

GROUND ANCHORING SYSTEM

5 In my published UK Patent Application 2,085,386A there is described a ground anchoring system in which a generally flat, slotted anchor plate is secured to one end of a flexible anchoring web or strap and driven edge-first into the ground by a driving tool.

10 When the driving tool is removed and a lifting force is subsequently applied to the anchoring web or strap, the plate tends to skew across the hole and thereby resist extraction from the ground. A somewhat similar but less efficient device is disclosed in US Patent 4,003,169.

15 On the whole this system works satisfactorily, but I have found that there is often a significant delay before the plate is skewed after a lifting force is applied to the line. During this period, the plate can be pulled some distance back up the hole, and the anchored object may not then be firmly anchored in its desired position. This problem is particularly troublesome when anchoring
20 objects to the river or sea bed. For example, when anchoring a frond mat to the sea bed to combat erosion of the bed beneath structures such as oil or gas pipelines, any "lifting" of the mat after it has been anchored can seriously affect subsequent performance of the mat under
25 operating conditions.

A further disadvantage of this known system is that it lacks the ability to precisely control the orientation of the plate while it is being driven into the ground.

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An object of the present invention is to provide an anchor plate which retains the advantages associated with the above-described system but which provides faster

retention and improved orientation control.

According to the present invention there is provided a ground anchoring system comprising: an anchor plate of the type having transverse slot means for receiving and retaining one end of a flexible anchoring strap or web, the strap or web extending upwardly from the plate for connection to the object being anchored, and the plate further comprising means for releasably retaining a driving tool in such a manner that the plate is maintained substantially aligned with the tool while being driven edge-first into the ground, and projecting flap means retained in a cocked position offering minimum drag resistance when driving the plate downwardly into the ground, the flap means being subsequently released from the cocked position to resist reverse upward movement of the plate when the driving tool is withdrawn and the anchor line is tensioned.

The retaining means for the driving tool is preferably welded to one side of the plate toward the leading edge thereof and may comprise, for example, an elongate socket disposed beneath the transverse slot means.

The flap means preferably extends rearwardly from a trailing edge of the plate. In its cocked position the flap means is generally aligned with the plate, the angle being in the range of 0 to 15° and preferably less than 10°. In its released position, on the other hand, the angle increases and generally lies in the range of 20° to 60° with a preferred range of 30° to 45°.

In use, the increased angle causes a trailing edge of the flap means to bite into the side of the channel produced by the downward movement of the plate, and the plate

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therefore pivots about this trailing edge into a skew position across the channel immediately the anchor line is tensioned.

5 The flap means is preferably resiliently biased into its released position but may alternatively fall freely into the released position when the driving tool is removed. It may comprise a deformable strip projecting from the trailing edge, or it may be hinged to the trailing edge.
10 In either case it is preferably retained in its cocked position by a co-operating portion _____

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of the driving tool so that it is automatically released when the tool is withdrawn.

By way of example only, an embodiment of the invention will now be described with reference to the accompanying drawings, in which:-

Fig. 1 is a front elevation view of an anchor plate fitted with an anchoring strap;

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Fig. 2 is a side elevation of the plate and strap;

Fig. 3 shows the plate being driven into the ground by a driving tool; and

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Fig. 4 shows the skew position of the plate when the strap is subsequently tensioned after driving the plate into the ground.

Referring first to Figs. 1 and 2, a generally flat, wedge-shaped anchor plate 10 includes a pair of slots 11, 12 for receiving a flexible anchoring strap 13. A looped end of the strap 13 is inserted through the lower slot 12 from the rear side (as viewed in Fig. 1), and is then fed back through the upper slot 11. A split elongate retaining ring 14 receives the looped end and prevents the strap being withdrawn from the slots.

An elongate socket 15 is welded to the front side of the plate 10 for receiving an extended driving rod 22 (Fig. 3) of an hydraulic hammer tool (not shown) such that the leading edge 30 of the plate can be driven downwardly into the ground. As shown in Fig. 3, the rod 22 fits into the socket with a loose push fit and maintains the plate 10 aligned with the rod in a substantially

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vertical orientation when driving the plate into the ground.

A flap 17 projects rearwardly from the trailing edge 18 of the plate 10. A longitudinally split hollow tube 19 is welded to the trailing edge 18 and pivotally mounts a spindle 20 secured to a central portion 21 of the flap. The flap 17 is thereby hinged to the trailing edge 18 and is movable through an angle determined by the width of the slit in the tube 19. It is resiliently biased by springs 23 into the position shown in full outline in Fig. 2; the angle θ_2 being approximately 40° . The other extreme position is shown by the chain-dot outline in Fig. 2, the angle θ_1 being approximately 5° .

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The operation of the system is illustrated in Figs. 3 and 4. The object being anchored (not shown) is attached to the top end of the strap 13. The driving rod 22 of the hammer tool is then inserted into the socket 15. To insert the rod into the socket, the hinged flap 17 must first be moved back against its resilient bias into the cocked position shown in full outline in Fig. 3. The rod 22 once inserted in socket 15 then holds the flap 17 in its cocked position against the bias of spring 23, the rod being accommodated by the recess 31 (Fig. 1) in the rear edge of the flap.

The hammer is then actuated to drive the plate 10, strap 13 and rod 22 into the ground, the location of rod 22 in socket 15 maintaining the plate aligned in the rod with a generally vertical orientation as shown in Fig. 3.

Once the plate and strap have been driven to the required depth, say 1-2 metres, the rod 22 is withdrawn



from socket 15 and the flap 17 automatically springs into the position shown in chain-dot outline in Fig. 3. In this position the serrated rear edge 24 of the flap digs into the side of the hole 25 and thereby resists reverse upward movement of the plate. Moreover it immediately provides a fulcrum about which the plate 10 is forced to pivot to a skew position as shown in Fig. 4 when the strap 13 is subsequently tensioned by lifting forces applied to the object being anchored. This action ensures that the plate is immediately locked in its skew position and cannot be pulled back up the hole.

The centre of gravity of the plate 10 is positioned above the lower slot 12 so that the plate will tend to rotate in the direction shown by the arrows in Fig. 4 when the rod 22 is withdrawn from socket 15. This further assists in urging the serrated edge 24 of flap 17 into engagement with the side of the hole 25.

Moreover, a short bar 26 welded to the ring 14 spaces the strap 13 from the rear face of the plate 10 so that an additional turning moment is applied in the direction of the arrows shown in Fig. 4 when the strap 13 is tensioned. In practice the forces on the plate are such that it continues to rotate into a generally horizontal locked position as the rear edge 24 of the flap 17 digs further into the side of the hole.

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CLAIMS

1. A ground anchoring system comprising: an anchor plate of the type having transverse slot means for receiving and retaining one end of a flexible anchoring strap or web, the strap or web extending upwardly from the plate for connection to the object being anchored, and the plate further comprising means for releasably retaining a driving tool in such a manner that the plate is maintained substantially aligned with the tool while being driven edge-first into the ground, and projecting flap means retained in a cocked position offering minimum drag resistance when driving the plate downwardly into the ground, the flap means being subsequently released from the cocked position to resist reverse upward movement of the plate when the driving tool is withdrawn and the anchor line is tensioned.
2. A ground anchoring system according to claim 1 in which the flap means is retained in the cocked position by a cooperating portion of the driving tool when the tool is retained by the retaining means.
3. A ground anchoring system according to claim 1 or claim 2 in which a portion of the flap means is recessed to accommodate the alignment of the driving tool with the plate.
4. A ground anchoring system according to any one of the preceding claims in which the retaining means for the driving tool is welded to one side of the plate toward the leading edge thereof.
5. A ground anchoring system according to any one of the preceding claims in which the trailing edge of the



flap means is serrated.

5 6. A ground anchoring system according to any one of the preceding claims in which the flap means is hinged to the trailing edge of the anchor plate.

10 7. A ground anchoring system according to claim 6 in which the hinge comprises a split hollow tube secured to the trailing edge of the plate, the flap means having an associated spindle rotatable within the tube.

15 8. A ground anchoring system according to any one of the preceding claims in which the flap means is retained in its cocked position against a resilient bias.

20 9. A ground anchoring system according to any one of the preceding claims in which the anchor plate has a generally tapered leading section with a truncated leading edge, the length of the plate being of the same order as its width.

25 10. A system according to any one of the preceding claims in which the flap means is inclined to the plate at an angle not exceeding 15° in its first cocked position.

30 11. A system according to claim 10 in which the flap means is movable to a position inclined at an angle to the plate of between 20° and 60° when released from its cocked position.

35 12. A system according to any one of the preceding claims in which the anchoring strap or web extends upwardly from one side of the plate and the flap means projects from the opposite side of the plate.



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13. A ground anchoring system substantially as herein described with reference to the accompanying drawings.

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