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E. A. RIX & P. B. DONAHOO.

DREDGING MACHINERY.

(Application filed Apr. 19, 1898.)

(No Model.)

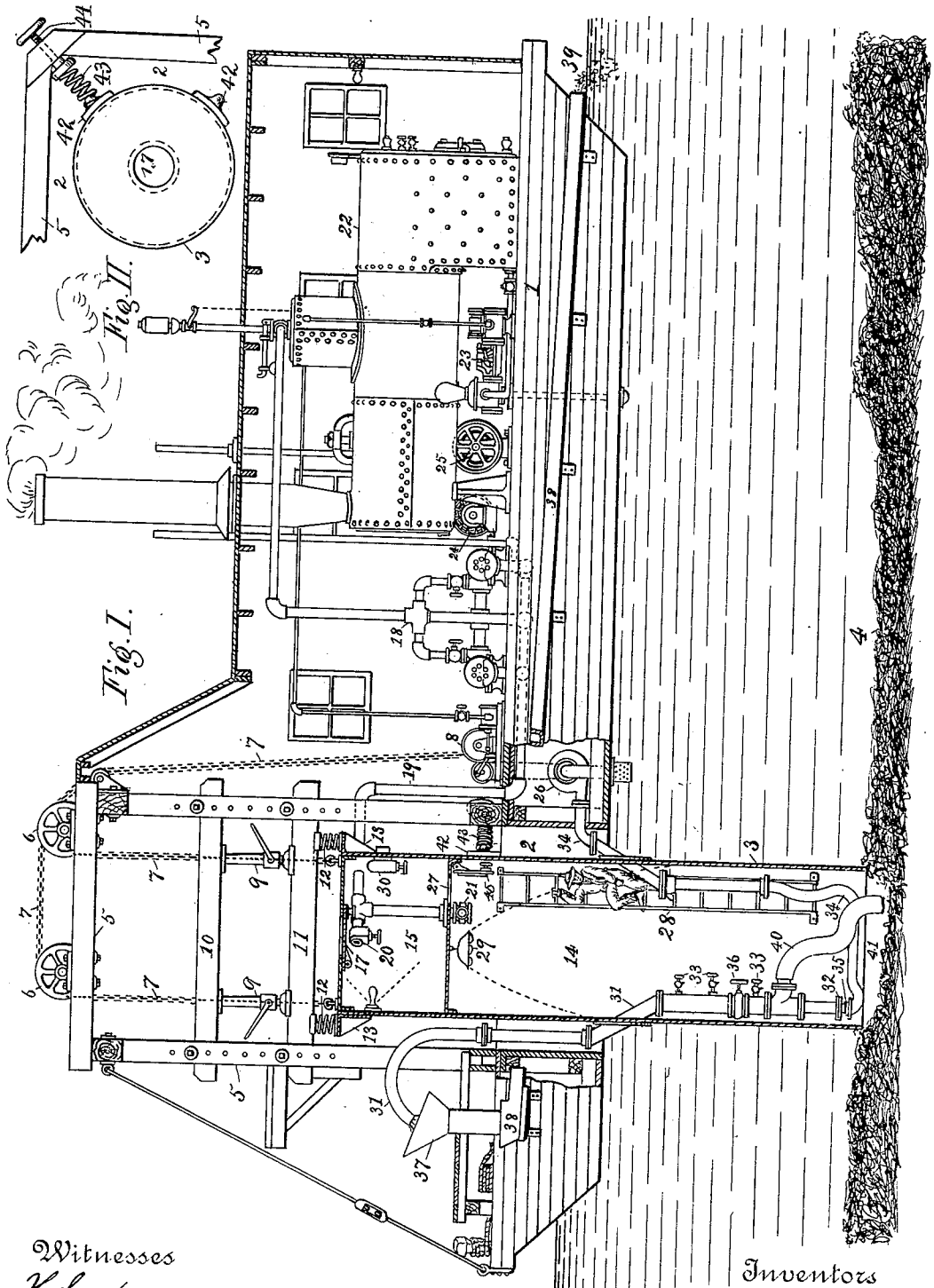


Fig. II.

Fig. I.

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UNITED STATES PATENT OFFICE.

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DREDGING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 635,270, dated October 17, 1899.

Application filed April 19, 1898. Serial No. 678,117. (No model.)

To all whom it may concern:

Be it known that we, EDWARD A. RIX and PETER B. DONAHOO, citizens of the United States, residing at San Francisco, county of San Francisco, and State of California, have invented certain new and useful Improvements in Dredging Machinery; and we hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to subaqueous exploring and excavating in alluvial deposits and over the rock bed beneath in streams, estuaries, bays, or open waters by means of pneumatic or other apparatus that permits visual examinations of the material before it is excavated and raised.

Our improvement consists in a vessel or barge, hereinafter called the "pontoon," on which the machinery and apparatus are supported, conveyed, and adjusted, capable of being moored by ordinary means and in working free from all disturbing strains in a horizontal plane and provided with a wellway to receive a pneumatic caisson and devices to raise and lower the same. It also consists in motive power, air-compressing and water-impelling machinery, means for raising and expelling excavated material by introducing air into the uptake or spoil pipe and by the inductive action of a jet of water impelled by a pump, with various accessories that make up an organized plant or apparatus for subaqueous dredging on a new and improved method, as hereinafter more particularly explained by aid of the drawings herewith and forming a part of this specification.

The especial objects of our invention are to explore for and secure gold in auriferous deposits and also other minerals or valuables, natural or artificial, that are submerged and inaccessible to observation from the surface and not available by the ordinary methods of dredging.

Referring to the drawings, Figure I represents in elevation and partially in section a side view of an organized plant and apparatus for subaqueous dredging and exploration constructed and operating according to our invention. Fig. II is a transverse section showing the elastic lateral supports for the pneumatic caisson.

In the lodgment of sedimentary and alluvial materials, especially fluvial deposits, the particles are arrested by their gravity and obstruction. Gold having a specific gravity of eighteen and the particles being of rugged contour, the latter seek the lowest points, lodging in fissures or crevices on a rugged bottom or in the lowest points on the bed-rock when that is bared, so that only a small portion can be secured by the ordinary methods employed in subaqueous dredging even with suction apparatus, because the velocity of the intake flow falls off immediately beyond the intake-orifice and ceases to be effective within a short distance therefrom. Therefore the only effective means of securing gold from subaqueous deposits is by visual exploration, the same as is practiced above water or in what is called "placer-working."

The object of our invention is to supply the same methods below the water-level, consisting, essentially, in expelling the water from the surfaces to be explored, so as to admit of visual and manual working on the bottom and especially over areas that have been dredged by ordinary means.

In carrying out our invention we employ mainly well-known devices arranged in a peculiar and novel manner with special reference to the work to be done, employing therefor a floating vessel or pontoon 1, preferably quadrangular in form, having an open wellway 2 formed therein, through which a sealed pneumatic chamber 3, hereinafter called a "caisson," can be lowered to the bottom 4 of a river or other body of shallow water where valuable deposits do or are supposed to exist. The caisson 3 is supported vertically by means of a strong frame 5, stepped on the back of the pontoon and braced, as seen in the drawings, and provided with pulleys 6, over which pass sustaining ropes or chains. Lateral support of the caisson 3 is provided for by means of the elastic bearings shown in Fig. II, preferably four in number, consisting of bearing-blocks 42, springs 43, and screws 44. This permits rocking or other motion of the pontoon 1 without disturbing the caisson 3 when it rests on the bottom 4 and also introduces a

degree of flexibility necessary in structures of this kind. These chains or ropes 7 after passing over the pulleys 6 are led to a drum-winch 8, driven by a steam-engine or other suitable motor and adapted by winding right or left to raise or lower the caisson 3, as occasion may require.

To force the caisson downward against the bottom 4 or through alluvial matter resting thereon, there are employed hydraulic or screw jacks 9, that abut against an adjustable cross-beam 10 at the top and a movable cross-beam 11 at the bottom, the latter resting on springs 12, that bear on the lugs 13, riveted to the top of the caisson 3, so that by means of the hydraulic or screw jacks 9 the caisson 3 is forced downward to form a close joint at the bottom or to cut through silt or any loose material thereon. The downward pressure thus imparted is equalized by the springs 12, that permit some motion of the pontoon 1 without affecting the caisson 3. This downward strain upon the caisson 3 exerts an equal upthrust upon the frame 5 and upon the pontoon 1 and with the bearings shown in Fig. II tends to anchor and hold the pontoon in a fixed position laterally, as will be understood.

The caisson 3 is divided transversely into two compartments—a working chamber 14 and an air lock-chamber 15, the latter entered by a door 17, that when shut is sealed against escape of air from the chamber 14. From an air-compressing engine 18 a pipe-line 19 leads to the two chambers 14 and 15 of the caisson 3, where air under pressure is admitted by the valves 20 and 21 to either chamber or to both, as will be hereinafter explained.

Steam for motive power is furnished by a steam-boiler 22. A pump 23 is provided to supply the boiler 22 and for other purposes.

24 is an electric dynamo for lighting the chambers 14 and 15 and for other purposes and is driven by a small engine 25.

26 is a centrifugal pump, the purpose of which will be presently explained.

Other details will be described in connection with the manner of operating, which is as follows: The pontoon 1 is moved to the desired position and moored, if necessary, and the caisson 3 lowered by means of the winch 8 until it rests upon the bottom 4, as seen in the drawings. The cross-beams 10 and 11 are adjusted and pressure is applied by the screw or hydraulic jacks 9 sufficient to balance the weights of the water that rises within the chamber 14. Air under pressure is admitted to the working chamber 14 until the water therein is expelled therefrom and air begins to escape at the bottom. The workmen then enter the chamber 15, and after closing the door at 17 air is admitted to this chamber by the valve 20 until there is an equilibrium of pressure in the two chambers 14 and 15. By opening the door 45 workmen can then descend through the hatchway 27 and by a ladder 28 to the bottom, the interior of the chamber 14 and the bottom at 41 being brilliantly lighted by an electric lamp 29, as indicated in the drawings. At the bottom exploitation and working can be carried on the same as upon dry ground, with the advantage that the compressed air in the chamber is employed to raise and expel water and all kinds of comminuted material—such as silt, sand, and gravel—in the manner presently explained. On the workmen going out they ascend into the chamber 15, the door 45 is shut, and communication is closed between the chamber 15 and the working chamber below. The valve 20 is then closed, and the one 30 is opened, so the compressed air will escape from the chamber 15 down to the atmospheric pressure, and a door 17 at either the top or side of the chamber 15 is opened for exit.

In the case of solids, such as boulders that have to be removed from the chamber 14, these can be raised by ordinary tackle to the chamber 15 and taken from there through the door 17, or the caisson 3 can be slightly raised, so that boulders or other solids can be pushed out beneath it.

For all kinds of spoil that can be raised and expelled by entrainment of water we provide an uptake-pipe 31, having an inlet-nozzle at 32 and flexible suction-pipe 40. As no flow will take place through this pipe by means of the air-pressure in the chamber 14, such pressure being only equal to the hydrostatic head of water around the caisson 3, we admit air to this pipe 31 by means of cocks 33, which air mingles with water and spoil and reduces the gravity on the well-known method of pneumatic water-raising apparatus.

In case the induction of air into the pipe 31 is not sufficient to raise the spoil of a heavy or adherent nature we provide water-induction apparatus consisting of a pump 26, a pipe 34, an ejecting-nozzle 35, that forces water through the pipe 31 on the well-known principle of ejector-nozzles employed for like purposes in open air. With the exception that air may be introduced through the cocks 33 and mingling with the water and spoil lightens it, it thus renders the ejector action of the pump more efficient. A valve 36, easily accessible to the workmen, is provided to regulate the flow through the uptake-pipe 31.

When the induction or ejector method is employed to raise the water and spoil in the pipe 31, the material is drawn through a suction-hose 40 from a sump 41, as shown in the drawings. In the other case the bottom end of the pipe 31 can form the inlet for spoil. The pipe 31 discharges into the hopper 37, from where the water and spoil are conducted to a flume 38, provided with gold-catching devices to the rear of the pontoon 1, and are discharged at 39, as indicated in the drawings.

It will be understood that the spoil sent up through the pipe 31 can be treated by various methods for the extraction of minerals. We have shown the most simple form—that of a flume in which riffles and quicksilver can be placed.

It will be understood that most of the various elements or parts that enter into our invention existed in other combinations and directed to other purposes, and while we do not claim these separately or in other combinations and operating under different conditions,

We do claim as our invention—

1. In subaqueous dredging and exploring apparatus, a floating pontoon, a wellway therethrough and a pneumatic caisson suspended therein, means to raise and lower the caisson, screw or hydraulic apparatus to force the caisson downward, and springs interposed between the hydraulic or screw devices, to maintain an equal pressure around the pontoon, substantially as specified.

2. In subaqueous dredging and exploring apparatus, a floating pontoon and wellway therethrough, a pneumatic caisson suspended in the wellway, means to raise or lower the caisson and to force it downward, and elastic bearings or abutments between the sides of the pontoon and wellway, so the pontoon may rock or move without disturbing the caisson, substantially as specified.

3. In exploring and dredging apparatus, a floating pontoon on which the operating parts are mounted, a double-chambered caisson adapted to be lowered from the pontoon to the bottom of a stream or other waters, in which the pontoon is moored, means to fill the caisson with air under pressure and expel the water therefrom, a spoil-pipe extending upward and outward from the bottom of the caisson provided with an inlet or inlets for air that will mingle with the water and spoil that ascends the pipe, substantially as specified.

4. In subaqueous dredging apparatus, a floating pontoon, a pneumatic caisson mounted thereon, means to raise, lower and force downward the caisson, means to expel the water therefrom, a spoil-pipe extending upward and outward from the bottom of the caisson, an air-inlet in said spoil-pipe, an induction-nozzle discharging into said spoil-pipe, and a rotary pump, forcing water through said induction-nozzle into said spoil-pipe, substantially as specified.

5. In subaqueous exploring and dredging apparatus, the combination of a floating pontoon, a pneumatic caisson, a gallows-frame to support the caisson, and means to raise and lower the same, a spoil-discharging pipe from the bottom of the caisson, extending upward and outward to the external air, air-inlets at the lower portion of the discharge-pipe and in combination therewith an induction-nozzle at and discharging into the lower end of the discharge-pipe, arranged and operating substantially as specified.

6. In dredging and exploring apparatus, a floating pontoon, an open-bottomed caisson suspended therefrom, means to raise and lower the latter, and means to expel the air therefrom, a discharge for water and spoil leading from the bottom of the caisson to the open-air inlet or inlets, and an induction-nozzle for water and a flexible suction hose or pipe through which the spoil is drawn, substantially as specified.

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