ABSTRACT: In an apparatus for levelling underwater ground, an underwater bulldozer is suspended from a ship by means of a cable, and a diver is lowered near the bulldozer to remotely manipulate the bulldozer by operating a control panel carried by him. Electric signals from the control panel are supplied to the bulldozer via an electric cable. The ship is provided with a cavity to accommodate the bulldozer, a winch to raise and lower the bulldozer and retractable bulldozer-supporting means.
APPLARATUS FOR LEVELLING UNDERWATER GROUND

BACKGROUND OF THE INVENTION

This invention relates to a novel method and apparatus for levelling underwater ground such as sea bottom. Heretofore, divers have been worked to level ground to build foundations of breakwaters, caisson towers and the like. However, such method of levelling underwater ground requires much labor and time and is not efficient.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to use an underwater bulldozer to level underwater ground. A further object of this invention is to provide a novel method of manipulating an underwater bulldozer by a diver. Another object of this invention is to provide a novel apparatus for levelling underwater ground.

The invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawing, in which:

FIG. 1 shows a perspective view of an underwater ground-leveling apparatus embodying this invention;
FIG. 2 is a diagrammatic plan view of the ship employed in the embodiment shown in FIG. 1; and
FIG. 3 shows a longitudinal section of the ship shown in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The levelling apparatus shown in FIG. 1 comprises a ship 1 having a pair of vertical anchoring posts 2 and 2' at the stern thereof. Anchoring posts 2 and 2' are adjustable in the vertical direction at 5' passing around pulleys 4 and 4' at the upper ends of fixed towers 3 and 3' and are fixed to their adjusted positions by means of fixing members 6 and 6', respectively. Flanges 7 and 7' are secured near the lower ends of respective posts 2 and 2' whereas the other ends of the cables are connected to winches 8 and 8'. Another pair of winches 9 and 9' are provided at the bow of the ship to operate ordinary anchors 10a and 10b', respectively.

Behind these winches 9 and 9' is provided a bridge 10 and a power unit 11 is provided near the stern. In addition to propel the ship 1, the power unit 11 operates to drive a drum 13 of a winch 12 through a chain 14 and a gear 15. The winch 12 is supported by legs 16 and 16' across a cavity 17 near the center of the ship 1. An underwater or submersible bulldozer 19 is connected to the lower end of a cable 18 wound around the drum 13.

The bulldozer 19 may be of any desired construction so long as it can be remotely operated by a control panel 20 carried by a diver. Thus, a control cable 22 is provided along the air hose 21 to the diver to transmit control signals from the control panel 20. Although not shown in the drawing, it is to be understood that the cable 18 to the bulldozer 19 comprises an electric power cable, a command cable corresponding to the control cable 22 and a cable for hanging the bulldozer 19 from the drum 13. For example, an electric motor (not shown) in the underwater bulldozer 19 is energized from the power unit 11 through the power cable in the cable 18 to drive an oil pressure pump (not shown) in the bulldozer. Control signals from the control panel 20 are transmitted to a control device (not shown) for the oil pressure pump through the control cable 22 and the command cable. The oil pressure pump operates driving wheels 23 of the underwater bulldozer 19 and an oil pressure cylinder 25 for operating a plough 24.

As best shown in FIGS. 2 and 3, the cavity 17 at the center of the ship is provided with a pair of opposed lever-shaped retractable supporting members 27 and 27'. In the illustrated example, these supporting members are located at the bottom of the ship and are operated in the longitudinal direction of the ship by means of oil pressure cylinders 28 and 28' with one end pivotally connected to the ship at 29 and 29' and the other ends to the inner ends 27 and 27' at 30 and 30' respectively. Supporting members 27 and 27' extend through bearings 31 and 31'.

To level the underwater ground by utilizing the novel apparatus, the ship 1 is anchored to any desired working site by lowering anchoring posts 2 and 2' and anchors 10 and 10'. Then the underwater bulldozer 19 is lowered on the sea bottom by the operation of the winch 12 and cable 18. Thereafter diver A connected to the ship 1 through the hose 21 and the control cable 22 is lowered near the bulldozer to manipulate the bulldozer 19 by control signals supplied thereto through the control cable 22 and the command cable from the control panel 20.

Thus, in accordance with this invention, advance, retreat and turning motions of the bulldozer as well as the operation of the plough 24 are readily controlled by the driver who manipulates the control panel 20 while directly viewing the underwater bulldozer. When the desired underwater operation is completed the underwater bulldozer is raised by the winch 12 and the ship is propelled to the next site.

To house the bulldozer 19 in the cavity 17 the oil piston cylinders 28 and 28' are operated to retract supporting members 27 and 27' and then the winch 12 is operated by the power unit 11 to take up the cable 18 to raise the bulldozer. When the bulldozer 19 is received in the cavity 17, the oil piston cylinders 28 and 28' are operated in the opposite direction to advance supporting members 27 and 27' to securely support the bulldozer.

Thus, this invention provides a novel method and apparatus for levelling underwater ground in which an underwater bulldozer can be readily and accurately manipulated by a diver in the same manner as on the ground. Moreover, the novel apparatus can be anchored at any desired position and can be moved while the underwater bulldozer is housed therein. While an underwater bulldozer has been illustrated it will be clear that any other underwater ground-leveling machine may be used.

What is claimed is:

1. An apparatus for levelling ground under water comprising:
a ship (1);
an underwater bulldozer (19);
a cavity (17) in said ship, said cavity being opened at its bottom to accommodate said underwater bulldozer;
a winch (12) on said ship to wind and unwind a ship's cable (18) connected to said underwater bulldozer (19);
supporting means at the bottom of said cavity;
means (28, 28') to operate said supporting means into and out of the operating position in which said supporting means support said bulldozer when it is received in said cavity;
a control panel (20) to be carried by a diver;
an electric cable (22) interconnecting said control panel and said bulldozer to operate the same by electric signals from said control panel with an air hose (21) provided along said electric cable between said ship and control panel to supply air to said diver;
a power unit (11) mounted on said ship to supply power to drive said underwater bulldozer; and,
at least one anchoring post (2) and means to raise and lower said anchoring post.