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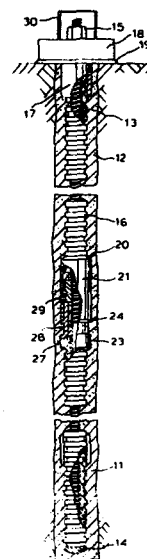
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Ground anchors.

A ground anchor comprises an inner steel bar (13) and an outer tube (16), which may be of corrugated plastics material, surrounding the inner bar. Each of the inner bar and the outer tube is made up of at least two sections connected together by a coupling comprising a screw threaded sleeve (29) in which correspondingly screw threaded ends of respective bar sections (13) are engaged and an outer tube connecting assembly (20, 21 and 23). The outer tube connecting assembly comprises two parts (20, 21 and 23) which are connected to respective tube sections (16) and which are interconnectible to form a sealed joint between them. One of the parts comprises a collar (20) and a sleeve (21) which extends beyond the screwed end of its respective inner bar section and the other part (23) is slideably engageable with the sleeve (21).



M&C FOLIO: 230P50554X

WANGDOC: 0307h

"GROUND ANCHORS"

This invention relates to ground anchors of the kind usually referred to as bar anchors. In a bar anchor, a bore hole is occupied by an inner bar with a protective outer tube surrounding it. This is normally encased in
5 a grout which may be cement or other settable material and there also may be normally a filling of grout or other suitable material between the inner bar and the protective tube.

Where the anchor is long, the bar and tube may be
10 made up of more than one section, the respective sections being joined together. It is a requirement that the inner bar is so joined that tension can be applied between the ends of the whole bar, the loads sometimes being very substantial.

15 Although the outer tube is not necessarily load carrying, it must nevertheless be strong enough to withstand side loads resulting, for example, from soil collapse around the anchor and the same must be true of the coupling between sections of the outer tube. The
20 outer tube coupling must also provide protection to the inner bar at least equal to that afforded by the outer tube sections themselves.

Various systems for coupling the bar and tube sections have been proposed and used. In prior constructions, the bar sections are connected by screw threaded coupling elements, the bar itself being screw threaded either over appropriate portions or, even over the whole of its length. The outer tube coupling is achieved by means of a sleeve which, in known constructions, is moved into place when the connection between sections of the bar has been made. With some existing systems there is some risk that the inner bar will not be effectively and reliably connected since the screw threaded connecting sleeve may not reliably engage on a bar end but instead may engage on the other adjacent bar end to a longer than required extent, so that on one bar there is a very short threaded engagement and on the other a long one. This may result in breakage of the bar when tension is applied, after installation. The sleeve fitting arrangement in known systems may also be unreliable in that the sleeve may not be carefully fitted, allowing corrosion to set in on the inner bar. Any fault may not become apparent for some considerable time, since the coupling will be hidden from sight as soon as installed. In addition coupling of the bar and tube sections with known coupling systems takes considerable time.

The present invention therefore seeks to provide a ground anchor which mitigates against the drawbacks of the prior art.

In accordance with the present invention, there is
5 provided a ground anchor comprising an inner bar and an outer tube surrounding the inner bar, each made up of at least two sections, the sections of inner bar and outer tube being connected together by a coupling comprising a screw threaded sleeve in which correspondingly screw
10 threaded ends of respective bar sections are engaged, and an outer tube connecting assembly, wherein the outer tube connecting assembly comprises two parts which are connected to respective tube sections and which are interconnectible to form a sealed joint between them.

15 Preferred and/or optional features of this invention are set forth in claims 2-11.

Where a long anchor is required the ground anchor may include more than two sections, jointed by respective couplings.

20 The arrangement is such that connection of two adjacent sections involves connection of the bar sections and the outer tube sections simultaneously.

The invention will now be described by way of example with reference to the accompanying drawings in
25 which:

Figure 1 is a part cross sectional view of a ground anchor constructed in accordance with the invention;

Figure 2 is a cross sectional view on a larger scale of a coupling in accordance with the invention, and

5 Figure 3 is a view of one of the components of the coupling.

The ground anchor in Figure 1 is shown installed. The inner end is in rock or other hard substance whereas the outer end can be in relatively soft uncompacted
10 material. Alternatively, the anchor may be used to secure a concrete or other structure. The anchors can be used for many civil engineering applications and may have substantial loads applied depending upon operating conditions. The ground in which this anchor is fitted
15 is generally indicated at 10 in Figure 1. The process for installing the anchor is to drill a hole to the required depth removing the soil or rock so as to make provision for entry to the anchor. The anchor is pushed into the hole and a filling of liquid grout indicated at
20 11 is injected or poured around it. When this sets, the anchor is held firmly in place particularly at the inner end of the hole. A casing may be used to support the surrounding soil particularly in the area of loose soil near the surface. When the casing has been removed
25 secondary grout indicated at 12 is placed into the hole, if required.

The anchor as illustrated comprises an inner bar 13 sometimes called the tendon. This is made from high tensile or other steel and may be screw threaded through out the whole of its length. The anchor is sealed at the inner end by an end plug 14 of non-corrodable material and its outer end carries a nut 15 used to retain tension in the bar. Further reference will be made to this later.

Surrounding the inner bar is a tube 16 which in this example is a corrugated plastics tube secured at one end to the end plug 14 and at the other end to a sleeve 17 connected to a member 18 which rests on or against the surface to be supported or retained. Sealing material 19 may be used around this member. Further grout is provided between the inner bar 13 and the tube 16.

The assembly is pre-assembled on the surface prior to installation. A number of sections are used to make up the complete ground anchor and the sections are connected by couplings to which further reference will be made. In this example, there are two sections but in other cases, several more sections may be used depending upon the length or depth of the hole.

Each individual section has a part of the coupling and in the case of the lower or inner section shown in Figure 1 there is a coupling part connected to the end remote from the end plug 14. Similarly, in the case of

the upper or outer section of the Figure 1 construction, a coupling part is fitted at one end whereas the other end extends out of the surface and carries the nut 15 as described.

5 Intermediate sections have respective coupling parts at their two ends. Thus, each intermediate section carries at one end the coupling part fitted to the lower or inner section shown in Figure 1 and at its other end a coupling part as fitted to the upper or outer sections
10 shown in Figure 1. Such intermediate sections are preformed prior to installation including the internal grout and the coupling parts are fixed to the sections of inner bar and outer tube.

Figures 2 and 3 show the components of the coupling
15 for the outer tube. These comprise a flanged collar 20 secured in one end of a cylindrical sleeve 21, such as by welding. The outer end of the collar is formed with grooves 22 which engage in and are securable with the interior of the adjacent section of tube 16. The collar
20 20 is secured within the tube 16 so as to be sealed against ingress of corrosive materials and is also secured against rotation relatively to the tube 16.

Secured to the tube 16 of the adjacent section, there is a component 23 which is slideably engageable
25 with the end of the sleeve 21. This component 23 comprises a hollow stepped generally cylindrical member

with a flange 24 which may abut against the end of the sleeve 21. An end portion which slideably engages in the sleeve 21 has at least one but preferably a plurality of grooves 25 to accept sealing rings. At its
5 other end the component 23 has a grooved portion 26 engageable over the outer tube 16 of the adjacent section. This can be secured in a manner similar to the securement of the portion 22 both against ingress of corrosive materials and also against relative rotation.

10 In the side of the grooved portion 26 there may be an opening 27 for entry of internal grout which is pumped into each section to fill the space between the inner bar and the outer tube.

On the exterior of the component 23 a pair of flats
15 28 are provided for engagement by a clamp or support device or spanner.

Within the components shown in Figures 2 and 3 there is a coupling sleeve 29 for the inner bar sections. As previously described, the sections are screw threaded
20 with relatively coarse threads throughout their lengths. Grout which fills the space between the inner bar and the outer tube, however, leaves the bar end exposed and it is on to this bar end that the sleeve 29 is screwed. Prior to installation of an individual
25 section, the sleeve 29 is fitted to the bar end of the lower or inner section, i.e. the bar end not situated

within the sleeve 21. The arrangement is such that the sleeve 29 will not screw further onto the bar end of the lower bar section than the position shown in Figure 1 in which the bar end is approximately half way along the length of the sleeve 29. This can be achieved by providing a dead spot in the thread of the sleeve 29 midway between its ends so that the threads on the bar end and sleeve will not mate beyond the position shown in Figure 1.

To make the coupling between the two sections, the section carrying the component 23 and coupling sleeve 29 is introduced into the hole but its upper end remains above the surface for the time being. It is held by means of a clamp which supports the weight of the section as well as preventing its rotation. The section is gripped below the component 23 around the outer tube 16. Alternatively, forks of a support device may be engaged on the flats 28 of the component 23.

The next section which carries the sleeve 21 is now introduced over the supported section. The sleeve 21 is pre-packed with corrosion resistant grease or other material (and, if necessary, taped over to prevent dirt entering the grease or other material during transportation) so as substantially to fill the space within the coupling but allows movement of the coupled tendon during tensioning. The two sections are engaged

together by screwing the upper section. This results in engagement of the bar end of the upper section in the sleeve 29 and at the same time engaging the sleeve 21 over the component 23. A coupling is completely secure

5 when the inner bar ends of the adjacent section engage one another and this will coincide with a position in which the sleeve end 21 will abut against the flange 24 or will be within a defined distance from the flange 24 of a component 23. By this means, coupling of the inner

10 bar as well as the outer tube takes place simultaneously and reliably. Moreover, the coupling can be completed in a matter of a minute or two. The clamp or support can then be released and the anchor lowered or driven further into the hole which has been prepared for it.

15 Any appropriate number of sections can be added. It is to be understood that the anchor can be fitted in any orientation and therefore references to lowering the anchor into the hole may be inappropriate where the anchor is fitted horizontally or upwardly.

20 When the complete anchor has been installed and the space around it filled with grout as described, tension can be applied to the inner bar in conventional manner. It is usual to grip the outer end of the bar and apply appropriate force to it and then to turn the nut 15 so

25 as to engage on the member 18 to retain the bar in tension. A cover 30 is finally fitted to enclose the bar end and nut.

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The inner bar is normally coated with a release agent over parts of its length between the couplings, so as to allow for elongation when tension is applied.

M&C FOLIO: 799P50554X

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CLAIMS:

1. A ground anchor comprising an inner bar (13) and an outer tube (16) surrounding the inner bar, each made up of at least two sections, the sections of inner bar and outer tube being connected together by a coupling
5 comprising a screw threaded sleeve (29) in which correspondingly screw threaded ends of respective bar sections (13) are engaged, and an outer tube connecting assembly (20, 21 and 23), wherein the outer tube
10 connecting assembly comprises two parts (20,21;23) which are connected to respective tube sections (16) and which are interconnectible to form a sealed joint between them.
2. The ground anchor of claim 1, wherein one of the two parts of the outer tube connecting assembly includes an outer tube connecting sleeve (21) which extends beyond
15 the screwed end of its respective inner bar section (13) and the other part (23) is slideably engageable with the outer tube connecting sleeve.
3. The ground anchor of claim 2, wherein said one part also includes a collar (20) which connects the outer
20 tube connecting sleeve to its respective outer tube section (16).

4. The ground anchor of claim 3, wherein the collar (20) has a circumferential flange between its ends and wherein one end of the collar extends into the outer tube connecting sleeve (21) and the other end of the collar extends into the aforesaid respective outer tube section (16).

5. The ground anchor of any one of claims 2-4, wherein the outer tube connecting sleeve (21) is pre-packed with corrosive resistant material, e.g. grease.

10 6. The ground anchor of any one of claims 2-5, wherein the screw threaded sleeve (29) is pre-mounted on the screw threaded end of the bar section (13) not situated, prior to assembly of the coupling, in the outer tube connecting sleeve (21).

15 7. The ground anchor of any one of claims 2-6, wherein the other part (23) fits into the outer tube connecting sleeve (21) and has one or more circumferentially extending grooves (25) to accept sealing rings.

8. The ground anchor of any one of the preceding
20 claims, wherein the two parts of the outer tube connecting assembly (20, 21 and 23) are secured to respective outer tube sections (16) so as to be sealed against ingress of corrosive materials.

9. The ground anchor of any one of the preceding claims, wherein the screw threaded ends of the two bar sections (13) can each only be threadably engaged with half or substantially half of the length of the screw threaded sleeve (29).
5
10. The ground anchor of any one of the preceding claims, wherein the inner bar sections (13) are screw threaded over their entire length.
11. The ground anchor of any one of the preceding
10 claims, wherein the outer tubes (16) are corrugated plastics tubes.

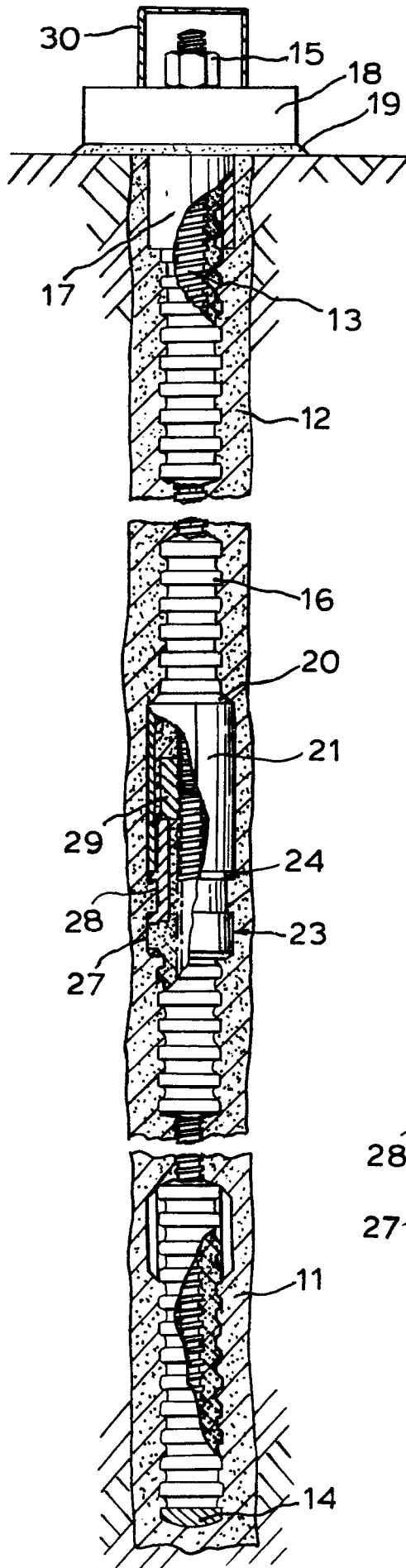


FIG. 1.

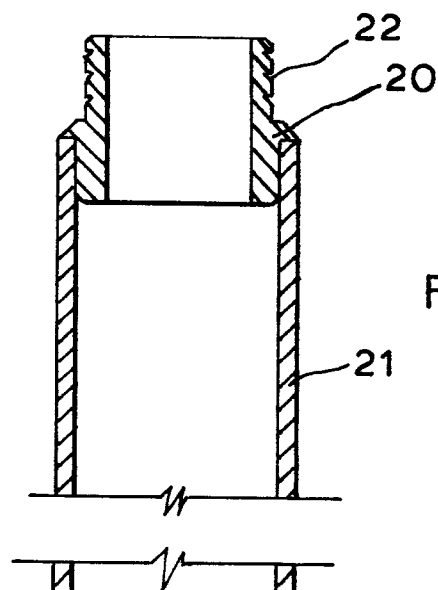


FIG. 2.

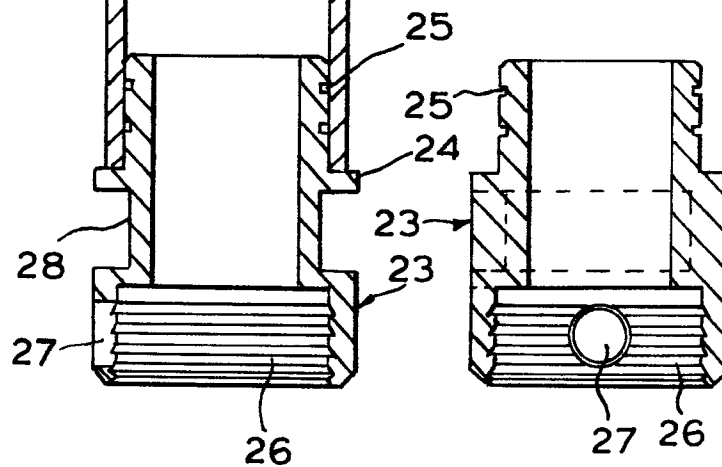


FIG. 3



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	DE-A-2 019 166 (L. MOLL) * Page 2, line 27 - page 3, line 9; page 3, line 25 - page 4, line 8; page 5, line 13 - page 6, line 16; claims 7-15; figures 1,2 *	1,8	E 02 D 5/80 E 02 D 5/76
Y		9-11	
A		5,7	
Y	FR-A-2 077 119 (L. MOLL) * Page 2, lines 1-12; page 5, line 2 - page 6, line 4; claims 5,7,15,21; figure 2 *	9,10	
A		2-4, 7, 11	TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
Y	FR-A-2 122 094 (BAUER) * Page 6, lines 19-25; claim 1; figures 1,2 *	11	E 02 D E 21 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24-03-1986	Examiner KERGUENO J.P.D.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			