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(54) Method for driving a pile and lengthening piece

(57) A method for driving a pile (1) into the ground to a position below the ground level by means of a lengthening piece (2) which is pulled out of the ground after the pile has been driven to the desired depth. The pile is provided with at least one pipe which is open at its ends, said pipe extending at least substantially along the length of the pile and being fixed to said pile. A lower end of a flexible pipe (11) accommodated within the extension piece is connected to the upper end of the pipe that is fixed to the pile, and an upper end of the flexible pipe that freely extends within the lengthening piece is connected to a grout pump via a lead-through extending through the wall of the lengthening piece. Grout is forced into the ground through the open lower end of the pipe (4), via the flexible pipe (11) and the pipe (14) fixed to the pile, by means of the grout pump during the pile-driving operation. Once the pile has been inserted, the lengthening piece is pulled out of the ground.

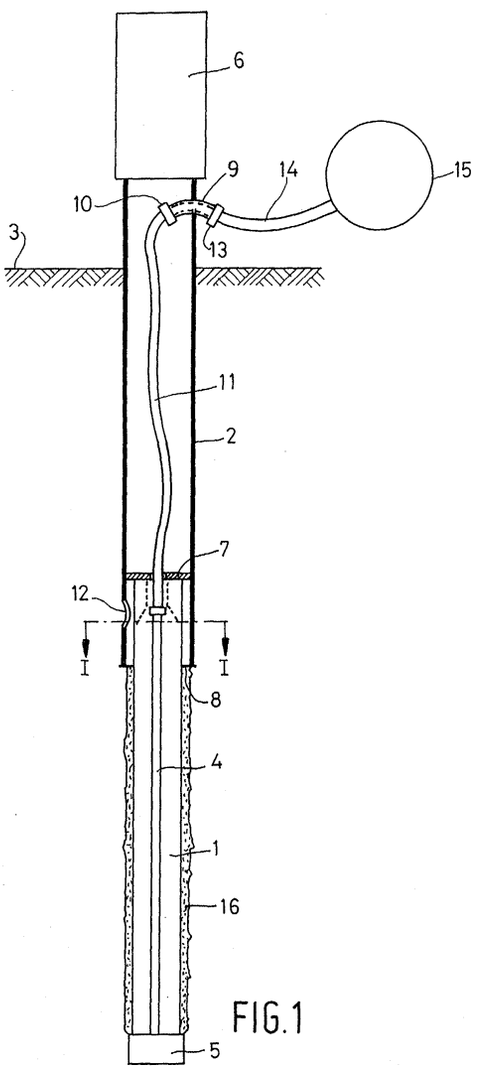

FIG.1

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Description

[0001] The invention rel ates to a method for driving a pile into the ground to a position below the ground level by means of a lengthening piece which is pulled out of the ground after the pile has been driven to the desired depth, wherein said pile is provided with at least one pipe which is open at its ends, said pipe extending at least substantially along the length of the pile and being fixed to said pile.

[0002] Such a pipe fixed to the pile is used for supplying grout into the ground near the lower end of the pile while the pile is being driven into the ground, in such a manner that the pile is being provided with a grout envelope.

[0003] When the pile is inserted into the ground in such a manner that the upper end of the pile is positioned near the ground level, such supplying of grout can generally take place without any problems. A problem arises, however, when the upper end of the pile is to be driven into the ground to a position some distance below the ground level by means of a so-called lengthening piece that is to be placed on the upper end of the pile.

[0004] According to the invention, a lower end of a flexible pipe accommodated within the extension piece is connected to the upper end of the pipe that is fixed to the pile, and an upper end of the flexible pipe that freely extends within the lengthening piece is connected to a grout pump via a lead-through extending through the wall of the lengthening piece, with grout being forced into the ground through the open lower end of the pipe that is fixed to the pile, via the flexible pipe and the pipe fixed to the pile, by means of the grout pump during the pile-driving operation, and once the pile has been inserted into the ground to the desired depth, the lengthening piece together with the flexible pipe accommodated in the lengthening piece is pulled out of the ground, with the flexible pipe being pulled loose from the pipe that is fixed to the pile.

[0005] The use of a flexible pipe in the lengthening piece, which is only connected to a lead-through extending through the wall of the lengthening piece with one end and which is connected to the pipe that is fixed to the pile with its other end prevents the flexible pipe being exposed to load variations during the pile-driving operation, which load variations may cause the connection between the pipe and the lengthening piece and even the pipe itself to fracture in those cases in which a rigid pipe fixed to the lengthening piece is used.

[0006] In accordance with the invention, a suitable lengthening piece for implementing the method according to the invention is provided with a flexible pipe extending freely within the lengthening piece, which pipe is connected with one end to a lead-through extending through the wall of the lengthening piece.

[0007] The invention will be explained in more detail hereinafter with reference to the accompanying schematic Figures.

[0008] Figure 1 schematically shows the insertion of a pile into the ground by means of a lengthening piece placed on the upper end of the pile.

[0009] Figure 2 is a sectional view of Figure 1 along the line I-I in Figure 2, showing the pile in a position turned through 90° relative to the position that is shown in Figure 1.

[0010] Figure 1 schematically shows a pile 1, which has been inserted into the ground to a position some distance below the ground level 3 by means of a lengthening piece 2. As is shown in particular in Figure 2, a pile 1 of H-shaped section is used in the illustrated embodiment, but it will be understood that the method according to the invention can be carried out in the same manner with piles having a different sectional shape.

[0011] Two rigid pipes or tubes 4 having open ends are fixed to the pile 1, which pipes are intended for passing grout therethrough. Furthermore, a weighted foot 5 is connected to the lower end of the pile 1 in the illustrated embodiment.

[0012] As already said before, a lengthening piece 2 placed on top of the pile 1 is used for driving the pile 1 into the ground to a position below the ground level, on the upper end of which lengthening piece a piling hammer 6 may act for driving the pile into the ground.

[0013] A hammering plate 7, which is supported on the upper end of the pile 1 during the pile-driving operation, is mounted in the lengthening piece 2 at a position some distance above the lower end of the lengthening piece. As a result of this arrangement, the lower end of the lengthening piece extends around the outer circumference of the pile 1 over some distance, for example a distance of 1 m, during the pile-driving operation, so that any attachments present at that location for subsequent anchoring of the pile or the like are protected during the pile-driving operation.

[0014] A closing plate 8 surrounding the pile 1, which may or may not be fixed to the lengthening piece, may be provided at the lower end of the lengthening piece for preventing soil entering the lengthening piece during the pile-driving operation.

[0015] A lead-through or bent tube 9 is passed through a hole formed in the wall of the lengthening piece 2 and fixed to the lengthening piece near the upper end of the lengthening piece.

[0016] The upper end of a flexible pipe 11 is connected to the end of the lead-through 9 present in the interior of the lengthening piece 2 by means of a rubber buffer 10. As is shown in Figure 1, the flexible pipe 11 freely extends in downward directions within the lengthening piece 2. In addition to the flexible pipe 11 as shown, a second flexible pipe (not shown) will be provided in a similar manner. Said flexible pipes are passed through holes formed in the hammering plate 7.

[0017] Before the pile 1 is driven into the ground to a position below the ground level 3, the flexible pipes 11 are connected to the ends of the pipes 4 that are fixed to the pile 1, which pipes still extend above the ground

level at that stage. In order to enable said connecting of the lower ends of the flexible pipes 11 to the upper ends of the pipes 4, a hole 12 is formed in the wall of the lengthening piece at a position below the hammering plate 7, so that the lower ends of the flexible pipes 11 and the upper ends of the pipes 4 are accessible via said hole for connecting the pipes 11 to the pipes 4.

[0018] One end of a further flexible pipe 14 is connected to the end of the lead-through 9 extending outside the lengthening piece 2 by means of a rubber buffer 13, which pipe 14 is connected to a grout pump 15 with its other end. The other flexible pipe, too, will be connected to the grout pump in a similar manner.

[0019] While the pile 1 is being driven into a ground to a position some distance below the ground level, grout can be pumped to the lower end of the pile 1 by means of the grout pump 15 via the flexible pipes 14, the lead-throughs 9, the flexible pipes 11 and the pipes 4, as a result of which a grout envelope 16 is formed around the pile 1 in a manner which is known per se. Also as a result of the presence of the rubber buffers 10, 13, the flexible pipes 11 and 14 are capable of absorbing vibrations that occur during the pile-driving operation without any risk of fracturing.

[0020] Once the pile has been driven to the desired depth, the lengthening piece 2 can be pulled out of the ground, during which operation the ends of the flexible pipes 11 are pulled off the pipes 4, with the flexible pipes 11 possibly being severed from ends of the pipes 11 that remain behind on the upper ends of the pipes 4.

Claims

1. A method for driving a pile into the ground to a position below the ground level by means of a lengthening piece which is pulled out of the ground after the pile has been driven to the desired depth, wherein said pile is provided with at least one pipe which is open at its ends, said pipe extending at least substantially along the length of the pile and being fixed to said pile, **characterized in that** a lower end of a flexible pipe accommodated within the extension piece is connected to the upper end of the pipe that is fixed to the pile, and an upper end of the flexible pipe that freely extends within the lengthening piece is connected to a grout pump via a lead-through extending through the wall of the lengthening piece, with grout being forced into the ground through the open lower end of the pipe that is fixed to the pile, via the flexible pipe and the pipe fixed to the pile, by means of the grout pump during the pile-driving operation, and once the pile has been inserted into the ground to the desired depth, the lengthening piece together with the flexible pipe accommodated in the lengthening piece is pulled out of the ground, with the flexible pipe being pulled loose from the pipe that is fixed to the pile.

2. A method according to claim 1, **characterized in that** the grout pump is connected to the lead-through extending through the wall of the lengthening piece by means of a flexible pipe.

3. A method according to claim 1 or 2, **characterized in that** a flexible pipe is connected to the lead-through by means of a rubber buffer.

4. A method according to any one of the preceding claims, **characterized in that** a closing element surrounding the pile and at least substantially closing the lower end of the lengthening piece is provided near the lower end of the lengthening piece.

5. A lengthening piece provided with a flexible pipe extending loosely within said lengthening piece, which pipe is connected with one end to a lead-through extending through the wall of said lengthening piece.

6. A lengthening piece according to claim 5, **characterized in that** a hammering plate is mounted in the lengthening piece at a position some distance above the lower end of the lengthening piece, which hammering plate is provided with a passage for passing the flexible pipe therethrough.

7. A lengthening piece according to claim 5 or 6, **characterized in that** an opening is present in the wall of the lengthening piece near the lower end of said lengthening piece, via which opening the lower end of the flexible pipe present within the lengthening piece is accessible.

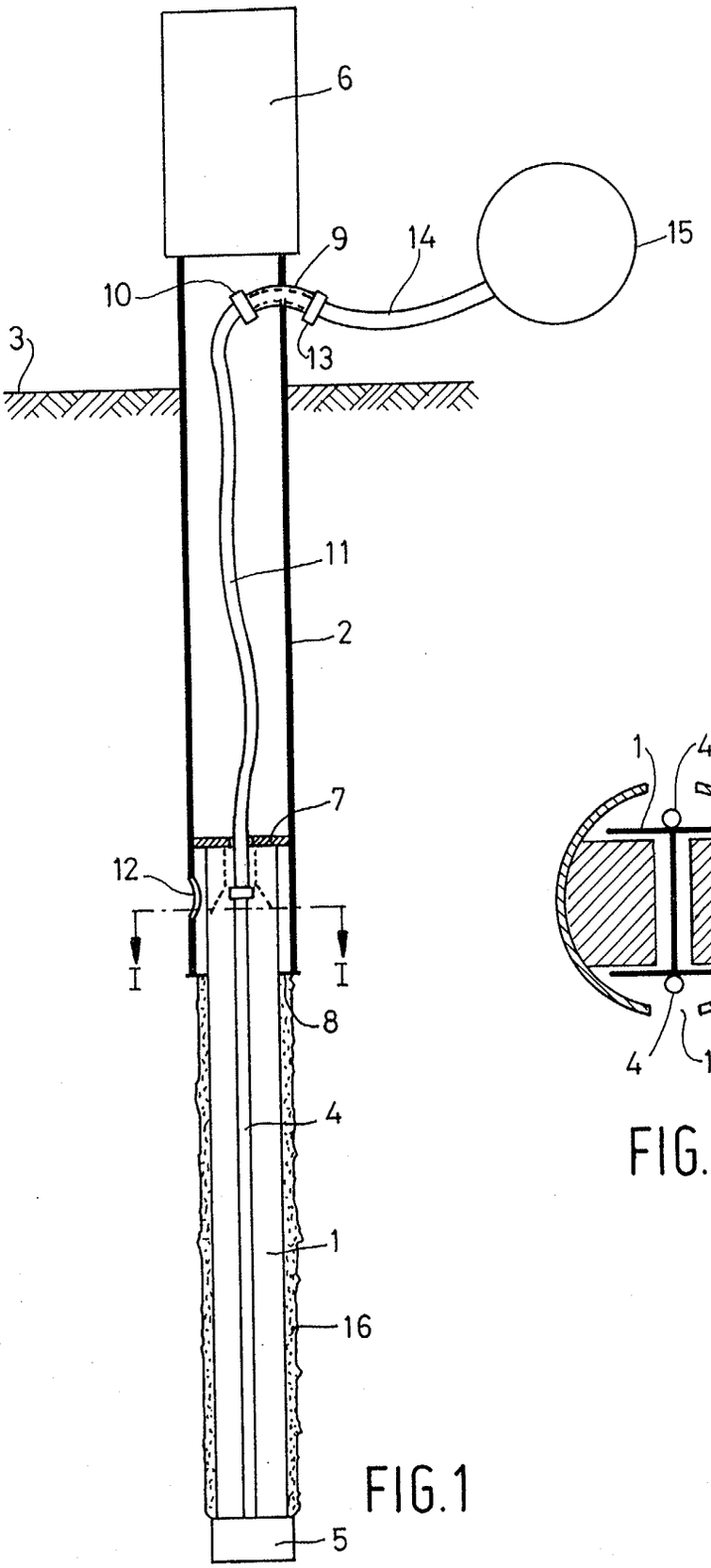

FIG.1

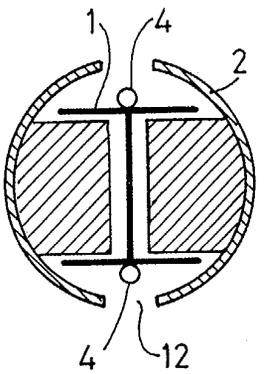

FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 03 07 7614

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.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 December 2003	De Neef, K

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family membersrelating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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