May 29, 1951 H. F. CAUDILL 2,554,896

BUTTON BOTTOM PILE

Filed Aug. 9, 1948

Fig. 1.

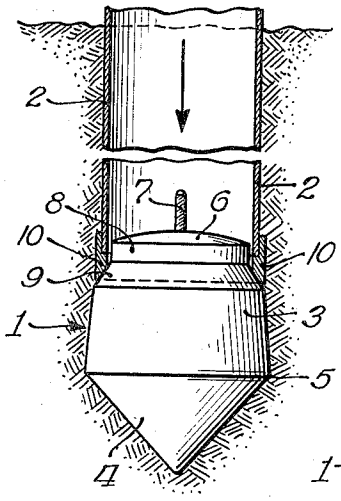


Fig. 2.

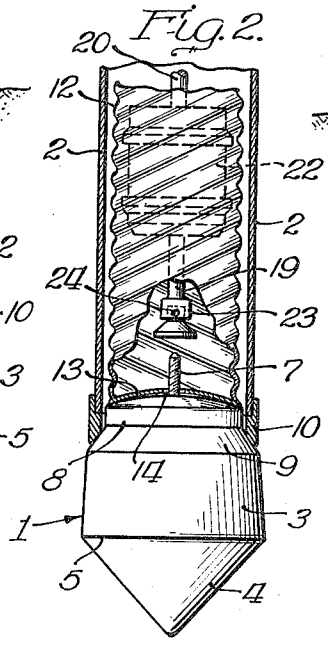


Fig. 4.

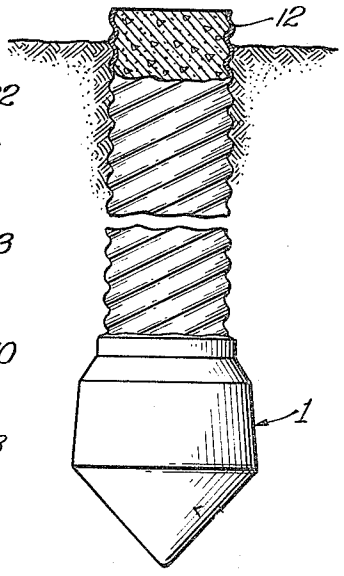


Fig. 3.

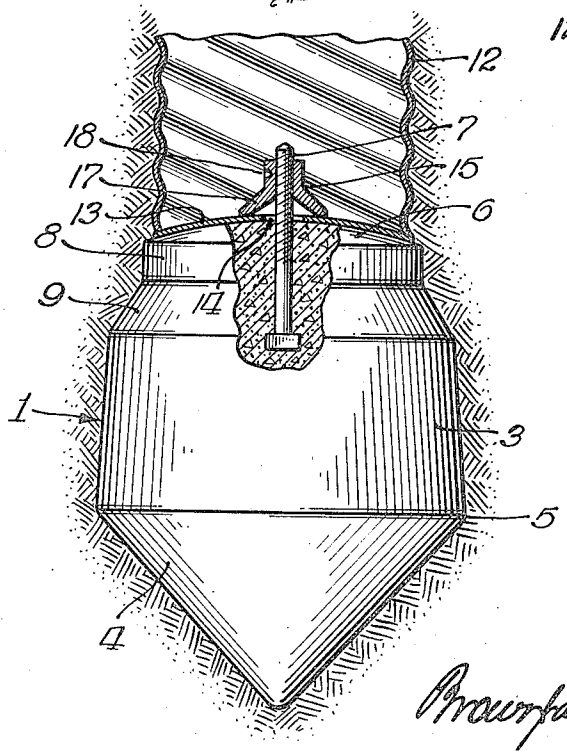


Fig. 5.

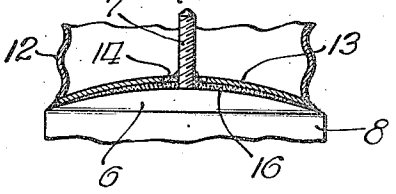
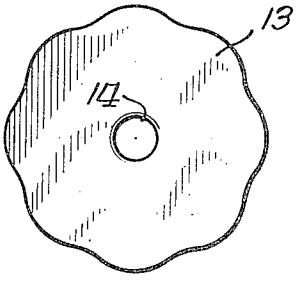


Fig. 6.



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UNITED STATES PATENT OFFICE

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BUTTON BOTTOM PILE

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5 Claims. (Cl. 61—57)

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The present invention relates to a cast-in-place concrete pile employing a steel shell resting upon an enlarged preformed point. This type is sometimes designated as a button bottom pile.

The present invention is an improvement upon the invention disclosed in the patent to J. H. Thornley, No. 1,778,925, of October 21, 1930.

According to said Thornley patent, No. 1,778,925, a short section of the inner shell is embedded in the body of the point, and the main section of the shell is spliced to the short section by an intermediate section or wrapping held to the adjacent sections by encircling clamping hoops. Such construction involves the following disadvantages which the present invention cures:

(1) The joint is inconvenient to make and is not always tight.

(2) Since the splice can only be made before the point is driven, the point is driven with the shell attached. This involves some inconvenience in handling, and the jarring of driving the point tends to loosen the joint in the shell.

The object of the invention is to provide a pile and a method of constructing the same which will uniformly give the desired support, with the certainty that is to be sought in foundations, and with economy in time, labor and material.

The theory of the present pile is relatively simple. It consists in providing a pre-cast driving head or point, which is made of a diameter larger than the driving sleeve, hence the name "button bottom." In effect, the sleeve with the enlarged head is a probe, this probe being thrust down into the soil to find a suitable resistance which will provide the required bearing. Then the temporary shaft of the probe is replaced by a permanent structure of suitable material to provide a permanent shaft or column resting upon the probe head and constituting the finished support.

According to the present invention, a driving head or point is preformed of concrete. It is provided with a lower driving face which may be conical, flat or otherwise. At its upper end it is provided with an annular frusto conical driving shoulder preferably with a short neck or stem joined by said conical annular shoulder to the main body of the point. A heavy walled driving sleeve engages the conical driving shoulder for applying impact pressure to the head. The head is of a diameter which is substantially larger than that of the driving sleeve. The head pushes the soil away as it penetrates the soil to reduce temporarily the friction with the driving sleeve as

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the point is driven downward in the nature of a probe. Since the diameter of the point or button is greater than the diameter of the driving sleeve, the friction on the latter will be temporarily relieved, so that no false bearing value of the upper strata will invalidate the driving formula. The point is driven to the penetration required to carry the design load.

When the point or button has been driven to the desired distance or refusal, the light inner shell is lowered into place down through the driving sleeve. This light shell is joined to the driving point or button after the latter has been driven to seat. To join a shell in water-tight relation to button or head after the same has been driven to seat far below the surface of the ground, is a problem presenting considerable difficulty. The shell should be so joined to the point or button that it may be cleared of water and sand, and it should be mechanically fastened to the button or point with sufficient strength to resist heave of the soil operating upon its sides whereby to prevent possible separation of the shell from the point or button. The shell is filled with concrete, and the driving sleeve is withdrawn.

The present invention specifically provides a novel form of head or button, and a novel mechanism and method for fastening or joining the head or button to the shell. The shell constitutes a novel part also for cooperation with the head and with the fastening means.

In order to acquaint those skilled in the art with the manner of constructing and operating a device embodying my invention, I shall now describe, in connection with the accompanying drawings, a preferred structure and mode of constructing the same.

In the drawings:

Figure 1 is a vertical section showing the driving sleeve in the operation of driving the point or button to seat;

Figure 2 is a similar section showing the point or button driven to seat, the permanent shell lowered into place, and the operation of the attaching means;

Figure 3 is a section on an enlarged scale, with respect to Figure 2, showing the permanent shell and the button and the attaching means for joining the two permanently;

Figure 4 is a front elevation, partly in section, of the finished pile;

Figure 5 is a fragmentary view illustrating the application of a sealing compound between the top of the button and the bottom of the permanent shell; and

Figure 6 is a bottom plan view of the permanent shell, showing the hole in the base plate.

The button, or point 1, comprises a main body portion 3 which has a driving face 4. In the preferred form, the driving face is conical with the apex downwardly, but this particular form is optional, since the driving face may even be flat. In the form shown in the drawings, the maximum diameter is at the junction 5 of the driving face 4 and the main body portion 3, which latter preferably is tapered inwardly and upwardly. In other words, there is no necessity for any extended length of maximum diameter.

The upper end of the button 1 has a generally horizontal convex clamping face 6 from the center of which extends the stud 7. The area of the face 6 radially outside the stud 7 is the load-bearing area upon which the shaft of the pile rests when the pile is completed. Preferably a short neck 8 extends upwardly above the annular conical driving shoulder 9, this neck 8 serving to assist in aligning the driving point or button with the driving sleeve 2. The neck or shank 8 is in the case of the nominal 12 inch pile of a diameter approximately 12½ inches. The crown of the face 6 is approximately one inch, and the stud 7 is in this instance preferably ⅞ inch diameter, approximately 9 inches long, and is provided with a heavy thread of about seven threads to the inch. The maximum diameter of the button or head 1 is in this instance about 17½ inches. The driving sleeve 2 has an inside diameter in this instance of approximately 13 inches. It is provided at its lower end with a reenforcing ring 10 which is welded to the sleeve. The tapered shoulder 9 cooperates with a correspondingly tapered surface on the inside of the reenforcing ring 10 to center the sleeve 2 with respect to the button 1 and to permit the application of impact pressure through the sleeve and reenforcing ring 10. The tapered ring 10 bearing on the tapered shoulder of the point or button acts in compression upon the concrete body whereby the impact pressure has less tendency to crack or break the concrete body 1. The angle of this taper may be varied, but is preferably of the order of 60° from the horizontal. It should not be so low as to cause sticking.

When the driving sleeve is applied to the button, the two parts may be sealed together by a roofing mastic or similar sealing compound, so that ground water will not enter the shell 2 until the parts are purposely separated.

After the point has been driven to the desired bearing value, as indicated in Figure 2, the light sheet metal shell 12 complete and in one length is lowered inside the sleeve 2. The shell 12 is intended, as shown in Figure 4, to be filled with concrete to complete the pile, but at the stage shown in Figure 2, it is necessary to join the shell to the button 1 by a means which can be operated from the top of the hole, and which will nevertheless provide sufficient strength against separation that the friction of the ground heaving up around the sides of the sleeve 12 as may later be the case when other piles are driven in the neighborhood, will not cause dislocation of the shell 12 with respect to the button 1. The shell 12 is preferably made of light sheet metal stock, which, for instance, may be 18 gauge, with an outside diameter of 12¼ inches and corrugations ½ inch deep each way. This shell is preferably made up of spiral strip joined by a lock seam, and of the length desired to carry the same from the desired point above the ground

down to the button 1 as a continuous piece. A dished bottom plate or closure 13 shown in bottom plan in Figure 6 is attached by welding to the lower end of the shell 12 to form a strong, tight joint with the said shell. A hole of approximately two inches diameter is formed in the center of the bottom plate 13 to pass over the threaded stud 7. The hole 14 is at the center of the upwardly crowned bottom plate 13, the crown acting as a guide tending to assist the operator in passing the shell 12 and its base plate 13 down over the stud 7, as shown in Figure 2. When the shell has thus been dropped down over the stud, it is then in order to thread the clamping nut 15 over the threaded stud 7 to clamp the bottom plate against the clamping face 6 of the button or point. The crown in the bottom plate 13 corresponds to the crown on the clamping face 6, so that the two parts may fit fairly closely. Additionally, a layer of roofing mastic, as indicated at 16 in Figure 5, may be applied to the two cooperating surfaces, or to either of them to form a tight seal for excluding ground water and sand. To apply the clamping nut 15 is simplified by provision of the funnellike flange 17 formed on the lower part of the nut 15. The nut 15 has a polygonal top portion, preferably square with one face provided with a depression at 18, as shown in Figure 3, to be engaged by a snap socket wrench 19, as shown in Figure 2. This wrench 19 comprises a relatively long stem 20 with a barrellike guide 22 at the lower end adjacent the socket portion 23. The socket 23 has a spring plunger of well known type 24 for entering the depression 17 in the nut 15, and thereby holding the nut in the socket wrench. By lowering the tool and the nut down through the shell 12 until it rests on the stud and rotating the same, the upwardly and inwardly tapered bottom surface of the flange 17 will guide itself upon the stud 7, and may thereupon be drawn up tight. After the nut has been turned home, the socket wrench may be detached by an upward pull and the tool removed. Thereupon, the shell 12 may be filled with concrete of the desired composition and strength, the driving sleeve 2 withdrawn, and the job is complete. The upper end of the pile may be connected to a structure to be supported in any well known manner. A pile cap is one common method.

The advantages of this construction and method of operation are apparent, since the button or point is of substantially larger diameter than the sleeve so as to clear the driving sleeve of lateral friction to a great extent. The positive bearing value is discovered by the resistance which the button encounters. Since the resistance to driving is the test of the bearing value of the pile, no false bearing value of the upper strata on the side walls of the pile will be involved.

The method of driving and installing the shell is such that the shell cannot be torn or distorted in the process of locating it. The permanent shell can be inspected before it is concreted, and it is left in place as a form for the concrete.

I claim:

1. A driving point for a button bottom pile comprising a circular precast body of concrete having a head portion adapted to be exposed to the soil during driving and having a top clamping face, a threaded rodlike clamping stud of small diameter as compared to the diameter of the clamping face anchored in the body and projecting axially upward out of said face, said face being circular and of a diameter substantially less than that of the head portion, the area of the

said top clamping face radially outside the clamping stud constituting the main load-bearing area for supporting a pile shaft above it and an annular conical driving shoulder below said clamping face for receiving impact pressure to drive said point to a supporting stratum.

2. In a button bottom pile, the combination of a precast concrete body constituting a driving point having a top clamping face, a stud anchored in said body and extending from substantially the central part of the clamping face, a tubular light steel shell having a bottom plate closing the lower end, said plate having a central opening adapted to be slipped over said stud and a clamping nut threaded over the stud to clamp the bottom plate to the said clamping face.

3. In a button bottom pile, the combination of a precast concrete body constituting a driving point having a convex top clamping face, a threaded stud anchored in said body and extending from substantially the central part of said clamping face, a tubular light steel shell, a closure plate for the lower end of the shell, said plate having a central hole and being concave on the bottom toward the hole whereby to guide the same over the stud, and a flanged clamping nut threaded upon said stud to clamp the shell to the point, the flange of the nut being of larger diameter than the hole whereby to close the same.

4. As an article of manufacture a button bottom pile shell comprising a thin walled corrugated steel shell open at its upper end and having a dished up closure plate welded to the lower end thereof, said closure plate having a central bolting aperture.

5. Method of installing a button bottom pile, which comprises forming a precast driving point with an enlarged body, a clamping stud and an annular driving shoulder at the upper end thereof driving said point by impact pressure upon the shoulder applied through a driving sleeve of less diameter than the point until the point is driven to load sustaining seat, then lowering a light sleeve shell through the driving sleeve onto the point and thereafter clamping the sleeve to the point, filling the shell with concrete and withdrawing the driving sleeve.

HOWARD F. CAUDILL.

REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
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