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REMOVABLE GROUND ANCHOR

This invention relates to ground anchors, and more particularly to ground anchor assemblies from which the anchor cable may be removed after use.

It is commonplace in the construction of deep foundations of large civil engineering structures to anchor a temporary earth retaining wall against lateral movement at least, by means of cables themselves held within elongate bores in the surrounding ground. There are many conventional way of effecting this in detail. By and large they involve the bonding of the inner end of the cable(s) into a cementitious or resin grout in the bore so that there is resistance to pullout movement of the cable.

Occasionally it is appropriate to leave the cable and anchor in place, but frequently they are temporary expedients and where possible should be removed when the structure is complete and self-supporting.

It is of course possible to remove only the projecting cables by cutting the cable at the top end of the elongate bore, so that there is no surface projection, and thus leave a proportion of the cable in

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the bore. However, since the bores in question are sometimes upto 20 or 40 metres in length, it can happen that they pass beyond the boundaries of the property upon which the construction is taking place and into the ground beneath adjacent properties. The abandoned components of such ground anchors may be detrimental to subsequent work on the adjacent site. In particular, while the bore itself and the solidified anchor grout is of no particular importance, and while any minor fastening elements, of discrete nature and relatively small size, can be readily removed from subsequent excavations, the existence of a length of high tensile cable stretching across a site to be developed, at some distance under the ground, is undesirable and it is frequently stipulated that any such cables must be removed on completion of adjacent building construction.

The present invention is concerned with an assembly for a ground anchor from which assembly the anchor cable can be removed after the desired period of use.

In one aspect the invention consists in a ground anchor assembly held within an elongate bore by a solidified retaining material and comprising at least one cable protruding from the bore and a retention member within the bore acting in use to retain the cable, characterised in the retention member is a saddle member, around which the or each cable is looped, held



in the bore by the grout so as to resist movement of the or each cable when both respective ends of such cable are pulled but permit extraction of the or each cable when one end only thereof is pulled.

The solidified retaining material is typically a grout, as described below. Possibly it could be a resinous material. For ease of description the term 'grout' is used below, as describing the more usual expedient.

The ground anchor assembly saddle member may possess an integral portion or attached member extending along the bore. Moreover, tubular members may surround any cable at those lengths thereof nearest the saddle.

The arcuate surface of the saddle member may be grooved or recessed to accept the cable, or more than one cable.

If desired a bore may be provided with more than one such assembly at different distances along the bore.

The invention will be further described with reference to the accompanying drawings, in which: -

Figure 1 is a longitudinal medial section of a bore equipped with a removable ground anchor assembly in



accordance with one embodiment of the present invention,

Figure 2 shows in perspective, and on an enlarged scale, a saddle member as utilized in the assembly of figure 1, and

Fig. 3 shows a like saddle member adapted to receive more than one such cable.

Figure 1 shows an elongate bore 1 in which is emplaced a removable ground anchor assembly 2 itself comprising a length of cable 3; a saddle member 4, about which the cable is looped, extending generally across the bore; a longitudinal extension 5 to the saddle member; and rigid tubular members 6 surrounding the cable 3 at its regions nearest the saddle member.

In use the whole assembly is held in the elongate bore 1 by a solidified body of grout G which has been pumped into the bore as a liquid slurry and allowed to set and harden.

Figure 2 shows a form of saddle member 4 in more detail. As shown it possesses a saddle outer surface 7 grooved or recessed at 8 to accept and locate the cable loop. One such loop is shown, but more than one cable could be looped about the saddle. The inner saddle surface 9 lies largely transverse to the axis of the



bore. To it is fixed a suitable extension 5, to transfer stresses exerted on the saddle 4.

Fig. 3 shows a suitable saddle for use with more than one cable (in the example shown, two cables) in recesses 8a, 8b, other references being as for Fig. 2.

The device is installed and used as follows: -

1. A suitable elongate bore 1, perhaps up to 20 or 40 metres in length, is drilled through the retaining ground, usually at an inclined angle.
2. A length of pre-bent cable 3 looped generally at its middle portion around the groove or recess 8 in saddle 4 is fed into the bore. More than one such length can be so positioned if desired, either using a saddle as in Fig. 3 or by using two or more saddles as in Fig. 2.

Optionally the or each cable is greased, and may therefore be sheathed to cover such grease. Optionally moreover the or each cable is provided with rigid tubular members 6, for reasons disclosed below, where indicated and optionally at other more remote locations from the saddle, also as discussed in more detail below.

The exact nature of the saddle 4 can be varied provided it allows arcuate positioning of the more or



less central portion of the cable 3, (or plurality of cables) and that it extends partially across the bore. It is preferred but not absolutely essential to provide the recess 8 (or recesses 8a, 8b) for locating the cable or cables. The extension 5, extending upwards from the saddle to some extent, is also an optional but preferred feature.

3. Grout, which is a slurry comprising settable cementitious material with water, is pumped into the bore so as to fill the bore and surround the or each cable 3 and saddle 4.

If desired the grout at this stage may be pumped only to cover the tubular members 6. In such a case a second assembly, with single or multiple cables; can be inserted in the bore above this first grout level. If such a second or subsequent such assembly is so located, further tubes 6 may be located about the cable 3 at regions where they pass an upper saddle.

4. The grout is allowed to set and harden.

5. The two cable ends of the cable or of each of any plurality of cables used, are stressed simultaneously to the desired extent to act as an anchor.

The function of extension 5 is to give good transfer



of that resistant force provided within the grouted bore via the or each cable for restraining the earth retaining wall and allowing construction of the foundations. The tube 6 resists the tendency of the grout to crack under strain by compressing such cable itself, especially when this is sheathed and thus possesses some internal minor voids or compressible spaces. Also if and where the cable portions of a lower saddle pass the stresses exerted at an upper saddle there is a similar internal compressive potential and thus reinforcement tubes such as tube 6 can be positioned on the cables at these relatively high positions.

6. When it is desired to move the anchor cable one end of the cable (or of said cables) is pulled and the other end is released. The cable moves longitudinally in relation to the grout and the loop or each loop, passes around the saddle surface so that it can be withdrawn, leaving only the bore hole full of grout and the minor discrete metal members such as the saddle 4 and its extension 5, and the metal tubes 6.

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CLAIMS:

1. A ground anchor assembly (2) held within an elongate bore (1) by a solidified retaining material (G) and comprising at least one cable (3) protruding from the bore and a retention member within the bore acting in use to retain the cable (3), characterised in the retention member is a saddle member (4), around which the or each cable is looped, held in the bore (1) by the grout (G) so as to resist movement of the or each cable when both respective ends of such cable are pulled but permit extraction of the or each cable (3) when one end only thereof is pulled.

2. A ground anchor assembly as claimed in claim 1 in which the retaining material is a cementitious grout.

3. A ground anchor assembly as claimed in claim 1 or claim 2 in which the saddle member possesses an integral portion or attached member (5) extending along the bore.

4. A ground anchor assembly as claimed in claim 1, 2 or 3 in which tubular members (6) surround any cable at lengths thereof nearest the saddle.

5. A ground anchor assembly as claimed in any one preceding claim in which the arcuate surface (7) of the saddle member is recessed (8, 8a, 8b) to accept and

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locate the or each cable.

6. A ground anchor installation comprising one or more bores each having secured therein one or more ground anchor assemblies as claimed in any of claims 1 to 5.

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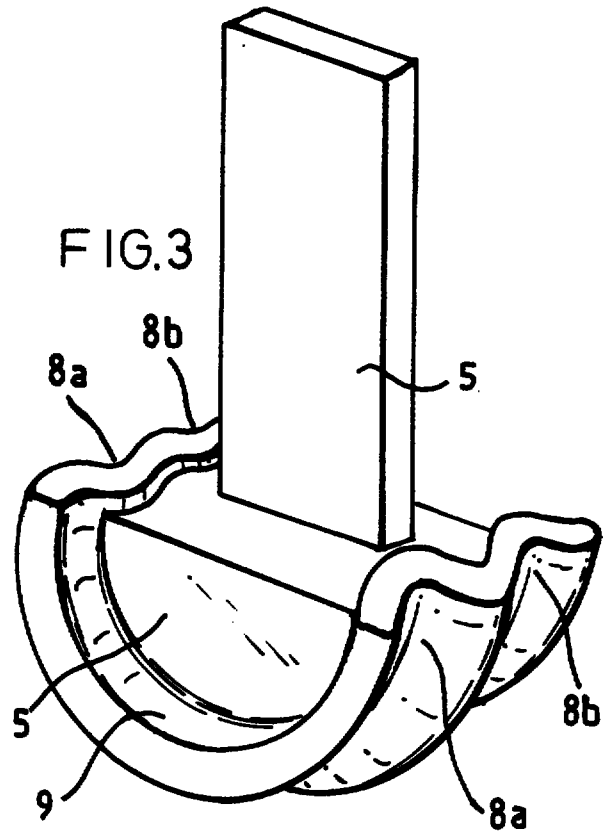
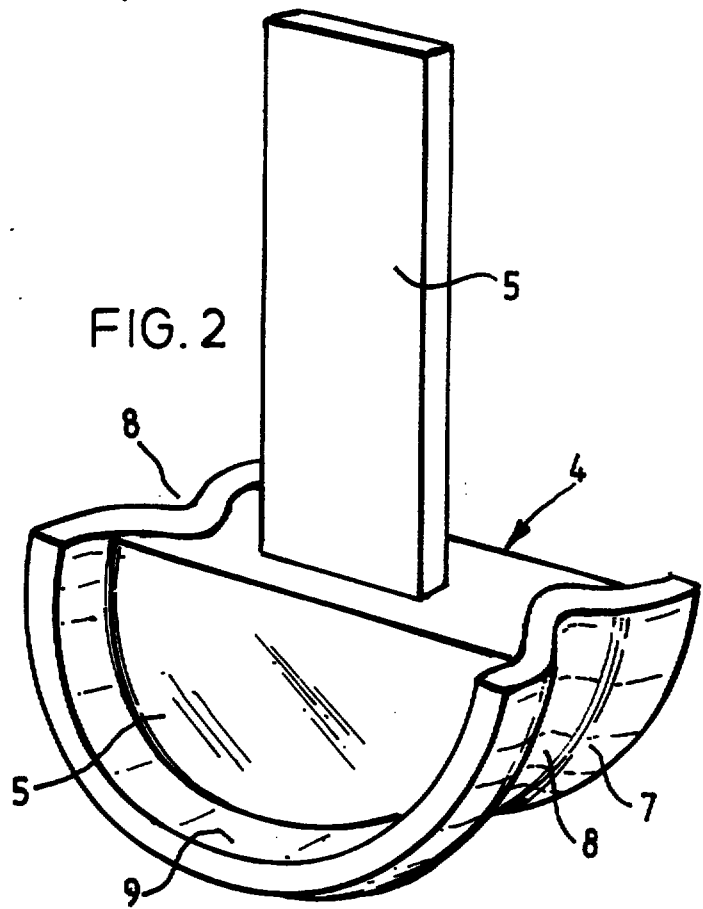
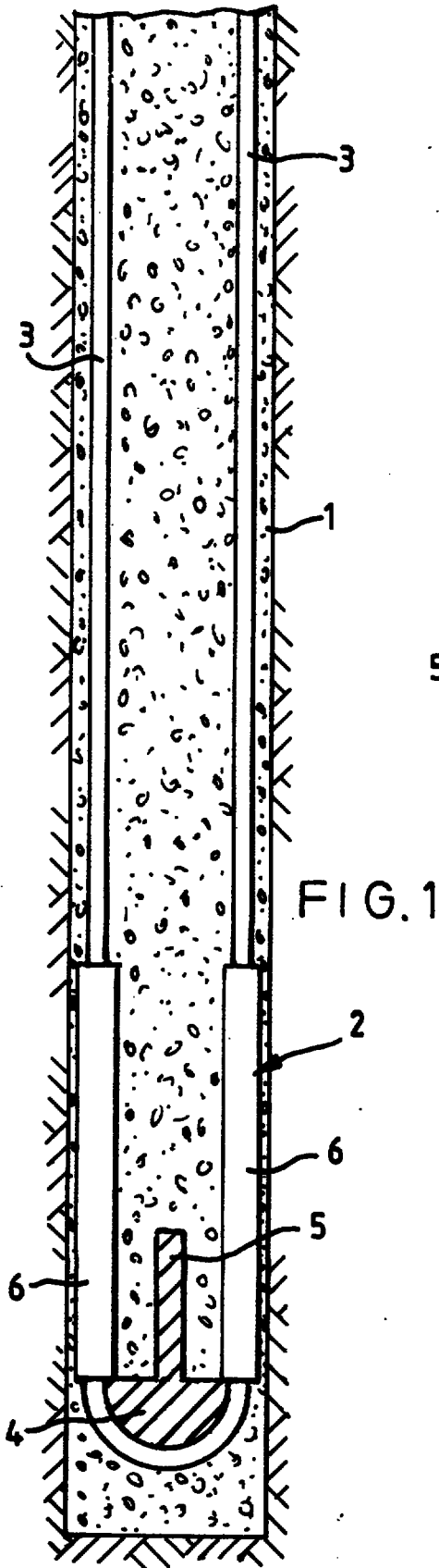
ABSTRACTREMOVABLE GROUND ANCHOR

A ground anchor assembly comprises a looped cable 3 passing around a saddle 4 with one or more optional recesses 8 in its outer surface 7, all this being held in place by solidified grout or the like in an elongate bore 1. Extension 5 gives good transfer of forces when both cable ends are stressed outwards, and tubes 6 prevent internal cracking of the grout. After a period of use the cable 3 can be removed by pulling one cable end only.

More than one such cable 3 can pass round saddle 4, and more than one such assembly can locate in the bore 1.

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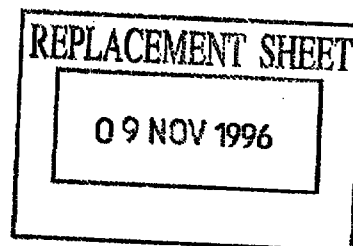


ABSTRACT

A ground anchor assembly comprises a looped cable 3 passing around a saddle 4 with one or more optional recesses 8 in its outer surface 7, all this being held in place by solidified grout or the like in an elongate bore 1. Extension 5 gives good transfer of forces when both cable ends are stressed outwards, and tubes 6 prevent internal cracking of the grout. After a period of use the cable 3 can be removed by pulling one cable end only.

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Figure 1



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REMOVABLE GROUND ANCHOR

This invention relates to ground anchors, and more particularly to ground anchor assemblies from which the anchor cable may be removed after use.

It is commonplace in the construction of deep foundations of large civil engineering structures to anchor a temporary earth retaining wall against lateral movement at least, by means of cables themselves held within elongate bores in the surrounding ground. There are many conventional way of effecting this in detail. By and large they involve the bonding of the inner end of the cable(s) into a cementitious or resin grout in the bore so that there is resistance to pullout movement of the cable.

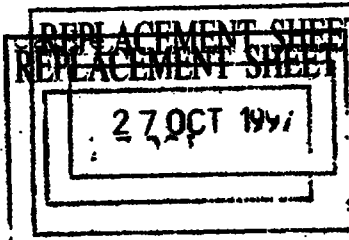
Occasionally it is appropriate to leave the cable and anchor in place, but frequently they are temporary expedients and where possible should be removed when the structure is complete and self-supporting.

It is of course possible to remove only the projecting cables by cutting the cable at the top end of the elongate bore, so that there is no surface projection, and thus leave a proportion of the cable in

the bore. However, since the bores in question are sometimes upto 20 or 40 metres in length, it can happen that they pass beyond the boundaries of the property upon which the construction is taking place and into the ground beneath adjacent properties. The abandoned components of such ground anchors may be detrimental to subsequent work on the adjacent site. In particular, while the bore itself and the solidified anchor grout is of no particular importance, and while any minor fastening elements, of discrete nature and relatively small size, can be readily removed from subsequent excavations, the existence of a length of high tensile cable stretching across a site to be developed, at some distance under the ground, is undesirable and it is frequently stipulated that any such cables must be removed on completion of adjacent building construction.

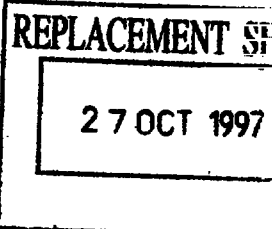
The present invention is concerned with an assembly for a ground anchor from which assembly the anchor can be removed after the desired period of use.

The present invention provides a ground anchor assembly held within an elongate bore by a solidified retaining material and comprising at least one cable protruding from the bore and a saddle member held within the bore by the grout so as to resist movement of the or each cable when both respective ends of such cable are pulled but permit extraction of the or each cable when one



end only thereof is pulled, the saddle member having a saddle outer surface around which the or each cable is looped, and the saddle inner surface lying substantially transverse to the axis of the bore, characterised in that an integral portion or attached member extends along the bore from the saddle inner surface.

The solidified retaining material is typically a grout, as described below. Possibly it could be a resinous material. For ease of description the term 'grout' is used below, as describing the more usual expedient.



The arcuate surface of the saddle member may be grooved or recessed to accept the cable, or more than one cable.

Preferably, tubular members are provided extending from the saddle inner surface surrounding any cable at lengths thereof nearest the saddle.

If desired a bore may be provided with more than one such assembly at different distances along the bore.

The invention will be further described with reference to the accompanying drawings, in which: -

Figure 1 is a longitudinal medial section of a bore

equipped with a removable ground anchor assembly in accordance with one embodiment of the present invention,

Figure 2 shows in perspective, and on an enlarged scale, a saddle member as utilized in the assembly of figure 1, and

Fig. 3 shows a like saddle member adapted to receive more than one such cable.

Figure 1 shows an elongate bore 1 in which is emplaced a removable ground anchor assembly 2 itself comprising a length of cable 3; a saddle member 4, about which the cable is looped, extending generally across the bore; a longitudinal extension 5 to the saddle member; and rigid tubular members 6 surrounding the cable 3 at its regions nearest the saddle member.

In use the whole assembly is held in the elongate bore 1 by a solidified body of grout G which has been pumped into the bore as a liquid slurry and allowed to set and harden.

The or each cable is provided with rigid tubular members 6, for reasons disclosed below, where indicated and optionally at other more remote locations from the saddle, also as discussed in more detail below.

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REPLACEMENT

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detail. As shown it possesses a saddle outer surface 7 grooved or recessed at 8 to accept and locate the cable loop. One such loop is shown, but more than one cable could be looped about the saddle. The inner saddle surface 9 lies largely transverse to the axis of the bore. To it is fixed a suitable extension 5, to transfer stresses exerted on the saddle 4.

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Fig. 3 shows a suitable saddle for use with more than one cable (in the example shown, two cables) in recesses 8a, 8b, other references being as for Fig. 2.

The device is installed and used as follows:-

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2. A length of pre-bent cable 3 looped generally at its middle portion around the groove or recess 8 in saddle 4 is fed into the bore. More than one such length can be so positioned if desired, either using a saddle as in Fig. 3 or by using two or more saddles as in Fig. 2.

Optionally the or each cable is greased, and may therefore be sheathed to cover such grease.

The exact nature of the saddle 4 can be varied provided it allows arcuate positioning of the more or

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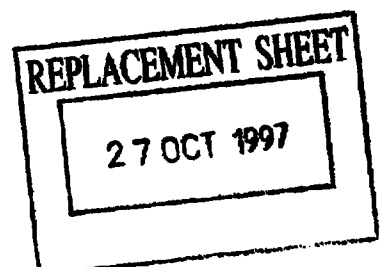
3. Grout, which is a slurry comprising settable cementitious material with water, is pumped into the bore so as to fill the bore and surround the or each cable 3 and saddle 4.

If desired the grout at this stage may be pumped only to cover the tubular members 6. In such a case a second assembly, with single or multiple cables; can be inserted in the bore above this first grout level. If such a second or subsequent such assembly is so located, further tubes/6 may be located about the cable 3 at regions where they pass an upper saddle.

4. The grout is allowed to set and harden.

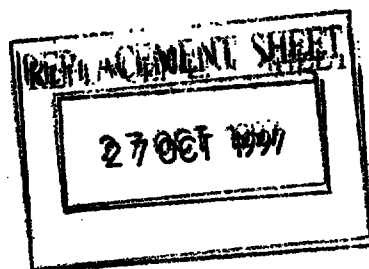
5. The two cable ends of the cable or of each of any plurality of cables used, are stressed simultaneously to the desired extent to act as an anchor.

The function of extension 5 is to give good transfer



of that resistant force provided within the grouted bore via the or each cable for restraining the earth retaining wall and allowing construction of the foundations. The tube 6 resists the tendency of the grout to crack under strain by compressing such cable itself, especially when this is sheathed and thus possesses some internal minor voids or compressible spaces. Also if and where the cable portions of a lower saddle pass the stresses exerted at an upper saddle there is a similar internal compressive potential and thus reinforcement tubes such as tube 6 can be positioned on the cables at these relatively high positions.

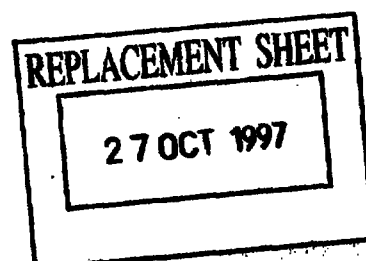
6. When it is desired to move the anchor cable one end of the cable (or of said cables) is pulled and the other end is released. The cable moves longitudinally in relation to the grout and the loop or each loop, passes around the saddle surface so that it can be withdrawn, leaving only the bore hole full of grout and the minor discrete metal members such as the saddle 4 and its extension 5, and the metal tubes 6.





CLAIMS

1. A ground anchor assembly (2) held within an elongate bore (1) by a solidified retaining material (G) and comprising at least one cable (3) protruding from the bore and a saddle member (4) held within the bore (1) by the grout (G) so as to resist movement of the or each cable when both respective ends of such cable are pulled but permit extraction of the or each cable (3) when one end only thereof is pulled, the saddle member (4) having a saddle outer surface (7) around which the or each cable (3) is looped, and a saddle inner surface (9) lying substantially transverse to the axis of the bore, characterised in that an integral portion or attached member (5) extends along the bore from the saddle inner surface (9).
2. A ground anchor assembly as claimed in Claim 1 in which the retaining material is a cementitious grout.
3. A ground anchor assembly as claimed in Claim 1 or Claim 2, in which tubular members (6) are provided extending from the saddle inner surface (9) surrounding any cable (3) at lengths thereof nearest the saddle.
4. A ground anchor assembly as claimed in any one preceding claim, in which the outer arcuate surface (7) of the saddle member is recessed (8, 8a, 8b) to accept and locate the or each cable.
5. A ground anchor installation comprising one or more bores each having secured therein one or more ground anchor assemblies as claimed in any of Claims 1 to 4.
6. A ground anchor, comprising a plurality of ground anchor assemblies according to any preceding claim, at different distances along a bore (1).



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