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(54) Telescoping auger drill

(57) A continuous-screw drilling equipment for drilling the ground having an extension rod with at least two sections of rod of the type in which the continuous screw constituting the tool is carried by an extension rod which is able to slide along a motor assembly from which it receives the rotary motion about a longitudinal axis thereof; the extension rod is made up of at least two coaxial sections or stretches of rod, of which the internal one (4) is without turns and is rigidly connected at the bottom end to the continuous-screw tool (5), whilst the external one (6), which is able to slide on the internal one (4) and along the motor assembly (3), has some turns constituting the screw (7) in the bottom area, the rods (4 and 6) being equipped with splined couplings for connection with one another, and the external rod (6) is in turn equipped with a splined coupling also with respect to the motor (3) so as to transmit the rotary motion from the motor to the respective screw (5 and 7).

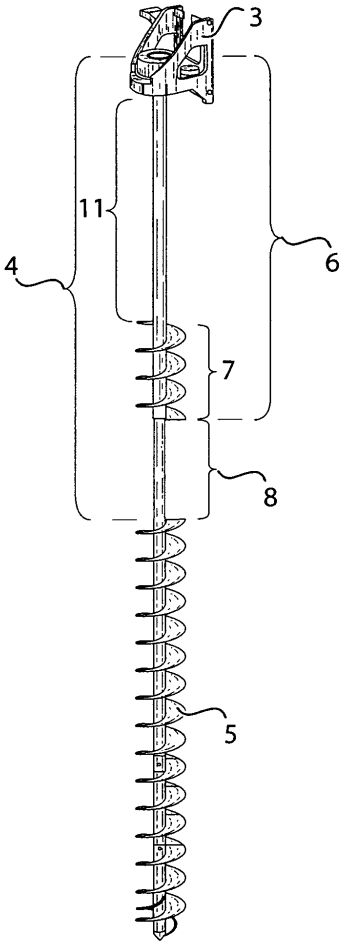

Fig. 3

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Description

[0001] The invention relates to continuous-screw drilling equipment for drilling the ground having an extension rod with at least two sections of rod and to a drilling method which uses said equipment.

[0002] Continuous-screw drilling equipment for drilling the ground is known, in which a motor assembly slides along a guide maintaining in rotation a screw tool, which is substantially as long as the guide itself; such equipment is able to drill a hole in the ground that is as deep as the length of the tool itself.

[0003] The operation of drilling occurs in two main steps:

- the first step, which is referred to as "step of advance", consists in screwing of the tool into the ground;
- the second step, referred to as "step of extraction", consists in raising the tool loaded with soil.

[0004] In order to increase the depth of the drilling, it is necessary to increase the height of the guide, and this entails the need to provide a heavier base, with a resting base of larger dimensions and a system for raising the guide (from the position of conveyance or of working) that is more powerful. This leads to rapidly increasing costs and weights, and to greater difficulties for transportation on the road, for installation, and for use.

[0005] In order to increase the drilling depth without increasing the height of the guide, solutions are known such as the one described in the Italian patent No. 1.267.370 filed in the name of the present applicant, which employ a rod without any turns which can slide vertically within the motor assembly, with a splined coupling which enables transmission of the motion of rotation.

[0006] The length of said extensions, however, cannot be increased indefinitely; in fact, above the uppermost turn the debris coming from the drilling accumulates without any interruption, thus forming a plug.

[0007] When the tool is extracted from the earth, the plug is compressed and pushes against the walls of the drilling, thus preventing extraction or else tearing out the surrounding soil so forming a conical crater.

[0008] On the other hand, any partial emptying of the screw is not allowed on account of the risk of caving.

[0009] A purpose of the invention is to propose equipment that will be able to overcome the drawbacks referred to above.

[0010] A further purpose of the invention is to propose equipment, which, in overcoming the aforesaid drawbacks, will, however, not require any modifications to the machine nor will involve any supplementary operating time during extraction of the screw.

[0011] Yet a further purpose of the invention is to propose equipment that will enable an increase in the depth of drilling without sensibly slowing down the drilling cycle itself.

[0012] For the above and further purposes, which will appear more readily understandable from what follows, the invention proposes the provision of continuous-screw drilling equipment for drilling the ground having an extension rod with two sections according to Claim 1, as well as a drilling method which uses the aforesaid equipment according to Claim 3.

[0013] There now follows a description of the equipment according to the invention with reference to the attached plate of drawings, in which:

- Figure 1 and 1bis illustrate a tool of the type in question according to the state of the art in two operating conditions; and
- Figure 2 and 3 illustrate the tool according to the invention in two operating conditions.

[0014] Equipment constituting the state of the art (see, for example, that of the aforementioned patent No. 1.267.370) may be seen in Figures 1 and 1bis, in which a rod 1 may be noted, without any screw, which can slide vertically within the motor assembly 3 with a splined coupling, which enables transmission of the motion of rotation to the screw 2 in any position.

[0015] The length of said extensions, however, cannot be increased indefinitely; in fact, above the uppermost turn the debris from drilling accumulates without any interruption, so forming a plug.

[0016] The invention draws its origin from the awareness that up to a certain length the plug of debris does not create insurmountable difficulties of extraction. Consequently, the solution proposed by the invention consists in dividing the plug into at least two parts of acceptable length, separated by screw elements that support the plug located on top of said elements.

[0017] The extension rod is made up of two coaxial sections or stretches of rod (see Figures 2 and 3), of which the internal one 4 is without turns and is rigidly connected to the screw tool 5. The external one 6, which slides on the internal one and within the motor assembly, has some turns 7 in the bottom area.

[0018] The rods 4 and 6 are equipped with splined elements for coupling with one another, and the external rod 6 is in turn equipped with a splined coupling also with respect to the motor 3 so as to transmit the rotary motion from the motor to the respective screws 5 and 7.

[0019] In the position of start of drilling (Figure 2), the extension elements 4 and 6 are in the position of maximum projection above the motor assembly 3, with the screws 5 and 7 set up against one another so filling the entire area underlying the motor assembly.

[0020] The tool is set in operation by the motor and starts drilling; when the screw 5 has completely penetrated into the ground, the motor assembly 3 is raised, leaving the tool 5 in the drilling.

[0021] The motor 3 first of all slides around the outer rod 6 until it comes to a stop against its arrest collar 9.

At this point, proceeding with the raising operation, the external rod 6, with its screw, is also raised and slides with respect to the internal rod 4 until it bears upon a respective arrest collar 10.

[0022] In this way, the tool has its screw 5 completely sunk into the ground, followed by a stretch 8 without any turns, which projects from the ground, then followed by the bottom turns 7 of the outer extension 6 and by the stretch without any turns of said outer extension 6 and by the stretch 11 of said extension.

[0023] As the drilling operation continues, also the top screw 7 penetrates into the ground, whilst the plug of debris is penetrated by this second set of turns, which support its uppermost part.

[0024] In order to achieve a better penetration, the lowest turn of this second set 7 may have a sharpened or shaped end in order to gradually cut into the recompacted soil.

[0025] For instance, the turn may have a conical shape or be equipped with teeth.

[0026] The operating cycle of the equipment is as follows:

- start of drilling, in which the coaxial stretches 4 and 6 of the extension rod are translated into the highest possible position above the motor assembly 3, with the respective screws 5 and 7 set up against one another so filling the entire area underlying the motor assembly;
- reaching of the depth that is possible in this position, in which the turns 5 of the internal stretch 4 are sunk into the earth, whilst the turns 7 of the external stretch 6, which slides on the internal one, remain out of the earth;
- raising of the motor assembly 3, leaving the turns 5 of the internal stretch 4 in the drilling, by sliding the motor on the outer rod 6 until the motor comes to bear upon the arrest collar 9 of the external rod 6;
- continuation of the raising of the motor 3, with consequent raising also of the external rod 6 by sliding it with respect to the internal rod 4 until it bears upon the arrest collar 10;
- continuation of the drilling operation until the motor 3 has descended to the level of the ground;
- extraction of the equipment at least until the internal stretch 4 is out of the ground;
- lowering of the motor 3 until it is brought back into the condition of start of drilling, and blocking thereof along the rods; and
- complete extraction of the equipment in this configuration.

[0027] Blocking of the motor along the rods and of the rods with respect to one another in the desired positions can be obtained using mechanical systems (e.g., bayonet couplings) or magnetic systems which are altogether known to a person skilled in the branch and which, hence, will not be described herein.

[0028] From the above description, the following advantages of the equipment according to the invention emerge clearly.

· The equipment does not require modifications to the machine, and consequently extends its operating capacities in an inexpensive and immediate way.
· The operation of extension of the screw does not involve any supplementary operating time, since it is similar to the existing single extension. Consequently, productivity is not penalized.
· Potentially, with an extension made in two parts, the increase in depth is doubled as compared to other currently existing extensions.
· By increasing the number of slidable elements, it is possible to provide extensions with multiple rod sections, thus further increasing the drilling depth without markedly slowing down the drilling cycle.

Claims

1. Continuous-screw drilling equipment for drilling the ground having an extension rod with at least two sections of rod of the type in which the continuous screw, constituting the tool, is carried by an extension rod which is able to slide along a motor assembly from which it receives the rotary motion about a longitudinal axis thereof; said equipment being **characterized in that** the extension rod is made up of at least two coaxial sections or stretches of rod, of which the internal one (4) is without turns and is rigidly connected at the bottom end to the continuous-screw tool (5), whilst the external one (6), which is slidable on the internal one (4) and along the motor assembly (3), has some turns constituting the screw (7) in the bottom area, the rods (4 and 6) being equipped with splined couplings for connection with one another, and the external rod (6) is in turn equipped with a splined coupling also with respect to the motor (3) so as to transmit the rotary motion by the motor to the respective screws (5 and 7).

2. The equipment according to Claim 1, **characterized in that** the rods (4, 6) are provided with collars (9, 10) in an area corresponding to the respective top ends, designed to constitute the top contrast elements of the external rod (6) along the internal rod (4) and of the motor (3) along the external rod (6).

3. A drilling method which uses the equipment according to the preceding claims, **characterized by** the following steps:

- start of drilling, in which the coaxial stretches of the extension rod (4 and 6) are translated into the highest possible position, on top of the motor assembly (3), with the respective screw (5 and

7) set up against one another so filling the entire area underlying the motor assembly;
- reaching of the depth that is possible in this position, in which the turns (5) of the internal stretch (4) are sunk into the earth, whilst the turns (7) of the external stretch (6), which slides on the internal one, remain out of the earth;
- raising of the motor assembly (3), leaving the turns (5) of the internal stretch (4) in the drilling, by sliding the motor on the outer rod (6) until the latter comes to bear upon the arrest collar (9) of the external rod (6);
- continuation of raising of the motor (3), with consequent raising also of the external rod (6), by sliding it with respect to the internal rod (4) until it bears upon the arrest collar (10);
- continuation of the drilling until the motor (3) has descended to the level of the ground;
- extraction of the tool at least until the internal stretch of rod (4) comes out of the ground;
- lowering of the motor (3) until it is brought back into the condition of start of drilling, and blocking thereof along the rods; and
- complete extraction of the equipment in the latter configuration.

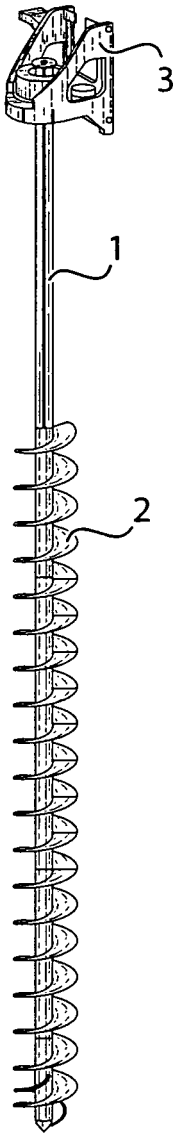

Fig. 1bis

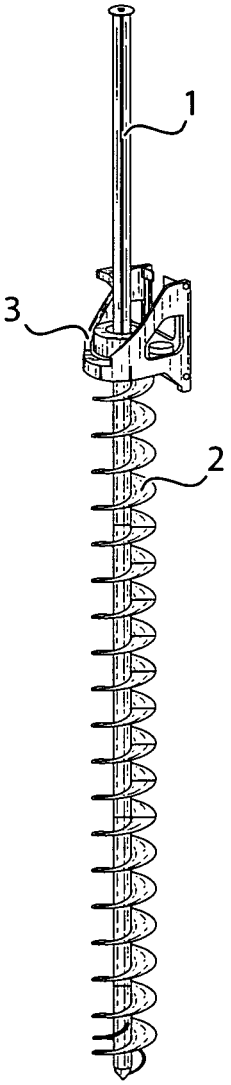

Fig. 1

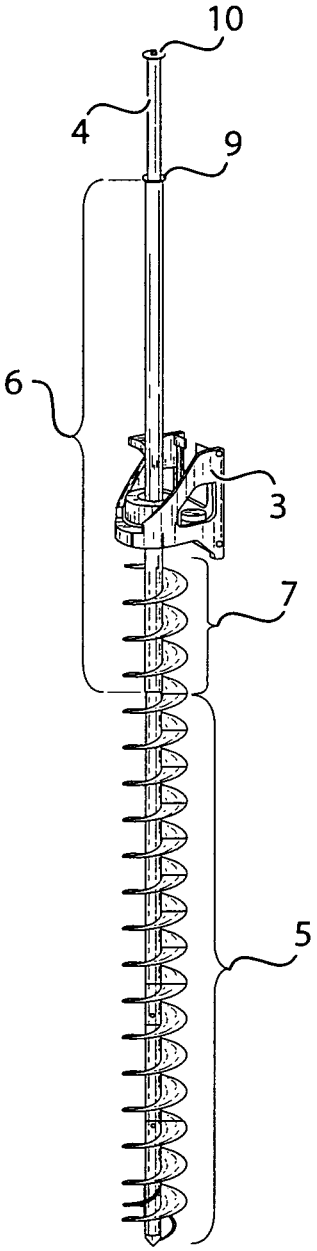

Fig. 2

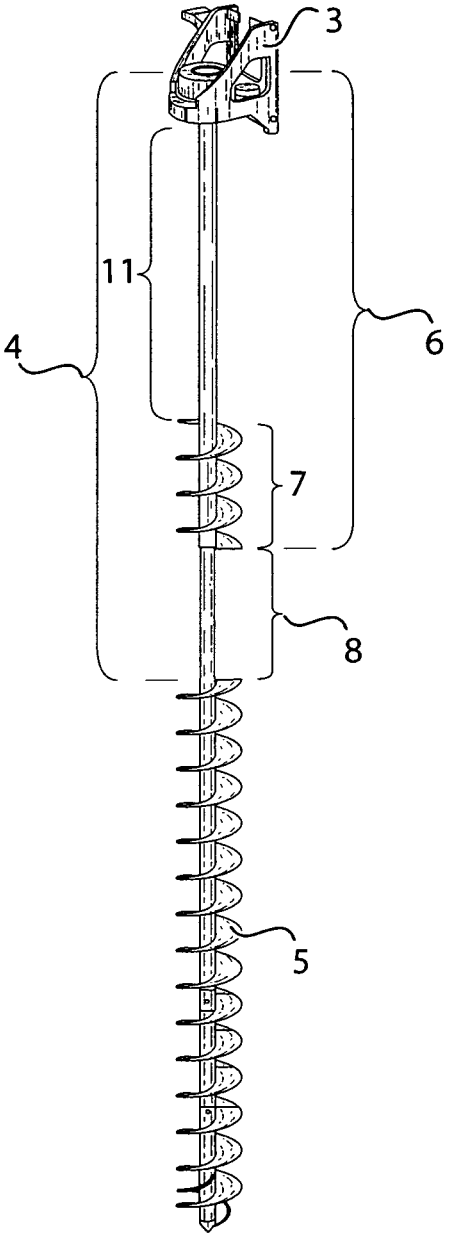

Fig. 3