

[Name of the Document] Specification

[Title of the Invention]

PILE BORING TOOL AND BORING APPARATUS FOR PRODUCING A PILE BORE

[Technical Field]

[0001]

The invention relates to a pile boring tool and a boring apparatus, and more particularly to a pile boring tool for producing a pile bore, having a central tube coaxial to the boring axis, at least one edge directed transversely to the boring axis and on which is located a plurality of cutting teeth and a conveying device for receiving and/or conveying away the material removed by the cutting teeth.

[Background Art]

[0002]

Pile bores are e.g. used to produce pile foundations, so-called foundation piles, for buildings. Such foundations are necessary if the subsoil on which the building is to be erected does not have an adequate bearing power. Thus, by means of pile bores large column-like cavities are driven sufficiently far into the ground to ensure an adequate bearing power. Subsequently said cavities are filled with cement or some similar material. In order to be able to ensure a maximum foundation stability, it is particularly important that the piles can be made in the ground at the precisely calculated location. More particularly deviations in the boring direction must be avoided.

[0003]

As pile boring tools e.g. so-called boring buckets are known. Such pile boring tool are operated in a discontinuous boring process, i.e. firstly the pile boring tool is bored into the ground. When sufficient soil has been loosened and the boring bucket has filled, the tool with the soil is drawn out

of the pile borehole. The boring bucket is emptied and then boring can be continued.

[0004]

Patent Document 1 discloses a pile tool with a boring screw which can be turned into the ground during boring. In the case of screw boring the cutting teeth loosen soil and the latter is conveyed upwards by a screw conveyor. Such pile boring tools are used for continuous and discontinuous boring. A mounted, downwards directed centre point is used for the precise orientation and guidance of the pile boring tool during boring.

[0005]

As such pile bores serve as bores for foundation piles they must be made correspondingly large. Thus, as disclosed in Patent Document 2, a pile borer must generally be positioned for boring purposes by e.g. a caterpillar-type tracked vehicle. During boring said support or carrying implement can guide the upper area of the boring tool. When making particularly deeper pile bores said upper guidance is scarcely sufficient for an accurately directed boring.

[0006]

[Patent Document 1] DE 42 09 854

[Patent Document 2] DE 41 32 314 C1

[Disclosure of the Invention]

[Problems to be Solved by the Invention]

[0007]

As described above, according to conventional art, guidance of the upper area of the boring tool is performed as increasingly large pile boring tools are used. However, the upper area guide device may not be sufficient for an accurately directed boring, and is scarcely sufficient when making particularly deeper pile bores. The object of the invention

is to provide a pile boring tool permitting a particularly precise pile production. The object of the invention is to provide a pile boring tool and boring apparatus permitting a particularly precise pile production.

[Means for Solving the Problems]

[0008]

This object is achieved by a pile boring tool having the features of claim 1. Preferred embodiments are given in the dependent claims.

[0009]

The pile boring tool according to the invention is a pile boring tool for producing a pile bore in the ground having a central tube coaxial to the boring axis, at least one edge directed transversely to the boring axis and on which is provided a plurality of cutting teeth, and a conveying mechanism for receiving and/or conveying away the soil removed by the cutting teeth, wherein there are at least two cutting edges upstream of the cutting teeth in the boring direction which are mutually offset and spaced from one another so as to form a central free space, wherein the two cutting edges each comprise at least a longer outwardly inclined outer edge and at least a shorter inwardly inclined inner edge, and wherein there is furthermore a substantially horizontal edge for working away a soil plug which is cut out by the inner edges.

[0010]

A fundamental idea of the invention is to be able to better guide the pile boring tool in the desired direction during boring by a double centring function. A first centring function is brought about by the two cutting edges located in the centre of the underside of the pile boring tool. Said spaced cutting edges on the pile boring tool form a free space in the centre in which part of the soil is left. Thus, in the centre

of the pile bore a guiding cone is formed and provides a second centring function. These mutually displaced three, four or more cutting edges consequently provide inner and outer guide surfaces. Thus, particularly in the case of deeper pile bores, which can reach depths of approximately 20 to 100 m, said double centring function significantly reduces the danger of deviations at the auger bit.

[0011]

In a particularly preferred embodiment the conveying mechanism is constructed as a boring bucket. The double centring according to the invention is particularly useful in the case of a boring bucket, because the latter is only guided over its relatively small length of 1 to 3 m on the borehole wall. Otherwise guidance takes place by means of the boring rod which is spaced from the borehole wall.

[0012]

It is particularly easy to use a boring bucket if on its underside there is at least one opening with a closable cover and the edge with the cutting teeth is located at the opening. Thus, during boring, the soil loosened by the cutting teeth is directly fed into the interior of the boring bucket. As a result of the possibility of closing said opening, it is possible to close or seal the boring bucket when it has been filled with soil and is removed from the borehole for emptying purposes. Thus, no soil can drop back into the borehole.

[0013]

In the case of a particularly preferred pile boring tool the at least two mutually spaced cutting edges are constructed integrally as an auger bit. As the auger bit is intended for the directional guidance of the pile boring tool, very considerable forces act thereon. It is consequently advantageous to integrally construct said cutting edges in

order to be able to better handle the forces which occur. In soils where said forces are not particularly high, three or four cutting edges can be used.

[0014]

A particularly easy closing of the boring bucket opening can be brought about in that the auger bit is firmly connected to the cover, which is mounted in rotary manner with respect to the boring bucket. The rotary connection of the cover relative to the boring bucket is such that when the pile boring tool is actively rotated in the ground, i.e. in a specific rotation direction, as a result of the rotary movement the cover opens the boring bucket opening. On removing the boring bucket from the pile borehole, the pile boring tool is rotated in the opposite direction and the cover is slid over the opening in the boring bucket and seals the latter. This leads to a simple construction for closing the boring bucket opening and which can be provided without additional expenditure on a boring bucket.

[0015]

A further pile boring tool according to the invention is characterized in that the conveying mechanism has at least one helix fitted to the central tube. The use of such a conveying or feed helix as a conveying mechanism offers the advantage that as a result continuous boring can take place. The soil removed is conveyed upwards by means of the one or more helixes.

[0016]

In order to support the bored borehole with respect to the adjacent soil, it is particularly advantageous to construct the central tube for the introduction of suspension. Thus, during the retraction of the borer a support suspension can be introduced into the borehole. Said central tube also makes it possible to introduce a hardenable suspension into

the borehole, so that the latter can be filled with the aid of said suspension and then with further agents the suspension can be hardened or set in order in this way to produce a solid body in the pile borehole.

[0017]

It is particularly advantageous for the auger bit to be detachably fixed in a receptacle at the lower end of the central tube. As a result individual auger bit replacement is possible in the case of damage. The detachable fitting also provides the possibility of selecting the auger bit in accordance with the subsoil to be bored and thereby achieve a better advance and guidance of the pile boring tool.

[0018]

In principle, the auger bit receptacle can have a random construction. However, it is particularly advantageous for the receptacle to be polygonal, particularly rectangular. In this way the torque of the rotary movement of the pile boring tool is transmitted particularly well to the auger bit.

[0019]

A particularly advantageous embodiment of the inventive pile boring tool has on its top a connecting device for the detachable connection to a boring rod. The torque is transmitted to the pile boring tool through said boring rod, which can have further screw members. The advantage of a detachable connection is that both the boring rod and also the pile boring tool can be used separately or together with other means.

[0020]

In order to produce a pile bore with the pile boring tool according to the invention, provision is also made of a boring apparatus with a mast, a rotary drive located thereon and a boring rod, which is driven in rotary manner by the rotary

drive. These means are appropriate so that on producing a pile bore large depths can be reached and also the diameter of such pile bores can be relatively large. The boring apparatus with the mast also further stabilizes the direction of the pile boring tool.

[Achieved Effect of the Invention]

[0021]

A particularly accurate pile production is made possible by the pile boring tool and boring apparatus according to the invention.

[Best Mode for Carrying Out the Invention]

[0022]

The preferred embodiments of the invention are described in detail hereinafter referring to the drawings.

[0023]

Fig. 1 shows a perspective side view of an inventive pile boring tool 1 in an embodiment with a boring bucket 2. By means of a central tube 20 positioned coaxially to the boring axis a radial torque is transmitted to the pile boring tool 1. A row of four cutting teeth 3 for loosening the soil are provided on an edge 8. Through an opening 11 of the boring bucket 2 upstream of the edge 8 the loosened material can enter the boring bucket 2. When the boring bucket 2 has been filled with sufficient material, it is closed with the aid of a rotary cover 4. As a result of the rotary mounting of the cover 4, which is firmly connected to an auger bit 5, this can take place in a particularly simple manner. As a result of a rotation counter to that direction normally used during boring, the cover 4 is rotated in front of the opening 11 of the boring bucket 2, which ensures that the removed material cannot drop back again into the borehole from the boring bucket 2.

[0024]

After the pile boring tool 1 has been conveyed to the surface again, with the aid of a release mechanism 6 a cover closure 7 is released and as a result the laterally articulated cover 4 of the boring bucket 2 can swing down and the soil in said bucket can pass out without difficulty. On reclosing the cover 4 of boring bucket 2, the pile boring tool 1 can be conveyed into the borehole again for boring purposes.

[0025]

On its top surface the cylindrical boring bucket 2 has an angular central tube 20 used for connection to a boring rod. In certain constructions the central tube 20 can extend through the boring bucket 2 in order to introduce a suspension into the borehole. However, in the present construction it is constructed as a short socket.

[0026]

The auger bit 5 is detachably fixed to the lower end of the pile boring tool, being located in a tubular receptacle 10 forming part of the central tube 20. The said receptacle 10 and the auger bit 5 located therein are detachably connected by a transverse locking bolt 9.

[0027]

Fig. 2 shows another embodiment of the inventive pile boring tool, where the latter is provided with a helix 21, which is welded to the central tube 20. Together they form a so-called screw conveyor. The material broken away by the cutting teeth 3 is conveyed on in the surface direction through the screw conveyor.

[0028]

Fig. 2 also shows the connecting device 22 constructed on the central tube 20 for connecting the pile boring tool 1 to a not shown boring rod. By means of said boring rod a torque is transmitted to the pile boring tool 1. If a suspension passes

into the borehole through central tube 20, the boring rod is provided with a feed line for the suspension. The fixing of the auger bit 5 takes place in the same way as in the first embodiment. The auger bit 5 is fixed in the receptacle 10 by a bolt 9. This embodiment of the inventive pile boring tool 1 is particularly suitable for non-water-bearing soils.

[0029]

Figs. 3 and 4 show side views of the auger bit 5 of the inventive pile boring tool 1. The integral construction of the cutting edges 31 is readily apparent. It is also possible to see the rectangular shape of the auger bit 5 in the area introduced into the receptacle 10. As a result of the detachable fixing of the auger bit 5 to the pile boring tool 1, it is particularly easy to replace said auger bit 5. Thus, the pile boring tool 1 can be particularly readily adapted to the soil characteristics by using different constructions of the auger bit 5.

[0030]

In the area intended for introduction into the receptacle 10, the auger bit 5 has a through bore 32. For fixing the auger bit 5 to the receptacle 10 the latter also has a bore. These two bores are positioned in such a way that a locking bolt 9 for fixing the auger bit 5 can be slid through said two bores. A step 34 between the cutting edges 31 and the rectangular body with rounded angles provided for introduction into the receptacle 10 leads to a particularly good positioning of the auger bit 5 in the receptacle 10. Said step 34 also makes it possible for the through bore 32 to coincide with the bore in the receptacle 10 in such a way that the locking bolt 9 can be introduced in problem-free manner.

[0031]

At the cutting teeth 3 at the lower end the auger bit 5 has in each case an arrow-like shape having a long outer edge 35 and a short inner edge 36. Considered from the rotation axis of the auger bit 5, the long outer edge 35 is outwardly inclined contributing to a particularly good guidance of the auger bit 5 and therefore also of the entire pile boring tool 1. The short inner edges 36, which are inwardly inclined with respect to the rotation axis, cut out a soil plug which brings about the second centring function. During boring the soil plug extends to substantially horizontal edge 33. During a pile boring tool rotation necessary for boring, the soil plug is worked away by said concavely curved sharp edge 33 so as to permit a further penetration into the soil by the pile boring tool 1.

[0032]

The embodiment of a pile boring tool 1 shown in Fig. 5 has a second helix 41. Said second helix 41, in the same way as the first helix 21, is welded to the central tube 20. The pile boring tool 1 now has two edges 8, 44 to which are fixed cutting teeth 3 for removing the soil. In the embodiment shown said cutting teeth are fitted in a curved line to the edge. The use of two edges 8, 44 with the cutting teeth fitted there offers the advantage that the pile boring tool 1 is subject to symmetrical loading during boring. This symmetrical loading of the pile boring tool 1, like the auger bit 5, prevents a deviation of the pile boring tool 1 from the desired boring direction. To particularly well maintain the desired boring direction, an additional guidance edge 45 is provided at the end of the spindle.

[0033]

The second helix 41 welded to the pile boring tool 1 is a three-quarter helix, but this is sufficient for symmetrically loading the pile boring tool 1. A holding ring

42 is fitted to the connecting device 22 of pile boring tool 1. This holding ring 42 is used for transporting the pile boring tool 1, when the latter is not fixed to the boring rod. It is also possible to see connecting holes 43 on connecting device 22. These connecting holes 43 are firstly used for frictionally connecting the connecting device 22 to the boring rod, which can e.g. take place by further locking bolts. However, the connecting holes 43 on the angular connecting device 22 can also permit a connection for a line supplying suspension to the central tube 20. For example in the vicinity of the auger bit 5, said suspension can pass out of the central tube 20 through exit ports.

[Brief Description of the Drawings]

[0034]

[Fig. 1] Fig. 1 is a perspective view of a pile boring tool with boring bucket, according to an embodiment of the invention.

[Fig. 2] Fig. 2 is a perspective view of a pile boring tool with a helix, according to an embodiment of the invention.

[Fig. 3] Fig. 3 is a side view of the auger bit of a pile boring tool according to an embodiment of the invention.

[Fig. 4] Fig. 4 is a side view of the auger bit of a pile boring tool according to an embodiment of the invention.

[Fig. 5] Fig. 5 is a perspective view of a pile boring tool with in part two helixes, according to an embodiment of the invention.

[Description of the Reference Numerals]

1 pile boring tool; 2 boring bucket; 3 cutting teeth; 4 cover; 5 auger bit; 6 release mechanism; 7 cover closure; 8,44 edges; 9 locking bolt; 10 receptacle; 11 opening; 20 central tube; 21,41 helix; 22 connecting device; 31 cutting

edge; 32 through bore; 33 edge; 34 step; 35 outer edge; 36 inner edge; 42 holding ring; 43 connecting hole; 45 guidance edge.

[Name of the Document] Claims

[Claim 1]

A pile boring tool for producing a pile bore in the ground, having a central tube coaxial to the boring axis, at least one edge directed transversely to the boring axis and on which is provided a plurality of cutting teeth, and a conveying mechanism for receiving and/or conveying away the soil removed by the cutting teeth,

wherein there are at least two cutting edges upstream of the cutting teeth in the boring direction which are mutually offset and spaced from one another so as to form a central free space,

wherein the two cutting edges each comprise at least a longer outwardly inclined outer edge and at least a shorter inwardly inclined inner edge, and

wherein there is furthermore a substantially horizontal edge for working away a soil plug which is cut out by the inner edges.

[Claim 2]

Pile boring tool according to claim 1,

wherein the conveying mechanism is constructed as a boring bucket.

[Claim 3]

Pile boring tool according to claim 2,

wherein on its underside the boring bucket has at least one opening with a closable cover and that the edge with the cutting teeth is located at the opening.

[Claim 4]

Pile boring tool according to claim 1,

wherein the at least two mutually spaced cutting edges are integrally constructed as an auger bit.

[Claim 5]

Pile boring tool according to claim 4,
wherein the auger bit is firmly connected to the cover,
which is mounted in rotary manner with respect to the boring
bucket.

[Claim 6]

Pile boring tool according to claim 1,
wherein the conveying mechanism has at least one helix,
which is fitted to the central tube.

[Claim 7]

Pile boring tool according to claim 4,
wherein the central tube is constructed for introducing
suspension.

[Claim 8]

Pile boring tool according to claim 4,
wherein the auger bit is detachably fixed in a receptacle
at the lower end of the central tube.

[Claim 9]

Pile boring tool according to claim 8,
wherein the receptacle is polygonal, particularly
rectangular.

[Claim 10]

Pile boring tool according to claim 1,
wherein on the top surface is formed a connecting device
for detachable connection to a boring rod.

[Claim 11]

Boring apparatus with a mast, a rotary drive located
thereon and a boring rod driven in rotary manner by the rotary
drive,

wherein a pile boring tool according to claim 1 is
provided.