United States Patent

Deike

[15] **3,680,274**

[45] **Aug. 1, 1972**

[54] **ANCHORING DEVICE**

[72] Inventor: **Robert F. Deike,** Cheyenne, Wyo.

[73] Assignees: **William H. Chamberlain; Anna B. Chamberlain,** Cheyenne, Wyo. ; part interest to each

[22] Filed: **June 25, 1970**

[21] Appl. No.: **49,727**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 758,554, Sept. 9, 1968.

[52] **U.S. Cl.** **52/157,** 52/160, 61/53.68

[51] **Int. Cl.** **E02d 5/80**

[58] **Field of Search**.....52/165, 157, 160, 155, 156, 52/166; 61/53.68, 53.5

[56] **References Cited**

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Primary Examiner—Price C. Faw, Jr.
Attorney—Hills, Sherman, Meroni, Gross & Simpson

[57] **ABSTRACT**

A compression and tension load carrying ground or earth anchor having an elongated tubular pile member with tapered helical vanes therearound, a head plate at its upper end thereof, a cup slidable therein, tentacles depending from the cup, and tentacle bending orifices formed in the side wall. The vanes act as screw threads or plow shares when the pile member is driven in the ground, the head plate compacts the underlying earth and seals off any leakage path formed by the pile member or vanes, and the cup is forced downwardly in the pile member to extrude the tentacles through the bending orifices to form anchoring roots at one or more levels. The tentacles have barbed pointed ends fitting flush in the bending orifices. The tentacles may be tubular with orifices downstream from their pointed ends, orifices may be formed in the pile member and through the vanes and concrete may be pumped through the pile member and tentacles to flow through the orifices and form a bed of concrete around the anchor.

10 Claims, 12 Drawing Figures

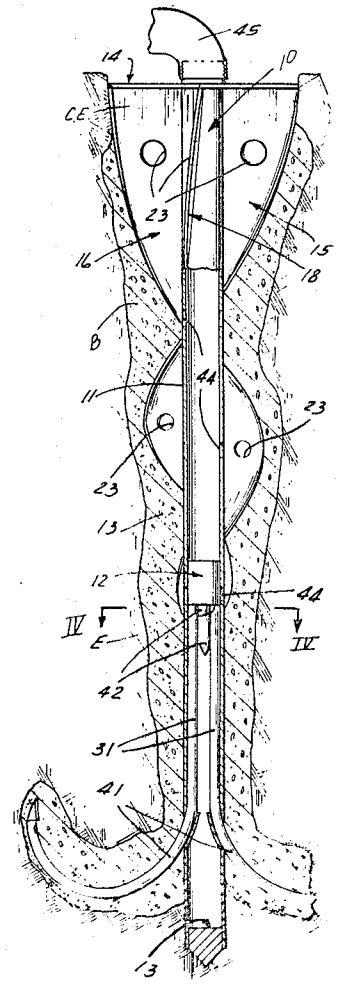

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Fig. 1

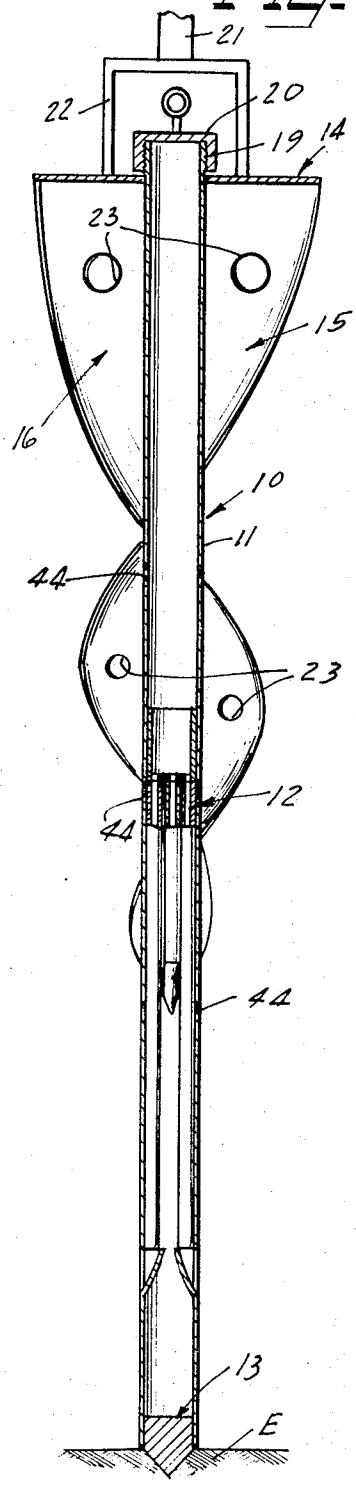


Fig. 2

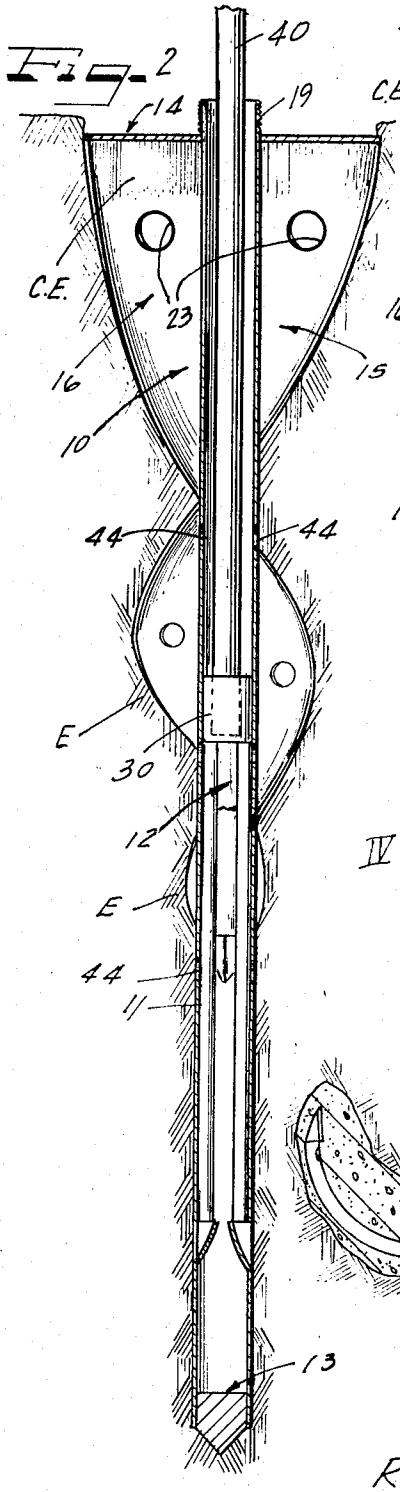
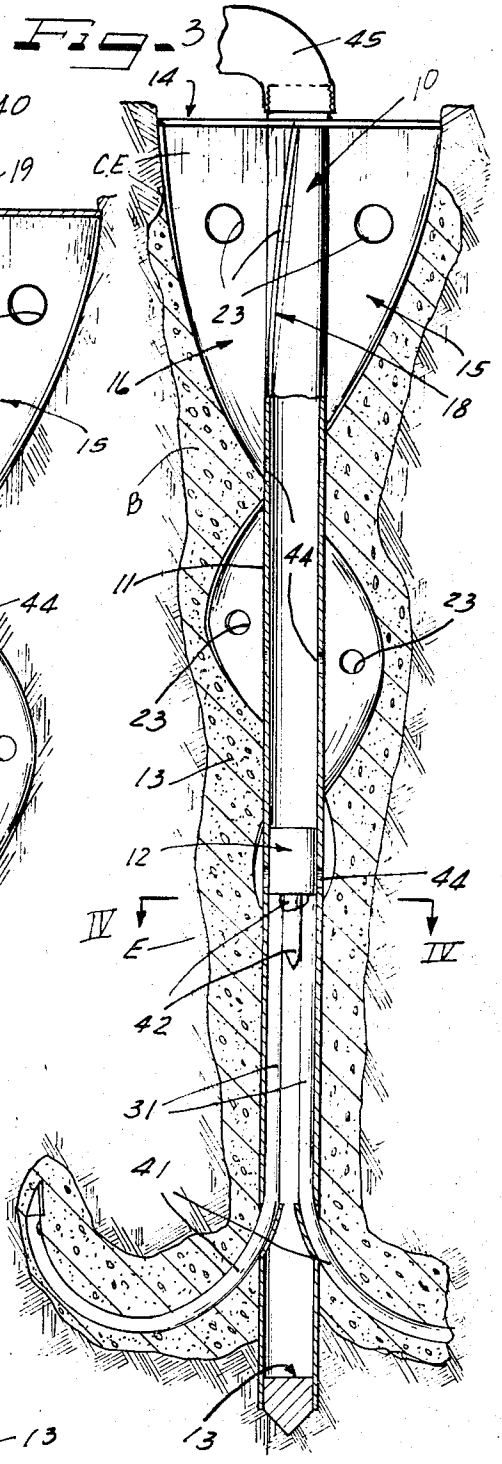


Fig. 3



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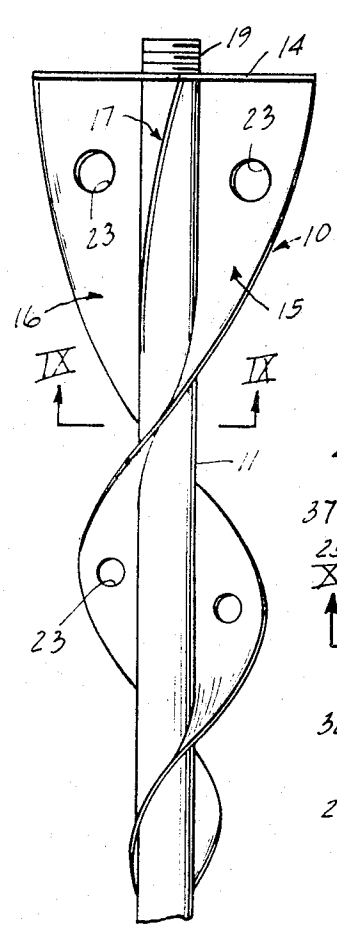

Fig. 5

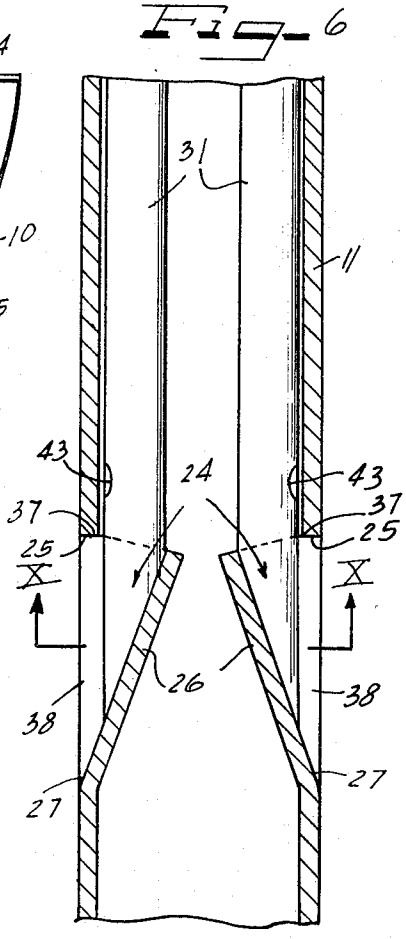

Fig. 6

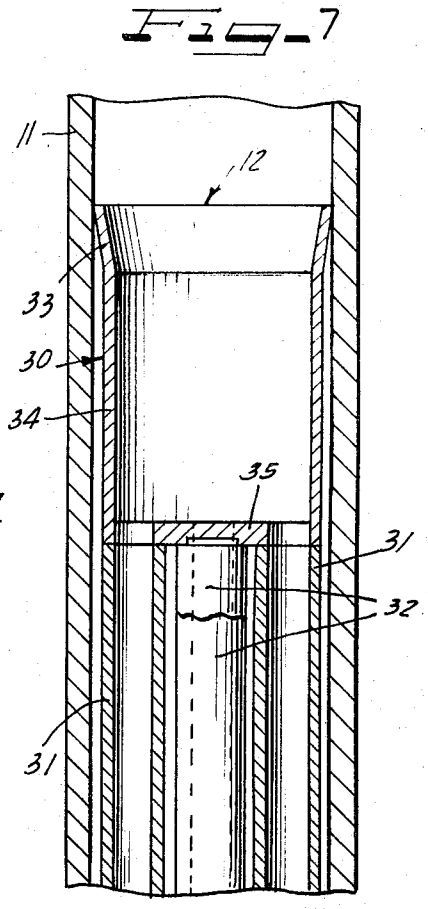

Fig. 7

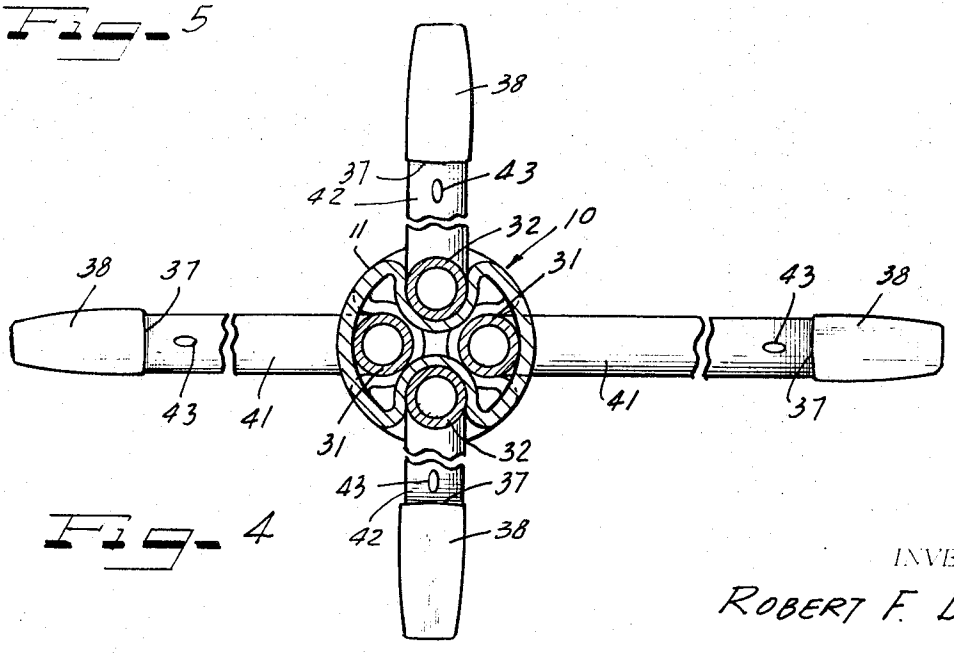

Fig. 4

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Fig. 8

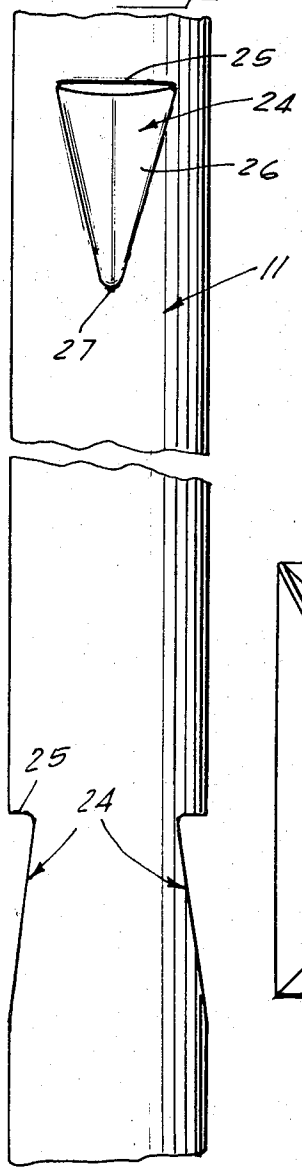


Fig. 12

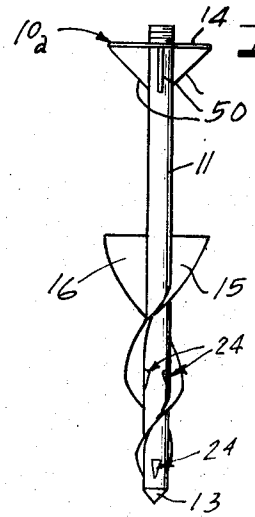
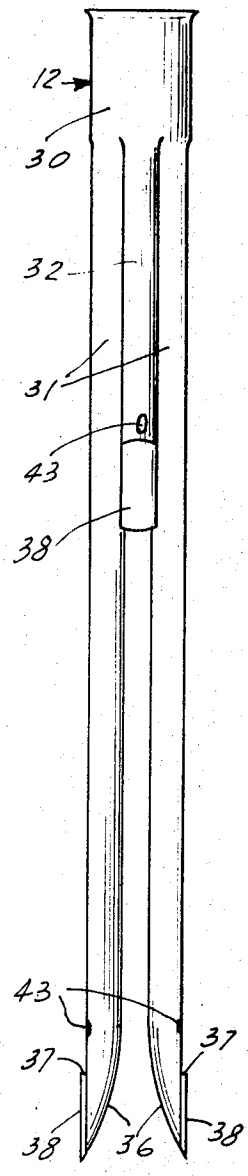


Fig. 11



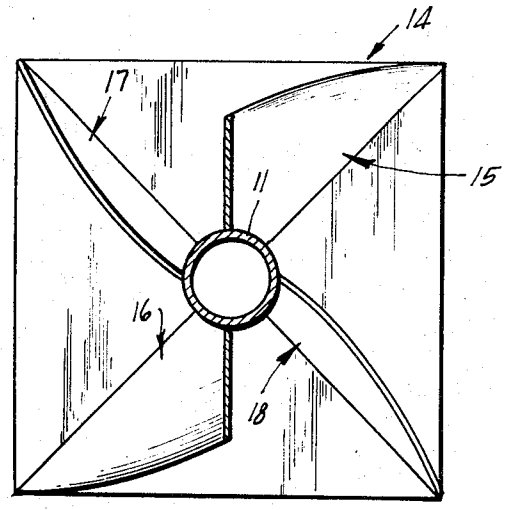


Fig. 9

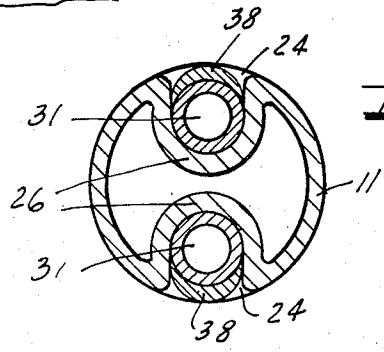


Fig. 10

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ANCHORING DEVICE

RELATED APPLICATION

This application is a continuation-in-part of my copending application, U.S. Serial **758,554**, filed September **9, 1968**, entitled "ANCHORING DEVICE", U.S. patent **3,526,069** granted September **1, 1970**.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the art of anchoring structures to the ground and capable of supporting heavy tension or compression loads.

2. Description of the Prior Art

Fence posts and pole anchors with prongs forced laterally of the driving point are known in the art as, for example, in the Adams U.S. Pat. No. 314,303 patented Mar. 24, 1885 and in the Hovrud U.S. Pat. No. 958,127 patented May 17, 1910. Such devices are not suitable for supporting compression loads and do not have lateral stability. Compression load supporting piles with straight divergent prongs are also known in the art as, for example, in the Proctor U.S. Pat. No. 3,332,247 dated July 25, 1967. Such piles, however, have little tension load carrying capacity and are difficult to drive into the ground.

BRIEF DESCRIPTION OF THE INVENTION

This invention now provides improvements on the Anchoring Device of my aforesaid parent U.S. Pat. application, Ser. No. 758,554 filed Sept. 9, 1968, enhancing both the tension load and compression load carrying capacity of the device. These improvements include the provision of screw-like vanes around at least a portion of the pile member, the provision of a head plate on the pile member, and the provision of extrusion orifices co-acting with the leading ends of the tentacles in such a manner as to present a smooth side wall on the pile free from protuberances. In addition, a simplified self-sealing cup-like head carries the tentacles in the pile member. These improvements cooperate to facilitate driving of the pile member into the ground when the tentacles are retracted in the pile member, to compact and seal off the ground around the pile member and to resist loosening of the pile member in the ground when the tentacles are extended. The pile member is driven into the ground and allowed to rotate so that the vanes act like screw threads or plow shares to thread the pile member into the ground, thus facilitating the pile driving operation. When the tentacles are extended from the pile member, however, reverse rotation is prevented and the pile member is firmly locked in the ground. The locked vanes provide large face areas in friction confronting relation to the surrounding earth, and the pile member is thus locked against sinking under compression loads and against raising under tension loads.

In addition, the vanes stiffen the pile member and the top plate on the pile member compacts the soil, sealing off any leakage paths around the pile member and vanes so that the sunken anchoring device may be surrounded with concrete pumped through the pile and tentacles. In addition, the vanes are preferably apertured so that the concrete can flow from one vane face to the other, forming a reinforcing bar and locking the concrete to the vane.

The devices of this invention have enhanced usage as footings for houses, as well as for post and tower supports and tie-down mountings.

It is then an object of this invention to improve the device of my parent application, Ser. No. 758,554, U.S. Pat. No. 3,526,069 by providing helical vanes around the pile member, a laterally extending head plate at the top of the pile member and co-acting tentacles and orifices which fit flush with the contour of the pile member.

Another object of this invention is to provide a ground anchor with enhanced compression and tension load carrying capacity having a pile member partially surrounded with helical screw vanes stiffening the pile member against bending, facilitating driving of the pile member into the ground, and resisting movement of the pile member in the ground.

Another object of this invention it to provide a ground anchor with a head plate compacting the ground around the anchor.

A further object of the invention is to provide a ground anchor with a tubular pile member having bending orifices integrally formed in the sides of the tube.

A specific object of the invention is to provide an improved pile member for ground anchors having die-pressed downwardly opening orifices in the side walls thereof and tentacle bending faces projecting into the tube and diverging to the surface of the tube.

Another specific object of this invention is to provide a tentacle equipped orificed tubular pile member for ground anchors free from protuberances interfering with the driving of the pile member into the ground.

Another specific object of this invention is to provide a tubular ground anchor with screw vanes and an overlying ground compacting plate.

Other and further objects of the invention will become apparent to those skilled in this art from the following descriptions of a preferred embodiment of the invention shown on the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a vertical cross-sectional view, with parts in elevation, of a ground anchor according to this invention illustrating the position of the components at the start of the driving of the device into the earth;

FIG. **2** is a view similar to FIG. **1** illustrating the ground anchor after it has been driven into the earth;

FIG. **3** is a view similar to FIG. **2** but illustrating the device after the tentacles have been extended and concrete has been forced around the device in the earth;

FIG. **4** is a transverse cross-sectional view, with parts broken away, taken generally along the line IV—IV of FIG. **3**;

FIG. **5** is a fragmentary elevational view of the ground anchor of FIGS. **1–4** showing one of the short vanes supporting the top head plate;

FIG. **6** is an enlarged fragmentary vertical sectional view of a portion of the pile tube of the device illustrating the manner in which the tentacles are initially seated in the bending orifices;

FIG. **7** is a view similar to FIG. **6** but illustrating the head end of the tentacle unit in the pile tube;

FIG. **8** is a fragmentary broken side elevational view of the pile tube showing the bending orifices;

FIG. 9 is a transverse sectional view taken generally along the line IX—IX of FIG. 5;

FIG. 10 is a transverse cross-sectional view taken along the line X—X of FIG. 6;

FIG. 11 is an elevational view of the tentacle unit; and

FIG. 12 is an elevational view similar to FIG. 5 but illustrating a modified positioning of the vanes on the pile tube.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The anchor **10** of FIGS. **1–5** has a metal pile tube **11**, a tentacle unit **12** slidable in the tube, a ground-piercing head **13** secured in the bottom of the tube, a flat head plate **14** surrounding the top of the tube, a pair of diametrically opposed tapered helical vanes **15** and **16** secured to the tube along their axial length having wide top ends secured under the head plate **14** and narrow leading ends axially spaced from the head plate and a pair of diametrically opposed short gusset vanes **17** and **18** are provided between the vanes **15** and **16** and extend from wide top ends under the head plate **14** to pointed leading ends on the tube.

The tube **11** has a threaded top end **19** projecting above the head plate **14** and a cap **20** threaded on this end, as shown in FIG. **1**, may serve as a means for connecting the device to tie lines or the like or the threaded end of the tube may be directly connected to the bottom end of a post or the like.

The vanes **15** and **16** are helically twisted to provide about one complete revolution or turn of the pile tube **11** as it is driven into the ground to a depth where the head plate **14** compacts the top level of the ground. The vanes are about two feet in length so that rotation is about one turn in about two feet of insertion into the ground. The short gusset vanes are twisted to conform with the pitch of the top ends of the vanes **15** and **16** so that the screw thread effect of the vanes **15** and **16** will not be resisted by the vanes **17** and **18**.

As shown in FIG. **1**, the device **10** has the point **13** entering the earth E and an impact hammer **21** with a cup end **22** surrounding the threaded end **19** of the tube **11** and resting on the head plate **14** adjacent the tube is provided to drive the device into the earth E to a depth where the head plate **14** will engage the ground as shown in FIG. **2**. During this driving operation, the tentacle unit **12** is completely retracted inside of the tube **11** and offers no resistance to the driving action. As illustrated in FIG. **2**, the earth underlying the head plate **14** is compacted at C.E. and the driving of the device into soft or loose earth may require forcing of the plate **14** below ground level, as illustrated.

It should be understood that the driving of the pile member **11** into the earth E is initially a straight axial movement much in the nature of driving a nail into a block of wood. Then when the leading ends of the vanes **15** and **16** engage the earth, further driving of the pile member into the earth will effect a rotation of the pile member much in the nature of threading a screw into a block of wood. The helical pitch of the vanes **15** and **16** is such as to actually assist the driving of the pile into the ground, and the threading action has a plow share effect on the earth loading and compacting the soil on the back side of the vanes. Apertures **23** are preferably provided through the vanes **15–18** to permit concrete to flow therethrough as will be more fully hereinafter described.

The tube **11**, as shown in FIGS. **6**, **8** and **10** has bending orifices **24** formed in the side wall thereof. These orifices are provided in pairs in diametrically opposed relation, as shown in FIGS. **6** and **8**, and several pairs of such orifices at different levels along the length of the tube may be provided, as shown in FIG. **8**. Each orifice is formed by die punching the tube, providing a transverse cut **25** and depressing the tube wall under lying the cut into the tube forming a downwardly opening hole and a bending shoe **26** diverging from the inner rim of said hole to the exterior surface of the tube and also converging from the lateral extremities of the cut **25** to a pointed end **27**. Thus, the orifices **24** are free from any protruding lips or bulges and, as shown in FIG. **6**, have a downwardly opening entrance end inside of the tube **11** and a lateral opening backed by the bending shoe **26**.

The tentacle unit **12**, best shown in FIG. **11**, includes a head **30** with two pairs of dependent tentacle tubes **31** and **32**. The tubes **31** are in diametrically opposed relation and are longer than the tubes **32**, which are offset π° from the tubes **31**.

The head **30**, as shown in FIG. **7**, is a metal cup with a deformable, outwardly bevelled mouth **33** slidable on the inner wall of the pile tube **11** and converging to a cylindrical side wall **34** which fits freely in the tube **11** and has an apertured bottom **35** from which depends the tentacle tubes **31** and **32** so that the interiors of these tubes are in full communication with the interior of the cup.

The tentacle tubes **31** and **32** have pointed ends **36** fitting the bending shoe walls **26** of the orifices **24** and also have barbs **37** engaging the cut edge **25** of the orifices. The outer faces **38** of these pointed ends are cylindrical and fit flush with the wall of the tube **11** so that the orifices are closed and no protuberances are provided.

When the pile **11** is driven into the ground to its desired depth, as shown in FIG. **2**, a ram rod **40** is inserted through the open top end of the tube to engage the head **30** of the tentactle unit **12** and the unit is driven toward the bottom of the tube **11**, thereby forcing the tentacles **31** and **32** through the orifices **24** whereupon the bending shoe portions **26** of these orifices deform the tentacles laterally outwardly and axially upwardly from the tube into the earth to provide a first pair of anchoring roots **41** adjacent the bottom end of the tube **11** and a second pair of anchoring roots **42** at a level above the roots **41** and in right angle relationship therewith, as shown in FIG. **4**.

The tentacle tubes may be apertured as at **43**, immediately behind the barbed portions **37** of the points **36**. The roots **41** and **42**, of course, anchor the tube **11** to the earth, preventing relative movement of the tube in the earth.

If desired, the tube **11** can also be apertured at spaced intervals along its length as shown at **44** in FIG. **3**, and a conduit **45** can be coupled to the top end of the tube for pumping concrete through the tube. The pressure of the concrete will spread the deformable mouth **33** of the cup **30** into tight sealed engagement with the tube **11** so that the concrete can only flow through the

tentacle rods to be discharged through the orifices **43** and through the tube orifices **44**. A bed B of concrete will thus be formed around the tube **11** and the anchoring roots **41** and **42**. This concrete will tend to flow along the front faces of the vanes **15–18** and can flow through the apertures **23** in these vanes to form concrete columns extending on both faces of the vanes. The compacted earth C.E. underlying the head plate **14** will seal off the earth surrounding the anchor device so that the concrete will not flow above ground level. A very firm concrete bed is thus easily formed around the anchoring device to enhance the tension and compression load carrying capacity of the device.

As shown in FIG. **12**, a modified anchoring device **10***a* of this invention has the vanes axially spaced from the head plate. As therein shown, the pile tube **11** has the head plate **14** secured thereto near the upper end thereof with gusset vanes **50** secured to the under face of the plate and to the side wall of the pile tube **11** to provide a rigid head. The pair of vanes **15** and **16** described in connection with the anchor unit **10**, are then secured to the sides of the pile tube **11** to terminate in spaced relation beneath the gusset vanes **50**. It will, therefore, be understood that the vanes can be positioned anywhere along the length of the pile member **11**.

From the above descriptions, it should be therefore understood that the anchor devices **10** and **10***a* of this invention have tubular pile members driven into the ground and equipped with helical vanes to provide a screw thread action during the driving operation, to resist bending of the pile, and to provide additional ground engaging surfaces preventing movement of the device relative to the earth after it has been driven into position in the earth. The devices of this invention include tentacle units slidably mounted in the tubular pile and having pointed barbed leading ends locked in orifices in the tube wall. The tentacle unit is subjected to a driving operation after the pile has been driven into the ground to its desired depth and the unit provides anchoring roots projecting from the tube. The tube has a head compacting the earth and enhancing the compression load carrying capacity of the device. Concrete may be pumped through the pile member of the device and through the tentacles to provide an anchoring bed in the earth surrounding the device.

I claim as my invention:

1. A ground anchor comprising a tubular pile member adapted to be driven into the ground, a tentacle unit slidable in the pile member having an open top cup and depending hollow tentacle rods, bending orifices in the side wall of the pile member receiving said tentacle rods therethrough and shaped to deform said rods laterally outwardly and axially upwardly from the pile member when the cup is driven toward the leading end of the pile member, screw vane means surrounding a portion of the pile member, a head extending laterally from the pile member adjacent the top end of the pile member, said vane means adapted to thread the pile member into the ground, said head adapted to compress the underlying ground, and said pile member adapted to receive concrete therethrough under pressure for flowing through the cup and hollow tentacle rods to form a concrete bed around the pile member.

2. The anchor of claim **1** wherein the cup has a deformable mouth sealing against the tube when receiving concrete.

3. The anchor of claim **1** wherein a long pair and a short pair of tentacle rods depend from the cup and have leading ends fitting in the orifices flush with the outer wall of the tubular pile member.

4. A ground anchor comprising a rigid tube adapted to be driven in the ground, transverse cuts in said tube, the portions of said tube underlying said cuts being deformed into the tube forming downwardly opening holes in the tube defined by the top end edges of the deformed portions and the bottom edges of the cuts, and said deformed portions diverging outwardly and downwardly from the top end edges to the outer wall of the tube forming bending shoes, and tentacle rods in said tube having leading ends projecting through said holes and overlying said bending shoes with outer faces flush with the outer tube wall, said shoes deforming said rods laterally outward of the tube when the rods are forced through the holes.

5. The anchor of claim **4** wherein the leading ends of the tentacle rods are pointed and have trailing barbs engaging the bottom edges of the cuts to prevent retraction of the rods into the tube.

6. An earth anchor comprising a pile member adapted to be driven into the ground, said pile member having a flat head and diametrically opposed laterally extending screw vanes with wide trailing ends supporting the head and narrow leading ends terminating short of the leading end of the pile member, said vanes being twisted to provide about one turn of the pile member as it is driven into the ground up to said head and having a steep pitch to assist the driving of the pile member into the ground with a threading action having a plowshare effect on the earth loading and compacting the soil on the back side of the vanes, tentacle means carried by the pile member in a retracted position during the driving of the pile member into the ground, and means on the pile member effective to deform the tentacle means laterally outward from the pile member when the tentacle means are forced toward the leading end of the pile member, said laterally projected tentacle means locking the vanes against rotation in the ground to provide support for both tension and compression loads on the pile member.

7. An earth anchor comprising a pile member adapted to be driven into the ground, said pile member having a laterally projected head plate on the top end thereof, gusset plates secured to the pile member reinforcing the head plate against deformation and laterally extending screw vane means underlying said head plate and extending around the pile member with a steep pitch to assist the driving of the pile member into the ground with a threading action having a plowshare effect on the earth loading and compacting the soil on the back side of the vane means, tentacle means carried by the pile member in a retracted position during the driving of the pile member into the ground, and means on the pile member effective to deform the tentacle means laterally outwardly from the pile member when the tentacle means are forced toward the leading end of the pile member, said laterally projected tentacle means locking the vanes against rotation in the ground to provide support for both tension and compression loads on the pile member.

8. An earth anchor comprising an elongated tube apertured along the length thereof and adapted to be driven into the ground, laterally extending screw vane means around a portion of the tube having a steep pitch effective to thread the tube into the ground during the driving of the tube with a plowshare effect on the earth loading and compacting the soil on the back side of the vane means, a head on the tube adapted to compact the ground above the screw vane means, tentacle means carried by the tube in a retracted condition that will not interfere with the driving of the tube into the ground and constructed and arranged to be driven toward the leading end of the tube and laterally projected from the tube into the ground thereby locking the screw vane means against rotation and holding the head against the ground to cooperate with the vane means for supporting tension and compression loads on the pile member, and said vane means having apertures adapted to flow concrete from the tube.

9. An earth anchor comprising an elongated pile member adapted to be driven in the ground, laterally extending screw vane means around a portion of the pile member having a steep pitch effective to thread the pile member into the ground during the driving of the pile member with a plowshare effect on the earth loading and compacting the soil on the back side of the vane means, a flat plate head on the pile member adapted to compact the ground above the screw vane means, said screw vane means having wide upper ends secured to the bottom of said plate and tapering therefrom to narrow bottom ends, and tentacle means carried by the pile member in a retracted condition that will not interfere with the driving of the pile member in the ground and constructed and arranged to be driven toward the leading end of the pile member and laterally projected from the pile member into the ground thereby locking the vane means against rotation and holding the head against the ground to cooperate with the vane means for supporting tension and compression loads on the pile member.

10. The anchor of claim 9 where the screw vane means are a pair of diametrically opposed screw vanes and plate reinforcing gusset vanes are provided between said pair of screw vanes and are secured to the pile member and plate.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,680,274 Dated November 2, 1972

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 4, line 26, cancel "π" and insert --90--.

Signed and sealed this 6th day of March 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334