets-Sheet 1

FIG.1.

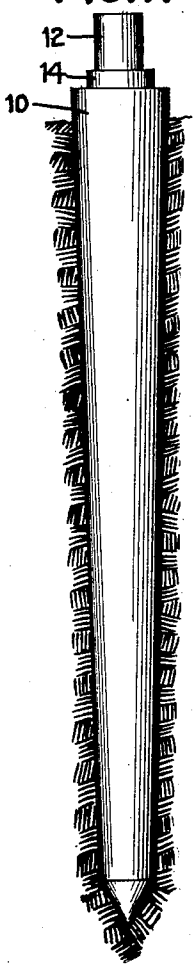



FIG.2.

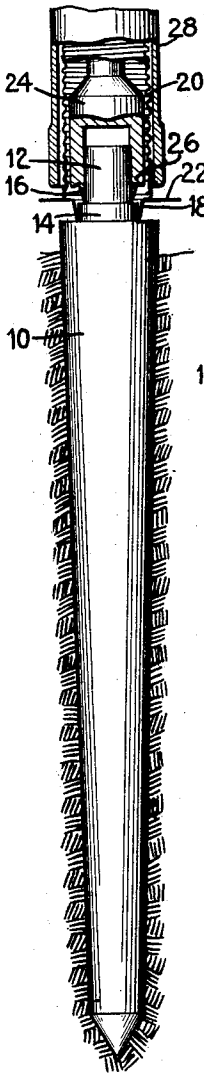



FIG.3.

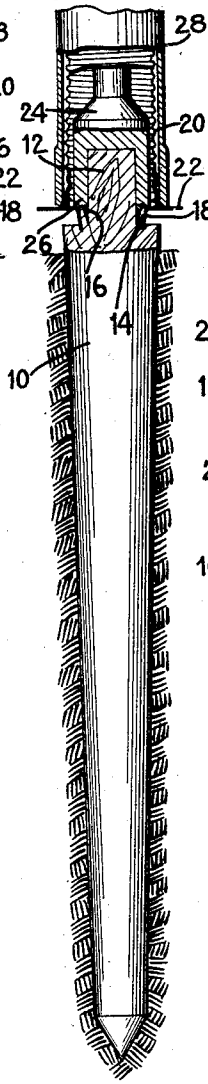



FIG.4.

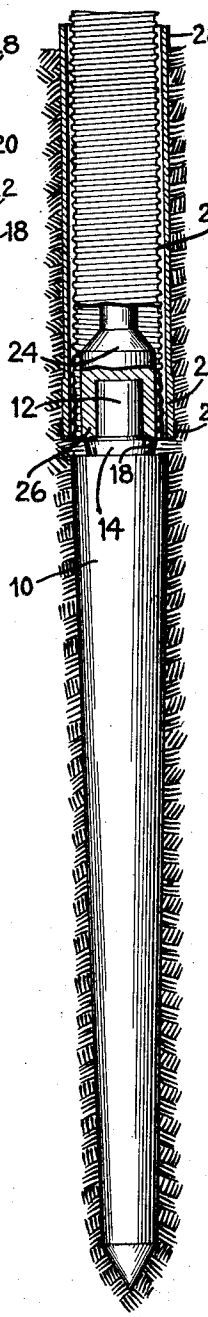
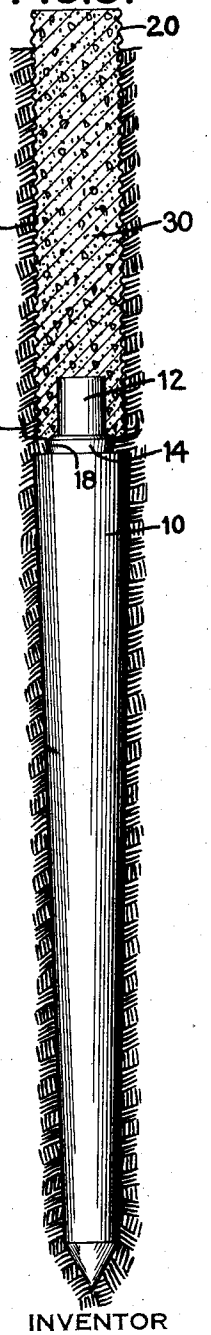



FIG.5.




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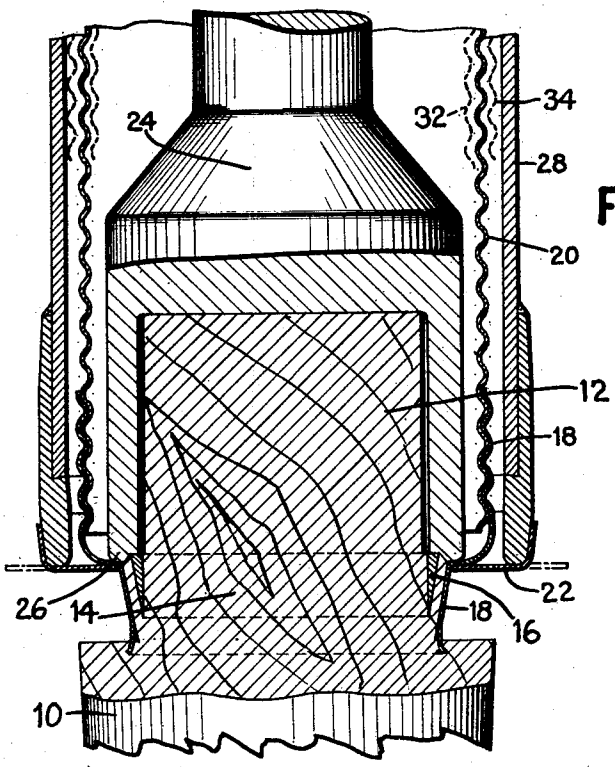



FIG.6.

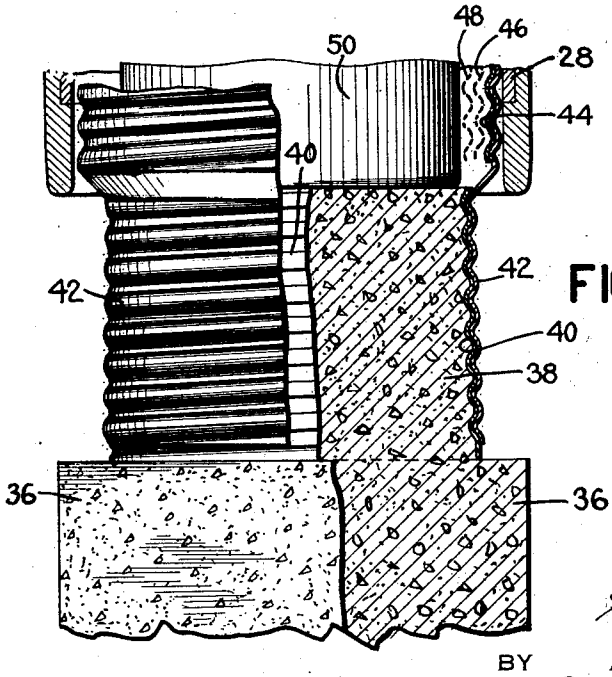



FIG.7.

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# UNITED STATES PATENT OFFICE

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## METHOD AND APPARATUS FOR FORMING COMPOSITE PILES

Application filed June 20, 1931. Serial No. 545,720.

This invention pertains to the manufacture of composite piles of the type in which a pre-formed lower pile section is surmounted by a cast-in-place upper concrete section.

In one method of manufacture the lower section is driven until its upper end approaches ground level, then a corrugated shell is mounted on the head of the lower section, after which the lower section and shell are sunk further by means of a core resting on the head of the lower section and engaging the interior walls of the shell by radially movable pads adapted to engage the shell corrugations.

In order to withstand the strains imposed on the shell by the driving core, and the severe abrasion to which the shell is subjected by contact with the ground through which it is driven, it has been found desirable to make the shell of comparatively thick metal.

According to the present invention the shell is enclosed during the driving operation in a temporary casing which prevents contact of the shell with the ground, thereby obviating the necessity of drawing the shell down by means of a core. Because the shell is relieved of all driving strains it may be made of much lighter gauge metal than formerly. For instance, under certain circumstances it has been found possible to reduce the metal thickness from 20 to 24 gauge. The shell is attached to the lower pile section in any suitable manner and the lower section is driven by a follower resting on the head of the lower section within the shell. The temporary casing is driven with the follower and the permanent shell, between the temporary casing and the follower, simply follows the lower section down by gravity.

If desired, sufficient space may be provided between the follower and the temporary casing to accommodate shells of different sizes, whereby the same apparatus may be used for sinking shells of different diameters, which cannot be done when the shells are driven by cores, because each core is suitable for only one particular size of shell. This feature often leads to important savings in cost of manufacture, especially when the piles are formed at a place distant from the place of manufacture of the shells. If shells of a single diameter are used, they cannot be "nested" in shipment and the freight charges are excessive in relation to the total cost of the job. If, on the other hand, shells of various diameter are used, freight is kept down, but, since by previous methods, each particular diameter of shell requires a driving core of its own, and since the cost of collapsible cores is very high, the expense of using cores of various diameters on a single job is often prohibitive.

The present invention overcomes the above objections. The apparatus comprises no expensive equipment but only a follower and a tubular casing, both simple and inexpensive. The apparatus will sink shells of various diameters, therefore the shells may be nested for shipment. In actual practice three sizes of nestable shells have been driven with the same apparatus.

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 a wooden pile driven until its head is near ground level, the head being adapted for the wedge-ring type of connection to the shell.

Fig. 2 shows the wedge-ring, shell, coupling-ring, follower, boot and drive casing before the wedge-ring is pushed home.

Fig. 3 is similar to Fig. 2 except that the wedge-ring has locked the coupling to the lower section.

Fig. 4 shows the parts during the driving operation with the boot cupped around the lower end of the drive casing.

Fig. 5 shows the completed pile after the shell is filled with concrete.

Fig. 6 is an enlarged detailed view of a portion of Fig. 4.

Fig. 7 is a view of a slightly modified form of the invention applied to a concrete lower pile section.

For the purpose of illustration the invention is shown in Figs. 1 to 6, applied to a

wooden lower section having a head adapted for use of a wedge-ring for locking the upper shell coupling to the lower section. A modified embodiment is shown in Fig. 7 in which a concrete lower section is used.

Referring to Figs. 1 to 6 inclusive, the wooden lower section designated 10 has a tenon 12 and an annular shoulder 14 around the base of the tenon. After section 10 is driven as in Fig. 1, the wedge-ring 16 is applied around tenon 12 and resting on shoulder 14; shell coupling 18 is put in place with its lower end around shoulder 14 and its upper end attached to the lower end of corrugated shell 20; annular plate 22 is placed around the lower end of coupling 18; follower 24 is lowered into place within shell 20 until the rim 26 of its lower counterbored end rests on wedge-ring 16; and the outer temporary casing 28 is placed around shell 20. The parts are then in the positions shown in Fig. 2. Next, the follower 24 and casing 28 are driven to the positions shown in Fig. 3, in which wedge-ring 16 has been forced downwardly into shoulder 14 to expand a portion thereof into engagement with the tapered lower end of coupling 18, thereby locking the coupling (and consequently shell 20) to the lower pile section; follower 24 rests on the top of tenon 12; and the lower end of casing 28 contacts with ring 22.

Further driving forces the parts into the ground as in Fig. 4 with all parts in the same positions as in Fig. 3 except that passage through the ground has forced the outer rim of plate 22 into a cup-shaped boot formation around the lower end of casing 28 thereby serving to exclude dirt from the space between shell 20 and casing 28.

Fig. 5 shows the pile after it has been driven to proper footing; after follower 24 and casing 28 have been removed; after shell 20 has been filled with concrete 30; and after the surrounding earth has closed around the upper pile section.

In Fig. 6 are shown, in enlarged form, most of the details mentioned above. Coupling sleeve 18 is shown as threaded onto shell 20, but it may of course be fastened thereto by welding or otherwise. In Fig. 6 the fact is brought out that there is sufficient space between the exterior of follower 24 and the interior of temporary casing 28 to accommodate at least three diameters of nestable shells, for instance a shell 32, (dotted) of lesser diameter, and a shell 34 (dotted) of greater diameter than shell 20, any of which may be driven by the same apparatus, the only necessary change being to provide a coupling 18 having an upper end of proper shape to engage the particular shell being used.

Fig. 7 shows the invention applied to a concrete lower section instead of to a wooden lower section as described above. The lower section is of square concrete 36, having a tenon 38 formed by casting it in a helically corrugated sleeve 40 which remains on the tenon to receive the lower end of a coupling 42 adapted at its upper end for attachment to the lower end of a shell such as 44, 46 or 48. A follower 50 serves to drive the lower precast section. This embodiment serves to illustrate the fact that under some conditions of soil, etc., boot plate 22 may be omitted because the soil will not enter the space between shell and casing sufficiently to do any harm.

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 sinking into the ground a pre-formed lower pile section having a complete upper pile shell permanently attached thereto in which an upper concrete pile section is to be cast in situ, comprising means for driving said lower section whereby said section and said shell are sunk into the ground, in combination with a temporary casing surrounding said shell and driven simultaneously therewith, said temporary casing serving to protect the shell in driving and adapted to be withdrawn after driving of the shell.

2. The invention set forth in claim 1 in which means is provided for closing the space between said shell and the bottom of said temporary casing to prevent entrance of earth therebetween during driving.

3. Apparatus for sinking into the ground a pre-formed lower pile section having a complete upper pile shell permanently attached thereto in which an upper concrete pile section is to be cast in situ, comprising, in combination, a follower within the shell and a temporary casing without the shell, said follower and said casing being adapted for driving simultaneously, said follower serving to sink the lower section and shell into the ground and said casing serving to protect said shell from contact with the ground during the driving operation and to be withdrawn after driving of the shell.

4. The invention set forth in claim 3 in which an annular plate below said casing forms, during the driving operation, a cup-shaped boot around the lower end of said casing to prevent entrance of earth between said shell and said casing.

5. In the method of forming a composite pile, the steps of attaching a complete upper pile shell to the upper end of a pre-formed lower pile section, sinking said lower section and said shell into the ground and surrounding said shell with a casing to prevent con-

tact of said shell with the ground during the driving operation.

6. In the method of forming a composite pile, the steps of attaching a complete upper pile shell to the upper end of a pre-formed lower pile section, sinking said lower section and said shell into the ground, surrounding said shell with a casing to prevent contact of said shell with the ground during the driving operation and filling said shell with concrete to form the upper pile section.

7. In the method of forming a composite pile, the steps of attaching a complete upper pile shell to the upper end of a pre-formed lower pile section, sinking said lower section and said shell into the ground, surrounding said shell with a casing to prevent contact of said shell with the ground during the driving operation and removing said casing.

8. In the method of forming a composite pile, the steps of attaching a complete upper pile shell to the upper end of a pre-formed lower pile section, sinking said lower section and said shell into the ground, surrounding said shell with a casing to prevent contact of said shell with the ground during the driving operation, removing said casing, and filling said shell with concrete to form the upper pile section.

9. Apparatus for sinking into the ground a preformed lower pile section adapted to have a complete upper pile shell of one of various predetermined diameters attached thereto in which an upper concrete pile section is to be cast in situ, comprising a follower for driving said lower section whereby said section and said selected shell are sunk into the ground, in combination with a temporary casing surrounding said selected shell, said casing being adapted to be driven simultaneously with said follower, substantially as described.

10. The method of forming a composite pile which comprises driving a preformed lower pile section with a thin complete upper pile shell permanently attached to its upper end to be subsequently filled with concrete, and providing protecting means for preventing contact of such shell with the ground during driving.

11. The method of forming a composite pile which comprises driving a preformed lower pile section into the ground, with a thin complete upper pile shell permanently attached to the upper end thereof, providing protecting means for preventing contact of the shell with the ground during driving and subsequently filling the shell with concrete.

12. The method of forming a composite pile which comprises driving a preformed lower pile section into the ground with a thin complete upper pile shell permanently attached to the upper end thereof, providing protecting means for the shell to prevent contact with the ground during driving, subsequently filling the shell with concrete, and then withdrawing the shell protection to permit the surrounding ground to contact with the shell.

13. The method of forming a composite pile which comprises driving a preformed lower pile section into the ground, with a thin complete upper pile shell attached to the upper end thereof, simultaneously driving a casing surrounding the shell to protect the same against contact with the ground during driving, subsequently filling the shell with concrete and then withdrawing the casing to permit the surrounding ground to contact with the shell.

14. The method of forming a composite pile which comprises driving a preformed lower pile section into the ground, with a thin complete upper pile shell attached to its upper end thereof, surrounding the shell with a protecting casing and driving said casing simultaneously with the preformed section and damming off the space between the casing and shell to prevent entrance of dirt therebetween during driving.

In testimony whereof I hereto affix my signature.

HERMAN R. SMITH.