Sept. 2, 1969 L. A. TURZILLO 3,464,216

METHOD AND MEANS FOR FORMING CAST-IN-PLACE REINFORCED CONCRETE PILE

Filed Jan. 8, 1968 2 Sheets-Sheet 1

FIG. 7

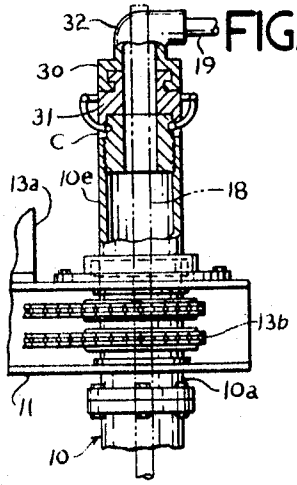


FIG. 2

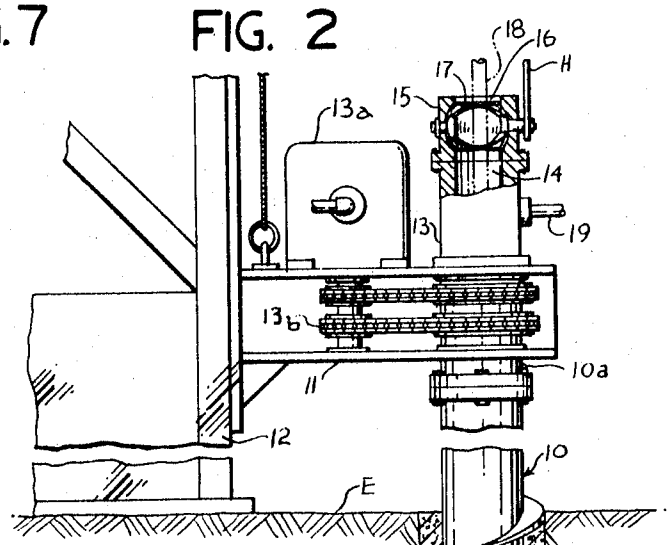
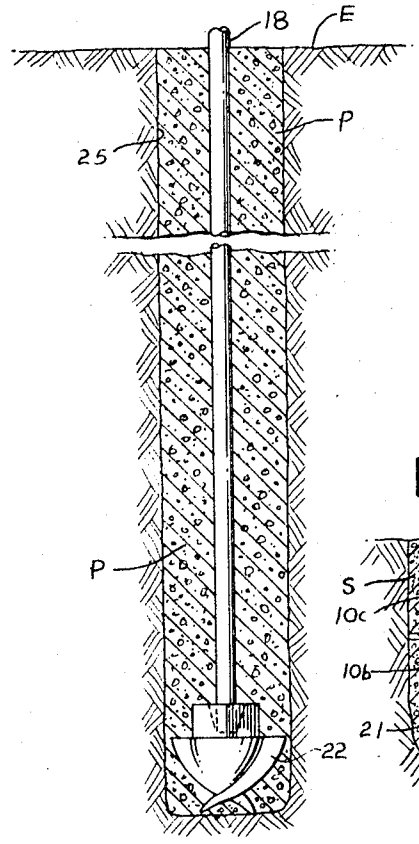


FIG. 1



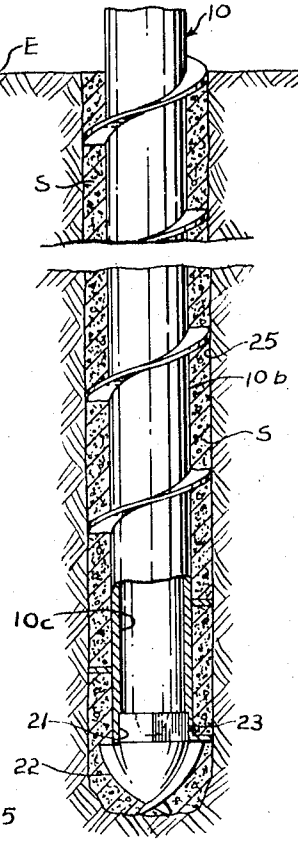
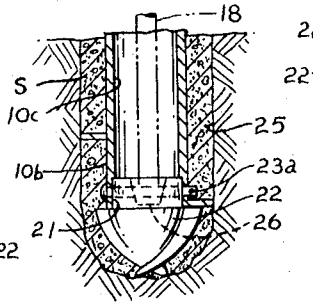


FIG. 8



INVENTOR.
Lee A. Turzillo

BY
William Cleland
Attorney

Sept. 2, 1969 L. A. TURZILLO 3,464,216

METHOD AND MEANS FOR FORMING CAST-IN-PLACE REINFORCED CONCRETE PILE

Filed Jan. 8, 1968 2 Sheets-Sheet 2

FIG. 3

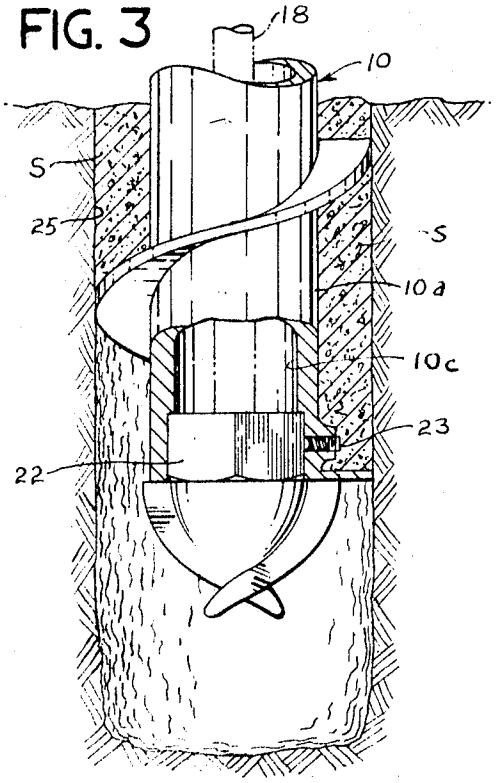


FIG. 4

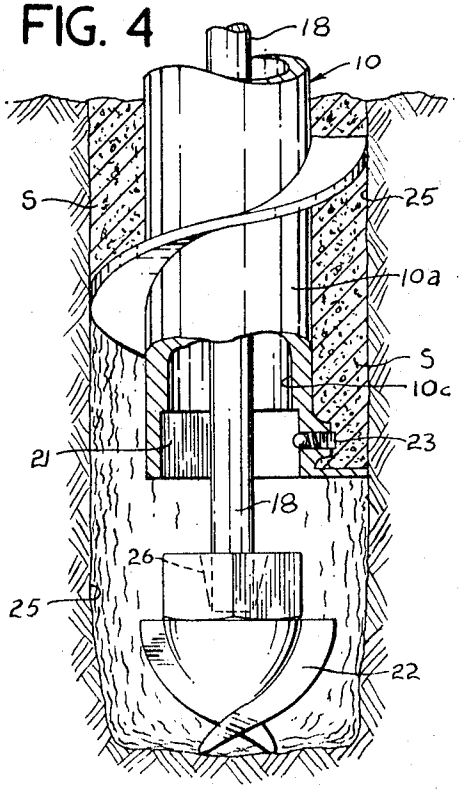


FIG. 5

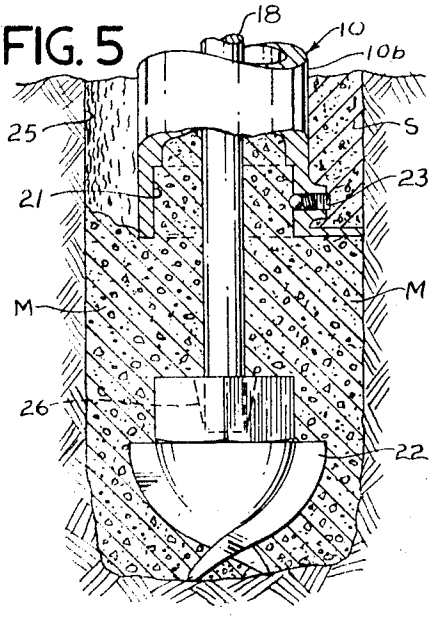
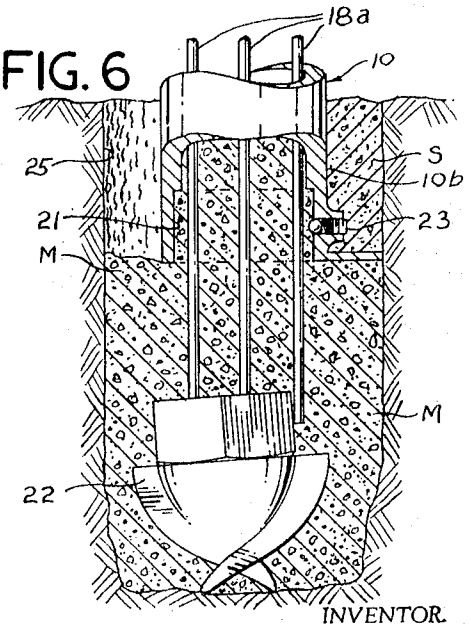


FIG. 6



INVENTOR.
Lee A. Turzillo

BY William Cleland
Attorney

United States Patent Office 3,464,216 Patented Sept. 2, 1969

3,464,216

METHOD AND MEANS FOR FORMING CAST-IN-PLACE REINFORCED CONCRETE PILE

Lee A. Turzillo, Bath, Ohio
(2078 Glengary Road, Akron, Ohio 44313)

Filed Jan. 8, 1968, Ser. No. 696,212
Int. Cl. E02d 5/36, 5/34
U.S. Cl. 61—53.64 6 Claims

ABSTRACT OF THE DISCLOSURE

Hollow-shafted auger screwed to required depth of hole in situs then held stationary, while rigid rod is fed through auger shaft to release driving bit from lower end of auger into drilled hole. Rod retained centrally upright in hole by shaft, while auger progresively withdrawn and hydraulic cement mortar pumped through shaft to fill hole. Mortar initially anchors lower end of rod in upright position then progressively forms a pile body upwardly about rod.

BACKGROUND OF INVENTION

Heretofore, reinforced concrete piles have been provided in an earth situs by drilling or otherwise providing a cavity in the situs, filling the cavity with fluid cement mortar, and manually forcing an elongated, steel rod downwardly through the formed, still fluid pile body. It has, however, been found virtually impossible to center the rods axially within such fluid pile bodies, because of the strong tendency of such rods to drift from the intended axial courses thereof. In fact, test piles have shown a high incidence of cases in which the rods projected angularly of the axes of the piles to extend outwardly of the peripheral walls of the piles at points intermediate the ends thereof. This problem was multiplied as the lengths of the pile bodies increased.

Copending U.S. patent application Ser. No. 441,052, now Patent No. 3,363,422, discloses a method in which a hollow-shafted auger is used to drill a hole in an earth situs. In that method, however, anchoring rods were affixed to a driving bit and both the rod and bit were released into the drilled hole as a unit. The rod, therefore, had to be in place within the auger shaft before earth drilling operations commenced, and only one rod could be installed.

SUMMARY OF INVENTION

In the present invention, a hollow-shafted auger is screwed into an earth situs to define a hole of predetermined depth and location, and thereafter an elongated reinforcing rod is released down the auger shaft, to disengage a driving bit from the inner end of the same into the bottom of the hole. As the auger is withdrawn from the hole, fluid hydraulic cement mortar is pumped down the auger shaft, first to surround the lower end of the rod and hold it centered in the hole, and then progressively to surround the upper portions of the rod. The hollow shaft, being smaller in diameter than the drilled hole, serves as guide means to maintain the rod substantially centered in the resultantly formed pile body.

An object of the invention is to provide an improved method and means of the character described, by which one or more rods of requisite lengths may be positioned within the hole after it is drilled, and by which such rods are effectively maintained substantially in axially centered relation by the auger shaft while mortar is progressively pumped through the auger shaft, into the drilled hole.

Other objects of the invention may be resorted to without departing from the spirit thereof or the scope of the appended claims.

Of the accompanying drawings:

FIGURE 1 is a vertical cross-section, partly broken away, through a rod-reinforced concrete pile, formed in an earth situs by the method of the invention.

FIGURE 2 is a similar vertical cross-section, showing a preliminary step in the method, in which a hollow-shafted continuous-flight auger has been screwed into an earth situs to drill a hole of requisite depth and location in the situs by displacement of earth therein, and wherein is illustrated a driving bit releasably affixed on the lower end of the auger shaft.

FIGURE 3 is an enlarged fragmentary cross-section of the lower portion of a drilled situs, showing a step of partially withdrawing the auger to present the lower end of the auger, with the releasable bit thereon, freely in lower portion of the hole or cavity formed by displacement of earth.

FIGURE 4 is a view corresponding to FIGURE 3, in which by operation of valve means shown at the upper portion of FIGURE 2, a pile-reinforcing rod is fed down the auger shaft to release the releasable driving bit from the lower end of the auger shaft.

FIGURE 5 is a view corresponding to FIGURE 4, in which the reinforcing rod has come to rest in axially centered relation, and hardenable, fluid mortar has been pumped down the auger shaft to surround and anchor the rod in the hole in substantially axially centered position, to facilitate effective completion of the pile as shown in FIGURE 1.

FIGURE 6 is a fragmentary view corresponding to FIGURE 5, but illustrating use of the method to provide a concrete pile or column with a plurality of reinforcing rods embedded therein.

FIGURE 7 is a fragmentary cross-section, corresponding to the upper portion of FIGURE 2, and on the same scale, illustrating a modified means for feeding a pile-reinforcing rod down the auger shaft.

FIGURE 8 is a fragmentary cross-section, corresponding to the lower portion of FIGURE 2, and on the same scale, illustrating a modified means for releasably retaining the auger bit on the lower end of the auger shaft.

Referring to FIGURE 2 of the drawings, there is illustrated apparatus suitable to practice the method of the invention to produce a reinforced concrete pile or like column P in an earth situs E, as shown in FIGURE 1. Such apparatus may include a continuous flight, hollow-shafted auger **10**, interchangeably affixed on a chambered adapted **10***a*, rotatably mounted on a carriage **11** which is vertically movable on a crane or like rig **12** by suitable power means (not shown). A reversible hydraulic motor **13** on carriage **11** is operable through a chain drive **14**, selectively to rotate the auger **10** in either of opposite directions.

The adapter **10***a*, to which auger **10** is removably affixed, may be rotatably mounted on carriage **11**, to connect with a fixed housing **13** on the carriage **11** having a chamber **14** communicating at its upper end with a normally closed flapper valve **15**, and at its lower end with the axial passage **10***c* of auger shaft **10***b*, through the fixed adapter **10***a*. The flapper valve **15** may have a top access opening **16**, adapted to be opened by a manually rotatable arcuate valve plate **17**, for inward reception of a reinforcing rod **18**, to the interior of auger shaft **10***b*, as shown in chain-dotted lines in FIGURE 2, and for purposes to be described later.

When the valve plate **17** has been rotated to close the valve access opening **16**, pressuriezed hydraulic cement mortar from a suitable source (not shown), may be supplied through a conduit **19**, to chamber **14** and the auger shaft **10***b*.

The lower end of the hollow auger shaft **10***b* may be provided with a reduced irregular-shaped orifice **21**, de-

fining a seat for releasable non-rotative reception of a driving bit **22** serving as a closure member. Spring-pressed detent means **23** may be provided for releasably retaining the bit non-rotatably seated in the orifice **21**.

Referring to FIGURE 2 in particular, the above-described auger-drilling apparatus may be used in the method of invention to form a reinforced column or pile P in an earth situs E, as shown in FIGURE 1. To this end, the auger **10** with the driving bit **22** releasably closing the lower end of auger shaft **10***b* is, by operation of motor **13**, screwed vertically into the situs E to define a pile cavity or hole **25** of predeterminate depth and location. When this has been accomplished, as shown in FIGURE 2, the motor **13** may be reversed to rotate the auger **10** while the carriage **11** is elevated as necessary to withdraw the auger and thereby lift or displace the loose earth S from the cavity **25**.

In an initial stage of such withdrawal of the auger **10**, an elongated rigid element, such as a steel reinforcing rod **18**, may be dropped or otherwise fed through the top opening **16** in the open flapper valve **15** (see FIGURE 2), through chamber **14** in the relatively fixed housing **13**, and down the inside of the auger shaft **10***b* (whether moving or stationary). The rod **18** may be of easily predetermined length (as shown in FIGURE 1), and controlled in its descent to engage the lower end of the same with the driving bit **22**, and thereby release the bit into the bottom of the pile cavity **25**, which is now partially vacated by displacement of earth, as illustrated in FIGURES 3 and 4.

At about the time the rod **18** releases the bit **22** from the auger, as described, the handle H on valve **15** is operated to close valve opening **16**, as previously described, and with continued progressive upward movement and requisite rotation of the auger to continue displacement of earth from the formed cavity, fluid hydraulic cement mortar M is pumped under pressure through conduit **19**, chamber **14**, and through the orifice **21** of auger shaft **10***b*. Thus, fluid mortar fills the space vacated by the progressively displaced earth, initially to embrace the lower end of the positioned rod, to anchor the same substantially axially centered with reference to the cavity **25**, somewhat as shown in FIGURE 5. For this purpose, the inner end of the bit **22** may have provided therein a tapered recess **26**, designed to be loosely centeringly engaged by the lower end of the downwardly injected rod, to keep the rod generally centered with reference to the auger shaft **10***a* and, therefore, the cavity **25**.

With continued progressive withdrawal of the rotating auger to displace all earth S from the defined cavity **25**, the fluid mortar is progressively formed upwardly in the cavity and around the centered rod, until the auger is completely retracted and the pile P is fully formed, as shown in FIGURE 1. The formed concrete body P is then allowed to set or harden with the rod **18** centeringly embedded therein.

FIGURE 6, correspondingly substantially to FIGURE 5, illustrates use of the method described to install a pile P in a cavity **25**, with a plurality of reinforcing rods **18***a*, **18***a* incorporated therein.

In any event, the method of the invention may be utilized to produce partial pile bodies or columns P, deep in an earth situs, to have one or more reinforcing rods anchored therein, with or without extensions thereof projected outwardly for use as anchoring bars of known type. In some instances, it may be desirable to leave earth S in an upper extent of the cavity above the anchoring concrete pile or body, as by turning the auger in screwing direction while withdrawing it from the defined cavity.

It is also readily apparent that the present method and means also makes it possible to stop movement of the drill, as well as stop inward passage of fluid mortar, periodically and momentarily, to allow reinforcing rods or similar means of varying lengths and proportions to be placed through the valve opening **16** as before, and then to resume the progressive pumping and auger withdrawing operations as before. Thus, the finished pile may be variously reinforced at different levels in the pile body as needed.

Referring to FIGURE 7, there is illustrated a modified mortar-supply means at the upper end of the auger **10***a*, adapted for feeding reinforcing rods **18** down an auger shaft having an extension **10***e* which rotates freely above the carriage **11** with rotation of the adapter **10***a*. For this purpose a quick-release coupling C may have an outer part **30** releasably rotatably connected to an inner coupling part **31** threaded or otherwise attached to the extension **10***e*, to be rotatable therewith. A swivel connector **32** on mortar supply line or conduit **19** may be rotatably attached to upper end of the outer coupling part **30** to permit the connector **32** and conduit **19** to be held affixed while extension **10***e*, adapter **10***a*, and auger **10** are rotated, in the manner previously described. Accordingly, upon removal of quick-release coupling C from extension **10***e*, a reinforcing rod **18** may be fed or dropped down the auger shaft, as indicated in chain-dotted lines in FIGURE 7, while the auger is either rotating or stationary.

FIGURE 8 illustrates a modification of the invention wherein the drill bit **22** may be generally the same as before, except that it is releasably affixed in the lower end of the auger shaft **10***b* by a shear pin **23***a*, adapted to be sheared by forcible engagement of the bit **22** by rod **18**, to eject the bit from the end of the auger shaft, as best shown in FIGURE 5.

Other modifications of the invention may be resorted to without departing from the spirit thereof or the scope of the appended claims.

What is claimed is:

1. A method for forming a reinforced concrete pile or like column in an earth situs, comprising the steps of: providing a hollow-shafted auger with a driving bit member releasably affixed to, and closing an inner end of the auger shaft to rotate therewith; screwing said auger and bit member thereon inwardly into the situs to define a hole therein of predetermined depth and location by displacement of earth; lowering insert means through access opening means at the outer end of said auger shaft until an inner portion of the insert means engages and forcibly releases said bit member from the inner end of the shaft into the defined hole; while maintaining said access opening means closed progressively withdrawing said auger from the defined hole and supplying pressurized fluid hydraulic cement mortar thereto through said shaft to replace said displaced earth; said fluid mortar entering said defined hole at the lower end of the shaft, whereby with continued said progressive withdrawal of the auger the fluid mortar is progressively formed upwardly in the defined hole; and allowing said formed mortar to harden within the hole with at least a portion of said insert means anchored therein.

2. A method for forming a concrete pile or like column in an earth situs, comprising the steps of: providing a hollow-shafted auger having a closure member releasably mounted on the lower end of the shaft; screwing said auger into the situs to define a hole therein of requisite depth and location by displacement of earth; feeding an elongated, rigid element of predetermined length down said shaft from opening means at the top thereof to engage the lower end of the element with said member with ramming force, thereby forcibly to release the member from the shaft and provide a passage therefrom through which said lower portion of the rigid element projects into the portion of the said hole vacated by displacement of earth, upon initial upward withdrawal of the auger; and closing said top opening means of the auger to provide a fluid seal and supplying hardenable fluid cementitious material under pressure through said auger shaft and passage into said hole, while simultaneously continuing progressive

withdrawal of the auger, anchoringly to embrace said rigid element and form a column of the cementitious material within said hole.

3. A method as in claim 2, wherein a plurality of rods are released into said hole through said auger shaft.

4. A method for forming a concrete pile or like column in an earth situs, comprising the steps of: providing a hollow-shafted auger having a closure member releasably affixed on the lower end of the hollow shaft to rotate therewith; screwing said auger into the situs to define a hole therein of requisite depth and location by displacement of earth; urging rigid reinforcing means inwardly within said shaft into engagement of a leading end thereof with said member with sufficient ramming force to release the closure member from said lower end of the hollow shaft into said defined hole below the auger; and supplying hardenable fluid cementitious material under pressure through said auger shaft into said hole, while progressively withdrawing the auger therefrom to form a column of the cementitious material within said hole with the rigid reinforcing means anchoringly embedded therein.

5. A method as in claim 4, wherein said auger is rotated simultaneously with said withdrawal of the same from the defined hole.

6. A method as in claim 4, wherein said member is provided with a guide recess for centering engagement of said leading end upon application of said ramming force by the reinforcing means.

References Cited

UNITED STATES PATENTS

2,729,067	1/1956	Patterson	61—53.64
3,303,656	2/1967	Landau	61—63
3,300,988	1/1967	Phares	61—63
3,371,494	3/1968	Lagerstrom	61—39

OTHER REFERENCES

German printed application, 1,104,905 (1961).

JACOB SHAPIRO, Primary Examiner

Disclaimer

3,464,216.—*Lee A. Turzillo*, Bath, Ohio. METHOD AND MEANS FOR FORMING CAST-IN-PLACE REINFORCED CONCRETE PILE. Patent dated Sept. 2, 1969. Disclaimer filed Apr. 21, 1976, by the inventor.

The term of this patent subsequent to Jan. 16, 1984, has been disclaimed.

[*Official Gazette June 15, 1976.*]