Dec. 15, 1931. M. M. UPSON 1,836,140

APPARATUS FOR FORMING CONCRETE PILES

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FIG.2.

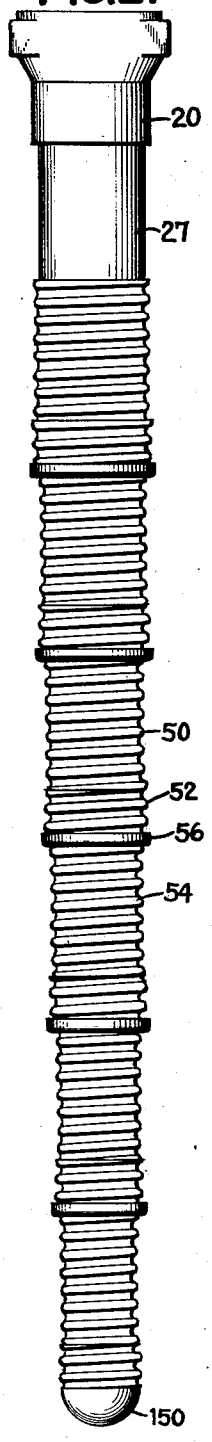


FIG.1.

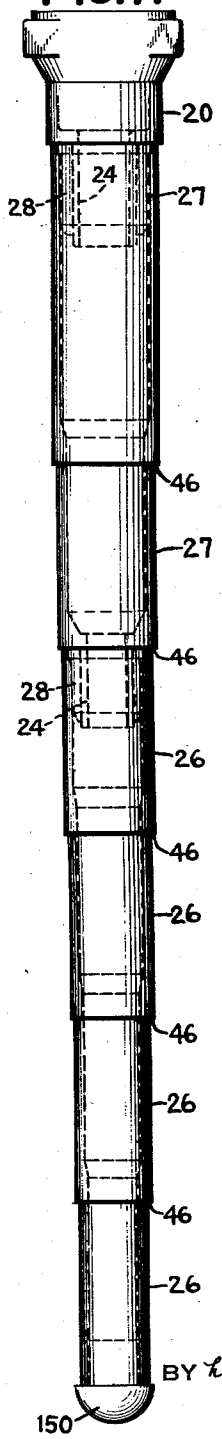
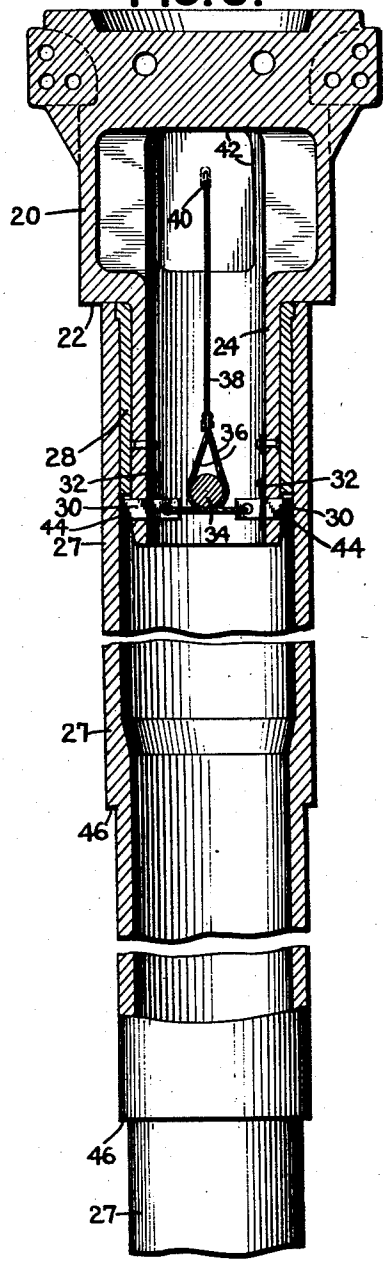


FIG.3.



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FIG.4.

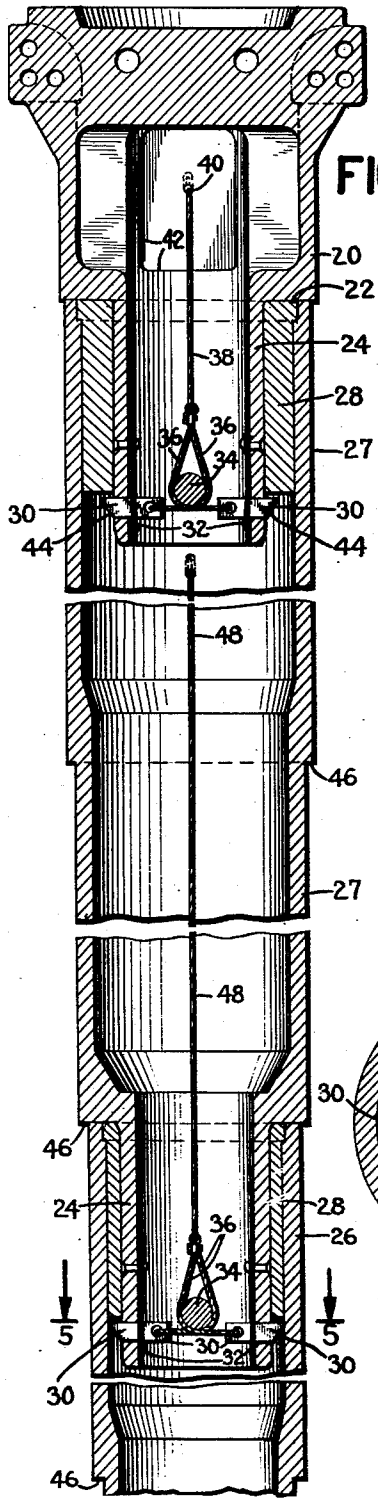


FIG.6.

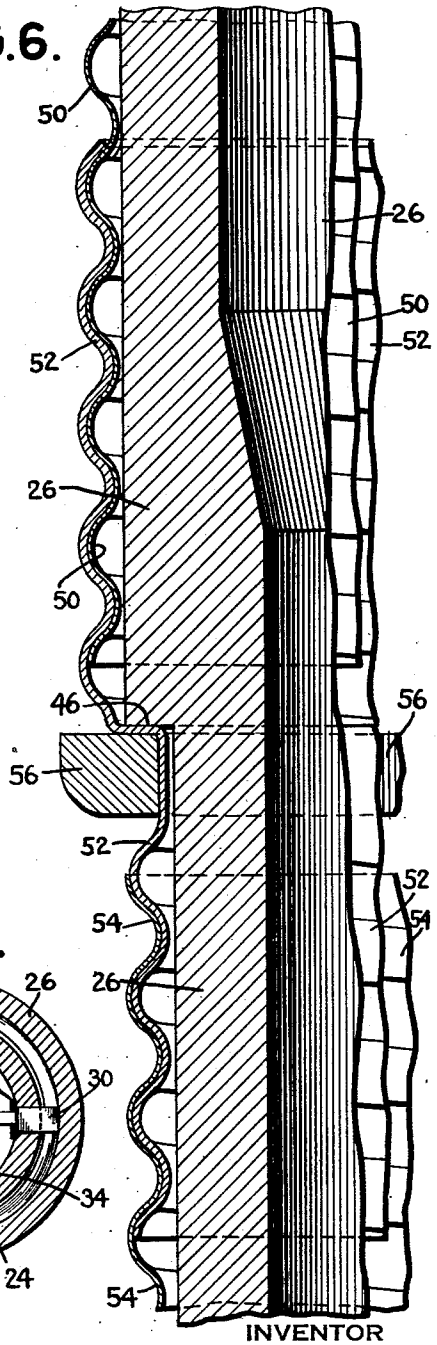
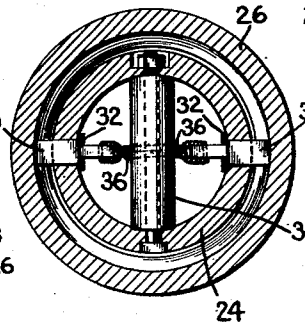


FIG.5.



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FIG.7.

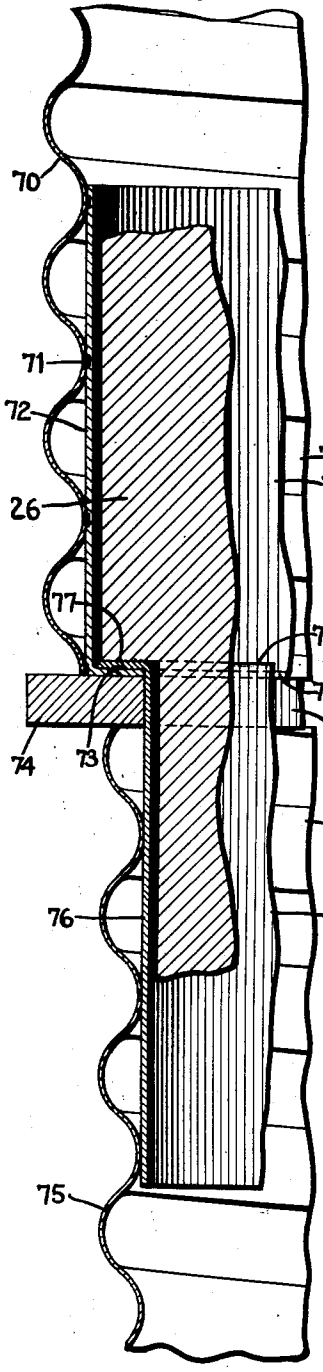


FIG.8.

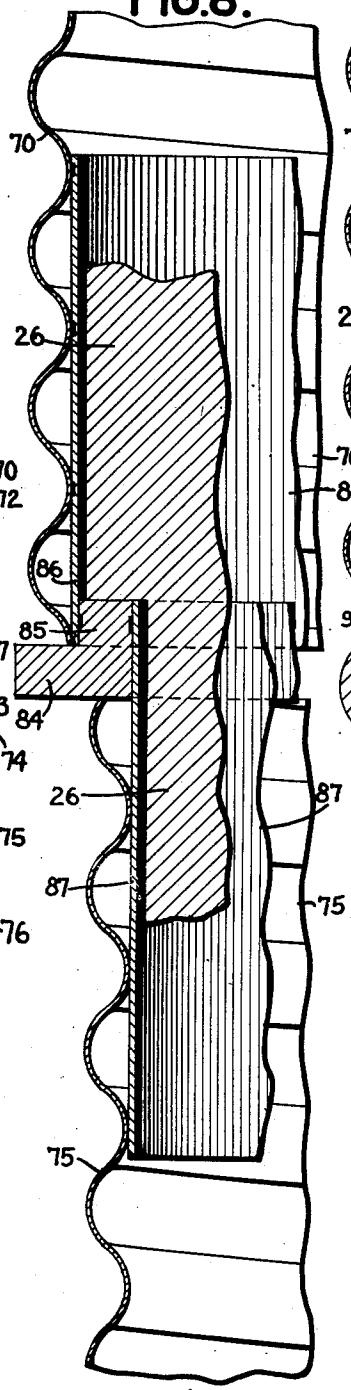
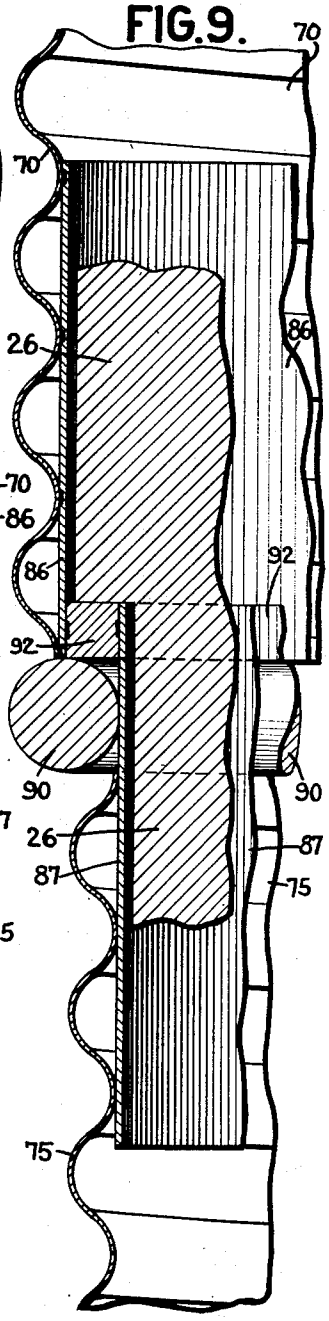


FIG.9.



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FIG. 10.

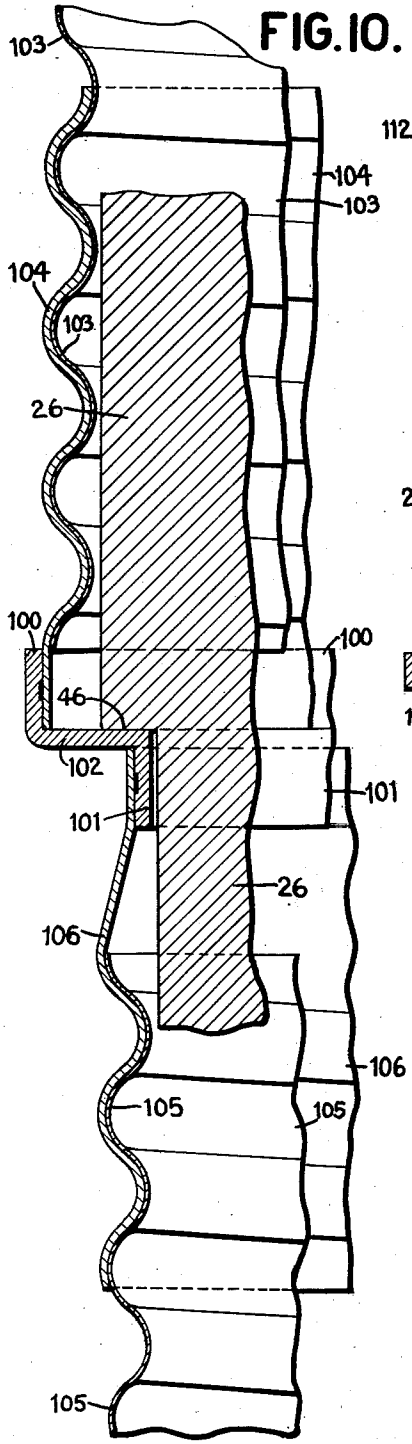


FIG. 11.

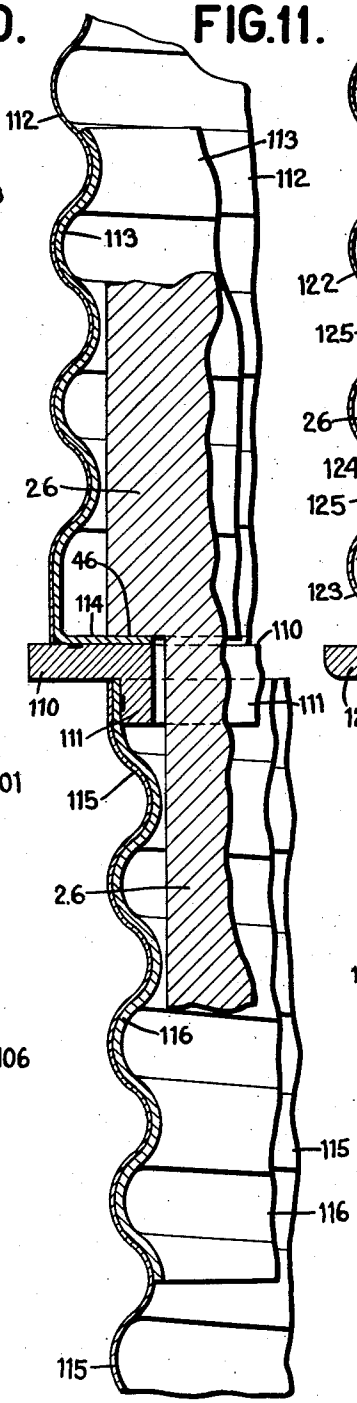
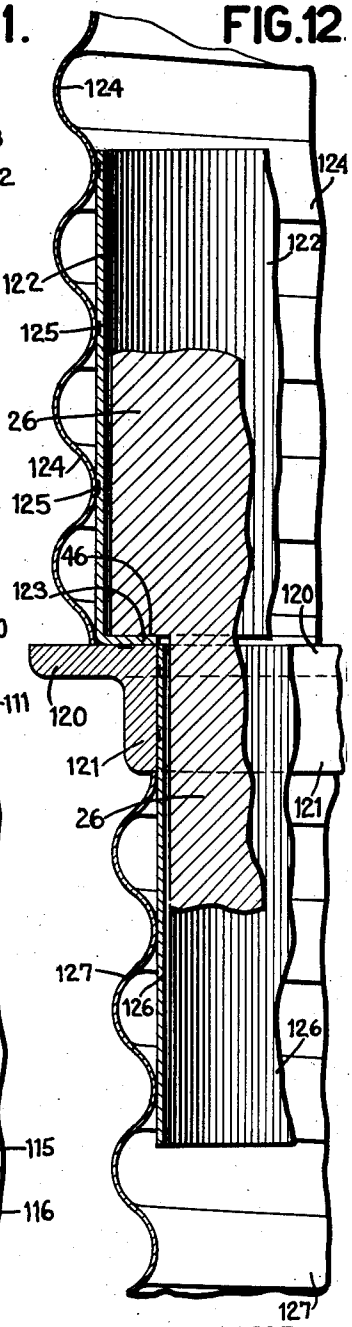


FIG. 12.



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FIG.13.

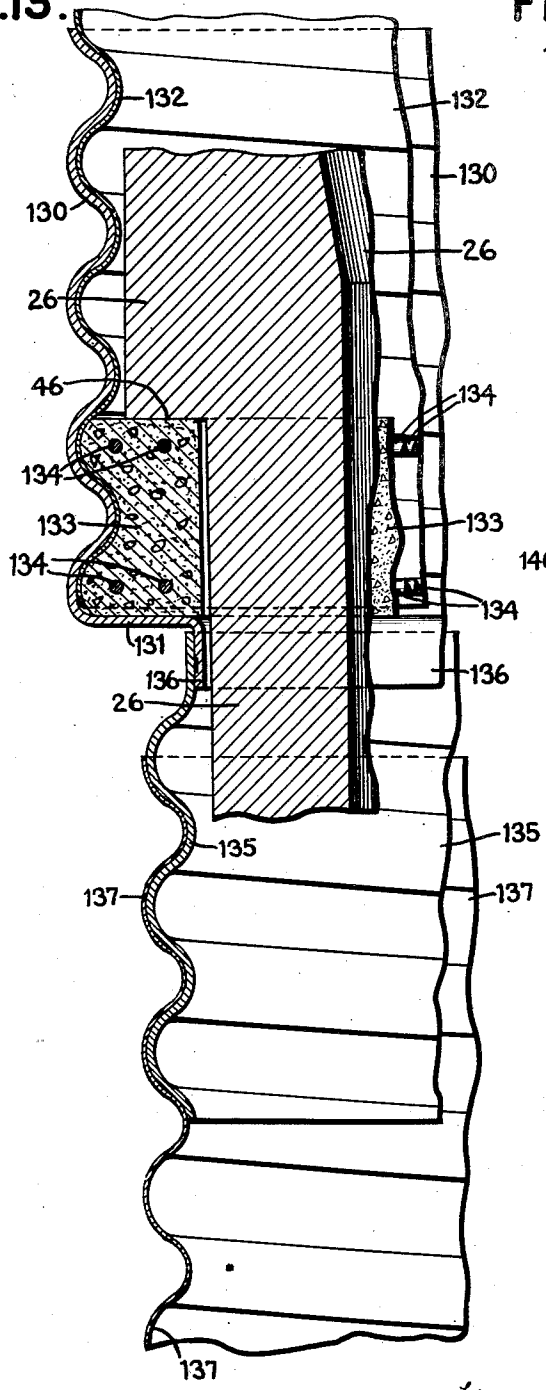
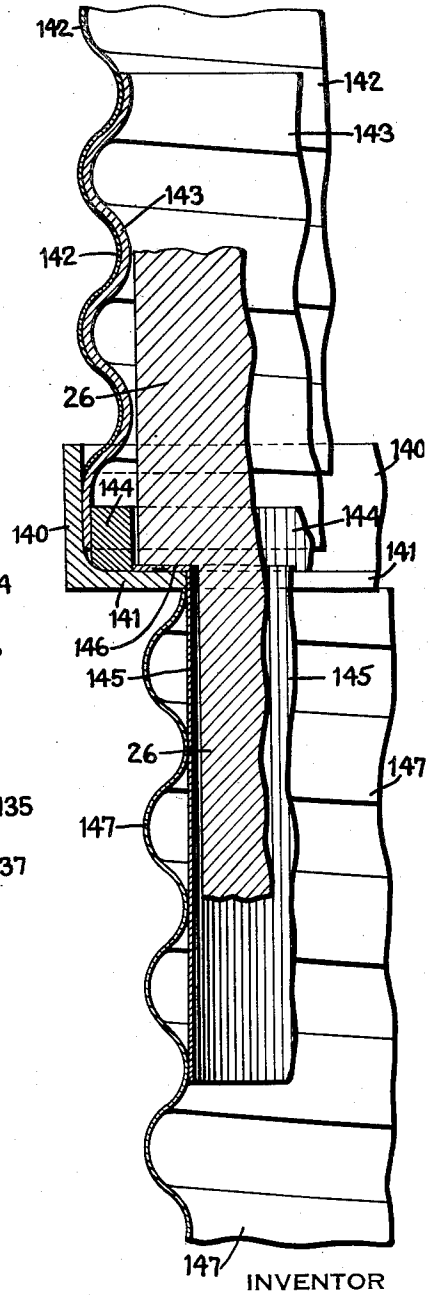


FIG.14.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR FORMING CONCRETE PILES

Application filed April 28, 1931. Serial No. 533,461.

The principal object of the present invention is to disclose ways and means for economically sinking into the ground concrete piles of unusual length.

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.

In the drawings:

Fig. 1 shows the assembled drive core and drive head.

Fig. 2 shows the core of Fig. 1 with shell sections mounted thereon ready for driving. This view also shows the plows which are provided below the shell sections.

Fig. 3 shows a core section with the drive head in operative position thereon.

Fig. 4 is a view similar to Fig. 3 but showing two core sections and the drive head.

Fig. 5 is a cross-section on line 5—5 of Fig. 4.

Figs. 6–14 inclusive are fragmentary views, substantially full size, showing various methods of coupling the shell sections together and providing plows for the sections.

Referring to Figs. 3 and 4, the drive head 20 is preferably a hollow casting having an annular downwardly facing shoulder 22, and a downwardly extending tubular stem 24. In operative position, shoulder 22 rests on top of core section 26 or 27. As will appear, the core sections are of different outer diameters but the internal diameter of the upper end of each section is adapted to snugly receive stem 24, the core section being lined, if necessary, with an integral bushing 28.

Means are provided for releasably locking stem 24 to the core section in order that the core may be raised when the drive head is raised. The locking means may take the form of dogs 30 (Figs. 3, 4 and 5) projecting in opposite directions through the walls of stem 24 and urged outwardly by flat springs 32 fast to the stem wall and engaging shoulders on the dogs.

Extending across the interior of stem 24 at right angles to the line of movement of dogs 30 is a round bar 34. A cable 36 from each dog 30 passes around bar 34 to join an upwardly extending cable 38 secured to the drive head at 40 so that it may be reached by the operator through an opening 42 in the wall of the drive head. It is evident, that by drawing cable 38 upwardly, dogs 30 may be retracted to permit removal of stem 24 from sleeve 28. The outer ends of dogs 30 being bevelled as at 44, they will be automatically retracted when stem 24 is pushed down through bushing 28, and, cable 38 being slack, will automatically lock, as shown, underneath bushing 28 when stem 24 reaches its operative position therein.

The drive core is, for convenience, hollow, and decreases in diameter towards its lower end. The decrease in diameter is not gradual, but takes place in steps (Fig. 1). The core therefore has the appearance of a stack of axially aligned cylinders with the smallest cylinder at the bottom and each succeeding cylinder of larger diameter so that a series of downwardly facing annular abutments 46 is provided.

Preferably, for ease of handling, the core is made in sections. As many sections as desired may be used, but it is deemed sufficient in the present disclosure to show only two sections, i. e. a lower section 26 comprising four steps, and an upper section 27 comprising two steps.

For joining the upper and lower sections together, the lower end of section 27 is provided with a stem 24 similar in dimensions and equipment to the stem on the driving head, and the upper end of section 26 is provided with an integral sleeve 28 of proper dimensions to receive the stem on section 27 (Fig. 4). A cable 48 extending to a point near the top of section 27 serves to retract dogs 30 when it is desired to separate the sections. In operation, as will appear, head 20 is placed on section 26 and that section is driven. Then the head is removed, section 27 is placed on top of section 26, head 20 is placed on top of section 27, and the driving is resumed. The purpose of the above described core is to carry down into the ground a hollow shell, to be filled with concrete after the core has been removed from the shell.

According to the present invention, the

shell is made in sections, each larger in diameter than the one below it, and each adapted to surround one of the cylindrical steps of the core. To save cost it is desirable to form the shell of as thin material as possible, which means that the shell must be pulled into the ground under tension instead of being pushed or driven down under compression. In order to reduce wear and tear of the soil on the thin shell sections, a rigid ring, of greater diameter than the shell section, is provided to plow a path for each section. Since the shell must have sufficient rigidity to withstand the compression of the surrounding earth after the core is removed and before the concrete is poured, the metal of the shell is preferably corrugated, thereby providing the necessary resistance against crushing.

Shoulders 46 on the core are utilized to push down the plow rings and pull down the shell sections.

Figs. 2 and 6 disclose one arrangement of cores, plow rings, shell sections, and shell section couplings. The upper corrugated shell section 50 is threaded into the upper end of corrugated coupling 52, and the lower shell section 54 is screwed onto the lower end of coupling 52. Coupling 52 is preferably of thicker material than the shell sections and is formed by a pressing operation to engage plow ring 56, so that when placed on the core the coupling passes between the drive core and the ring and between the top surface of the ring and shoulder 46. Ring 56 is of substantially greater outer diameter than shell 50 and coupling 52; therefore during the driving operation, being forced downwardly by shoulder 46 it plows a path or hole into which shell section 50 is readily drawn by coupling 52.

Fig. 7 shows a modification in which upper shell section 70 is spot welded as at 71 to an annular shell 72 having an inwardly flanged lower end 73 resting on plow ring 74. Lower shell section 75 surrounds an annular shell 76 which passes through ring 74 and has at its upper end a flange 77 resting on and welded to flange 73.

The arrangement in Fig. 8 is similar to that in Fig. 7 except that ring 74 is replaced by a ring 84 having a reduced annular portion 85 to which the lower end of upper coupling shell 86 and upper end of lower coupling shell 87 are welded thus requiring no flanges on the ends of shells 86 and 87.

The arrangement in Fig. 9 is similar to that in Fig. 8 except that a ring 90, of circular cross-section is used in place of rectangular ring 84, and a detached ring 92 replaces ring 85.

In the modification of Fig. 10 the plow ring is of Z steel having upwardly and downwardly extending flanges 100 and 101 and a horizontal web 102 upon which shoulder 46 rests. The upper shell 103 is screwed into a coupling member 104 welded to flange 100. Likewise, lower shell 105 is screwed into coupling member 106 welded at its upper end to flange 101.

In the modification of Fig. 11 the plow ring is of angle cross-section having horizontal and vertical webs 110 and 111. The upper shell section 112 is screwed onto upper coupling member 113 which has a flanged lower end 114 above web 110 and upper shoulder 46. Flange 114 may also be welded to web 110. Lower shell section 115 is screwed onto coupling member 116 which at its upper end is welded to web 111.

Fig. 12 shows a modification in which the plow ring is of angle cross-section having a horizontal web 120 and a vertical web 121. The upper coupling member 122 comprises an annular shell having a flange 123 at its lower end adapted to rest between web 120 of the ring and shoulder 46 of the core. Upper shell section 124 is welded as at 125 to coupling member 122. Lower coupling member 126 is an annular shell welded at its upper end to web 121. Lower shell section 127 encircles coupling member 126 and may or may not be welded thereto.

Fig. 13 shows a modification in which the upper coupling member 130 is flanged inwardly at its lower end as at 131. The upper shell section 132 is screwed into coupling member 130 and a concrete reinforcing member 133 is placed in shell 132 to rest between flange 131 of the coupling member and shoulder 46 of the core. This concrete member may be reinforced as by wires 134 and serves to reinforce the comparatively thin metal of the coupling member in order that it may hold its shape while being driven. Lower coupling member 135 is welded at its upper end to ring 136 which is turned downwardly from flange 131. Lower shell section 137 is screwed onto lower coupling member 135.

Fig. 14 shows a modification in which the plow ring is of angular cross-section having vertical and horizontal webs 140 and 141 respectively. The upper shell section 142 is screwed onto upper coupling member 143 which in turn is secured at its lower end between the inner surface of web 140 and the outer surface of a ring 144 which is placed above web 141 and within web 140. The parts may be welded together if desired. The lower coupling member comprises an annular shell 145 having an outwardly turned flange 146 at its upper end. This flange rests on the inner surface of web 141. Lower shell section 147 surrounds member 145 and may be welded thereto if desired.

The bottom of the core is provided with a drive shoe 150, of sufficient outer diameter to serve as a plow for the lowest shell section.

It is to be understood that the invention is not limited to the specific embodiment here-

in 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 a concrete pile comprising a shell formed of a series of thin metallic sections adapted to remain in the ground to be filled with concrete, said sections decreasing in diameter from top to bottom of the shell, a plow ring at the joint between each of said sections, said ring being of greater diameter than the shell section above it, means for driving said rings into the ground, and means for operatively interconnecting each ring with the shell section above it whereby each shell section is drawn down solely by tension into the hole formed by the ring below it.

2. A concrete pile shell comprising a series of thin metallic sections adapted to remain in the ground to be filled with concrete, said sections decreasing in diameter from top to bottom of the shell, means for coupling said sections together to form shoulders therebetween, in combination with a drive core adapted for engaging said shoulders to force them into the ground, whereby each shell section is drawn downwardly solely by virtue of its connection with the coupling below it.

3. A concrete pile shell comprising a series of thin metallic sections adapted to remain in the ground to be filled with concrete, said sections decreasing in diameter from top to bottom of the shell, means for coupling said sections together to form shoulders therebetween, in combination with a plow ring associated with each of said couplings and of greater diameter than the shell section above it; and means for driving said rings into the ground, whereby the shell section above each ring is drawn downwardly solely by tension into the hole formed by the ring below it.

4. A concrete pile shell comprising a series of thin metallic sections adapted to remain in the ground to be filled with concrete, said sections decreasing in diameter from top to bottom of the shell, means for forming a shoulder at the lower end of each of said sections, in combination with means for engaging said shoulders to force them into the ground, thereby drawing each shell section downwardly solely by tension applied to its lower end.

5. A concrete pile shell comprising a series of thin sections adapted to remain in the ground to be filled with concrete, said sections decreasing in diameter from top to bottom of the shell, means for forming a shoulder of thicker material at the lower end of each of said sections, in combination with means for engaging said shoulders to force them into the ground, thereby drawing each shell section downwardly solely by tension applied to its lower end.

6. A concrete pile shell comprising a series of sections adapted to remain in the ground to be filled with concrete, said sections decreasing in diameter from top to bottom of the shell, means for forming a shoulder at the lower end of each of said sections, in combination with means for engaging said shoulders to force them into the ground, thereby drawing each shell section downwardly solely by tension applied to its lower end, and means effective while the shell is being drawn downwardly for forming a hole in the ground below each shell section, of greater diameter than said shell section.

7. A concrete pile shell comprising a series of thin sections adapted to remain in the ground to be filled with concrete, said sections decreasing in diameter from top to bottom of the shell, means for forming a shoulder of thicker material at the lower end of each of said sections, in combination with means for engaging said shoulders to force them into the ground, thereby drawing each shell section downwardly solely by tension applied to its lower end and means effective while the shell is being drawn downwardly for forming a hole in the ground below each shell section, of greater diameter than said shell section.

8. A concrete pile shell comprising a series of thin sections adapted to remain in the ground to be filled with concrete, said sections decreasing in diameter from top to bottom of the shell, means for forming a shoulder at the lower end of each of said sections, in combination with means for engaging said shoulders to force them into the ground, thereby drawing each shell section downwardly solely by tension applied to its lower end and reinforcing means within each of said shoulders whereby said shoulders retain their shapes during the forcing operation.

9. A concrete pile shell comprising a series of thin sections adapted to remain in the ground to be filled with concrete, said sections decreasing in diameter from top to bottom of the shell, means for forming a shoulder at the lower end of each of said sections, in combination with means for engaging said shoulders to force them into the ground, thereby drawing each shell section downwardly solely by tension applied to its lower end, and means comprising a reinforced concrete ring within each of said shoulders whereby said shoulders retain their shapes during the forcing operation.

10. Apparatus for forming a concrete pile comprising a thin metallic shell adapted to remain in the ground to be filled with concrete and having a series of shoulders decreasing in diameter from top to bottom of the shell, a plow ring at each of said shoulders and extending outwardly beyond its associated shoulder, in combination with a driving core adapted to enter said shell and simul-

taneously engage said shoulders, substantially as described.

11. A concrete pile shell comprising a series of thin screw-threaded corrugated steel sections decreasing in diameter from top to bottom of the shell, screw-threaded couplings between said sections, and means adapted for engaging said couplings to force them into the ground whereby each of said shell sections is drawn down solely under tension by virtue of its connection with one of said couplings.

12. A concrete pile shell comprising a series of thin screw-threaded corrugated steel sections decreasing in diameter from top to bottom of the shell, screw-threaded couplings between said sections, means adapted for engaging said couplings to force them into the ground whereby each of said shell sections is drawn down solely under tension by virtue of its connection with one of said couplings, and a plow ring associated with each of said couplings, said ring being of greater diameter than the shell section above it, for the purpose set forth.

13. Apparatus for forming a concrete pile, comprising in combination, a drive head, a plurality of drive core sections of dfferent diameters and means for operatively interconnecting said head with any of said core sections.

14. Apparatus for forming a concrete pile, comprising in combination, a plurality of drive core sections of different outside diameters, bushings of uniform inside diameter in the upper ends of said core sections and stems on the lower end of said sections of suitable diameter to snugly enter any of said bushings whereby the lower end of any of said core sections may be operatively associated with the upper end of any other selected section, substantially as described.

15. Apparatus for forming a concrete pile comprising in combination, a plurality of drive core sections of different outside diameters, bushings of uniform inside diameter in the upper ends of said core sections, stems on the lower ends of said sections of suitable diameter to snugly enter any of said bushings whereby the lower end of any of said core sections may be operatively associated with the upper end of any other selected section, and means for releasably locking said sections together when said stem is inserted in said bushing.

16. Apparatus for forming a concrete pile comprising in combination, a plurality of drive core sections of different outside diameters, bushings of uniform inside diameter in the upper ends of said core sections, stems on the lower ends of said sections of suitable diameter to snugly enter any of said bushings whereby the lower end of any of said core sections may be operatively associated with the upper end of any other selected section, and means comprising manually releasable dogs carried by each of said stems for engaging the bushing in which it is inserted whereby the drive core sections are locked together.

In testimony whereof I hereto affix my signature.

MAXWELL M. UPSON.