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(54) METHOD AND APPARATUS FOR DOWN-THE-HOLE DRILLING

VERFAHREN UND VORRICHTUNG FÜR BOHREN IM BOHRLOCH

PROCÉDÉ ET APPAREIL DE FORAGE EN FOND DE TROU

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Description

[0001] The invention relates to a method and apparatus for down-the-hole drilling according to the preambles of the independent claims.

[0002] For example in patent publication FI 75650 there has been presented a boring tool, which is meant for boring and/or hammer drilling, to be used in connection with a drill rod unit placed inside a mantle pipe. The boring tool to be attached at the front end of the drill rod unit has a center drill, being provided with a cutting unit, and an eccentric reaming drill, being placed after the center drill, the reaming drill having also a cutting unit. The reaming drill moves with respect to the center drill between a drilling position, in which it is positioned sidewards in front of the mantle pipe, and a return position, in which it is withdrawn in radial direction inside the mantle pipe. Deviating from earlier solutions, in which the center drill is in most cases provided with four cutting parts directed radially and being made of hard metal, the reamer for its part comprising either one or two radially directed cutting parts made of hard metal, in the solution according to the publication in question, the cutting parts are replaced by bit parts being arranged in a certain manner. With the solution presented in this publication such constructions of the center drill and the reaming drill have been aimed that the operating time of the boring tool will be as long as possible.

[0003] A way to carry out overburden drilling in a more developed manner compared to prior art, is formerly known e.g. from Finnish. Patent No. 95618. The drilling head of the drilling unit of the drilling apparatus existing inside a casing part or in other words a so called casing pipe according to this patent, is formed of a first frame part and an annular second frame part, in the drilling surfaces of which there has been arranged drilling organs, such as drill bits or like, of the first and second drilling means or in other words of the pilot and the reamer. In this solution the first drilling means that is the first frame part forming the pilot, is being released from the second frame part forming the reamer in order to pull the same alone off from a drilled hole after the drilling situation. In the solution in question the second organs of the flushing means for removal of drilling waste being generated are arranged to lead drilling waste by means of an assembly belonging to the counterpart surface arrangement, which connects the said drilling means together for a drilling situation unrotatively in respect with each other and in both directions longitudinally, which, in other words, is being carried out as an advantageous embodiment by loosening grooves, belonging to a bayonet coupling, placed longitudinally in the outer periphery of the first frame part.

[0004] Document WO96/15351 discloses an apparatus for down-the-hole drilling, having a drilling device that comprises a casing part and drilling unit, at the drilling head of which there are first drilling means or a pilot for drilling a center hole, second drilling means or a reamer for reaming the center hole for the casing part and a flushing flow arrangement. In the drilling device a flushing medium flow is directed through a centric main channel and a distribution channel between the pilot and the reamer prior to drifting into the ground. This type of a drilling device is a so called Reverse Circulation (RC) drill, in which drilling waste is removed through the center of the pilot. This kind of a drilling device is not designed particularly for drilling with pneumatic flushing, nor applicable for the same, e.g. due to high velocity of the flushing medium when getting sprayed out from between the pilot and the reamer.

[0005] Furthermore document FR 2889 556 discloses an asymmetric type (or wing-type) of a drilling device that is meant for down-the-hole drilling with or without a casing pipe by means of a pilot and a reamer in connection therewith by using a pressurized flushing fluid. In the drilling device a flushing medium flow is directed through a centric main channel and a distributed within the frame of the pilot horizontally for leading thereof into the ground in the longitudinal direction of the device through holes in the frame on the drilling surface of the pilot. This kind of a drilling device is not designed for drilling with pneumatic flushing, nor applicable for the same, e.g. due to high velocity of the flushing medium when getting sprayed out from the holes of the pilot frame.

[0006] Particularly a so called pile drilling has rapidly become common in making of both so called micro piles and large-diameter foundation piles. An advantage of pile drilling is among other things the fact that drilled piles can be mounted quickly and accurately in a desired position, direction and depth. Straightness of the piles, verification of the bottom and accurate positioning are factors, thanks to which the pile drilling has often taken the place of pile driving particularly in demanding construction sites. A drilled pile displaces a corresponding amount of soil to its volume by bringing up the drilled soil entirely. This is why not any horizontal strains will be caused that might brake surrounding structures, which may take place when piles are rammed. Pile drilling is also relatively silent and quite shakeless (the operating frequency of the hammer is higher than the natural frequencies of soil and structures) when compared to piles being rammed. On the other hand the possibility offered by a drilled pile to get a casing pipe mounted reliably and without efforts even into a sloping rock surface, are superiority factors when comparing the method to piling by digging.

[0007] Thus a significant number of superiority factors are related to pile drilling, which in practice very often make the same as the most recommendable alternative. Thanks to the pile drilling being the most efficient piling method also by its production capacity and due to the fact that it enables piling with relatively small, easily transportable, and space-saving machines that can be put quickly into working order, also foundation constructors almost without exception take up a positive attitude towards the same.

[0008] Pile drilling uses pressurized air for operating

the down-the-hole hammer and as the means for bringing up the loosened material. Careless use of air in flushing has brought about, however, some problems, solving of which is necessary for the standpoint of development regarding pile drilling.

[0009] Problems caused by flushing air can be devided in two main categories:

- use of flushing air may overdrill an excessive amount of material on surface of the earth, in which case both the foundation to be built and surrounding structures are in danger. This is a typical situation particularly with frictional soil (sand, silt etc.),

- the second problem is due to "pushing" of air into the soil particularly in case of cohesive soil (such as clay), whereby air may get drifted around load supporting piles (e.g. rammed wood piles) existing in the neighbourhood, in which case weight carrying capacity of the pile (or piles) may decrease very quickly.

[0010] Careless use of flushing air has already led to denial of pile drilling by a down-the-hole hammer among other things in some sites, which have been grounded on support of old wood piles driven in cohesive soil, in which case air that has been "escaped" into the soil has caused sudden sinkings and cracks in buildings. On the other hand in some sites, a significantly greater amount of soil has been over drilled by flushing air than the piles have actually replaced, due to which surrounding buildings have been caused to tilt.

[0011] Because down-the-hole hammer drilling is, however, a very efficient way to operate, applicable for all soil circumstances and because the piles erected by the same are straight and reliable, the disadvantages related to its use need to be eliminated in order to enable down-the-hole hammer drilling also in the future.

[0012] As stated above, the problems caused by the use of flushing air in down-the-hole hammer drilling are usually due to poor professional skill or carelessness of the operating personnel, but in practice also drill bit structures and drilling techniques may effect essentially to arising of the problems. In this context e.g. drill bits are originally designed usually for rock drilling, whereby the flushing air must first of all be directed as efficiently as possible to the drilled point for removing of the particles quickly in order to avoid multiple crushing, and on the other hand with such a volume (and speed), that the material gets brought up through the casing. This is why the flushing openings of the drill bits are thus aimed directly at the rock surface. During drilling the flushing air may not get back upwards in rock hole, but along a hole with unbroken walls. The situation is, however, different in overburden drilling, whereby the ground may penetrate air even very easily. In this case turning of the flushing air back to the casing pipe or in connection therewith is very problematic or even impossible, if carried out by traditional drill bits. On the other hand, a large amount of air is needed for lifting of the soil, which leads also to a high velocity inside the casing pipe and to very effective blowing of flushing air directly to the soil.

[0013] A very controlled air circulation is thus required of bits operating under such circumstances or in other words when the flushing air is returned back to the casing pipe or in connection therewith though the soil was relatively easily air permeable. The drilling action must be performed on the other hand in a space protected as well as possible so that the pressure of the ground does not block input openings of the flushing air or in other words so that the pressure of the flushing air to be fed exceeds the pressure of the ground and on the other hand so that the easiest way for air from the drilled point takes place in a desired manner back to the casing part or in connection therewith.

[0014] It is an aim of the method and apparatus according to the present invention to achieve a decisive improvement in the problems described above and thus to raise essentially the level of prior art. In order to carry out this aim, the method and apparatus according to the invention are mainly characterized by what has been presented in the characterizing parts of the independent claims related thereto.

[0015] As the most important advantages of the method and apparatus according to the invention may be mentioned simplicity and efficiency of the constructions and operating principles enabled by the same first of all thanks to the fact that it is possible to exploit therewith drill bit constructions that have been found technically very well functionable. On the other hand the invention enables further use of pressurized air as flushing medium thanks to the drilling head of the drilling unit being provided with a counterpart surface arrangement according to the invention operating idealistically so that a direct flow of flushing air may not get directed to the soil, which is why among other things overdrilling and foundations of surrounding structures getting damaged can be avoided, which is nowadays being tried to prevent when drilling by present technique e.g. by protective pilings limiting the drilling site, which become naturally disproportionately expensive. With the method and apparatus according to the invention thanks to improvement of safety, it is thus possible to achieve also clear savings in performing of the drilling itself.

[0016] Advantageous embodiments of the method and apparatus according to the invention have been presented in the dependent claims related thereto.

[0017] In the following description the invention is depicted in detail with reference to the appended drawings, in which

in figure 1 is shown an example of the method and apparatus not forming part of the present invention when exploiting a so called symmetrical drilling unit, which is based on removal of drilling waste internally in the casing part,

in figure 2 is shown an advantageous embodiment of the method and apparatus when exploiting a drilling unit operating on eccentric principle, in which drilling waste is removed internally in the casing part,

in figure 3 is shown a partial cross-sectional view from an end of a symmetric drilling unit according to the invention, in which drilling waste is removed externally in respect of the casing part, and

in figure 4 is shown a partial cross-sectional view from an implementation according to the invention in connection with a drilling unit based on eccentric principle, in which drilling waste goes away externally in respect of the casing part.

[0018] The invention relates to a method for down-the-hole drilling, the drilling being carried out by an apparatus, having a drilling device 1 that comprises a casing part 2 and at least during a drilling situation an essentially inside thereof existing drilling unit 3, at the drilling head of which there are at least first drilling means 4 for drilling a center hole, second drilling means 5 for reaming the center hole for the casing part 2 and a pneumatic flushing flow arrangement 6 for leading of drilling waste by influence of pressurized air at least partly upward. The first drilling means 4 are coupled with the second drilling means 5 first of all power-transmittedly in order to carry out cooperation thereof at least during a drilling situation with the second drilling means 5 for a rotational motion w4, a feeding motion z4 and/or a hammering motion t4 produced by a hammer device 7 and on the other hand removably in order to enable removal thereof from the hole. The casing part 2 is furthermore arranged to be drawn into a hole to be drilled by the drilling unit 3. Flushing air is led while being led onto the drilling surface P1, P2 of the first and/or second drilling means into a counterpart surface arrangement X existing essentially at an end of a drilling unit 3, particularly in order to decrease kinetic energy thereof by changing its flow direction prior to drifting thereof into the ground.

[0019] In the method it is being exploited when operating with a drilling apparatus, in which the drilling head of the drilling device 1 is formed of a first frame part 4a and a second frame part 5a, the drilling surfaces P1, P2 of which being provided with drilling organs of the first and the second drilling means 4, 5, such as an integrated drilling part, separate drilling pieces, bits or like, and whereby a reamer is being used as the second drilling means 5 that has an essentially continuing drilling surface radially when viewed in a cross-section perpendicular to a longitudinal direction s of the drilling unit 3. The flushing air is in this case being led as an advantageous embodiment particularly with reference to the implementations shown in figure 3 from a main channel 6; 6a in the first frame part 4a by one or several distribution channels 6; 6b directed outward from center toward a counterpart surface X' existing in the first frame part.

[0020] With reference to the embodiments shown in figures 2 and 4, respectively, the method is exploited when operating with a drilling apparatus, in which the drilling head of the drilling device 1 is formed of a first frame part 4a and a second frame part 5a, the drilling surfaces P1, P2 of which being provided with drilling organs of the first and the second drilling means 4, 5, such as an integrated drilling parts, separate drilling pieces, bits or like, and whereby a reamer is being used as the second drilling means 5 that operates on eccentric principle, being non-cymmetrical and that opens radially outward for drilling. The flushing air is in this case being led from a main channel 6; 6a in the first frame part 4a by one or several distribution channels 6; 6b, being directed outward from center, toward a counterpart surface X' existing in the first 4a frame part.

[0021] Furthermore with reference to the appended drawings, speed and/or direction of the flushing air flow HV is altered by a flow space X", being in connection with the counterpart surface X; X' and the cross-section of which being increased in respect to the same of the distribution channel 6; 6b and/or directed to a differing direction.

[0022] The invention relates also to an apparatus for down-the-hole drilling as explained above, in which an end of the drilling unit 3 is provided with a counterpart surface arrangement X, which is meant particularly for decreasing kinetic energy of a flushing air flow HV to be brought into the drilling surface P1, P2 of the first and/or second drilling means, by changing its flow direction prior to drifting thereof into the ground.

[0023] A drilling head of the drilling device 1 of the apparatus according to the invention is formed furthermore advantageously of a first frame part 4a and a second frame part 5a, the drilling surfaces P1, P2 of which being provided with drilling organs of the first and the second drilling means 4, 5, such as an integrated drilling part, separate drilling pieces, bits or like. Particularly with reference to the embodiments shown in figures 1 and 3, the second drilling means 5 comprise a reamer that has an essentially continuing drilling surface radially when viewed in a cross-section perpendicular to a longitudinal direction s of the drilling unit 3. In this case, the flushing flow arrangement comprises a counterpart surface X; X' in the first frame part 4a. Furthermore one or several distribution channels 6; 6b existing in the first frame part 4a and being directed outward from center, is/are led toward the above counterpart surface.

[0024] Furthermore as an embodiment of the apparatus according to the invention particularly with reference to the exemplary implementations shown in figures 2 and 4, a reamer is being used as the second drilling means 5 that operates on eccentric principle, being non-cymmetrical and that opens radially outward for drilling. In this case the flushing flow arrangement comprises first of all a counterpart surface X; X' in the first frame part 4a. On the other hand one or several distribution channels 6; 6b existing in the first frame part 4a and being

directed outward from the center, is/are led toward the above counterpart surface.

[0025] The counterpart surface arrangement comprises furthermore a flow space X", the cross-section of which is increased in respect to the distribution channel 6; 6b and/or being directed to a differing direction therefrom as shown in figure 3 particularly in order to alter speed and/or direction of the flushing air flow HV. In the embodiments shown in figures 1, 2 and 4, the flow space X; X" is arranged by a recess in the first frame part 4a, at an end of the distribution channel 6; 6b on the drilling surface P1. Correspondingly with respect to figure 3, in the exemplary implementation presented therein, the counterpart surface X; X' is arranged essentially perpendicularly to the flushing air flow HV.

[0026] It is clear that the invention is not limited to the embodiments presented or described above, but instead it can be modified within the basic idea of the invention according to the needs at any given time. It is thus clear that the constructions of the drilling heads being illustrated in the appended drawings may vary in practice very much merely when being carried out with differing diameters. Instead of the type of embodiments shown in figures 2 or 4, it is naturally possible to use as the drilling device also other drilling devices that are applicable for the same purpose, in which a casing part is being exploited in connection with the drilling so that is most advantageously not rotated when being drawn into the ground. It is not that significant for the method and the apparatus according to the invention, either, how the first and second drilling means are coupled to work, so that most heterogeneous solutions can be exploited as the power transmission assemblies between the same starting from a screw joint locking. Also the casing shoe can be placed in an integrated manner at the end of the casing part etc. It is furthermore possible to complement the flushing flow arrangement e.g. by a flow pipe connected to the space between the casing part and the drilling unit e.g. in order to keep the space surrounding the drilling unit empty, and/or by a flushing assembly that greases the joint between the drilling means and the casing shoe etc.

Claims

1. Method for down-the-hole drilling, the drilling being carried out by an apparatus, having a drilling device (1) that comprises a casing part (2) and at least during a drilling situation an essentially inside thereof existing drilling unit (3), at the drilling head of which there are at least first drilling means (4) for drilling a center hole, second drilling means (5) for reaming the center hole for the casing part (2) and a flushing flow arrangement (6) for leading of a pressurized flushing air for drilling through a centric main channel (6a1) in order to direct the flushing air by means of one or more distribution channels (6b) from the centric main channel through a drilling surface (P1) of the first drilling means (4) and for leading of drilling waste at least partly upward, whereby the first drilling means (4) are coupled with the second drilling means (5) power-transmittedly in order to carry out cooperation thereof at least during a drilling situation with the second drilling means (5) for a rotational motion (w4), a feeding motion (z4) and/or a hammering motion (t4), wherein direct aiming of a flushing air flow (HV) at the soil is being prevented by means of a counterpart surface arrangement in order to decrease kinetic energy of the flushing air flow prior to drifting thereof into the ground by directing the flushing air at an end of the drilling unit (3) into a counterpart surface (X') and a flow space (X"), by means of which direction and speed of the flushing air flow (HV) is being altered, wherein a cross-section of the flow space is increased in respect with a cross-section of the distribution channel (6b) and the flow space is directed to a different direction than the distribution channel, and wherein the drilling head of the drilling device (1) is formed of a first frame part (4a) and a second frame part (5a), comprising respectively the drilling surface (P1) of the first drilling means (4) and a drilling surface (P2) of the second drilling means (5) being respectively provided with drilling organs of the first and the second drilling means (4, 5), such as an integrated drilling part, separate drilling pieces, bits or like, **characterized in that** the flushing air is being led through the distribution channel (6b) to the flow space (X;X") that is arranged by a recess with the counterpart surface (X;X') in the first frame part (4a) at the end of the distribution channel on the drilling surface (P1) of the first drilling means (4).

2. Method according to claim 1, **characterized in that** in the method a reamer is being used in the drilling apparatus as the second drilling means (5) that has an essentially continuing drilling surface radially, when viewed in a cross-section perpendicular to a longitudinal direction (s) of the drilling unit (3), and wherein the first drilling means (4) are coupled with the second drilling means (5) removably in order to enable removal thereof from the drilled hole.

3. Method according to claim 1, **characterized in that** in the method a reamer is being used in the drilling apparatus as the second drilling means (5) that operates on eccentric principle, being non-symmetrical and that opens radially outward for drilling.

4. Apparatus for down-the-hole drilling, having a drilling device (1) that comprises a casing part (2) and at least during a drilling situation an essentially inside thereof existing drilling unit (3), at the drilling head of which there are at least first drilling means (4) for drilling a center hole, second drilling means (5) for

reaming the center hole for the casing part (2) and a flushing flow arrangement (6) for leading of a pressurized flushing air for drilling through a centric main channel (6a1) in order to direct the flushing air by means of one or more distribution channels (6b) from the centric main channel through a drilling surface (P1) of the first drilling means (4) and for leading of drilling waste by influence of the pressurized flushing air at least partly upward, whereby the first drilling means (4) are coupled with the second drilling means (5) power-transmittedly in order to carry out cooperation thereof at least during a drilling situation with the second drilling means (5) for a rotational motion (w4), a feeding motion (z4) and/or a hammering motion (t4), wherein, in order to prevent direct aiming of a flushing air flow (HV) at the soil, the drilling unit (3) comprises a counterpart surface arrangement in order to decrease kinetic energy of the flushing air flow prior to drifting thereof into the ground by means of a counterpart surface (X') and a flow space (X") that alter direction and speed of the flushing air flow (HV), wherein a cross-section of the flow space is increased in respect with a cross-section of the distribution channel (6b) and the flow space is directed to a different direction than the distribution channel, and wherein the drilling head of the drilling device (1) is formed of a first frame part (4a) and a second frame part (5a), comprising respectively the drilling surface (P1) of the first drilling means (4) and a drilling surface (P2) of the second drilling means (5) being respectively provided with drilling organs of the first and the second drilling means (4, 5), such as an integrated drilling parts, separate drilling pieces, bits or like, **characterized in that** the flow space (X") is arranged by a recess with the counterpart surface (X;X') in the first frame part (4a) at the end of the distribution channel on the drilling surface (P1) of the first drilling means (4).

5. Apparatus according to claim 4, **characterized in that** the second drilling means (5) comprise a reamer that has an essentially continuing drilling surface radially, when viewed in a cross-section perpendicular to a longitudinal direction (s) of the drilling unit (3), and wherein the first drilling means (4) are coupled with the second drilling means (5) removably in order to enable removal thereof from the drilled hole.

6. Apparatus according to claim 4, **characterized in that** the second drilling means (5) comprise a reamer that operates on eccentric principle being non-symmetrical and that opens radially outward for drilling.

Patentansprüche

1. Verfahren für Bohren im Bohrloch, wobei das Bohren mit einer Vorrichtung durchgeführt wird, die eine Bohrvorrichtung (1) beinhaltet, die ein Mantelteil (2) und zumindest während einer Bohrsituation eine im Wesentlichen innerhalb desselben vorhandene Bohreinheit (3) umfasst, deren Bohrkopf mindestens erste Bohrmittel (4) zum Bohren eines zentralen Bohrlochs aufweist, zweite Bohrmittel (5) zum Erweitern des zentralen Bohrlochs für das Mantelteil (2) und eine Spülvorrichtung (6) zum Einleiten einer unter Druck stehenden Bohrspülluft durch einen zentrischen Hauptkanal (6a1), um die Spülluft mittels eines oder mehrerer Verteilerkanäle (6b) vom zentrischen Hauptkanal durch eine Bohrfläche (P1) der ersten Bohrmittel (4) zu leiten und Bohrklein zumindest teilweise nach oben zu leiten, wobei die ersten Bohrmittel (4) kraftübertragend mit den zweiten Bohrmitteln (5) gekoppelt sind, um ihr Zusammenwirken zumindest während einer Bohrsituation mit den zweiten Bohrmitteln (5) für eine Drehbewegung (w4), eine Vorschubbewegung (z4) und/oder eine Rammbewegung (t4) zu bewirken, wobei die direkte Ausrichtung eines Spülluftstroms (HV) auf das Erdreich mittels einer Gegenflächenanordnung verhindert wird, um die kinetische Energie des Spülluftstroms vor seiner Ableitung in den Boden zu verringern, indem die Spülluft an einem Ende der Bohreinheit (3) in eine Gegenfläche (X') und einen Strömungsraum (X") gelenkt wird, durch die Richtung und Geschwindigkeit des Spülluftstroms (HV) geändert werden, wobei ein Querschnitt des Strömungsraums in Bezug auf einen Querschnitt des Verteilungskanals (6b) vergrößert und der Strömungsraum in eine andere Richtung als der Verteilungskanal gerichtet ist und wobei der Bohrkopf der Bohrvorrichtung (1) aus einem ersten Rahmenteil (4a) und einem zweiten Rahmenteil (5a) gebildet wird, die jeweils die Bohrfläche (P1) der ersten Bohrmittel (4) und eine Bohrfläche (P2) der zweiten Bohrmittel (5) umfassen und jeweils mit Bohrorganen der ersten und der zweiten Bohrmittel (4, 5) versehen sind, wie beispielsweise einem integrierten Bohrteil, separaten Bohrstücken, Bohrkronen oder dergleichen, **dadurch gekennzeichnet, dass** die Spülluft durch den Verteilungskanal (6b) zu dem Strömungsraum (X; X") geleitet wird, der durch eine Aussparung und die Gegenfläche (X; X') im ersten Rahmenteil (4a) am Ende des Verteilungskanals auf der Bohrfläche (P1) der ersten Bohrmittel (4) gebildet wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** bei dem Verfahren in der Bohrvorrichtung ein Bohrlochräumer als zweites Bohrmittel (5) verwendet wird, der bei Betrachtung in einem Querschnitt senkrecht zu einer Längsrichtung (s) der Bohreinheit (3) eine im Wesentlichen radial fortgesetzte Bohrfläche aufweist und wobei die ersten Bohrmittel (4) demontierbar mit den zweiten Bohrmitteln (5) gekoppelt sind, um deren Entfernung aus dem gebohrten Loch zu ermöglichen.

3. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** bei dem Verfahren in der Bohrvorrichtung ein Bohrlochräumer als zweites Bohrmittel (5) verwendet wird, der nach exzentrischem Funktionsprinzip arbeitet, unsymmetrisch ist und sich zum Bohren radial nach außen öffnet.

4. Vorrichtung zum Bohren im Bohrloch mit einer Bohrvorrichtung (1), die ein Mantelteil (2) und zumindest während einer Bohrsituation eine im Wesentlichen innerhalb desselben vorhandene Bohreinheit (3) umfasst, deren Bohrkopf mindestens erste Bohrmittel (4) zum Bohren eines zentralen Bohrlochs aufweist, zweite Bohrmittel (5) zum Erweitern des zentralen Bohrlochs für das Mantelteil (2) und eine Spülvorrichtung (6) zum Einleiten einer unter Druck stehenden Bohrspülluft durch einen zentrischen Hauptkanal (6a1), um die Spülluft mittels eines oder mehrerer Verteilerkanäle (6b) vom zentrischen Hauptkanal durch eine Bohrfläche (P1) der ersten Bohrmittel (4) zu leiten und um Bohrklein durch Einwirkung der unter Druck stehenden Spülluft zumindest teilweise nach oben zu leiten, wobei die ersten Bohrmittel (4) kraftübertragend mit den zweiten Bohrmitteln (5) gekoppelt sind, um ihr Zusammenwirken zumindest während einer Bohrsituation mit dem zweiten Bohrmittel (5) für eine Drehbewegung (w4), eine Vorschubbewegung (z4) und/oder eine Rammbewegung (t4) zu bewirken, wobei die Bohreinheit (3) zur Verhinderung einer direkten Ausrichtung eines Spülluftstroms (HV) auf das Erdreich eine Gegenflächenanordnung aufweist, um die kinetische Energie des Spülluftstroms vor seiner Ableitung in den Boden mittels einer Gegenfläche (X') und eines Strömungsraums (X"), die Richtung und Geschwindigkeit des Spülluftstroms (HV) ändern, zu verringern, wobei ein Querschnitt des Strömungsraums in Bezug auf einen Querschnitt des Verteilungskanals (6b) vergrößert und der Strömungsraum in eine andere Richtung als der Verteilungskanal gerichtet ist und wobei der Bohrkopf der Bohrvorrichtung (1) aus einem ersten Rahmenteil (4a) und einem zweiten Rahmenteil (5a) gebildet wird, die jeweils die Bohrfläche (P1) der ersten Bohrmittel (4) und eine Bohrfläche (P2) der zweiten Bohrmittel (5) umfassen und jeweils mit Bohrorganen der ersten und der zweiten Bohrmittel (4, 5) versehen sind, wie beispielsweise integrierten Bohrteilen, separaten Bohrstücken, Bohrkronen oder dergleichen, **dadurch gekennzeichnet, dass** der Strömungsraum (X") durch eine Aussparung und die Gegenfläche (X;X') im ersten Rahmenteil (4a) am Ende des Verteilungskanals auf der Bohrfläche (P1) der ersten Bohrmittel (4) gebildet wird.

5. Vorrichtung nach Anspruch 4, **dadurch gekennzeichnet, dass** die zweiten Bohrmittel (5) einen Bohrlochräumer umfassen, der bei Betrachtung in einem Querschnitt senkrecht zu einer Längsrichtung (s) der Bohreinheit (3) eine im Wesentlichen radial fortgesetzte Bohrfläche aufweist und wobei die ersten Bohrmittel (4) demontierbar mit den zweiten Bohrmitteln (5) gekoppelt sind, um deren Entfernung aus dem Bohrloch zu ermöglichen.

6. Vorrichtung nach Anspruch 4, **dadurch gekennzeichnet, dass** die zweiten Bohrmittel (5) einen Bohrlochräumer umfassen, der nach exzentrischem Funktionsprinzip arbeitet, unsymmetrisch ist und sich zum Bohren radial nach außen öffnet.

Revendications

1. Procédé de forage en fond de trou, le forage étant exécuté par un appareil, doté d'un dispositif de forage (1) qui comprend une partie de boîtier (2) avec essentiellement en son intérieur au moins durant une situation de forage une unité de forage existante (3), à la tête de forage de laquelle se trouvent au moins des premiers moyens de forage (4) pour le forage d'un trou central, des seconds moyens de forage (5) pour aléser le trou central pour la partie de boîtier (2) et un agencement de flux de rinçage (6) pour conduire un flux d'air pressurisé pour forer dans un canal principal central (6a1) afin de diriger l'air de rinçage au moyen d'un ou plusieurs canaux de distribution (6b) depuis le canal principal central à travers une surface de forage (P1) des premiers moyens de forage (4) et pour diriger au moins une partie des résidus de forage vers le haut, les premiers moyens de forage (4) étant accouplés aux seconds moyens de forage (5) en mode de transmission de puissance afin d'instaurer leur coopération au moins durant une situation de forage avec les seconds moyens de forage (5) pour un mouvement rotatif (w4), un mouvement d'alimentation (z4) et / ou un mouvement de percussion (t4), où l'orientation directe d'un flux d'air de rinçage (HV) vers le sol est empêchée au moyen d'un ensemble de surface de contrepartie afin de réduire l'énergie cinétique du flux d'air de rinçage avant de le dériver vers le sol en dirigeant l'air de rinçage à une extrémité de l'unité de forage (3) dans une surface de contrepartie (X') et un espace de flux (X"), au moyen duquel l'orientation et la vitesse du flux d'air de rinçage (HV) sont modifiées, où une section transversale de l'espace de flux est augmentée par rapport à une section transversale du canal de distribution (6b) et l'espace de flux est orienté dans une autre direction que le canal de distribution, et où la tête de forage du dispositif de forage (1) est constituée d'une première partie de cadre (4a) et d'une seconde partie de cadre (5a), comprenant respectivement la surface de forage (P1) des premiers moyens de forage (4) et une surface de forage (P2) des seconds moyens de forage (5) respectivement pourvues d'organes de fo-

rage des premiers et seconds moyens de forage (4, 5), tels qu'une pièce de forage intégrée, des pièces de forage séparées, mèches ou éléments similaires, **caractérisé par le fait que** l'air est conduit à travers le canal de distribution (6b) jusqu'à l'espace de flux (X;X") disposé par un retrait avec la surface de contrepartie (X;X') dans la première partie de cadre (4a) à l'extrémité du canal de distribution sur la surface de forage (P1) des premiers moyens de forage (4).

2. Procédé décrit dans la revendication 1, **caractérisé par le fait qu'**un aléseur est utilisé dans l'appareil de forage en tant que seconds moyens de forage (5) qui a une surface de forage essentiellement continue dans le sens radial, vue en coupe transversale perpendiculaire au sens longitudinal (s) de l'unité de forage (3), et où les premiers moyens de forage (4) sont accouplés aux seconds moyens de forage (5) de façon amovible afin de permettre leur retrait du trou foré.

3. Procédé décrit dans la revendication 1, **caractérisé par le fait que** dans le procédé, un aléseur est utilisé dans l'appareil de forage en tant que seconds moyens de forage (5) fonctionnant selon un principe d'excentricité, étant asymétrique et s'ouvrant radialement vers l'extérieur pour le forage.

4. Appareil de forage en fond de trou, pourvu d'un dispositif de forage (1) comprenant une partie de boîtier (2) et essentiellement en son intérieur, au moins durant une situation de forage, une unité de forage (3), à la tête de forage de laquelle se trouvent au moins des premiers moyens de forage (4) pour le forage d'un trou central, des seconds moyens de forage (5) pour l'alésage du trou central pour la partie de boîtier (2) et un agencement de flux de rinçage (6) pour conduire un flux d'air pressurisé pour forer dans un canal principal central (6a1) afin de diriger l'air de rinçage au moyen d'un ou plusieurs canaux de distribution (6b) depuis le canal principal central à travers une surface de forage (P1) des premiers moyens de forage (4) et pour diriger au moins une partie des résidus de forage vers le haut, les premiers moyens de forage (4) étant accouplés aux seconds moyens de forage (5) en mode de transmission de puissance afin d'instaurer leur coopération au moins durant une situation de forage avec les seconds moyens de forage (5) pour un mouvement rotatif (w4), un mouvement d'alimentation (z4) et / ou un mouvement de percussion (t4), où, pour éviter l'orientation directe d'un flux d'air de rinçage (HV) vers le sol, l'unité de forage (3) comprend un agencement de surface de contrepartie afin de réduire l'énergie cinétique du flux d'air de rinçage avant de le dériver vers le sol au moyen d'une surface de contrepartie (X') et un espace de flux (X") qui modifie l'orientation et la vitesse du flux de rinçage (HV), où une section transversale de l'espace de flux est augmentée par rapport à une section transversale du canal de distribution (6b) et l'espace de flux est orienté dans une autre direction que le canal de distribution, et où la tête de forage du dispositif de forage (1) est constituée d'une première partie de cadre (4a) et d'une seconde partie de cadre (5a), comprenant respectivement la surface de forage (P1) des premiers moyens de forage (4) et une surface de forage (P2) des seconds moyens de forage (5) respectivement pourvues d'organes de forage des premiers et seconds moyens de forage (4, 5), tels qu'une pièce de forage intégrée, des pièces de forage séparées, mèches ou éléments similaires, **caractérisé par le fait que** l'espace de flux (X") est pourvu d'un retrait avec la surface de contrepartie (X;X') dans la première partie de cadre (4a) à l'extrémité du canal de distribution sur la surface de forage (P1) des premiers moyens de forage (4).

5. Appareil décrit dans la revendication 4, **caractérisé par le fait que** les seconds moyens de forage (5) comprennent un aléseur ayant une surface de forage essentiellement continue dans le sens radial,vue en coupe transversale perpendiculaire au sens longitudinal (s) de l'unité de forage (3), et où les premiers moyens de forage (4) sont accouplés aux seconds moyens de forage (5) de façon amovible afin de permettre leur retrait du trou foré.

6. Appareil décrit dans la revendication 4, **caractérisé par le fait que** les seconds moyens de forage (5) comprennent un aléseur fonctionnant selon un principe d'excentricité étant asymétrique et s'ouvrant radialement vers l'extérieur pour le forage.

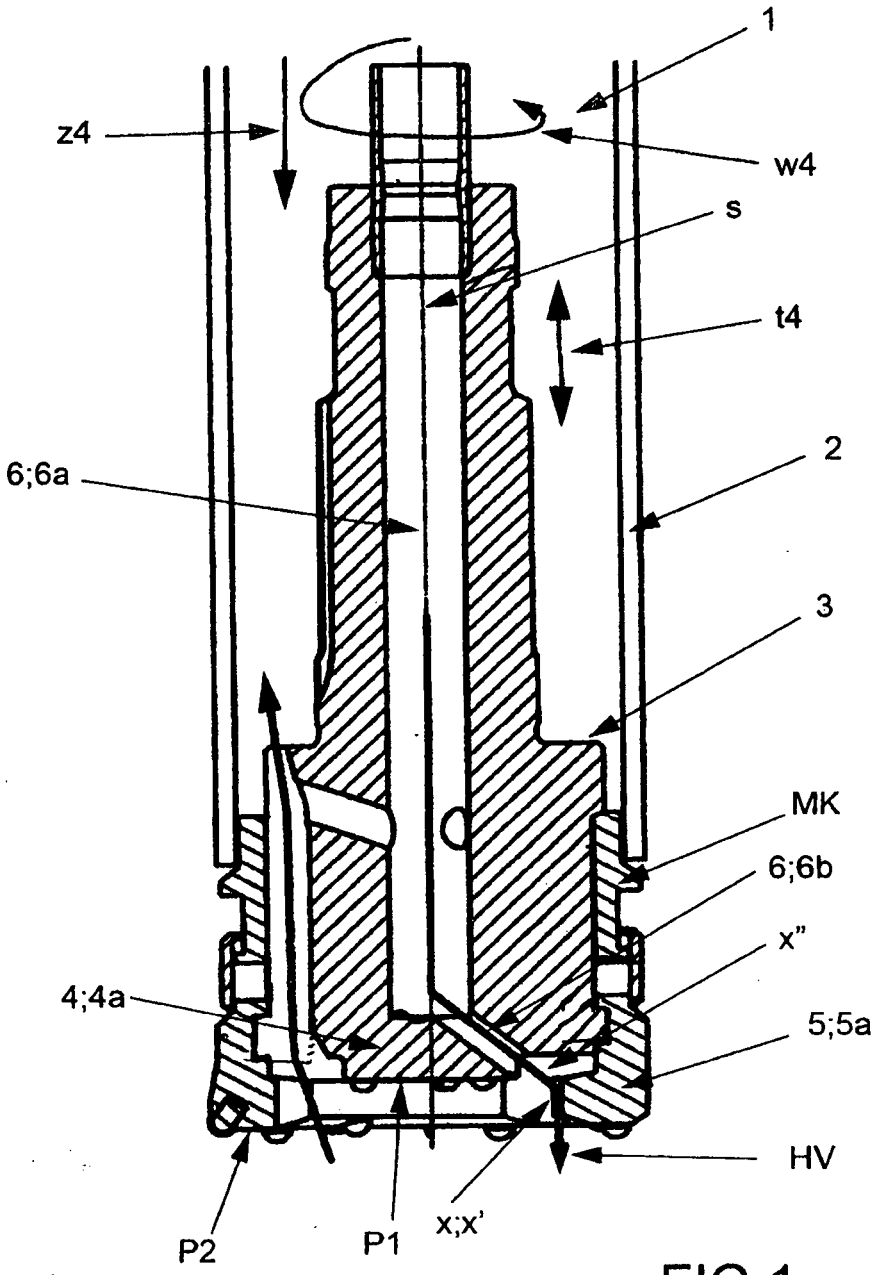

FIG.1

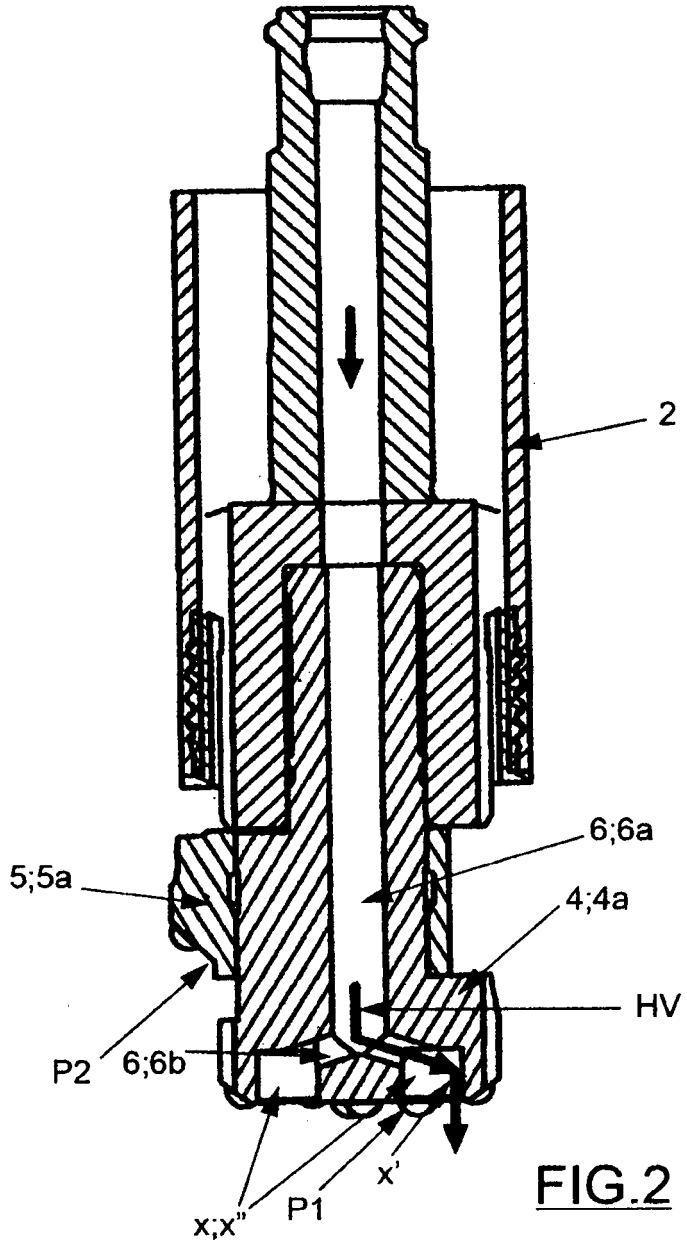

FIG.2

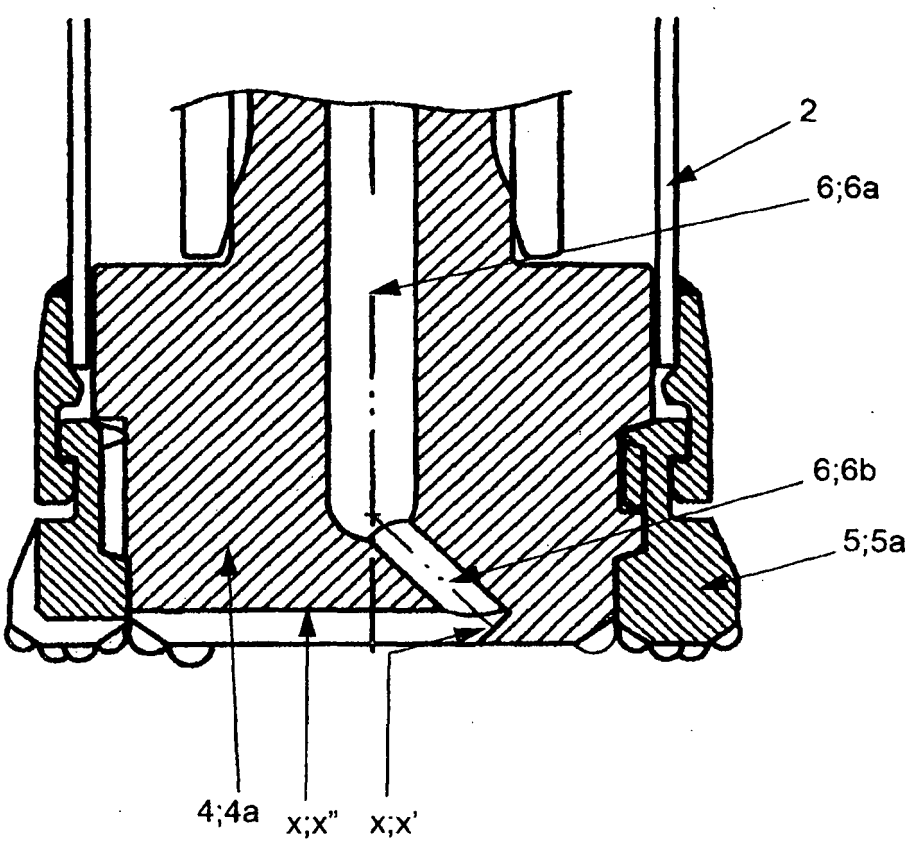

FIG.3

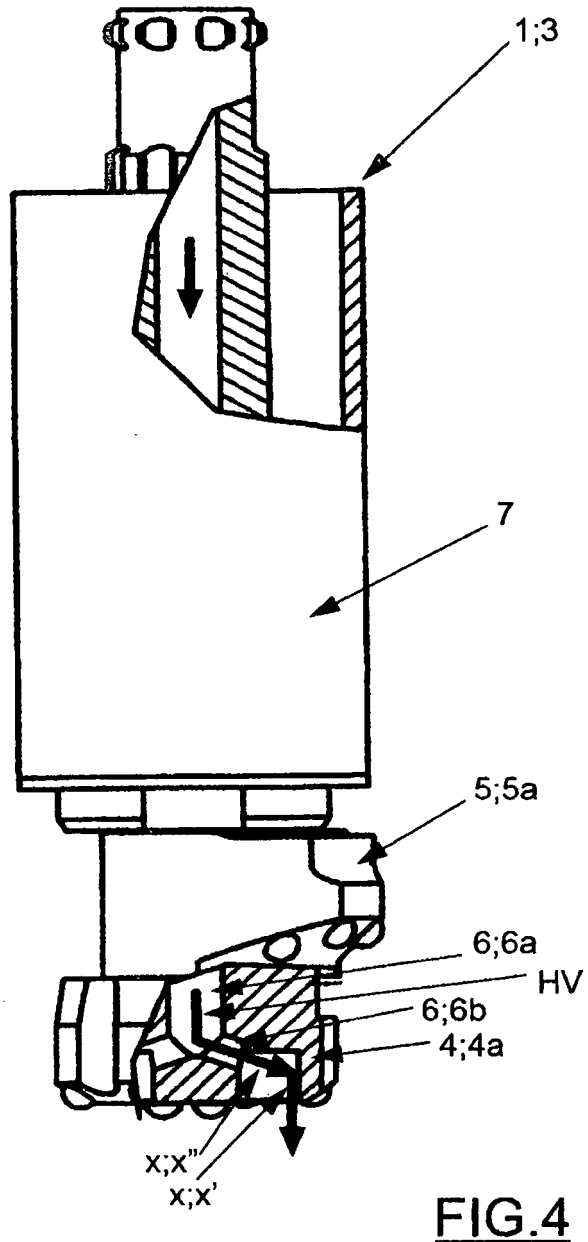

FIG.4

REFERENCES CITED IN THE DESCRIPTION

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