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(54) **Anchoring assembly**

(57) An anchoring assembly for anchoring a structure to the ground, comprising an anchoring pile (2) having a rotatably drivable shaft (3) which is provided at least at its free end with a ground drill element (4) for screwing the anchoring pile (2) into the ground, and an elongate foundation element (8) which can be moved into the ground, in which the shaft (3) of the anchoring pile (2) is rotatably connected to the foundation element (8), extends substantially in the longitudinal direction of the foundation element (8) and, together with the drill element (4), extends at least partially as far as under the foundation element (8).

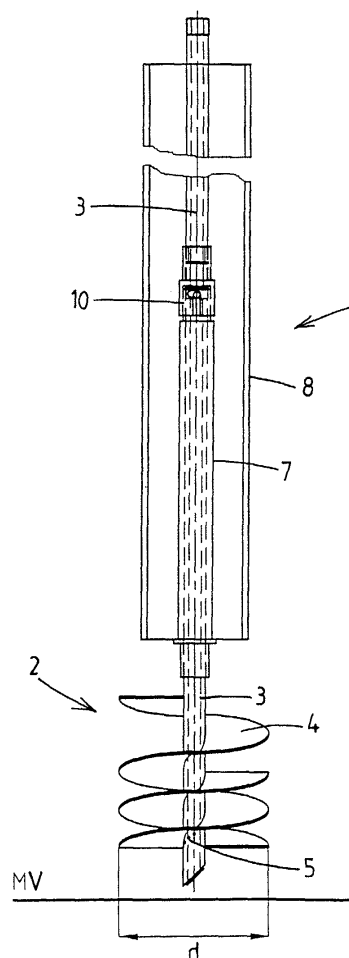


Fig. 1

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Description

[0001] The invention relates to an anchoring assembly comprising an anchoring pile according to the preamble of claim 1.

[0002] It is known in the prior art to anchor structures to the ground using anchoring piles of this type. These anchoring piles generally consist of a shaft provided with a helical blade extending over a number of turns. The anchoring piles are intended to be driven into the ground over distances of many meters while rotating, subsequent to which they can be subjected to tensile and/or compressive load in the longitudinal direction. In this context, consideration may be given to very diverse applications, including anchoring earth-retaining and/or water-retaining structures, anchoring guys for mast structures, anchoring concrete structures which need to be secured against buoyancy to the ground and the like.

[0003] More particularly, an anchoring pile of the injection anchor type is known, for example from NL-C-1000439, the shaft of which is hollow and in which apertures are provided in the hollow-shaft wall distributed over the length of the helical blade. This makes it possible to reinforce the earth mass locked in by the turns of the helical blade and/or surrounding the shaft even during and/or after screwing the anchoring pile to its desired depth by injecting said earth mass with a settable liquid mass, which is supplied under pressure via the hollow-shaft space and emerges via the apertures in the shaft wall. In this way, a column with a high load-bearing capacity is formed at the location of the helical blade and, if desired, along the rest of the shaft, in which the anchoring pile becomes fixedly secured and which provides a secure connection to the surrounding earth by means of the lateral extensions of the set mass. The tensile and/or compressive load which can be absorbed by the anchoring pile can in this case be increased by extending the axial length of the helical blade, thereby extending the length of the earth column to be reinforced, and/or by selecting the diameter of the helical blade turns to be greater.

[0004] A disadvantage of the anchoring pile is that it is relatively flexurally weak in the transverse direction. If structures need to be anchored to the ground which may also be subjected to loads in the lateral direction, a large number of anchoring piles is required and a number of them need to be screwed into the ground at an angle. The larger number of anchoring piles not only makes anchoring expensive, but at the same time, it is not always possible to screw the anchoring piles into the ground at an angle. Furthermore, the maximum compressive load of the anchoring piles is limited.

[0005] It is an object of the present invention to eliminate the abovementioned disadvantages, at least partially, and/or to provide a usable alternative. More particularly, it is an object of the invention to provide an anchoring assembly which can be installed quickly and inexpensively, can withstand tensile and compressive

load well and also offers sufficient stiffness in the lateral direction.

[0006] This object is achieved by an anchoring assembly according to claim 1. In this claim, the assembly consists of a combination of an anchoring pile and a foundation element, connecting means being provided which rotatably connect a shaft of the anchoring pile to the foundation element. The shaft extends substantially in the longitudinal direction of the foundation element, while a drill element which is provided at the free end of the anchoring pile extends at least partially as far as under the foundation element. The assembly consisting of an anchoring pile and a foundation element may advantageously be arranged in the ground simultaneously without this requiring too much force. In this case, the drill element drills the way clear, as it were, for the foundation element which follows. While the assembly is being arranged in the ground, the anchoring pile which is moving through the ground by means of a screw movement can pull the foundation element behind it into the ground. It is also possible to exert a small external force on the foundation element. Once the anchoring assembly has been driven to the desired depth, it provides a very advantageous combination of tensile and compressive strength plus lateral flexural stiffness.

[0007] In one particular embodiment, the foundation element is formed by a profile section having an at least half-open cross section, for example an H-shaped profile section or a C-shaped profile section. This offers the advantage that loosened soil cannot accumulate inside the foundation element. As a result, it is easier for the anchoring pile to pull the foundation element along, without too much force needing to be exerted on the foundation element from above.

[0008] More particularly, connecting means are provided between the anchoring pile and the foundation element which comprise a guiding sleeve connected to the foundation element, through which guiding sleeve the shaft of the anchoring pile extends. It has been found that such a simple solution already suffices to achieve this object and at the same time, during assembly, it is very easy to push the shaft of the anchoring pile through the guiding sleeve and thus to accomplish the desired connection.

[0009] In one variant, the anchoring pile is connected to the foundation element so as to be movable up and down over a certain distance. This advantageously makes it possible to use the drill element of the anchoring pile as a crusher in case a hard object is hit when the anchoring pile is being screwed into the ground. The foundation element does then not need to be moved up and down along with and during an up-and-down crushing stroke of the anchoring pile. The axial movability may be achieved, for example, by providing the shaft with delimiting means on both sides of the connecting means at desired intervals.

[0010] In a further variant, the drill element has a diameter which is substantially larger than or equal to the

largest transverse dimension of the foundation element. This ensures that the drill element loosens the soil across the entire cross section of the foundation element, so that the foundation element can easily be moved along into the ground.

[0011] Further advantageous embodiments are defined in the subclaims.

[0012] The invention also relates to a method for arranging an anchoring assembly of this type in the ground.

[0013] The invention will be explained in more detail with reference to the attached drawing, in which:

Fig. 1 shows a front view of an embodiment of the anchoring assembly according to the invention;
Fig. 2 shows a top view of Fig. 1;
Fig. 3 shows a sectional view on line III-III in Fig. 2; and
Figs 4a, b and c show views according to Fig. 1 during successive stages of driving the anchoring assembly into the ground.

[0014] In Figs 1-3 the anchoring assembly is denoted in its entirety by the reference numeral 1. The anchoring assembly 1 comprises an injection anchor 2 with a hollow shaft 3 which is made up of several sections and provided with a helical blade 4 at its lower end. In this case, the helical blade 4 is provided with a double helical blade over its first pitch. At the location of the helical blade 4, injection apertures 5 have been provided in the shaft 3 for supplying a lubricant and/or settable reinforcement mass from inside and via the hollow shaft 3.

[0015] The shaft 3 extends through a guiding sleeve 7 which is connected to a wall section of a foundation element 8. In this case, the foundation element 8 is formed by an H-shaped profile section in which the anchor 2 extends on one side of its central wall section. The centre line of the anchor 2 here extends parallel to that of the foundation element 8.

[0016] The several sections of the shaft 3 are connected to one another by means of a bayonet coupling 10. The bottom end of the bayonet coupling 10 and the top end of the helical blade 4 form delimiting means which are positioned on both sides of the guiding sleeve 7. The distance between the delimiting means is in this case larger than the axial dimension of the guiding sleeve 7. This ensures axial movability of the connection between the anchor 2 and the foundation element 8.

[0017] The bayonet coupling 10 which is situated above the guiding sleeve 7 is made up of two sections, each of which is screwed onto a respective free end of the associated shaft part 3 by means of a threaded connection 3. This makes it advantageously possible to push a shaft section 3 through the guiding sleeve 7 from below during assembly and only then to screw a bayonet coupling section 10 onto this shaft section 3, following which the sections are interlocked.

[0018] The diameter d of the helical blade 4 is larger

than the largest transverse dimension of the H-shaped profile section, as can clearly be seen in Fig. 2.

[0019] Figs 1 and 4a-c show the stages of arranging the anchoring assembly 1 in the ground. In this case, the anchor 2 is screwed into the ground from surface level MV. As soon as the anchor 2 has been screwed a certain depth into the ground corresponding to the length of the section of the anchor 2 which projects under the foundation element 8, the foundation element 8 will be pulled along into the ground. The foundation element 8 will encounter little resistance in this case, due to the fact that the ground has already been loosened in this location by the helical blade 4. The pulling force of the anchor 2 is here transmitted to the foundation element 8 via the bayonet coupling 10. Once the assembly 1 has been taken to the desired depth, the topmost shaft section 3 can advantageously be uncoupled in a simple manner by turning this top shaft section 3 one turn in the direction counter to the screw-in direction. As a result, the two bayonet coupling sections 10 will uncouple, the bottom bayonet coupling section 10 remaining on the bottom shaft section 3. The top shaft section 3 can thus advantageously be re-used for a subsequent anchoring assembly.

[0020] During the operation of screwing the assembly into the ground, a grout mixture is supplied via the injection apertures 5. This serves as a lubricant for the helical blade and hardens the ground around the assembly 1 after setting.

[0021] While the entire assembly 1 is being sunk or after the entire assembly 1 has been sunk and the superfluous shaft section 3 has been removed, a settable reinforcement mass can also be applied around the foundation element 8 and in particular in the semi-open space(s) thereof. After this reinforcement mass has set, the assembly acquires its desired anchoring properties. The top section of the foundation element 8, which is known as top profile, is ideally suited for having components welded to it or for connecting a structure to be anchored to it in another way.

[0022] Many variants are conceivable in addition to the embodiment shown. Thus, it is also possible to use other types of anchoring piles and/or foundation elements or a different size of helical blade, or a different kind of drill element can be used instead of a helical blade, for example a drill point. In addition to the supply of lubricant and/or settable reinforcing mass by means of the hollow shaft of the anchoring pile, it is also possible to arrange separate supply lines provided with discharge apertures in the foundation element or to integrate these therein.

[0023] Although the portion of the anchoring pile which is under the foundation element seems relatively short in the drawings, this can also be designed to be a few metres long, if desired. Thus, it is possible to optimize the ratio between the anchoring pile and the foundation element depending on the composition of the ground.

[0024] The invention thus provides an anchoring assembly which can be arranged in the ground quickly, efficiently and inexpensively and which can absorb both large forces in the axial direction as well as lateral loads.

Claims

1. Anchoring assembly for anchoring structures to the ground, comprising:

an anchoring pile (2) having a rotatably drivable shaft (3) which is provided at least at its free end with a ground drill element (4) for screwing the anchoring pile (2) into the ground;

characterized in that

the assembly furthermore comprises an elongate foundation element (8) which can be moved into the ground, in which the shaft (3) of the anchoring pile (2) is rotatably connected to the foundation element (8), extends substantially in the longitudinal direction of the foundation element (8) and, together with the drill element (4), extends at least partially as far as under the foundation element (8).

2. Anchoring assembly according to claim 1, in which the foundation element (8) is a profile section having an at least half-open cross section.

3. Anchoring assembly according to claim 2, in which the profile section is an H-shaped profile section.

4. Anchoring assembly according to one of the preceding claims, in which the foundation element (8) is provided with a guiding sleeve, through which the shaft (3) extends.

5. Anchoring assembly according to one of the preceding claims, in which the shaft (3) is connected to the foundation element (8) so as to be movable up and down over a certain distance.

6. Anchoring assembly according to one of the preceding claims, in which the drill element (4) has a diameter (d) which is substantially larger than or equal to the largest transverse dimension of the foundation element (8).

7. Anchoring assembly according to one of the preceding claims, in which the shaft (3) is made up of a number of releasably connected sections.

8. Anchoring assembly according to claim 7, in which the shaft sections (3) are connected to each other by means of a bayonet coupling (10).

9. Anchoring assembly according to one of the preceding claims, in which the drill element (4) is a helical blade provided on the shaft (3).

10. Anchoring assembly according to one of the preceding claims, in which the shaft (3) is hollow and is provided with injection apertures (5) for supplying a lubricant and/or settable reinforcement mass, in particular grout.

11. Method for arranging an anchoring assembly in the ground according to one of the preceding claims, comprising the following steps:

- screwing the anchoring pile (2) into the ground;
- moving the connected foundation element (8) along with it into the ground; and
- applying a settable mass around the anchoring pile (2) and/or foundation element (8).

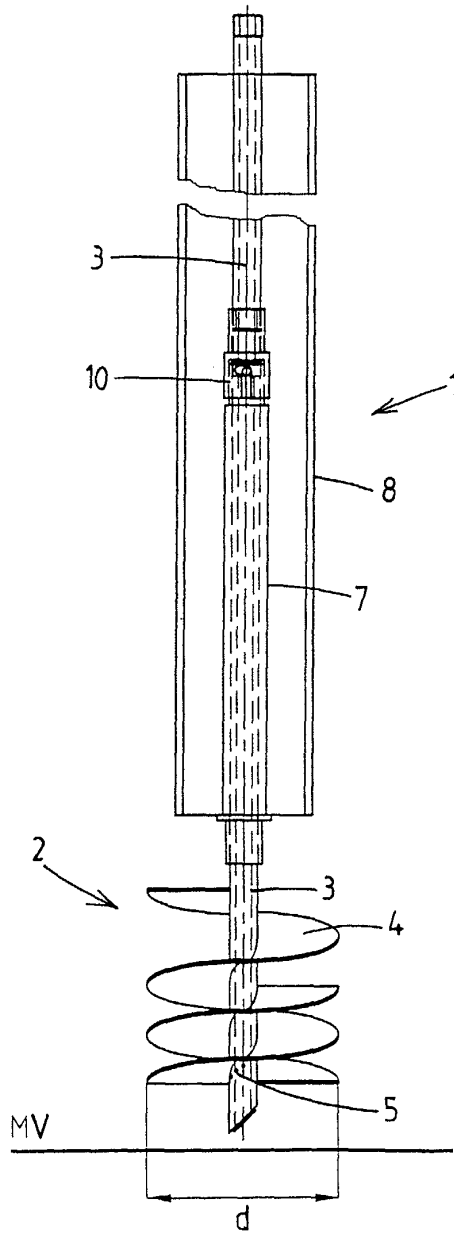


Fig. 1

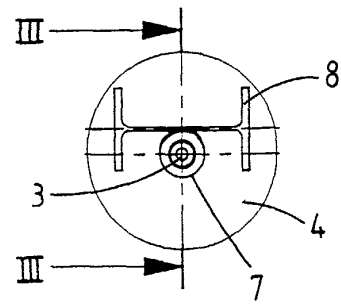


Fig. 2

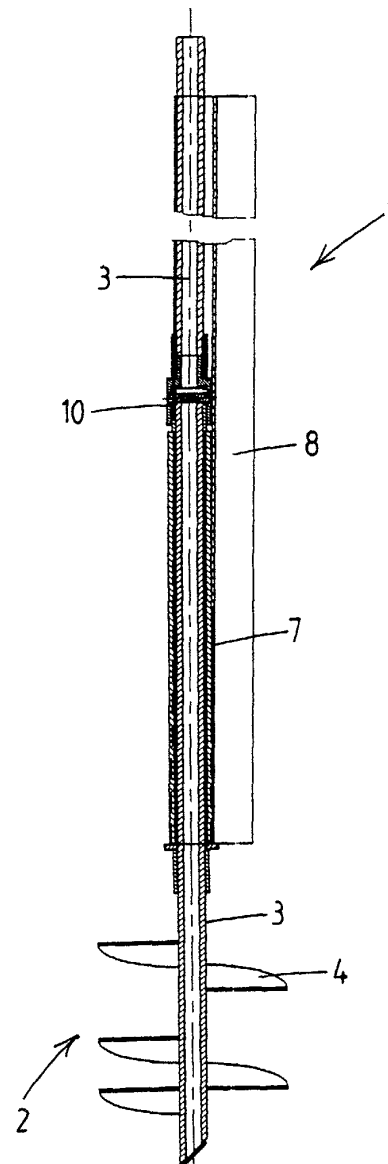
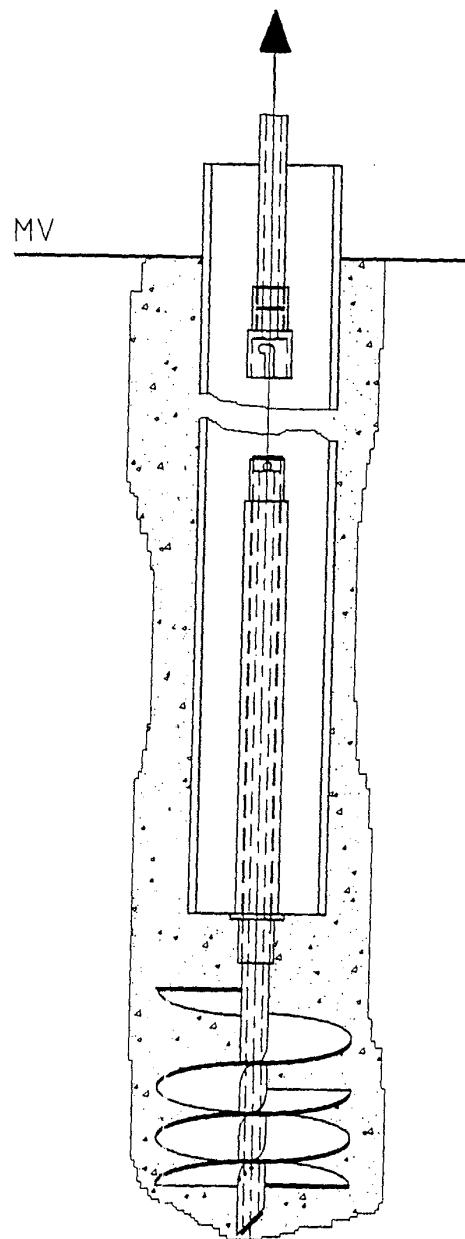
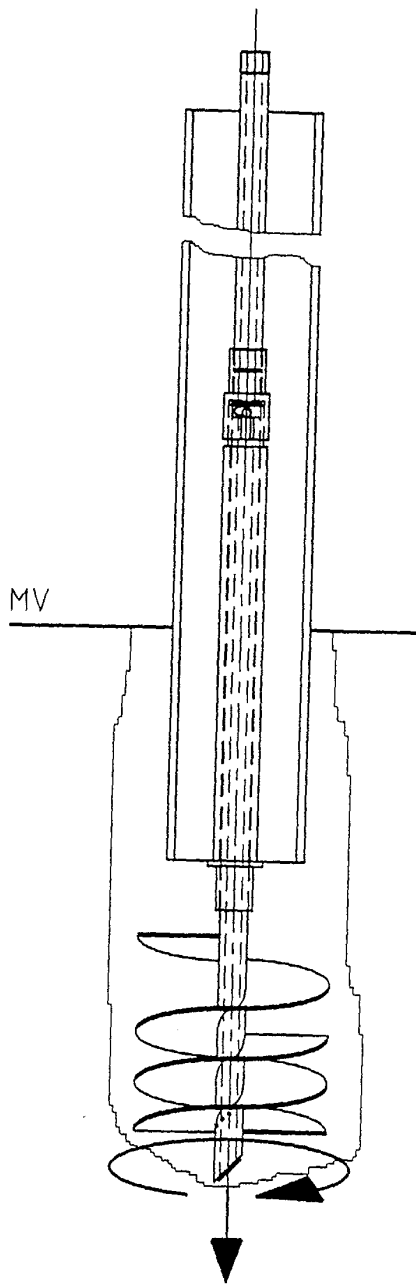


Fig. 3



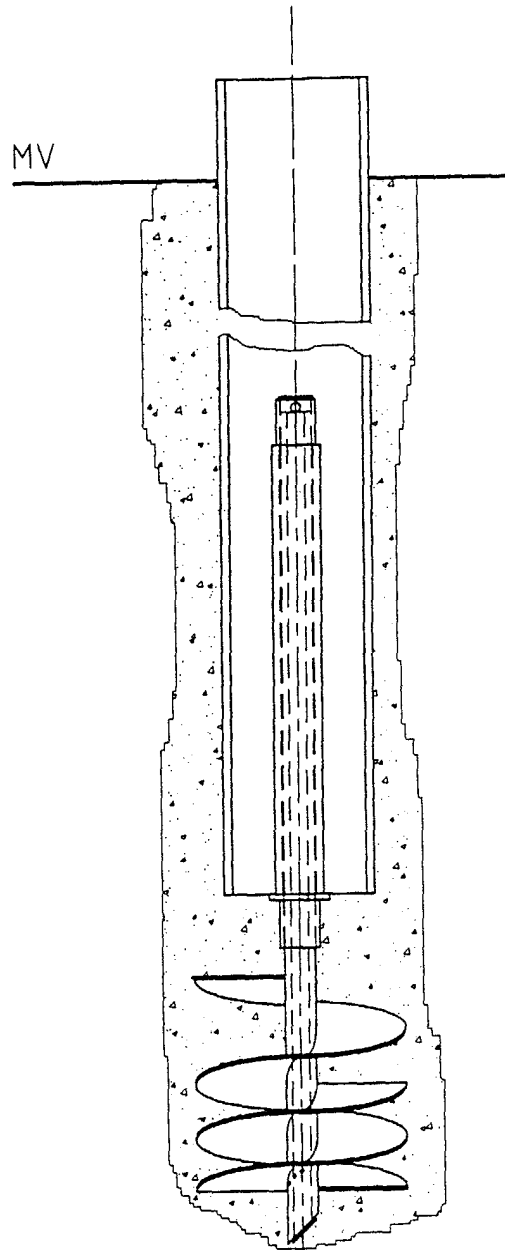


Fig. 4c