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GROUND ANCHOR

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment of any royalty thereon.

This invention relates to ground anchors or stays for guy lines and the like.

A primary object of the invention is to provide a device that will be suitable for anchoring guy lines and the like to the ground, characterized by ease of penetration into the ground, maximum resistance to extraction therefrom due to force exerted by the guy cable, and withdrawal of the cable without the necessity of removing the anchoring device.

A further object is to provide a ground anchor having a novel and simplified means for connecting the same with a guy line above the ground, affording an extremely strong connection between the anchor and the guy line, and allowing the guy line to be removed intact from the ground while the anchor remains in the ground.

Another object is to provide a ground anchor characterized by simple, efficient, and inexpensive construction which is extremely light in weight, substantially unitary in construction, and adapted to be manufactured in the form of a metal casting or the like as an expendable article, if desired.

Another object is to provide a ground anchor which may be hand driven into substantially any soil by means of a simple rod and hammer.

Still another object of the invention is to provide a ground anchor for guy lines which tends to orient itself within the ground to a plane substantially at right angles to the guy line, after the guy line is tightened and placed under tension, the anchor then offering a maximum resistance to extraction from the ground due to tension in the guy line.

Other objects and advantages will be understood and most fully appreciated by a study of the following description given in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of one embodiment of the present invention showing the means by which the guy line is attached;

FIG. 2 is a side elevation of the same anchor showing the groove through which the lanyard is connected;

FIG. 3 is an edge view of the anchor;

FIG. 4 is a view of the opposite side from that shown in FIG. 2;

FIG. 5 is a cross sectional edge view showing how the anchor may be driven into the ground;

FIG. 6 is an edge view of the anchor with a section of the guy line attached showing the position the anchor would take in relation to the guy line when embedded in the ground; and

FIG. 7 is a perspective view of another embodiment of the present invention.

In the drawings, where for the purpose of illustration is shown a preferred embodiment of the invention, the numeral 20 designates generally my ground anchor. The anchor is comprised of a plate 21 which is flat and has substantially the shape of an equilateral triangle with the apex 22 of the triangle adapted to be directed downwardly for penetration into the ground. Since a major purpose of the ground anchor is to serve as a tie-down for aircraft and hence must be carried in quantity in air-

craft, the ground anchor is preferably formed of a light weight material, such as aluminum or an aluminum alloy, and is provided with weight reducing apertures to provide an anchor of minimum weight consistent with the required strength.

The plate 21 is provided at the center of the base 23 and along the line through the apex 22 which bisects the base 23 with a rib 24 which substantially tapers to a point at the apex 22, where the rib has substantially the same thickness as the plate 21. The end 25 of the rib 24 remote from the apex 22 is flat and flush with the base 23 of the triangular plate 21. At this end 25, the rib 24 is substantially wider than the thickness of the plate 21.

A recess 26 with an opening 27 centrally positioned on the end 25 of the rib 24 and extending longitudinally within the rib 24 approximately one half the distance from the end 25 toward the apex 22 is adapted to receive a driving rod 28 which may be used to drive the anchor into the ground when fitted within the recess 26.

Extending lengthwise on both sides of the rib 24 upon the face of the anchor as shown in FIG. 4 are substantially parallel grooves 29 which extend approximately one-half the length of the anchor from the apex to the base edge. Notches or slots 30 open at their outer ends to the corresponding side edges 31 of the anchor plate near the midlength locations of the side edges and extend inwardly from the side edges toward the rib portion 24 of the anchor plate. These slots are somewhat inclined from their open ends inwardly and toward the base edge 23 and have a width to receive the loop end portion of the flexible strand 32, as shown in FIG. 1. The grooves 29 extend from the inner ends of the corresponding slots 30 to the base edge 23 and are both provided in one side of the plate to receive the side or leg portions of the strand loop engaged in the slots 30. A curved groove 33 is provided in the opposite side of the anchor plate between the inner ends of the slots 30 and the corresponding ends of the grooves 29 and is convex toward the apex of the anchor plate. The groove 33 receives the bight portion of a strand loop engaged in the slots 30 as is also clearly shown in FIG. 1.

The connecting line 32 received in notches 30 and grooves 29 and 33 is preferably a highly flexible, easily severable strand of suitable material, such as nylon thread, which can be pulled through the slots and grooves in the anchor plate while the plate is embedded in the ground, to release the line from the plate and which can be cut by a machine, such as a lawn mower, if the line is inadvertently left in position after a tied down aircraft has been released and removed. This line is doubled before being applied to the anchor plate and the ends secured together to form a loop. The end portion of the loop is drawn through slots 30 so that the bight of the loop lies in groove 33 at one side of the plate and the sides or legs of the loop lie in grooves 29 at the opposite side of the plate. The flexible loop, secured in the ground at one end, provides an attachment to which a lashing line can be secured. It should be noted that the grooves through which the connecting line 32 is attached are of sufficient depth so that the anchor may be driven into the ground with the anchor substantially breaking the ground before any part of the connecting line 32 passes through the area, thus reducing friction and preventing unnecessary wear upon the connecting line 32. This arrangement forms a very strong connection between the anchor 20 and the connecting line 32. The half-circle cross sectional shape of the U-shaped groove 33 provides a rounded surface for contact with the bight portion of the connecting loop. It is thus seen that the connecting line 32 pulls on the anchor near the center of the triangular plate 21, and this arrangement permits the ground anchor to automatically orient itself when under tension to a position sub-

stantially at right angles to the direction of pull upon the connecting line as is shown in FIG. 6. Holes 34 may be inserted in the anchor at appropriate locations to reduce the weight of the device.

A modification of the anchor described previously is shown in FIG. 7. In this embodiment there is no difference from that previously described except the lack of holes 34 and the lack of grooves 29 tapering to a flush relationship with base 23. The grooves 35 in this modification are substantially equal in depth along their entire length from base 36 to the location in which they cut through the anchor to become interconnected to form U-shaped groove 37.

In the use of my ground anchor to tie down aircraft, for example, appropriately positioned ground anchors are driven into the ground with suitable lashings interconnecting the aircraft and the anchor. A rod 28 is engaged within the recess 25 for the purpose of driving downwardly into the ground in a generally vertical fashion as shown in FIG. 5 or at any chosen angle to the ground. The anchor may be driven into the ground at any depth depending upon the length of the driving rod. The desirable depth of the anchor in the ground depends upon the resistance of the soil in which it is embedded to extraction of the device as compared to the relative tension upon the guy line attached thereto necessary to hold the aircraft, for example, in position. Due to the tapering shape of the rib 24 and anchor as a whole, the anchor will penetrate even very hard soil with ease.

When the anchor has been driven to the desired depth, the upper end of the connecting line loop 32 will extend above the surface of the ground for connecting with the end of a lashing cable or guy line. The end of the lashing is connected with the loop end of the connecting line 32 and tightened in any preferred manner until the line has the desired degree of tension. When the line is thus placed under tension as illustrated in FIG. 6, the anchor automatically changes position in the ground and orients itself in a plane substantially at a right angle to the direction of pull of line 32. This will occur because the connecting line 32 engages the anchor plate 20 at substantially the center of the triangular plate. As the tension in the line 32 increases, the anchor will shift from the nearly vertical position of FIG. 5, to the inclined position of FIG. 6. The position of the anchor when the line 32 is thusly tensioned is at a right angle thereto offering a maximum resistance to extraction from the ground since the entire triangular area of the flat plate is exerted against the pull of the line. When the anchor is no longer desired to be used, the tension on the line 32 is released. By separating the ends of the connecting line 32 and pulling on one end of this line in a direction approaching that of the plane of the anchor 20, the line is caused to slip around the U-shaped groove 33 and become disengaged from the anchor plate. Accordingly, the line 32 engaging the anchor 20 may be removed intact and the anchor may be left in the ground relieving any necessity for its removal. Hence, the U-shaped groove 33 serves significantly both in securing the line 32 when tension is applied and as an aid to easy removal of the line when it is loosened. If an anchor connecting line should inadvertently be left attached to its anchor plate and extending above the ground, it will not cause damage to implements or machines such as mowing machines.

Although only one use of my ground anchor has been described the anchor is adaptable for a wide variety of uses such as anchoring lines for towers, poles, walls, etc. Also, although the embodiments of the invention shown and described are triangular in shape, other shapes, such as semicircular, trapezoidal, or other polygonal forms may be suitable.

It should be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention.

I claim:

1. A ground anchor comprising a body of triangular shape having an apex or drive point, a base edge opposite said apex and side edges extending from the apex to the corresponding ends of the base edge, said body having a medial rib tapering from said base toward said apex and being substantially symmetrical in both plan area and thickness, said body also tapering in thickness from said rib to said side edges and having a socket recess in said rib opening to said base edge to receive a driving rod, slots opening to the side edges of said body and extending inwardly from said side edges intermediate the length of said side edges, substantially parallel grooves in one side of said body extending from the inner ends of said slots to said base edge along the corresponding sides of said rib, and a curved groove in the opposite side of said body extending between the inner ends of said slots and being convex toward said apex, said slots and said grooves being adapted to receive a looped flexible connecting line, whereby a line looped through said slots and curved groove and extending through said parallel grooves will be protected while said ground anchor is being driven into the ground.

2. A ground anchor comprising a metal body of substantially triangular shape having an apex at one corner constituting a driving point, a base edge opposite said apex, side edges extending from said apex to the corresponding ends of said base edge and having a thickened medial portion providing a rib tapering from said base edge toward said apex, said rib having therein a longitudinally extending well opening to said base edge and providing a socket for an end of a driving rod, said body tapering in thickness from said base edge toward said apex and from said rib toward said side edges and having therein weight reducing apertures arranged to reduce the amount of metal in said body without materially reducing the strength thereof and having slots opening one to each side edge intermediate the length of said side edges and extending from said side edges toward said rib, said slots being inclined from their open ends inwardly and toward said base edge and having a width to receive a loop end portion of a doubled flexible strand, said body having a curved groove in one side thereof extending between the inner ends of said slots and having parallel grooves in the opposite side thereof extending respectively from the inner ends of said slots to the base edge of said body, whereby a line looped through said slots and curved groove and extending through said parallel grooves will be generally below the surfaces of said body and thus protected while said ground anchor is being driven into the ground.

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