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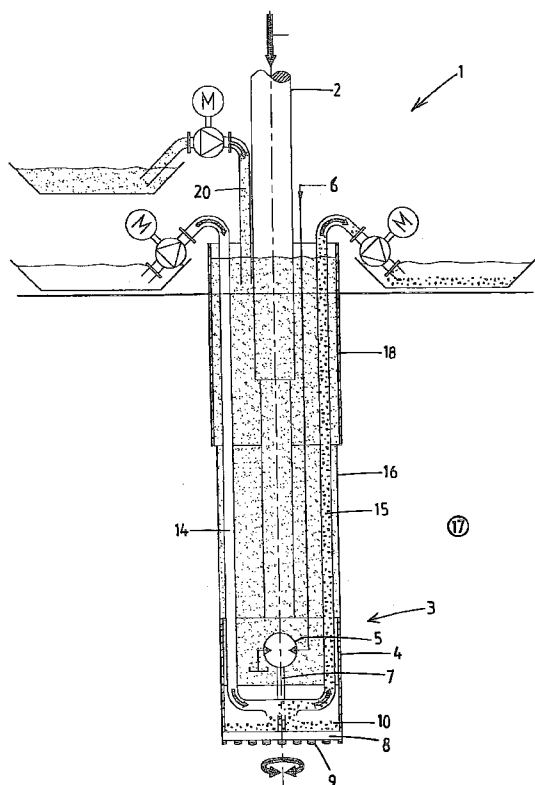
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(54) Title: DRILL HEAD FOR THE EXCAVATION IN THE GROUND OF A PIT, AND A FOUNDATION SYSTEM FOR THE FORMING OF A FOUNDATION PILE IN THE GROUND



(57) Abstract: A drill head for the excavating in the ground of a pit, in particular a pit to be filled with a hardenable mass, for the forming after hardening of a foundation pile, comprises a housing (31) having a drive shaft (35) which is rotatable with respect to the housing (31), a first drive unit (33) for the driving in rotation, by means of driving of the drive shaft (35), of at least one first digging member (36) positioned on one side of the drill head (30) being provided in the housing (31). Furthermore, a second drive unit (51) for the driving in rotation of at least one second digging member (50) positioned on the other side of the drill head (30) is provided in the housing (31).

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**Title: Drill head for the excavation in the ground of a pit, and a foundation system for the forming of a foundation pile in the ground**

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The invention relates to a drill head for the excavation in the ground of a pit and to a foundation system for the excavation in the ground of a pit to be filled with a hardenable mass for the forming after hardening of a foundation pile.

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Known in the art are soil drill heads having a surrounding housing in which a drive unit is provided for driving a toothed wheel dredge or the like. For example, for producing a pit for a foundation pile, the drill head then drills into the ground until a desired pit depth has been reached. In order to prevent the pit from wholly or partially collapsing, the pit is filled during excavation with a bentonite-containing suspension which serves as a support liquid. Once the desired depth has been reached, the drill head is brought back upwards through the support liquid. The pit is subsequently filled with bentonite which in this case expels the support liquid, so after hardening a concrete foundation pile is formed.

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A drawback of the prior art system is that, despite the presence of the support liquid, there is a risk of damage to the previously formed pit wall, for example during or after the moving of the housing of the drill head along the pit wall. This can, in particular, lead to major problems if during excavation pit wall parts return wholly or partially to the pit. Examples include soil or stones which were initially pressed aside by the advancing drill head and which return to their original position once the drill head has passed. This can impede and/or delay the recovery of the drill head and can even lead to complete jamming of the drill head.

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It will be noted that WO 03/085208 discloses a system for the forming of a foundation element in the ground, using a drill head provided with its own drive unit. The drive unit is located within a housing and is powered from an energy source located above ground. The drill head is itself able to dig down into the ground. Simultaneously with the drilling process, tube segments are pressed

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into the ground with the aid of a press installation in the pit excavated by the drill head. These tube segments are intended to be left behind in the ground where they form the pit wall of the foundation element. Once the desired depth has been reached, the  
5 drill head is then also removed, through the tube segments which are left behind, up out of the pit thus formed. The drill head is for this purpose configured with smaller radial dimensions than the tube segments. The tube segments prevent local collapsing of the pit wall and ensure reliable and easy recovery of the drill head. However,  
10 for many applications, the introduction of such tube elements along with the soil is unnecessary or else prohibitively expensive.

The object of the present invention is to overcome at least some of the above-mentioned drawbacks or else to provide a usable  
15 alternative. In particular, the object of the invention is to provide a multifunctional drill head allowing in a broad range of soil types reliable, rapid and efficient excavation of a pit, following which the drill head can be recovered, again rapidly and efficiently, from the excavated pit for further use.

20 This object is achieved by a drill head according to claim 1. The drill head comprises a housing having a drive shaft which is rotatable with respect to the housing. A first and a second drive unit are provided in the housing for the driving in rotation of at  
25 least one first digging member positioned on one side of the drill head or for the driving in rotation of at least one second digging member positioned on the other side of the drill head. The first digging member is then driven during the excavation of a pit, whereas the second digging member can be driven while the drill head  
30 is brought back out of the pit. The second digging member then advantageously ensures that any non-uniformity formed in the pit wall once the drill head has passed along the wall during excavation is drilled out of the way or else pressed back into the pit wall. During the recovery of the drill head, the second digging member can  
35 be driven continuously or else only when necessary. Continuous driving has in this case the advantage of providing a qualitatively better pit wall. The invention allows the drill head now to be brought at all times rapidly and efficiently back out of an

excavated pit. The attachment of tube segments forming the pit wall is no longer necessary for this purpose.

The first and second drive units are preferably configured as  
5 separate drive units but can if necessary also be integrated in one  
common drive unit. In this case, there is then preferably provided a  
suitable switching mechanism which serves, depending on whether the  
step of excavating or withdrawing is carried out, alternately to  
drive the first and the second digging member in rotation.

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In one particular embodiment, the drill head comprises flushing  
chambers which are positioned before the first and/or second digging  
member in the housing and have a supply and discharge extending from  
the drill head to a position above ground. The supply is used in  
15 this case for the pressurized introduction during drilling of a  
flushing liquid into the flushing chamber. The discharge is used to  
discharge during drilling the supplied flushing liquid mixed with  
soil removed by the respective digging member out of the flushing  
chamber. Soil which is removed by the activated digging member  
20 passes automatically into the flushing chamber. The removed soil is  
in this case pressed continuously into the flushing chamber by the  
respective digging member and the advancing drill head. The soil  
which is released can mix in the flushing chamber with the flushing  
liquid and easily be discharged via the discharge. It is in this  
25 case possible to discharge the flushing liquid containing the  
removed soil via a suitable pipe system to far outside the immediate  
working area, for example to a sludge repository. It has been found  
that the use of a flushing chamber of this type allows water, for  
example water from a nearby lake or river, itself to serve as a  
30 highly effective flushing liquid without further additions to  
increase viscosity. A further advantage is that the discharge of  
removed soil does not necessarily lead to contamination of the  
remainder of the drill head, of the previously excavated pit portion  
and of the working environment above ground. In particular, if the  
35 previously excavated pit portion is filled with a support liquid,  
this advantageously does not give rise to contamination of the  
removed soil with the support liquid.

The pressure of the flushing liquid supplied in the flushing chamber is preferably set to an excess pressure slightly higher than the prevailing groundwater pressure in the surrounding soil. In particular, the excess pressure is in this case approx. 0.1 - 0.3  
5 bar. This excess pressure ensures that the soil at the site of the digging member can be discharged in a controlled manner. This reduces the risk of undesirable disturbances in the surrounding soil and thus the risk of scouring and subsidence. The use of the flushing chamber at a slight excess pressure allows the discharge  
10 rate of the soil mixture to be precisely adapted to the desired drilling speed.

In one embodiment, the flushing chamber before the first digging member in the housing is delimited by a base plate provided with  
15 inlets and/or the flushing chamber before the second digging member in the housing is delimited by a cover plate provided with inlets. This increases the efficiency with which the flushing liquid mixes with the removed soil particles.

20 Further preferred embodiments are defined in the dependent sub-claims.

The invention also relates to a foundation system according to claim 10. The system comprises in this case a rod-like drive-in member, to  
25 the lower end of which the drill head according to the invention is connected. The drive units are provided at the desired moments with energy by means of a power supply extending from an energy source above ground to the drive units in the housing of the drill head. Also provided is an installation for the lowering into the ground,  
30 during driving of the first digging member, of the drive-in member together with the drill head. A pit can thus be formed in the ground in a continuous excavating process, while the forces required to do this are relatively low. The rod-like drive-in member and a large portion of the drill head do not have to be driven in rotation. Once  
35 the desired depth has been reached, the drill head can be brought back up out of the pit while driving the second digging member. This recovery can, for example, be carried out by bringing the drive-in member back upward, wherein the drive-in member then entrains the

drill head. It is also possible to raise the drill head by winching, wherein the drill head then presses the drive-in member up with it.

The invention further relates to a method according to claim 11.

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The invention also relates to a method according to claims 26 - 28, to an assembly consisting of a drive-in member and a drilling head according to claim 29 and also to a foundation pile according to claim 30.

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The invention will be described hereinafter in greater detail with reference to the appended drawings, in which:

Figure 1 is a schematic view in longitudinal section of an embodiment of a foundation system according to the invention during excavation of the pit;

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Figure 2 is a schematic view in cross section of a variation of the drilling head in Figure 1;

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Figures 3a, b, c and d show successive steps of a method according to the invention using a foundation system according to Figure 2;

Figure 4 is a view corresponding to Figure 2 containing different types of drilling members; and

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Figures 5a, b, c and d show successive steps corresponding to Figure 3 utilizing a Kelly bar and a crane installation.

30 In Figure 1, the foundation system is denoted in its entirety by reference numeral 1. The foundation system 1 comprises a rod-like drive-in member 2 formed in this case by a telescopically extendable rod. The lower end of the drive-in member 2 is connected to a drill head 3. The drill head 3 comprises a housing 4 containing a drive unit 5 formed in this case by a hydraulic motor, and in particular a hydraulic motor having two directions of rotation, which is powered by means of a hydraulic line 6 from a pressure reservoir located above ground. The drive unit 5 connects to a drive shaft 7 which is mounted in the housing 4 so as to be able to rotate and to which a

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digging member 8 is connected. The digging member 8 is in this case formed by a wheel dredge, located on the underside of which are a plurality of cutter heads 9 which extend downwards and between which feed-through openings are provided for allowing removed soil particles to pass upwards.

Located above the digging member 8 is a flushing chamber 10 which is in this case delimited by wall parts of the housing 4 and the digging member 8. Connected to the flushing chamber 10 is a supply 14 for the pressurized supplying thereto of a flushing liquid. Also connected to the flushing chamber 10 is a discharge 15 for the discharging therefrom of the supplied flushing liquid mixed with the soil particles removed by the digging member 8.

A pit 16 is excavated in the ground 17 by activating the drive unit 5 and at the same time lowering the drive-in member 2 into the ground. Before the drilling process, an insert sleeve 18 is pressed into the ground. The insert sleeve 18 serves to guide the drill head 3 during excavation of an initial portion of the pit precisely into a desired position in the ground 17 and also to prevent undesirable collapsing of the crushable pit portion. Once the drilling process has been completed, this insert sleeve 18 can, if necessary, be removed again from the ground.

The foundation system 1 further comprises a supply 20 for the supplying during drilling of a support liquid to the previously excavated pit portion. The support liquid is, in particular, a bentonite-containing suspension. The supply 20 in this case opens at the top in the excavated pit portion.

The outer circumferential wall of the housing 4 of the drill head 3 is configured to rest during excavation directly against the earth circumferential wall of the pit 16 excavated by the digging member 8. The housing 4 has for this purpose a substantially cylindrical outer circumferential wall part. As a result of the fact that this cylindrical outer circumferential wall part of the housing 4 moves downwards along the wall, excavated immediately beforehand, of the pit 16, it advantageously helps to reinforce the pit wall.

A possible method for the forming of a foundation pile in the ground using the foundation system 1 includes the following steps.

5 Firstly, the insert sleeve 18 is conveyed into the ground, for example by means of ramming or vibrating. Subsequently, the assembly consisting of the drive-in member 2 and the drill head 3 is guided into the portion of the insert sleeve 18 that protrudes above ground with the aid of an installation (not shown). The installation comprises for this purpose, for example, a crane installation  
10 provided with gripping means which are configured to act on the drive-in member 2. By then telescopically extending, for example hydraulically, the drive-in member 2, the drill head 3 can be lowered while digging into the ground 17 with a desired insertion force. The drive unit 5 is thus activated, as are the pumps  
15 connected to the supply 14 and discharge 15. Afterwards, the assembly consisting of the drive-in member 2 and drill head 3 is gradually lowered into the ground using the digging member 8 which is driven in rotation. Once a specific initial pit depth has been reached, a pump connected to the supply 20 is activated for  
20 gradually supplying the support liquid into the pit. The rotational speed of the digging member 8, the drive-in speed of the drive-in member 2 and the pump speeds of the pumps connected to the supply and discharge are in this case precisely coordinated with one another.

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As soon as the drill head 3 has passed the insert sleeve 18, the outer circumferential wall of the housing 4 of the drill head 3 enters during excavation of the remainder of the pit 16 into direct contact with the surrounding soil 17. Once the desired pit depth has  
30 been reached, the drive-in member 2 is telescoped, as a result of which the drill head 3 is brought back upwards through the support liquid 1.

35 Subsequently, a reinforcement can, if necessary, be attached in the excavated pit and a hardenable foundation mass is conveyed into the pit 16. As a result of the difference in specific weight between the foundation mass and the support liquid, the support liquid will in this case be displaced upwards out of the pit 16. However, preferably the support liquid is pumped out of the pit and stored

for subsequent use at the same time as the hardenable foundation mass is supplied. Once the entire pit space has been filled with the foundation mass and the foundation mass has had time to harden, a foundation pile according to the invention is formed. The hardened mass of the foundation pile rests over the majority of the length of the foundation pile directly against the surrounding soil 17 which in some cases it even partially infiltrates.

Figure 2 shows an alternative embodiment of the drill head. The drill head 30 comprises in this case a housing having a cylindrical circumferential wall part 31. The housing contains a mounting flange 32 on which a drive 33 is mounted for the driving of a digging member 36 mounted on a drive shaft 35. The drive 33 is in this case formed by a hydraulic motor. The hydraulic motor has the advantage that it takes up little space, can produce a high output and is not sensitive to moisture and dirt. The upper side of the hydraulic motor can be connected to a hydraulic feed line (not shown).

Located below the mounting flange 32 is a base plate 40 provided with inlets. A flushing chamber 43 is delimited between the mounting flange 32 and the base plate 40. Connected to the flushing chamber 43 are a supply (not shown) for the supplying at a slight excess pressure of a flushing liquid and a discharge 45 for the discharging from the flushing chamber 43 of the supplied flushing liquid mixed with the soil particles removed by the digging member 36. As a result of the removal during operation of the soil by the digging member 36 and the simultaneous advancement of the drill head 30 down into the ground, the removed soil is automatically pressed into the flushing chamber 43 via inlets in the digging member 36 and the base plate 40 respectively. In the flushing chamber, the removed soil particles mix with the flushing liquid and this mixture can be conveyed upwards to outside the excavated pit via the discharge 45. The flushing liquid enters the flushing chamber 43 via the supply, strikes the base plate 40 and then sprays up on all sides. The resulting vortex advantageously ensures thorough mixing of the flushing liquid with the soil.

The inlets are preferably configured so as to widen toward the top. As a result, the soil particles entering the inlets will pass into the flushing chamber 43 as they are discharged.

5 It is possible temporarily to reverse the functions of the supply and discharge in order to flush blockages out of the flushing chamber. The reversal can advantageously be carried out above ground. A bypass containing an activatable valve can be provided between the supply and the discharge 45. The supply and discharge  
10 also contain activatable valves. The pipes can be efficiently flushed by activating these valves in a suitable manner.

The drill head 30 further comprises on its upper side a second digging member 50. The digging member 50 can be driven by a drive 51  
15 which in this case is also formed by a hydraulic motor. A cover plate 52 provided with inlets is located below the digging member 50. Provided below the cover plate 52 is a second flushing chamber 54 extending annularly around the drive 51. Also provided on this flushing chamber 54 are a supply (not shown) for the supplying at a  
20 slight excess pressure of a flushing liquid and a discharge 55 for the discharging from the flushing chamber 54 of the supplied flushing liquid mixed with soil particles removed by the digging member 50. This provision of the second digging member 50 and the associated flushing chamber 54 with a supply and discharge 55 allows  
25 any non-uniformity of the bore hole to be drilled out and eliminated when the drill head 30 is withdrawn upwards. This will be described hereinafter in greater detail with reference to Figure 4.

Figure 3a shows the situation in which the drill head 30 is, when  
30 the digging member 36 is driven, at the same time lowered into the ground by exerting a downwards force on a rod-like drive-in member 57 connecting to the drill head 30. A support liquid 61 is introduced into the excavated pit portion 60 formed above the drill head 30 (see Fig. 3b). During drilling, flushing liquid is supplied  
35 to the flushing chamber 43 where the flushing liquid mixes with removed soil particles, which mixture is subsequently discharged upwards via the discharge 45. The rod-like drive-in member 57 is in this case advantageously hollow in its configuration, thus allowing the supply and discharge and also the power supplies before the

drives to extend therethrough. Once the desired final depth has been reached (Fig. 3c), the drive 33 for the first digging member 36 is disconnected and the supply and discharge 45 after the flushing chamber 43 are shut off. Subsequently, the drive 51 before the  
5 second digging member 50 is activated and the supply and discharge 55 after the second flushing chamber 54 are activated. Subsequently, the drill head 30 can be drawn upwards out of the pit 60 by means of the rod-like drive-in member 57 (Fig. 3d). The second digging member 50 in this case also eliminates any non-uniformity from the bore  
10 hole located above the drill head 30.

As may be seen in Figure 2, the drill head 30 is provided with equalizing pipes 64 containing shut-off valves 65. The equalizing pipes extend from the underside to the upper side of the drill head  
15 30. When the drill head 30 is withdrawn upwards, the shut-off valves 65 are placed in the open position and thus ensure that the support liquid which is in the first place located only above the drill head 30 can flow away downwards toward the free space formed during the withdrawal below the drill head 30.

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In Figure 4, like components are denoted by the same reference numerals as in Figure 2. An alternative embodiment of the drill head, using other types of digging members, is shown. The left-hand half of Figure 4 shows in this case a first variation of the digging  
25 member, whereas the right-hand half of Figure 4 shows a second variation of the digging member. In both variations, the digging member comprises a plurality of fold-in digging elements 70 distributed over the circumference. The fold-in digging elements 70 extend in the radial direction as a kind of spoke and are able to  
30 hinge about hinge pins 71 connected to the remainder of the digging member. The digging elements are thus free to automatically hinge downwards as soon as the drill head 30 is raised. In addition, the digging elements 70 are free to automatically hinge upwards to a folded-out position as soon as the drill head 30 is placed on the  
35 ground and drilling is commenced. This has the advantage that, in the folded-out position, the digging elements 70 can have radial dimensions which are somewhat larger than the remainder of the drill head, whereas in the folded-in position they assume smaller radial dimensions. As a result, the digging elements 70 do not obstruct the

drill head as it is drawn upwards out of the ground, thus reducing the risk of damage to the excavated drill pit wall and allowing the withdrawal forces advantageously to be reduced.

5 In order to ensure that the digging elements 70 do indeed fold upwards when positioned on the ground, they are downwardly delimited at angles of 30 degrees or less with respect to the horizontal.

10 The left-hand type of digging element 70a is distinguished in that a plurality of scoops positioned next to one another are provided on the underside thereof, whereas the right-hand type of digging element 70b is provided on its underside with a series of teeth. A specific type can be selected depending on the type of soil to be drilled into.

15 Figure 5 shows a variation of Figure 3. In this case too, like components are denoted by the same reference numerals. The major difference is that a different type of rod-like drive-in member is used in this case. The drive-in member consists in this case of an  
20 assembly of telescoped tubes which are configured in such a way that they can each be engaged with one another in an extended position by exerting a rotational force on the respective tubes. An example of a telescopic tube assembly of this type with rotational engagement is commercially available as a Kelly bar. For this purpose, use is made  
25 of a crane installation 80 comprising a drive 81 which is configured to act on the outer tube 82 in order to rotate the outer tube with respect to the drill head and the tubes already engaged therewith. In a variation, the drill head 30 can also be rotated while the outer tube is fixed. This also gives rise to engagement.  
30 Disengagement can be carried out by rotating the drive 81 or the drill head 30 respectively in the opposite direction. Figure 5c shows a position in which two inner tubes 84, 85 are guided out of the outer tube 82 and engage with respect thereto, after which the crane installation 80 has lowered the engaged tube assembly into the  
35 ground over a specific stroke while driving the drill head 30.

A hoisting wire 87, which is rigidly connected to a lower portion of the tube assembly, is provided for removing the drill head 30 upwards, as is shown in Figure 5d. By disengaging the tubes with

respect to one another and subsequently raising the hoisting wire, the tubes are thus telescoped and drawn upwards together with the drill head 30 out of the excavated pit.

5 In addition to the abovementioned embodiments, a large number of variations are possible. The drill head can also be used for the drilling out of pits for other purposes than foundation piles, and the orientation of the pit may have any desired direction. The second digging member for drilling the drill head out of the pit may  
10 have any desired embodiment and for example, they may be constructed in foldable just like the first digging member. The drive-in member may also be omitted or shaped differently, and for example may thus also be formed by a non-telescopically extendable rod, for example a segmented rod as shown in Figure 4, to which in each case a new rod  
15 part can be fastened in order to extend the rod. The drive-in installation in this case comprises, for example, gripping means which are configured to exert a continuous downwards force on the rod. The gripping means may also be provided so as to be able to move up and down in order in each case to secure a rod part, to  
20 press it downwards in order then to release this rod part, to move unimpeded upwards where it secures a new rod part. The installation for the lowering into the ground of the drive-in member together with the drill head is preferably configured to act on the outer circumferential wall of the drive-in member. It is also possible to  
25 provide in the drill head a different type of drive unit, for example an electric drive such as an electric motor. The digging members preferably have radial dimensions which are greater than or equal to those of the outer circumferential wall of the housing of the drill head. The digging members may be of a different type. If  
30 the drive-in member is used, then the drill head has, in particular, radial dimensions larger than those of the drive-in member. More particularly, the outer circumferential wall of the housing of the drill head has radial dimensions which are at least two times larger than those of the drive-in member. The outer circumferential wall of  
35 the housing can have any desired shape. Preferably, the housing is cylindrical in its configuration. If a drive-in member is used, then both during excavation and during the bringing back upwards of the drill head, the outer circumferential wall of the drive-in member of the drill head rests against the surrounding soil of the pit

excavated and kept free by the digging members and thus reinforces the pit wall owing to the drilling/sliding forces which are produced. If a drive-in member is used, then both during excavation and during the bringing back upwards of the drill head, the outer  
5 circumferential wall of the drive-in member is not in direct contact with the surrounding soil. This advantageously restricts the forces required.

The invention thus provides an efficient and reliable operating  
10 drill head which is particularly suitable for use in a foundation system, which can advantageously be used for all types of projects, in particular for the production of foundation piles having a length between 50 - 100 metres. These foundation piles are characterized by a high load bearing capacity, partly owing to the fact that the  
15 hardened foundation mass rests directly against or mixes to a certain extent with the surrounding soil.

**Claims**

1. Drill head for the excavating in the ground of a pit, in particular a pit to be filled with a hardenable mass, for the formation after hardening of a foundation pile, comprising:
- 5 - a housing (31) having a drive shaft (35) which is rotatable with respect to the housing (31), a first drive unit (33) for the driving in rotation, by means of driving of the drive shaft (35), of at least one first digging member (36) positioned on one side of the drill head (30) being provided in the housing (31),
- 10 characterized in that a second drive unit (51) for the driving in rotation of at least one second digging member (50) positioned on the other side of the drill head (30) is provided in the housing (31).
- 15
2. Drill head according to claim 1, wherein the drill head (30) comprises a flushing chamber (54) positioned before the second digging member (50) in the housing, to which flushing chamber (54) is connected at least one supply for the pressurized introduction during drilling into the flushing chamber (54) of a flushing liquid, and to which flushing chamber (54) is connected at least one discharge (55) for the discharging during drilling out of the flushing chamber (54) of the flushing liquid mixed with soil removed by the second digging member (50).
- 20
- 25
3. Drill head according to claim 2, wherein the flushing chamber (54) positioned before the second digging member is delimited in the housing (30) by a cover plate (52) provided with inlets.
- 30
4. Drill head according to any one of the preceding claims, wherein a supply (6) is provided for the supplying of energy to the drive units (33, 51), which supply (6) extends from an energy source above ground to the drive units (33, 51) in the housing (31) of the drill head (30).
- 35
5. Drill head according to any one of the preceding claims, wherein the drive units (33, 51) are hydraulic motors.
6. Drill head according to any one of the preceding claims,

wherein the digging member (36, 50) is a wheel dredge provided with a plurality of cutter heads (9).

7. Drill head according to any one of the preceding claims,  
5 wherein the digging member (36, 50) comprises a plurality of fold-in digging elements (70).

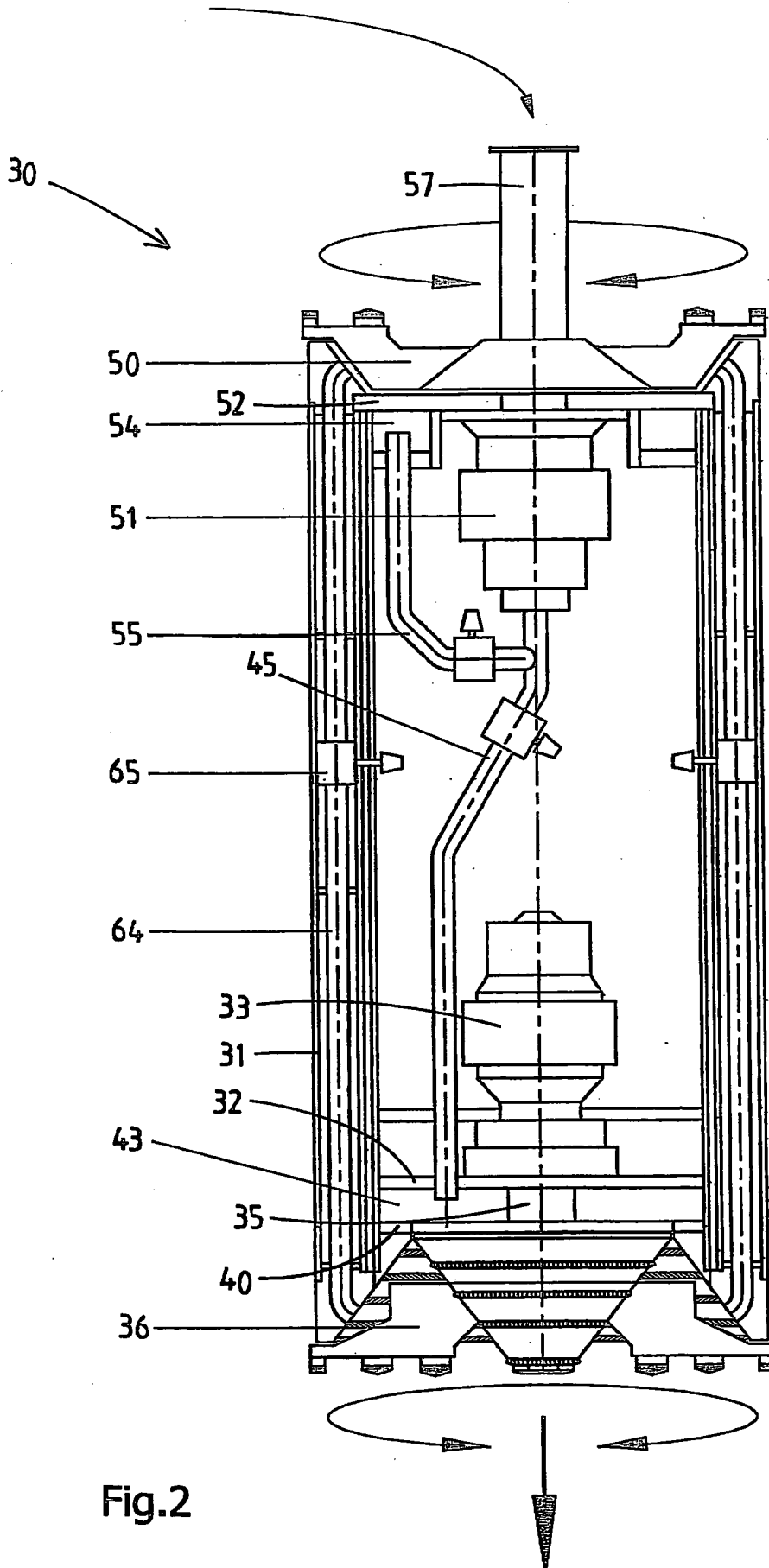
8. Drill head according to claim 7, wherein the fold-in digging  
10 elements (70) are configured for assuming in the folded-out position radial dimensions which are larger than the outer circumferential wall of the housing (31) and for assuming in the folded-in position radial dimensions which are smaller than the outer circumferential wall of the housing (31) of the drill head (30).

15 9. Drill head according to any one of the preceding claims, wherein there is provided an equalizing pipe (64) which is provided with an activatable shut-off valve (65) and extends from the underside to the upper side of the drill head (30).

20 10. Foundation system comprising:  
- a drill head (30) according to any one of the preceding claims;  
- a rod-like drive-in member (57), the lower end of which is connected to the drill head (30); and  
- an installation for the lowering into the ground of the drive-in  
25 member (57) together with the drill head (30).

11. Method for the formation of a foundation pile in the ground, including the following steps:  
- the excavation in the ground of a pit using a drill head (30)  
30 according to any one of claims 1 - 9, wherein the first drive unit (33) drives the first digging member (36) in rotation;  
- the removal of the drill head (30) from the pit excavated in the ground, wherein the second drive unit (51) drives the second digging member (50) in rotation;  
35 - the filling of the pit (16) with a hardenable mass during or after removal of the drill head (30) for the formation after hardening of the foundation pile.





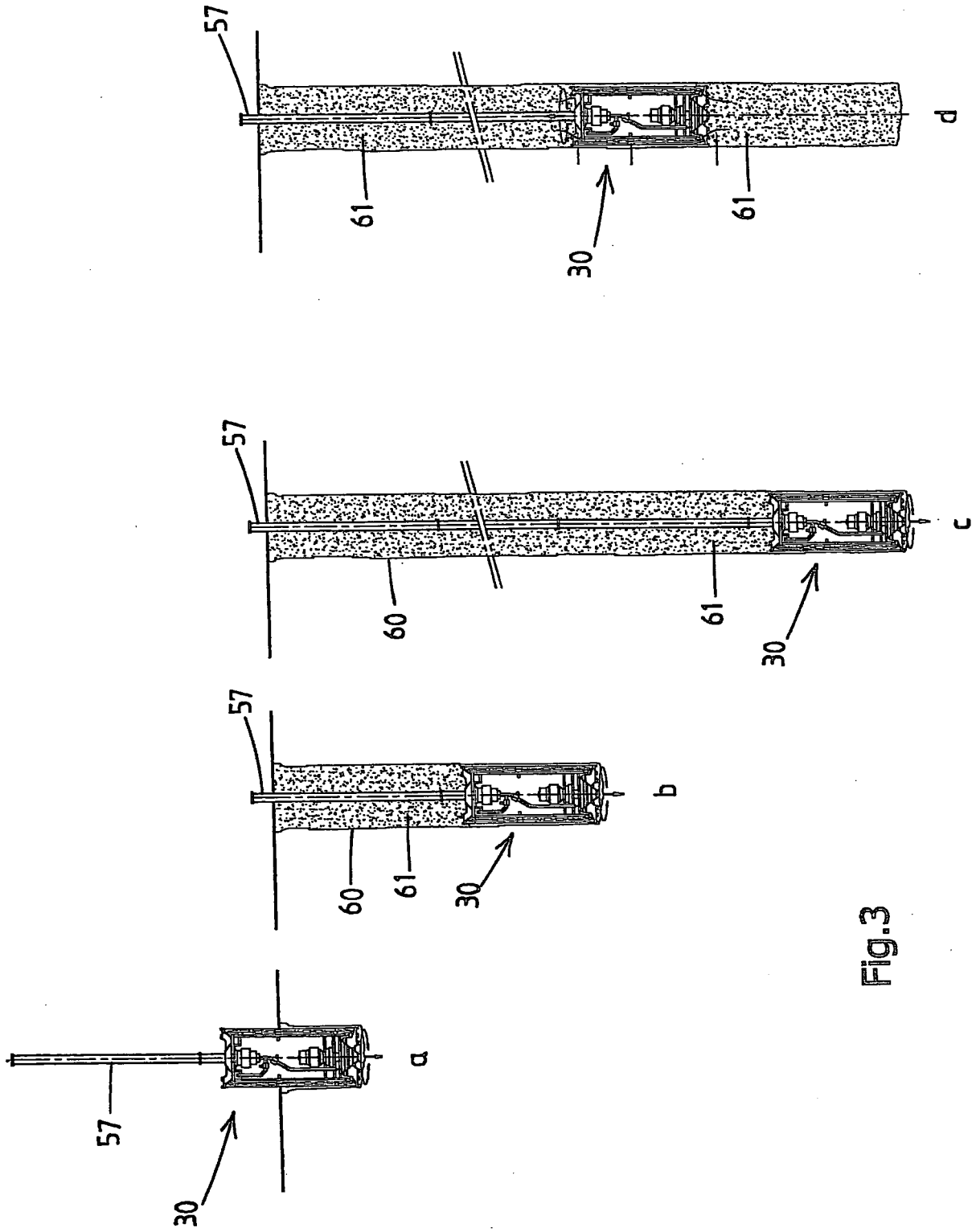


Fig.3

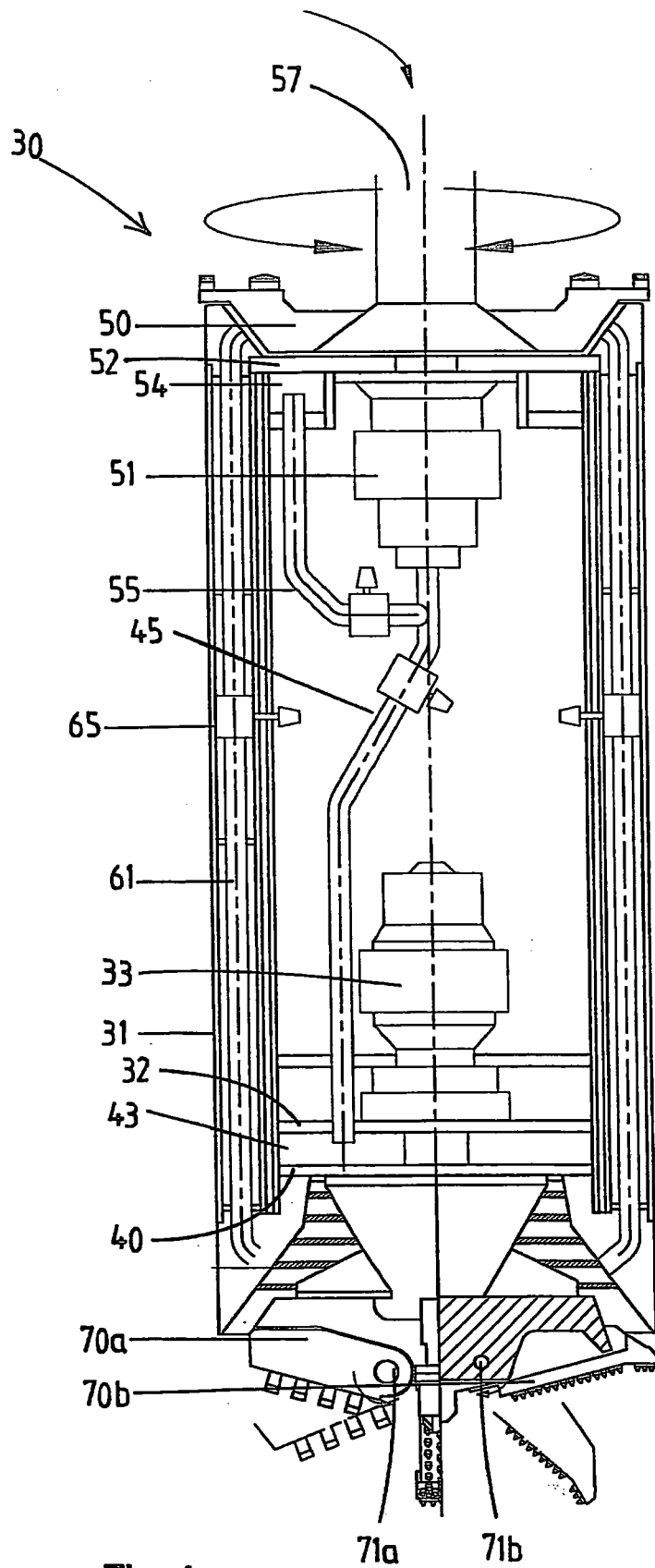


Fig.4

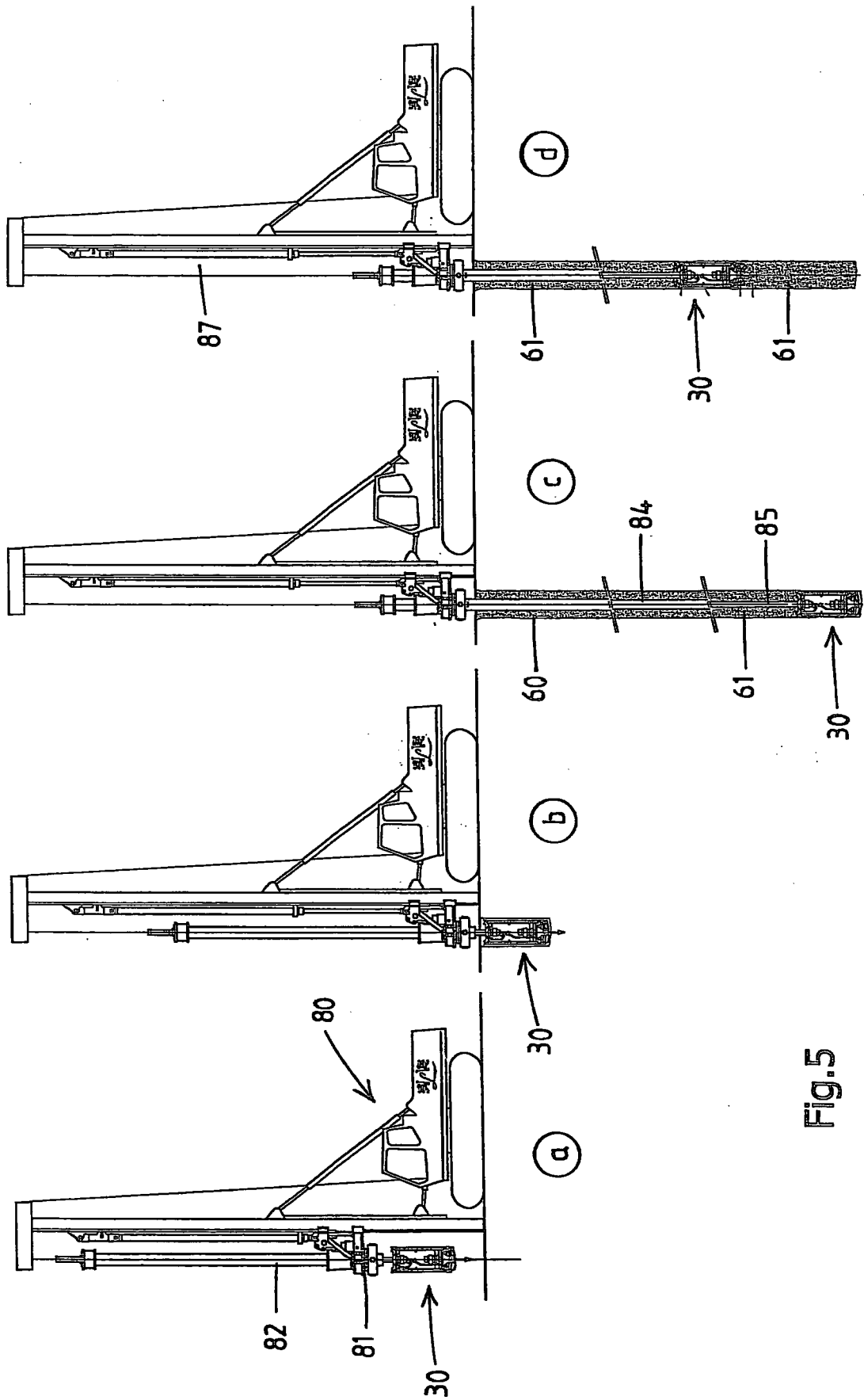


Fig.5