June 4, 1935. H. E. SATRE 2,003,393

METHOD OF FORMING PILES

Filed Feb. 29, 1932

Fig. 1

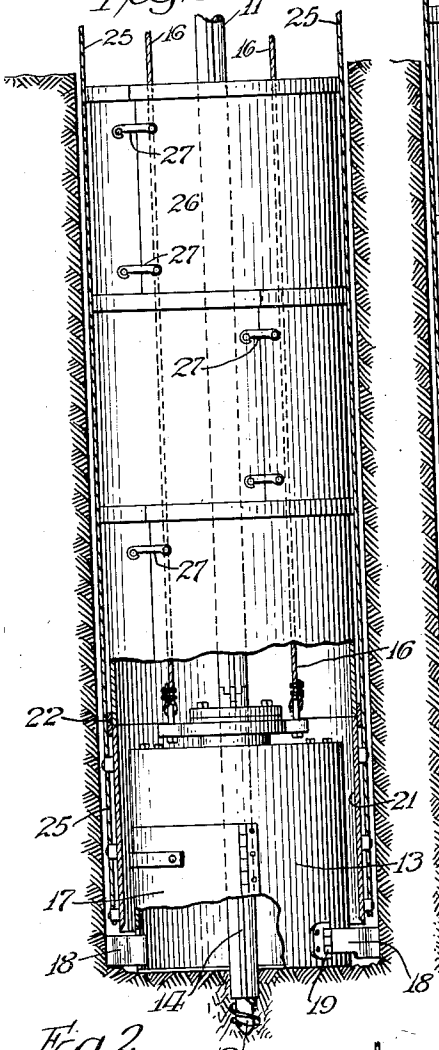


Fig. 3

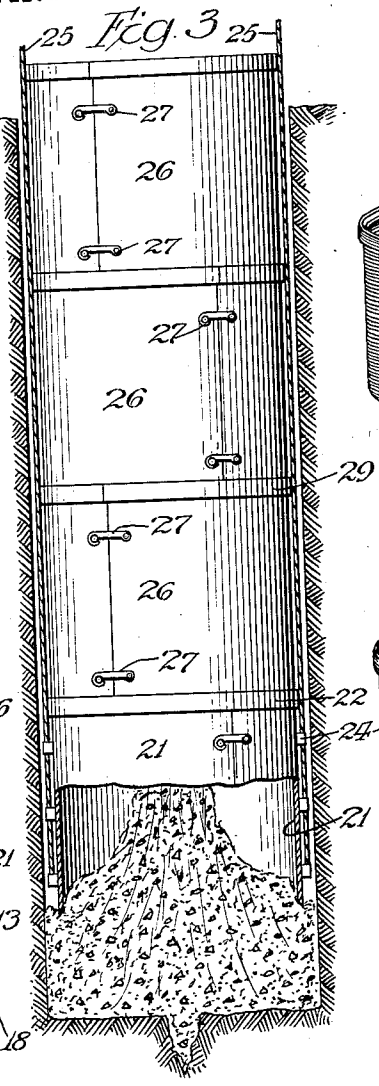


Fig. 5

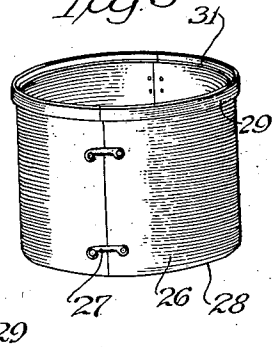


Fig. 6

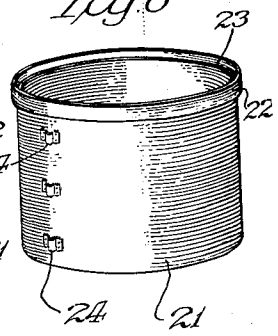


Fig. 2

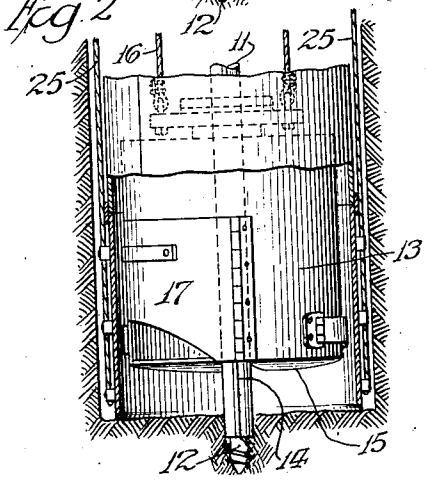
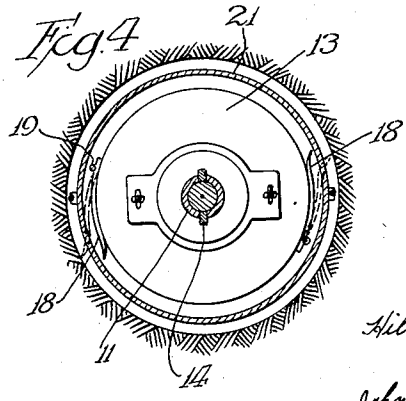


Fig. 4



Inventor:
Hilman E. Satre
John C. Carpenter
Atty.

Patented June 4, 1935

2,003,393

UNITED STATES PATENT OFFICE

2,003,393

METHOD OF FORMING PILES

Hilmar E. Satre, Chicago, Ill., assignor, by mesne assignments, to Spencer, White & Prentis, Incorporated, New York, N. Y., a corporation of Connecticut

Application February 29, 1932, Serial No. 595,755

6 Claims. (Cl. 61—57)

This invention relates to the boring and lining or casing of holes and also to the filling of such holes with concrete or other material, and while it is particularly related to the formation of caissons, it will be readily apparent that from various aspects it has valuable application to the boring and/or filling of holes for other purposes.

A principal object of the invention is the provision of an improved process for mechanically boring and lining holes of considerable depth and of large diameter, which will effect substantial savings both in labor and in material.

Caissons such as are usually provided to extend through soft ground to a firm anchorage below to support great weight, such as a tall building, have been usually constructed in the past by lining the caisson holes as they are dug, the lining of the casing being constructed at each newly dug zone by workmen working in the hole itself; each section once positioned has remained in place and as the digging progresses new sections have been constructed or erected therebeneath. Moreover, in accordance with usual previous practices, the casing sections, (i. e. the entire casing), have been left in place to provide a form for the pouring of the concrete or other filling material. Ordinarily such constructions have been constructed of wood, which manifestly adds nothing to the supporting strength of the casing, and in any event rots away in a relatively short time. Accordingly, caisson holes thus lined have of necessity been of enlarged diameter to provide holding columns of the required strength.

This invention has for one of its important objects the provision of a process which will permit of the filling of the entire excavated hole with the concrete, to the end that a hole of minimum diameter may be dug to provide a concrete caisson column of specified final dimension.

Another important object of the invention is the provision of a process which may be practiced to entirely dig, case and fill the hole without need of the workmen descending into it.

In connection with the preceding purposes of the invention, it may be mentioned that manual operations of the workmen in the holes are attended by a number of most serious dangers. One of these is from gas of poisonous, or at least noxious character, which is not infrequently liberated in the digging of the holes, and there is always also the danger of the caving in of the earth before the casing can be constructed at a new zone provided by the extension of the hole.

Another important object of the invention is the provision of a process which will permit of the production of the final caisson without leaving the casing in the hole so that when the caisson is completed the casing used is available in undamaged condition for employment in the construction of a succeeding caisson.

Another important object of the invention is the provision of a process which will permit of the progressive construction of the casing as the digging progresses, and without the need of withdrawing the digging elements from the hole where the hole is being dug by a machine. In this connection my invention contemplates the employment of the machine of my pending application for United States patent, Serial No. 517,845, filed February 24th, 1931. This machine accomplishes the digging through the active agency of a rotating combined excavating and receiving element, which in its rotation bores the hole, taking up the material for subsequent discharge above the ground level. An auger shaft extends through the excavating and receiving element and periodically the element is slid up the shaft to a discharge position. The shaft remains in the ground as a fixed guide and my invention has for one of its purposes the provision of a process for lining or casing the hole without requiring the removal of the shaft from its operative position.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, when taken in connection with the accompanying drawing, illustrates typically a preferred practice of the invention.

Referring to the drawing,

Figure 1 is a schematic section showing portions of a boring machine in operative position and the hole lined or cased close to the plane or zone of digging;

Fig. 2 is a similar partial view showing the withdrawing of the excavating element and continuation of the lining of the hole;

Fig. 3 is a view similar to Fig. 2, illustrating the steps in the process of filling the hole;

Fig. 4 is a transverse sectional view illustrating the withdrawal or retraction of the side cutters of the excavating element;

Fig. 5 is a perspective view of one of the upper casing sections; and

Fig. 6 is a similar view of the lower or leader casing section adapted to be employed in the practice of the present invention.

Figs. 1, 2 and 4 of the drawing illustrate the digging of the hole with the machine of my co-

pending application. Detailed description of this machine is not thought necessary to an understanding of the present invention. Generally the machine comprises a vertical shaft 11 with a leader or pilot bit 12 at its lower end to extend down beneath the floor of the hole as it is dug and to guide and advance the shaft as may be required. A combined excavating and receiving element or bucket, generally indicated at 13, is arranged upon this shaft in splined connection 14 with it so that rotation of the shaft causes rotation of the excavating element. The excavating element is provided with cutters 15 which cut the floor of the hole and scoop the material dug up into the bucket where it is progressively received until a full charge is accumulated. The excavating and receiving element 13 is adapted to slide lengthwise of the shaft and to be pulled up to a position above the ground by cables 16 suitably trained over hoisting elements (not shown) to lift the excavating element for discharge of the dirt through a discharge door 17.

Side cutters 18 are arranged at the lower end of the excavating element and these are pivoted at 19 to be swung out into the cutting position (shown in Fig. 1 and in dotted lines in Fig. 4) when the bucket turns in a counterclockwise direction (viewing the last mentioned figure). When, however, the excavating element is rotated slightly in the opposite direction, the side cutters are retracted to the full line position shown in Fig. 4, in order that the element with its charge of dirt may move up through the casing.

As the digging progresses the hole is cased or lined in accordance with my invention by first inserting a leader casing section at the top, and thereafter superimposing successive casing sections, moving the preceding section or sections downwardly through the hole so that the leader section is always disposed close to the floor of the hole. The leader section is, or may be, constructed of a continuous circular shell 21, offset near its top at 22 to provide a shouldered recess 23, in which a lower edge of the next succeeding section may rest. The leader section 21 is provided with clamps 24 at opposite sides, in which are fastened the lower ends of cables 25. These cables extend up to above the ground surface and serve to support the casing during the digging, and for other purposes which will be later more fully explained. The leader section is placed about the intended center of the hole before the digging is begun and follows the floor of the hole on down until the hole is completely dug.

Each of the upper casing sections (indicated by reference character 26 and typically illustrated in Fig. 5) consists of two parts adapted to be separated or secured together by hooks 27. Thus constructed each upper casing section may be wrapped about, or caused to encircle the shaft 11 without removing the shaft from the ground or disconnecting it from its power mechanism. Each upper section 26 may be positioned by merely separating the sections at one or both sides, bringing the sections then to the desired position and rehooking them so that the lower edge 28 may rest upon the subposed section. Each upper section 26 is offset at the top at 29 to provide a shouldered recess 31, similar to the shouldered recess 23 of the leader section 21. Thus arranged each section above the section 21 rests at its bottom edge upon the shouldered recess 23 so that the entire casing is supported by the cables 25.

In the digging of the hole it is desirable that the casing be always disposed as closely as possible to the floor of the hole, and in Fig. 1 it is shown as arranged just above the side cutters 18. When the cutters are retracted, preliminarily to the raising of the excavating element to deposit a charge of earth, the casing may be moved down into contact with the floor as shown in Fig. 2.

My invention contemplates the removal of the casing as an incident to the filling of the hole with concrete or other material. This is accomplished by the progressive upward lifting of the casing and the successive removal of its sections as concrete is poured in to provide the caisson body. The concrete has sufficient strength and substance to prevent cave-in of the side walls of the hole, and preferably the removal of the sections is accomplished in such manner as to maintain the bottom of the casing at all times filled with concrete. This is, however, merely preferred and is not necessary, particularly in certain types of soil. A charge of concrete is poured through the casing into the hole, the casing raised correspondingly as the depth of concrete body increases. The removing of the casing is accomplished while the concrete is soft and the concrete flows out beneath the lower casing edge into firm engagement with the side walls. As the lifting of the casing disposes successive sections at above the ground line they are independently removed and the process continued.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the steps and their order of accomplishment of the process described without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the process hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. The process of boring holes in the ground and lining the same, which comprises digging the hole and inserting casing sections in the hole as the hole is deepened in superposed unattached relation and with the insertion of each section lowering previously inserted sections, and controlling from above the ground the downward movement of said sections by operation upon the lowermost only of mid sections.

2. The process of boring and filling a hole, which comprises excavating the hole, lining the same by successively superposing unattached sections of casing and moving previously added sections downwardly as the hole is deepened. filling the hole through the lining, and lifting the casing by force applied from below as the hole is filled.

3. The process of forming a caisson hole in the ground which comprises progressively cutting the earth with a hollow rotary auger, diverting the loosened earth into the auger, withdrawing the cutting elements into the body of the auger to reduce its effective diameter, periodically lifting the auger to discharge its load of earth, guiding the auger in line with the axis of the hole both during its descent and ascent, and progressively lowering a lining into the hole about the space occupied by the auger.

4. The process of forming a caisson which comprises progressively cutting the earth with a hollow rotary auger, diverting the loosened earth into the auger, withdrawing the cutting elements towards the center of the auger to reduce its effective diameter, periodically lifting the auger

to discharge its load of earth, guiding the auger in line with the axis of the hole both during its descent and ascent, progressively lowering a lining into the hole about the space occupied by the auger, thereafter removing the auger and guiding device and pouring concrete into the lining, and progressively removing the lining upwardly by force applied from below as the concrete settles into the hole below the casing.

5. The method of forming piling and the like, which comprises progressively forming a hole in the earth, maintaining a cutting shaft in said hole, inserting a primary supporting casing in said hole, progressively lowering said primary supporting casing so as to maintain the same in position adjacent the lower portion of said hole, attaching split secondary casings about said shaft without removing the latter from said hole, positioning said secondary casings in unattached superimposed and supported relation with respect to said primary supporting casing, withdrawing said cutting shaft from said hole, pouring a plastic pile forming material into said hole and within said casings, withdrawing said prmary supporting casing from said hole progressively with the filling of the latter with said material, whereby to remove all of said casings from said hole, and separating said casings when emerging from said hole.

6. The method of forming piling and the like, which comprises progressively cutting a hole in the earth, maintaining a cutting shaft in said hole, inserting a primary supporting casing in said hole, controlling the position of said primary casing from the outside portion thereof and from the top of said hole, whereby to maintain said primary casing in position adjacent the lower portion of said hole, attaching split secondary casings about said shaft without removing the latter from said hole, positioning said secondary casings in unattached superimposed and supported relation with respect to said primary supporting casing, withdrawing said cutting shaft from said hole when the hole is complete, pouring a plastic pile forming medium in said hole and within said casing, withdrawing said primary casing from said hole progressively with the filling of the latter with said material whereby to remove all of said casings from said hole, and separating said casings when emerging from said hole.

HILMAR E. SATRE.