VIBRATORY DEVICE FOR TAKING BOTTOM SEDIMENTS CORES

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A vibratory device for taking bottom sediments cores, comprising a string of pipes deepened into the ground by means of a vibrator disposed thereon. In accordance with the present invention it is provided with an arrangement connected with the vibrator and providing for periodical engagement and disengagement of the vibrator with the string of pipes, and a hoist providing for periodical displacement of the vibrator which is originally disposed on the lower portion of the string of pipes up the latter as it is being deepened, and operatively coupled with the engaging arrangement.

4 Claims, 4 Drawing Figures
FIG. 4
VIBRATORY DEVICE FOR TAKING BOTTOM SEDIMENTS CORES

The present invention relates to devices for taking bottom sediments cores.

Known in the art are devices for taking bottom sediments cores, for example, the device according to U.S. Patent No. 3,434,551 (Cl. 175—6), which comprises a string of pipes, a vibrator secured at the upper end of said of pipes and actuated by an electric or hydraulic drive, a piston disposed inside the string of pipes, and a system for stabilizing the string of pipes in the vertical position after it reaches the sea bottom. The stabilizing system consists of a load platform installed at the sea bottom and hinge-connected to the string of pipes, due to which fact the string of pipes is kept in the vertical position, and a float connected to the load platform of the system by guide cables, the piston disposed inside the string of pipes being connected to the float by a cable.

When the string of pipes is deepened into the bottom under the action of the vibrator, the piston which remains at the level of the sea bottom provides for filling up of the string of pipes with a non-deformed core of sediments due to the fact that the latter is pressed against the piston under the action of vacuum built up in the string of pipes.

The afore-described device, as well as other similar conventional devices, is disadvantageous in that the vibrator is disposed at the upper end of the string of pipes and, therefore, only a relatively short string of pipes (not longer than 20 m) can be deepened into the ground and, consequently, only small cores of bottom sediments can be taken.

In case its length is increased, the string becomes unstable vertically and bends under the weight of the vibrator. For instance, a string of pipes of the diameter of 60–70 mm becomes unstable when its length is 15–20m, the greater part of the energy of the vibrator being absorbed in this case by elastic vibrations of the string.

It is possible to raise the vertical rigidity of the string of pipes by increasing its diameter, but this is exterminally undesirable as it sharply increases the weight and overall dimensions of the device.

It is an object of the present invention to eliminate the above-mentioned disadvantages.

It is an object of the present invention to provide such a vibratory device for taking bottom sediments cores, that would make it possible to considerably increase the length of cores being taken.

This and other objects of the present invention are accomplished by means of a device for taking bottom sediments cores, comprising a string of pipes deepened into the ground by means of a vibrator disposed thereon, a piston freely moving in the string of pipes and fixed when a core is being taken to suck into the pipes bottom sediments under the action of vacuum built up inside the pipe when it moves in the course of deepening relative to the piston, a system to stabilize the device, which consists of a support platform, a float and guide cables. In accordance with the present invention, the device is provided with an arrangement connected with the vibrator and ensuring periodical engagement and disengagement of the vibrator with the string of pipes, and a hoist operatively connected to said arrangement and ensuring periodical displacement of the vibrator which is originally disposed on the lower portion of the string of pipes up the string as the latter is being deepened into the ground.

It is expedient to fashion the arrangement ensuring periodical engagement and disengagement of the vibrator with the string of pipes as toothed grippers connected with levers which disengage the vibrator from the string of pipes when the levers contact the load platform and engage the vibrator with the pipes when the vibrator reaches the coupling connection while moving up the string of pipes.

It is also expedient to make the hoist of the device as a draw works secured on the device and a frame coupled with the load platform, which frame unloads the float and along which the vibrator moves.

It is possible to rigidly secure the draw works on the vibrator and to secure its cable to the frame.

It is also possible to rigidly secure the draw works on the frame and to secure its cable to the vibrator.

As a result of the present invention there has been provided a device for taking cores of bottom sediments, comprising a string of pipes possessing a sufficient vertical stability and making it possible to take long (30–60m) cores of bottom sediments.

The following description of an exemplary embodiment of the present invention is given with reference to the accompanying drawings, in which:

FIG. 1 shows diagrammatically a vibratory device for taking bottom sediments cores, built according to the present invention;

FIG. 2 shows an arrangement for engaging and disengaging the vibrator with the string of pipes, in the engaged position, and a hoist, built according to the present invention;

FIG. 3 is ditto, with the arrangement in the disengaged position.

FIG. 4 shows diagrammatically a vibratory device according to the invention with a draw works rigidly secured on the frame.

A vibratory device comprises load platform 1 (Fig. 1) and platform 3 hinge-connected to the latter by means of universal joint 2. Secured on the platform 3 is vertical frame 4. Secured to the frame 4 are two guide cables 5 pulled vertically by float 6 which is somewhat sunk. Passed through the frame is string 7 of pipes 9 hung on cable 8 of the ship winch (not shown in the drawing) and consisting of separate pipes 9 connected by coupling 10. Periodically moving vibrator 11 is hung of the coupling 10 which is the lowest with respect to the ground, and is held thereon by toothed grip 12. Mounted on the vibrator 11 is draw works 13 with cable 14 whose outer end is secured to the frame 4. The lower end portion of the string of pipes accommodates a piston 34 supported by cable 15 connected to the float 6.

The vibrator 11 (FIGS. 1, 2, 3) is an electromechanical one (in FIG. 2 it is conventionally shown as a rectangle). Connected to the vibrator 11 is guide pipe 16 and upright 17 hinge-connected to which is oscillating lever 18 with draw works 13 rotated by electric motor 19. (In accordance with another variant of the device embodiment the draw works 13 can be rigidly secured on the frame 4, and its cable 14 is secured to the vibrator 11).
Cut in the guide pipe 16 are three vertical ports having three hinged toothed grips 12 passed therethrough, secured on joints 20 and used to engage the vibrator 11 with the clutch 10. The grips 12 are fixed by sleeve 21 hinge-connected with lever 18; to prevent it from arbitrarily rising the sleeve 21 is kept in the lower position by comb 22. Disposed under the comb 22 is pusher 23 used to disengage the comb 22 from the sleeve 21.

Welded to the pipe 16 is chuck 24 accommodating pin 25 of preliminary fixation, which is pressed by spring 2. The pin 25 has two ports 27 and 28 cut therein. Passed through the port 27 is rod 29 used to disengage the pin 25 from the coupling 10, and passed through the port 28 is pusher 30 which locks the pin 25 and prevents it from premature engagement with the coupling 10. The pin 25 is controlled by lever 31 whose left arm is fashioned as fork 32 engaging the pipe 9. With the coupling 10 moving downward, the fork 32 is forced by the coupling to displace downward too and takes the position as shown in FIG. 2.

To carry out the work, the vibrator is hung onto the lower coupling 10 of the string 7 of pipes 9 (Fig. 1). In the course of vibration the vibrator 11 moves downward along with the string 7 of pipes 9. At a certain moment the rod 29 (FIG. 3), reaching the platform 3, thrusts against the latter, moves upwards and disengages the pin 25 from the groove of the coupling 10. During the vibrator further lowering, the pusher 23 which is also supported by the platform 3, moves the comb 22 aside and releases the sleeve 21. Thereupon, the rod 29, while continuing to move upwards, turns the levers of switches (not shown in the drawing), thus deenergizing the vibrator 11 and simultaneously supplying electric current to the electric motor 19 of the draw works 13. The draw works 13 starts operating and winds up the cable 14 whose outer end is secured to the frame 4. The oscillating lever 18 is pulled upwards and raises the closing sleeve 21, thus releasing the grips 12. The grips are moved aside, and the vibrator 11 is hung on the cable 14.

As the cable is wound up by the draw works, the vibrator 11 is moved up along the string of pipes. After the rod 29 has left the guide pipe 16, the oscillating fork 32 lets the coupling 10 pass by and is turned clockwise under the action of the spring 33, whereupon the thickened end of the pusher 30 enters the port 28 of the pin 25. The rod 29 moves downward and its thickened portion leaves the port 27. From this time on the pin 25 is held in the retracted position by the pusher 30 only.

With the next coupling 10 passing through the guide pipe 16, the lever 31 is moved downwards by the thickened portion of the coupling 10, the pusher 30 leaves the port 28, and the pin 25 thrusts against the coupling 10 at a point which is somewhat above the groove. Concurrently, the pusher 30 turns the lever of one of the switches in the opposite direction, and the electric motor 19 of the draw works 13 is deenergized.

Under gravity the vibrator starts sliding down the string of pipes until the pin 25 enters the groove of the coupling 10 and fixes the vibrator 11 on the coupling. Both, under gravity and the action of the weights of the electric motor 19 and the draw works 13 the lever 18 moves downward together with the sleeve 21, thus releasing the grips 12 which engage the coupling 10 and are gradually locked by the sleeve 21 sliding down. Then, the comb 22 engages the sleeve 21. While continuing to move downward, the lever 18 turns in the opposite direction the lever of the second switch supplying electric current to the circuit of the vibrator 11.

The vibrator 11 starts operating, thus deepening the string 7 into the ground. The sleeve 21 is lowered until stop, thus completely engaging the grips 12 with the coupling 10. After the vibrator 11 reaches the platform 3, the cycle is repeated. After it is deepened into the ground, the string of pipes is extracted out of the ground with the aid of the cable 8 of the ship wrench, with the vibrator operating. Then, the vibrator is deenergized, and the string of pipes is taken aboard the ship.

The vibratory device of the design according to the present invention allows to considerably (approximately by three times) increase the length of the cores being taken (from 15–20 m). At the same time, there is provided vertical stability of the string of pipes due to the fact that the point at which the vibrator is fixed on the string of pipes in the course of deepening of the latter is brought much lower, and the energy of vibration is not wasted on unproductive elastic vibrations of the string of pipes.

The fact that the vertical assembly of the string of pipes can be effected outside the ship makes it possible to use the vibratory device according to the present invention on small-tonnage ships (beginning with displacement of 60 tons).

What is claimed is:

1. A vibratory device for taking bottom sediments cores, comprising a string of pipes with coupling connections; a vibrator disposed on said string of pipes and used to deepen the latter into the ground; an arrangement providing for periodical engagement and disengagement of the vibrator with said string of pipes; a hoist providing for periodical displacement of said vibrator which is originally disposed on the lower portion of said string of pipes up the string as the latter is being deepened into the ground, and operatively coupled with said engaging arrangement; a piston freely moving in said string of pipes and fixed when a core is being taken to suck bottom sediments into the pipes under the action of vacuum built up inside the pipes during the displacement of the latter relative to the piston in the course of deepening; a system stabilizing said device and comprising a load platform mounted on the ground; a frame hinge connected with said platform and a float connected by guide cables with said frame.

2. A vibratory device according to claim 1, in which said arrangement providing for periodical engagement and disengagement of said vibrator with said coupling connections of said string of pipes comprises toothed grips, levers and pushers interacting with said levers, said levers upon contact of said pushers with said load platform urging said toothed grips to engage or disengage with said coupling connections when said vibrator moves up said string of pipes.

3. A vibratory device according to claim 1, in which said hoist is fashioned as a draw works rigidly secured on said vibrator and its cable is secured to said frame.

4. A vibratory device according to claim 1, in which said hoist is fashioned as a draw works rigidly secured on said frame and its cable is secured to said frame.

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