

Feb. 7, 1967

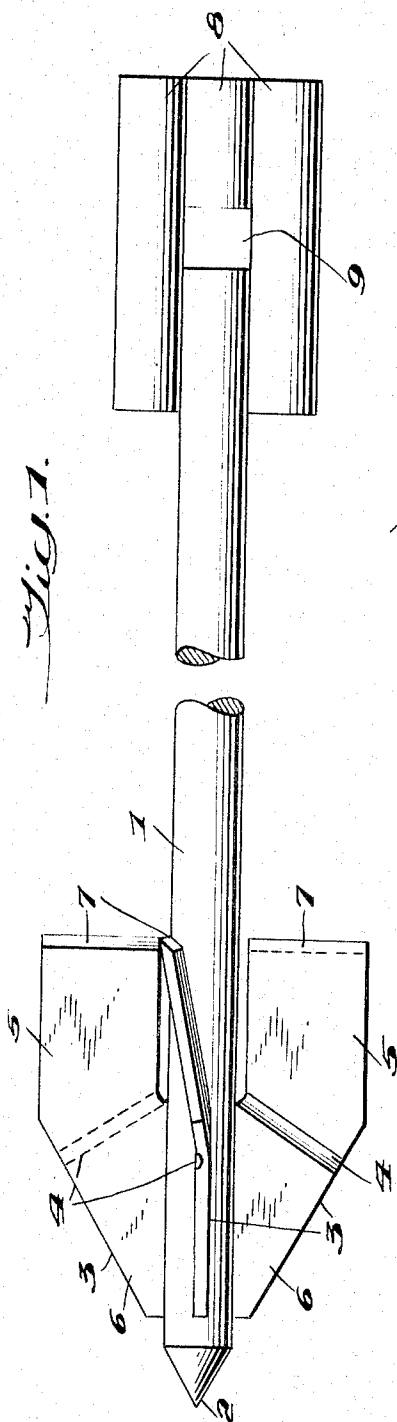
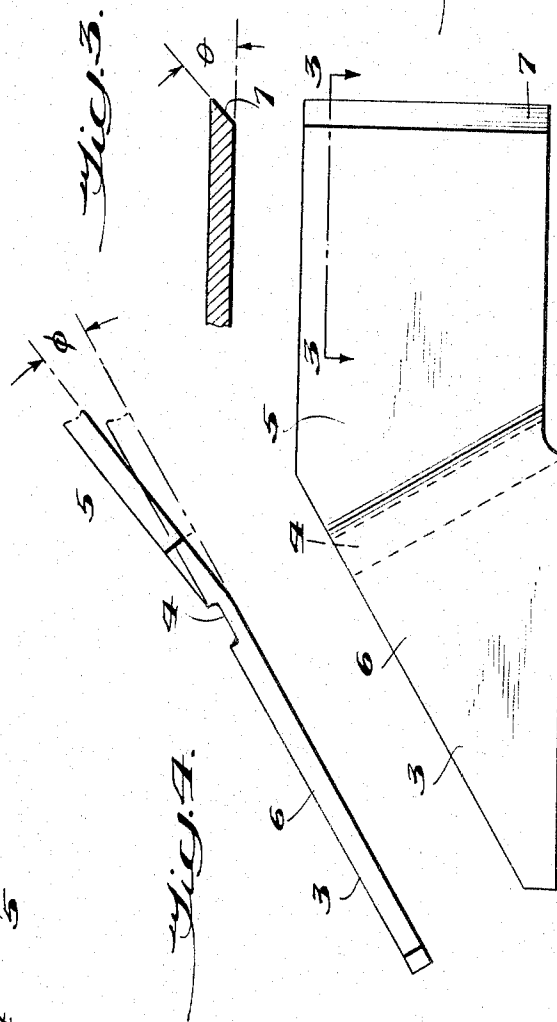
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DRIVE ANCHORS WITH RETAINING FLUKES

Filed Nov. 27, 1964

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Fig. 5.

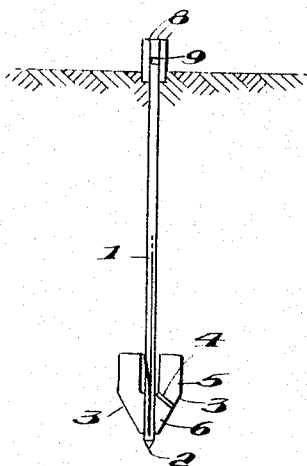


Fig. 6.

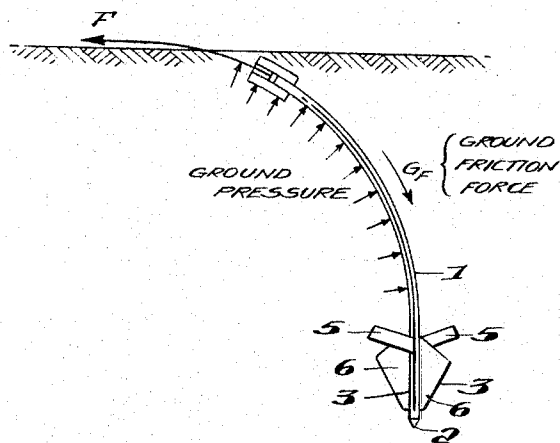


Fig. 7.

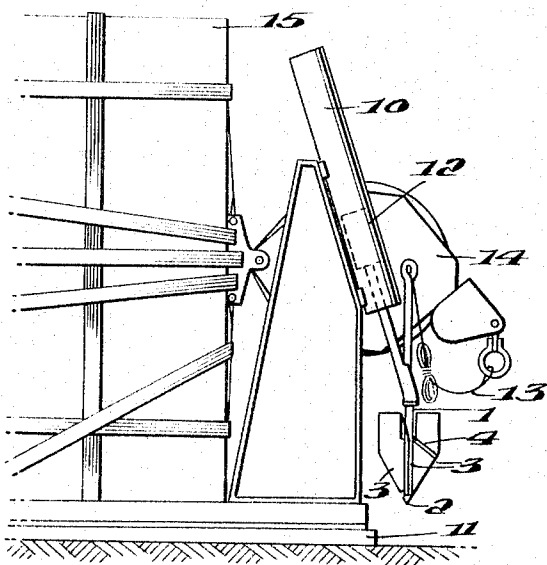
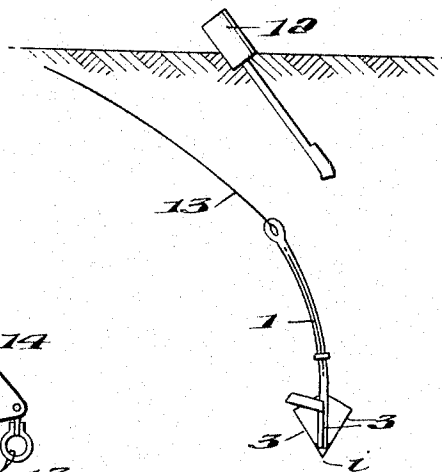


Fig. 8.



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DRIVE ANCHORS WITH RETAINING FLUKES
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4 Claims. (Cl. 52-154)

This invention relates to anchoring devices, more particularly to ground anchors which may be driven into the soil by mall, power hammer, or ballistically.

There are three basic methods by which to implant ground anchors, namely, by burying, augering, or by driving. Of the three, driving would be the quickest and the easiest. However, in order for the anchor to be of a shape which offers the greatest resistance to extraction, it also offers the greatest resistance to implanting and even if driven, causes the soil to be so disturbed as to no longer offer adequate resistance.

It has been proposed previously to use hinged or expandable flukes but these devices are not only extremely expensive but are also very bulky and difficult to drive. Furthermore, they are uncertain of actuation, there being no positive method of expanding the flukes when in the ground.

It is an object of this invention to provide a ground anchor which may very easily be implanted in the soil but which is extremely difficult to extract.

It is another object of this invention to provide a ground anchor having bendable flukes, which flukes may be bent while in the ground by the action of applying a pulling or extracting force thereto.

It is another object of this invention to provide a ground anchor having bendable flukes, said flukes having a predetermined bend line such that each fluke will bend toward the next adjacent fluke, enabling each fluke to act as a stop and as a support for another fluke.

It is another object of this invention to provide a ground anchor having bendable flukes, the upper portions of which are initially formed at a slight angle to ensure that they will bend in a desired uniform direction when extractive force is applied to the anchor.

It is a further object of the invention to provide a ground anchor having the foregoing characteristics which will be efficient in use, durable, and which can be manufactured at a reasonable cost.

Further and other objects will be apparent from the description of the accompanying drawings in which like reference characters designate like corresponding parts throughout the several views.

In the drawings:

FIGURE 1 is a side view of the anchor device showing the flukes attached at the anchoring end of a shaft;

FIGURE 2 is an enlarged view of one of the flukes;

FIGURE 3 is a fragmentary sectional view taken on the lines 3-3 of FIGURE 2;

FIGURE 4 is a fragmentary view showing the edge of the fluke illustrating the bend groove and the angle of the upper portion of the fluke;

FIGURE 5 is a view of the anchor as implanted in the soil;

FIGURE 6 is a view of the anchor illustrating its reaction to a lateral force applied generally normal to the axis of the shaft;

FIGURE 7 shows another embodiment of the invention, wherein the anchor device is ready to be ballistically implanted from a gun mounted on a supply pallet;

FIGURE 8 shows the anchor of FIGURE 7 in its maximum drag position.

Referring to the drawings, the anchoring device of this invention comprises a shaft 1, one end of which is pointed

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as shown at 2 and has attached thereto a plurality of flukes 3. Flukes 3 are designed in such a manner as to facilitate the penetration of the anchor into the ground.

Each fluke 3 is a solid plate of material, preferably metal, having a bend groove 4 formed therein extending from one edge to the other, separating it into what shall be referred to, for descriptive purposes, as upper and lower portions 5 and 6. Each fluke 3 is suitably attached, preferably by welding, to shaft 1. The outermost edge of the lower portion 6 of each fluke 3 is formed tapering away from the point 2 of shaft 1 so that it closely resembles the form of an arrow head. The upper portion 5 of the fluke 3 is not fixed to shaft 1 and is formed so that both edges are substantially parallel with the axis of the shaft.

The bend groove 4 extends from the uppermost point of connection between shaft 1 and fluke 3 to the outer edge of fluke 3. It is preferably a milled groove which may be of semi-circular, V-shaped, or rectangular cross-section. It has been found by experiment that, for ease of bending while maintaining a sufficient amount of strength in the fluke, a depth of approximately one half the thickness of the fluke is most desirable.

The bend groove 4 is geometrically positioned on the fluke 3 so that, when bent, the upper portion 5 of each fluke 3 rests upon the next adjacent fluke. Thus the bent flukes are held in their maximum drag position and act to support one another.

A pulling force applied to the anchor can cause the upper portion 5 of each fluke to bend over until it touches and is supported by it adjacent fluke. To ensure that each fluke bends in the direction desired, the top edge 7 of each fluke is uniformly beveled at an angle θ . Experiment has shown the most desirable angle θ to be approximately 45°. These flukes may also be bent over and set by rotating the anchor from the top with a wrench or rod.

Additionally, the upper portion 5 of the fluke may be bent at a slight angle ϕ to the plane of the lower portion 6 of the fluke prior to implanting the anchor. Angle ϕ may be set at the discretion of the user, but experiment has indicated that an angle of about 10° is preferred. If this angle is too great, the upper portion of the fluke interferes with rather than implements the smooth entry of the anchor into the soil.

FIGURES 6 and 8 depict the anchor in its maximum drag condition with the upper portions 5 of the flukes in their extreme bent positions abutting the adjacent flukes. The shape assumed by the anchor shaft 1 under the application of an extracting force has been exaggerated for purposes of illustration. FIGURE 6 diagrams the forces acting upon the shaft.

FIGURE 1 illustrates an anchor which may be manually driven into the soil. Additional short lengths of rod or shaft 8 are shown affixed to the upper portion or head of main shaft 1. These rods 8 are merely to enlarge the head and thereby to present a greater driving area; as such they may take almost any shape desired. Space 9 is provided for the attachment of a cable or line.

FIGURE 7 illustrates one method whereby a ballistically driven anchoring device may be utilized. In this embodiment, the anchor is fired from a gun 10 mounted on a cargo pallet 11 dropped from a low flying aircraft. The anchor is misaligned in order to achieve proper orientation of the anchor at launch.

To the anchor shaft 1, which may be of any desired length, is attached a lanyard 13, the other end of which is attached to an energy absorber 14 suitably fixed to the cargo 15 and to the pallet 11. Thus the cargo pallet is brought to a smooth, safe, and rapid stop. An anchor such as this could be driven by a rocket, a recoilless rifle, or even by a conventional gun.

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It is to be understood that the embodiments shown are illustrative of the principal operation of a ground anchor which offers maximum resistance to extraction and that certain changes, alterations, modifications or substitutions can be made in the structure of the device without departing from the spirit and scope of the claims.

What is claimed is:

1. An anchoring device comprising a central shaft having affixed thereto a plurality of flukes, each said fluke consisting of a single piece of material having a lower portion whose inner edge is affixed to said shaft and whose outer edge is tapered in a direction divergent from the sharpened point of said shaft, said fluke having an upper portion spaced from said shaft, the edges of which are generally parallel thereto, said upper and lower portions of said fluke having therebetween a cross-section substantially less than the general thickness of said fluke, along which said cross-section, said fluke will bend when a force is applied to said anchoring device.

2. An anchoring device in accordance with claim 1 wherein the bend groove of each fluke is at such an angle and the upper portion of said fluke is of such a length that, when bent in the desired direction, the upper portion of each fluke will abut upon and be supported by the next adjacent fluke.

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3. An anchoring device in accordance with claim 2 wherein the upper edge of the upper portion of each of the flukes is beveled so that a pulling force applied in a direction generally parallel to the axis of the central shaft will cause the upper portions of all of said flukes to bend generally uniformly in a desired direction.

4. An anchoring device according to claim 2 wherein the upper portions of said flukes are biased at a slight angle to the plane of the lower portions of said flukes so that the application of a pulling force generally parallel to the axis of the central shaft will cause the upper portions to bend generally uniformly in a desired direction.

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