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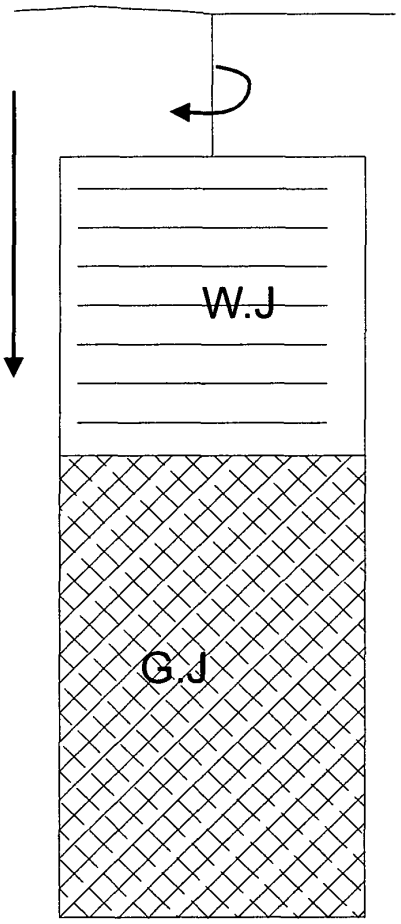
(54) Soil improvement process using jet grouting which provides high grouting material savings

(57) The invention finds application in the field of soil improvement and particularly relates to the process known in the art as "jet grouting". Particularly, with this process, in suitable soils part of the column volume is formed in a Water-Jet (WJ) step, using 2 soil eroding fluids, air and water, and the rest of the volume is formed using cement grout jacketed in air as a soil eroding fluid to be pumped through the same nozzle in the Grout-Jet (GJ) step; these steps are both carried out in the nozzle descending stage. The slurry created during the WJ step is displaced by the backfill (rich in grouting material) during the GJ step.

FIG. 1



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Description

[0001] The present invention relates to a soil improvement process using jet grouting, which provides considerable savings in grouting material.

[0002] The soil improvement process known in the art as jet grouting is known to require in situ mixing of soil with a grout (usually a mixture of water and cement), which is injected therein under high pressure (above 200 bar).

[0003] This process destroys the soil matrix and creates a soil and grout mixture to form a homogeneous and continuous columnar element having predetermined mechanical characteristics.

[0004] A variety of soil improvement mixtures may be formed, by changing the type of grouting mixture depending on the soil type or by changing the angles of rotation of the tool or not rotating it at all, or the tool withdrawal time.

[0005] This may substantially provide cylindrical columns by continuous 360° rotation of the tool in combination with an upward vertical translation thereof, or quasi-rectangular panels by withdrawing the tool without rotating it.

[0006] Pressures of up to 400-600 bar are currently used.

[0007] Thus, in prior art a mixture of water and cement is injected under high pressure during withdrawal of the tool to form the desired volume.

[0008] This prior art method involves considerable cement waste, because during injection most of the injected material overflows due to an un unbalance between the injected volume and the volume to be stabilized.

[0009] The object of the present invention is to dramatically reduce cement waste during the injection step.

[0010] Considerable grout savings derive from the provision that the column volume is partly formed of water, which is later displaced by the backfill (rich in grouting material), during the Grout-jet (GJ) step, in which the upwardly flowing backfill displaces the "slurry" created during the previous step.

[0011] Thus the process, when carried out in suitable soils, consists in forming part of the column volume in a downstage 2-fluid (air and water) Water-Jet (WJ) step, and in forming the rest of the volume (still downstage) using cement grout and air as a soil eroding fluid to be pumped through the same nozzle (double fluid Grout-Jet - GJ).

[0012] It shall be noted that both steps are carried out while the nozzle is moved down.

[0013] These objects and advantages are achieved by the soil improvement process using jet grouting, which provides considerable savings in grouting material according to the present invention, which is characterized by the annexed claims.

[0014] This and other features will be more apparent upon reading the following description of the process, which is shown by way, of example and without limitation in the accompanying drawings, in which:

- Figure 1 is a diagrammatic representation of the present process;
- Figure 2 is a simplified representation of the process in the completion stage.

[0015] Referring to Figure 1, the soil is drilled to a desired depth using a conventional tool, in a socalled exploration drilling step.

[0016] Particularly referring to Figures 1 and 2, W.J. designates the layer formed using the double fluid (air and water) Water jet technology, and G.J. designates the layer formed using the Grout-Jet technology.

[0017] In greater detail, the process includes:

- a first step of drilling soil from ground level to column head level;
- a second downstage (Water-Jet) step at constant speed from the column head to a depth in a range from 1/3 to 2/3 of the total length of the column, using water jacketed in air (double fluid step);
- a third (Grout-Jet) step, still downstage, at constant speed and with constant parameters (different from those of the previous step) which uses cement grout (i.e. grouting material, cement) jacketed in air (double-fluid step) to be pumped through the same nozzle as used in the previous step. In this step, the backfill material, rich in grouting material, displaces the "slurry" created during the second step, thereby providing uniform physical and mechanical properties of the jet grouting column throughout its length (see Fig. 2).

[0018] This process is also applicable to the multiple nozzle configuration.

Claims

1. A soil improvement process using jet grouting, which provides considerable savings in grouting material, **characterized in that** it allows, in suitable soils, part of the column volume to be formed in a Water-Jet (WJ) step, using 2 soil eroding fluids, i.e. air and water, and the rest of the volume to be formed using cement grout jacketed in air as a soil eroding fluid to be pumped through the same nozzle in the Grout-Jet (GJ) step; said steps are both carried out in the nozzle descending stage; the slurry created during the Water Jet (WJ) is displaced by the backfill (rich in grouting material) during the Grout-Jet (GJ) step.

2. A soil improvement process as claimed in claim 1, **characterized in that** it includes a first step of drilling the soil from ground level to column head level.

3. A soil improvement process as claimed in claim 1, **characterized in that** the downstage Water-Jet

(WJ) step is carried out at constant speed from the column head to a depth in a range from 1/3 to 2/3 of the total length of the column.

4. A soil improvement process as claimed in claim 1, **characterized in that** the downstage Grout-Jet (GJ) step is carried out at constant speed and with constant parameters, different from those of the previous step using the same nozzle as in the previous step.

5. A soil improvement process as claimed in claim 1, **characterized in that** one or more nozzles are used therein.

FIG. 1

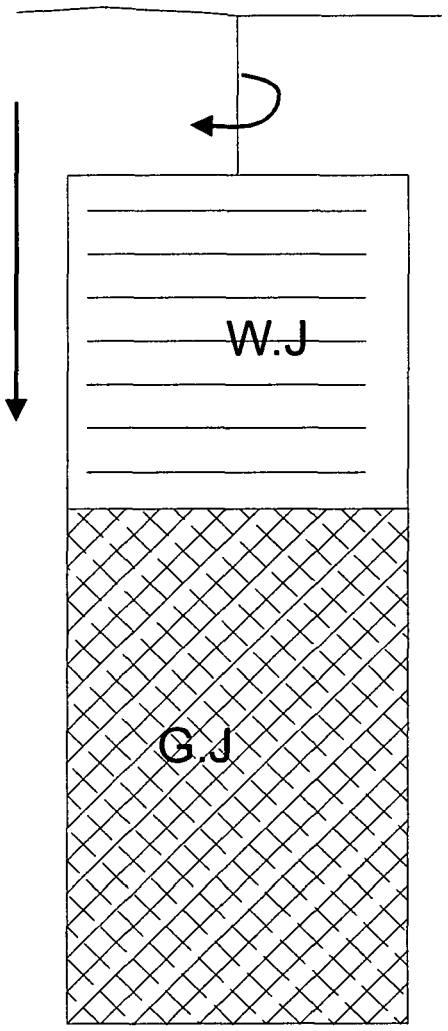

FIG. 2