United States Patent

[11] 3,591,936

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[21] Appl. No. 791,261
[22] Filed Jan. 15, 1969
[45] Patented July 13, 1971

[73] Assignee Koninklijke Maatschappij tot het uitvoeren van openbare werken "Adriaan Volker" N. V.
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[54] **SUBMARINE CUTTER DREDGER**
4 Claims, 10 Drawing Figs.

[52] U.S. Cl. 37/56, 37/67, 37/73, 61/46
[51] Int. Cl. E02f 3/88, E02f 9/04
[50] Field of Search 35/54, 56, 67, 72, 73; 61/46.5, 46; 280/1.181

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ABSTRACT: A submersible dredge including a dome-shaped body to rest on the bottom of a waterway and having a vertical air shaft to atmosphere. The dome is formed in part by a rotatable annular mounting to which one end of a ladder is pivotally mounted, and on the other end of the ladder is a soil digging tool forward of one end of a suction tube. A driving motor for the tool is mounted on the ladder at the tool, above the inlet end of the suction tube, the latter being connected to a pump within the body. Two oppositely disposed sets of legs are provided to propel the dredge on the bottom of a waterway, the sets being operated alternately and each comprising three legs including one pair which are vertically movable and horizontally shiftable together, the other leg being in effect a prop.

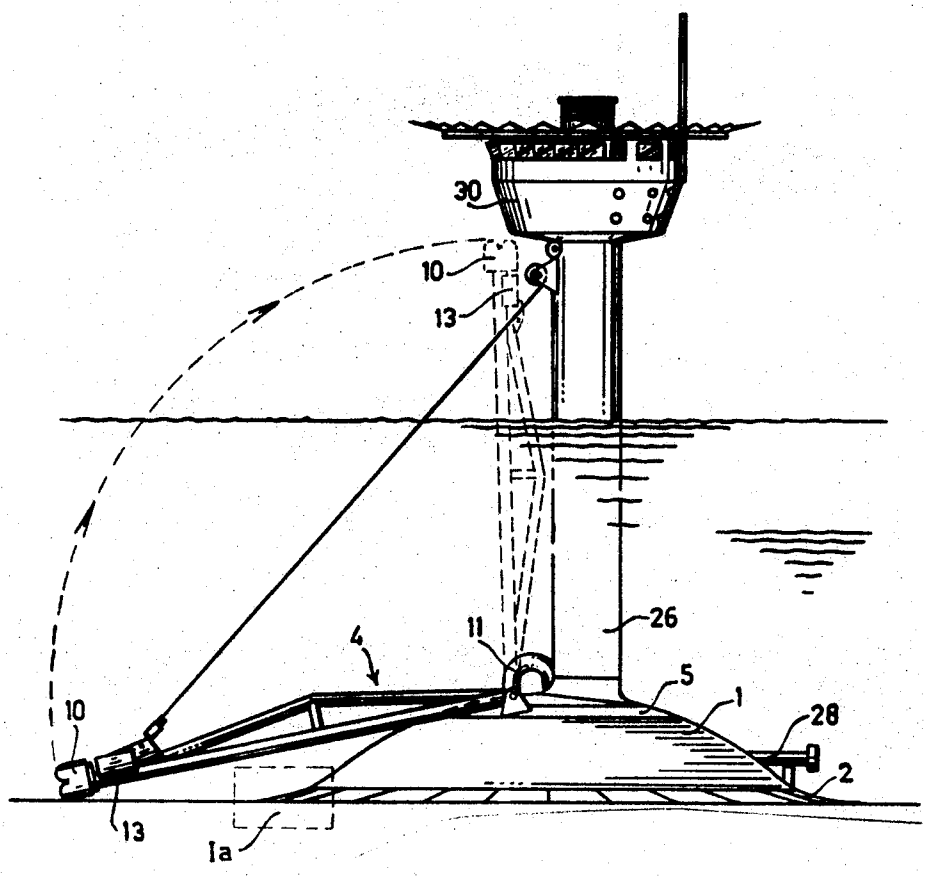


Fig. 1a.

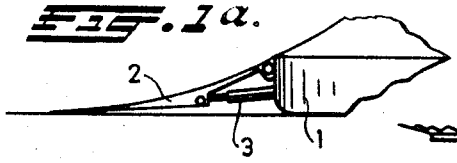


Fig. 1.

Fig. 2.

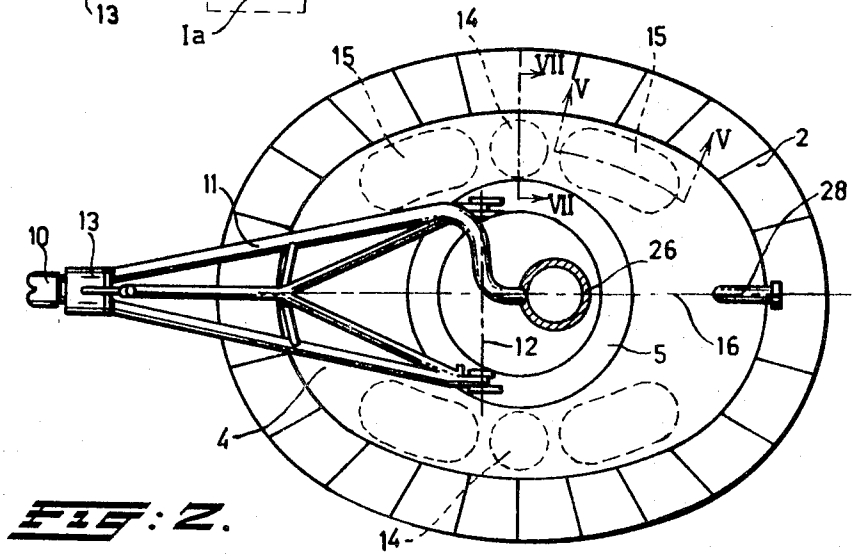


FIG. 3.

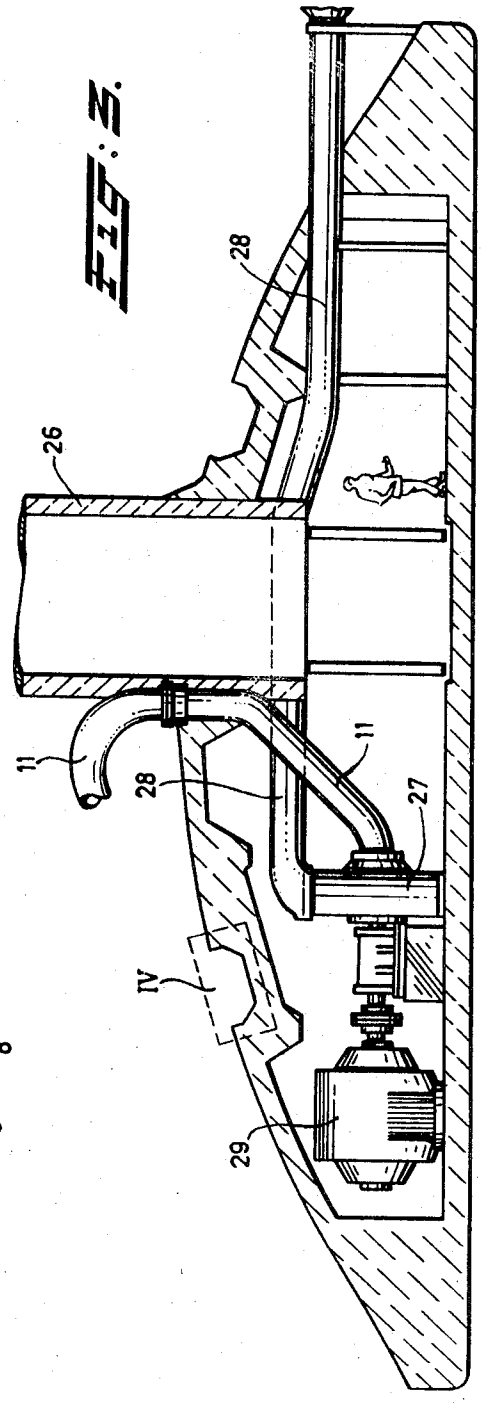


FIG. 4.

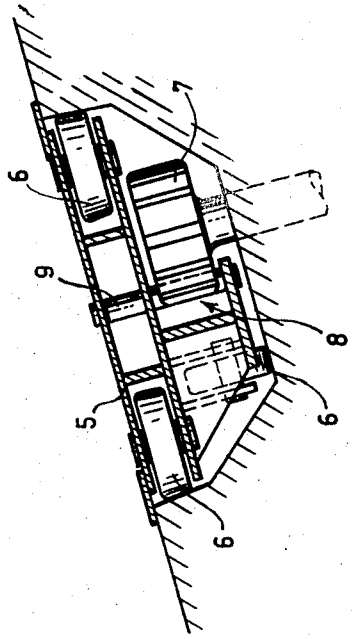
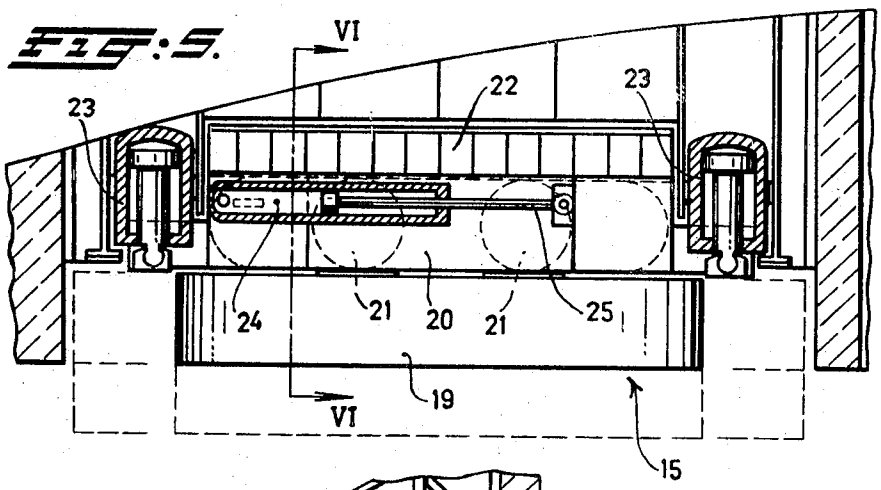


Fig: 5.



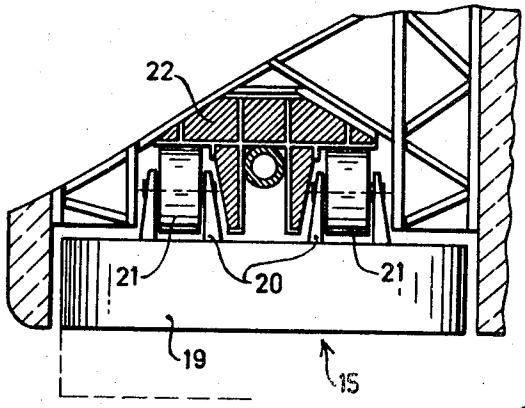


Fig: 6.

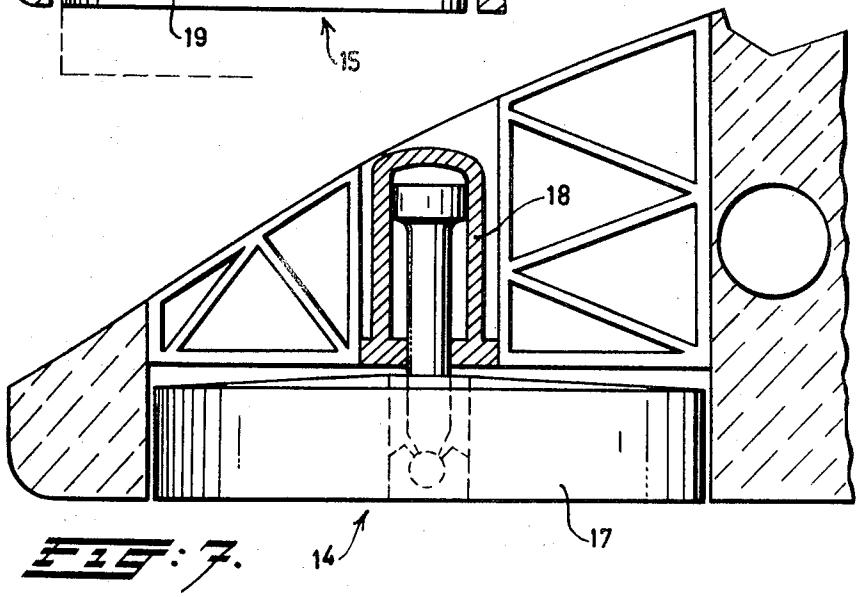
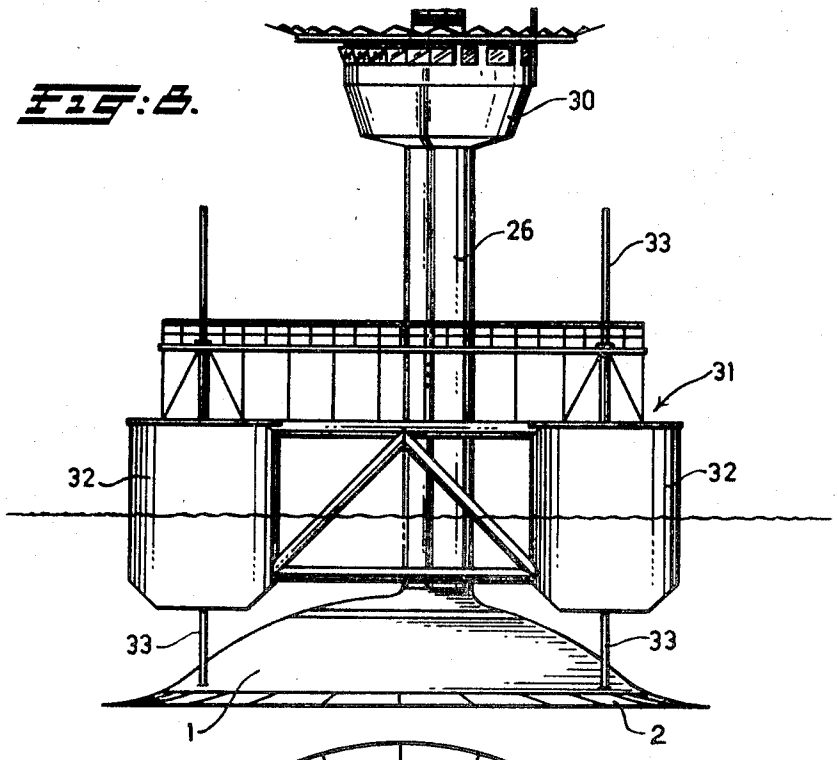


Fig: 7.

Fig: 8.



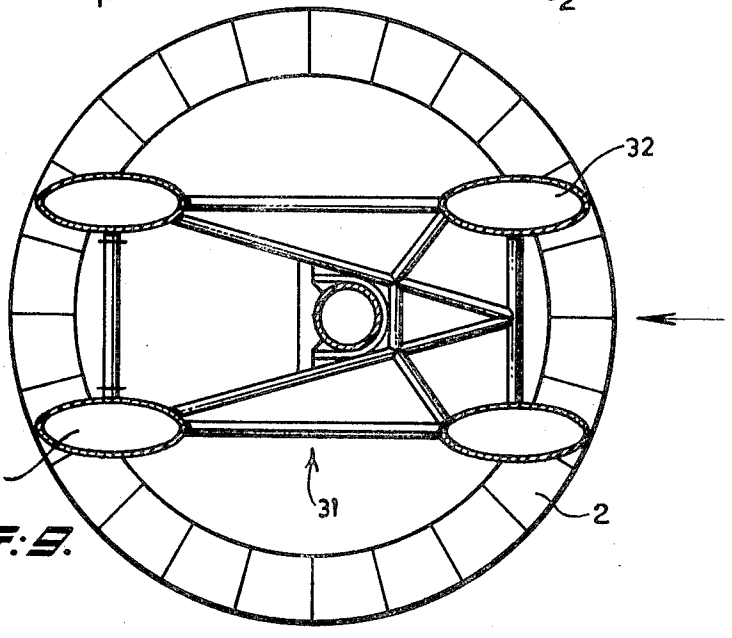


Fig: 9.

SUBMARINE CUTTER DREDGER

My invention relates in general to an installation for cutting or loosening the bottom of a water way and to suck this ground up in order to pump it through a conduit to a delivery station.

My invention relates in particular to a cutter dredger that can be placed on the bottom of the channel or basin to be dredged.

It is an object of my invention to provide a cutter dredger which is practically not influenced by the wave effect of the surface of the water so that it is less dependent on the weather conditions.

A further object is to provide travelling means for the dredger, so as to enable the operator or the crew to advance or turn the installation over the bottom, thus permitting subsequent cutting strokes of the cutter head.

Another object of my invention is to provide means for temporary lifting the installation from the bottom, in order to ring the cutter dredger in a floating condition for conveying it to some other location by means of a conventional marine propulsion system.

The main object of my invention is obtained in a cutter dredger comprising a ladder with a suction tube having a driven cutter head at one end, further comprising a working space with at least one suction pump and means for driving the pump and for moving the ladder with the suction tube, whereby the working space consists of a dome-shaped body which can be lowered to the bottom, said body having a ratio height: maximum length smaller than 1:4 and preferably 1:6.

The above-mentioned and further objects of my invention will now be more clearly described with reference to the accompanying drawing in which:

FIG. 1 is an elevational view of the installation, and

FIG. 1*a* an enlarged detail I*a*;

FIG. 2 is a top view, partly in section through the plane II–II in FIG. 1, showing an oval-shaped underwater body;

FIG. 3 is an enlarged vertical section FIG. 2;

FIG. 4 is detail IV from FIG. 3;

FIG. 5—7 are sections along the line V–V in FIG. 2, the line VI–VI in FIG. 5 and the line VII–VII in FIG. 3 respectively;

FIG. 8 is an elevational view of the installation in floating condition by means of a lifting pontoon;

FIG. 9 is a horizontal sectional view of FIG. 8, showing a circular-shaped underwater body.

The underwater body 1 of the cutter dredger is dome-shaped. The base is circular (FIG. 9) or oval (FIG. 2). The cross section of the dome is rather flat; the arrow ratio will be determined according to the local circumstances. In most cases the ratio arrow: diameter will range from 1:5 to 1:6, but other ratios are possible in case of more or less severe requirements imposed by the stream and wave effect.

The section of the dome should always show a fluent convex curve which at the foot of the dome merges into a concave curve the tangent of which is the surface of the bottom. This shaping aims at avoiding as much as possible turbulent flows, dangerous for erosion (scouring) or accretion by creating a fluent transition of the bottom to the underwater-body, while also the orbital movement of the waves along the underwater-body is favorably influenced.

The transition from the underwater-body 1 to the bottom consists of concave plates 2 (vide FIG. 1A) which are hingedly connected with the body 1 and allow for downward movement in case of scouring. The plates have a mechanism 3 enabling to adjust their position at will.

The cutter ladder 4 is secured to an annulus 5 with rollers 6 provided in the upper part of the underwater-body (vide FIG. 3 and 4). The cutter ladder 4 describes horizontal reciprocal movements by means of the pinion 7 engaging a circular rack 8 formed by the pins 9 of the annulus 6. At the end of the ladder 4 a driven cutter head 10 is mounted, whilst a suction tube 11 leads from near the cutter head to the top of the dome 1.

For repair jobs and for adjusting the cutting depth the ladder 4 is adapted to turn about a horizontal axis 12, whereby it becomes possible to bring the cutter ladder into a substantially vertical position, so that the cutterhead 10 and the motor 13 of the cutter emerge from the water for maintenance.

The underwater body advances slowly and stepwise on the bottom by means of two central supporting legs 14 and four legs 15, the latter permitting a small stroke. One leg 14 and two legs 15 form a set of supporting legs on either side of a longitudinal vertical symmetry plane 16 through the body 1.

Each set is lying on an arc having its center in the axis of the opposite leg 14. The leg 14 comprises a large pad 17 (FIG. 7) which is extendable by means of an hydraulic cylinder 18. Each leg 15 (FIGS. 5 and 6) comprises also a large pad 19 connected to a carrier 20 with four rolling elements 21 cooperating with a rail track 22. This track which is about twice as long as the carrier 20, is extendably connected to the body 1 by means of two hydraulic cylinders 23. Power means, embodied as an hydraulic cylinder 24 is provided between the track 22 and the carrier 20, for moving both members relative to each other. To this end the cylinder 24 is secured to the body 1, whereas the piston rod 25 is connected to the carrier 20. FIG. 5 shows the carrier 20 halfway between both end positions. Each leg 14 of one set is used simultaneously with both legs 15 of the other set in the following manner:

The steering board central leg 14 and the two port side legs 15 are pressed downwards. In this way the entire underwater body is lifted free from the bottom or at least the friction is decreased to such an extent that the body 1 can turn on the rotatable steering side central pad 17 as a pivot. When the stroke of the legs 15 is terminated, these three pints of support are withdrawn whilst the central leg 14 on the port side and the two legs 15 on the steering side are pressed downwards. The same rotary motion is now performed with the central pad 17 on the port side as a pivot and in this way the whole cutter dredger advances slowly as a "turtle" by repeating continuously these movements.

The pads 17 and 19 have a large surface to keep the superficial pressure on the bottom low. The cutter dredger can in this way move forwardly and backwardly and describe straight and curved paths and even describe a circle around one of the centers of rotation.

The underwater body 1 is connected with atmosphere via a shaft 26 which may be rigid or flexible. This shaft serves in the first place as a feed- and discharge-channel for the air, so that one may work in the engine room and other compartments at the pressure of the atmosphere (vide FIG. 3). This working space comprises at least one pump 27 for sucking the loosened ground through the tube 11 and conveying it through the conduit 28 to any desired place. A motor 29 drives the pump 27.

The shaft 26 serves further to enable the crew to enter or leave and to allow for the supply and discharge of the materials and parts which are required for exploration.

The shaft 26 ends above the water level in a structure 30 which may have different shapes but which in addition to its function as an air channel will essentially always serve as a transhipment place for ships and helicopters bound for the cutter dredger and as a command and observation post.

The displacement of the cutter dredger over greater distances is effected by the aid of a lifting pontoon 31 (vide FIGS. 8 and 9) consisting of four coupled floating members 32, retaining the cutter dredger around the shaft 26 and having four connecting rods 33 by which it engages the underwater body 1.

By pumping out ballast from the hollow members 32, the apparent weight of the cutter dredger is rendered equal to the lifting capacity of the lifting pontoon 31.

After the cutter dredger is lifted from the bottom it is towed while it is hanging in the lifting pontoon, or it can move due to its own propelling power to its new destination.

I claim:

1. In a dredge, a submersible dome-shaped body to rest on the bottom of a waterway, a hollow shaft mounted on said

body and extending upwardly therefrom to atmosphere in a waterway of a depth less than the height of said shaft, a ladder pivotally mounted on said body to rotate in two directions, a rotary soil loosening tool mounted on said ladder, drive means operable to rotate said tool, a suction pump within said body having an intake and an outlet, a suction tube connected at one end thereof to the intake of said pump and having an inlet affixed to said ladder adjacent said cutting tool, two sets of oppositely disposed vertically retractable propelling means within said body at the bottom thereof, each of said sets of propelling means including a pair of vertically and horizontally shiftable legs and an intermediate and separately vertically shiftable leg between said pair of vertically and horizontally shiftable legs and hydraulic means for each set of legs

operable to shift the pair of one set and the intermediate leg of the other set alternately with the pair of said other set and the intermediate leg of said one set.

2. In a dredge as defined by claim 9 wherein said dome-shaped body includes a rotatable annular support for pivotally mounting said ladder.

3. In a dredger as defined by claim 1 wherein the length of said ladder is substantially equal to the height of said hollow shaft.

4. In a dredge as defined by claim 1 wherein said drive means is a motor mounted on said ladder at said tool and above the inlet end of said suction tube.