

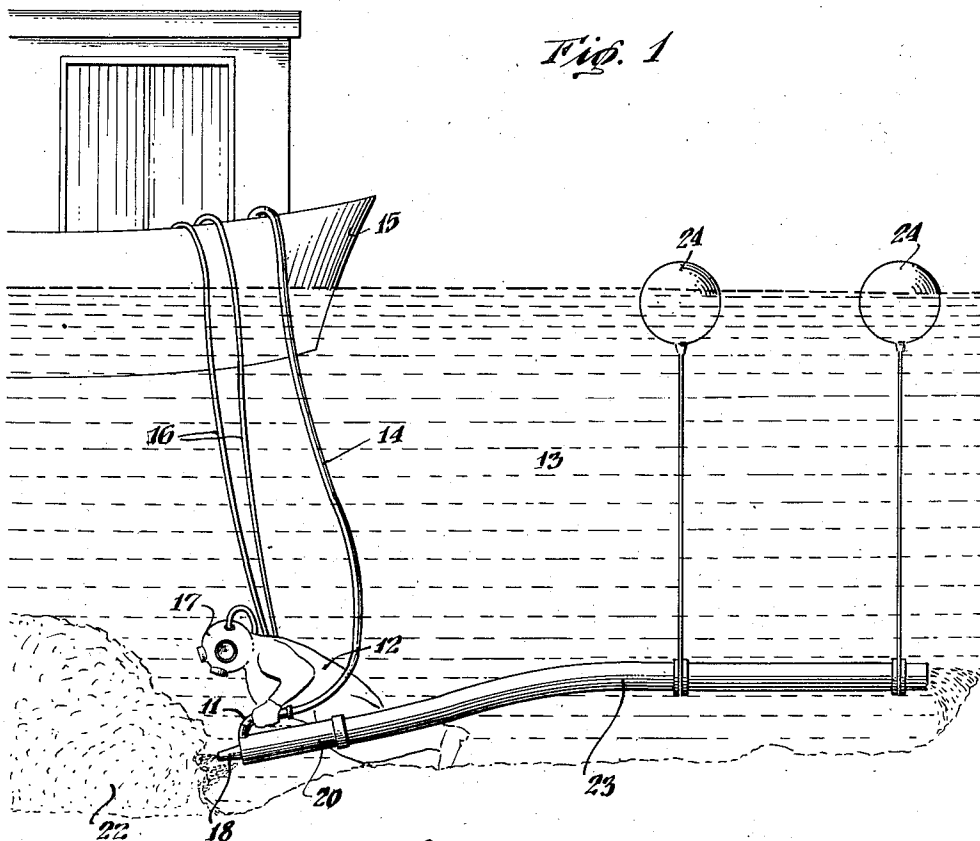
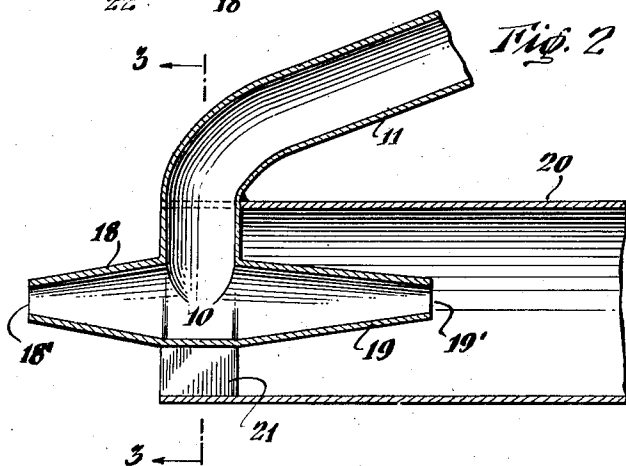
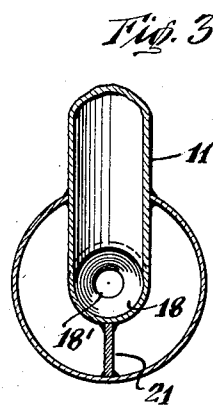
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PORTABLE EXCAVATING AND EJECTING MACHINE

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PORTABLE EXCAVATING AND EJECTING MACHINE

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4 Claims. (Cl. 37—62)

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This invention relates to that type of apparatus adapted to be used by divers or other under-water workers for loosening and dislodging mud, sand, gravel, silt, clay or other impeding granular matter from their beds or from a given location and simultaneously ejecting or discharging the loosened particles of the deposit of material in suspension, that is, commingled with water, to a different location remote from the loosening operation and where its presence does not impede the work under progress.

The principal object of the invention is the production of a unitary apparatus or device of the above character which shall be portable and compact and easily manipulated by the operator, such as a diver or other under-water worker, and which shall also utilize a fluid, preferably water, under high pressure as the loosening as well as the ejecting agent.

A further object of the invention is the production of an apparatus of the above character in which the excavating and ejecting fluid under pressure shall be supplied to a common chamber from a suitable source of supply for simultaneous discharge from both an excavating nozzle and an ejecting nozzle thereby conserving the amount of fluid under pressure ordinarily required for operations of the character referred to.

A further object of the invention is the production of an apparatus having the above characteristics in which the inlet pipe for supplying fluid under pressure to the fluid chamber shall provide a convenient gripping means or handle for the operator of the device.

Still a further object of the invention is the production of a combined portable excavating and ejecting device or apparatus in which the excavating and ejecting nozzles shall be positioned in alignment and in opposed relation to each other and shall be of equal or the same size or capacity whereby the thrust of one nozzle in one direction produced or created by the force of the jet of fluid under pressure discharged therefrom shall be counterbalanced or neutralized by the thrust of the other nozzle in the opposite direction resulting in internally balanced forces.

Other and further objects and advantages of the invention will appear from the accompanying description, the invention consisting in the novel portable combined excavating and ejecting apparatus hereinafter more particularly described and then specified in the claims.

The device of the invention is especially useful, for instance, in the salvaging of sunken sub-

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marines where speed of operation often is a highly important factor particularly where the lives of entrapped persons depend on the rapidity with which the submarine can be raised. In disasters of this character it is necessary for a diver to burrow through the earth immediately beneath the submarine to provide tunnels or openings extending transversely thereof for the passage of lifting chains. These operations may be carried on with speed and facility by means of the present invention in contradistinction to many devices old in the art which are cumbersome in character, consume valuable time for purposes of installation and most of which require one apparatus for the excavating operation and a separate one for the removing or ejecting operation. Furthermore, in most of these old devices the rearward thrust produced or developed by the discharge of water or air under pressure from the excavating nozzle makes the device extremely difficult of handling and manipulation by the diver or other under-water operator.

In the accompanying drawing illustrating a practical embodiment of the invention:

Fig. 1 is an elevation showing a diver or other under-water operator using the device of the invention under actual working conditions.

Fig. 2 is a fragmentary section taken through the apparatus itself and,

Fig. 3 is a vertical cross-section on the line 3—3 of Fig. 2.

Referring in detail to the several figures of the drawing:

A metallic fluid chamber for receiving fluid under pressure, either air or water, is indicated at 10 and is connected, preferably integrally, with a metallic fluid inlet pipe 11 which is bent or curved and extends rearwardly of the device, as shown, and provides a convenient handle or gripping device for a diver 12 who is shown at work in Fig. 1 beneath the surface of water indicated at 13. A flexible tube or hose 14 is connected at one end to inlet pipe 11 and at the other end to a source of supply of fluid under pressure (not shown) which may be a driving motor and pump carried by a boat 15. Conventional air lines 16 are shown connected to the usual helmet 17 for the diver 12 and they extend to their source of supply within the boat 15.

Extending forwardly of the fluid chamber 10 and communicating therewith is a hollow cone-shaped member 18 preferably integral with a wall of chamber 10 and constituting the excavating nozzle of the device. Said nozzle is pro-

vided with a tapering or inclined wall terminating at its forward end in a discharge opening 18' of restricted size. The opposite side of said fluid chamber 10 is provided with a rearwardly extending hollow cone-shaped member 19 opposed to and in alignment with the excavating nozzle 18 and also preferably integral with a wall of chamber 10. Said member 19 communicates with fluid chamber 10 and it constitutes the ejecting or discharge nozzle of the device. It is also provided with an inclined or tapering wall, as shown, terminating in a discharge opening 19' of restricted size. The discharge openings 18' and 19' of the nozzles are of equal or the same diameter and therefore of the same capacity, that is, they are adapted to discharge, in a given unit of time, the same amount of fluid under pressure forcibly fed to them from the common fluid chamber 10.

A metallic pipe or tube is indicated at 20 and constitutes a receiving and ejecting chamber for the material in suspension excavated by the action of nozzle 18. Said chamber is cut away or provided with an opening adjacent its open end for the reception of inlet pipe 11 to which it is secured by welding, soldering or otherwise. A strut member 21 may be provided which is fastened to chambers 10 and 20. Said strut member acts to support and strengthen fluid chamber 10 and its attached nozzles 18 and 19 and it also provides a stop for preventing large objects from entering or being drawn into chamber 20. As illustrated, fluid chamber 10 and nozzle 19 are entirely encompassed by tube or chamber 20 and nozzle 19 extends an appreciable distance within said tube and in spaced relation thereto.

In Fig. 1 the diver 12 is shown at work on a mound of granular material indicated at 22 which is to be broken down into particles and removed in suspension in the water by means of the apparatus of the invention. The jet of fluid under high pressure discharged from the excavating nozzle 18 loosens and breaks away the granular matter of the mound of the material and it is drawn in suspension in the water into the tube or chamber 20 by suction created by the force of the jet of fluid under high pressure discharged from nozzle 19. The kinetic energy of the jet discharged from said nozzle is imparted to the material in suspension drawn into chamber 20 and drives it through a hose or tube 23 to a point remote from the work at hand as shown in said Fig. 1. Hose 23 is preferably flexible and is of substantially the same diameter as tube or chamber 20. It may be coupled or otherwise connected to tube or chamber 20 in any convenient manner. Also, if so desired, said flexible hose 23 may be held in any desired suspended position to clear obstructions by means of hollow floating members 24 connected to said hose.

It will be obvious from the above description that inasmuch as nozzles 18 and 19 are of equal or the same capacity, the rearward thrust created by the force of the jet of fluid under pressure discharged from nozzle 18 when the device is in operation is counterbalanced by the thrust in the opposite direction created by the force of the jet of fluid under pressure discharged from nozzle 19 so that the device may be easily directed and manipulated by the operator without undue effort. The nozzle 19 not only acts to draw the suspended material within the chamber 20 and to eject it therefrom but it acts as a counterbalancing medium for the apparatus as well. As the excavating and ejecting operations are carried

on substantially simultaneously, the water adjacent the work at hand does not become beclouded thereby permitting the diver to carry on his operations with clear vision.

The invention claimed is:

1. A portable apparatus for excavating and ejecting under-water materials comprising a fluid chamber, an inlet pipe communicating with said fluid chamber and adapted for connection with a source of fluid under pressure and providing gripping means for manipulating the apparatus, an excavating nozzle connected to and extending outwardly from said fluid chamber for excavating materials by the force of the jet of fluid discharged from said nozzle, an ejecting chamber having an opening adjacent said excavating nozzle for receiving the excavated materials in suspension in water, an ejecting nozzle connected to said fluid chamber and extending within said ejecting chamber for discharging a jet of fluid under pressure therein to draw the excavated materials in suspension through said opening and within said ejecting chamber by suction, said ejecting nozzle being positioned in alignment with and in opposed relation to said excavating nozzle and both of said nozzles having discharge orifices of equal capacity whereby the thrust of one nozzle in one direction counterbalances the thrust of the opposed nozzle in the opposite direction and means connected to said ejecting chamber for discharging the excavated materials in suspension therefrom to a point remote from the excavating nozzle.

2. A portable apparatus for excavating and ejecting under-water materials comprising a fluid chamber, means for supplying said chamber with a fluid under pressure, an outwardly extending cone-shaped nozzle extending from and in communication with said chamber for excavating the materials, an inwardly extending cone-shaped ejecting nozzle in alignment with said first-named nozzle and also in communication with said chamber, said nozzles being of equal capacity whereby the thrust of one nozzle created by the force of the jet of fluid under pressure discharged therefrom counterbalances the thrust of the other nozzle in an opposite direction and an ejecting chamber receiving said ejecting nozzle for ejecting the materials in suspension loosened and broken away by the action of the excavating nozzle.

3. A portable apparatus for excavating and ejecting under-water materials comprising a fluid chamber, means for supplying said chamber with a fluid under pressure, an outwardly extending cone-shaped excavating nozzle extending from and in communication with said chamber, an inwardly extending cone-shaped ejecting nozzle in alignment with said first-named nozzle and also in communication with said chamber, said nozzles being of equal capacity whereby the thrust of one nozzle in one direction created by the force of the jet of fluid under pressure discharged therefrom counterbalances the thrust of the other nozzle in an opposite direction and an ejecting chamber receiving said ejecting nozzle and spaced therefrom and comprising a tube encompassing said fluid chamber and having an open end adjacent said excavating nozzle for receiving the material in suspension in water excavated by the action of said excavating nozzle.

4. A portable apparatus for excavating and ejecting granular materials from beneath the surface of a body of water comprising a fluid chamber, a cone-shaped excavating nozzle integral

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therewith, a cone-shaped ejecting nozzle in alignment with said first-named nozzle and also integral with said chamber, an inlet pipe communicating with and integral with said chamber, a tube providing an ejecting chamber open at one end for receiving the excavated material in suspension in water and provided with an opening receiving said inlet pipe, said tube encompassing said chamber and ejecting nozzle, a strut con-

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nected to said chamber and tube for supporting said chamber and nozzles, a flexible hose connected to said tube for ejecting the excavated material in suspension in water to a point remote from said excavating nozzle and flotative means for holding said flexible hose in suspended position.

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