

Sept. 1, 1970

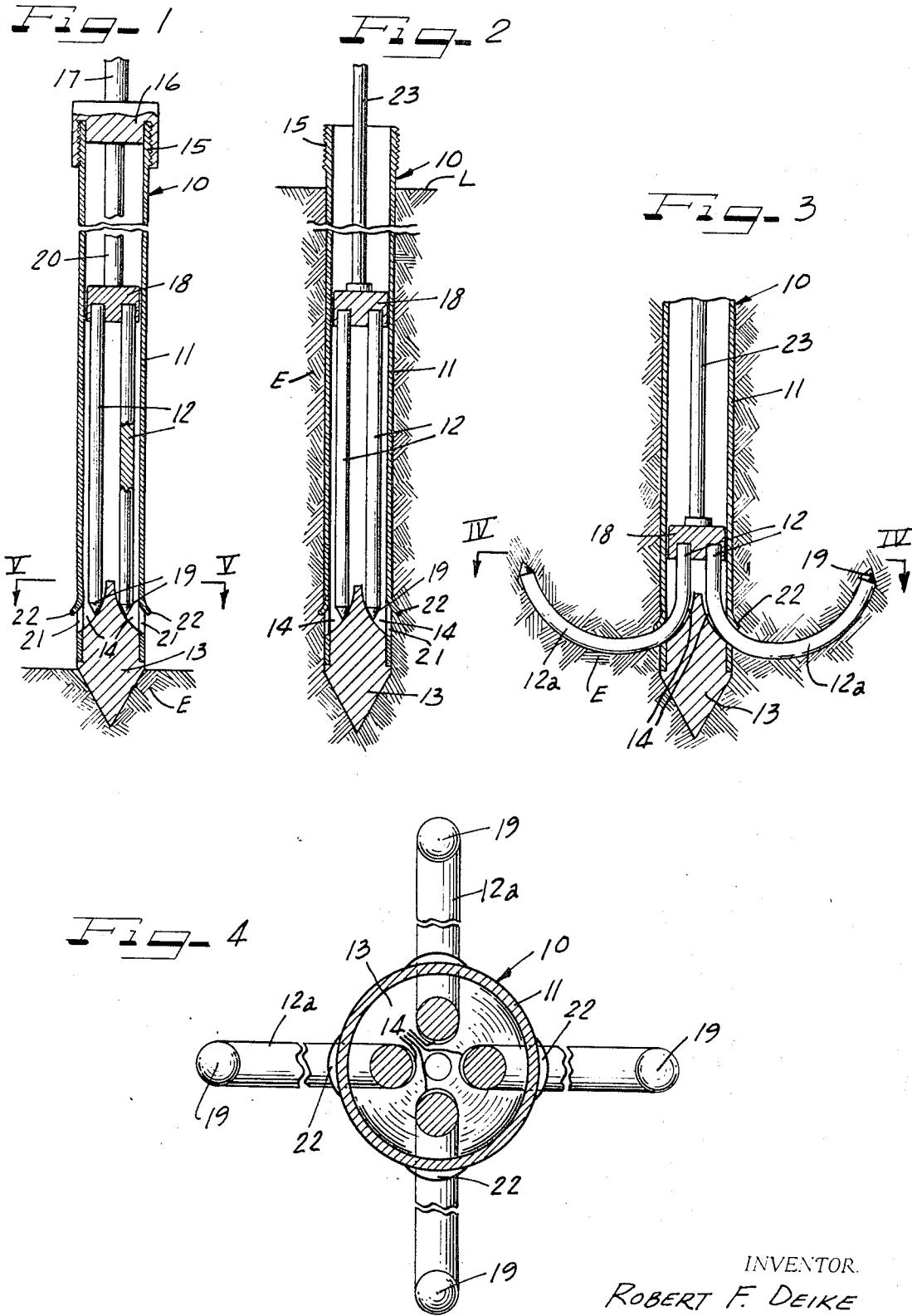
R. F. DEIKE

3,526,069

ANCHORING DEVICE

Filed Sept. 9, 1968

3 Sheets-Sheet 1



INVENTOR.
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Sept. 1, 1970

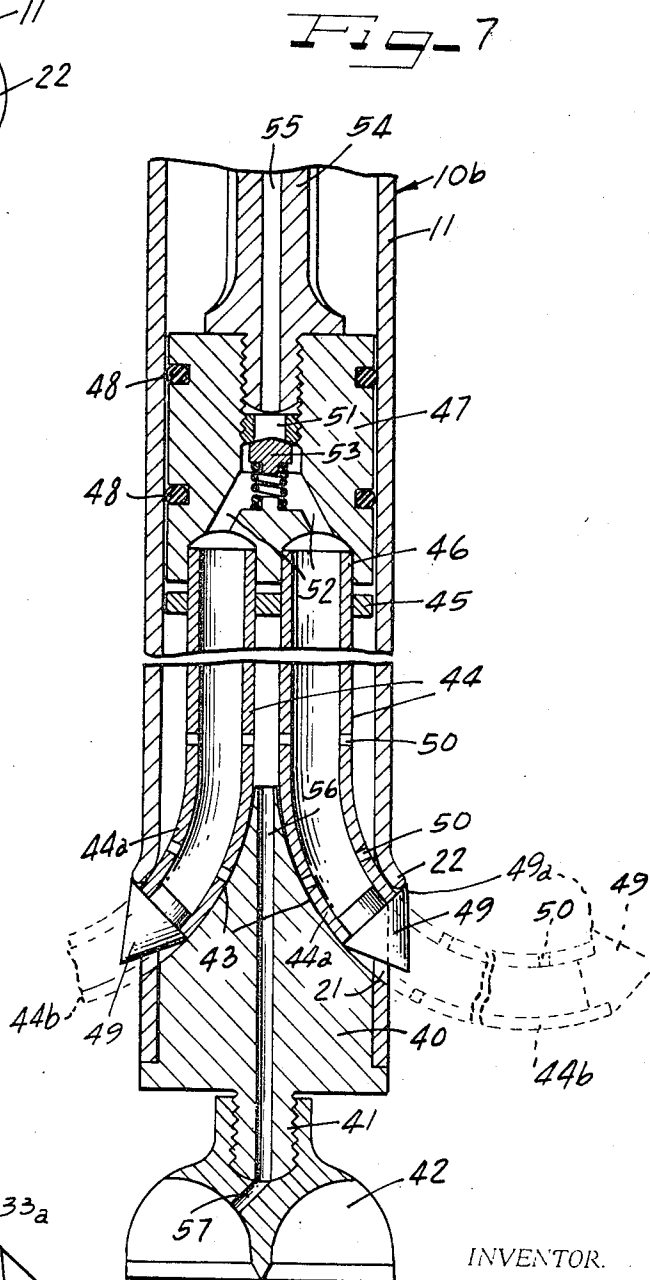
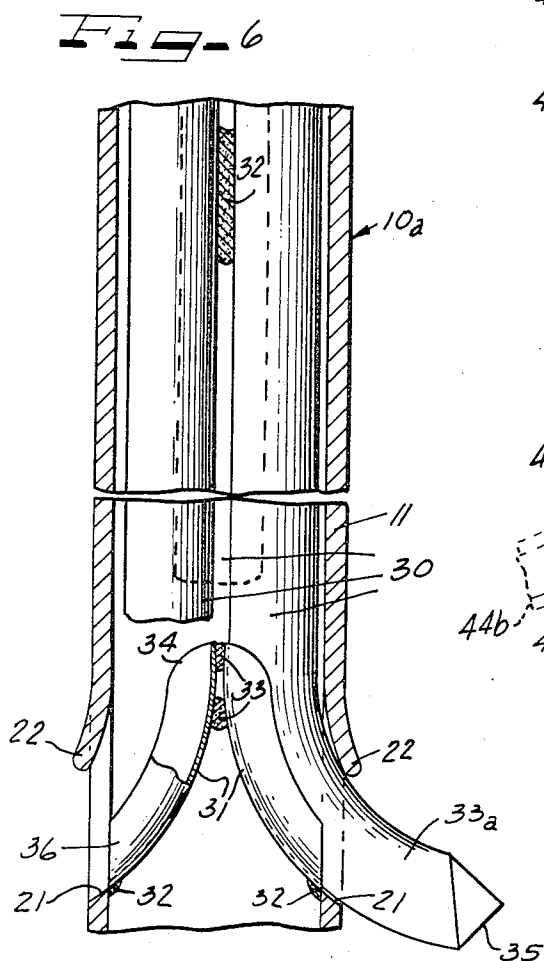
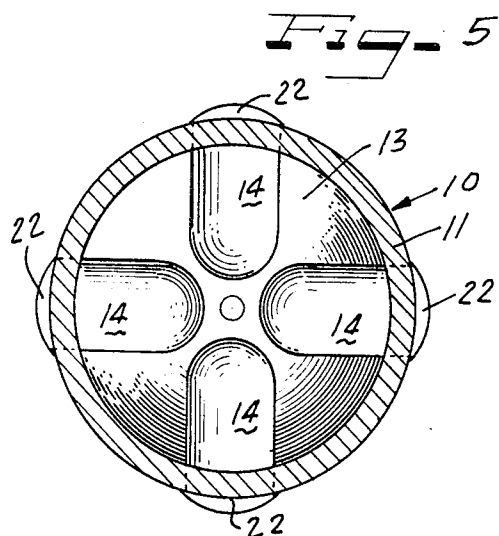
R. F. DEIKE

3,526,069

ANCHORING DEVICE

Filed Sept. 9, 1968

3 Sheets-Sheet 2



INVENTOR.

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Sept. 1, 1970

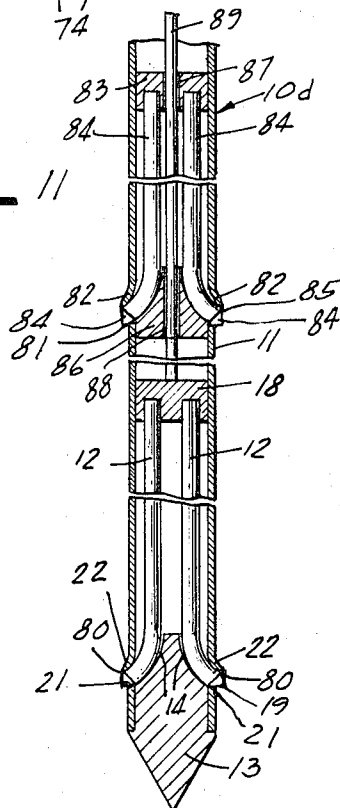
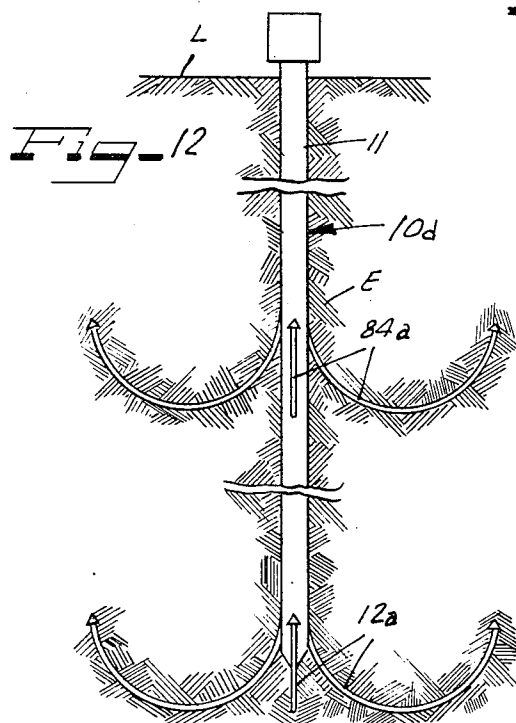
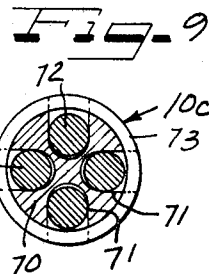
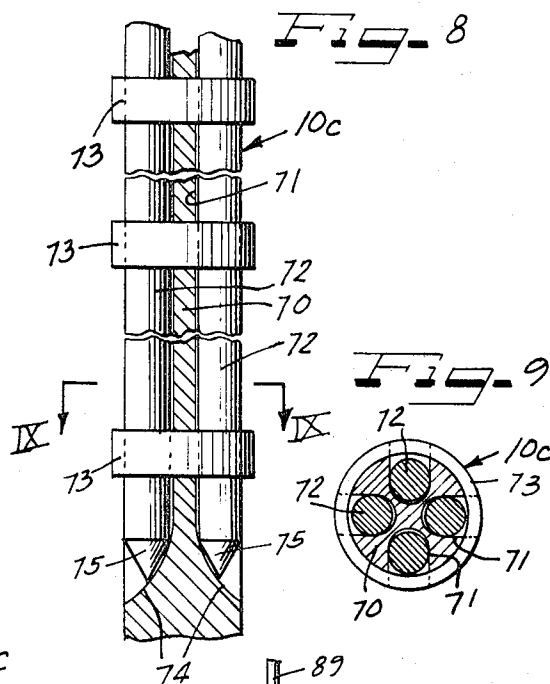
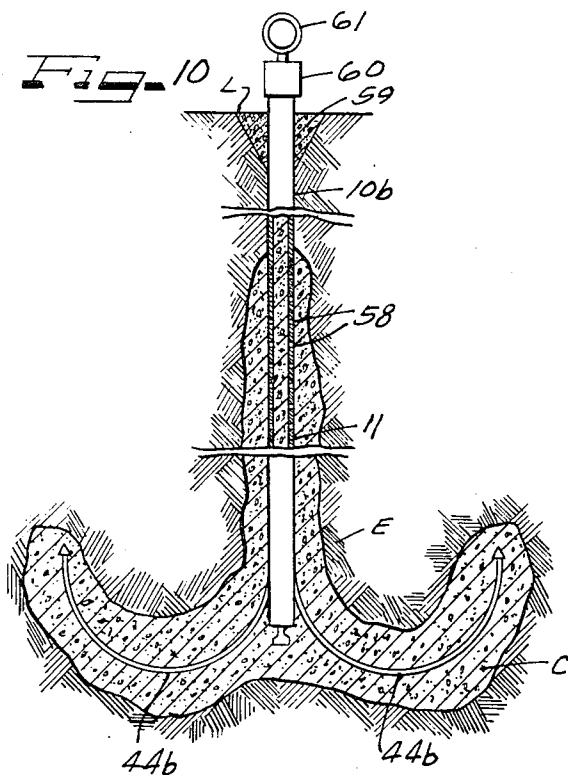
R. F. DEIKE

3,526,069

ANCHORING DEVICE

Filed Sept. 9, 1968

3 Sheets-Sheet 3



INVENTOR.

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3,526,069

ANCHORING DEVICE

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Int. Cl. E02d 5/80

U.S. Cl. 52-160

15 Claims

ABSTRACT OF THE DISCLOSURE

A ground or earth anchor for poles, posts, towers, guy-lines, tie-down mountings and the like composed of a pile member to be driven in the ground to a desired depth, rigid tentacle rods slidably carried by the pile member, means for forcing the rods downwardly along the pile member, and forming shoes on the pile member coacting with apertures in the pile member to provide extrusion orifices to deform the tentacle rods laterally outward and upwardly from the pile member to form anchoring roots resisting movement of the pile member under tension loads. The tentacle rods may be hollow with openings in their extended ends to force fluid, such as concrete, into the ground or to receive fluid, such as oil or water, from the ground.

FIELD OF THE INVENTION

This invention relates to the art of anchoring or firmly affixing structures to the soil or ground.

DESCRIPTION OF THE PRIOR ART

It has heretofore been proposed to increase the anchoring capacity of hollow piles by expanding the bases or bottoms thereof by means of mechanical expanders as in the Stevens U.S. Pat. 1,413,503, dated Apr. 18, 1922, or by means of explosives as in the Thomas U.S. Pat. 3,233,415 dated Feb. 8, 1966. Such arrangements require flexible and frangible hollow piles and surrounding soil formation or cavities which will accommodate the expansion.

SUMMARY OF THE INVENTION

According to this invention, there is provided a wide range of anchoring devices to suit a myriad of uses and conditions. These devices do not require flexible or frangible piles or stakes, do not even require hollow piles, are operative in solid rigid soil strata and do not require formation of surrounding cavities in the soil strata.

The anchoring devices of this invention are composed of an elongated pile or stake member which may be in the form of a hollow tube or pipe, a solid rod or bar, or a beam of any configuration such as an I-beam, H-beam, or a T-beam. This member is driven into or otherwise embedded in the earth for all or any portion of its length. It carries anchor rods, bars or tubes in parallel relation and slidably guides them to shoes and through orifices which extrude or bend them laterally or radially outward and axially upward as they are forced downwardly along the member. These anchor rods, bars or tubes are referred to as rigid tentacles which bore their way for a considerable distance into the soil surrounding the pile member to from upturned hooks embedded in the soil like roots on a tree. A driving rod or fluid pressure mechanism

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is provided to force the tentacles along the pile member against the shoes which are carried by the pile member at a desired level, preferably close to the leading or bottom end of the member.

The shoes on the pile member not only bend the tentacles from parallel relation with the pile member to cause them to radiate outwardly from the member but they also cooperate with the orifices in the pile member to have an extrusion die action to bow them upwardly as they radiate outwardly. The extended tentacles embedded in the soil resist movement of the pile member much like the tines or hooks or a sea anchor prevent movement when embedded in the ocean floor.

While a single tentacle is useful to resist movement of the pile member under axial tension loads and side loads in the plane of the extended tentacle, it is preferred to provide a plurality of tentacles radiating in different directions to resist movement of the pile member under tension loads applied in any direction. These tentacles may also be provided at different levels along the embedded portion of the pile member.

In a preferred embodiment of the invention, the pile member takes the form of a hollow pipe or tube with a piercing point or chisel-like drilling bit on the leading end thereof. The tentacles are slidably mounted in this tube and depend from a head which can easily be engaged with a driving rod actuated by a pneumatic hammer or form a piston actuated by a pneumatic hammer or from a piston actuated by fluid under pressure to force the tentacles over the forming shoes which can be a part of the piercing point or end plug on the tube.

In another embodiment, the tentacle rods may be in the form of hollow but rigid tubes capable of conveying fluid to either eject cement through holes along the length thereof and provide for a cementing of the pile member in position or to receive fluid such as water or oil from surrounding soil strata. In this arrangement, the anchor device also becomes a well conduit.

It is than an object of this invention to provide a ground anchor having rigid tentacles which are extended into surrounding earth to provide radiating hooks resisting movement of the anchor under tension loads.

Another object of this invention is to provide a ground anchor which is easily embedded in the ground and which carries tentacle rods in parallel relation therewith which are extruded radially outward to bore into the surrounding ground at desired levels for providing anchoring roots.

Another object of this invention is to provide a ground anchor having an elongated stake adapted to be embedded in the ground and carrying rigid tentacle rods adapted to be extruded from the stake into the surrounding ground to provide anchoring roots for the stake.

Another object of this invention is to provide a ground anchor having a tubular pile, tentacle rods slidable in the pile, and means for deforming the rods radially outward and axially upward as they are forced downwardly in the pile.

A specific object of this invention is to provide a combined anchoring and fluid conveying device composed of a hollow stake and hollow tentacle tubes extrudable radially from the stake to provide anchoring and fluid conveying members.

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Another object of this invention is to provide a ground anchor with in situ formed anchoring tentacles at one or more desired levels along the length thereof.

Other and further objects of this invention will be apparent to those skilled in this art from the following description of the annexed sheets of drawings which illustrate preferred embodiments of the invention:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a broken vertical cross-sectional view of a tubular type ground anchor according to this invention illustrating the initial driving of the device into the earth.

FIG. 2 is a view similar to FIG. 1 but illustrates the device after it has been driven into the earth.

FIG. 3 is a fragmentary sectional view of the bottom portion of the device of FIGS. 1 and 2 illustrating the completion of the tentacle extrusion operation.

FIG. 4 is a horizontal cross-sectional view taken generally along the line IV—IV of FIG. 3 but on a larger scale.

FIG. 5 is a cross-sectional view with parts omitted, taken along the line V—V of FIG. 1 showing the forming shoes in plan and on a larger scale.

FIG. 6 is a fragmentary broken longitudinal sectional view of a modified tentacle rod and shoe arrangement.

FIG. 7 is a fragmentary broken longitudinal cross-sectional view illustrating another embodiment using hollow tentacle rods.

FIG. 8 is a fragmentary broken, side elevational view with a part in longitudinal section illustrating another embodiment using a solid pile rod slidably supporting the tentacle rods.

FIG. 9 is a cross-sectional view taken along the line IX—IX of FIG. 8.

FIG. 10 is a somewhat diagrammatic side view illustrating an anchor device according to this invention in position in the ground and used for injecting cement into the soil strata to provide added anchoring strength and sealing.

FIG. 11 is a fragmentary broken cross-sectional view of a further embodiment of the anchoring device of this invention having two sets of tentacle rods at different levels.

FIG. 12 is a broken side view of the device of FIG. 11 in position in the ground.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The anchoring device 10 illustrated in FIGS. 1-5 is composed of a metal tube or pipe 11 providing the pile member, a plurality of solid rigid rods 12 providing the tentacles, a piercing point 13 secured to the bottom of the tube 11 and projecting into the tube to provide the forming shoes 14 for deforming the rods 12 as they are forced downwardly in the tube.

The tube 11, as illustrated, has a threaded end 15 receiving, in FIG. 1, a cap 16 with an extension rod 17 driven by a pneumatic hammer or the like (not shown) to force the device 10 into the earth E with the point 13 forming a piercing tool.

The rods 12 are secured to and depend from a cylindrical head or piston 18 which slides in the tube. The bottoms of the rods 12 have pointed ends 19 resting on the shoes 14. During the driving of the tube into the earth E, a spacer rod 20 may be positioned between the head 18 and the cap 16 to prevent the tentacle rods from bouncing off the shoes 14.

The tube 11 has apertures 21 registering with the shoes 14 and lips 22 are outturned around the tops of these apertures to cooperate with the shoes for forming extrusion orifices to properly shape the tentacle rods as they are forced radially out of the tube.

As shown in FIGS. 4 and 5, the top of the piercing point 13 provides the shaping shoes 14 and four of these shoes are provided at 90° intervals in the top of the

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piercing point. These shoes are chute-like paths, semi-circular in cross section, in the top of the point 13 which are open at the top and receive the pointed ends 19 of the rods 12. The paths are inclined radially outward to the apertures 22 and their exiting ends register with these apertures. In effect, therefore, the shoes are slides or guideways for bending the upright rods 12 radially outward to project through the apertures 21 while the lips 22 provide top walls holding the extruding rods against the bottoms of the shoes to cause them to assume the radius of curvature or inclination of the shoe walls. The angle of inclination of the shoes preferably lies in the range of 15° to 45° from the vertical and the lengths of the shoes are correlated with the angle of inclination so that the tentacles will be directed radially outward and upward without looping back toward the pile tube 11.

As illustrated in FIG. 2, after the tube 11 has been driven into the earth E to a desired depth, preferably where the threaded end 15 projects just above ground level L, the cap 16 and spacer rod 20 are removed from the tube and an elongated driving rod 23 is inserted through the open top of the tube and impacted against the head 18 to force the tentacle rods 12 downwardly where they will be bent by the shoes 14 to extrude through the apertures 21 while held by the lips 22 to assume the shapes illustrated in FIG. 3.

As shown in FIG. 3, the rod 23 has forced the head 18 close to the shoes 14 and the rods 12 have been extruded radially out of the tube into the earth E to form upwardly curved hooks 12a radiating for an appreciable distance from the tube and firmly embedded in the earth. The pointed ends 19 of these rods bore through the earth as the rods are forced downwardly in the tube and the shoe surfaces coact with the lips 22 so that the rods will always move outwardly and upwardly with the radius of curvature being such that it does not permit the rods to curl back on themselves and form inwardly directed loops.

It will be appreciated that when the hooks 12a radiate from the tube 11, as illustrated in FIG. 3, they form roots which will resist movement of the tube under tension loads whether applied axially upwardly or at an angle to the tube 11. Thus, the tube is not only securely anchored by virtue of its being driven in the ground but is caused to grip the ground through the tentacle rods similar to the manner in which tree roots hold the tree in upright position. The upward curve of the hook portions 12a will resist bending of the rods under upward pulling loads to a much greater extent than straight laterally or downwardly inclined projecting portions. Further, the bending of the rods along a curved path does not fatigue the metal nearly as much as if a right-angle bend were involved.

In the embodiment 10a of FIG. 6, the tube 11 receives three tentacle rods 30 in equal circumferentially spaced relation and welded together in such relation by weld bonds 31 at the top ends of the rods. The tube 11 has three apertures 21 for the three rods 30 and these apertures have overlying lips 22 as described in connection with the device 10. The bending shoes, however, are formed of three members 31 welded at 32 and 33 to the interior of the tube 11. Each shoe 31 is a semicylindrical member providing an axial open top 34 receiving the pointed end 35 of a rod 30 and the lower portion of each shoe has an open end 36 aligned with the aperture 21 to discharge the rod laterally out through the aperture. The shoes 31 are curved to bend the rod and form the hook-like projection 33a in the same manner that the hook-like portion 12a is formed on the rod 12 of the device 10. Thus, in the device 10a, the shoes are separate from the piercing point as in the device 10, can be at any level in the tube, and the end of the tube can be provided with any type of drill bit or piercing point.

In the anchor device 10b of FIG. 7, the tube 11 receives an end plug 40 in the bottom end thereof which has a depending threaded lug 41 on which is mounted a

rockdrill bit 42. The upper end of the plug 40 provides shoes 43 for shaping the tentacle rods through the tube apertures 21 as described in connection with the device 10. However, in the device 10b, the tentacle rods take the form of hollow tubes 44 having their upper ends welded in a reenforcing ring 45 to provide the rod assembly. The upper ends of the tubes project beyond the ring 45 to provide portions 46 which extend into recesses in a piston head 47 slidably mounted in the tube and equipped with seals or piston rings 48 to provide a tight leak-proof sliding connection in the tube for the piston.

The tentacle tubes 44 are initially curved at 44a along their bottom ends over the shoes 43 and have piercing points 49 secured in their outer ends lying in the apertures 21. Holes 50 are provided in the tubes behind these piercing points.

The piston 47 has a central passage 51 connected by branch passages 52 to the upper ends 46 of the tubes 44 which are secured in the recesses in the bottom of the piston. A spring-loaded valve 53 separates the passage 51 from the passages 52.

A rod 54 is threaded into the top of the piston 47 and has a fluid passage 55 therethrough registering with the passage 51 above the valve 53.

When the tube 11 is being driven in the ground and the tentacle rods 44 are encased in the tube, fluid can be forced through the rod passage 55 under sufficient pressure to open the valve 53 for flow through the tubes 44 and out of the apertures 50 into a passage 56 in the plug 40 which registers with a passage 57 in the rockdrill bit 42. Thus, the drill bit can be lubricated with water or other fluid during the impacting of the tube into the earth. The piercing points 49 on the ends of the tentacle tubes 44 close the tubes and the apertures 21 so that the fluid fills the tube 11 between the piston 47 and the plug 40 and can flow through the passage 56 to the tool bit.

The points 49 have barbs 49a thereon engaging the lips 22 to prevent retraction of the tentacle tubes 44 into the tube 11.

When the tube 11 has been embedded in the earth to a suitable depth, the rod 54 can be impacted to force the piston 47 toward the bottom of the tube 11 thereby extruding the hollow rods 44 causing them to form the anchoring hook portions 44b radially outward from the tube. Instead of driving the piston 47 with an impacting rod, hydraulic or pneumatic pressure in the tube 11 above the piston can be utilized to force the piston downwardly in the tube 11.

In the extended positions of the tubular rods 44 the apertures 50 are located outside of the tube 11 and fluid such as cement can be forced through the tube 11, through the hollow rods 44 and through the apertures 50 to more firmly anchor the hook-like ends 44a in the earth. Conversely the apertured hollow rods can be used to receive water or oil from surrounding soil so that the device 10b is also useful as a well conduit.

FIG. 10 illustrates the manner in which an anchoring device 10b such as shown in FIG. 7 can be used to convey cement around the tube 11 and around the hook portions 44b of the hollow tentacle rods 44. As shown in FIG. 10, cement C ejected from the apertures in the hook-like ends 44b of the tentacle rods surround these rods in the earth E and in addition, the tube 11 is perforated at 58 to eject cement around the tube. A cone 59 of cement is provided around the tube at the ground level L. As shown, the projecting end of the tube 11 receives a cap 60 with an eye member 61 providing an anchor for a guyline or the like. The cementing technique can be used to cement well casings in place and for many other purposes.

The anchor device 10c of FIGS. 8 and 9 utilizes a solid rod 70 in place of the tube 11. This rod 70 has four equally-spaced grooves 71 extending longitudinally along the length thereof and each groove 71 receives a tentacle rod 72 in sliding relation. These rods 72 are held in the grooves by circumscribing rings or sleeves 73 at spaced

intervals along the length of the rods 71. The bottom ends of the grooves are curved radially outward to provide the forming shoes 74 and in the initial position, the pointed ends 75 of the tentacle rods 72 rest in the top ends of these shoes 74.

When the pile rod 70 is driven in the ground to the desired depth, the tentacle rods 72 can be driven downwardly along the pile rod to be extruded by the shoes 74 to form the hook-like anchors described hereinabove.

The anchor device 10d of FIG. 11 is provided with two sets of tentacle rods for extrusion at different levels. As shown, the pointed end 13 provides the shoes 14 discharging to the apertures 21 in the same manner as in the device 10 and the head 18 has the tentacle rods 12 depending therefrom as in the device 10. However, the bottom ends of the tentacle rods adjacent the points 19 thereof are initially bent outwardly to project through the apertures 21. Barbs 80 are provided on these pointed ends 19 to lock against the mouths of the apertures 21 and prevent retraction of the rods into the tube during the driving of the tube into the ground. The rod and head assembly are thus locked against reciprocating movement in the tube during the driving of the tube into the ground.

The tube 11 has a second set of apertures 81 at a higher level than the apertures 21 and these apertures have the over-hanging forming lips 82, the same as the lips 22. A second head 83 is provided in the tube and has a plurality of tentacle rods 84 depending therefrom with outwardly bent pointed ends 84 projecting through the apertures 81 and having the barbs 85 locked against the mouths of these apertures to hold the assembly against reciprocation in the tube and to prevent retraction of the rods back into the tube during the driving of the tube into the ground. A second set of forming shoes 86 is provided in the tube and secured thereto so as to discharge the rods through the apertures 84.

The head 83 has a central aperture 87 and the shoes 86 have a central aperture 88 so that a driving rod 89 can be passed through the head and shoes to engage the bottom head 18 and effect the extrusion of the rods 12. The rods 84 are similarly extruded by a rod such as 89 which will engage the head 83.

As shown in FIG. 12, when the device 10d is driven in the ground and the rods extruded therefrom, upwardly bowed hook-like portions 12a of the bottom rods and 84a of the upper rods will be formed to provide two sets of anchor hooks at different levels. It will, of course, be understood that while four rods 12 are illustrated together with four rods 84 to form two sets of four anchoring hooks radiating from the tube at different levels, any desired number of tentacle rods can be used and any number of sets of such rods can be used. For example, it may be desirable in some instances to provide the rod sets in multiples of two or three rods each and to so orient the rods of the respective sets as to have them radiate in different planes when extruded into the ground.

From the above description, it should therefore be clear that the ground anchors of this invention utilize a unique principle of extruding rigid tentacles from retracted positions parallel with a pile member to radiating positions providing rigid hooks resisting movement of the pile member under tension loads. The rigid tentacles have a capacity of boring outwardly and upwardly into the soil strata surrounding the pile member as they are being extruded and the upwardly curved contour of the extruded tentacles resists bending to increase the resistance to movement of the device even under very high tension loads.

Although I have herein set forth my invention with respect to certain specific principles and details thereof, it will be understood that these may be varied.

I claim as my invention:

1. A ground anchor comprising an elongated pile member for embedding in the ground, rigid tentacle means slidably supported by said pile member, shoe means

carried by said pile member acting on said rigid tentacle means when said tentacle means are forced thereagainst, means overlying the shoe means cooperating therewith to form a separate extrusion orifice for each tentacle means holding said tentacle means against said shoe means, and said shoe means having an angle of inclination relative to said pile member and a guiding length so correlated therewith that said tentacle means will be directed radially outward and upward without looping back toward the pile member when forced through said extrusion orifices for forming anchoring root means for the pile member.

2. An earth anchor which comprises an elongated pile member to be embedded in the earth, bending shoes on said pile member near the leading end thereof, rigid tentacle rods slidably supported by said pile member lengthwise of the pile member and having leading ends engageable with said bending shoes, said pile member having a separate aperture in the side thereof for each rod adjacent the bending shoes cooperating therewith for forming a separate extrusion orifice for each tentacle rod holding the tentacle rod against the bending shoe, and said bending shoes having an angle of inclination relative to the pile member and a bending length correlated with the angle of inclination to direct the tentacle rods outwardly and upwardly without looping back toward the pile member, and means for forcing said tentacle rods over said shoes, and through said apertures, to be deformed thereby and radiate from the pile member to provide root means therefor.

3. A device for anchoring structure to the ground which comprises an elongated rigid tube adapted to be driven into the ground to a desired depth, ground piercing means on the leading end of said tube, bending shoes in said tube, said tube having circumferentially spaced apertures registering with said bending shoes, surfaces around the top portions of said apertures coacting with the bending shoes for forming extrusion orifices, a piston member slidably mounted in said tube, a plurality of rigid rods depending from said piston member having leading free ends engaging said bending shoes, means for forcing said piston toward said bending shoes to extrude the rods through said orifices, said bending shoes having surfaces receiving said rods inclined relative to said tube and of a length correlated with the angle of inclination to direct said rods outwardly from said tube without looping back toward the tube, and said surfaces around the top portions of said apertures holding said rods against said bending shoe surfaces to force the rods to assume the configuration of said surfaces to radiate from said tube and form anchoring roots for the tube.

4. An earth anchor which comprises an elongated rigid pile member adapted to be embedded in the earth, axial grooves in the periphery of said pile member open to said periphery along the length thereof, tentacle rods slidably mounted in said grooves, means embracing said tentacle rods holding them in parallel relation to the pile member, said pile member having bending surfaces communicating with said grooves engaging said tentacle rods, means holding said tentacle rods against said bending surfaces, and said tentacle rods being bendable over said bending surfaces to radiate from the pile member and form root anchors thereof.

5. An anchor device comprising an elongated pile member adapted to be driven into the ground, a plurality of rigid tentacle means slidable longitudinally along said pile member and having free leading ends near the leading end of the pile member, extrusion die means on said pile member engaging the leading ends of the tentacle means, means for forcing said tentacle means against said die means, apertures in the sides of the pile member adjacent the die means receiving the tentacle means there-through and holding the tentacle means against said die means, and said die means being shaped to extrude the tentacle means radially outward and axially upward from

the pile member to form anchoring hook-like projections around the pile member.

6. The anchor device of claim 5 wherein the tentacle means are a plurality of elongated hollow rods having openings at their leading ends.

7. The ground anchor of claim 1 wherein the rigid tentacle means are a plurality of circumferentially spaced elongated rods depending from a head slidably supported by the pile member.

8. The ground anchor of claim 1 having a plurality of sets of tentacle means in superimposed relation slidably supported by said pile member, a plurality of sets of shoe means carried by said pile member at a plurality of levels, each coacting with a separate set of tentacle means at said levels, means overlying said shoe means at each level cooperating therewith to form separate extrusion orifices for the tentacle means to provide anchoring root means at a plurality of levels along the length of said pile member.

9. The ground anchor of claim 2 wherein the pile member is a hollow tube, the bending shoes are positioned at a plurality of levels along the length of said tube, and the separate apertures are provided adjacent each bending shoe at the different levels whereby the tentacle rods will provide root means at a plurality of levels.

10. The anchor of claim 9 wherein the tentacle rods are carried in sets by superimposed heads slidable in the tube, the heads above the bottom head having passages therethrough, and impacting means adapted to fit through said passages in said heads are provided to engage said heads for forcing the tentacle rods against the shoes.

11. A ground anchor comprising an elongated tubular pile member having a lower end for embedding in the ground, a piston head slidable in the tubular pile member, a plurality of rigid hollow tentacle rods depending from said piston head in said pile member, said pile member having a separate aperture in the side thereof for each rod, means for driving said piston head to force said rods through said apertures for bending said rods laterally outwardly from said pile member through said apertures, the leading ends of said rods having openings for conveying fluid, and a fluid passageway through said piston head communicating with the interiors of said rods to transmit fluid between the rod openings and the upper end of the pile member.

12. An earth anchor which comprises an elongated tubular pile member adapted to be embedded in the earth, tentacle rods slidably supported in said tubular pile member, circumferentially spaced apertures in the sides of said tubular pile member receiving the tentacle rods there-through, bending shoe means in said tubular pile member registering with said apertures to provide extrusion orifices for said tentacle rods, and said tentacle rods having pointed ends with barbs engaging said orifices to prevent retraction of the rods into the tube.

13. A device for anchoring structure to the ground which comprises an elongated rigid tube adapted to be driven into the ground to a desired depth, ground piercing means on the leading end of said tube, bending shoes in said tube, apertures in said tube registering with said bending shoes having surfaces coacting with the shoes to form extrusion orifices, a piston member slidably mounted in said tube, a plurality of hollow rods depending from said piston member, said piston member having a passage therethrough communicating with said hollow rods, means for forcing said piston to drive the rods through said orifices for radiating from the tube to provide anchoring roots for the tube, said rods having orifices along the lengths thereof projected from said tube, and means for forcing fluid through said piston passage and rods for ejection through said openings.

14. The device of claim 13 wherein the tube is also apertured for flow of fluid therefrom.

15. An earth anchor which comprises an elongated hollow tube adapted to be embedded in the earth, said

tube having apertures in the sides thereof, rigid hollow rods slidable in said tube and deformable through said apertures to form anchoring roots projecting from the tube, openings through the hollow rods along the projected lengths thereof, and means for receiving fluid from the tube that is drained from surrounding earth through the openings in said hollow rods.

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PRICE C. FAW, JR., Primary Examiner

U.S. Cl. X.R.

61—53.68

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,526,069

Dated September 1, 1970

Inventor(s) ROBERT F. DEIKE

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 63, "from" should be --form--.

Column 2, line 12, "or a sea" should be --of a sea--.

Column 2, lines 28 and 29, "actuated by a pneumatic hammer or from a piston actuated by fluid" should be --actuated by fluid--.

Column 5, line 33, "entacle" should be --tentacle--.

Column 5, line 72, "tenacle" should be --tentacle--.

Column 6, line 68, "fourth" should be --forth--.

Column 7, line 35, "circumerentially" should be --circumferentially--.

Signed and sealed this 4th day of January 1972.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents