March 1, 1960 C. B. HOPPE 2,926,500

APPARATUS FOR MAKING CONCRETE PILES

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FIG. 1

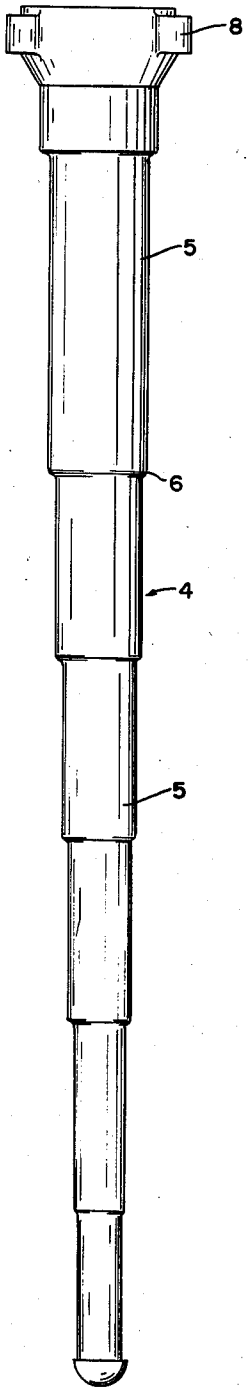


FIG. 2

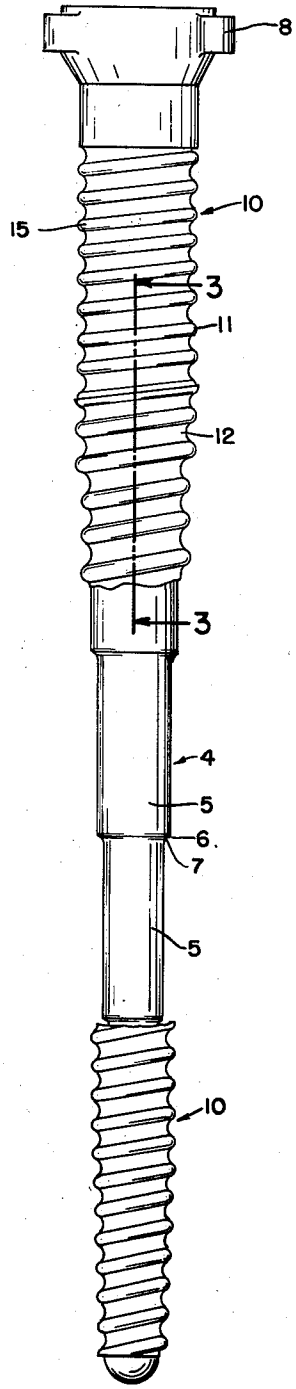
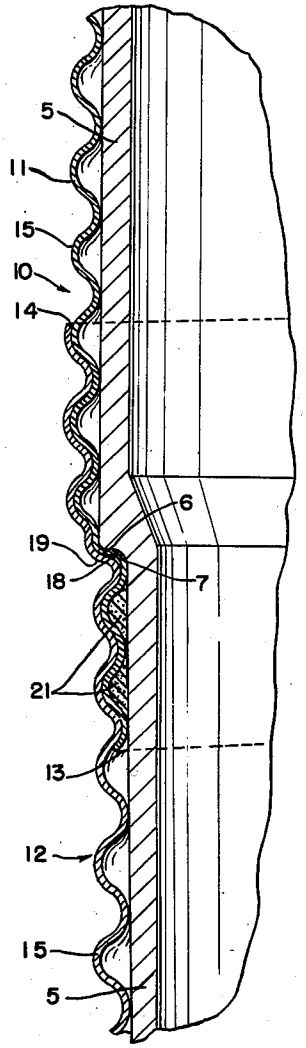


FIG. 3



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FIG. 4

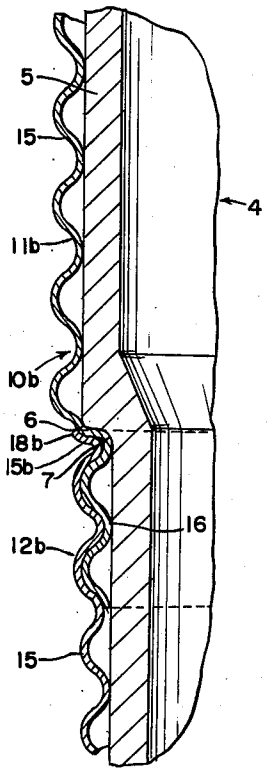


FIG. 5

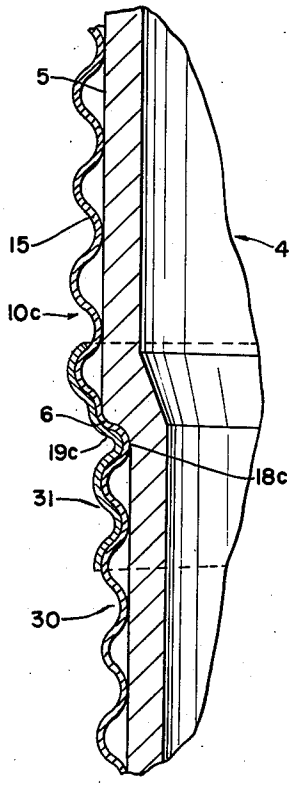
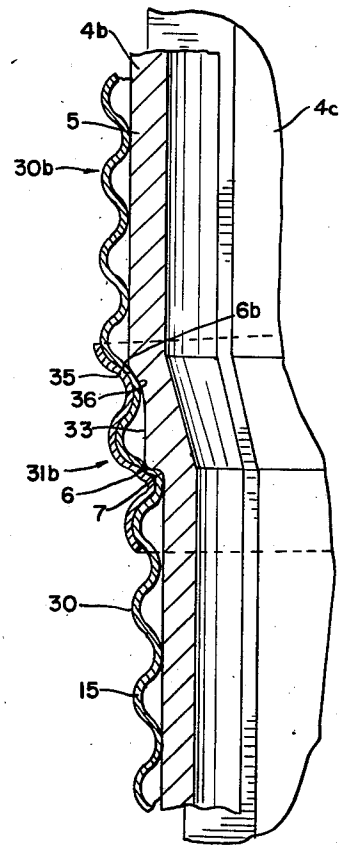


FIG. 6



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APPARATUS FOR MAKING CONCRETE PILES

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Application December 17, 1957, Serial No. 703,335

4 Claims. (Cl. 61—53)

This invention relates to apparatus for forming concrete piles, and has for its object to provide certain improvements in the casings or shells for the piles, and an improved mandrel or core for driving the shells.

An important object of the invention is to provide shells formed of a series of sections adapted to be driven into the ground and to be filled with concrete, connections being provided between adjacent shell sections which are produced by overlapping related end portions of adjacent shell sections so that they interengage to preclude endwise movement of the connected sections relative to each, while at the same time forming radially inwardly projecting annular shoulders and radially outwardly projecting shoulders which serve the functions of plow rings, and a mandrel having shoulders which engage the inwardly projecting shoulders on the shell sections.

Another important object of the invention is to provide pile driving shells formed of a series of sections adapted to be driven into the ground and to be filled with concrete, the sections of the shells being telescoped or overlapped upon each other in mutually supporting and connected relation, the sections decreasing in diameter from top to bottom of the shell and the overlapped or telescoped portions of the sections constituting reinforced stiffened or rigidified portions, certain of the rigidified portions being formed to provide shoulders for engaging the undersides of annular shoulders or steps on a driving core or mandrel, the core shoulders being defined by plain cylindrical stepped portions decreasing in diameter from top to bottom of the core, the outside of the shell shoulders serving the functions otherwise performed by digging or plow rings.

The invention also provides corrugated concrete pile shells having continuous side walls which are circumferentially and radially inwardly indented to provide shoulders to engage under the driving core shoulders, the shell shoulders being reinforced and rigidified by external collars which conform to the outside contours of the corrugations. Advantageously, the pile shells have helical corrugations in which adjacent sections are screw threaded together to form the joint therebetween.

Other important objects and advantageous features of the invention will be apparent from the following description and the accompanying drawings, wherein, for purposes of illustration only, specific embodiments of the apparatus of the invention are set forth in detail.

In the drawings:

Fig. 1 is a side elevation of a driving core or mandrel;

Fig. 2 is a side elevation with parts removed of a shell having helical corrugations in place on the core of Fig. 1;

Fig. 3 is an enlarged fragmentary transverse section taken on the line 3—3 of Fig. 2;

Fig. 4 is a similar view of a modification of Fig. 3;

Fig. 5 is a similar view of another form of shell involving an external reinforcement; and

Fig. 6 is a similar view of a modification of Fig. 5.

Referring to the drawings, the driving core or mandrel 4 is of the stepped type having several sections 5 decreasing in diameter from the top to the lower end and defining annular shoulders 6 therebetween. The sections 5 may be cylindrical or they may be downwardly tapered or upwardly tapered dependent upon the material from which the shells are formed, and the shoulders 6 can be squared with the axis of the core or have somewhat upwardly beveled or flared and rounded undersurfaces 7, as shown in Fig. 2. The upper end of the core 4 is provided with a driving head 8 which is larger in diameter than the uppermost section 5. Instead of using the unitary mandrel illustrated I may use a segmented mandrel as shown in Fig. 6 and as more fully described in my copending application Serial No. 550,528, filed December 2, 1955 and now abandoned.

As shown in Fig. 2 the shell 10 is composed of an appropriate number of sections which decrease in diameter from the top to the bottom so as to fit the outside of the related core sections 5. Vertically subjacent upper and lower shell sections 11 and 12, respectively, are selected for descriptive purposes.

In the form of the invention shown in Fig. 3, the corresponding terminal ends 13 and 14 of the upper and lower shell sections 11 and 12, respectively, overlap and are formed with complementary spiral corrugations 15 so that the lower end of the upper section may be screwed into the upper end of the lower section. Intermediate the overlapping portions, the adjoining shell sections are reduced in diameter to provide an inner shoulder 18, adapted to engage beneath the shoulder 6 of the core and an overlying outer shoulder 19 which, as before stated, under normal conditions serves the function of a plow ring. Thus, at the point of reduction of diameter the walls of the adjoining sections form an integrated, radially inwardly directed concave-convex shoulder 18—19 which substantially conformably engages the under surface 7 of the related core shoulder 6, whereby downward driving of the core 4 exerts a downward pull on the upper shell section 11 through connection with the next lower shell section 12.

An important feature of the invention is achieved by forming the concave-convex shoulder 18—19 in the wall of the shell section 12, in that, under normal conditions, the exterior or outside of the shoulder 19 serves the same general functions as a conventional plow ring, and enabling elimination of the expense and trouble of providing, assembling, and operating plow rings. Because of the absence of squared or sharp edges or faces such as are characteristic of conventional plow rings, the designedly rounded and upwardly flaring surfaces or faces of the shoulder 19 produce less friction with the sides of the pile hole and reduce the amount of driving power required, without material sacrifice of plowing effectiveness. In most instances this enables driving the shells more quickly than heretofore.

It will be understood that the related ends of vertically adjacent shell sections of the shell 10 below the above described upper and lower shell sections are formed similarly to the described upper and lower shell sections.

The shell 10, that is the sections thereof, as is the case with all of the shells hereinafter described, are constructed to be capable of being selectively made of such materials as steel, pressed and impregnated paper, plastics, fiber glass, pressed wood and combinations of such materials. Selections of such materials is dictated by considerations of cost of manufacture, relative lightness in weight, moisture absorption or non-absorption, resistance to corrosion or to rotting, and the like. In order to provide adequate strength and rigidity where extra thin-walled sections are employed, fillings 21 of concrete or grout may be formed and hardened in the

troughs of the corrugations facing the mandrel prior to driving, as shown in Fig. 3, thereby enabling using metal shells of lighter than usual gauge.

Connection together of the above described upper and lower shell sections is effected by any suitable means, such as by spot or line welding the sections together at points of contact, such as at the overlapping terminal ends 13 and 14 of the sections.

The preferred form shown in Fig. 3 of the drawings, in which its upper and lower shell sections 11 and 12, respectively, screw together, also provides double thickness across the area of the core shoulder 6 and at opposite sides thereof, the shell sections 11 and 12 being devoid of plain cylindrical portions, the spiral corrugations 15 thereof being continuous to the upper end 14 of the lower section 12 and continuous in the upper section 11 as far as the lower end 13 thereof. The upper and lower sections are deformed intermediate their ends to provide the interengaged shoulders 18 and 19, with the shoulder 18 directly engaging under the core shoulder 6.

In the form of the invention shown in Fig. 4, the upper and lower sections of the shell 10*b* are also screw threaded together, but they do not provide a double shell thickness across the shoulder 6 of the core 4, the core 4 being the same as illustrated in Fig. 3.

The upper shell section 11*b* is provided with spiral corrugations 15 throughout its length including its reduced diameter lower portion 16, with the exception that the juncture of the upper and lower portions is in the form of a concave-convex shoulder 18*b* for conforming engagement with the undersurface of the core shoulder 6 at a point intermediate the ends of the upper shell section 11*b*.

The lower shell section 12*b* is located entirely below the shoulder 18*b* of the upper shell section 11*b*, is threaded on the lower portion 16 of the upper shell section 11*b* and terminates in an upper end 15*b* which engages under the shoulder 18*b*.

Fig. 5 shows another form of the invention, employing the above described core 4, and involving a shell 10*c* comprising a shell section 30 which extends across the area of the core shoulder 6 and at both sides thereof, with the area of the shell section 30 across the shoulder area of the core reinforced and stiffened by a relatively short collar reinforcement 31, the reinforcement collar 31 and the shell section 30 being formed with interengaging shoulders 18*c* and 19*c*, with the shoulder 18*c* engaging under the core shoulder 6. The collar 31 may be threaded on the shell section 30, in which case both are provided with spiral corrugations 15. However, the collar 31 and shell section 30 may be formed with parallel, non-spiral corrugations, if desired.

The form of the invention shown in Fig. 6 is the same as that shown in Fig. 5, with one exception in that the core is longitudinally divided into sections 4*b* and 4*c* and has besides the shoulder 6, an extra or second shoulder 6*b* provided at a point spaced above the shoulder 6, the material intervening between the two core shoulders being reduced to form an annular recess 33; and with the further exception that the collar 31*b* and the shell section 30*b* are formed with additional or upper interengaging shoulders 35 and 36, respectively, with the shoulder 36 engaging under the upper shoulder 6*b*. The core illustrated in Fig. 6 preferably has three core sections, only two being shown, as described more fully in my said patent application.

It is to be understood that any change or changes can be made in the form, relative management, and composition of the components of the invention herein disclosed, without departing from the invention, as defined by the subjoined claims.

I claim:

1. Apparatus for forming concrete piles into the earth which comprises a shell for receiving concrete consisting of several connected sections decreasing in diameter from the top to the bottom, thereby forming a series of sections which are upper and lower with respect to one another, said sections being corrugated and having end portions telescopically connecting one section to another, at least one corrugation at each connection consisting of inner and outer parts in conforming overlapping relation, the outer overlapping part being offset inwardly and the inner overlapping part being offset outwardly, said inwardly and outwardly offset portions reinforcing one another and cooperating to form a shoulder, and a driving mandrel having the approximate shape of the shell within the shell to drive the shell into the earth, said mandrel having a shoulder for engaging each inwardly projecting shoulder of the shell, whereby the shoulders of the mandrel bear directly on the rinforced inwardly projecting shell shoulders and the outwardly projecting portions serve as plows in driving the shell into the earth.

2. Apparatus as defined in claim 1 which comprises shell sections having helical corrugations, the sections being connected together by screwing one section into the other.

3. Apparatus as defined in claim 1 in which each shoulder is of larger diameter than the shoulder below but not greater in diameter than the immediately adjacent upper shell section.

4. Apparatus as defined in claim 1 in which the space between the corrugations directly below the inwardly projecting shoulder and the mandrel are filled with reinforcing material.

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