M. M. UPSON.

PILE SHELL.

APPLICATION FILED SEPT. 4, 1909.

990,611.

Patented Apr. 25, 1911.

Fig. 1.

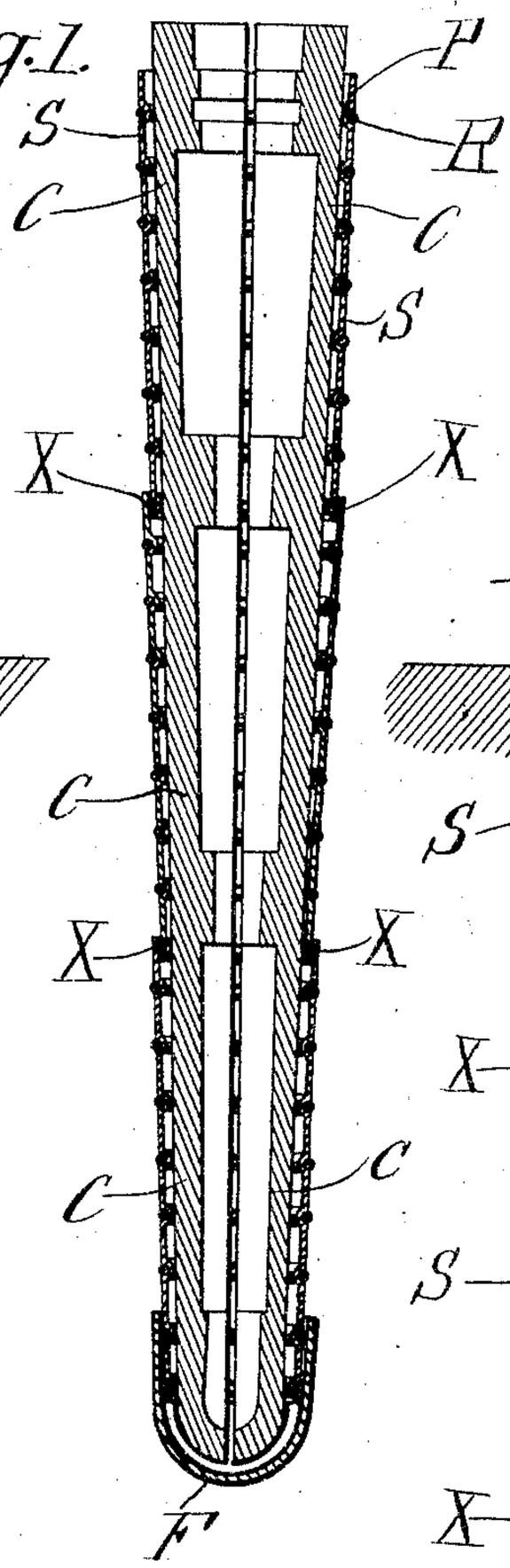


Fig. 3.

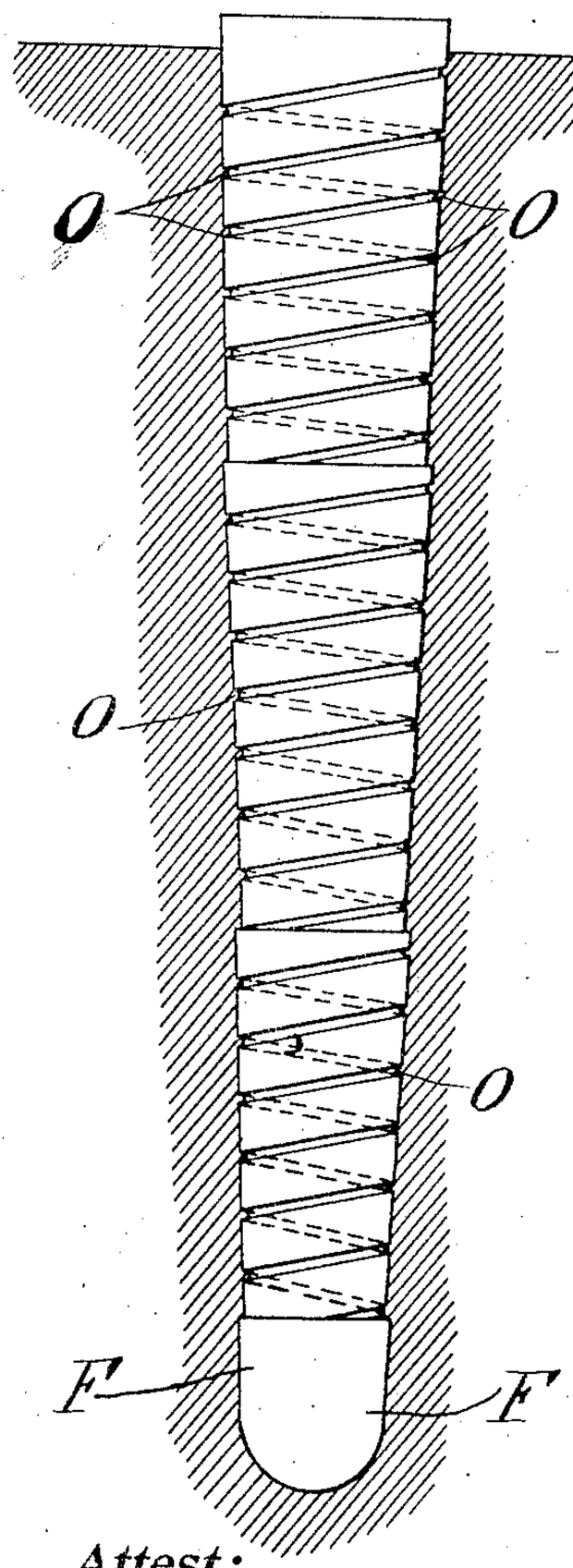
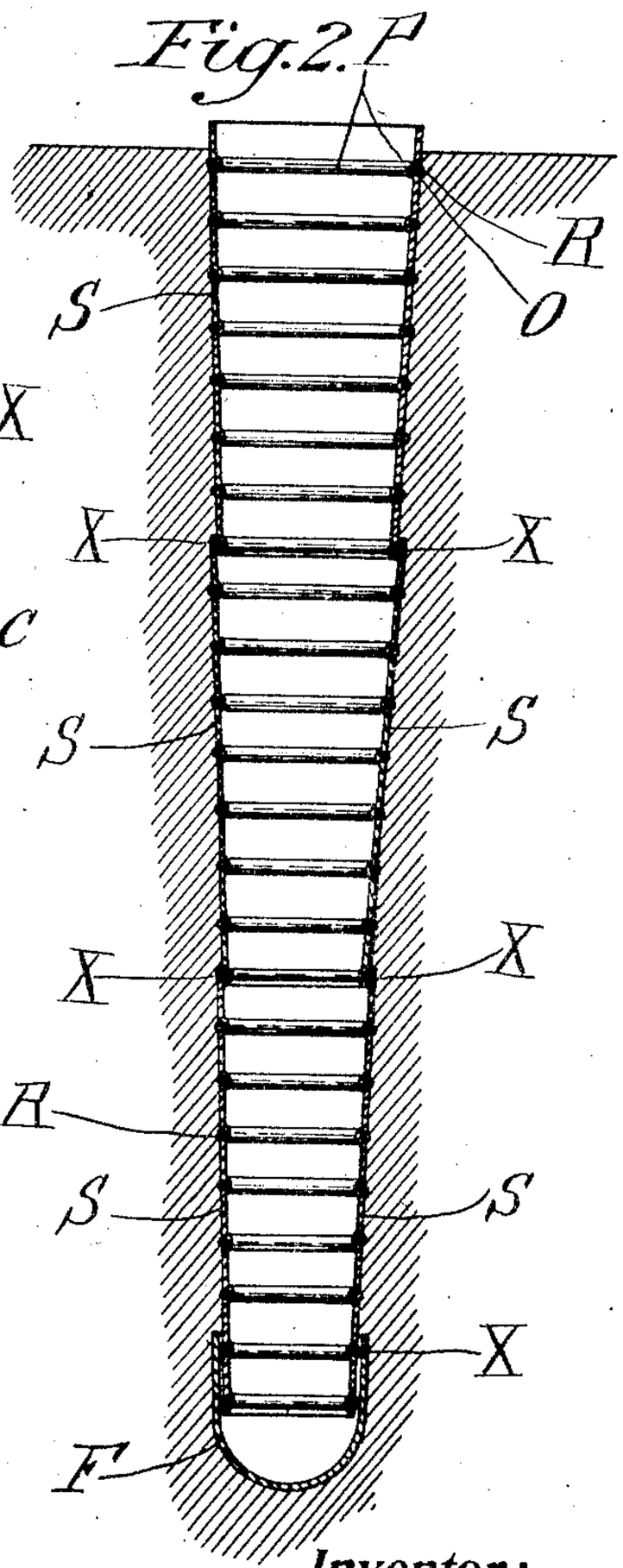


Fig. 2.



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PILE-SHELL.

990,611. Specification of Letters Patent. Patented Apr. 25, 1911.

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To all whom it may concern:

Be it known that I, MAXWELL M. UPSON, a citizen of the United States of America, and a resident of Englewood, New Jersey, have invented certain new and useful Improvements in Pile-Shells, the principles of which are set forth in the following specification and accompanying drawing, which disclose the form of the invention which I now consider to be the best of the various forms in which the principles of the invention may be embodied.

This invention relates to improvements in the construction of molds or pile-shells for concrete piles, such shells being adapted for employment in the placing of piles in accordance with such methods as those disclosed in United States Letters Patent to Raymond, Nos. 589,626 and 806,838, whether or not the shell is left in the ground as a permanent part of the pile, and particularly when the shell stands in the ground prior to being filled with concrete, as, for example, when the driving core of the first specified patent is withdrawn, or in case the outer pipe of the last-mentioned patent be withdrawn prior to filling the inner shell with concrete. In brief, the invention is applicable to all cases of molding concrete piles *in situ* where a shell is used as a mold for the concrete, whether such mold-shell be temporary for purposes of molding, or permanent for use both as a mold or a permanent part of the concrete pile installation.

The object of the invention is a pile-shell constructed or arranged to withstand the strains to which it is subjected under the above-specified unfilled, earth-surrounded condition, all within the limits of practical economy; and the invention consists of such a shell constructed and arranged for such object, and in substance as illustrated by the disclosures herein of exemplification embodiments such as those shown in the accompanying drawing, in which—

Figure 1 is a vertical longitudinal section of my improved pile shell with a withdrawable core in place therein; Fig. 2 is a similar section of the shell, partly in perspective, without the core, and Fig. 3 shows, in perspective, a modified form.

The core may be of any suitable construction, such as the three plates C shown, to be moved in and out respectively by a suitable wedged interior spindle not shown; or as the expansible and collapsible core of United States Letters Patent 777,351; or the core need not be employed when the shell is equivalently grounded, as, for example, in the disclosure of the above-specified Patent No. 806,838.

The shell S, and the core when used and fitting inside the shell, are preferably but not necessarily tapering, or frusto-conical, as shown, in order not only to facilitate driving but also to increase the load-carrying capacity of the ultimate concrete pile. The shell or shell-sections may be withdrawn after the soft concrete has been placed in it, and preferably before the concrete sets: but the present practice is to leave it in the ground to serve as a permanent pile-covering, and, in an upper water stratum, as a coffer-dam. Generally, a rounded "point" or footing F is provided to close the bottom of the shell, as shown, this being preferably hollow and of thin material like the main shell-part, as shown, and in such case, and generally, constituting a permanent part of the concrete pile.

The shell is thin, being made of thin sheet-metal such as steel, or of paper, the material in any case being liable to collapse by external pressure on account of the thinness of the shell-wall and consequent small mass, adopted from considerations of economy, particularly when, as in the present practice, the shell constitutes a permanent part of the pile. The shell usually consists of sections, preferably horizontal as shown, as in Patent No. 700,707. If desired, the shell may consist of a single part, or if sectional, the sections may be vertical, with vertical overlaps, as for the purpose of more ready removal, section by section, after the introduction and before the setting of the concrete, in cases where the shell is not to be a permanent part of the pile. The shell, or a shell section, may be formed preliminarily from sheet material in any desired manner, such as by the winding machine of United States Letters Patent No. 848,394, or of 848,851. The overlapping vertical edges may be welded or riveted together. After the shell or its sections are formed from the sheet, and completed in accordance with the invention, and ready for use, the core, in expanded condition, is elevated by the pile-driver, and the shell-sections are successively drawn up over the expanded core, as shown. Each section may

overlap the section next above it, as shown, or an upper section may overlap a lower section.

Any shell-section or shell portion, which, in the grounded, unfilled condition of the shell, is subjected to excessive inward pressure from exterior earth, is formed with one or more annular, transverse projections P or an equivalent, as shown, and the formation of these projections interiorly, as shown, is more advantageous than an exterior projection-formation, in that it does not engage with the exterior earth during driving and thereby increase the necessary work. The object of these hollow projections of the shell is to reinforce the thin shell and increase its collapsing strength such that it shall have an ability to resist inward pressure of exterior earth prior to concrete-filling, to a degree comparable with that of a much heavier and correspondingly expensive shell, such as the heavy-gage iron shell which it has been necessary to use in many cases in the absence of said reinforcing projections of this invention or their equivalents. Preferably the projections are hollow, as shown at O, but that is not absolutely necessary. The reinforcing effect of these projections will be understood by those skilled in the art, and such persons will readily design them for special cases; and their dimensions and the distance between them will be dependent upon the thickness and strength of the material constituting the thin shell, and upon the character of the soil with respect to the inward pressure on the shell tending to collapse it. In practice the projection may be made a half inch deep radially of the shell, a half inch high across the base of the projection, and two inches apart, *i. e.*, in about the proportions shown, although these will vary greatly according to the varying conditions of special cases. The projection may be made by the pressure of suitable dies upon the shell formed by winding as above, or upon the sheet before winding, in any suitable manner, as well known to those skilled in the art; and the precise method of manufacture is immaterial, except such as is inherently essential to forming hollow projections from sheet material. The wall of the integral projection is formed in the wall of the shell, and almost invariably the thickness of the shell-wall is uniform throughout. The result of simple stamping in a die is to form the hollow or groove O in one side of the projection, and this is the preferred and most effective as well as the simplest form. The shape of the projection as a whole is, however, immaterial, broadly speaking, provided only that it serves as a reinforcement. While it is far preferable that the projection extend entirely around the shell, (whether in the form of plural projections or of a helix), yet that is not absolutely necessary. It is preferable that the projection should have some horizontal direction, as in the case of a helix or spiral helix, or, as shown, in annular form, but that is not absolutely necessary. The word "annular" is used herein to include a helical or spirally helical arrangement.

Integral projections are not the only reinforcing means contemplated within the invention.

In some cases small stiffening rods, wires or rings R, of metal or other suitable material, are placed in position to be located preferably in the hollows of the projections, which then serve as retaining-grooves. They may be applied in any suitable way, as, after the hollow projections have been formed, by bending a rod to the lineal shape of the groove and then welding together the abutting ends of the rod in the groove. When these rods or rings are applied in exterior grooves (of interior projections), as shown, instead of in interior grooves as permissible, they serve to prevent a collapsing of the interior projections by the pressure of the driving-core during the driving operation. In any case, wherever located with respect to the grooves, the rods or rings act as additional reinforcements which are particularly useful in cases of exceptionally thin shells or shells of very readily collapsible material. In any case, if desired, the rods or rings may be welded, riveted or otherwise secured to the shell, particularly when they are not arranged in the grooves and retained thereby. As to the horizontal or vertical direction of the rings or rods and their disposition relative to the circumference of the shell, the same is contemplated as above specified of the hollow projections.

It will be clear from the above that when the core, collapsed, is withdrawn, but before the concrete is placed in the shell, this invention provides ample reinforcement for the thin shell, either by the integral projections, or by such projections and the rods or rings, to prevent its collapse by the back-pressure of the surrounding earth compressed by the driving operation. So far as I know, this is the first time that the object of the invention has been accomplished.

It is preferred that the reinforcement be arranged so as to reinforce the overlapping horizontal sections of the shell, as illustrated at X in Figs. 1 and 2.

It is contemplated that the means for reinforcing the shell may be, as disclosed herein by way of example, either integral with the shell alone, or a combination of integral means and means mechanically separate from the shell; and that when integral it may consist of a special configuration of the shell itself, such as the hollow projections;

and that when non-integral means is employed in combination, it may consist of rings, rods, etc., which, although mechanically separate from the shell, may be riveted or welded to it.

I do not claim the non-integral means independently of the integral means, as that is the invention of another for which a separate application is to be filed.

I claim:

1. The combination with a pile-shell of thin collapsible material for molding concrete piles, of hollow interior projections formed in the wall of the shell and reinforcing the shell against inward collapsing pressure of external earth, an expansible driving-core for the shell, and means non-integral with the shell and supported in the hollows of the projections, to reinforce the hollow projections against the outward pressure of the driving-core.

2. The combination with a tapered pile-shell for molding concrete piles, comprising vertically overlapping horizontal sections of thin collapsible material, of means reinforcing the overlapping portions of the sections against inward collapsing pressure of external earth.

3. The combination with a pile-shell of thin collapsible material for molding concrete piles, of hollow interior projections formed in the wall of the shell and forming exterior retaining grooves, and stiffening rods in the exterior grooves to reinforce the grooves and shell.

4. The combination with a pile-shell of thin collapsible material for molding concrete piles, of a retaining groove in the shell and a stiffening rod in the groove to reinforce the groove and shell.

5. The combination with a pile-shell of thin collapsible material for molding concrete piles, of hollow, transverse, annular projections formed in the wall of the shell, the hollows of said projections forming retaining grooves, and stiffening rings retained in the grooves and reinforcing the grooves, and reinforcing the shell against inward collapsing pressure of external earth.

6. The combination with a tapered pile-shell of thin collapsible material for molding concrete piles, of transverse, annular, interior projections formed in the wall of the shell and forming retaining grooves, and reinforcing rings supported by the shell in said grooves.

7. The combination with a pile-shell of thin collapsible material for molding concrete piles, of transverse annular projections formed in the wall of the shell and resisting inward collapsing pressure of surrounding earth.

8. The combination with a pile-shell of thin collapsible material for molding concrete piles, of transversely-disposed reinforcing projections formed in the wall of the shell and resisting inward collapsing pressure of surrounding earth.

9. The combination with a pile-shell of thin collapsible material for molding concrete piles, of interior reinforcing projections formed in the wall of the shell and resisting inward collapsing pressure of surrounding earth.

10. The combination with a tapered pile-shell of thin collapsible material for molding concrete piles, of a hollow projection formed in the wall of the shell, and reinforcing rings supported by the shell within the wall of the tapered shell.

11. The combination with a pile-shell of thin collapsible material for molding concrete piles, of a hollow projection formed in the wall of the shell and resisting inward collapsing pressure of external earth.

12. The combination with a pile-shell of thin collapsible material for molding concrete piles, of a hollow projection formed in the wall of the shell and resisting inward collapsing pressure of external earth, and additional reinforcing means arranged in the hollow of said projection.

13. The combination with a pile-shell of thin collapsible material for molding concrete piles, of projections formed in the wall of the shell, and reinforcing members secured to the shell and arranged to resist inward pressure of surrounding earth tending to collapse the shell.

14. The combination with a pile-shell of thin collapsible material for molding concrete piles, of reinforcing members arranged to resist inward pressure of surrounding earth tending to collapse the shell.

15. The combination with a pile-shell of thin collapsible material for molding concrete piles, of coöperating means respectively integral and non-integral with the shell, for reinforcing it against inward collapsing pressure of external earth.

16. The combination with a pile-shell of thin collapsible material for molding concrete piles, of means integral with the shell for reinforcing it against inward collapsing pressure of external earth.

17. The combination with a tapered pile-shell for molding concrete piles, comprising vertically overlapping sections, of means reinforcing at least one section of the shell against inward collapsing pressure of external earth.

18. The combination with a tapered sectional pile-shell of thin collapsible material for molding concrete piles, of means for reinforcing the sections against inward collapsing pressure of external earth.

19. The combination with a pile-shell of thin collapsible material for molding concrete pile, of reinforcing rings non-integral

with said shell, and means for maintaining said rings in proper relation to said shell.

20. The combination with a pile-shell comprising a plurality of horizontal overlapping sections of collapsibly thin material, of reinforcing means arranged along the wall of a section to resist inward pressure of earth surrounding the shell when grounded and tending to collapse the thin material of the shell.

21. The combination with a pile-shell comprising a plurality of overlapping sections of collapsibly thin material, of reinforcing means arranged along the wall of a section to resist inward pressure of earth surrounding the shell when grounded and tending to collapse the thin material of the shell.

22. The combination with a pile-shell comprising a plurality of tapering overlapping sections of collapsibly thin material, of reinforcing means arranged along the wall of a section to resist inward pressure of earth surrounding the shell when grounded and tending to collapse the thin material of the shell.

23. The combination with a pile-shell of collapsibly thin material for molding concrete piles in place in the ground, of a plurality of independent self-reinforcing rods successively arranged along the wall of the shell and reinforcing it, when grounded, against pressure of external earth.

MAXWELL M. UPSON.

Witnesses:
IRVING A. FISK,
PAUL DE FOREST CASE.