

TITLE: SCREW PILE ANCHOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

THIS INVENTION relates to a screw pile anchor. The
5 anchor is particularly suitable for, but not limited to, supporting
lighting columns.

2. Prior Art

The use of screw pile anchors, eg., of the type
manufactured by A. B. Chance Co., Centralia, Missouri, USA, to
10 support a wide range of loads, is well known. The pile anchors usually
have a shaft, with a base plate at the upper end (to which is bolted or
welded a mounting plate on the lighting column or the load to be
supported), and at least one helical screw or flyte at, or adjacent, the
ground engaging end. Usually, the ground engaging end is provided
15 with a digging point which cuts a hole in the ground for the shaft, as
the pile anchor is rotatably driven into the ground.

Such pile anchors may only have a low lateral stability
and so may not be suitable, particularly in loose or sandy soils, to
support lighting columns or the like. This means that the speed of
20 installation possible with pile anchors, as supports for lighting
columns, cannot be enjoyed and conventional supports, which may
have an installation span of two weeks (while the concrete pile sets)
must be employed.

One attempt to increase the lateral stability of known screw pile anchors is disclosed in AU-A-14807/97 (VANDERFEEN). A pair of pipes, fitted one inside the other, are mounted on the shaft via a collar and are operable to compress the ground down onto the helical screw or flyte. However, the increase in lateral stability due to the vertical compression of the ground is only marginal.

SUMMARY OF THE PRESENT INVENTION

It is an object of the present invention to provide a means to increase the lateral stability of the pile anchors.

10 It is a preferred object of the present invention to provide such means immediately below the base plate.

It is a further preferred object to provide such means where the degree of increased lateral stability can be selected dependent on the ground in which the anchor is to be driven.

15 It is a still further preferred object to provide a simple, efficient method for interconnection of respective portions of the shaft.

It is a still further preferred object to provide a simple, efficient method for the manufacture of the helical screws or flytes.

20 Other preferred objects of the present invention will become apparent from the following description.

In one aspect, the present invention resides in a stabilizing assembly for a screw pile anchor, of the type having a shaft

with at least one helical screw or flyte at or adjacent a ground engaging end of a shaft (and an optional base plate at or adjacent the other end of the shaft), the stabilizing assembly including:

at least one collar or plate rotatably mountable on the
5 shaft; and

a plurality of fins radiating from the collar(s) or plate(s) and adapted to be pulled into the ground as the screw pile anchor is driven into the soil, the stabilizing assembly providing resistance against lateral movement to at least the portion of the shaft to which
10 the stabilizing assembly is mounted.

Preferably, three, four or more, fins are provided on the collar(s) or plate(s), preferably at equal spacings, about the shaft.

Preferably, the fins extend substantially radially to the shaft, although the fins may be curved, S-shaped or other shape in
15 plan view.

The fins may extend from a single collar rotatably journalled about the shaft, or from two or more vertically spaced collars or annular plates rotatably journalled about the shaft.

Preferably, the lower edges of the fins are inclined to the
20 horizontal, so that they will progressively cut into the ground as the screw pile anchor is driven into the ground. Where the fins have ground engaging points distal from the shaft, they will tend to vertically stabilize the pile anchor before it is fully driven into the

ground.

Preferably, one or more bolts are provided on the fins, collar(s) and/or annular plates and extend upwardly for releasable engagement with a mounting on a lighting column or other load to be supported.

In a second aspect, the present invention resides in a screw pile anchor including:

a shaft;

at least one helical screw or flyte at or adjacent a ground engaging end of the shaft;

an optional base plate at or adjacent the other end of the shaft; and

a stabilizing assembly, having at least one collar or plate rotatably mounted on the shaft, and a plurality of fins radiating from the shaft and adapted to be pulled into the ground as the screw pile anchor is driven into the soil, the stabilizing assembly providing resistance against lateral movement to at least the portion of the shaft on which the stabilizing assembly is mounted.

The screw pile anchor may be provided with two or more of the stabilizing assemblies at spaced intervals along the shaft.

Preferably, a cable entry slot is provided in the wall of the tubular shaft below the fins.

In a third aspect, the present invention resides in a

method of coupling respective portions of a tubular shaft of a screw pile anchor, where one end of one of the portions is telescopically interfitted into an adjacent end of the other of the portions, wherein:

the one end of the one portion has a first coupling zone
5 having an angular inclination (relative to the longitudinal axis of the shaft) greater than the inclination of a second coupling zone, the coupling first and second coupling zones being engageable in complementary coupling zones at the adjacent end of the other portion.

10 Preferably, the one coupling zone and complementary zone provide coupling of the portions in a direction longitudinal of the shaft; and the second coupling zone and its complementary zone provide coupling of the portions for rotation of the shaft.

In a fourth aspect, the present invention resides in a
15 coupling between two portions of a tubular shaft for a screw pile anchor of the type where one end of one of the portions is telescopically interfitted in an adjacent end of the other of the portions, wherein:

the one end of the one portion has a first coupling zone
20 having an angular inclination (relative to the longitudinal axis of the shaft) greater than the angular inclination of a second coupling zone, the first and second coupling zones being engageable in complementary coupling zones at the adjacent end of the other

portion.

In a fifth aspect, the present invention resides in a helical flyte of a screw pile anchor including:

5 a pair of flyte plates, each of substantially helical configuration, mountable on the shaft at spaced locations and convergent at a peripheral rim.

The leading and trailing portions of the flyte plates may be convergent to respective leading and trailing edges. One or more flanges may be formed integrally with the flyte plates to enable
10 mounting of the flyte plates on the shaft; and the flanges and flyte plates may be formed integrally from a single piece of sheet metal.

BRIEF DESCRIPTION OF THE DRAWINGS

To enable the invention to be fully understood, preferred embodiments will now be described with reference to the
15 accompanying drawings in which:

FIG. 1 is a view of a typical installation of a lighting column on a first embodiment of a screw pile anchor in accordance with the present invention;

FIG. 2 is a perspective (exploded) view of the mounting
20 of the lighting column on the screw pile anchor in more detail;

FIG. 3 is a perspective view of the screw pile anchor of FIGS. 1 and 2;

FIGS. 4 and 5 are perspective views of second and third

embodiments of the screw pile anchor;

FIG. 6 is a plan view illustrating how the stabilizing assembly of the present invention operates;

FIG. 7 is a sectional side view corresponding to FIG. 6;

5 FIG. 8 is a similar view to FIG. 7, the screw pile anchor having a pair of the stabilizing assemblies of the present invention;

FIG. 9 is an (exploded) perspective view of a fourth embodiment of the screw pile anchor;

10 FIG. 10 is a perspective view of a first embodiment of the coupling between two shaft portions;

FIG. 11 is a sectional side view of a second embodiment of the coupling between two shaft portions;

FIG. 12 is a perspective view of a first embodiment of a helical flyte; and

15 FIG. 13 is a similar view of a second embodiment of the helical flyte.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, this shows a typical installation of a lighting column on a screw pile anchor in accordance
20 with the present invention.

The screw pile anchor 10 has a tubular shaft 11 terminating at its ground engaging end in a removal drilling point or bit 12. A base plate 13 is welded (or otherwise fixed) to the upper end of

the shaft 11 and may be provided with slots or recesses 14.

The stabilizing assembly 30 has three, vertically spaced, collars 31, 32, 33 rotatably journalled on the shaft, the collar 31 being immediately below the base plate 13, and a locating ring (not shown)
5 is provided adjacent the lower collar 33 to limit movement of the stabilizing assembly along the shaft 11.

Four fins 34, 35, 36, 37 extend radially from the collars 31 to 33 at equal, angular spacings.

Each fin 34, 35, 36, 37 has a lower, cutting edge 38
10 which is inclined downwardly in a radially-outward direction and terminates in a ground engaging point 39 distal from the collar 33.

A respective mounting bolt or stud 40 extends vertically from the top edge 41 of each of the fins 34 to 37 and may be provided with nuts 42 to secure a mounting plate 51 of a lighting
15 column assembly 50 to the screw pile anchor 10 after the latter has been installed.

Referring to FIG. 3, the screw pile anchor 10 is provided with an alternative helical screw or flyte 20a, to be hereinafter described in more detail and an alternative drilling point or bit 12a.

20 A cable hole 52 is provided in a locating ring 33a, below the lower collar 33, enabling electrical cables to be fed to the interior of the tubular shaft 11 for connection to cables (not shown) for the light assembly 52 mounted on the lighting column 53 (see FIG. 1).

Referring to FIG. 4, the screw pile anchor 110 is modified in that the stabilizing assembly 130 only has three fins 134 to 136 spaced at 120° intervals. This embodiment may be preferred where the ground into which the screw pile 110 is to be driven has a higher mechanical strength than the ground where the screw pile anchor 10 is to be employed. It will also be noted that the screw pile anchor 110 can only provide three mounting bolts 140 for the mounting plate of the lighting column assembly or other load to be supported.

In the embodiment of FIG. 5, the screw pile anchor 210 has eight fins 234 to 237, 234a to 237a, where the four primary fins 234 to 237 are provided at 90° intervals and are bisected by a respective one of the secondary fins 234a to 237a. In addition, the primary fins 234 are deeper and extend from the upper collar 231 to the lower collar 233, while the secondary fins 234a to 237a extend from the upper collar 231 only to the central collar 232. It will be noted that both the primary and secondary fins have inclined cutting edges 238, 238a terminating in ground engaging points 239, 239a distal from the shaft 211.

The screw pile anchors 10, 110, 210 are driven into the ground using a standard power driving head, the drilling bits 12, 112, 212 cutting a hole for the tubular shafts 11, 111, 211. The screw pile anchors 10, 110, 210 pull themselves into the ground until the ground engaging points 39, 139, 239 engage the ground surface. The

stabilizing assemblies 30, 130, 230, which have tended to rotate with the shafts 11, 111, 211, cease rotation and the cutting edges 38, 138, 238 (and 238a) on the fins 34 to 37, 134 to 136, 234 to 237 cut downwardly into the soil. In the embodiment of FIG. 5, the cutting edges 238a will enable the secondary fins 234a to 237a to enter the ground when their digging points 239a engage the soil.

The screw pile anchors 10, 110, 210 are driven into the ground until their respective base plates 13, 113, 213 are at, or just above, the ground surface.

Referring to FIGS. 5 and 6, where a cable trench 60 has been cut in the ground 61, back-filling 62 of the trench will result in reduced resistance to lateral movement of the upper end of the screw pier 10, particularly when medium to high wind loads 70 are applied to the light column assembly 50 in the direction of the arrow in FIG. 6.

However, by providing the stabilizing assembly 30, the fins 34 to 37 tend to compress the ground in the area generally indicated by the triangular shaded area 63 in FIG. 6. Tests have shown that the compression of the ground may increase the resistance of the upper end of the shaft 11 (and thereby the screw pile anchor 10) against lateral movement by a factor of five to ten times, more generally six times. The rate of degree of resistance depends on factors such as the number of fins provided on the stabilizing assembly, the depth and the width of the fins, and the structure of the

surrounding soil. Where the ground has a low mechanical strength, it is preferable to use the screw pile anchors 10, 210, illustrated in FIGS. 3 and 5 over the screw pile anchor 110 of FIG. 4, as greater lateral resistance is provided by increasing the number of fins.

5 By use of the stabilizing assemblies 30, 130, 230, it is possible to use thinner gauge material in the manufacture of the tubular shafts 11, 111, 211 without loss of vertical load capacity or reduction in lateral bending resistance below prescribed limits.

FIG. 8 shows a modified embodiment of the screw pile
10 anchor of FIG. 7 which is suitable for use in soils which have stratas having different mechanical strengths. In this embodiment, a pair of the stabilizing assemblies 30 are provided at spaced intervals along the shaft 11 of the screw pile anchor 10, where the upper end of the shaft 11 and the lower end of the shaft 11 are in ground stratas 64,
15 65 of relatively low mechanical strength, and are separated by a ground strata 66 of relatively higher mechanical strength.

It will be readily apparent to the skilled addressee that where any soils strata is of relatively low mechanical strength, two or more of the stabilizing assemblies 30 may be provided along the shaft
20 11 to increase the resistance of the shaft 11 to lateral movement within that strata or stratas.

In the preferred embodiments shown in FIGS. 1 to 8, the cutting edges 38, 138, 238 (and 238a) have been shown to be

downwardly inclined to the ground engaging points, 39, 139, 239 (and 239a) distal from the shafts 11, 111, 211. In alternative embodiments (see FIG. 9), the cutting edges 338a may be upwardly inclined radially outwardly (as shown in dashed lines) so that they
5 initially cut the ground adjacent the lower collar 33, 133, 233.

In a further alternative embodiment (not shown), the spaced collars 31 to 33, 131 to 133, 231 to 233 may be substituted by a single tubular collar or by one or more annular plates rotatably journaled about the shafts 11, 111, 211.

10 Referring to FIG. 9, it is possible to provide the stabilizing assembly 330 as a kit for mounting on the tubular shaft of an existing screw pile anchor (eg., of the type manufactured by A. B. Chance Co.); or on tubular shaft portions not especially adapted to receive the stabilizing assemblies 330. An example of such a kit is illustrated
15 where the fins 334 to 336 are radially mounted on spaced collars 331 to 333 dimensioned to be rotatably journaled on a tubular shaft portion 311a, adapted to be coupled to a second tubular shaft portion 311b fitted with the helical flyte 320 and, in turn, adapted to be coupled to a third tubular shaft portion 311c having the digging point
20 312.

A method of coupling the respective tubular shaft portions 311a to 311b and 311b to 311c will hereinafter be described with reference to FIGS. 10 and 11.

Locating rings 331a and 333a are provided with locking screws (not shown) to enable them to be secured to the tubular shaft portion 311a to locate the stabilizing assembly 330 along the tubular shaft portion 311a while permitting rotation of the stabilizing assembly 330 about the shaft portion.

Referring to FIG. 10, a first embodiment of a coupling between the adjacent tubular shaft portions, eg., 311a and 311b, the lower end of tubular shaft portion 311a has a first coupling zone 380 and a second coupling zone 381 adapted to be telescopically interfitted with, and engaged with, complementary first and second coupling zones 390 and 391 at the upper end of the tubular shaft portion 311b. It will be noted that the angular inclination of the first coupling zone 380, eg., of $2-5^{\circ}$ relative to the longitudinal axis of the tubular shaft portion 311a, is less than the angular inclination of the second coupling zone 381, eg., $5-15^{\circ}$, more preferably $5-10^{\circ}$. The shallow angle of inclination, and large surface area, of the complementary first zones 380, 390 enables a larger driving torque to be provided down the shaft portions 311a, 311b, to enable the drill bit 312 and helical flyte 320 to cut respective pathways down the soil. The higher angle of inclination of the second coupling zones 381, 391 provides longitudinal location between the respective tubular shaft portions 311a, 311b, to resist the downward force on the shaft portions supplied by the driving head.

In the alternative embodiment shown in FIG. 11, the first driving zones 380a, 390a have the increased angular inclination relative to their longitudinal axis of the tubular shaft portions and the secondary coupling zones 381a, 319a may be inclined in the range of 0-5°, more preferably, 0-2° to the longitudinal axis.

Referring to FIG. 12, this illustrates a first embodiment of the helical flyte or screw in accordance with the present invention.

The helical flyte 320 is formed from two helical flyte plates 321, 322 which are each cut from a steel sheet and are deformed into a substantially helical shape. Each plate 321, 322 is welded, brazed or otherwise fixed to the tubular shaft portion 311 and is oppositely inclined so that the two plates 321, 322 are convergent at the peripheral rim 323 of the helical flyte. The plates are joined by welding, brazing or other suitable fixing means, and the "triangulation" formed by the inclination of the two plates to each other results in a helical flyte which is easily manufactured but which has a high mechanical strength.

In use, the space between the plates is quickly filled with soil, which forms a "plug" which pushes other ground out of the way as the helical screw flyte 320 is rotatably driven into the ground.

In the second embodiment shown in FIG. 13, the two helical plates 321a, 322a are formed integrally (eg., by folding) from a single piece of sheet metal, and flanges 324a and 325a enable the

helical flyte 320a to be welded, brazed or otherwise fixed to the tubular shaft portion 311. (Reinforcing ribs 329a can be formed integrally in the helical plates 321a, 322a to increase the strength thereof.)

5 It will be readily apparent to the skilled addressee that the helical screw flytes 320, 320a illustrated in FIGS. 12 and 13 can be manufactured from thinner section steel than would otherwise be required for a conventional helical screw flyte having the same load characteristics.

10 It will be readily apparent to the skilled addressee that the stabilizing assembly, and associated features hereinbefore described for the screw pile anchors, enable anchors to be manufactured with the same, or higher, resistance to lateral movement, and the same or higher vertical loadings, than conventional screw pile anchors using
15 thicker section, and thereby heavier, components. For example, the stiffness of the composite section of the anchor which comprises the stabilizing assembly and shaft is approximately 50% more than the shaft stiffness alone.

 The stabilizing assembly can provide resistance to lateral
20 movement of the shaft of the screw pile anchor which can be many times greater than the resistance of a conventional unrestrained (or unstabilized) anchor. The use of the fins increases the effective area of the ground restraining the shaft against lateral movement, not only

to many times greater than the diameter of the shaft, but also many times greater than the width of the fins.

Various changes and modifications may be made to the embodiments described and illustrated without departing from the present invention as defined in the claims.

CLAIMS

1. A stabilizing assembly for a screw pile anchor, of the type having a shaft with at least one helical screw or flyte at or adjacent a ground engaging end of a shaft (and an optional base plate at or adjacent the other end of the shaft), the stabilizing assembly including:
5 at least one collar or plate rotatably mountable on the shaft; and
a plurality of fins radiating from the collar(s) or plate(s) and adapted to be pulled into the ground as the screw pile anchor is driven into the soil, the stabilizing assembly providing resistance
10 against lateral movement to at least the portion of the shaft to which the stabilizing assembly is mounted.
2. A stabilizing assembly as claimed in Claim 1, wherein:
three, four or more fins are provided on the collar(s) or
15 plate(s) at equal spacings, about the shaft.
3. A stabilizing assembly as claimed in Claim 1 or Claim 2 wherein:
the fins extend substantially radially to the shaft, or are curved, S-shaped or other shape in plan view.
- 20 4. A stabilizing assembly as claimed in any one of Claims 1 to 3 wherein:
the fins extend from a single collar rotatably journalled about the shaft, or from two or more vertically spaced collars or

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annular plates rotatably journaled about the shaft.

5. A stabilizing assembly as claimed in any one of Claims 1 to 4 wherein:

the lower edges of the fins are inclined to the horizontal,
5 so that the lower edges will progressively cut into the ground as the screw pile anchor is driven into the ground.

6. A stabilizing assembly as claimed in Claim 5 wherein:

the lower edges are downwardly inclined outwardly from the shaft and terminate in ground engaging points distal from the
10 shaft, the ground engaging points tending to vertically stabilize the screw pile anchor before the screw pile anchor is fully driven into the soil.

7. A stabilizing assembly as claimed in any one of Claims 1 to 6 wherein:

15 one or more bolts are provided on the fins, collar(s) and/or annular plate(s) and extend upwardly for releasable engagement with a mounting plate on a lighting column or other load to be supported.

8. A screw pile anchor including:

20 a shaft;

at least one helical screw or flyte at or adjacent a ground engaging end of the shaft;

an optional base plate at or adjacent the other end of the

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shaft; and

a stabilizing assembly having at least one collar or plate rotatably mounted on the shaft, and a plurality of fins radiating from the shaft and adapted to be pulled into the ground as the screw pile anchor is driven into the soil, the stabilizing assembly providing resistance against lateral movement to at least the portion of the shaft on which the stabilizing assembly is mounted.

9. A screw pile anchor as claimed in Claim 8 wherein the stabilizing assembly is as claimed in any one of Claims 1 to 7.

10. A screw pile anchor as claimed in Claim 8 with two or more of the stabilizing assemblies as claimed in any one of Claims 1 to 7 at spaced intervals along the shaft.

11. A screw pile anchor as claimed in any one of Claims 8 to 11 wherein:

15 a cable entry slot is provided in the wall of the shaft below the fins.

12. A method of coupling respective portions of a tubular shaft of a screw pile anchor, where one end of one of the portions is telescopically interfitted into an adjacent end of the other of the portions, wherein:

20 the one end of the one portion has a first coupling zone having an angular inclination (relative to the longitudinal axis of the shaft) greater than the angular inclination of a second coupling zone,

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the first and second coupling zones being engageable in complementary coupling zones at the adjacent end of the other portion.

13. A method of coupling as claimed in Claim 12, wherein:

5 the one coupling zone and complementary zone provide coupling of the portions in a direction longitudinal of the shaft; and the second coupling zone and its complementary zone provide coupling of the portions for rotation of the shaft.

14. A coupling between two portions of a tubular shaft for a
10 screw pile anchor of the type where one end of the portions is telescopically interfitted in an adjacent end of the other of the portions, wherein:

the one end of the one portion has a first coupling zone having an angular inclination (relative to the longitudinal axis of the
15 shaft) greater than the angular inclination of a second coupling zone, the first and second coupling zones being engageable in complementary coupling zones at the adjacent end of the other portion.

15. A helical flyte for a screw pile anchor including:

20 a pair of flyte plates, each of substantially helical configuration, mountable on the shaft at spaced locations and convergent at a peripheral rim.

16. A helical flyte as claimed in Claim 15 wherein:

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the leading and trailing portions of the flyte plates are convergent to respective leading and trailing edges.

17. A helical flyte as claimed in Claim 15 or 16 wherein:

one or more flanges are formed integrally with the flyte
5 plates to enable mounting of the flyte plates on the shaft.

18. A helical flyte as claimed in Claim 17 wherein:

the flanges and flyte plates are formed integrally from a single piece of sheet metal.



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