March 19, 1968 W. O. BACKMAN 3,373,569

ARTICULATED PILE STABILIZER AND ANCHORING DEVICE

Filed Nov. 1, 1966 2 Sheets-Sheet 1

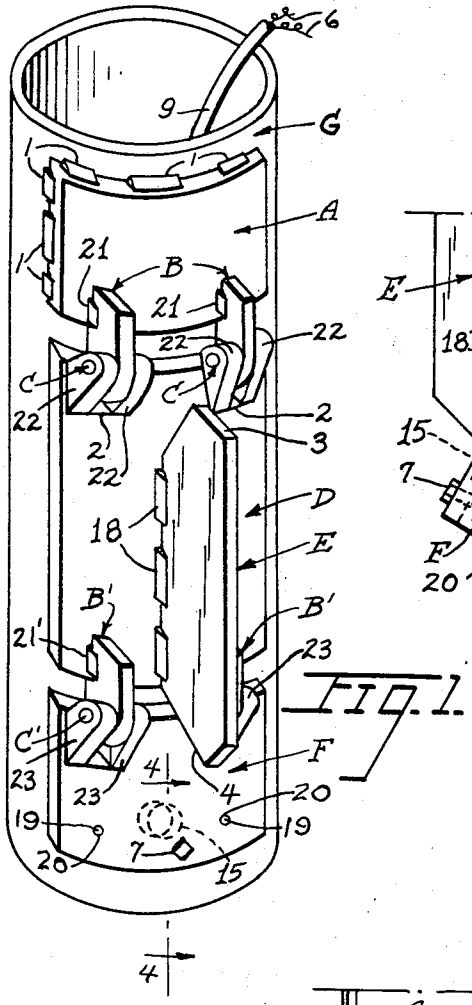


FIG. 1.

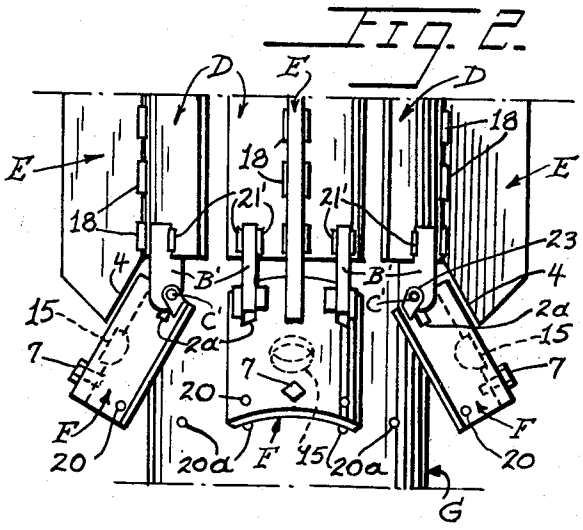


FIG. 2.

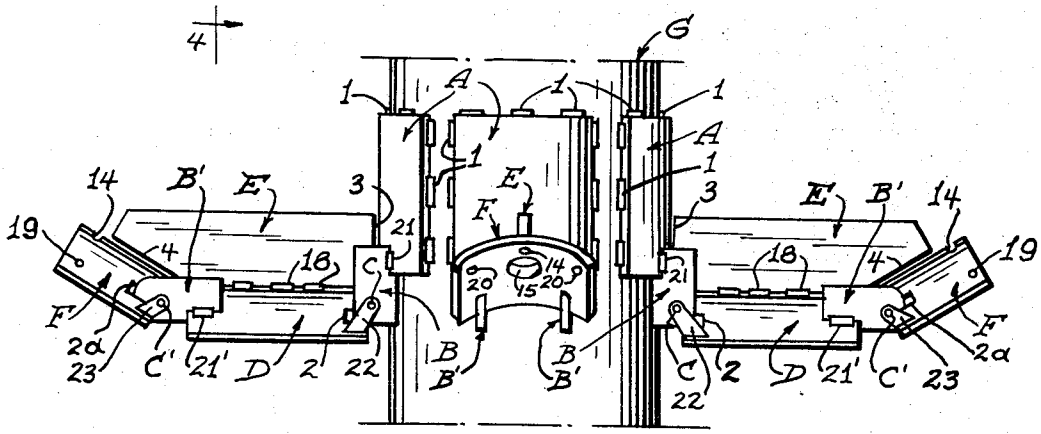


FIG. 3.

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ARTICULATED PILE STABILIZER AND ANCHORING DEVICE

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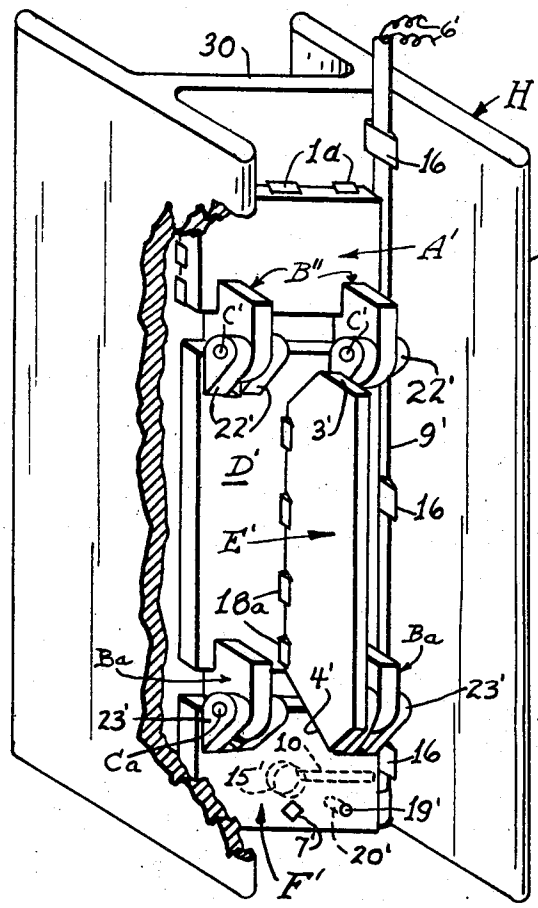


FIG. 6.

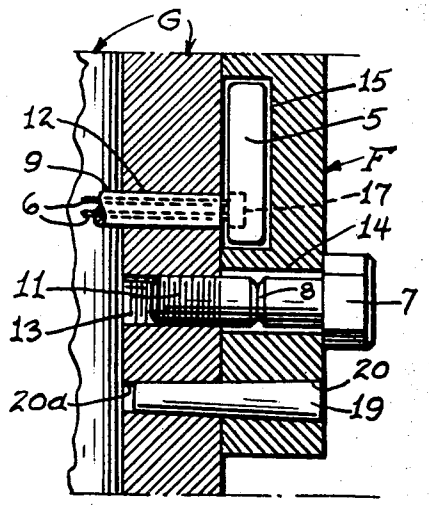


FIG. 5.

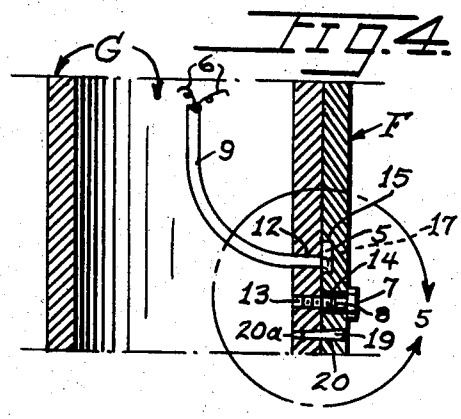


FIG. 4.

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ARTICULATED PILE STABILIZER AND ANCHORING DEVICE

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8 Claims. (Cl. 61—53.68)

The present invention relates to improvements in an articulated pile stabilizer and anchoring device and it consists in the combination, construction and arrangement of parts hereinafter described and claimed.

An object of my invention is to provide an articulated pile stabilizer and anchoring device that may be attached to a pile whether it be wooden or metal and whether the metal pile be cylindrical or hollow or an I-beam or reinforced concrete. One or more of my devices can be secured to the pile at any desired positions along the length of the pile and it is possible to have the devices entirely encircle the pile at any desired point.

One of the novel features of the device lies in the provision of a stabilizing fluke for the pile which is pivotally connected to the device and held in inoperative position during the initial driving of the pile into the ground or other material until the pile reaches a predetermined depth. At this point the operator can actuate an electrically controlled means for freeing an auxiliary activating fluke and for forcing it outwardly to extend at an angle to the outer surface of the pile. This auxiliary fluke is pivotally connected to the end of the main stabilizing fluke and as the pile is driven deeper into the ground, the auxiliary fluke will be moved outwardly and will cause the main stabilizing fluke to be swung outwardly into a pile-supporting position. If each pile is provided with a sufficient number of the devices so that they will encircle the pile and if adjacent piles are placed close enough to each other so that the outwardly extending main stabilizing flukes from each pile will practically cover the intervening space between piles, then a substantial supporting and stabilizing mat will be provided of sufficient strength and area to permit the piles to support a building or other permanent structure on ground that otherwise could not be used for such a purpose.

The pile stabilizer when extended into operative position, retards the pile from sinking into the ground. If my device is attached to a pile or other member in an inverted position, and then the member driven into the ground after which the main fluke is moved into operative position, then the device will act as an anchor in the ground for preventing the embedded member from being pulled out of the ground.

A further object of my invention is to provide a device of the type described that is simple in construction and can be attached to any type of pile.

Other objects and advantages will appear as the specification continues and the novel features of the invention will be set forth in the appended claims.

Drawings

For a better understanding of my invention, reference should be made to the accompanying drawings, forming a part of this application, in which:

FIGURE 1 is a perspective view of the device as shown attached to a hollow cylindrical metal pile.

FIGURE 2 is an elevational view of a number of the devices attached to a pile and encircling it. The auxiliary activating flukes are shown freed from their inoperative positions and extending outwardly at an angle and attached to the lower ends of the main stabilizing flukes. The supporting plates for the stabilizing flukes are not shown.

FIGURE 3 is an elevational view similar to FIGURE 2, and shows the auxiliary activating flukes and their associate main stabilizing flukes fully extended into operative positions with respect to their main supporting plates.

FIGURE 4 is a vertical section through a part of the device and is taken along the line 4—4 of FIGURE 1.

FIGURE 5 is an enlarged section of the dot-dash circled portion 5 shown in FIGURE 4.

FIGURE 6 is a perspective view of a modified form of the device which is shown designed to be attached to an I-beam type of pile.

While I have shown only the preferred forms of my invention, it should be understood that various changes, or modifications, may be made within the scope of the annexed claims without departing from the spirit thereof.

Detailed description

In carrying out my invention, I show a cylindrical hollow metal pile at G in FIGURES 1 to 5 inclusive although the pile could be of wood, reinforced concrete, or any other material suitable for such a purpose. One of my articulated stabilizing and anchoring devices is illustrated in FIGURE 1 as being attached to the tubular pile G. The device comprises a supporting plate A that is rectangular in shape and curved so as to fit against the outer surface of the tubular pile. The plate A is attached to the pile G by welding 1 or other suitable fastening means.

I mount hinge blocks B on the plate A and weld them in place by welds 21. The hinge blocks project below the lower edge of the plate A and they carry hinge pivot pins C, note the side views of two of the hinge blocks B in FIGURE 3. In this figure, I show three of my devices secured to the pile G and they encircle the pile. All three of them are shown in fully opened or pile anchoring and stabilizing positions whereas in FIGURE 1, the device is shown in inoperative position. A primary stabilizing fluke D has projections or ears 22 that are pivotally mounted on the pins C. The fluke D is rectangular in shape and is curved so as to conform to the cylindrical outer surface of the tubular pile G when the fluke contacts the pile as shown in FIGURE 1. It will be explained hereinafter how the fluke D can swing outwardly into a position which is substantially at right angles to the support plate A, as shown in FIGURE 3, when the fluke is in operative position. The fluke D has slots 2 in its upper edge for receiving the lower ends of the hinge blocks B.

The fluke D carries an outwardly extending reinforcing plate E that also acts as a stop for limiting the outward swing of the fluke and preventing further swinging movement when the fluke is positioned substantially at right angles to the plate A as shown in FIGURE 3. The reinforcing plate E is welded to the primary stabilizing fluke D by welds 18 and the plate extends radially from the fluke as clearly shown in FIGURES 1, 2 and 3. The upper edge 3 of the reinforcing plate E acts as an abutting surface as a stop when the fluke D is swung outwardly into a position substantially at right angles to the support plate A. When the fluke is in this fully operative position the stop-edge 3 will abut the plate A and prevent any additional swinging in the same direction.

I provide an auxiliary activating fluke F for starting the initial swinging of the stabilizing fluke D into operative position. The lower end of the fluke D carries hinge blocks B' and these are secured in place by welds 21', see FIGURE 1. The hinge blocks B' carry hinge pivot pins C' and the auxiliary fluke F carries projections or ears 23 that are pivotally mounted on the pins C'. The fluke F has slots 2a, see FIGURE 2, for receiving the lower ends of the hinge blocks B'. FIGURES 1, 2 and 3 show the reinforcing and stop plate E with its lower end extending below the bottom edge of the fluke D and provided

with a stop-edge 4 that extends at an angle to the inner edge of the plate E that is secured to the outer surface of the fluke D by welds 18. The purpose of the stop-edge 4 is to contact with the auxiliary fluke F when the latter has swung outwardly at a slight angle from the position shown in FIGURE 1, into the position shown in FIGURES 2 and 3. The purpose for holding the auxiliary fluke F, at an angle with respect to the stabilizer fluke D will be set forth when describing the operation of the device.

In FIGURES 4 and 5, I illustrate in enlarged detail how the auxiliary flukes F are secured to the tubular pile G and how the flukes F are freed from the pile and are swung outwardly at an angle about their hinge pivot pins C', shown in FIGURES 1, 2 and 3. A frangible cap screw 7 is inserted in an opening 14 in the auxiliary activating fluke F, and has a threaded portion 11 that is screwed into a threaded bore 13 in the tubular pile G. The cap screw has a shear zone in the form of an annular groove 8. A releasable tapered dowel pin 19 is received in aligned tapered holes 20 and 20*a* in the auxiliary fluke F and the tubular pile G, respectively. The dowel pin 19 prevents any shifting of the stabilizer assembly along the length of the pile G during the time the pile is being forced through the soil and into the ground.

The auxiliary fluke F has explosive means for forcing the fluke outwardly away from the pile G and breaking the shear cap screw 7 along the weakening annular groove 8 and for pulling the dowel pin 19 from the tapered hole 20*a* in the pile G. In FIGURES 4 and 5, I show the fluke F provided with a pocket or cavity 15 on its inner surface and disposed immediately above the shear cap screw 7. An explosive preform 5 is placed in the cavity 15 and an electrically wired squib 17 is inserted into the explosive preform, see FIGURE 5. Electric wires 6 lead to the squib 17 and are enclosed in a conduit 9. The wires extend through a hole 12 in the tubular pile G so that the conduit 9 can extend up through the interior of the pile as shown in FIGURE 1. It will be seen from FIGURE 5 that the cavity 15 in the auxiliary fluke F is covered by the adjacent outer surface of the pile G. Therefore, when the explosive preform 5 is detonated by the firing of the squib 17, the explosive force will be exerted against the pile and against the inner wall of the cavity 15 for swinging the auxiliary fluke F outwardly about its hinge pins C'. Two dowel pins 19 are shown in FIGURE 1, received in the tapered holes 20.

Operation

From the foregoing description of the various parts of my invention, the operation thereof may be readily understood. FIGURES 2 and 3 show a number of my pile stabilizing devices secured to the pile G at a certain position along the length of the pile and arranged around its circumference. One of the devices is shown in FIGURE 1 and one or more may be attached to the pile at any desired place on it. The pile is driven into the ground or other material in the usual manner by any desired means, none being illustrated. When a predetermined depth has been reached by the pile in the ground, the electrical wires 6 are connected to a source of electric current, not shown, and will detonate the squibs 17 and explode the preforms 5 to swing the auxiliary flukes F outwardly so that further downward movement of the pile will cause the soil to swing the flukes as shown in FIGURE 2. The outward swinging of the flukes F will force them against the lower inclined edges 4 of the reinforcing and stop plates E.

The pile G is now driven deeper into the ground and the soil or other material will be forced upwardly under the outwardly inclined auxiliary flukes F to swing them outwardly and carry with them the lower ends of the main stabilizing flukes D, see FIGURE 3. The main flukes D will swing outwardly about their hinge pins C until the upper edge 3 of the reinforcing and stop plates E abut against the outer surfaces of the support plates A. The main stabilizing flukes D and the auxiliary flukes F will assume the final positions shown in FIGURE 3.

This type of stabilizing device for the pile should find use in many fields where permanent, heavy duty piling supports are necessary. It is possible to invert the device on the pile and use it as an anchoring rather than as a load supporting device. The fully opened device when in an inverted position on the pile or other embedded member would prevent the member from being pulled from the soil or other material. The enlarged detail of FIGURE 2, does not show the tops of the main stabilizing flukes connected to the support plates A. However, FIGURE 3 shows the entire articulated assemblies and illustrates them in full opened positions. The assembly may be called an articulated permanent anchor when used in an inverted position.

When the device is inverted, the member with the device on it would be forced into the soil to a desired depth and then the explosive preform would be detonated. By reason of the expansion of the gases from the explosion, the shear cap screws 7 would be broken and the scoop-like auxiliary flukes F would be forced partly outwardly into the surrounding soil. At this moment any reversal in the direction of the movement of the tubular member G would cause the soil to be forced under the flukes and causing the main flukes D to open. Further movement of the tubular member G in the aforementioned reverse direction would cause the assembly to achieve its finally fully operated position where it would act as an anchor.

A slightly modified form of my invention is disclosed in FIGURE 6. A pile H in the shape of an I-beam has my device operatively applied to the web 30 that extends between the two sides of the I-beam. The support plate A' is made flat rather than arcuate like the support plate A because it is secured to the flat web of the I-beam H instead of to the outer cylindrical surface of the tubular pile G. Welding 1*a* attaches the flat plate A' to the web 30 of the I-beam pile. The hinge blocks B'' and the hinge pivot pins C' connect the main stabilizing fluke D' to the plate A'. The primary fluke D' is flat instead of being arcuate as is true of the main stabilizing or primary fluke D shown in FIGURE 1.

The fluke D' has a reinforcing and stop plate E' welded thereto at 18*a* and it functions in the same manner as the plate E in the form of the device shown in FIGURE 1. The edges 3' and 4' on the plate E' are similar to the edges 3 and 4 on the plate E in FIGURE 1 and perform the same functions. The auxiliary fluke F' is also flat rather than arcuate like the auxiliary fluke F and it is pivotally secured to the main fluke D' by hinge blocks B*a* and hinge pivot pins C*a*.

The electrical conduit 9' receives wires 6' and is mounted in the corner formed by the I-beam web 30 and a side 31 of the beam or pile H. Welding 16 secures the conduit 9' to the I-beam H and holds it in the corner of the beam. The conduit 9' communicates with a passage 10 provided in the auxiliary fluke F' and the wires 6' extend through the passage to the cavity 15' that is similar to the cavity 15 in the auxiliary fluke F. The cavity 15' contains an explosive preform similar to that shown at 5 in FIGURE 5, and it also contains the squib that has the wires 6' connected thereto and this squib is similar to the electrically wired squib 17. Directly below the cavity 15', I mount the frangible cap screw 7' which is similar to the frangible cap screw 7 and serves the same purpose of securing the auxiliary fluke F' to the web 30 until the I-beam pile H is driven into the ground to the desired distance and then a switch, not shown, is closed for connecting the wires to a source of electric current for detonating the squib and exploding the preform. This will swing the auxiliary fluke F' outwardly at an angle and further downward movement of the pile H will swing the main fluke D' outwardly in the same manner as already explained for

the form of the device shown in FIGURES 1 to 5 inclusive.

If desired, the auxiliary fluke F' may be additionally held in place by the dowel pin 19' that is mounted in the tapered opening 20'. The dowel pin 19' is shown in FIGURE 6. The operation of this form of the invention is the same as that described for the form shown in FIGURE 1. If the device is inverted on the I-beam H, it could be used to anchor the I-beam in whatever material it was embedded.

My device is adapted to be used on both tubular and solid piles or anchors and can also be used on solid steel piles of different cross sections, such as I-beams. My device need not be integrally manufactured with the pile or anchor, but may be installed at the construction site. The auxiliary activating or terminal end flukes F and F' are hinged to the primary stabilizing flukes D and D' and are simultaneously swung outwardly into operative position when the explosive preforms 5 are ignited by the squibs 17. Further downward movement of the pile into the ground will cause the auxiliary flukes to swing the main flukes outwardly into positions for stabilizing and aiding in supporting the pile. My stabilizing and supporting devices may be positioned anywhere along the length of the pile or anchor. In soft or mushy ground several of the devices may be attached to the pile and along the length thereof to give greater support.

I claim:

1. An articulated pile stabilizer and anchoring device comprising:
   (a) a support plate secured to a pile;
   (b) a primary stabilizing fluke having one end pivotally secured to said plate and adapted to lie adjacent to the surface of the pile;
   (c) an auxiliary fluke having an end pivotally secured to the other end of said primary fluke and adapted to lie adjacent to the pile surface;
   (d) frangible means securing said auxiliary fluke to the pile;
   (e) means between said auxiliary fluke and said pile for forcing said auxiliary fluke outwardly and for breaking said frangible means; and
   (f) stop means on said primary fluke for abutting the support plate to limit the pivotal movement of said primary fluke about its pivotal connection to said plate and for limiting the pivotal movement of said auxiliary fluke about its connection to the primary fluke.

2. The combination as set forth in claim 1: and in which
   (a) said means for forcing said auxiliary fluke outwardly includes an explosive placed between said auxiliary fluke and the pile; and
   (b) means for detonating the explosive.

3. The combination as set forth in claim 2: and in which
   (a) said frangible means is a bolt for securing the auxiliary fluke to the pile, said bolt having a weakened portion that will break when said auxiliary fluke is forced outwardly by the detonation of said explosive. of said primary stabilizing fluke.

4. The combination as set forth in claim 1: and in which
   (a) said stop means comprises a reinforcing stop plate with an edge that extends at an acute angle to said auxiliary fluke when the latter lies adjacent to the pile;
   (b) the edge on said stop plate contacting with said auxiliary fluke when the latter swings outwardly a predetermined distance;
   (c) whereby further outward swinging movement of said auxiliary fluke will cause an outward swinging of said primary stabilizing fluke.

5. The combination as set forth in claim 4: and in which
   (a) said reinforcing stop plate has a second edge that extends at an angle to said support plate when said primary stabilizing fluke lies adjacent to the pile;
   (b) the second edge on said stop plate contacting with said support plate when said primary stabilizing fluke swings outwardly a predetermined distance.

6. The combination as set forth in claim 1: and in which
   (a) tapered dowel pins extend through said auxiliary fluke and into the pile for temporarily aiding in securing the two together; said pins pulling free from the pile when said means force said auxiliary fluke to swing outwardly and away from the pile.
   rent will cause the squib to detonate the explosive.

7. The combination as set forth in claim 2: and in which
   (a) said means for detonating the explosive includes an electrically wired squib placed in the explosive so that a connecting of the wires to a source of current will cause the squib to detonate the explosive.

8. The combination as set forth in claim 2: and in which
   (a) said auxiliary fluke has a recess therein that opens onto the pile;
   (b) said explosive being placed in said recess so that the force created by the detonation of the explosive will be directed between said auxiliary fluke and the adjacent portion of the pile for swinging said auxiliary fluke outwardly.

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JACOB SHAPIRO, *Primary Examiner.*