

- [54] **ANCHOR TIE CONSTRUCTION AND METHOD OF SETTING AN ANCHOR TIE IN THE GROUND**
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- [58] Field of Search.....52/1, 2, 155, 156, 127, 741, 52/742, 166; 61/53.56, 53.58, 53.62, 45 B

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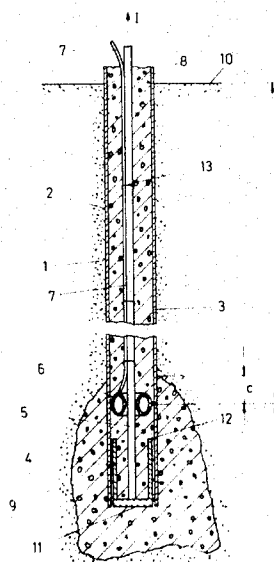
- [57] **ABSTRACT**
 A method of setting an anchor tie in the ground, the

anchor tie comprising an anchor body and a rod or bar connected to the anchor body and extending to above ground level. The anchor tie is placed in a bore hole traversing the ground and settable material, such as concrete, is introduced into the bore hole to surround the anchor body and the adjacent portion of the rod. In accordance with the invention, the settable material surrounding the rod adjacent the anchor body is displaced from the settable material in the region of the anchor body by introducing a pressure medium between the respective regions. This may be accomplished by surrounding the rod adjacent the anchor body with an inflatable elastic annular tube or bag into which pressure medium, such as water, is forced after the settable material has been poured but before it has set.

Considered from another aspect, the invention provides for an anchor tie construction wherein the anchor body proper is set in the ground, surrounded by a set mass of material, such as concrete, the rod extending from the anchor body being spaced from the set mass in the region adjacent the anchor body by an inflated annular bag or tube surrounding the rod means.

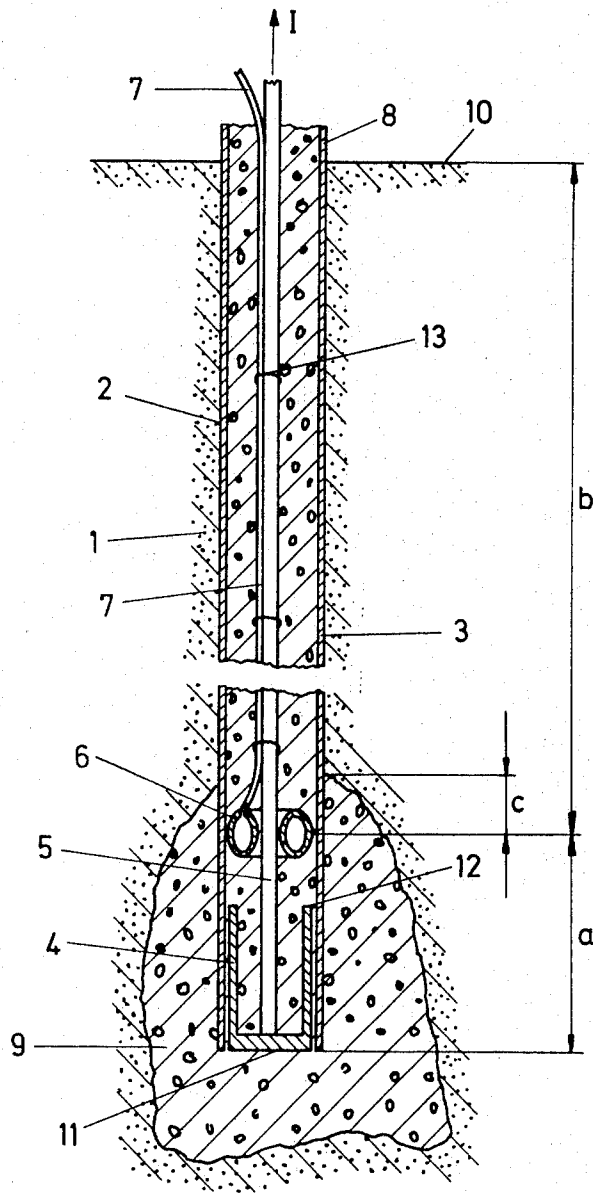
Considered from a still further aspect, the invention provides for a testing method for determining the resistance to pulling force of an anchor tie construction set in the ground. According to the method, a pressure medium containing bag or tube surrounds the rod adjacent the anchor tie body proper. Communication to ground level is established with the pressure medium containing bag or tube, for example by a pipe or conduit extending from the bag to above ground level. A pulling or drawing force is then exerted on the rod. If the anchor tie is dislodged by this force, it will press against the pressure medium containing bag, thereby causing pressure medium to be forced through the conduit towards ground level. By contrast, if the anchor tie withstands the pulling force, no pressure medium will reach ground level.

9 Claims, 1 Drawing Figure



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ANCHOR TIE CONSTRUCTION AND METHOD OF SETTING AN ANCHOR TIE IN THE GROUND

FIELD OF INVENTION

The invention relates to anchor ties or tie rods which are set in the ground and which are used for anchoring construction elements.

BACKGROUND INFORMATION AND PRIOR ART

Anchor ties are set in the ground for the purpose of anchoring construction elements. Such anchor ties usually comprise an anchor body proper and a rod or bar connected to the anchor body and extending vertically therefrom to a location above ground level. In practice, such anchor ties are inserted in a bore hole traversing the ground with the anchor body resting on the bottom of the hole. Settable construction material, such as for example concrete, is then poured or injected into the bore hole to surround the anchor body and to penetrate the surrounding earth formation to form, after setting, as set mass which effectively retains the anchor tie in the ground. The settable material, which is introduced into the bore hole, of course also surrounds the rod, at least in the region adjacent the anchor body. However, it is desired that settable material surrounding the rod, at least in the zone or region adjacent the anchor body proper, is spaced or separated from the set material surrounding the anchor body. According to a prior suggestion, the separation of the settable materials is accomplished by an additional pull or drawing member which surrounds the anchor rod over a predetermined length. By pulling this pulling member, a pulling force is exerted on the settable material surrounding the anchor rod and in this manner the settable material in the respective region is moved away from the bulk of the settable material surrounding the anchor body and a spacing between the settable material and the rod is thus accomplished. It has also been suggested that stationary spacers of rigid or soft material be interposed between the settable material and the rod means. All these prior art constructions, however, have serious disadvantages, are cumbersome and do not always yield the desired results.

SUMMARY OF THE INVENTION

It is a primary object of the invention to overcome the disadvantages of the prior art proposals and to accomplish the desired separation between the two regions of the settable material in an exceedingly simple and efficient manner which moreover can be readily controlled and regulated.

Another object of the invention is to provide a superior anchor tie construction.

It is also an object of the invention to provide for a method of testing the resistance to pulling forces of anchor tie constructions set in the ground.

Generally, it is an object of the invention to improve on the art of anchor tie construction as presently practiced.

Briefly, and in accordance with the invention the settable material, after it has been introduced into the bore hole, is displaced, prior to setting, in the boundary region or transition zone between the anchor body proper and the rod. This is accomplished by a pressure

medium. From a practical point of view the rod, in the region adjacent the anchor body proper is surrounded by an inflatable elastic bag or tube which communicates with ground level through a pipe or conduit. When the settable material, such as concrete, is poured into the bore hole, the bag or tube is in deflated condition and lies flat against the rod. However, after the introduction of the settable material, a suitable pressure medium, such as for example water, is injected into the bag or tube, thereby inflating it and displacing the settable material, before it has set, away from the rod and thus away from the settable material surrounding the anchor body.

The inflatable bag or tube which preferably is of annular nature, is advantageously arranged about the rod at a level adjacent the rear or top end of the anchor body proper as distinguished from the front or bottom end of the anchor body. Due to the separation accomplished in accordance with the invention, any force to which the rod is subjected, is introduced into the surrounding soil formation through the tie rod construction proper only.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawing and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

The single FIGURE of the drawing illustrates a longitudinal section through a formation in which an anchor tie construction is being set in accordance with the invention.

Referring now to the drawing the anchor tie, comprising an anchor rod 5 and an anchor body 4, is set in a formation 1, ground level being indicated by reference numeral 10. The formation 1 is traversed by a bore hole 2 which is lined with casing as indicated by reference numeral 3. The casing 3 may be in the nature of a drilling pipe. The anchoring body 4 is of substantially U-shaped cross-section and has a bottom or front end 11 and a rear or top end 12. The anchor body 4 and the rod 5 are connected to each other, the rod extending from the anchor body 4 to a location above the ground level 10. The casing 3 also extends to above ground level as indicated by reference numeral 8.

In accordance with the invention, an annular tube or bag 6 of elastic material surrounds the rod 5 at a location adjacent the rear or top end 12 of the anchor body 4. A conduit or pipe 7 extends from the bag or tube 6 to above ground level, the conduit being tied to the rod by string or wire as indicated by reference numeral 13. In practice, the bore hole 2 is first drilled and lined with the casing 3,8. The anchor tie is then inserted into the bore hole with the anchor body 4 resting on the bottom of the hole and the rod 5 extending to a location above the ground level 10 as shown. The anchor tie is inserted into the bore hole with the bag or tube 6 connected thereto, the bag or tube being in deflated or flat condition. Settable construction material, such as for example, concrete, is then injected into the bore hole. This may be accomplished thereby that a source of the material is connected to the projecting end 8 of the cas-

ing 3 and the material, such as concrete, is forced into the bore hole under pressure. The setttable material thus enters the bore hole, surrounds the anchor body 4 and penetrates into the surrounding earth formation. The setttable material, however, also surrounds the rod. During the pouring of the setttable material, the casing 3 is preferably raised, thereby facilitating penetration of the setttable material into the earth formation. The setttable material after setting forms the so-called anchor block 9 which is in fact a hard set mass. The lifting or raising of the casing 3, while simultaneously pouring the setttable material under pressure, should advantageously be effected until the casing has reached a location behind the bag or tube 6, to wit, at the upper end of the path *c*. Prior to setting of the setttable material, a pressure medium is now introduced into the bag or tube 6 for inflation purposes. This is accomplished by suitably connecting the end 7 of the conduit projecting above ground level to a pressure medium source, such as water. The bag or tube 6 is thus inflated and due to the inflation, of course, displaces the setttable material in the zone or region of the rod adjacent the rear or top end 12 of the anchor body, thereby separating the setttable material surrounding the rod from the bulk of the setttable material surrounding the anchor body. Once the bag or tube 6 has been inflated by the pressure medium, to wit for example, water, the casing 3 may be raised further and additional setttable material may be introduced to fill the bore hole up to ground level. Usually it is unnecessary to effect the introduction of the additional setttable material under substantial pressure. Due to the inflated separating bag or tube, the setttable material in the zone *a*, as indicated in the drawing, is thus effectively separated from zone *b*.

Once the material has set, the inventive arrangement is peculiarly suitable for testing whether or not forces applied to the anchor tie are actually introduced into the ambient or surrounding earth formation solely through the anchor block 9. For the purpose of testing, a pulling force is exerted on the rod 5 in the direction of the arrow I, while the outer end of the conduit 7 is opened. If, as a result of the pulling force, no liquid exits from the open end of the conduit 7, it follows, of course, that the anchor block 9 has not been dislodged within the earth formation but has been able to withstand the pulling force. By contrast, if the pulling force, to which the rod 5 is subjected, results in movement of the anchor block 9, pressure will, of course, be exerted on the water containing bag or tube 6 resulting in water appearing through the open end of the conduit 7. This, of course, is then an indication that the anchor tie construction has not withstood the pulling force. Once it has been established, in the manner referred to, that the anchor tie construction has been properly set and is capable of withstanding the desired forces, setttable material, such as concrete, may also be introduced into the bag or tube 6. This is simply accomplished by displacing the water or the like pressure medium in the bag or tube by the setttable material through the conduit 7.

To prevent corrosion, it is advantageous to coat the rod 5 over its entire length with a corrosion resistant insulating layer.

What is claimed is:

1. A method for setting an anchor tie in the ground, said anchor tie consisting essentially of an anchor body and rod means fixed to said anchor body, said method comprising the steps of:

5 inserting the anchor tie into a bore traversing the ground with a portion of said rod means projecting to above ground level;

10 locating inflatable means in said bore at a point surrounding said rod means which point is proximate to above said anchor body, said inflatable means including means extending to above ground level through which a pressure medium may be directed into or out of said inflatable means;

15 introducing setttable material into said bore to surround said anchor body, said rod means and said inflatable means;

20 injecting a pressure medium into said inflatable means prior to setting of said setttable material whereby portions of said setttable material surrounding said inflatable means are displaced from the volume occupied by said inflatable means thereby to form a separation between the setttable material surrounding said rod means and the setttable material surrounding said anchor body; and
25 thereafter permitting said setttable material to set whereby said anchor tie may be formed with the setttable material which surrounds said rod means separated from the setttable material which surrounds said anchor body.

2. A method according to claim 1, wherein said inflatable means comprises an inflatable elastic annular bag having a tube extending therefrom to above ground level, said setttable material being introduced into said bore with said bag in a deflated condition, said pressure medium thereafter being injected into said bag through said tube to inflate said bag thereby to cause said displacement of the setttable material.

3. A method as claimed in claim 1, wherein said pressure medium is water.

4. A method as claimed in claim 1, wherein said bore is lined with casing, said casing being at least partially lifted out of said bore before said setttable material has set.

5. A method as claimed in claim 1, wherein said bore is lined with casing, said casing being raised while said setttable material is introduced into said bore.

6. A method according to claim 5, including the steps of introducing said setttable material under a first higher pressure for a period of time until said casing which is being raised is situated a small distance above said inflatable member, subsequently injecting said pressure medium into said inflatable means, and thereafter, and while said casing is continued to be raised, introducing additional amounts of setttable material under a second lower pressure.

7. A method according to claim 2, wherein setttable material is introduced into said bag through said tube subsequent to injection therein of said pressure medium, whereby said pressure medium is displaced by said setttable material, whereafter the setttable material in said bag is allowed to set.

8. A method for testing the resistance to pulling force of an anchor tie set in the ground, said anchor tie consisting essentially of an anchor body and rod means fixed to said anchor body, said anchor tie being sur-

rounded by a mass of settable material and having said rod means extending from said anchor body to a location above ground level, said method comprising the steps of:

locating inflatable means to surround said rod means
 at a point proximately above said anchor body
 prior to placement of said settable material about
 said anchor tie, said inflatable means including
 means extending to above ground level through
 which a pressure medium may be directed into or
 out of said inflatable means;
 injecting a pressure medium into said inflatable
 means subsequent to placing of said settable
 material about said anchor tie but prior to setting
 of said settable material whereby portions of said
 settable material surrounding said inflatable means
 are displaced from the volume occupied by said in-
 flatable means thereby to form a separation
 between the settable material surrounding said rod
 means and the settable material surrounding said
 anchor body;
 thereafter permitting said settable material to set;
 applying a pulling force to said rod means; and de-
 tecting whether said pressure medium is displaced
 from within said inflatable means thereby to deter-
 mine whether said set material surrounding said
 anchor body has been displaced as a result of the
 pulling force applied to said rod means whereby

the effectiveness of the setting of said anchor tie in the ground may be determined.

9. An anchor tie construction anchored in the ground comprising an anchor body, rod means fixed to said anchor body and extending therefrom to a location above ground level, a first mass of set material surrounding said anchor body, a second mass of set material surrounding said rod means, said second mass being located adjacent said first mass, and inflatable means configured to surround said rod means and located between said first and said second mass of set material, said inflatable means including means extending to above ground level through which a fluid medium may be directed into and out of said inflatable means, said inflatable means being adaptable to being inflated by introduction of a pressure medium therein during a time when said set material is in an unset condition thereby to effect separation between said first and said second mass of set material prior to setting thereof, said inflatable means being also adapted to have unset settable material injected therein whereby said pressure medium may be displaced therefrom so that the internal volume of said inflatable means becomes occupied by set material which has been permitted to set after having been first introduced in said unset condition.

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