

The present invention relates to a device for discharging the excavated material during the digging of trenches or excavations of great depth.

5 It is already known to dig trenches or excavations with the aid of cutters which are driven in rotation by hydraulic or electric means in order to break up the soil by acting at the bottom of the trench in the course of drilling, which trench is filled with mud so as to ensure the retention of its sides.

10 It is also known to discharge the excavated material via piping which takes it up to the top of the trench by transporting it with the aid of a pump while it is mixed with the mud which fills up the trench.

15 Such trenches or excavations which go down to depths of 100 to 200 metres are at present being dug, which gives rise to considerable problems as regards the piping through which the mixture of excavated material and mud is discharged.

20 As it is not possible to use lifting apparatuses of excessive height, one solution consists in interrupting the drilling in order to extend the piping which is used to discharge the excavated material by attaching a new element. This solution has the drawback of requiring an interruption to the work, which constitutes a
25 considerable waste of time and money considering the immobilisation of the very costly equipment which is necessary for this type of work.

30 The present invention relates to a device which makes it possible to dig trenches or excavations of great depth with the aid of a lifting apparatus the height of which is only a fraction of the trench depth and without it being necessary to interrupt the drilling in order to modify the structure of the device which allows the excavated material to be discharged.

35 The subject of the present invention is a device for discharging excavated material resulting from the drilling of a trench or an excavation under mud of great depth, of the type in which a drilling apparatus is

linked to a flexible piping to discharge the excavated material above the ground, characterised by the fact that the piping for discharging the excavated material comprises a first section disposed near the drilling cutters and consisting of a telescopic tube and a second section comprising a flexible tube connected to the first section at one end, while its other end terminates close to the ground at the excavated material discharge point, said second section being supported between its two ends by a pulley which is suspended from the top part of the lifting apparatus, it being possible to modify the height of the pulley in the course of the work.

According to a preferred embodiment of the invention, it is advantageous to provide a locking device enabling the two elements of the telescopic tube to be fastened together, particularly in the position in which these two elements are retracted one into the other.

According to a preferred embodiment of the invention, the second, flexible section of piping is supported by a pulley, which in turn is suspended by a cable extending downwards from the top of the lifting apparatus and wound onto a winch preferably exerting a constant force.

In this way, the flexible section of the piping automatically fits the configuration of the device which varies with the lowering of the cutters into the ground.

According to a preferred embodiment, the top part of the female element of the telescopic tube as well as the top part of the male element of said tube are held in a vertical position by means of guide bushes to which they are fastened and through which passes a cable supporting the cutting apparatus during its operation.

The device according to the invention makes it possible for example, with the aid of a lifting apparatus which has an overall height of approximately 50 metres, to dig excavations, the depth of which may reach approximately 140 metres without it being necessary to modify the structure of the device during the lowering of

the cutter in the trench.

The device according to the invention may be implemented in various ways.

In all cases, at the time when drilling starts,
5 the two elements of the telescopic tube are retracted one into the other and are locked one onto the other in such a way that the telescopic tube does not extend under the action of the upflow pressure of the excavated material, while the pulley supporting the flexible section is taken
10 up to the top of the lifting apparatus.

According to a first form of use, the pulley is then progressively lowered as the drilling advances in such a way that the telescopic tube, the two elements of which are retracted one into the other, sinks into the
15 ground as the cutter progressively descends and this continues until the moment when the top part of the telescopic tube reaches ground level.

After the two telescopic elements have been unlocked and the top of the male element is fixed at the
20 ground surface, the cutter may continue to descend, while the two elements of the telescopic tube move progressively away from each other to their maximum distance.

It is then sufficient to release the male element
25 from its fastening to the ground surface and to allow the pulley which supports the flexible section of the piping to progressively descend until it is close to the ground so that the maximum excavation depth may be reached.

According to another form of use, starting from
30 the initial position, it is possible to start drilling by bringing the pulley down and by leaving the two elements of the telescopic tube inserted one inside the other, then, once the greatest depth which may be reached using this configuration has been obtained, it is sufficient to
35 take the cutter up in order to unlock the two elements of the telescopic tube and to move them into a separated position, which makes it possible to dig the trench to its maximum depth.

So that the invention may be more clearly understood, one of its embodiments, taken as an example and shown in the drawing, will now be described with no limitation being implied.

5 In this drawing;

- Figure 1 shows a diagrammatical view in elevation of a device according to the invention,

- Figures 2 to 5 show diagrammatical views on a smaller scale of the device according to Figure 1 in configurations corresponding to the various stages of its operation.

- and Figure 6 is a diagrammatical view of a device for holding the top part of the telescopic tube.

15 In Figure 1 may be seen the crane 1 mounted on caterpillar tracks 2 whose mast 3 of the conventional type rises to a considerable height which may be for example some tens of metres.

20 The cutting apparatus 4, shown diagrammatically, can also be seen and is intended to dig the trench 5 in the ground while being suspended from the top of the crane by one or several cables which are not shown.

25 The cutters are driven in rotation with the aid of electric or hydraulic motors which are supplied from the crane or from a power unit by leads which are not shown.

30 In accordance with the invention, the discharge of the excavated material from drilling mixed with the trench mud, is carried out according to the invention with a piping which comprises a first telescopic section 6 consisting of a female element 6a inside which a male element 6b may slide, which male element itself forms a tube allowing the excavated material and mud to flow.

35 In accordance with a preferred embodiment of the invention, a locking device which is not shown allows the element 6b to be immobilised relative to element 6a, in particular in the position where these two elements are completely retracted one into the other, as can be seen in Figure 1.

Figure 1 also shows the second section 7 of flexible piping, one end 7a of which is linked to the end of the element 6b and the other end 7b of which terminates close to the ground at the piping for
5 discharging the excavated material in an appropriate location with separation and possible recovery of the mud.

In accordance with the invention, the flexible piping section 7 is supported by a pulley 8 itself
10 suspended from a cable 9 passing over a pulley 10 at the top of the crane mast 3, in such a way that from the ground, it is possible to displace the pulley 8 at will in order to make it go up or down relative to the top of the crane.

15 According to a preferred embodiment of the invention, the other end of the cable 9 is linked to a winch which exerts a constant force on it, which thus makes it possible to automatically match the position of the pulley 8 to the lowering of the cutter.

20 The device according to the invention is shown in Figure 1 in its highest position, the male element 6b being retracted as much as possible into the female element 6a of the telescopic section 6, and the pulley 8 being taken up in its highest position relative to the
25 top of the crane.

In this configuration, the cutters are located slightly above the ground.

It is understood that the continuity in discharging the excavated material as the cutting apparatus 4 is
30 lowered may be ensured from this position by means of the invention, either by lowering the pulley 8, or by displacing the element 6b relative to the element 6a while causing the telescopic tube section 6 to extend, or by combined use of these two movements.

35 It is also understood that the extent of the descent of the cutter 4 corresponds approximately to twice the height of the lifting apparatus plus the increase in length of the telescopic section 6 which

corresponds to the maximum projection of the element 6b out of the element 6a.

5 It is thus possible to dig excavations a depth greater than 90 m with a crane the jib top of which is located approximately 30 metres from the ground and with a telescopic section which, in the retracted state, has a length of approximately 30 m.

The various stages of one use of the device according to the invention are shown in Figures 2 to 5.

10 Figure 2 shows the device in its initial position in which the male element 6b of the telescopic tube is completely retracted into the female element 6a, the pulley 8 being brought back to the top of the lifting apparatus.

15 In this position, the cutters are located at approximately ground level, and the elements 6a and 6b are secured to each other by any suitable device placed at the top part of the telescopic tube.

20 In the embodiment described, the cable 9 which supports the pulley 8 is linked to a constant-torque winch so that the pulley 8 is subjected to an upward force sufficient to hold the flexible piping section 7 while being able to follow the lowering movement of the cutters which progressively sink into the ground while digging the trench.

25 The stage shown in Figure 3 in which the top part of the telescopic tube is located close to the ground surface is thus arrived at.

30 The elements 6a and 6b of the telescopic tube are then uncoupled and under the action of the cable 9, the pulley 8 is brought back upwards until the male element 6b of the telescopic tube is totally extracted from the female element 6a. While continuing to dig with the aid of the cutters, the assembly progressively sinks into the ground as shown in Figure 4.

35 The male element 6b enters first of all in its entirety into the trench while being followed by the bottom end of the flexible tube section 7.

The stage shown in Figure 5 which corresponds to the maximum depth for the cutting apparatus is thus arrived at.

In this figure, for reasons of drawing clarity, the male element 6_b of the telescopic tube has been shown in a truncated manner, i.e. shorter. The same applies to the bottom part of the flexible tube 7.

It is indeed understood that in the maximum depth position corresponding to Figure 5, the elements 6_a and 6_b of the telescopic tube have remained in the position of Figure 4 while the bringing down of the pulley 8 has allowed the greater length of the flexible tube 7 to enter into the top of the trench.

Needless to say the description which has just been given of the device according to the invention does not limit the use which can be made of it.

In particular, it is clear that without necessarily departing from the scope of the invention, the cutter may be lowered as much as possible while holding the telescopic tube in the retracted state and while bringing the pulley 8 down to the position of Figure 5. Following which, after having taken the instrument back up, the elements of the telescopic tube are placed in the separated state, which makes it possible to deepen the trench by a height corresponding to that of the telescopic tube.

A guiding device which makes it possible to hold the elements of the telescopic tube in a vertical position is shown in Figure 6.

This device is useful firstly for guiding the male element 6_b when it is raised from the female element 6_a and secondly also for holding the top part of the female element 6_a in the case where the telescopic tube stands substantially higher than the chassis of the cutting apparatus as is the case in the embodiment shown in Figure 1.

The female element 6_a of the female telescopic tube 6_a in which the male element 6_b slides is again

shown in Figure 6.

The sealing joint located between these two elements has been diagrammatically shown at 11.

As before, the top part of the male element 6b is
5 linked to the end of the flexible piping 7.

It is understood that in the case where the element 6b is brought into a lengthened position relative to the element 6a, the telescopic tube may rise to a height of several tens of metres above the frame of the
10 cutting apparatus.

Furthermore, as the flexible tube 7 is capable of being subjected to movements resulting from the pumping of the excavated material, it is understood that the top part of the telescopic tube should preferably be held in
15 line with its bottom part.

This is achieved in accordance with the invention by fixing close to the top end of the female element 6a an arm 13 which engages onto the outer surface of the female tube 6a via a screw socket 14 and which comprises
20 a bush 15 through which the cable 12 which supports the cutting apparatus 4 passes.

It is indeed known that this type of device comprises cutting apparatuses of a considerable weight and which it is necessary to support with the aid of one
25 or several cables which terminate at the top of the lifting apparatus and which make it possible, by the tension which is exerted on them, to determine the bearing pressure exerted on the ground by the cutting apparatus.

The result is that this or these support cables are perfectly vertical and in line with the cutting
30 apparatus.

In this way, such a cable forms a perfectly effective guiding support.

As has been shown in Figure 6, a second arm 16 is
35 fixed with the aid of a screw socket 17 onto the top part of the male element 6b and is equipped with a bush 18 inside which the cable 12 passes.

In the case of a male element 6b of great length, it is also possible to arrange one or several other arms equipped with bushes between the sealing joint 11 and the arm 16 which has just been described.

5 Such arms must of course be loosened and pushed back upwards when the male element 6b is made to retract into the female element 6a.

10 It is perfectly clear that the embodiments which have been described above imply no limitation and may be modified in any desired manner without thereby departing from the scope of the invention defined by the claims.



CLAIMS

1. Device for discharging excavated material resulting from the drilling of a trench or an excavation under mud of great depth, of the type in which a drilling apparatus is linked to a flexible piping to discharge the excavated material above the ground, characterised by the fact that the piping for discharging the excavated material comprises a first section (6) disposed near the drilling cutters (4) and consisting of a telescopic tube (6a, 6b) and a second section comprising a flexible tube (7) connected to the first section at one end, while its other end terminates close to the ground at the excavated material discharge point, said second section (7) being supported between its two ends by a pulley (8) which is suspended from the top part of the lifting apparatus (1), it being possible to modify the height of the pulley (8) in the course of the work.
2. Device according to Claim 1, characterised by the fact that it includes a locking device enabling the two elements (6a, 6b) of the telescopic tube to be fastened together, particularly in the position in which these two elements are retracted one into the other.
3. Device according to either of the preceding claims, characterised by the fact that the second, flexible section (7) of the piping is supported by a pulley (8), which in turn is suspended by a cable (9) extending downwards from the top of the lifting apparatus (1) and wound onto a winch exerting a constant force.
4. Device according to any one of the preceding claims, characterised by the fact that the top part of the female element (6a) of the telescopic tube and/or the top part of the male element (6b) of said tube are held in a vertical position by means of guide bushes (15, 18) to which they are fastened and through which passes a cable (12) supporting the cutting apparatus (4) during its operation.