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Wolters

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[54] **SUCTION DREDGER WITH SWELL COMPENSATION**

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[51] **Int. Cl.** **E02f 3/90**

[58] **Field of Search** ..... 37/58, 72; 254/189, 188, 254/183, 172; 212/59 R, 59 A; 166/5; 175/5, 6, 7

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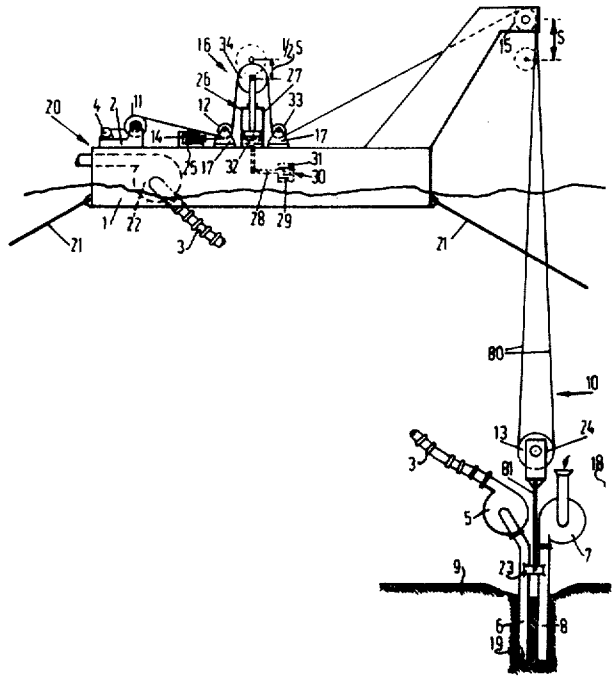
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Primary Examiner—Clifford D. Crowder
Attorney, Agent, or Firm—John P. Snyder

[57] **ABSTRACT**

The tension load on the cable suspending the nozzle and conduit of a suction dredger is reduced by employing one or more reversing sheaves at the nozzle with multiple cable passes thereover. In order to "sling" the nozzle end pulleys or sheaves and avoid movement between the slinging cable portions and the nozzle end pulleys as swell compensation is effected, the slinging pairs of cable portions are guided and maintained side-by-side and are acted upon in unison by the swell compensation device.

12 Claims, 2 Drawing Figures



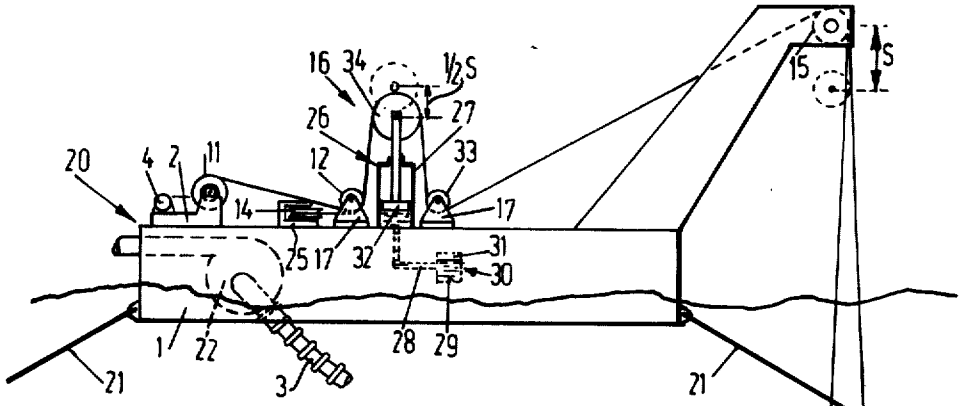

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FIG.1

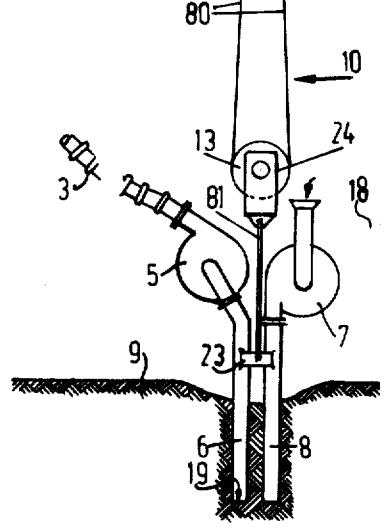
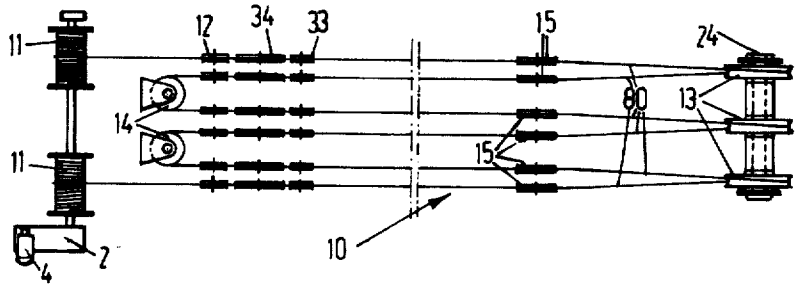

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FIG.2


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SUCTION DREDGER WITH SWELL COMPENSATION

The invention relates to an earth dredger comprising a vessel to be anchored during dredging of earth from an underwater soil and a duct suspended by at least one cable to the vessel and having a nozzle to be inserted into the soil, a plurality of cable portions extending between lower reversing discs anchored to the duct and upper reversing discs anchored to the vessel, whilst through a swell compensator comprising a cable-length varying device the cable is connected with a winch arranged on the vessel.

This known earth dredger has the disadvantage that each long, often thick and heavy lifting cable having to position part of the duct under water moves during each movement of the vessel due to the waves along the reversing discs so that this expensive lifting cable is exposed to rapid wear particularly at the immersed lower reversing discs. When the lifting cable is replaced, the operations of the earth dredger stagnate. The cable-length varying device arranged in the known earth dredger between the winch and the upper reversing discs has a long stroke in order to compensate for high swell. In this respect the invention provides an improvement in the earth dredger of the kind set forth in the preamble by arranging said plurality of cable portions via a cable-length varying device and via guide discs held by the vessel between the lower and upper reversing discs. During the wash of the waves the cable is practically not displaced with respect to the lower reversing discs owing to said arrangement of the cable-length varying device. Moreover, the stroke of the cable-length varying device is materially shortened.

When the two ends of the cable are wound on a winch drum, the cable has a minimum shift in place during the change of position of the duct.

The invention will be set out hereinafter with reference to the drawing.

The drawings show schematically:

FIG. **1** an earth dredger in accordance with the invention

and

FIG. **2** a plan view of an exploded view of the hoisting device of FIG. **1**.

The earth dredger **20** shown in FIG. **1** comprises a vessel **1**, which is anchored by means of anchor cables **21** during dredging of earth, for example, sand, from a soil **9**. The earth dredger **20** comprises furthermore a flexible duct **3** mainly consisting of a hose accommodating a pump **5** immersed under the water level **18** and a pump **22** arranged in the vessel **1**. The duct **3** has a nozzle **6** to be inserted into the soil **9** and connected by a bridge piece **23** with an outlet **8** of a pump **7** pumping the water **18** into the soil **9**. The nozzle **6** of the duct **3** is suspended to the vessel **1** by means of a cable **10**, six portions **80** of which extend, in accordance with the invention, via a cable-length varying device **26** and via six vessel-supported guide discs **15** between two upper reversing discs **14** anchored to the vessel **1** and three lower reversing discs **13** anchored to the duct **3**. The upper reversing discs **14** are journalled in bearings **25** rigidly secured to the vessel **1**, whereas the lower reversing discs **13** are journalled in a block **24**, which is connected by means of cables **81** with the bridge piece **23**. A swell compensator comprises a cable-length varying device formed by a hydraulic cylinder **27**,

which communicates through a duct **28** with an air container **30** filled with a liquid **29** and air **31** to an extent such that the upward pressure exerted on the piston **32** is sufficient to absorb the force in the cable **10**. The portions **80** of the cable **10** extend each along two guide discs **33** and **12** rotatably journalled in bearings **17** rigidly secured to the vessel **1** and along one movable guide disc **34** rotatably journalled on the piston **32**. The two ends of the cable **10** not passed along the upper reversing discs **14** are wound on two ganged winch drums **11** arranged on the vessel **1** and driven via a driving gear **2** by an engine **4**.

When the nozzle **6** is rigidly held in the soil **9**, each portion **80** of the cable **10** maintains approximately the same position relative to the winch drums **11**, the upper reversing discs **14** and the lower reversing discs **13** and the guide discs **12**, but the cable **10** will shift its position with respect to its guide discs **15**, **33** and **34**, whereas the piston **32** finds a position such that the cable **10** remains taut and the vessel **1** can follow the motion of the waves whilst the nozzle **6** substantially remains at its place. When the nozzle **6** is displaced for the suction process, the winch **11** is veered out so that the suction nozzle **19** of the nozzle **6** shifts to a greater depth in the soil **9**. In order to compensate for the motion of the waves the piston **32** moves against the air enclosed in the air vessel **30** so that the swell compensator **16** releases the cable **10** or takes up the same, whilst each lower reversing disc **13** can substantially remain stationary with respect to the cable **10**. It should be noted that the lifting cable **10** may have a plurality of portions differing from six.

In order to compensate for a movement of the waves producing a displacement of the guide discs **15** equal to S, the cable-length varying device **16** requires a displacement of not more than **1/2S**.

Instead of being formed by a hose the duct **3** may consist of three rigid tube portions pivotally connected with each other, each of which is positioned by a cable **10** in accordance with the invention.

What is claimed is:

1. In a suction dredger system comprising a buoyant vessel, and a suction dredger mounted on said vessel and including an elongate suction conduit terminating in a suction nozzle, the combination of:

a cable suspension system for suspending said nozzle from said vessel while the suction nozzle is inserted in the bottom below the vessel, said cable suspension system including at least one winch on said vessel, a cable wound on said winch and issuing therefrom, a reversing pulley connected to said suction nozzle whereby such reversing pulley is subject to an environment which is inherently dirty during dredging operation, said cable being trained over said reversing pulley and secured to said vessel whereby to present at least two cable portions extending from said vessel to said reversing pulley, guide pulley means carried by said vessel and over which said cable portions are trained to suspend said suction nozzle, further guide pulley means on said vessel for guiding and maintaining said cable portions in side-by-side relation; and

swell compensation means, engaging said cable portions which are maintained in side-by-side relation by said further guide pulley means, for paying out and taking in said cable portions in unison as said vessel rises and falls due to wave action, whereby

to move said cable relative to said guide pulley means only while obviating any significant movement of the cable over said reversing pulley.

2. In a suction dredger system as defined in claim **1** including at least two reversing pulleys at said suction nozzle and a further reversing pulley on said vessel, said cable passing over one of said reversing pulleys at said suction nozzle back to and over said further reversing pulley and then back to and over the other reversing pulley at said suction nozzle and thence back to said vessel whereby to define two pairs of cable portions between the suction nozzle and the vessel, said further guide pulley means guiding and maintaining said two pairs of cable portions in side-by-side relation, and said swell compensating means engaging said two pairs of cable portions for paying them out and taking them in in unison as the vessel rises and falls.

3. In a suction dredger system as defined in claim **2** including a third reversing pulley on said nozzle and a second reversing pulley on said vessel, over both of which said cable is passed to form three pairs of cable portions all of which are engaged by said swell compensation means for movement in unison thereby.

4. In a suction dredger system as defined in claim **1** wherein said further guide pulley means comprises two sets of pulleys, one on either side of said swell compensation means.

5. In a suction dredger system as defined in claim **4** including at least two reversing pulleys at said suction nozzle and a further reversing pulley on said vessel, said cable passing over one of said reversing pulleys at said suction nozzle back to and over said further reversing pulley and then back to and over the other reversing pulley at said suction nozzle and thence back to said vessel whereby to define two pairs of cable portions between the suction nozzle and the vessel, said further guide pulley means guiding and maintaining said two pairs of cable portions in side-by-side relation, and said swell compensating means engaging said two pairs of cable portions for paying them out and taking them in in unison as the vessel rises and falls.

6. In a suction dredger system as defined in claim **5** including a third reversing pulley on said nozzle and a second reversing pulley on said vessel, over both of which said cable is passed to form three pairs of cable portions all of which are engaged by said swell compensation means for movement in unison thereby.

7. In a suction dredger system as defined in claim **1** including a second winch on said vessel with which said cable is engaged.

8. In a suction dredger system as defined in claim **7** wherein said further guide pulley means comprises two sets of pulleys, one on either side of said swell compensation means.

9. In a suction dredger system as defined in claim **8** including at least two reversing pulleys at said suction nozzle and a further reversing pulley on said vessel, said cable passing over one of said reversing pulleys at said suction nozzle back to and over said further reversing pulley and then back to and over the other reversing pulley at said suction nozzle and thence back to said vessel whereby to define two pairs of cable portions between the suction nozzle and the vessel, said further guide pulley means guiding and maintaining said two pairs of cable portions in side-by-side relation, and said swell compensating means engaging said two pairs of cable portions for paying them out and taking them in in unison as the vessel rises and falls.

10. In a suction dredger system as defined in claim **9** including a third reversing pulley on said nozzle and a second reversing pulley on said vessel, over both of which said cable is passed to form three pairs of cable portions all of which are engaged by said swell compensation means for movement in unison thereby.

11. In a suction dredger system as defined in claim **7** including at least two reversing pulleys at said suction nozzle and a further reversing pulley on said vessel, said cable passing over one of said reversing pulleys at said suction nozzle back to and over said further reversing pulley and then back to and over the other reversing pulley at said suction nozzle and thence back to said vessel whereby to define two pairs of cable portions between the suction nozzle and the vessel, said further guide pulley means guiding and maintaining said two pairs of cable portions in side-by-side relation, and said swell compensating means engaging said two pairs of cable portions for paying them out and taking them in in unison as the vessel rises and falls.

12. In a suction dredger system as defined in claim **11** including a third reversing pulley on said nozzle and a second reversing pulley on said vessel, over both of which said cable is passed to form three pairs of cable portions all of which are engaged by said swell compensation means for movement in unison thereby.

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