

[54] **SUBMARINE DREDGING APPARATUS**
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61/69

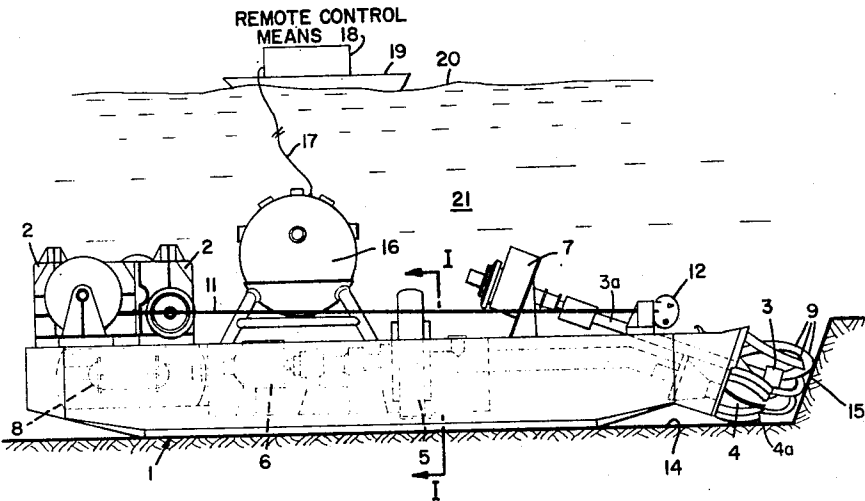
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[57] **ABSTRACT**

An underwater dredging device comprising a self-propelled submersible mechanical craft having devices and equipment to carry out dredging work underwater, and means for supplying electrical energy from an external source to operate these devices and equipment, and control devices thereof, the control devices being contained in a watertight bell capable of accommodating one or more operators.

9 Claims, 3 Drawing Figures

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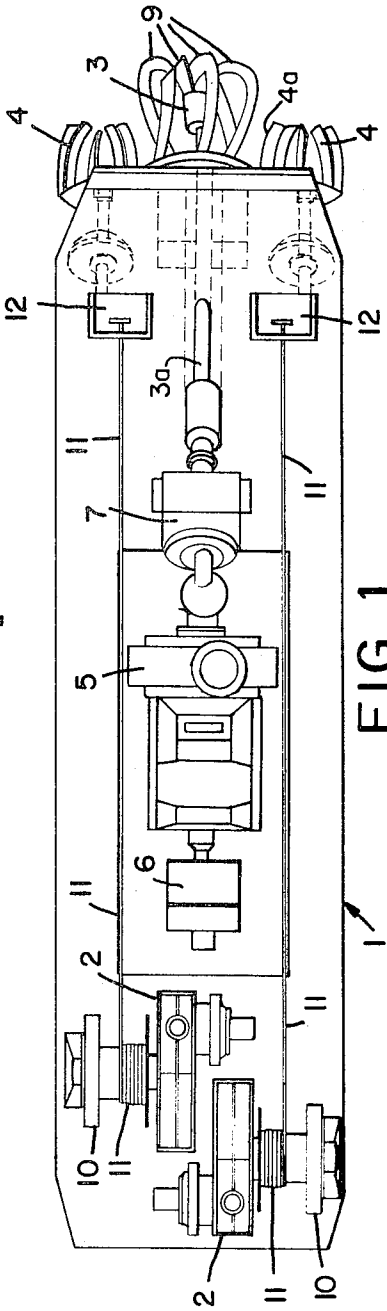
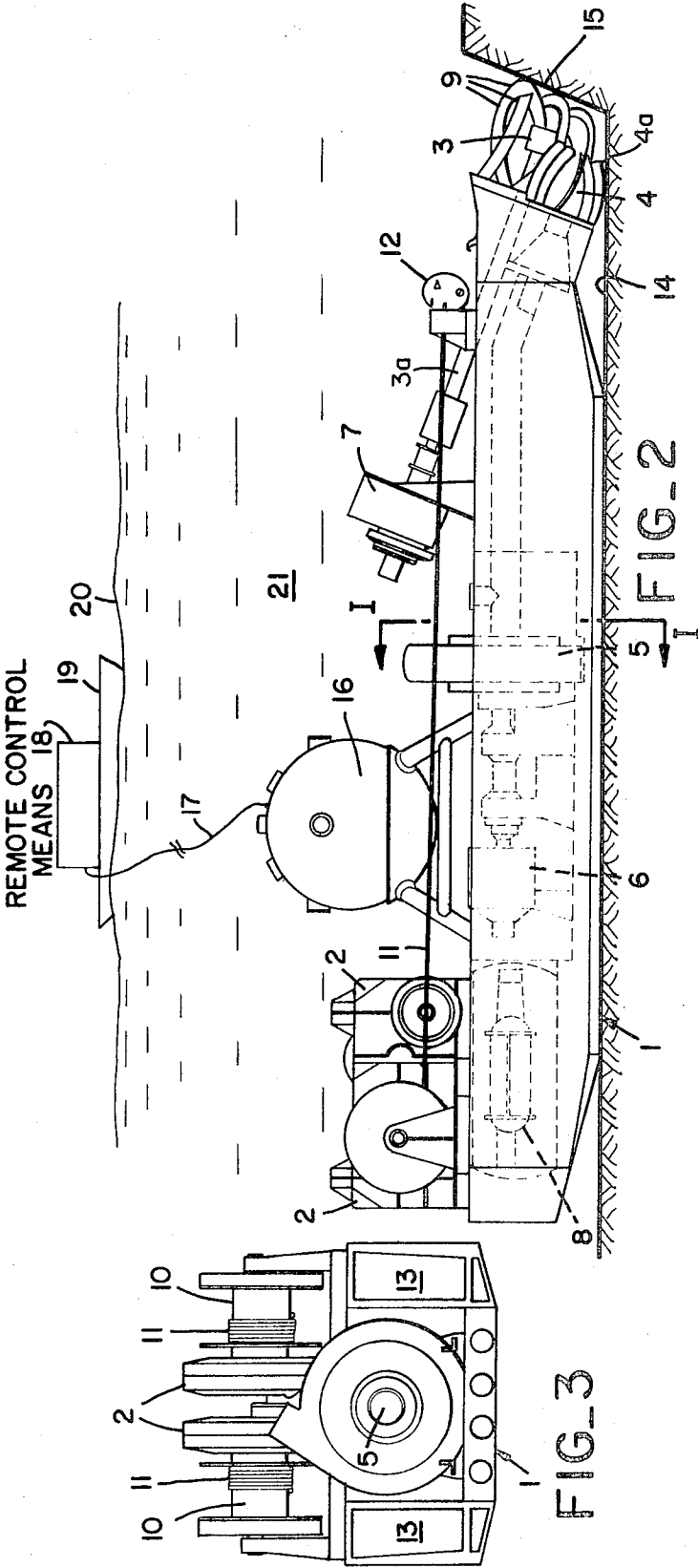
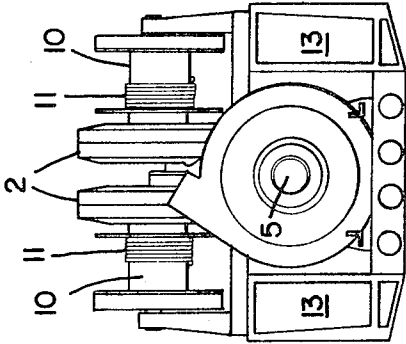


FIG. 1



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SUBMARINE DREDGING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a mechanical craft capable of being completely immersed in water up to a desired depth, to carry out dredging work on the bed of the sea, a lake or a river.

2. Description of the Prior Art

Prior art dredging devices do not work with great precision at deep depths. As the need for dredging in deeper and deeper waters arises, the need for an underwater craft that can work with precision at such depths becomes necessary.

SUMMARY OF THE INVENTION

It is an object of this invention to provide an underwater craft that is able to work with great precision at depths greater than those at which dredging could be carried out with the technical means available hitherto.

It is a further object of this invention to provide an underwater dredger that receives from the surface only electrical energy and is controlled when submerged by underwater workers who operate control devices located on the dredger itself.

These and other objects are preferably accomplished by providing an underwater dredger with essentially a metal hull that is watertight even at considerable depths, and which contains the various engines and various equipment for carrying out dredging. Furthermore, the underwater dredger according to the invention, though not fitted with propellers or wheels to move along the bottom, can nevertheless effect the movement necessary to carry out a given piece of work on the bottom by means of two winches located on the dredger itself. In fact, having available fixed points of support, on the bottom or at the surface, to which are attached cables ending at these winches, it is possible by operating the winches to effect movement of the underwater dredger in a previously fixed required direction.

Furthermore, in order to carry out dredging on the bottom, the underwater dredger according to the invention is fitted at the front with appropriate crushing devices and millers. The crusher may advantageously consist of a set of convergent and simultaneously operating blades inclined in such a way as to convey during their rotation the material removed towards the suction end of a hydraulic pump placed behind the blades, the blades being fixed to a single rotor shaft, preferably inclined downwards with respect to the longitudinal axis of the dredger when seen in side view but running parallel to the longitudinal axis of the dredger when seen in plan view. In a suitable embodiment of the invention, two rotating millers are located laterally to the above-mentioned crusher and symmetrically to it, rotating round axes parallel to the axis of the crusher rotor but arranged in a plane slightly below it. These lateral millers help by their rotary movement to remove the material and convey it towards the crusher, and are also themselves rotated independently by hydraulic motors.

Summarized, the underwater dredger according to the invention consists in a preferred embodiment of a submersible mechanical craft, having at the front a crusher and two lateral millers symmetrical to the

crusher and two winches in the upper part. These crushers, millers and winches are set in motion by hydraulic motors operated in turn by hydraulic pumps coupled to electric motors fed through an electric cable coming from the surface.

Furthermore, the underwater dredger is fitted with a suction pump to such up the material removed by the crusher and the millers and with a trimming pump for making vertical movements when submerged and for keeping the underwater dredger in a horizontal position. This trimming pump also produces backpressure to keep the machinery of the crusher and millers free.

The dredger according to the invention is also fitted with a watertight and airtight diving bell, located in its upper part, and containing the controls for the electrical and hydraulic machinery. This bell has room for one or more persons, who can remain in there even without breathing apparatus.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows a schematic plan view of an underwater dredger according to the invention;

FIG. 2 shows a side view of the underwater dredger shown in FIG. 1; and

FIG. 3 shows a sectional view taken along the lines I—I of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the FIGS. 1 and 2 of the drawing, the underwater dredger according to the invention comprises the submersible craft 1 on which are located towards the stern two winches 2 and towards the prow a central crusher 3 fitted with blades 9 at an appropriate inclination, and two lateral millers 4. The blades 9 are rotatable about a shaft 3a positioned parallel to the longitudinal axis of the craft 1 with respect to a plan view but in-clined downwardly with respect to the longitudinal axis when seen in side view. Each of the millers 4 is provided with a plurality of raised splines 4a. The splines 4a run along the sides of the millers 4 in a direction parallel to the axis of rotation of the millers 4.

In the middle portion, enclosed in the hull of the craft 1 is located suction pump 5 operated by motor 6 to remove the material brought up by the central crusher 3. Crusher 3 is moved by a motor 7, and the lateral millers 4 by other motors (not shown).

The winches 2 are operated by a single motor 8 and carry, wound on corresponding drums 10, a cable 11 which passes through a fixed point 12 and finishes at an external point preferably opposite the prow of the craft 1 and at a predetermined distance.

The hull of the craft 1 consists of lateral watertight tanks 13 (FIG. 3) which can be flooded by a pump (not shown). By flooding the watertight tanks 13, craft 1 can be submerged until it reaches the bottom 14 of the sea, lake or river (FIG. 2). In the upper rear portion is located a diving bell 16 in which are arranged all the controls for the machinery and which has room for one or more underwater operators, to control the underwater dredger 1. These operators when inside bell 16 may normally remain without breathing gear; while by putting on breathing gear they can go out and re-enter at will, the bell being pressurizable. These opera-

tors may, be operating suitable control devices (not shown), set in motion the central crusher 3 and the later millers 4, bringing about the removal of material 15. In fact, the lateral millers 4 convey the material 15 that is removed towards the crusher 3, while at the same time pump 5 sucks up this removed material and carries it to an appropriate designated site.

At the same time, the drums 10 of the winches 2 recover cables 11 fixed to external points of support opposite the prow and located at a predetermined distance, causing the craft 1 to move forward (FIGS. 1 and 3). The motion of winches 2 may be regulated according to the quantity of material 15 removed by the central crusher 3 and sucked up by pump 5. The dredging operation may be interrupted whenever it is desired to change the arrangement of the external fixing points of cables 11, while to change the direction of motion of craft 1 it is sufficient to act appropriately of winches 2 so that they operate differentially.

Among the principal advantages offered by the underwater dredger according to the invention is the fact that it can be maneuvered on site by operators in a protected environment at normal atmospheric pressure, who can carry out regular work shifts by day and night and can also temporarily leave the underwater dredger on site without taking any special security measures. Other advantages are provided by the continuous supply of electrical energy, rendering interruptions to the work for restoring supplies of energy or fuel unnecessary. Furthermore, it is possible to tug the underwater dredger at the site of operations just like a float, and remote control is also possible, as for example, by extending electrical conduits 17 from bell 16 (and from all of the motors discussed hereinabove) to a suitable remote control means 18 on a vessel 19 on the surface 20 of the body of water 21. Of course, all of the controls may be internal of bell 16 as discussed previously.

Obviously, numerous variants and/or modifications may be made by experts in the field to the underwater dredger according to the invention, without going beyond the scope of the invention itself.

I claim as my invention:

1. An underwater dredging device adapted to dig trenches underwater comprising:

a selectively submersible elongated watertight housing;

rotatable earth crushing means carried by and centrally positioned with respect to the forward end of said housing for crushing earth material encountered by said device; said crushing means compris-

ing a plurality of blades fixed to a shaft which is rotatably connected to the housing for rotation about an axis parallel to the longitudinal axis of said housing with respect to a plan view of the device;

a pair of rotatable milling means spaced laterally of said crushing means and symmetrical thereto carried by the forward end of said housing and associated with said earth crushing means for conveying earth material encountered by said device into said earth crushing means, each of said milling means being rotatable about an axis which is parallel to the axis of rotation of said shaft;

housing movement regulating means associated with said housing for moving said housing in a desired direction underwater; and

pumping means including a suction pump associated with said earth crushing means and carried by said housing for pumping earth material crushed by said earth crushing means to a location remote from said housing.

2. The device of claim 1 including a pressurizable water-tight diving bell associated with said housing for housing the controls for all of said means.

3. The device of claim 1 wherein said housing movement regulating means includes at least a pair of winches, each of said winches including a cable would therearound having a fixed point of support external of said housing and spaced from each other.

4. The device of claim 3 wherein said housing is in the general form of a hull having a prow, the spaced external points of supports for said cables being opposite said prow.

5. The device of claim 1 wherein said shaft is inclined downwardly with respect to the longitudinal axis of said housing with respect to a side view thereof.

6. The device of claim 5 wherein said milling means rotate about axes which are in a plane slightly below said crushing means shaft with respect to a side view of the device.

7. The device of claim 6 wherein said milling means comprise a miller body having a plurality of raised splines extending along the length thereof; said splines running along said body in a direction substantially parallel to the axis of rotation of said milling means.

8. The device of claim 1 including a plurality of floodable watertight tanks associated with said housing for selectively submerging said housing.

9. The device of claim 1 wherein all of said means are actuated by motive means coupled to control means located at the surface of said body of water.

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