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

VERFAHREN UND VORRICHTUNG FÜR ABWÄRTSLOCHBOHRUNGEN

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 related thereto.

[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position, in which it is positioned sidewards in front of the mantle pipe, and a return position, in which it is withdrawn in radial direction inside the mantle pipe.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] 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.

[0005] 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.

[0006] 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.

[0007] Problems caused by flushing air can be divided 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.

[0008] 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 overdrilled by flushing air than the piles have actually replaced, due to which surrounding buildings have been caused to tilt.

[0009] 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.

[0010] 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 get back upwards along unbroken walls of a rock hole. 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.

[0011] Thus a very controlled circulation of flushing medium is required particularly in pile drilling, but correspondingly also in any other type of down-the-hole drilling, in which liquid, such as water is being used as flushing medium, so that the flushing medium is mainly returned back on the surface of the earth through the casing pipe, though the soil would be relatively loose. 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 medium or in other words so that the pressure of the flushing medium to be fed exceeds the pressure of the ground and on the other hand so that the easiest way for flushing medium from the drilled point takes place in a desired manner back to the casing pipe.

[0012] International publication WO 2010/084238 discloses a method and apparatus for down-the-hole drilling, which are meant to overcome the above problems. This solution is based on a construction according to Finnish patent no. 95618 in which, the problems described above have been taken into consideration by a modification of the flushing flow arrangement of the down-the-hole drilling apparatus applied therein. In this case, the flushing medium is being brought onto the drilling surface and returned therefrom by in respect with each other separate and axially directed feed flow and return flow channels, when viewed in a cross-section, between the first and the second drilling means that is on an outer periphery of the first drilling means and/or in an inner periphery of the second drilling means.

[0013] The above solution enables extremely simple first drilling means or pilot regarding construction thereof particularly thanks to the fact that the flushing medium is both brought to the drilling surface and removed therefrom together with the drilling waste through a space between the pilot and the reamer, in which case a flushing flow is achieved that circulates very efficiently over the head of the pilot. On the other hand by providing the drilling head with a guide surface arrangement that controls passage of the flushing medium, drifting of the flushing medium to the drilling surface can be secured by simultaneously preventing entering thereof a return flow channel prior to drifting thereof onto the drilling surface.

[0014] So, the invention enables thus also use of pressurized air as the flushing medium in a safe manner furthermore e.g. by providing the drilling head of the drilling unit, when needed, with a counterpart surface arrangement, which directs passage of the pressurized air flow so, that it may not get directed to the soil.

[0015] In practice, when drilling certain kind of soil, a problem has, however, been noticed in the drilling with the type of drilling apparatus according to WO 2010/084238. This problem is caused by bits of rock or stones of certain size that get in front of the return flow openings of the return flow channels on the drilling surface, the openings getting thus blocked by the same along with drilling waste and soil. When a return flow opening gets stuck, the flushing flow circulation will get disturbed, which has a great impact on the whole drilling system in a way that an excessive amount of flushing medium may get drifted into the soil, because returning thereof along with the drilling waste through the return flow channels is not possible or efficient enough. This problem may endanger proper functioning of the drilling apparatus, which otherwise has the capability of avoiding excessive drifting into the ground of e.g. pressurized air, being used as the flushing medium.

[0016] Furthermore, patent application publication WO 2010/084238 discloses a system for overburden drilling, having the characteristics defined in the preamble of the independent claim related to the present apparatus for down-the-hole drilling. In this solution, in order to make more efficient return flow of flushing medium together with drilling waste through the one or more return flow channels, the drill bit being used in the system comprises an auxiliary flush assembly for introducing flushing medium from the first flushing means directly to the return flow channels. In this solution, feeding of an auxiliary flush flow through the auxiliary flush assembly at a return flow opening assembly of the return flow channels essentially to the drilling surface of the drilling device is not, however, made possible in order to avoid the problems related to the return flow openings from getting stuck or blocked. US 2004/0251054 discloses a similar system. It is an aim of the method and apparatus according to the present invention to achieve a decisive improvement in the prob-

lem 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.

[0017] 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 already been found technically very well functionable. On the other hand, by providing the drilling head with a guide surface arrangement that controls passage of the flushing medium, drifting of the flushing medium to the drilling surface can be secured by simultaneously preventing entering thereof a return flow channel prior to drifting thereof onto the drilling surface. Return flow of the flushing medium along with the drilling waste is not at risk thanks to an auxiliary flush assembly introducing fresh flushing medium that brings about turbulence at the point of the return flow openings of the return flow channels essentially on the drilling surface that prevents the openings from getting blocked. This is carried out efficiently by an auxiliary flush flow, being led advantageously from a feed channel of the flushing medium at the center of a first frame part, comprising the first drilling means, by one or several auxiliary distribution channels toward the return flow opening assembly at a sharp angle with respect to a plane essentially parallel with the drilling surface/surfaces. In this way the return flow opening assembly is kept clear, thus efficiently preventing interruption of the return flow of the flushing medium along with the drilling waste.

[0018] The invention enables also use of pressurized air as the flushing medium in a safe way by making sure adequate functioning of the return flow of the flushing flow arrangement without a risk of the return flow openings getting stuck. By virtue of the above 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, bringing about an improvement of safety, it is thus possible to achieve also clear savings in performing of the drilling itself.

[0019] Advantageous embodiments of the method and apparatus according to the invention have been presented in the dependent claims related thereto.

[0020] In the following description the invention is depicted in detail with reference to the appended drawings, in which

in figure 1 is shown a partial longitudinal cross-sectional view of a drilling device construction presenting prior art,

in figure 2 is shown a longitudinal cross-sectional view of an advantageous drilling device according to WO 2010/084238, and

in figure 3 is shown a longitudinal cross-sectional view of an advantageous drilling device belonging to the apparatus applying the method according to the invention,

in figure 4 is shown a perspective view of the embodiment shown in figure 3 as seen from the front, and

in figure 5 is shown a front view of the embodiment according to figures 3 and 4.

[0021] 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 an at least during a drilling situation essentially inside thereof existing drilling unit 3, at a 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 flushing medium onto a drilling surface P and for returning of drilling waste at least partly internally inside the casing part 2. 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, and on the other hand removably in order to enable removal thereof from the hole. The casing part 2 is arranged to be drawn into a hole to be drilled by the drilling unit 3 typically by means of a casing shoe 8. Furthermore the flushing medium is being brought by first flushing means 6a of the flushing flow arrangement 6 onto the drilling surface P and returned from the drilling surface P together with the drilling waste by second flushing means 6b of the flushing flow arrangement 6 through axially directed s and in respect with each other separate feed flow and return flow channels 6a', 6b' that exist, when viewed in a cross section, between the first and second drilling means 4, 5 that is on an outer periphery of the first drilling means 4 and/or an inner periphery of the second drilling means 5. With reference to figures 3-5 return flow of flushing medium together with drilling waste through one or more return flow channels 6b' is made more efficient by introducing flushing medium directly from the first flushing means 6a by means of an auxiliary flush assembly 6c at a return flow opening assembly 6b'o of the return flow channel/channels 6b' essentially on the drilling surface P.

[0022] As an advantageous embodiment, with reference to figure 3 in particular, 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 P; 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. A rotationally symmetrical 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 medium is being led from a flushing medium feed channel 6a1, being led centrically to the first drilling means 4, such as the first frame part 4a, by one or more distribution channels 6a2 directed outward therefrom into one or more feed flow channels 6a' on the outer periphery of the first drilling means 4, such as the first frame part 4a, at a distance e from the drilling surface P1 of the first drilling means. Furthermore passage of the flushing medium onto the drilling surface P is preferably guided e.g. according to figure 2 by a guide surface arrangement X existing at the drilling head of the drilling unit 3, such as in connection with the first and/or the second drilling means 4, 5, by means of which returning of the flushing medium feed flow from the feed flow channel 6a' to a return flow space 6b1 is prevented prior to drifting thereof onto the drilling surface P. An auxiliary flush flow ff is led from the flushing medium feed channel 6a1 by one or more auxiliary distribution channels 6c1, being directed radially outward therefrom, through an auxiliary flush opening assembly 6c2 into one or more, preferably each return flow channel/channels 6b'.

[0023] Direction of primary flushing medium feed flow is preferably altered e.g. according to figure 2 by a counterpart surface arrangement y essentially in connection with the drilling surface P particularly in order to decrease drifting thereof into the soil by decreasing its kinetic energy. As a further advantageous embodiment of the method according to the invention, the auxiliary flush flow ff is being led toward the return flow opening assembly 6b'o essentially at a sharp angle AN with respect to a plane essentially parallel with the drilling surface/surfaces P; P1, P2.

[0024] The invention also relates to an apparatus for down-the-hole drilling applying the method described above that has a drilling device 1 comprising a casing part 2 and an at least during a drilling situation essentially inside thereof existing drilling unit 3, at a 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 flushing medium onto a drilling surface P and for returning of drilling waste at least partly internally inside the casing part 2. 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, and on the other hand removably in order to enable removal thereof from the hole. The casing part 2 is arranged to be drawn into a hole to be drilled by the drilling unit 3 typically by means of a casing shoe 8.

[0025] Furthermore the flushing flow arrangement 6 comprises axially directed s and in respect with each other separate feed flow and return flow channels 6a', 6b' both for bringing of the flushing medium onto the drilling surface P by means of the first flushing means 6a of the flushing flow arrangement 6 and returning thereof from the drilling surface P together with the drilling waste by means of second flushing means 6b of the flushing flow arrangement 6, the channels existing, when viewed in a cross-section, between the first and the second drilling means 3, 4 that is on an outer periphery of the first drilling means 4 and/or an inner periphery of the second drilling means 5. With reference to figure 3-5, the apparatus comprises an auxiliary flush assembly 6c for introducing flushing medium directly from the first flushing means 6a at a return flow opening assembly 6b'o of the return flow channel/channels 6b' essentially on the drilling surface P in order to make more efficient return flow of flushing medium together with drilling waste through the one or more return flow channels 6b'.

[0026] As an advantageous embodiment of the apparatus with reference to figure 3 in particular, 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 P; 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. A rotationally symmetrical 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 first flushing means 6a of the flushing flow arrangement 6 comprise a flushing medium feed channel 6a1, being arranged centrically in the first drilling means 4, such as the first frame part 4a, and one or more distribution channels 6a2, being directed outward therefrom, in order to lead the flushing medium into the feed flow channel/channels 6a' on the outer periphery of the first drilling means 4, such as the first frame part 4a, at a distance e from the drilling surface P1 of the first drilling means. Furthermore the flushing flow arrangement 6 comprises preferably e.g. according to figure 2 a guide surface arrangement X for guiding passage of the flushing medium onto the drilling surface P at the drilling head of the drilling unit 3, which guide surface arrangement X prevents returning of the flushing medium feed flow from the feed flow channel 6a' to a return flow space 6b1 prior to drifting thereof onto the drilling surface P. The auxiliary flush assembly 6c comprises one or more auxiliary distribution channels 6c1, being directed radially outward from the flushing medium feed channel 6a1, in order to lead an auxiliary flush flow ff from the flushing medium feed channel 6a1 through an auxiliary flush opening assembly 6c2 into one or more, preferably each return flow channel/channels 6b'.

[0027] The flushing flow arrangement 6 comprises preferably e.g. according to figure 2 a counterpart surface arrangement y for altering direction of primary flushing

medium feed flow essentially in connection with the drilling surface P particularly in order to decrease drifting thereof into the soil by decreasing its kinetic energy. The one or more auxiliary distribution channels 6c1 are arranged at an essentially sharp angle AN with respect to a plane essentially parallel with the drilling surface/surfaces P; P1, P2 in order to lead the auxiliary flush flow ff toward the return flow opening assembly 6b'o.

[0028] As an advantageous embodiment, the auxiliary flush assembly 6c comprises one or more auxiliary distribution channels 6c1 going through the first drilling means 4, such as the first frame part 4a, and ending at the auxiliary flush opening assembly 6c2, such as a hole at a bottom of one or more, preferably each return flow channel/channels 6b', at a distance ey from the drilling surface P1 of the first drilling means 4.

[0029] As a further advantageous embodiment, the diameter of the one or more auxiliary distribution channels 6c1 is essentially smaller than the diameter of the one or more primary flushing medium distribution channels 6a2. In most typical drillings the diameter is in most cases between 4-20 mm depending on the diameter of the drilling unit 3.

[0030] 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 the appended drawings, 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.

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 an at least during a drilling situation essentially inside thereof existing drilling unit (3), at a 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 flushing medium onto a drilling surface (P) and for returning of drilling waste at least partly internally inside the casing part (2), whereby 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), and on the other hand removably in order to enable removal thereof from the hole, whereby the casing part (2) is arranged to be drawn into a hole to be drilled by the drilling unit (3), whereby the flushing medium is being brought by first flushing means (6a) of the flushing flow arrangement (6) onto the drilling surface (P) and returned from the drilling surface (P) together with the drilling waste by second flushing means (6b) of the flushing flow arrangement (6) through axially directed (s) and in respect with each other separate feed flow and return flow channels (6a', 6b') that exist, when viewed in a cross section, between the first and second drilling means (4, 5) on an outer periphery of the first drilling means (4) and/or an inner periphery of the second drilling means (5), whereby the flushing medium is being led from a centrical flushing medium feed channel (6a1) by one or more distribution channels (6a2) directed outward therefrom into the one or more feed flow channels (6a') on the outer periphery of the first drilling means (4) at a first distance (e) from the drilling surface (P1) of the first drilling means, and wherein, in order to make more efficient return flow of the flushing medium together with the drilling waste through the one or more return flow channels (6b'), the flushing medium is being introduced from the first flushing means (6a) by means of an auxiliary flush assembly (6c) to the return flow channel/channels (6b'), wherein an auxiliary flush flow (ff) is being led from the flushing medium feed channel (6a1) by one or more auxiliary distribution channels (6c1) at a return flow opening assembly (6b'o) of the return flow channel/channels (6b') at a second distance (ey) from the drilling surface (P1) of the first drilling means (4), **characterized in that** said second distance (ey) being smaller than said first distance (e).

2. Method according to claim 1 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 (P; P1, P2) of which being provided with drilling organs of the first and the second drilling means (4, 5) comprising an integrated drilling part, separate drilling pieces, bits or like, whereby a rotationally symmetrical 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), whereby the flushing medium is being led from the centrical flushing medium feed channel

(6a1) in the first frame part (4a) through the one or more distribution channels (6a2) into the one or more feed flow channels (6a') on the outer periphery of the first frame part (4a) at the first distance (e) from the drilling surface (P1) of the first drilling means, and whereby passage of the flushing medium onto the drilling surface (P) is being guided by a guide surface arrangement (X) existing at the drilling head in connection with the first and/or the second drilling means (4, 5), by means of which returning of the flushing medium feed flow from the feed flow channel (6a') to the return flow space (6b1) is prevented prior to drifting thereof onto the drilling surface (P), **characterized in that**, the one or more auxiliary distribution channels (6c1) are directed radially outward from the feed channel (6a1), wherein the auxiliary flush flow (ff) is being introduced through an auxiliary flush opening assembly (6c2) into the one or more return flow channels (6b'), wherein the auxiliary flush flow (ff) is being led toward the return flow opening assembly (6b'o) at a sharp angle (AN) with respect to a plane essentially parallel with the drilling surface/surfaces (P; P1, P2).

3. Method according to claim 1 or 2, **characterized in that**, direction of primary flushing medium feed flow is altered by a counterpart surface arrangement (y) in connection with the drilling surface (P) particularly in order to decrease drifting thereof into the soil by decreasing its kinetic energy.

4. Apparatus for down-the-hole drilling having a drilling device (1) that comprises a casing part (2) and an at least during a drilling situation essentially inside thereof existing drilling unit (3), at a 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 flushing medium onto a drilling surface (P) and for returning of drilling waste at least partly internally inside the casing part (2), whereby 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), and on the other hand removably in order to enable removal thereof from the hole, whereby the casing part (2) is arranged to be drawn into a hole to be drilled by the drilling unit (3), whereby the flushing flow arrangement (6) comprises axially directed (s) and in respect with each other separate feed flow and return flow channels (6a', 6b') both for bringing of the flushing medium onto the drilling surface (P) by means of the first flushing means (6a) of the flushing flow arrangement (6) and returning thereof from the drilling surface (P) together with the drilling waste by means of second flushing means (6b) of the flushing flow arrangement (6), the channels existing, when viewed in a cross-section, between the first and the second drilling means (3, 4) on an outer periphery of the first drilling means (4) and/or an inner periphery of the second drilling means (5), whereby the flushing medium is arranged to be led from a centrical flushing medium feed channel (6a1) by one or more distribution channels (6a2) directed outward therefrom into the one or more feed flow channels (6a') on the outer periphery of the first drilling means (4) at a first distance (e) from the drilling surface (P1) of the first drilling means, and wherein, in order to make more efficient return flow of the flushing medium together with the drilling waste through the one or more return flow channels (6b'), the apparatus comprises an auxiliary flush assembly (6c) for introducing the flushing medium from the first flushing means (6a) to the return flow channel/channels (6b'), wherein the auxiliary flush assembly (6c) comprises one or more auxiliary distribution channels (6c1) for directing an auxiliary flush flow (ff) at a return flow opening assembly (6b'o) of the return flow channel/channels (6b') at a second distance (ey) from the drilling surface (P1) of the first drilling means (4a1), **characterized in that** said second distance (ey) being smaller than said first distance (e).

5. Apparatus according to claim 4, 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 (P; P1, P2) of which being provided with drilling organs of the first and the second drilling means (4, 5) comprising an integrated drilling part, separate drilling pieces, bits or like, whereby a rotationally symmetrical 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), whereby the first flushing means (6a) of the flushing flow arrangement (6) comprise the centrical flushing medium feed channel (6a1) and the one or more distribution channels (6a2), in order to lead the flushing medium in the first frame part (4a) into the one or more feed flow channels (6a') on the outer periphery of the first frame part (4a) at the first distance (e) from the drilling surface (P1) of the first drilling means, and whereby the flushing flow arrangement (6) comprises a guide surface arrangement (X) for guiding passage of the flushing medium onto a drilling surface (P) at the drilling head of the drilling unit (3), which guide surface arrangement (X) prevents returning of the flushing medium feed flow from the feed flow channel (6a') to a return flow space (6b1) prior to drifting thereof onto the drilling surface (P), **characterized in that**, the one or more auxiliary distribution channels (6c1) are directed radially outward from the

flushing medium feed channel (6a1) for introducing the auxiliary flush flow (ff) through an auxiliary flush opening assembly (6c2) into the one or more return flow channels (6b') at a sharp angle (AN) with respect to a plane essentially parallel with the drilling surface/surfaces (P; P1, P2) in order to lead the auxiliary flush flow (ff) toward the return flow opening assembly (6b'o).

6. Apparatus according to claim 4 or 5, **characterized in that** the flushing flow arrangement (6) comprises a counterpart surface arrangement (y) for altering direction of primary flushing medium feed flow in connection with the drilling surface (P) particularly in order to decrease drifting thereof into the soil by decreasing its kinetic energy.

7. Apparatus according to claim 5 or 6, **characterized in that** the auxiliary flush assembly (6c) comprises one or more auxiliary distribution channels (6c1) going through a first frame part (4a) of the first drilling means (4) and ending at an auxiliary flush opening assembly (6c2) comprising a hole at a bottom of the return flow channel/channels (6b').

8. Apparatus according to any of the preceding claims 4-7, **characterized in that** diameter of the one or more auxiliary distribution channels (6c1) is essentially smaller than the diameter of the one or more primary flushing medium distribution channels (6a2).

Patentansprüche

1. Verfahren für Abwärtslochbohrungen, wobei das Bohren durch eine Vorrichtung ausgeführt wird, die eine Bohreinrichtung (1) aufweist, die ein Verrohrungsteil (2) und eine wenigstens während einer Bohrsituation im Wesentlichen innerhalb davon vorhandene Bohreinheit (3), wobei bei einem Bohrkopf davon wenigstens erste Bohrmittel (4) zum Bohren eines Mittellochs, zweite Bohrmittel (5) zum Erweitern des Mittellochs für das Verrohrungsteil (2) und eine Spülflussanordnung (6) zum Führen eines Spülmediums an eine Bohrfläche (P) und zum Zurückleiten von Bohrabgang wenigstens teilweise im Inneren innerhalb des Verrohrungsteils (2) vorhanden sind, umfasst, wobei die ersten Bohrmittel (4) zuerst Leistung übertragend, um wenigstens während einer Bohrsituation ihr Zusammenwirken mit den zweiten Bohrmitteln (5) für eine Drehbewegung (w4), für eine Vorschubbewegung (z4) und/oder für eine Schlagbewegung (t4) auszuführen, und andererseits abnehmbar, um ihre Entnahme aus dem Loch zu ermöglichen, mit den zweiten Bohrmitteln (5) gekoppelt sind, wobei das Verrohrungsteil (2) dafür ausgelegt ist, durch die Bohreinheit (3) in ein zu bohrendes Loch gezogen zu werden, wobei das Spülmedium durch axial gerichtete (s) und in Bezug zueinander getrennte Zufluss- und Rückflusskanäle (6a', 6b'), die in einem Querschnitt gesehen zwischen den ersten und den zweiten Bohrmitteln (4, 5) an einem Außenumfang der ersten Bohrmittel (4) und/oder an einem Innenumfang der zweiten Bohrmittel (5) vorhanden sind, durch erste Spülmittel (6a) der Spülflussanordnung (6) an die Bohrfläche (P) gebracht wird und von der Bohrfläche (P) zusammen mit dem Bohrabgang durch zweite Spülmittel (6b) der Spülflussanordnung (6) zurückgeleitet wird, wobei das Spülmedium von einem zentralen Spülmedium-Zufuhrkanal (6a1) durch einen oder mehrere Verteilungskanäle (6a2), die davon in einer ersten Entfernung (e) von der Bohrfläche (P1) der ersten Bohrmittel in den einen oder die mehrere Zuflusskanäle (6a') an dem Außenumfang der ersten Bohrmittel (4) nach außen gerichtet sind, geleitet sind, und wobei das Spülmedium von den ersten Spülmitteln (6a) mittels einer Zusatzspülbaugruppe (6c) in den Rückflusskanal/in die Rückflusskanäle (6b') eingeleitet wird, um einen effizienteren Rückfluss des Spülmediums zusammen mit dem Bohrabgang durch den einen oder die mehreren Rückflusskanäle (6b') zu veranlassen, wobei ein Zusatzspülfluss (ff) von dem Spülmedium-Zufuhrkanal (6a1) durch einen oder mehrere Zusatzverteilungskanäle (6c1) bei einer Rückflussöffnungs-Anordnung (6b'o) des Rückflusskanals/der Rückflusskanäle (6b') in einer zweiten Entfernung (ey) von der Bohrfläche (P1) der ersten Bohrmittel (4) geleitet wird, **gekennzeichnet dadurch, dass** die zweite Entfernung (ey) kleiner als die erste Entfernung (e) ist.

2. Verfahren nach Anspruch 1, beim Arbeiten mit einer Bohrvorrichtung, in der der Bohrkopf der Bohreinrichtung (1) aus einem ersten Rahmenteil (4a) und aus einem zweiten Rahmenteil (5a) gebildet ist, deren Bohrflächen (P; P1, P2) mit Bohrorganen der ersten und der zweiten Bohrmittel (4, 5), die einen integrierten Bohrteil, getrennte Bohrstücke, Bohrmeißel oder dergleichen umfassen, versehen sind, wobei als die zweiten Bohrmittel (5) ein rotationssymmetrischer Nachschneider verwendet wird, der in einem Querschnitt senkrecht zu einer Längsrichtung (s) der Bohreinheit (3) gesehen eine radial im Wesentlichen fortlaufende Bohrfläche aufweist, wobei das Spülmedium von dem zentralen Spülmedium-Zufuhrkanal (6a1) in dem ersten Rahmenteil (4a) über den einen oder die mehreren Verteilungskanäle (6a2) in den einen oder die mehreren Zuflusskanäle (6a') an dem Außenumfang des ersten Rahmenteils (4a) in der ersten Entfernung (e) von der Bohrfläche (P1) der ersten Bohrmittel geleitet wird, und wobei der Durchgang des Spülmediums an die Bohrfläche (P) durch eine bei dem Bohrkopf in Verbindung mit den ersten und/oder mit den zweiten Bohrmitteln (4, 5) vorhandene Führungsflächenanordnung (X) ge-

führt wird, mittels deren das Zurückfließen des Spülmediumzuflusses von dem Zuflusskanal (6a') zu dem Rückflussraum (6b1) vor dessen Driften an die Bohrfläche (P) verhindert wird, **dadurch gekennzeichnet, dass** der eine oder die mehreren Zusatzverteilungskanäle (6c1) von dem Zufuhrkanal (6a1) radial nach außen gerichtet sind, wobei der Zusatzspülfluss (ff) durch eine Zusatzspülöffnungs-Anordnung (6c2) in den einen oder die mehreren Rückflusskanäle (6b') eingeleitet wird, wobei der Zusatzspülfluss (ff) unter einem spitzen Winkel (AN) in Bezug auf eine Ebene im Wesentlichen parallel zu der Bohrfläche/den Bohrflächen (P; P1, P2) in Richtung der Rückflussöffnungs-Anordnung (6b'o) geleitet ist.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Richtung des primären Spülmediumzuflusses durch eine Gegenoberflächenanordnung (y) in Verbindung mit der Bohrfläche (P) geändert wird, insbesondere, um sein Driften in den Boden durch Verringern seiner kinetischen Energie zu verringern.

4. Vorrichtung für Abwärtslochbohrungen, die eine Bohreinrichtung (1) aufweist, die ein Verrohrungsteil (2) und eine wenigstens während einer Bohrsituation im Wesentlichen innerhalb davon vorhandene Bohreinheit (3), wobei bei einem Bohrkopf davon wenigstens erste Bohrmittel (4) zum Bohren eines Mittellochs, zweite Bohrmittel (5) zum Erweitern des Mittellochs für das Verrohrungsteil (2) und eine Spülflussanordnung (6) zum Führen eines Spülmediums an eine Bohrfläche (P) und zum Zurückleiten von Bohrabgang wenigstens teilweise im Inneren innerhalb des Verrohrungsteils (2) vorhanden sind, umfasst, wobei die ersten Bohrmittel (4) zuerst Leistung übertragend, um wenigstens während einer Bohrsituation ihr Zusammenwirken mit den zweiten Bohrmitteln (5) für eine Drehbewegung (w4), für eine Vorschubbewegung (z4) und/oder für eine Schlagbewegung (t4) auszuführen, und andererseits abnehmbar, um ihre Entnahme aus dem Loch zu ermöglichen, mit den zweiten Bohrmitteln (5) gekoppelt sind, wobei das Verrohrungsteil (2) dafür ausgelegt ist, durch die Bohreinheit (3) in ein zu bohrendes Loch gezogen zu werden, wobei die Spülflussanordnung (6) axial gerichtete (s) und in Bezug zueinander getrennte Zufluss- und Rückflusskanäle (6a', 6b'), sowohl, um das Spülmedium mittels erster Spülmittel (6a) der Spülflussanordnung (6) an die Bohrfläche (P) zu bringen, als auch, um es von der Bohrfläche (P) zusammen mit dem Bohrabgang mittels zweiter Spülmittel (6b) der Spülflussanordnung (6) zurückzuleiten, umfasst, wobei die Kanäle in einem Querschnitt gesehen zwischen den ersten und den zweiten Bohrmitteln (3, 4) an einem Außenumfang der ersten Bohrmittel (4) und/oder einem Innenumfang der zweiten Bohrmittel (5) vorhanden sind, wobei das Spülmedium dafür ausgelegt ist, von einem zentralen Spülmedium-Zufuhrkanal (6a1) durch einen oder mehrere Verteilungskanäle (6a2), die davon in einer ersten Entfernung (e) von der Bohrfläche (P1) der ersten Bohrmittel in den einen oder die mehrere Zuflusskanäle (6a') an dem Außenumfang der ersten Bohrmittel (4) nach außen gerichtet sind, geleitet zu werden, und wobei die Vorrichtung eine Zusatzspülbaugruppe (6c) umfasst, um das Spülmedium von den ersten Spülmitteln (6a) in den Rückflusskanal/in die Rückflusskanäle (6b') einzuleiten, um einen effizienteren Rückfluss des Spülmediums zusammen mit dem Bohrabgang durch den einen oder die mehreren Rückflusskanäle (6b') zu veranlassen, wobei die Zusatzspülbaueinheit (6c) einen oder mehrere Zusatzverteilungskanäle (6c1) umfasst, um einen Zusatzspülfluss (ff) bei einer Rückflussöffnungs-Anordnung (6b'o) des Rückflusskanals/der Rückflusskanäle (6b') in einer zweiten Entfernung (ey) von der Bohrfläche (P1) der ersten Bohrmittel (4a1) zu leiten, **gekennzeichnet dadurch, dass** die zweite Entfernung (ey) kleiner als die erste Entfernung (e) ist.

5. Vorrichtung nach Anspruch 4, in der der Bohrkopf der Bohreinrichtung (1) aus einem ersten Rahmenteil (4a) und aus einem zweiten Rahmenteil (5a) gebildet ist, deren Bohrflächen (P; P1, P2) mit Bohrorganen der ersten und der zweiten Bohrmittel (4, 5), die einen integrierten Bohrteil, getrennte Bohrstücke, Bohrmeißel oder dergleichen umfassen, versehen sind, wobei als die zweiten Bohrmittel (5) ein rotationssymmetrischer Nachschneider verwendet wird, der in einem Querschnitt senkrecht zu einer Längsrichtung (s) der Bohreinheit (3) gesehen eine radial im Wesentlichen fortlaufende Bohrfläche aufweist, wobei die ersten Spülmittel (6a) der Spülflussanordnung (6) den zentralen Spülmedium-Zufuhrkanal (6a1) und den einen oder die mehreren Verteilungskanäle (6a2) umfassen, um das Spülmedium in dem ersten Rahmenteil (4a) in den einen oder die mehreren Zuflusskanäle (6a') an dem Außenumfang des ersten Rahmenteils (4a) in der ersten Entfernung (e) von einer Bohrfläche (P1) der ersten Bohrmittel zu leiten, und wobei die Spülflussanordnung (6) eine Führungsflächenanordnung (X) umfasst, um den Durchgang des Spülmediums an die Bohrfläche (P) bei dem Bohrkopf der Bohreinheit (3) zu führen, wobei die Führungsflächenanordnung (X) das Zurückfließen des Spülmediumzuflusses von dem Zuflusskanal (6a') zu dem Rückflussraum (6b1) vor dessen Driften an die Bohrfläche (P) verhindert, **dadurch gekennzeichnet, dass** der eine oder die mehreren Zusatzverteilungskanäle (6c1) von dem Spülmedium-Zufuhrkanal (6a1) radial nach außen gerichtet sind, um den Zusatzspülfluss (ff) durch eine Zusatzspülöffnungs-Anordnung (6c2) unter einem spitzen Winkel (AN) in Bezug auf eine Ebene im We-

sentlichen parallel zu der Bohrfläche/den Bohrflächen (P; P1, P2) in den einen oder die mehreren Rückflusskanäle (6b') einzuleiten, um den Zusatzspülfluss (ff) in Richtung der Rückflussöffnungs-Anordnung (6b'o) zu leiten.

6. Vorrichtung nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** die Spülflussanordnung (6) eine Gegenoberflächenanordnung (y) zum Ändern der Richtung des primären Spülmediumzuflusses in Verbindung mit der Bohrfläche (P), insbesondere, um durch Verringern seiner kinetischen Energie sein Driften in den Boden zu verringern, umfasst.

7. Vorrichtung nach (einem der vorhergehenden Ansprüche) den Ansprüchen 5 oder 6, **dadurch gekennzeichnet, dass** die Zusatzspülbaugruppe (6c) einen oder mehrere Zusatzverteilungskanäle (6c1) umfasst, die durch ein erstes Rahmenteil (4a) der ersten Bohrmittel (4) gehen und bei einer Zusatzspülöffnungs-Anordnung (6c2), die ein Loch am Boden des Rückflusskanals/der Rückflusskanäle (6b') umfasst, enden.

8. Vorrichtung nach einem der vorhergehenden Ansprüche 4-7, **dadurch gekennzeichnet, dass** der Durchmesser des einen oder der mehreren Zusatzverteilungskanäle (6c1) wesentlich kleiner als der Durchmesser des einen oder der mehreren primären Spülmedium-Verteilungskanäle (6a2) ist.

Revendications

1. Procédé de forage en fond-de-trou, ce forage étant effectué par un appareil doté d'un dispositif de forage (1) comprenant un boîtier (2) et une unité de forage à l'intérieur (3), une tête de forage comportant un premier dispositif de forage (4) pour le forage d'un trou central, un deuxième dispositif de forage (5) pour aléser le trou central du boîtier (2) et un dispositif de flux de rinçage (6) pour l'acheminement d'un liquide de rinçage sur la surface de forage (P) et le retour des résidus de forage au moins en partie à l'intérieur du boîtier (2), où le premier dispositif de forage (4) est couplé avec le deuxième dispositif de forage (5) d'abord par le biais d'une transmission d'énergie afin d'assurer une coopération au moins lors d'une situation de forage avec le deuxième dispositif de forage (5) pour un mouvement rotatif (w4), un mouvement d'alimentation (z4) et/ou un mouvement de martelage (t4), et d'un autre côté par le biais d'un dispositif amovible afin d'assurer le retrait d'un trou, le boîtier (2) étant disposé de manière à être entrainé dans un trou à forer par l'unité de forage (3), le liquide de rinçage étant d'abord acheminé par un système de rinçage (6a) sur le dispositif de flux de rinçage (6) jusque sur la surface de forage (P) et ramené à partir de la surface de forage (P) avec les résidus de forage par un deuxième dispositif de rinçage (6b) du dispositif de flux de rinçage (6) par le biais d'un axe (s) et par rapport à chaque autre canal d'alimentation et de retour respectifs (6a', 6b'), dans une vue transversale, entre le premier et le deuxième dispositif de forage (4, 5), à l'extérieur du premier dispositif de forage (4) et/ou à l'intérieur du deuxième dispositif de forage (5), le liquide de rinçage étant acheminé depuis un dispositif d'alimentation du liquide de rinçage centrique (6a1) par au moins un canal de distribution (6a2) dirigé vers l'extérieur dans au moins un canal d'alimentation (6a') à l'extérieur du premier dispositif de forage (4) à une première distance (e) de la surface de forage (P1) du premier dispositif de forage, afin d'améliorer l'efficacité du flux de retour du liquide de rinçage avec les résidus de rinçage à travers au moins un canal de flux de retour (6b'), le liquide de rinçage étant introduit à partir du premier système de rinçage (6a) par le biais d'un assemblage de rinçage auxiliaire (6c) vers le(s) canal (aux) de flux de retour (6b'), un flux de rinçage auxiliaire (ff) étant acheminé hors d'un canal d'alimentation de liquide de rinçage (6a1) par au moins un canal de distribution auxiliaire (6c1) au niveau d'un assemblage d'ouverture de flux de retour (6b'o) du/des canal/aux de flux de retour (6b') à une deuxième distance (ey) de la surface de forage (P1) du premier dispositif de forage (4), **caractérisé par le fait que** cette deuxième distance (ey) est plus courte que la première distance (e).

2. Procédé conformément à la revendication 1 pour l'exploitation d'un dispositif de forage, la tête de forage du dispositif de forage (1) étant formée d'un premier cadre (4a) et d'un deuxième cadre (5a), dont les surfaces de forage (P, P1, P2) sont fournies avec des pièces de forage appartenant au premier et au deuxième dispositifs de forage (4, 5) comprenant une pièce de forage intégrée, des pièces de forage séparées, des accessoires et assimilés, une pièce d'alésage symétrique rotative servant de deuxième dispositif de forage (5) comportant une surface radiale de forage continu, considérée dans une vue transversale et perpendiculaire à une direction longitudinale (s) de l'unité de forage (3), le liquide de rinçage étant acheminé depuis le canal centrique d'alimentation du liquide de rinçage (6a1) dans le premier cadre (4a) à travers au moins un canal de distribution (6a2) jusqu'à au moins un canal de flux d'alimentation (6a') à l'extérieur du premier cadre (4a) à la première distance (e) de la surface de forage (P1) du premier dispositif de forage, le passage du liquide de rinçage dans la surface de forage (P) étant guidé par un dispositif de surface (X) existant au niveau de la tête de forage en rapport avec le premier et/ou le deuxième dispositif de forage (4, 5), et par lequel le retour du flux d'alimentation du liquide de

rinçage à partir du canal de flux d'alimentation (6a') vers l'espace de flux de retour (6b1) est empêché avant la dérive vers la surface de forage (P), **caractérisé par** l'orientation radiale d'au moins un canal de distribution auxiliaire (6c1) vers l'extérieur à partir du canal d'alimentation (6a1), le flux de rinçage auxiliaire (ff) étant introduit à travers un assemblage de rinçage auxiliaire (6c2) dans au moins un canal de flux de retour (6b'), le flux de rinçage auxiliaire (ff) étant mené vers l'assemblage d'ouverture de flux de retour (6b'o) à un angle aigu (AN) par rapport à un plan essentiellement parallèle à la/aux surface(s) de forage (P, P1, P2).

3. Procédé conformément à la revendication 1 ou 2, **caractérisé par** l'altération de l'orientation du liquide de rinçage principal par un dispositif de surface équivalent (y) en rapport avec la surface de forage (P), particulièrement afin de réduire la dérive dans la terre en réduisant l'énergie cinétique.

4. Appareil de forage en fond-de-trou doté d'un dispositif de forage (1) comprenant un boîtier (2) et une unité de forage à l'intérieur (3), une tête de forage comportant un premier dispositif de forage (4) pour le forage d'un trou central, un deuxième dispositif de forage (5) pour aléser le trou central du boîtier (2) et un dispositif de flux de rinçage (6) pour l'acheminement d'un liquide de rinçage sur la surface de forage (P) et le retour des résidus de forage au moins en partie à l'intérieur du boîtier (2), où le premier dispositif de forage (4) est couplé avec le deuxième dispositif de forage (5) d'abord par le biais d'une transmission d'énergie afin d'assurer une coopération au moins lors d'une situation de forage avec le deuxième dispositif de forage (5) pour un mouvement rotatif (w4), un mouvement d'alimentation (z4) et/ou un mouvement de martelage (t4), et d'un autre côté par le biais d'un dispositif amovible afin d'assurer le retrait d'un trou, le boîtier (2) étant disposé de manière à être entrainé dans un trou à forer par l'unité de forage (3), le dispositif de flux de rinçage (6) comprenant un flux d'alimentation et des canaux de flux de retour (6a', 6b') séparés et orientés axialement (s), à la fois pour l'acheminement du système de liquide de rinçage (6) sur la surface de forage (P) par le biais du premier système de rinçage (6a) et le retour à partir de la surface de forage (P) avec les résidus de forage par le biais d'un deuxième système de rinçage (6b) du dispositif de flux de rinçage (6), les canaux existant, vus en vue transversale, entre le premier et le deuxième dispositif de forage (3, 4) à l'extérieur du premier dispositif de forage (4) et/ou à l'intérieur du deuxième périphérique de forage (5), le liquide de rinçage étant disposé afin d'être acheminé depuis un canal centrique d'alimentation de liquide de rinçage (6a1) par au moins un canal de distribution (6a2) dirigé vers l'extérieur dans au moins un canal d'alimentation (6a') à l'extérieur du premier dispositif de forage (4) à une première distance (e) de la surface de forage (P1) du premier dispositif de forage, afin d'améliorer l'efficacité du flux de retour du liquide de rinçage avec les résidus de rinçage à travers au moins un canal de flux de retour (6b'), l'appareil comprenant un assemblage de rinçage auxiliaire (6c) le liquide de rinçage étant introduit à partir du premier système de rinçage (6a) vers le(s) canal(aux) de flux de retour (6b'), avec un assemblage de rinçage auxiliaire (6c) comprenant au moins un canal de distribution auxiliaire (6c1) pour l'orientation d'un flux de rinçage auxiliaire (ff) au niveau d'un assemblage de flux de retour (6b'o) du/des canal/aux de flux de retour (6b') à une deuxième distance (ey) de la surface de forage (P1) du premier dispositif de forage (4a1), **caractérisé par le fait que** cette deuxième distance (ey) est plus courte que la première distance (e).

5. Appareil conformément à la revendication 4, la tête de forage du dispositif de forage (1) étant formée d'un premier cadre (4a) et d'un deuxième cadre (5a), dont les surfaces de forage (P, P1, P2) sont fournies avec des pièces de forage appartenant au premier et au deuxième dispositifs de forage (4, 5) comprenant une pièce de forage intégrée, des pièces de forage séparées, des accessoires et assimilés, une pièce d'alésage symétrique rotative servant de deuxième dispositif de forage (5) comportant une surface radiale de forage continu, considérée dans une vue transversale et perpendiculaire à une direction longitudinale (s) de l'unité de forage (3), le premier système de rinçage (6a) du dispositif de flux de rinçage (6) comprenant le canal centrique d'alimentation du liquide de rinçage (6a1) à travers au moins un canal de distribution (6a2), afin d'acheminer le liquide de rinçage dans le premier cadre (4a) jusqu'à au moins un canal de flux d'alimentation (6a') à l'extérieur du premier cadre (4a) à la première distance (e) de la surface de forage (P1) du premier dispositif de forage, le système de flux de rinçage (6) étant guidé par un dispositif de surface (X) pour l'orientation du liquide coulant sur une surface de forage (P) au niveau de la tête de forage d'une unité de forage (3), le système de guidage en surface (X) empêchant le retour du flux d'alimentation de liquide de rinçage à partir du canal de flux d'alimentation (6a') vers un espace de flux de retour (6b1) avant la dérive vers la surface de forage (P), **caractérisé par** l'orientation radiale d'au moins un canal de distribution auxiliaire (6c1) vers l'extérieur à partir du canal d'alimentation (6a1), le flux de rinçage auxiliaire (ff) étant introduit à travers un assemblage de rinçage auxiliaire (6c2) dans au moins un canal de flux de retour (6b'), le flux de rinçage auxiliaire (ff) étant mené vers l'assemblage d'ouverture de flux de retour (6b') à un angle aigu (AN) par rapport à un plan essentielle-

ment parallèle à la/aux surface(s) de forage (P, P1, P2) afin de mener le flux de rinçage auxiliaire (ff) vers l'assemblage d'ouverture de flux de retour (6b'o).

6. Appareil conformément à la revendication 4 ou 5, **caractérisé par** le système de flux de rinçage (6) comprenant un système de surface équivalent (y) pour l'altération de la direction du flux d'alimentation du liquide de rinçage principal en rapport avec la surface de forage (P), particulièrement afin de réduire la dérive dans la terre en réduisant l'énergie cinétique.

7. Appareil conformément à 5 ou 6, **caractérisé par** le système de rinçage auxiliaire (6c) comprenant au moins un canal de distribution auxiliaire (6c1) traversant un premier cadre (4a) du premier dispositif de forage (4) et se terminant par un système d'ouverture de rinçage auxiliaire (6c2) comprenant un trou au fond du/des canal (aux) de flux de retour (6b').

8. Appareil conformément à n'importe laquelle des revendications précédentes 4-7, **caractérisé par** un diamètre d'au moins un canal de distribution auxiliaire (6c1) essentiellement plus petit que le diamètre de l'un des canaux moyens principaux de distribution de liquide de rinçage (6a2).

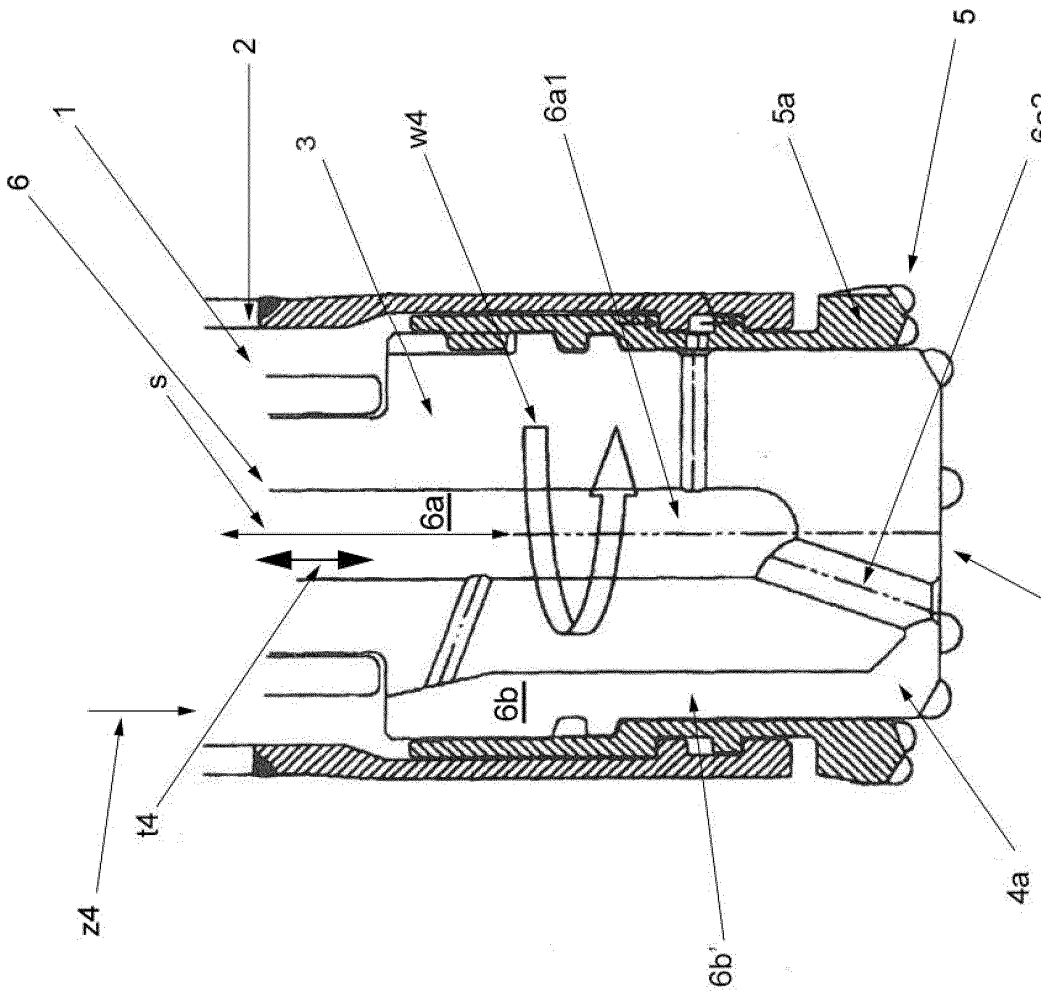

FIG.1
Prior art

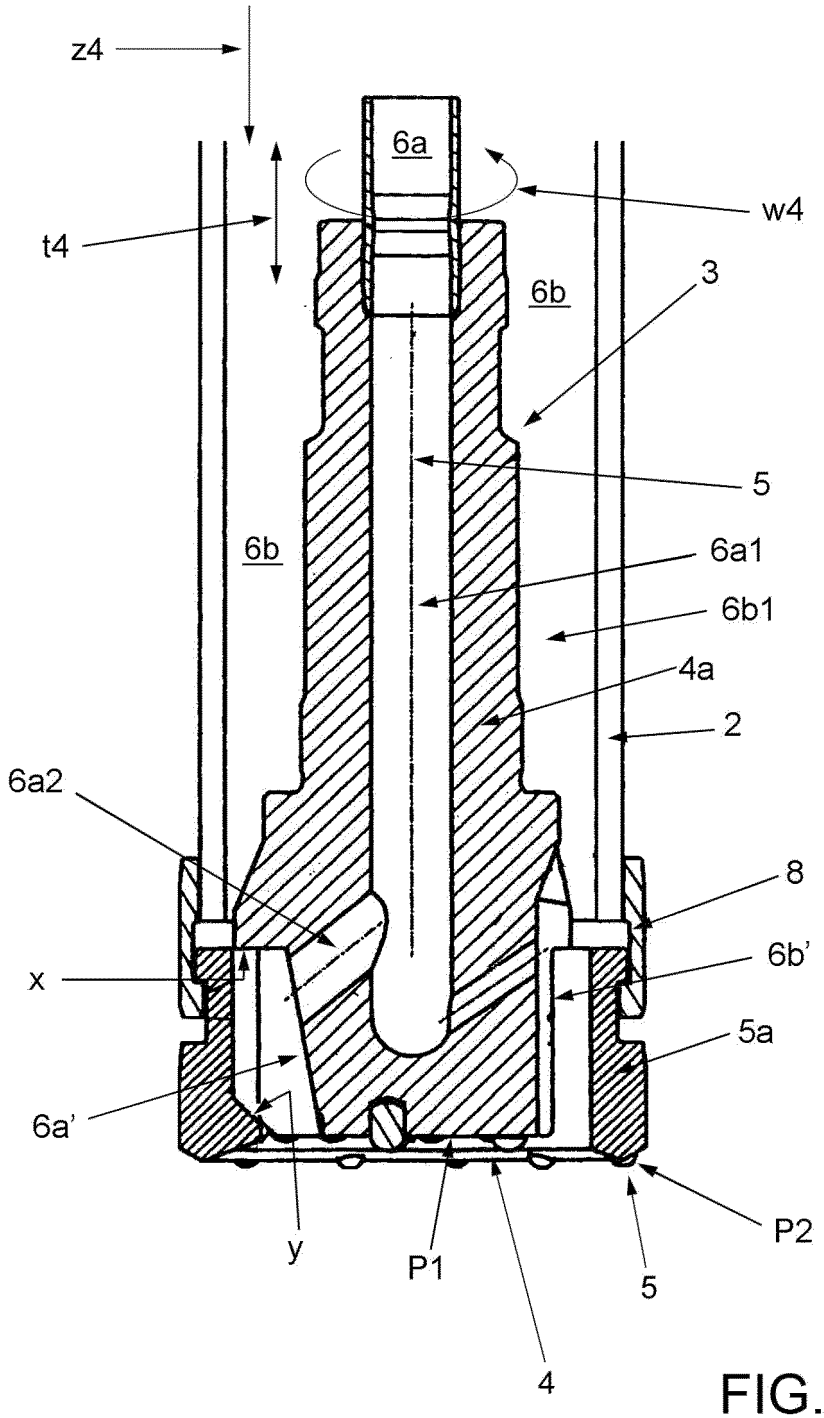

FIG.2
Prior art

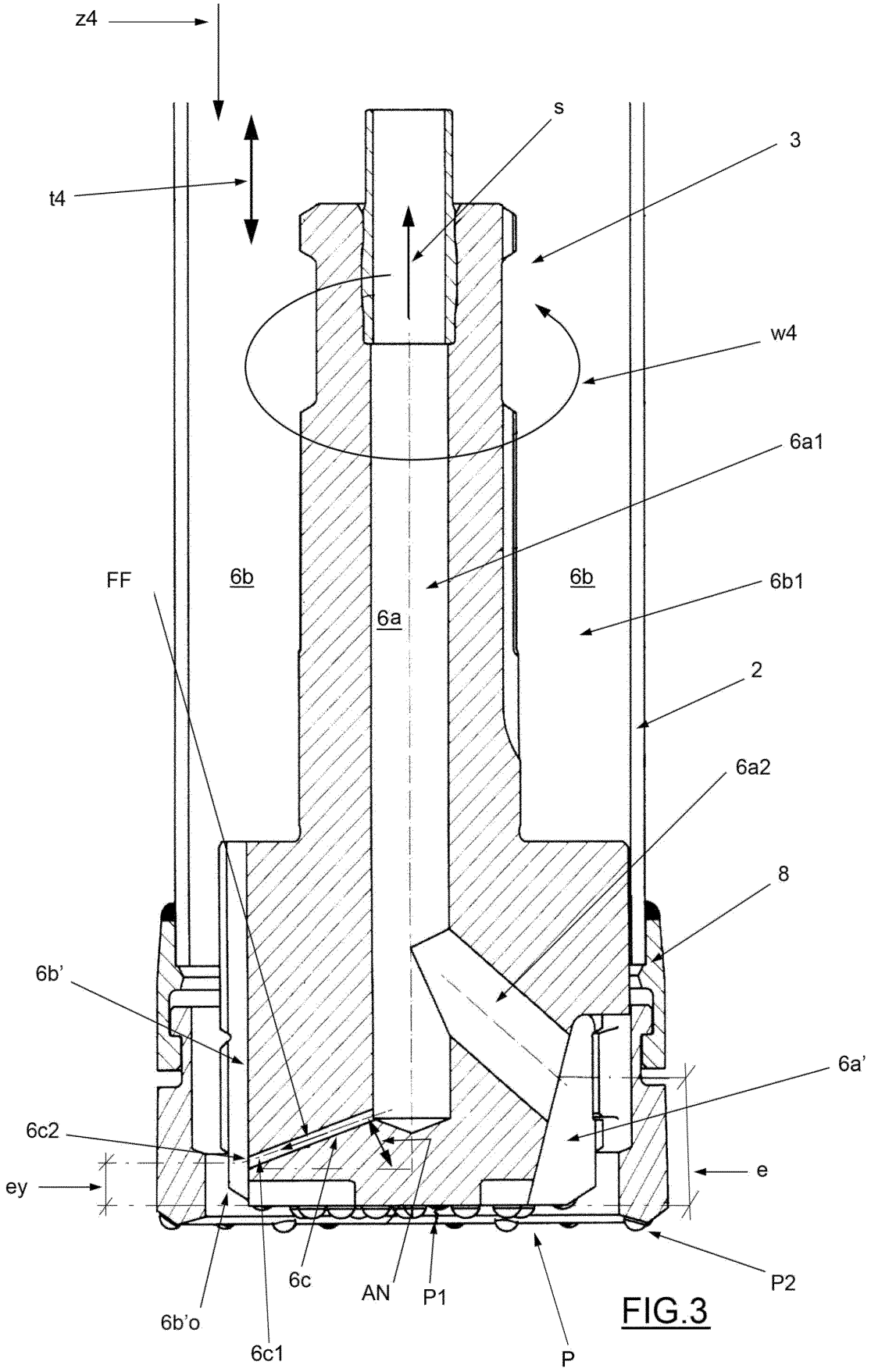
z4
t4
s
3
w4
6a1
FF
6b
6a
6b
6b1
2
6a2
8
6b'
6a'
6c2
ey
e
6c
AN
P1
P2
6b'o
6c1
P

FIG.3

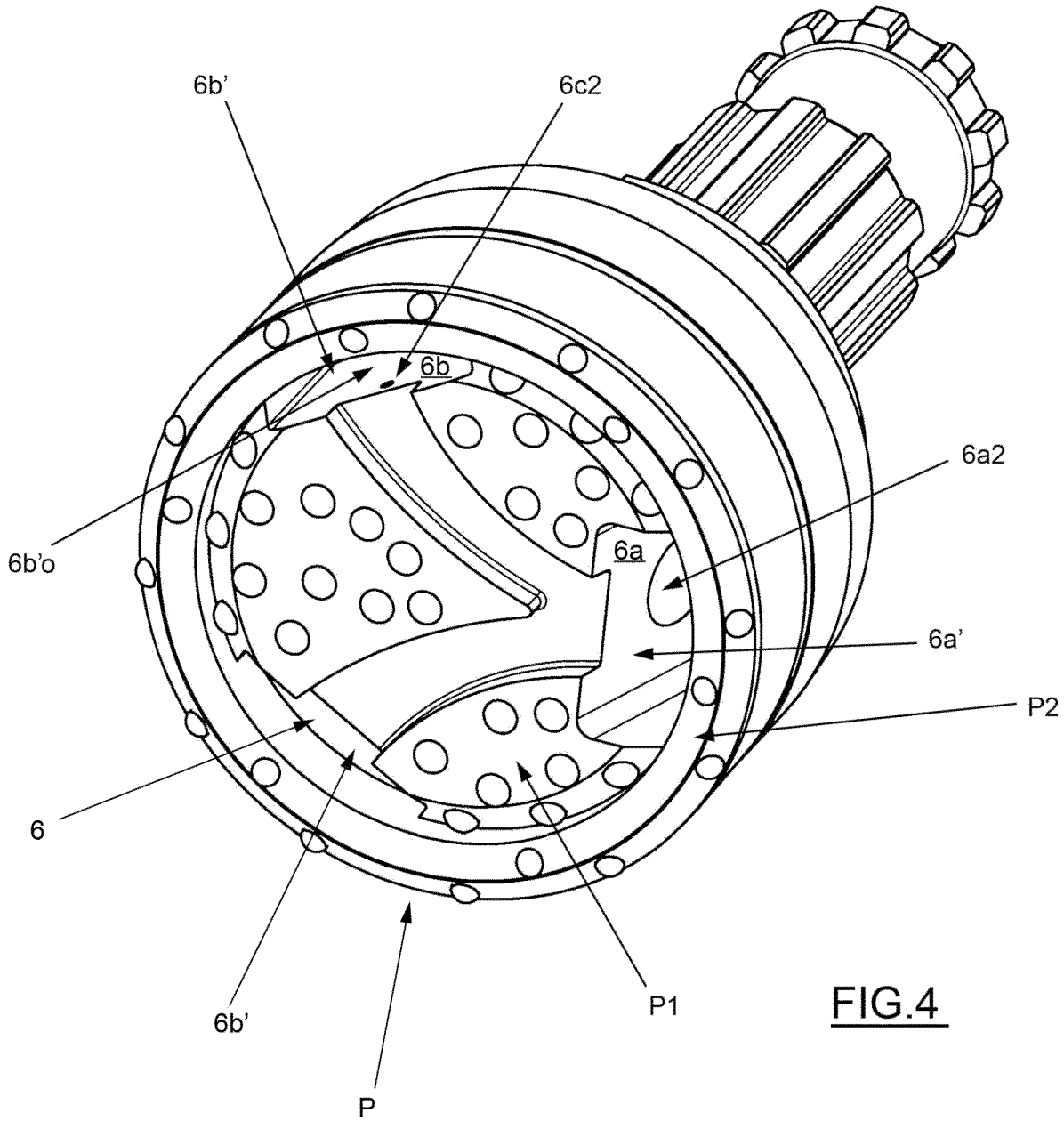

FIG.4

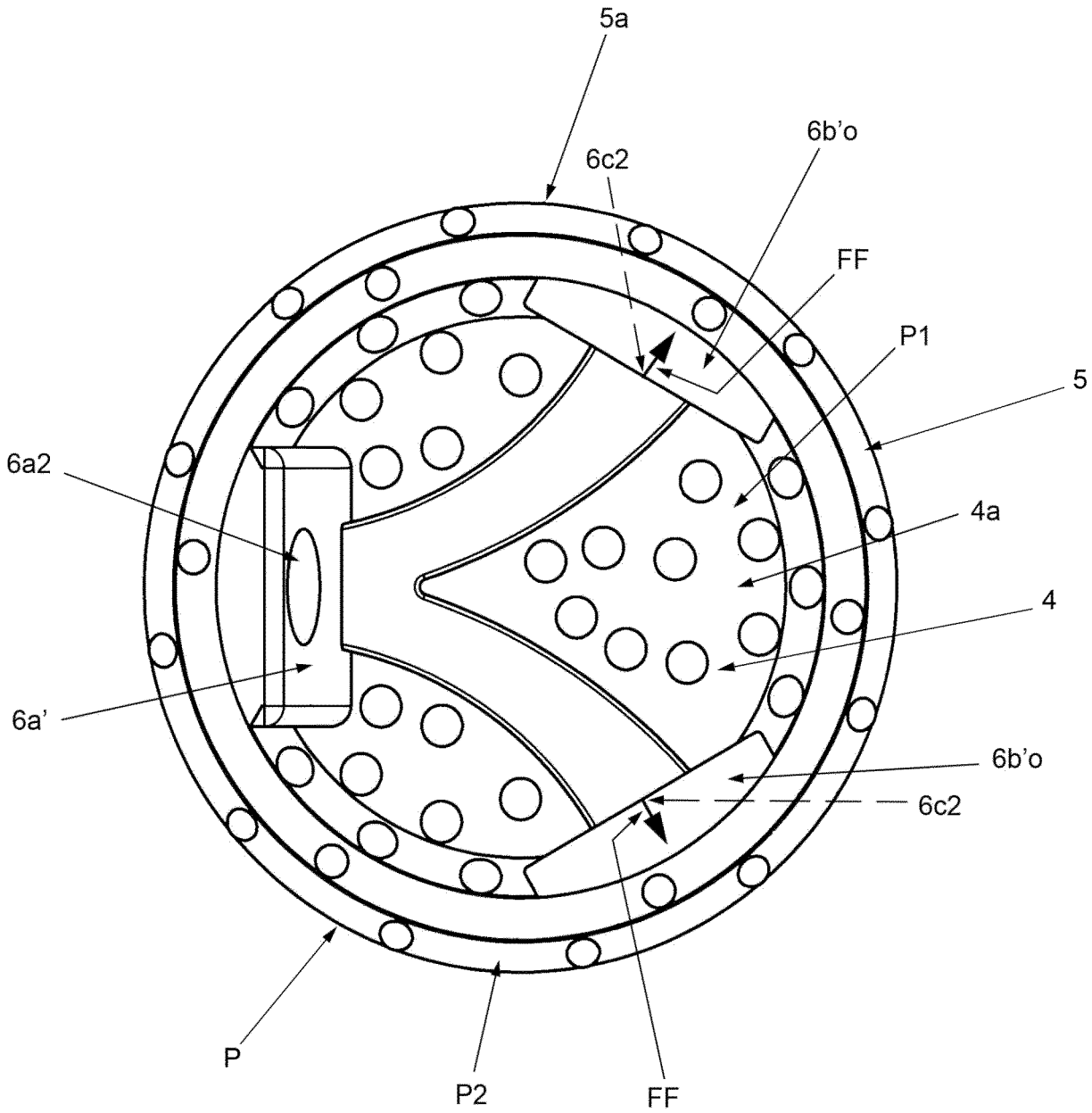

FIG.5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2010084238 A **[0012] [0015] [0016] [0020]**
- US 20040251054 A **[0016]**