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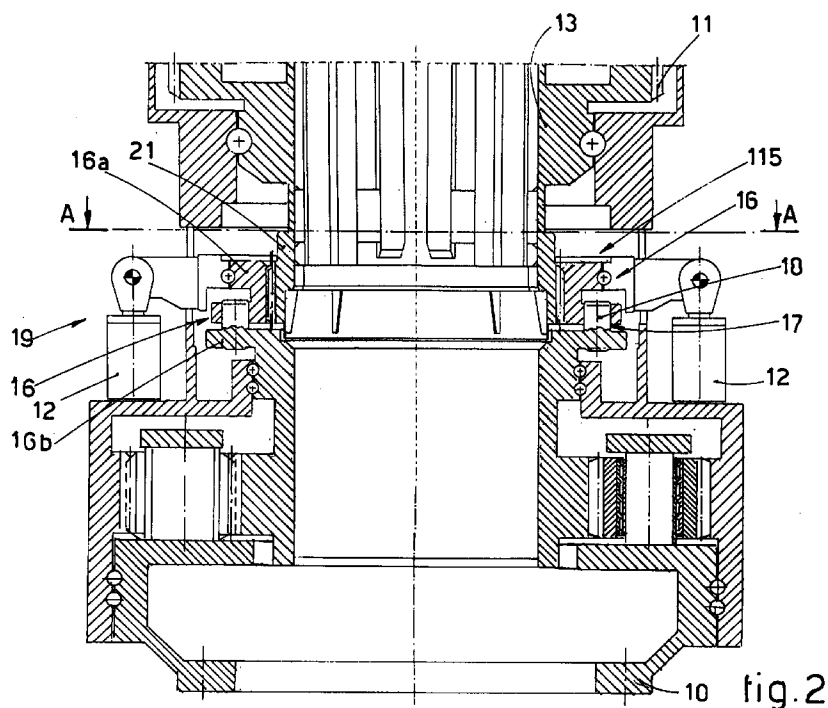
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(54) Casing rotating device for drilling machines

(57) Casing rotating device (10) for drilling machines, the device being associated and coaxial with a device (13) for the rotation of a drilling tool for the obtaining of foundation piles, the drilling tool rotation device (13) having its own motor, the rotary casing-

oscillator device (10) being located in a position below the drilling tool rotation device (13) and being associated with a reduction-gear and torque-multiplier transmission assembly (15,115).



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Description

This invention concerns a rotary casing-oscillator device for excavation machines with rotary tools, as set forth in the main claim.

The rotary casing-oscillator device according to the invention is applied to excavation machines employing rotary tools to make boreholes for foundations and, to be more exact, to the obtaining of foundation piles.

The excavation machines to which the invention is applied may be of a hydraulic or mechanical type and enable piles to be obtained with diameters ranging from 600 to 2500 mm. and with depths at least of 80 metres.

In the field of foundations and, to be more exact, of foundations produced by means of piling, in which cylindrical piles have to be obtained in the ground, operational machines employing rotary tools have been used for some time now.

These machines comprise a drilling assembly in which a rotation head is associated with a rotary tool together with a plurality of interposed shafts, which are assembled axially until the required depth has been reached.

Where the ground is friable or of a low consistency, with a view to avoiding landslides affecting the sidewall of the boreholes, the excavation machines include at their front an assembly to insert tubular casings having an outer diameter greater than that of the rotary tool, these casings being inserted into the ground in a position substantially on the same axis as the borehole and at least along a longitudinal part of the borehole and having the purpose of retaining the sidewall of the borehole.

When the excavation has ended, these casings are generally withdrawn and recovered by using the same machine as that used for their insertion.

Rotary casing-oscillators are employed at the present time for insertion of these tubular casings and ensure a high torque so as to be able to rotate the casing at the same time as they thrust the casing downwards.

These casing oscillators are associated in a front position with the foundation excavation machines and may form an element substantially independent of those machines or may be driven by the excavation machine with which they are associated.

This system requires a plurality of auxiliary accessories both for its installation and for its operation, and those accessories make the operations of producing the pile complicated and long.

So as to overcome these problems and to reduce the time required for equipping the machine, the state of the art has disclosed for some time now rotary casing-oscillator devices coaxial with, and solidly secured to, the excavation device which provides the rotation and forward movement of the rotary tool.

With this system a first device provides the rotation and thrust of the rotary tool and supplies continuously

the motion and thrust to a second device which provides the rotation and thrust of the casings.

The rotary casing-oscillator device is therefore associated directly and stably with the device that rotates the rotary drilling tool, and both devices are driven by the same motor.

These devices entail the problem that, when the insertion of a casing is no longer required, it is necessary to raise and keep in a raised position the tool rotation device and the rotary casing-oscillator device so as to release from the latter the casing which is inserted in the ground.

These operations are long, complicated and very delicate, and this situation makes the excavation operations much more burdensome owing to the downtimes required for these operations of connecting the casing to, and disconnecting the casing from, the rotary casing-oscillator device.

Moreover, in these rotary casing-oscillator devices of the state of the art it is impossible to release the tool rotation device from the rotary casing-oscillator device, so that the latter rotates whenever the tool rotation device rotates, with a resulting waste of electrical energy and, above all, with the creation thereby of great dangers for the operators of the machine producing the foundations.

The present applicants have designed, tested and embodied this invention to overcome the shortcomings of the state of the art and to achieve further advantages.

This invention is set forth and characterised in the main claim, while the dependent claims describe variants of the idea of the main embodiment.

This invention enables the rotary casing-oscillator device to be driven independently of the tool rotation device, depending on the specific requirements.

The rotary casing-oscillator device according to the invention is located on the same axis as, and in a lower position than, the tool rotation device.

According to a first embodiment of the invention the rotary casing-oscillator device is always independent of the tool rotation device, each of the two devices being associated with its own independent motor unit.

In this embodiment the tool rotation device and the rotary casing-oscillator device are coaxial and superimposed on each other, the tool rotation device being positioned above.

According to another embodiment of the invention the tool rotation device may be momentarily associated with, and released from, the rotary casing-oscillator device, and in this case the machine includes one single motor unit governing both the above devices.

In this case the motor unit therefore performs the twofold function of providing motion for the tool rotation device and for the rotary casing-oscillator device, but this supply to one or both of the devices depends only on the choice of the machine operator.

In this case, the invention enables the tool rotation device to be coupled with, and released from, the rotary casing-oscillator device with a simple, automatic and

remote-controlled operation when so required by the operations.

With the device according to the invention the times required for equipping and installing the casings on the insertion assembly are therefore greatly reduced with a considerable lessening of the overall costs of the piling operation.

Moreover, the dangers for the machine operators are in fact eliminated, and the waste of electrical energy due to the drawing of the rotary casing-oscillator device when the casings are not used during the making of the borehole are also eliminated.

According to the second embodiment of the invention the tool rotation device and the rotary casing-oscillator device are coaxial and superimposed on each other and are associated with each other by a transmission assembly, for instance of an epicyclic type.

The transmission assembly acts also as a multiplier of torque between the tool rotation device and the rotary casing-oscillator device, thus making available for the operation of insertion of the casing in the ground a twisting moment, and therefore a torque, much greater than that required for the insertion of the rotary drilling tool in the ground.

The transmission assembly includes vertically movable coupling flange means having a first coupling position and a second disconnected position.

In the first coupling position of the coupling flange means the rotary casing-oscillator device is rotatably connected to the drilling tool rotation device and is driven therewith but at a reduced angular speed.

When the coupling flange means is in the second disconnected position, the rotary casing-oscillator device is rotatably released from the tool rotation device, which is thus the only device to be driven.

In this way, when so required by the operations, such as for the making of boreholes in ground of a consistency such as not to require the employment of casings for instance, it is possible to rotate the rotary tool while keeping the rotary casing-oscillator device halted.

According to an advantageous form of embodiment, the coupling flange means comprise a pair of facing anchorage flanges including a first anchorage flange having anchorage elements of a male type (or female type) which cooperate momentarily with a coordinated plurality of anchorage elements of a female type (or male type) having a mating form and included in the second anchorage flange of the coupling flange means associated with the transmission assembly governing the rotary casing-oscillator device.

The momentary cooperation between the first and second anchorage flanges is obtained by an axial movement performed by raising/lowering one anchorage flange in relation to the other anchorage flange by means of actuator means, for instance.

The attached figures are given as a non-restrictive example and show two preferred embodiments of the invention as follows:-

Fig.1 is a diagram of a partial longitudinal section of a first form of embodiment of the rotary casing-oscillator device according to the invention;

Fig.2 shows a variant of the device of Fig.1;

Fig.3 shows in a reduced scale a cross-section of the device of Fig.2 along the line A-A.

The reference number 10 in the attached figures denotes generally a rotary casing-oscillator device according to the invention.

The rotary casing-oscillator device 10 according to the invention is fitted to an excavation machine with rotary tools which is employed in the field of foundations for the purpose of making a borehole and for the simultaneous insertion of a tubular casing for the production of piles.

The excavation machine to which the invention is applied has the rotary casing-oscillator device 10 coaxial with, and positioned below, the tool rotation device 13.

In a first embodiment of the invention shown in Fig.1 the tool rotation device 13 is driven by a first motor, not shown here, by means of a first gearwheel 11 shown only partly, whereas the rotary casing-oscillator device 10 is driven by a second motor 14 independent of the first motor.

In this case the second motor 14 cooperates with a second gearwheel 20 associated with a transmission assembly 15 of an epicyclic type.

This epicyclic train 15 acts as a torque multiplier and transmits motion to the rotary casing-oscillator device 10 according to the invention.

According to this embodiment of the invention it is possible to drive the rotary casing-oscillator device 10 independently of the tool rotation device 13, depending on the specific requirements.

In a second embodiment of the invention shown in Figs.2 and 3 the rotary casing-oscillator device 10 and the tool rotation device 13 are associated with each other in a manner such that they can be momentarily deactivated.

According to this embodiment the rotary casing-oscillator device 10 is associated with the tool rotation device 13 by means of a transmission assembly 115 which can be momentarily deactivated.

In this case the excavation machine comprises only one motor, which is not shown here and which transmits rotary motion by means of the first gearwheel 11 to the tool rotation device 13 and to the rotary casing-oscillator device 10 when so required by the operations.

In this case, the transmission assembly 115 comprises coupling flange means 16 and the epicyclic train 15, which acts as a torque multiplier to impart to the rotary casing-oscillator device 10 a speed and a torque such as will ensure the insertion of the casing in the ground.

The coupling flange means 16 comprise a first anchorage flange 16a and a second anchorage flange

16b, which are superimposed on each other and are associated respectively with the tool rotation device 13 and with the rotary casing-oscillator device 10.

According to this embodiment the coupling flange means 16 enable the rotary casing-oscillator device 10 to be released from the tool rotation device 13 in a simple, automatic and remote-controlled manner.

In this example the tool rotation device 13 includes on its lower side the solidly fitted second gearwheel 21, on which the first anchorage flange 16a is installed so as to be vertically movable but rotatably clamped.

The coupling flange means 16 have a first coupling position, in which the two anchorage flanges 16a, 16b are rotatably clamped to each other, and a second disconnected position, in which the two anchorage flanges 16a, 16b are rotatably released from each other and are free to rotate independently.

The first anchorage flange 16a of the coupling flange means 16 is solidly associated with lifting/lowering means 19, which in this example consist of diametrically opposed actuators 12.

These lifting/lowering means 19 enable the first anchorage flange 16a to be distanced from the second anchorage flange 16b so as to release the rotary casing-oscillator device 10 from the tool rotation device 13.

In this case, the first anchorage flange 16a comprises a plurality of peripherally arranged seating or holes 17, with which there cooperates momentarily a coordinated plurality of pins 18 having a mating form and included on the upper surface of the second anchorage flange 16b associated with the rotary casing-oscillator device 10.

By operating the lifting means 19 it is therefore possible to release the pins 18 from the seatings 17 and thus to release the rotary casing-oscillator device 10 from the tool rotation device 13.

tor device (10) is set in rotation by the tool rotation device (13), and a second disconnected position.

4. Rotary casing-oscillator device (10) as in Claim 3, in which the coupling flange means (16) comprise a first anchorage flange (16a) associated with the tool rotation device (13), and a second anchorage flange (16b) associated with the rotary casing-oscillator device (10).
5. Rotary casing-oscillator device (10) as in Claim 3 or 4, in which the first anchorage flange (16a) is associated with lifting/lowering means (19).
6. Rotary casing-oscillator device (10) as in any of Claims 3 to 5 inclusive, in which the first anchorage flange (16a) includes anchorage elements of a male/female type (18) cooperating momentarily with a coordinate plurality of anchorage elements of a female/male type (17) having a mating form and associated with the second anchorage flange (16b).

Claims

1. Rotary casing-oscillator device (10) for excavation machines with rotary tools, the device being associated and coaxial with a device (13) for the rotation of a drilling tool for the obtaining of foundation piles, the drilling tool rotation device (13) having its own motor, the rotary casing-oscillator device (10) being characterised in that it is located in a position below the drilling tool rotation device (13) and is associated with a reduction-gear and torque-multiplier transmission assembly (15, 115).
2. Rotary casing-oscillator device (10) as in Claim 1, which has available its own motor (14).
3. Rotary casing-oscillator device (10) as in Claim 1, in which coupling flange means (16) are included between the drilling tool rotation device (13) and the rotary casing-oscillator device (10) and have a first coupling position, in which the rotary casing-oscilla-

