

ANCHORING KIT FOR A DRILLING MACHINE

Background of the invention

5 The present invention relates to the field of drilling in the soil, in particular with a view to manufacturing foundations, such as for example continuous screens consisting of juxtaposed concrete wall elements.

It concerns more specifically the field of drilling machines for performing excavations in the soil along a substantially vertical drilling direction.

10 In order to perform such an excavation, it is known to use a drilling machine comprising a frame carrying a drilling module. The frame is generally suspended from a cable that extends from the end of the mast of a tracked carrier. The drilling module includes cutting members, most often cutting drums that are rotatably mounted about axes of rotation
15 perpendicular to the drilling path. Such a machine is generally called a milling cutter.

Most of the drilling machine models available on the market are not suitable for drilling hard or very hard soils. This type of standard machine allows forming in the soils such as clay, sand or soft rocks, but generally
20 not in inhomogeneous soils including hard rock or limestone.

In order to drill such types of soils, it is known to use machines provided with anchoring modules, as described in document EP 0 811 724 or WO2017042499. However, these machines are very specific and more expensive than standard machines. In addition, it is sometimes difficult for
25 an operator to have on the same construction site a standard machine and a specific machine for hard soils, for both cost and logistical reasons.

Object and summary of the invention

An aim of the present invention is to overcome the aforementioned drawbacks by proposing an anchoring kit that can be mounted on an existing standard drilling machine.

5 To do so, the invention relates to an anchoring kit for a drilling machine provided with a frame carrying a drilling module, the anchoring kit including at least a first anchoring module which comprises:

 a first part including an anchoring device for immobilizing the first part in the soil;

10 a second part including a fixing device for fixing the second part to the frame, the second part cooperating with the first part;

 a displacement device for moving the second part relative to the first part along a first direction.

15 The anchoring kit according to the invention is preferably intended for a standard drilling machine for making vertical trenches in the soil.

 The frame of the drilling machine extends along a longitudinal direction, which is generally vertical.

20 It is understood that the anchoring kit according to the invention is provided to be mounted on an existing standard machine without an anchoring module. By "anchoring module" is meant a module for immobilizing a part of the drilling machine in the soil, by bearing on the walls of the trench.

25 The anchoring kit therefore constitutes a structural unit distinct from the drilling machine which is added onto an existing and operational drilling machine. The anchoring kit is mounted to the drilling machine through the fastening device that fixes the second part to the frame.

 The anchoring device is advantageously configured to immobilize the first part in the soil.

30 It is also understood that the fixing device allows fixing the second part to the frame of the standard drilling machine. The fixing device is

advantageously dismountable in order to be able to dismount the anchoring kit when the latter is no longer useful.

When the anchoring device is actuated, the first part is immobilized in the soil. It is in particular blocked along the vertical direction. Then, when
5 the displacement device is actuated, the second part is moved relative to the first part which remains fixed. The displacement device therefore applies a force on the second part, which force is transmitted to the frame and to the drilling module. The fact that the first part is immobilized in the soil allows applying a significant force to the drilling module, which facilitates
10 the drilling of hard grounds.

Preferably, the displacement of the second part relative to the first part is a translation.

The second part preferably includes a guide pad to facilitate the vertical sliding of the second part along a wall of the trench.

15 In order to allow the relative displacement of the first part relative to the second part, the displacement device advantageously includes an actuator connected to the first part and to the second part of the first anchoring module. The actuator is advantageously disposed between the first part and the second part of the first anchoring module.

20 According to the embodiment envisaged, this actuator can exert a push or a pull on the second part.

Without departing from the scope of the present invention, it is possible to provide several actuators between the first and the second part.

Preferably, the anchoring kit is supplied with energy by the drilling
25 machine.

Preferably, the actuator comprises a hydraulic cylinder, and the anchoring kit further includes a hydraulic fitting connected to the hydraulic cylinder, the hydraulic fitting being configured to be connected to a hydraulic hose of the frame.

The presence of the hydraulic fitting allows easy mounting of the anchoring kit to the standard drilling machine and quick implementation of the anchoring kit to the drilling machine.

Advantageously, the anchoring device includes a first and a second
5 anchoring pad which are deployable along a second direction transverse to the first direction, the direction of deployment of the first pad being opposite to the direction of deployment of the second pad.

When the drilling machine equipped with the anchoring kit is disposed in the trench and when the anchoring device is actuated, the first
10 and second anchoring pads are deployed and bear against the opposite walls of the trench, preferably the two largest walls, which immobilizes the first part in the trench.

Without departing from the scope of the present invention, the first and second anchoring pads can alternately be deployed so as to bear
15 against the two smallest walls of the trench.

Preferably, the first part further includes a body, and the anchoring device includes an actuator connected to the first and second pads, the actuator being slidably mounted relative to the body along a third direction transverse to the first direction.

20 Thanks to this mounting called "floating" mounting, the anchoring of the anchoring device in the trench does not cause the displacement of the body along the third direction. One advantage is to avoid moving the frame during the anchoring in the trench, which allows not deflecting the drilling path.

25 Advantageously, the first anchoring module further includes a guide system for guiding the displacement of the frame relative to the first part. This guidance is advantageously carried out along the first direction. Preferably, the guide system has the function of guiding the displacement of the frame in vertical translation relative to the first part. One advantage

is to avoid a deflection of the drilling module when the displacement device exerts a vertical force directed downwardly on the drilling module.

Preferably, the guide system includes a first portion and a second portion slidably mounted relative to the first portion along the first direction, in which the second portion includes members for fixing to the frame, while the first portion is fixed to the anchoring device.

According to one advantageous embodiment, the anchoring kit further includes a second anchoring module and, preferably, a connecting device for securing together the first and second anchoring modules.

Preferably, the connecting device is fixed to the first parts of the first and second anchoring modules.

Preferably, the first and second anchoring modules are fixed to each of the small faces of the frame of the drilling machine and the connecting device extends between the first and second anchoring modules. Even more preferably, the connecting device includes first and second connecting members which flank the large faces of the frame.

According to another embodiment, the connecting device includes a passage for guiding the displacement of the frame, in which the displacement device includes a first actuator disposed between the connecting device and the second part of the first anchoring module and a second actuator disposed between the connecting device and the second part of the second anchoring module.

In this embodiment, the connecting device consists of the first parts of the first and second anchoring modules.

The passage is therefore arranged in said first parts. In this configuration, the connecting device has a cross-section, with reference to the longitudinal (vertical) direction of the frame, which is larger than the cross-section of the frame.

The invention further relates to a drilling machine which includes a frame extending along a longitudinal direction and having a lower part

carrying a drilling module, said drilling machine further including an anchoring kit according to the invention, the second part of the first anchoring module being fixed to the frame.

5 Preferably, the anchoring kit further includes a second anchoring module which comprises a second part fixed to the frame.

Advantageously, the lower part of the frame is provided with a pump, said drilling module being provided with cutting drums rotating about axes perpendicular to the longitudinal direction, in which the length of the drilling machine is less than 7 meters.

10 Such a machine is generally called "milling cutter". More particularly, this drilling machine is a compact milling cutter as its length is less than 7 meters.

Preferably, the length of the kit is substantially equal to the length of the frame.

15 According to a preferred but not exclusive embodiment, the second part is disposed between the first part and the drilling module. It is therefore understood that the displacement device exerts a vertical push directed downwardly on the first part, and therefore on the frame.

20 Without departing from the scope of the present invention, it could be provided that the first part to be disposed between the second part and the drilling module. In this case, the displacement device exerts a pull on the frame directed downwardly.

25 The invention also relates to a method for modifying a drilling machine, in which there is provided a drilling machine with a frame extending along a longitudinal direction, the frame having a lower part carrying a drilling module, method in which:

an anchoring kit according to the invention is provided;

the second part of the first anchoring module of the anchoring kit is fixed to the frame so that the first direction is parallel to the longitudinal direction.

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When the anchoring kit includes a second anchoring module, the modification method according to the invention includes fixing the second part of the second anchoring module to the frame, on the face opposite to the one receiving the second part of the first anchoring module.

- 5 Preferably, after having mounted the first and second anchoring modules, the aforementioned connecting device is put in place in order to connect together the first and second anchoring modules.

When the drilling machine includes one or more guide module(s) disposed along the small faces of the frame, the modification method
10 includes a step of previously dismounting said guide module(s) before fixing the second part(s) to the small faces of the frame.

Brief description of the drawings

The invention will be better understood upon reading the following
15 description of embodiments of the invention given by way of non-limiting examples, with reference to the appended drawings, wherein:

- Figure **1** is a drilling machine of the compact milling cutter type, known besides;
- Figure **2** illustrates the drilling machine of Figure **1** equipped with
20 an anchoring kit according to a first embodiment of the invention, the displacement device being retracted;
- Figure **3** illustrates the machine of Figure **2**, the displacement device being deployed to exert on the drilling module a force directed downwardly;
- Figure **4** is a detailed view of the anchoring kit according to the
25 first embodiment;
- Figure **5** is a schematic illustration, in side view, of the machine of Figure **3**;

- Figure **6** illustrates the drilling machine of Figure **1** equipped with an anchoring kit according to a second embodiment of the invention, the displacement device being deployed;
- 5 - Figure **7** illustrates the machine of Figure **6**, the displacement device being retracted to exert on the drilling module a force directed downwardly;
- Figure **8** illustrates the drilling machine of Figure **1** equipped with an anchoring kit according to a third embodiment of the invention, the displacement device being in the retracted position; and
- 10 - Figure **9** illustrates the machine of Figure **8**, the displacement device being deployed.

Detailed description of the invention

Figure **1** schematically illustrates a drilling machine **10** which is used to perform an excavation in a soil **S**. This drilling machine **10**, known besides, is a compact milling cutter having a height **H** on the order of 5 m.

The drilling machine **10** includes a frame **12** having an upper end portion **12a** which is fixed to lift cables **14**. In known manner, the lift cables **14** are connected to the upper end of a mast of a carrier, for example a tracked carrier (not illustrated here).

The frame **12** has a lower end portion **12b** which carries a drilling module **16**. In a known manner, the drilling module **16** includes cutting drums **18** which are rotatable about axes of rotation **Y**, **Z** perpendicular to the longitudinal axis **X** of the frame **12**. In this example, the longitudinal axis **X** of the frame is vertical, while the axes of rotation **Y**, **Z** of the rotary drums are horizontal.

The drilling machine **10** further includes a suction member **15** connected to a duct **17** for sucking and removing the cuttings mixed with the drilling mud.

In order to facilitate the sliding of the drilling machine **10** along the walls of the trench, the frame **12** is equipped with a first guide element **20** and a second guide element **22** which are fixed to the smallest faces **12c**, **12d** of the frame **12**. In a known manner, the guide elements **20**, **22** include guide plates allowing the frame to slide along the walls.

Such a drilling machine **10** includes, in a known manner, the drawback of applying a load on the tool, which is too low for drilling hard grounds or on re-bitten panels.

In order to overcome this drawback, the drilling machine **10** of Figure **1** is modified according to a modification method in accordance with the invention to mount an anchoring kit therein in accordance with the present invention.

It is therefore understood that the anchoring kit **100** constitutes an added structural unit which is distinct from the drilling machine **10**.

Three embodiments of the anchoring kit according to the present invention will be described below, as well as the modification method according to the present invention.

In Figure **4**, an anchoring kit **100** according to a first embodiment of the invention is illustrated.

The anchoring kit **100** includes a first anchoring module **110** which comprises a first part **112** including an anchoring device **114** for immobilizing the first part in the soil.

The anchoring device **114** will be described in more detail below.

The first anchoring module **114** further includes a second part **116** which includes a fixing device **118** for fixing the second part **116** to the frame **12**. In this example, the fixing device **118** includes for example bolts **119**.

It can also be observed that the second part **116** cooperates with the first part **112**. More specifically, the first anchoring module **110** includes a displacement device **122** for moving the second part **116** relative to the

first part **112** along a first direction **A**. It can be observed that, when the first anchoring module is mounted to the frame, the first direction **A** is parallel to the longitudinal direction **X** of the frame, these two directions being substantially vertical.

5 In this example, the displacement device **122** includes an actuator **124** connected to the first part **112** and to the second part **116**. The actuation of the actuator **124** has the effect of moving the second part **116** relative to the first part **112** in translation along the first direction **A**. In this example, the actuator **124** comprises a hydraulic cylinder **126**. In order to
10 allow supplying the hydraulic cylinder **126** with hydraulic fluid, the anchoring kit **100** further includes a hydraulic fitting **130** which is connected to the cylinder **126** and which is also configured to be connected to a hydraulic hose **13** of the frame **12**.

Referring to Figures **1**, **2**, **3** and **4**, it is understood that the fixing
15 device **118** allows securing, in a removable manner, the second part **116** to the first small face **12c** of the frame **12**.

The fixing device also allows dismounting the anchoring kit when the latter is no longer needed. Referring to Figures **4** and **5**, it can be observed that the anchoring device **114** includes a first and a second anchoring pad
20 **140**, **142** which are deployable along a second direction **B** transverse to the first direction **A**. It is also understood that the direction of deployment of the first anchoring pad **140** is opposite to the direction of deployment of the second anchoring pad **142**. Figure **5** illustrates the anchoring device in the anchored position, the first and second anchoring pads **140**, **142**
25 bearing against the opposite walls **P1** and **P2** of the trench **T** excavated in the soil **S** in order to immobilize the first part **112**.

Referring to Figure **5**, it can be observed that the first part **112** further includes a body **144**, and the anchoring device **114** includes first and second actuators **146**, **148**. In this example, hydraulic cylinders are
30 respectively connected to the first and second anchoring pads **140**, **142**.

The actuators **146**, **148** are slidably mounted relative to the body **144** along a third direction **C** transverse to the first direction **A**. In this example, the second and third directions **B**, **C** are parallel. This floating mounting has the effect of anchoring the first part **112** in the soil without modifying the position of the body **144**, which allows not modifying the position of the drilling module during anchoring. One advantage is not to deflect the drilling path during anchoring.

Referring again to Figures **2**, **3** and **4**, it can be observed that the first anchoring module **110** further includes a guide system **150** for guiding the displacement of the frame **12** in translation relative to the first part **112** along the first direction **A**.

The guide system **150**, better visible in Figure **4**, includes a first portion **152** and a second portion **154** which is slidably mounted relative to the first portion. The second portion **154** includes fixing members **156** for fixing the second portion **154** to the frame **12**. Furthermore, the first part **112** of the first anchoring module **110** includes the first portion **152** of the guide system **150**. In this example, the second portion **154** includes a rail **158**, while the first portion **152** includes a groove **160** in which the rail **158** engages, which allows defining a sliding connection between the frame **12** and the first part **112** of the first anchoring module **110**.

It is also understood that the rail **158** is securely fixed to the frame thanks to the fixing members **156**, for example bolts.

As understood from Figures **2** and **3**, the anchoring kit **100** further includes a second anchoring module **110'** which is here identical to the first anchoring module **110**.

The second anchoring module **110'** also includes a first part **112'** provided with an anchoring device **114'**, and a second part **116'** intended to be fixed to the frame **12**. It further includes a fixing device **118'** to the frame, as well as a displacement device **122'**.

As illustrated in Figures **2** and **3**, the anchoring kit **100** further includes a connecting device **170** for securing together the first and second anchoring modules **110**, **110'**. In this example, the connecting device **170** is arranged to secure together the first parts **112**, **112'** of the first and second anchoring modules **110**, **110'**. The connecting device here consists of bars **172**, **174** forming a rigid element which connects the first parts to each other.

Thanks to Figures **2** and **3**, it is understood that when the anchoring devices of the first parts of the first and second anchoring modules **110**, **110'** are actuated, said first parts are immobilized in the soil. In Figure **2**, the displacement devices are in the retracted position. The subsequent actuation of the displacement devices **122**, **122'** has the effect of deploying the hydraulic cylinders, which then exert a pull directed downwardly on the second parts of the first and second anchoring modules, and therefore on the frame and afterwards on the drilling module. As explained above, one advantage is to facilitate the drilling in the presence of hard ground.

In the example of Figures **2** to **4**, the second part **116** of the first anchoring module is disposed between the first part **112** and the drilling module **16**. Thanks to Figures **6** and **7**, a second embodiment of the anchoring kit **200** according to the present invention will now be described.

The anchoring kit **200** is mounted on the drilling machine **10** illustrated in Figure **1**. Like the first embodiment, the anchoring kit **200** includes a first anchoring module **210** which comprises a first part **212** including an anchoring device **214** for immobilizing the first part **212** in the soil, as well as a second part **216** including a fixing device **218** for fixing the second part to the frame **12**, the second part **216** cooperating with the first part **212**.

The anchoring kit **200** also includes a displacement device **222** for moving the second part **216** relative to the first part **212** along the first direction **A**.

It is understood from Figures **6** and **7** that the anchoring kit **200** according to the second embodiment is very similar to the anchoring kit **100** according to the first embodiment which has been described above. Said anchoring kit **200** includes anchoring devices **214, 214'**, as well as displacement devices **222, 222'** comprising hydraulic cylinders. The second embodiment of the anchoring kit **200** differs from the first embodiment in that the first part is disposed between the second part and the drilling module. In Figure **6**, the displacement devices **222, 222'** are in the deployed position. When the anchoring devices **214, 214'** are actuated, that is to say when the first part is immobilized in the soil, the actuation of the displacement devices **222, 222'** has the effect of bringing the cylinders of the displacement devices **222, 222'** in the retracted position, which exerts a pull directed downwardly on the second part **216**, which therefore causes a pull on the frame **12** and therefore on the drilling module **16**.

Thanks to Figures **8** and **9**, a third embodiment of the anchoring kit **300** according to the invention will now be described. Here again, the anchoring kit **300** is mounted on the drilling machine **10** illustrated in figure **1**.

The third embodiment of the anchoring kit **300** differs from the first embodiment in that the connecting device **370** which links together the first parts **312, 312'** of the first and second anchoring modules **310, 310'** includes a passage **372** for guiding the displacement of the frame **12** along the longitudinal direction **X**. Seen otherwise, the first parts **312, 312'** of the first and second anchoring modules **310, 310'** form a single piece. In this example, this single part includes an anchoring device **314** provided with a pair of large anchoring pads **315** which extend along the width of the drilling machine. Also, in this example, the second part **316** of the first anchoring module **310** is also disposed between the first part **312** of the first anchoring module **310** and the drilling module **16**.

This anchoring kit **300** includes a first actuator **323** disposed between the connecting device **370** and the second part **316** of the first anchoring module **310** and a second actuator **325** disposed between the connecting device **370** and the second part **316'** of the second anchoring module **310'**.

When the anchoring device **314** is actuated, the first part is immobilized in the soil. Like the first embodiment, the first and second actuators **323**, **325** are in the retracted position, as illustrated in Figure **8**, and the actuation of the displacement device **322** has the effect of deploying the first and second actuators **323**, **325**, which generates a push directed downwardly on the frame **12** and on the drilling module **16**.

CLAIMS

1. An anchoring kit (100, 200, 300) for a drilling machine (10) comprising a frame (12) which carries a drilling module (16), the anchoring kit including at least a first anchoring module (110, 210, 310) which comprises:
5 a first part (112, 212, 312) including an anchoring device (114, 214, 314) for immobilizing the first part (112, 212, 312) in the soil;
 a second part (116, 216, 316) including a fixing device (118, 218) for fixing the second part (116, 216, 316) to the frame (12),
10 the second part (116, 216, 316) cooperating with the first part (112, 212, 312);
 a displacement device (122, 222, 322) for moving the second part (116, 216, 316) relative to the first part (112, 212, 312) along a first direction (A).
15
2. The anchoring kit according to claim 1, wherein the displacement device (122, 222, 322) of the first anchoring module includes an actuator (124) connected to the first part (112, 212) and to the second part (116, 216, 316) of the first anchoring module.
20
3. The anchoring kit according to claim 2, wherein the actuator (124) comprises a hydraulic cylinder (126), and wherein the anchoring kit (100, 200, 300) further includes a hydraulic fitting (130) connected to the hydraulic cylinder, the hydraulic fitting being configured to be
25 connected to a hydraulic hose (13) of the frame (12).
4. The anchoring kit according to any one of the preceding claims, wherein the anchoring device (114) includes a first and a second anchoring pad (140, 142) which are deployable along a second
30 direction (B) transverse to the first direction (A), the direction of

deployment of the first anchoring pad (140) being opposite to the direction of deployment of the second anchoring pad (142).

5 5. The anchoring kit according to claim 4, wherein the first part (112) further includes a body (144), and the anchoring device (114) includes at least one actuator (146, 148) connected to the first and second anchoring pads, the actuator being slidably mounted relative to the body along a third direction (C) transverse to the first direction (A).

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6. The anchoring kit according to any one of the preceding claims, wherein the first anchoring module (110) further includes a guide system (150) for guiding the displacement of the frame (12) relative to the first part (110).

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7. The anchoring kit according to claim 6, wherein the guide system includes a first portion (152) and a second portion (154) slidably mounted relative to the first portion, wherein the second portion (154) includes members for fixing to the frame, while the first portion is fixed to the anchoring device (156).

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8. The anchoring kit according to any one of the preceding claims, characterized in that it further includes a second anchoring module (110').

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9. The anchoring kit according to claim 8, characterized in that it further includes a connecting device (170, 370) for securing together the first and second anchoring modules (110, 110').

10. The anchoring kit according to claim 9, wherein the connecting device (370) includes a passage (372) for guiding the displacement of the frame (12), wherein the displacement device (322) includes a first actuator (323) disposed between the connecting device and the second part (316) of the first anchoring module (310) and a second actuator (325) disposed between the connecting device (370) and the second part (316') of the second anchoring module (310').
11. A drilling machine (10) including a frame (12) extending along a longitudinal direction (X) and having a lower part (12b) carrying a drilling module (16), said drilling machine further including an anchoring kit (100, 200, 300) according to any one of the preceding claims, the second part (116, 216, 316) of the first anchoring module (112, 212, 312) being fixed to the frame (12).
12. The drilling machine according to claim 11, wherein the lower part of the frame is provided with a pump (15), said drilling module being provided with cutting drums (18) rotating about axes (Y, Z) perpendicular to the longitudinal direction, in which the length of the milling cutter is less than 7 meters.
13. The drilling machine according to claim 11 or 12, wherein the length of the anchoring kit (100, 200, 300) is substantially equal to the length of the frame.
14. The drilling machine according to any one of claims 11 to 13, wherein the second part (116, 316) is disposed between the first part (112, 312) and the drilling module.

15. A method for modifying a drilling machine, wherein there is provided a drilling machine (10) with a frame (12) extending along a longitudinal direction, the frame having a lower part carrying a drilling module, method in which:

5 an anchoring kit (100, 200, 300) according to any one of claims 1 to 10 is provided;

 the second part (116, 216, 316) of the first anchoring module of the anchoring kit is fixed to the frame so that the first direction is parallel to the longitudinal direction.