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(54) **A METHOD OF INTRODUCING AN ELONGATED FOUNDATION ELEMENT INTO THE SOIL**

VERFAHREN ZUM EINBRINGEN EINES LÄNGLICHEN FUNDAMENTELEMENTS IN DEN BODEN

PROCÉDÉ D'INTRODUCTION D'UN ÉLÉMENT DE FONDATION ALLONGÉ DANS LE SOL

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Description

[0001] The present invention relates to a method for introducing an elongated foundation element at least partially into the ground according to the preamble of claim 1.

[0002] Traditionally, introducing foundation elements takes place by means of pile-driving, however, this technique has several disadvantages. In particular, there is noise nuisance, and there is the risk of damage to surrounding buildings and the like as a result of the vibrations that accompany pile-driving. For this reason, techniques have been developed which make use of drilling. It is known to introduce a foundation element into the ground by rotating a hollow tube into the ground which tube at its bottom end engages a drilling head ("drilling tip") which drilling head pushes away the ground. Next, there are two different ways to continue. According to the first method, the tube is filled up with concrete, and the (expensive, metal) tube remains in the ground. According to the second technique, a prefabricated foundation element is introduced into the tube after introducing the tube into the ground, whereupon the cavities between the inner tube wall and the foundation element are filled up with concrete, while the tube is lifted up again before the concrete sets. According to an alternative method for introducing a prefab foundation element into the ground, a hole is drilled after which the foundation element is placed into the drilled hole.

[0003] JP2002081059 discloses a method in which an elongated foundation element is introduced into the soil using a drilling head provided with a spiral blade. Rotating the drilling head drives the drilling head into the ground, and it also pushes soil sideways; allowing the foundation element to be introduced. The drilling head remains in the ground after drilling. The method allows for a reduced risk of damage to the elongated driving pile due to torsional forces.

[0004] The object of the present invention is to provide a method for introducing an elongated prefab foundation element at least partially into the ground, which causes little nuisance, little damage to the surroundings, and is cost effective.

[0005] To this end, the invention provides a method for introducing an elongated prefab foundation element at least partially into the ground, comprising the steps as mentioned in claim 1.

[0006] The invention provides for introduction of a prefabricated foundation element into the ground. An important advantage that is achieved this way is that the load bearing capacity of such an element is better known beforehand, which is important for the construction of a building that is to be build on the foundation. Contrary to pile driving, the foundation element is not exposed to impact loading which limits the risk of cracking of the foundation element. Optionally, the reinforcement can also be closer to the surface of the foundation element than with foundation elements that are introduced into the ground by pile driving. The reinforcement can be prestressed reinforcement for those applications where the foundation element (also) has to be able to withstand pulling forces. With the method of the invention, the foundation element can be provided with a conduit for storing heat and/or cold in the ground or withdrawing heat and/or cold from the ground. Alternatively, or additionally, such a conduit may also be introduced into the channel after introducing the foundation element into the ground. By using the cheaper method according to the invention, such a usage of the ground is economically more feasible. In addition, the invention is extremely suitable for introducing foundation elements that are not round, which contributes to the economical aspect even more. When introducing the foundation element into the ground, the total of the rotating surface area that is in contact with the ground is significantly smaller or even zero (apart from, of course, the drilling head), in comparison with the technique of rotating a hollow tube into the ground, since the foundation element will not co-rotate simultaneously, or only slightly, thus reducing the friction and thus reducing the energy required for the introduction. According to the method of the invention the foundation element may have a circular cross section, but according to an important advantage of the invention the cross section may instead be unround, such as elliptical, a regular or irregular polygon (e.g. pentagonal, hexagonal, heptagonal, octagonal, nonagonal, decagonal, and from the viewpoint of costs preferably quadrangular or rectangular) etc., yet achieving a proper adhesive force of the outer longitudinal sides and/or longitudinal ribs of the foundation element to the ground. When in the present invention a channel is mentioned, a through-space in the longitudinal direction of the foundation element is meant. The foundation element is a hollow foundation element. Within the scope of the present invention the phrase "hollow foundation element" means that in cross section the foundation element exhibits a hole, which hole is the channel into which the driving shaft is introduced. According to an alternative construction which is not claimed, the space opens up at one side of the foundation element. In that case, the foundation element has for instance a U-shaped cross section. For effectively introducing into the ground and/or providing a foundation element that can be properly loaded, the central axis of the foundation element will in practice be within the space. The position of the central axis can be determined by wrapping an (imaginary) wire around the foundation element in a plane perpendicular to the longitudinal direction of the foundation element. In that case, the central axis is the line that runs in the longitudinal direction of the foundation element through the place-average centre of the circumference that is determined by the wire. The largest diameter of the foundation element is defined as twice the distance between the central axis and a point situated on the wire that is located furthest away of the central axis. The smallest diameter of the foundation element is defined as twice the distance between the central axis and a point situated on the imag-

inary wire that is located nearest to the central axis. Preferably, the method is carried out such that the ground is cut through by the drilling head less than 1 cm beyond the largest diameter of the foundation element, more preferably, the ground is not cut through beyond the largest diameter. For foundation elements having polygonal cross-sections, the diameter of the drilling head may also be somewhat smaller in which case the foundation elements may allow for an adhesive (friction) load, while intermediate areas have no adhesion until the ground around the foundation element has settled. Because of the selected shape and the rotating movement, the drilling head pushes away the earth sidewards, facilitated by the downward force exerted by the drilling head via the driving shaft. A (generally significantly smaller) downward force will be exerted on the foundation element also in order to ensure that the drilling head and the foundation element are not separated from one another to such an extent that the foundation element is no longer moved downward together with the drilling head. The downward pull and/or push force exerted on the drilling engine by a device (such as a winch, a hydraulic device and the like) which is exerted on the drilling head via the driving shaft, is at least 1 ton (i.e. 1 ton more than the tare weight of the totality of the drilling engine, foundation element and driving shaft), preferably at least 2 tons. This force is selected depending on the chosen circumstances (ground conditions, pile diameter, shape of the drilling head etc.), but can be readily determined by the ordinary expert: When the foundation element does not enter the ground or does not enter the ground quickly enough, the downward force has to be increased.

[0007] In general, the foundation element that has to be introduced into the ground will have over its length essentially the same dimensions (cross section). The ground that is pushed away by the drilling head will be displaced at least partially and in practice virtually entirely sidewards. When in the present application "which driving shaft is driven near the top end of the foundation element" is mentioned, this is intended to mean: At a greater distance from the lower end of the foundation element than from the top end. In practice, the driving shaft will be driven by the drilling engine at the upper end of the foundation element. By exerting the downward force it is also possible to introduce a prefab foundation element by drilling at an angle. This angle is for instance at least 5°, but can also be more than 10°. To avoid unnecessary friction between the bottom of the foundation element and the drilling head it is preferred that the downwardly directed force exerted on the drilling head is greater than the force that may be exerted on the foundation element. With the method according to the invention the drilling head remains in the ground.

[0008] DE19746731A1 discloses a system in which a sheet pile element is introduced into the ground wherein soil is loosened up by a drilling head and placed into a container which is regularly moved to the earth's surface to be emptied there. In order to achieve some load bearing capacity, grout has to be introduced at the bottom of the sheet pile element.

[0009] JP2003147770 discloses a method for introducing a foundation element into the ground wherein a drilling head is screwed into the ground. The load bearing strength of the foundation element is determined by the strength of the attachment of the spiral-shaped flange of the drilling head to the body of the drilling head, generally a weld. Alternatively, the flange may be an integrally cast portion, in which case the drilling head is very expensive, especially since the drilling head remains in the ground. Using this method, essentially only circular foundation elements can be (accurately) placed. With the method according to the present invention, the drilling head will substantially be a closed head (as a result of which at the most a negligible amount of soil will end up in the channel). Thus, the drilling head can be loaded very effectively. With the method according to the present application, the ground below the head is compressed, resulting in less settlement.

[0010] DE 20 2004 020804 discloses a method for introducing a foundation element into the ground, said foundation element having a central channel for an auger which is used to transport soil to the surface. It discloses the use of a chisel head to interrupt the introduction of the foundation element to break up stones and the like.

[0011] GB1125853 discloses a method for introducing an elongated prefab foundation element into the ground. The elongated prefab foundation comprises a channel extending along its length where a driving shaft is connected to a drilling head provided at the bottom of the prefab foundation element, said driving shaft with an auger being driven by a drilling engine. The engine is moved up and down by a platform to control the height of the drilling head and to clamp a bucket where the soil is to be stored.

[0012] According to a preferred embodiment, the driving shaft and the drilling head engage detachably and the driving shaft is removed from the channel of the foundation element after the foundation element has at least been partially introduced into the ground.

[0013] Because of this, the driving shaft can be used for the introduction into a channel of a subsequent foundation element. According to a practical embodiment of the method according to the invention, the driving shaft is retained by the drilling engine. In such a case, with this favorable embodiment, this retention can be used to pull the driving shaft up from the channel.

[0014] Preferably, the drilling head has a largest diameter between the smallest diameter and the largest diameter of the foundation element.

[0015] Thus, a foundation element that is not round can be introduced into the ground quickly, while the ground is further minimally disturbed and can accommodate itself to the foundation element around the foundation element. The diameter of an elongated foundation element is, as customary in the art, calculated transverse to the longitudinal direction of the elongated foundation

element, and is defined hereabove exactly.

[0016] According to a very favorable embodiment of the method according to the invention, the base of the foundation element is provided with an organ against which the drilling head can rotate with reduced friction, and wherein the organ is provided with an opening for letting through the driving shaft.

[0017] The organ can be a coating that is applied either prior to, during or after the manufacture of the foundation element, or a separate organ that is placed, clenched to the lower end of the foundation element or fastened therewith for instance by gluing. The opening allows the driving shaft to reach the drilling head in order to be able to drive it.

[0018] According to a preferred embodiment, the foundation element is a foundation element that has a space in the longitudinal direction thereof such that it allows for the driving shaft to be introduced into the channel via a longitudinal side of the foundation element.

[0019] This embodiment facilitates the introduction of the driving shaft into the channel, which saves time and costs. Consequently, the device for introducing the elongated foundation element into the ground can be significantly less high, which is a major advantage. The phrase "introducing the driving shaft into the channel via a longitudinal side of the foundation element" also includes fitting the driving shaft around the foundation element. For that matter, after introducing the driving shaft into the channel, the longitudinal side may be closed completely or partially thus forming a hollow foundation element as described above. In DE19746731A1 the space is used for passing through a protruding portion of the drilling head, and not for introducing the driving shaft via the longitudinal side.

[0020] The application also discusses a device for the introduction of a foundation element into the ground, which device is not part of the claimed invention, and which device includes a drilling engine for driving a driving shaft that is substantially directed vertically, the driving shaft being adjustable in height with respect to the drilling engine, and wherein the device is provided with an organ for exerting a downwardly directed force on the drilling engine.

[0021] Such a device is very flexible and, if so desired, can be used with hollow foundation elements or with foundation elements wherein the driving shaft is introduced into the channel via a longitudinal side of the foundation element. The term "substantially vertically" means at an angle between 45° and 90° with the horizontal. The organ for exerting a downwardly directed force is for instance a winch. Alternatively, or additionally, the downwardly directed force can also be exerted hydraulically and/or using rack-and-pinion driving and/or a chain- and gear driving. Such a device can introduce a foundation element into the ground more quickly, and thus more economically. Such a device also allows the introduction of foundation elements into types of soil other than soft soil.

[0022] According to a preferred construction of the device, the drilling engine is arranged to engage the driving shaft, and further the drilling engine is provided with a centering organ to centre the foundation element in order to prevent the driving shaft from touching the wall of the channel.

[0023] Especially at the beginning of the drilling, the centering organ plays an important role in sparing the wall of the channel since it limits swerves of the upper end to a large extent. Advantageously, the centering organ, which for instance has the shape of a coupling sleeve, also provides a downward pressure, or part thereof, on the foundation element when this stays behind relative to the drilling head because of sticking/adhesion when introducing it into the ground. Additionally, the centering organ is advantageously suspended rotatably around an axis - that coincides with the rotating axis of the drilling engine - but in such a way that translation of the centering organ in a plane transverse to that axis is avoided to a large extent. This makes it possible to readily include the upper end of a foundation element that is not round in the centering organ.

[0024] It will be understood that when a drilling engine is mentioned this also includes a drilling engine that is contained in a housing (case), where the housing includes the centering organ, the downward force is exerted on the housing and thus on the drilling engine etc. and that the term drilling engine hence also includes a housing therefore, as long as the housing includes a drilling engine, as a result of which such variants fall within the scope of the accompanying claims. If the driving shaft can be passed through the drilling engine, it can also be passed through the housing.

[0025] The present invention will now be elucidated referring to the drawings, where

- fig. 1 shows a device 1 for introducing a foundation element into the ground;
- fig. 2a and b show in top view respectively side view an organ which can be provided at the lower end of a foundation element to be introduced into the ground;
- fig. 3 shows a detail of the device of fig. 1 together with a foundation element that has been introduced into the ground partially; and
- fig. 4 shows sectional views of four foundation elements which can be introduced into the ground using the method according to the invention.

[0026] Fig. 1 shows a device 1 suitable for use in the method according to the invention, which in the embodiment shown here is designed as a vehicle having caterpillar tracks 2. The vehicle includes a leader 3. A leader 3 is that part of the device that carries and guides the heavy vertically movable parts of the device. In particular, the leader 3 is provided with a drilling engine 4. This drilling engine 4 can be moved along the leader 3 in a manner known per se. The drilling engine 4 can drive a shaft 5. Preferably, the drilling engine 4 is arranged such that the

driving shaft 5 can be passed through the drilling engine 4 and can be held at a desired position on the driving shaft 5.

[0027] Although the device 1 is a device that is substantially known, now first some known features of the device 1 as shown in figure 1 will be discussed. The leader 3 is connected with the vehicle such that it can be tilted via connecting element 25 capable of acting as a cardan joint. A hydraulic cylinder 26 is present for positioning the leader 3 at the desired height. The hydraulic cylinder 27 is present for positioning the leader 3 at the desired angle. At the ends of the leader 3, there are pulleys 20, 21 which serve to move the drilling engine 4 along the leader 3 using cables 22, 23. For moving upwards the drilling engine 4 along the leader 3, cable 23 is connected to winch 29 in a manner known per se via pulleys 21 and 42. For exerting a downward force on the drilling engine 4 the device 1 is provided with a winch 28, which force is transferred to the drilling engine 4 via cable 22 and a pulley 42. For the sake of the figure's clarity, the cable path within the leader 3 is not shown.

[0028] From the viewpoint of saving weight and in order to be able to handle large torque forces, the driving shaft 5 is preferably hollow. The diameter of the driving shaft 5 can vary depending on the diameter of a foundation element 100 to be introduced into the ground, and is for instance 10 - 20 cm. Its length will similarly also depend on the length of the foundation element as well as on the way in which the drilling engine 4 engages the driving shaft 5.

[0029] An elongated foundation element 100 to be introduced into the ground using the method according to the invention, has a channel 6 extending in the longitudinal direction of the foundation element, in general from one end of the foundation element 100 to the other. The driving shaft 5 is introduced into the channel 6. The way in which this can be done depends on the type of foundation element 100 that is used. When using a hollow foundation element 100 wherein the lumen of the channel 6 is in contact with the surroundings only at both ends of the foundation element, the driving shaft 5 will be introduced into the channel 6 at one end of the foundation element 100. In practice, this will take place when the foundation element 100 is preferably at least partially erected, and preferably when it is in a substantially vertical position. Another option will be discussed later.

[0030] Under the driving shaft 5 a drilling head 7, also called drilling tip, is connected which is designed for mainly sideward displacement. Such a drilling head 7 is known per se, and is for instance available from Rademakers Gieterij BV, Klazienaveen, The Netherlands. The driving shaft 5 engages a cavity in the drilling head 7. The drilling head 7 is for instance manufactured out of cast iron. The diameter of the drilling head 7 will be selected depending on the type of soil, diameter and cross section (shape) of the foundation element 100 and the like. In case there is a risk of negative adhesion, this may be prevented by selecting a drilling head 7 having a large diameter that can be larger than the largest diameter of the foundation element 100. When using a downward force exerted upon the foundation element 100 the diameter of the drilling head 7 may be smaller than when no such force is exerted.

[0031] Between the lower end of the foundation element 100 and the drilling head 7 an organ 8 may be provided, having at least 1 of the following functions: lowering the friction between the lower end of the foundation element 100 and the drilling head 7, avoiding that the driving shaft 5 touches the wall 9 of the channel and to make sure that the driving shaft 5 stays well centred in the channel 6.

[0032] The organ 8 has for instance the shape of a plate 10 (fig. 2) which at opposite ends is provided with upright edges 11 which are clamped around the lower end of the foundation element 100. The plate 10 further has a space or aperture 12 for letting through the driving shaft 5. The organ 8 is for instance manufactured out of cast iron.

[0033] For introducing the foundation element 100 into the ground the drilling engine 4 will drive the driving shaft 5, causing the drilling head 7 to rotate. The drilling head 7 pushes away ground, mainly sidewards, as a result of which a hole is formed in the ground and at the same time foundation element 100 is introduced into the ground. In general, the foundation element 100 does not rotate. Especially, when using a drilling head 7 having a relatively small diameter it can be necessary to exert a large downward force on the foundation element 100. In practice, exerting a large downward force will be necessary in order to be able to introduce a foundation element 100 into the ground when that ground is firm. However, also in the case of soft ground exerting a large downward force will be (economically) advantageous, as this saves time. The downward force is provided by exerting a downward force on the drilling engine 4, for instance by means of cable 22, pulley 42 and winch 28. By selecting an appropriate length of the driving shaft 5, or height at which this is held by the drilling engine 4, a downward force can be exerted on the foundation element 100 also.

[0034] The drilling engine 4 is at its bottom provided with a centering organ 30, here in the shape of a square coupling sleeve which is placed over the upper end of the foundation element 100, and incorporated therein. Alternatively, in the case of a hollow foundation element 100 the centering organ can also use the channel to centre the foundation element 100.

[0035] At the bottom of the leader 3 a guiding organ 41 is provided for guiding the foundation element 100. Here, the guiding organ 41 is in the shape of two arms, which either clasp with low friction or loosely surround the foundation element 100.

[0036] Fig. 3 shows the foundation element 100 partially introduced into the ground. The pulleys 20 and 42' (situated behind pulley 42) and cable 22 that are preferably used here also are, for that matter, not shown.

[0037] If it is desired to introduce the foundation ele-

ment 100 further into the ground than the drilling engine 4 can reach with respect to the leader 3, a so-called spacer (= intermediate element) may be used between the drilling engine 4 and the upper end of the foundation element 100.

[0038] It will be understood that using the method according to the invention, a foundation element 100 can also be introduced into the ground at another angle than vertical. In general, the leader 3 will be positioned at the same angle.

[0039] When the device 1 is used for introducing a foundation element 100 into the ground, wherein the lumen of the channel 6 is in contact with the surroundings only at both ends of the foundation element, the leader 3 will be provided with an extension arm 16 that can be moved parallel to the leader 3, for instance in the form of a telescopic tube, which may be hydraulic or pneumatic, but preferably has a winch (not shown). In that case, the driving shaft 5 will be connected near the upper end thereof, in such a way that the driving shaft 5 is still able to rotate around its axis, or be arranged to release the driving shaft 5 when the drilling engine 4 has to drive the driving shaft 5 (fig. 3).

[0040] According to a preferred embodiment, the use of such an extension arm 16 that can be moved parallel to the leader 3, is avoided by using a foundation element 100 that is arranged to introduce the driving shaft 5 into the channel 6 via a longitudinal side of the foundation element. Fig. 4 shows four sectional views of foundation elements 100-103, wherein the foundation elements 102 and 103 at a longitudinal side have a side opening 104. In practice, this will extend along the entire length of the foundation elements 102, 103. However, it is, for instance, conceivable that an end of the foundation element 102, 103 has a cross section for foundation elements 100 or 101 as shown in fig. 4, as long as the driving shaft (drilling rod) can be introduced into the channel 6 via the longitudinal side. The foundation elements 102, 103 can be said to have a U-shaped cross section.

[0041] Although, in fig. 4 four square foundation elements 100-103 are shown, a wide variety of cross-sections is possible, such as polygons that may or may not be regular, elliptical or circular cross-sections etc. All these variants are possible, and may or may not be combined with a side opening 104 allowing the driving shaft 5 to be introduced into the channel 6 via the side opening.

[0042] Although minor deviations are permissible, the central axis of the driving shaft 5 will generally coincide with the central axis of the channel 6, and the channel 6 will be dimensioned such that the outer periphery of the driving shaft 5 fits within the channel 6. From the viewpoint of strength, the channel 6 will generally have an at least partially circular cross section, but this is not necessary. A hollow foundation element could for instance have a channel with a square cross section (not shown).

[0043] It will be apparent to the ordinary person skilled in the art that the present invention can be varied in various ways within the scope of the accompanying claims. The channel may, for example, be used for introducing a conduit for the thermal usage of the ground, reinforcement can be provided into the channel and embedded in grout, the driving shaft can be hollow and the cavity can be used to introduce a setting mass (such as grout) into the cavity during the pulling upwards of the driving shaft etc. It is also possible to introduce a foundation element in more than 1 part, wherein these parts, if so desired, are for example connected via a mortise and tenon joint. For pile-driving this technique is very expensive as the joints have to be able to withstand the pile-driving process, but because of the low load (which is not impact-based), more simple (and thus cheaper) joints are possible. Before the drilling engine is pulled up, the driving shaft is disengaged (i.e. no longer clasped by the drilling engine). The drilling engine is pulled up over such a distance that a next section with an opening along the longitudinal side can be placed around the driving shaft, after which this section is at least partially introduced into the ground.

Claims

1. A method for introducing an elongated prefab foundation element (100) at least partially into the ground, the elongated prefab foundation element (100) having a channel (6) extending along the length of the foundation element (100), wherein a drilling head (7) provided at the bottom of the hollow foundation element (100) is driven by a driving shaft in the channel (6) of the foundation element (100), the driving shaft being driven by a drilling engine (4) near the top end of the foundation element (100),
wherein the drilling head is a substantially closed drilling head, with ground being pushed sideways virtually entirely and the foundation element (100) being introduced at least partially into the ground by the driving of the drilling head (7), following which the drilling head (7) is left in the ground,
characterized in that a downwardly directed pull and/or push force is exerted on the drilling engine (4), and via driving shaft (5) to the drilling head (7) by a device wherein the downwardly directed pull and/or push force results in the foundation element (100) being introduced into the ground.

2. A method according to claim 1, wherein the method comprises the step of exerting a downwardly directed force on the drilling engine (4) of at least 2 ton.

3. The method according to any of the preceding claims, wherein the foundation element (100) is a foundation element (100) having a side opening in the longitudinal direction thereof such that it allows the driving shaft to be introduced into the channel (6) via a longitudinal side of the foundation element (100).

4. The method according to any of the preceding claims, wherein the driving shaft and the drilling head (7) engage detachably, and the driving shaft is removed from the channel (6) of the foundation element (100) after the foundation element (100) has at least been partially introduced into the ground.

5. The method according to any of the preceding claims, wherein the drilling head (7) has a largest diameter between the smallest diameter and the largest diameter of the foundation element (100).

6. The method according to any of the preceding claims, wherein the base of the foundation element (100) is provided with an organ against which the drilling head (7) can rotate with reduced friction, wherein the organ is provided with an opening for letting the driving shaft through.

Patentansprüche

1. Verfahren zum zumindest teilweisen Einführen eines länglichen vorgefertigten Fundamentelementes (100) in den Boden, wobei das längliche vorgefertigte Fundamentelement (100) einen Kanal (6) hat, der sich entlang der Länge des Fundamentelementes (100) erstreckt, wobei ein Bohrkopf (7), der am Boden des hohlen Fundamentelementes (100) vorgesehen ist, durch eine Antriebswelle im Kanal (6) des Fundamentelementes (100) angetrieben wird, wobei die Antriebswelle durch eine Bohrmaschine (4) in der Nähe des oberen Endes des Fundamentelementes (100) angetrieben wird,
wobei der Bohrkopf ein im wesentlichen geschlossener Bohrkopf ist, wobei der Boden praktisch vollständig beiseitegeschoben wird und das Fundamentelement (100) zumindest teilweise in den Boden durch das Antreiben des Bohrkopfes (7) eingeführt wird, wonach der Bohrkopf (7) im Boden gelassen wird,
dadurch gekennzeichnet, dass eine nach unten gerichtete Zug- und/oder Schubkraft auf die Bohrmaschine (4) und über die Antriebswelle (5) auf den Bohrkopf (7) über eine Vorrichtung ausgeübt wird, wobei die nach unten gerichtete Zug- und/oder Schubkraft dazu führt, dass das Fundamentelement (100) in den Boden eingeführt wird.

2. Verfahren nach Anspruch 1, wobei das Verfahren den Schritt des Ausübens einer nach unten gerichteten Kraft auf die Bohrmaschine (4) von mindestens 2 t umfasst.

3. Verfahren nach einem der vorherigen Ansprüche, wobei das Fundamentelement (100) ein Fundamentelement (100) ist, das eine Seitenöffnung in der Längsrichtung desselben derart hat, dass sie der Antriebswelle ermöglicht, in den Kanal (6) über eine Längsseite des Fundamentelementes (100) eingeführt zu werden.

4. Verfahren nach einem der vorherigen Ansprüche, wobei die Antriebswelle und der Bohrkopf (7) lösbar ineinandergreifen, und die Antriebswelle aus dem Kanal (6) des Fundamentelementes (100) entfernt wird, nachdem das Fundamentelement (100) zumindest teilweise in den Boden eingeführt worden ist.

5. Verfahren nach einem der vorherigen Ansprüche, wobei der Bohrkopf (7) einen größten Durchmesser zwischen dem kleinsten Durchmesser und dem größten Durchmesser des Fundamentelementes (100) hat.

6. Verfahren nach einem der vorherigen Ansprüche, wobei die Basis des Fundamentelementes (100) mit einem Hilfsmittel versehen ist, gegen das der Bohrkopf (7) mit reduzierter Reibung rotieren kann, wobei das Hilfsmittel mit einer Öffnung zum Durchlassen der Antriebswelle versehen ist.

Revendications

1. Procédé d'introduction au moins partielle dans le sol d'un élément de fondation (100) préfabriqué allongé, l'élément de fondation (100) préfabriqué allongé comportant un canal (6) s'étendant suivant la longueur de l'élément de fondation (100),
dans lequel une tête de forage (7) disposée au fond de l'élément de fondation (100) creux est entraînée par un arbre de commande dans le canal (6) de l'élément de fondation (100), l'arbre de commande étant entraîné par un moteur de forage (4) près de l'extrémité supérieure de l'élément de fondation (100),
dans lequel la tête de forage est une tête de forage sensiblement fermée, le sol étant poussé sur le côté pratiquement entièrement et l'élément de fondation (100) étant introduit au moins partiellement dans le sol par l'entraînement de la tête de forage (7), à la suite de quoi la tête de forage (7) est laissée dans le sol,
caractérisé en ce qu'une force de traction et/ou de poussée dirigée vers le bas est exercée sur le moteur de forage (4) et par l'intermédiaire de l'arbre de commande (5) à la tête de forage (7) par un dispositif, dans lequel la force de traction et/ou de poussée dirigée vers le bas a pour résultat d'introduire l'élément de fondation (100) dans le sol.

2. Procédé selon la revendication 1, dans lequel le procédé comprend l'étape consistant à exercer sur le moteur de forage (4) une force dirigée vers le bas d'au moins 2 tonnes.

3. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'élément de fondation (100) est un élément de fondation (100) comportant une ouverture latérale dans sa direction longitudinale de telle sorte qu'il permet d'introduire l'arbre de commande dans le canal (6) par un côté longitudinal de l'élément de fondation (100).

4. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'arbre de commande et la tête de forage (7) sont en prise amovible, et l'arbre de commande est retiré du canal (6) de l'élément de fondation (100) après que l'élément de fondation (100) ait été au moins partiellement introduit dans le sol.

5. Procédé selon l'une quelconque des revendications précédentes, dans lequel le plus grand diamètre de la tête de forage (7) est compris entre le plus petit diamètre et le plus grand diamètre de l'élément de fondation (100).

6. Procédé selon l'une quelconque des revendications précédentes, dans lequel la base de l'élément de fondation (100) est pourvue d'un organe contre lequel la tête de forage (7) peut tourner avec un frottement réduit, dans lequel l'organe est pourvu d'une ouverture pour laisser l'arbre de commande passer à travers.

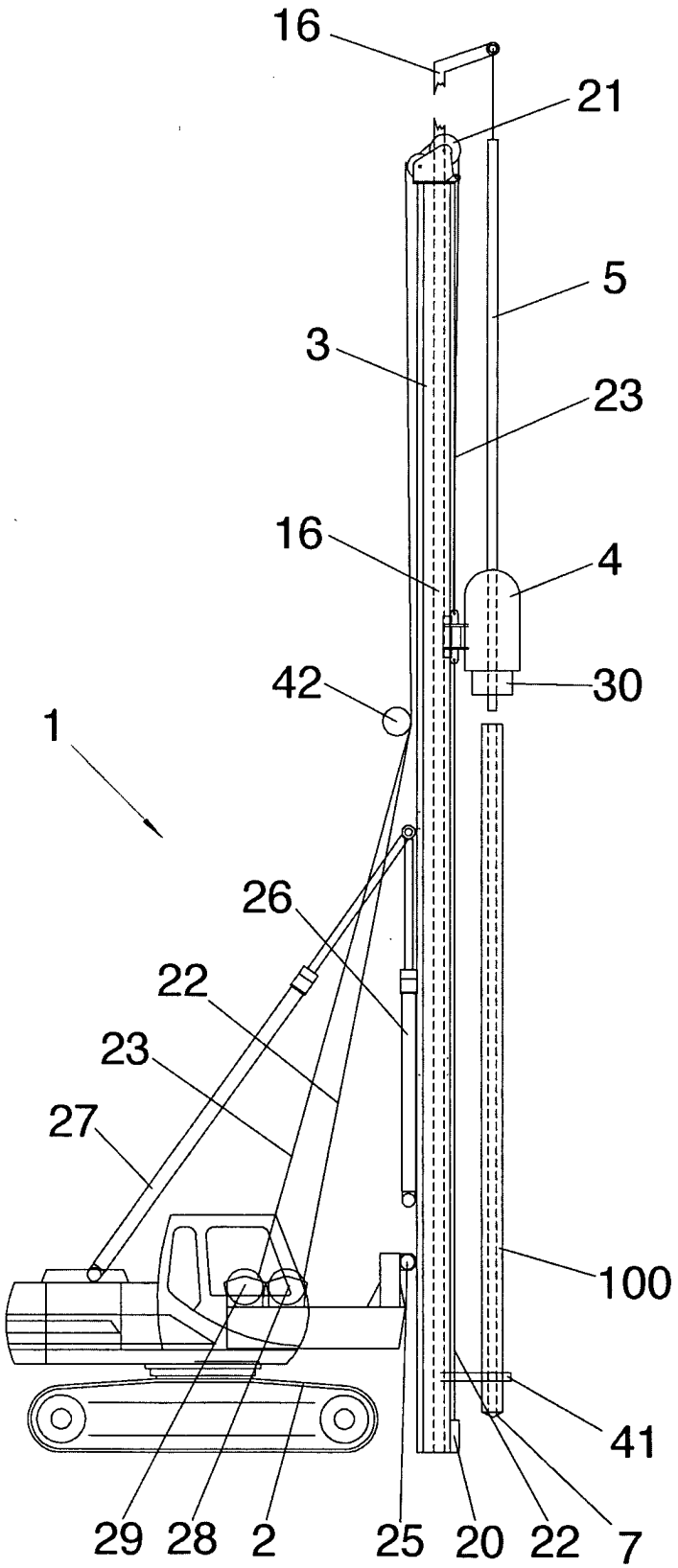
16
21
5
3
23
16
4
42
30
1
26
22
23
27
100
41
29
28
2
25
20
22
7

Fig. 1

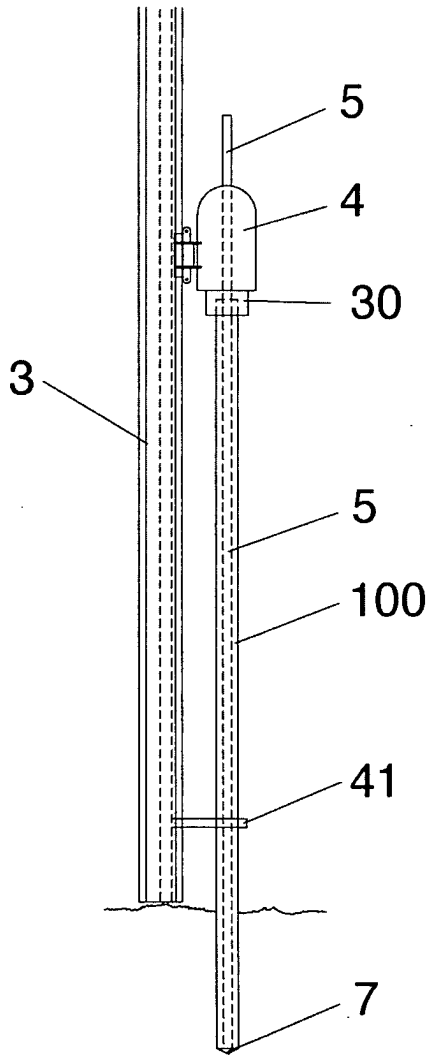
5
4
30
3
5
100
41
7

Fig.3

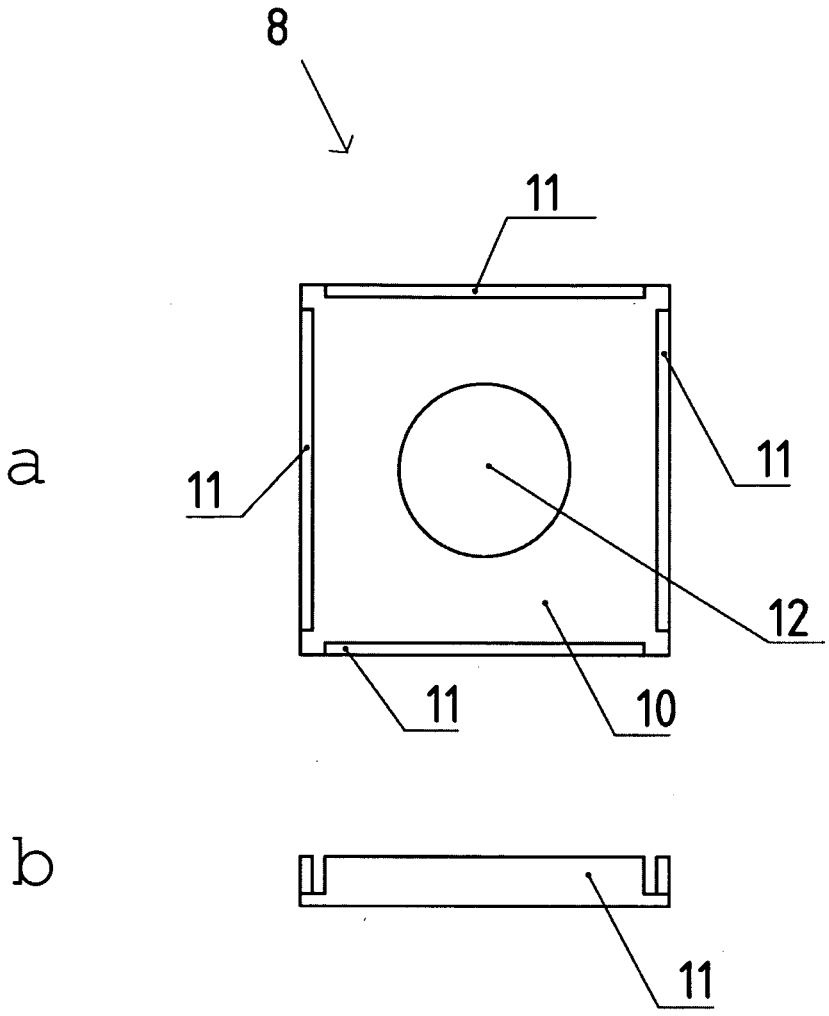

Fig. 2

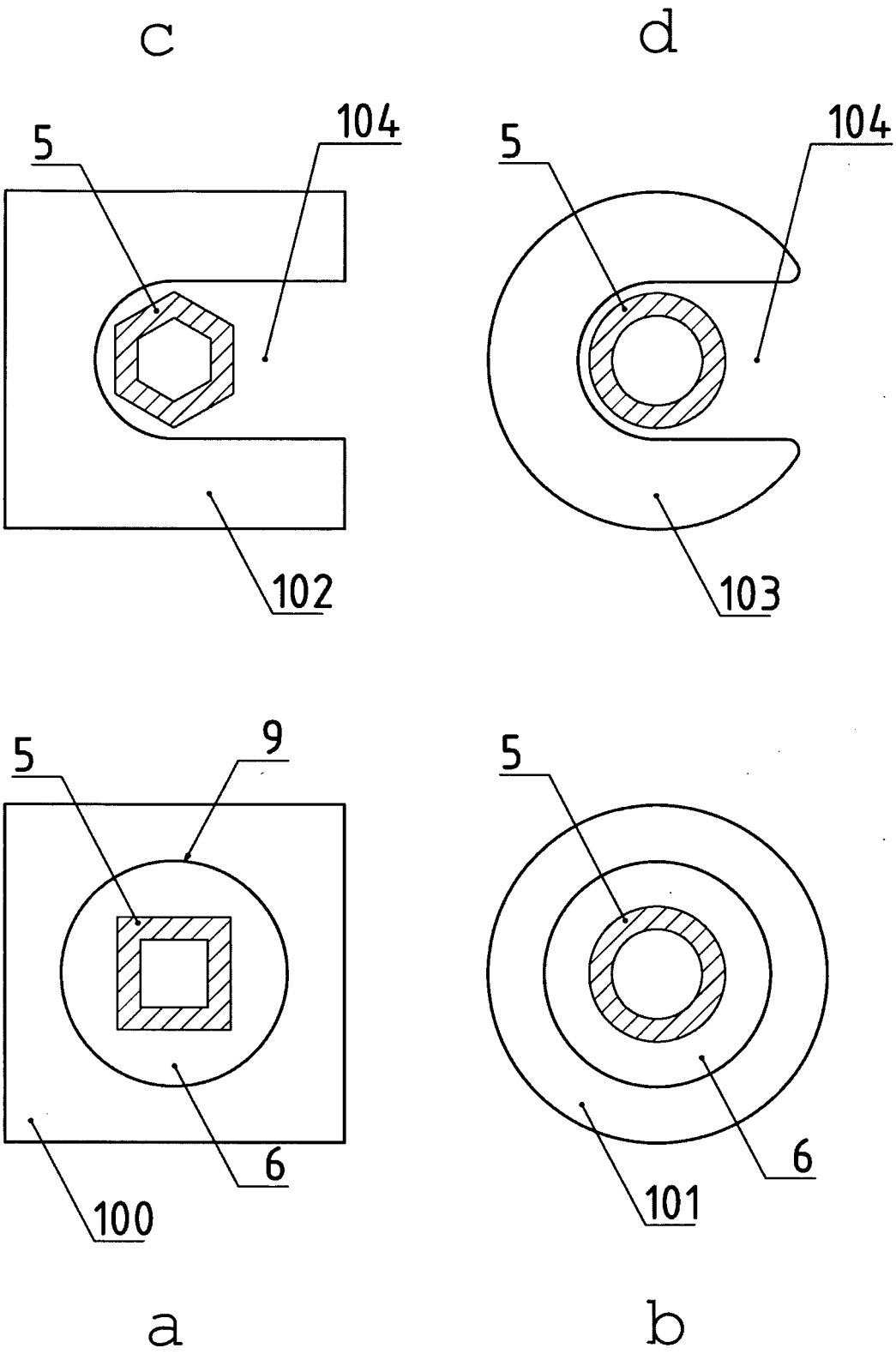

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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