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SIPHON DREDGING PUMP
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Fig. 1  Fig. 2  Fig. 3

Fig. 4  Fig. 6  Fig. 7

Fig. 5  Fig. 8  Fig. 9

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The purpose of this invention is to provide simple and efficient apparatus without mechanically moving parts, for raising material, such as sand, dirt, the rare metals and the like, from river beds, submerged vessels, or the like, in any place where submerged pumping is necessary, by vacuum action.

The invention is a fluid operated elevator in which fluids are forced downward to a submerged point and discharged in such a manner that a fluid of a lighter weight is distributed through a confined column of a liquid or any fluid of a heavier weight, and the fluids buoy or convey particles, such as fine gold, or other of the rare metals, sand, dirt, and the like, upward to suitably recovering means.

Many types of dredges and other apparatus have been provided for endeavoring to recover the materials from river beds or the like, and whereas these have been successful to a certain degree the amount of material recovered hardly compensates for the heavy cost of the machinery and also of the operation thereof.

The object of this invention is, therefore, to provide apparatus, having no moving parts, which may be lowered upon the bed of a river, or into the hold of a submerged vessel, or the like, and which will function to raise material as fluids are forced therethrough.

Another object is to provide a hydraulic elevator which may be used upon beds of rivers, or the like, which provides a confined air and water column for raising objects therefrom, by displacement of water therein with air.

Another object is to provide a cylinder open at the lower end with an air chamber around the lower end having openings communicating with the cylinder, that may be submerged in a body of water, means providing a continuous air supply to said chamber, and means injecting water into said cylinder.

Another object is to provide a cylinder adapted to be submerged in a body of water in which means is provided for supplying air thereto through small apertures and other means is provided for injecting water under pressure upward in said cylinder.

A further object is to provide means adapted to be positioned at the lower end of a pipe submerged in a body of water into which fine particles of gold, sand, dirt or the like may be drawn upward by a column of water rushing upward therethrough.

And a still further object is to provide apparatus for elevating material from river beds, submerged vessels, or the like, in which there are no moving parts, and which is of a simple and economical construction.

With these ends in view the invention embodies a vertical cylinder adapted to have the lower end submerged in a body of water, apertures in the wall of the cylinder communicating with an air chamber around the lower end thereof, a pipe for supplying air under pressure to the air chamber, and means for supplying water under pressure to said cylinder above the air chamber, and also to an area below the lower end of the cylinder.

The cylinder forms a force pump, the action of which is a rapid upward velocity of everything contained therein and this is stimulated by displacement of water by air by discharging air through apertures so that the air will expand and the expansion of the air, which is further expedited by the differential between the pressure of the air and the pressure of the surrounding water, causes a rapid churning which accelerates the velocity and as the movement is very rapid, it conveys all fine particles and even rocks and gravel upward through a column of water confined in the cylinder. The air is supplied at pressure slightly above the hydraulic head pressure and the openings through which it is injected are comparatively small so that the air that displaces the water is in the form of small bubbles, and the smaller the bubbles, the closer they congregate, and the more water they displace. The water is forced downward at from two to five hundred pounds pressure and as this is discharged into the cylinder above the air chamber, it will force all of the substances therein toward the center and also tend to accelerate the velocity of the resulting upward action therein.

The water may also be discharged at a suitable angle below the surface so that it may stir up or agitate the river bed below the lower open end of the cylinder and as the sand or gravel is agitated it will be drawn upward by the action in the cylinder, or siphon pump, as it may be termed.

Other features and advantages of the invention will appear from the following description taken in connection with the drawings, in which Figures 1 to 10 show an embodiment of the invention in outline, whereas Figures 11 to 14 show details of construction showing a completed device.

Figure 1 is a view showing a cross section through the cylinder of a typical design showing spiral pipes therein through which the air may be discharged.

Figure 2 is a view showing an alternate design.
in which the air is discharged through a comparatively thin flat chamber.

Figure 3 is a cross section through the device shown in Figure 2.

Figure 4 is a cross section through the upper part of the cylinder shown in Figure 1 showing a typical discharge chamber.

Figure 5 is a view looking upward toward the lower end of the suction pipe showing a typical arrangement of the spiral pipes therein.

Figure 6 is a detail showing an arrangement of the upper water discharge chamber and air chamber, in the design shown in Figures 1 and 3.

Figure 7 is a cross section through the cylinder in Figures 2 and 3.

Figure 8 is a detail showing a method of forming the openings in one of the sides of the air chamber.

Figure 9 is a cross section through the air discharge chamber.

Figure 10 is a view showing an alternate design in which the air and water supply pipes pass downward inside of the cylinder at the lower end thereof.

Figure 11 is a view showing a cross section through the device as it will be made with parts broken away and parts shown in elevation.

Figure 12 is a view showing the outside of the device shown in Figure 11 and also showing an alternate arrangement in which injection nozzles similar to the nozzles shown in Figures 1 and 3 are used on the lower end thereof.

Figure 13 is a detail showing one of the members forming the cylindrical wall of the mixing chamber in the lower part of the device.

Figure 14 is a cross section on line 14-14 of Figure 11.

In the drawings the device is shown as it may be made wherein numeral 1 indicates the cylinder of the arrangement shown in Figures 1 to 10, numeral 2 the air discharge chamber, and numeral 3 the water discharge chamber.

The cylinder 1, in the design shown in Figures 1 to 3, is made of pipe and may be of any diameter depending upon the material to be worked. This pipe may be continuous or may be made in sections and the air and water chambers may be provided in independent sections, as shown in Figure 6, or in a continuous section, as shown in Figures 1 to 3.

In the design shown in Figure 1 the air is supplied through a pipe 4, and this is connected to the lower end of spiral pipes 5 and 6 through the wall of the cylinder 1 through openings 7 and 8 and the spiral pipes 5 and 6 are provided with very fine openings 9 through which the air is discharged into the interior of the cylinder. It will be understood that the pipes 5 and 6 may be of any size, type, or design and may be arranged in any manner.

In the design shown in Figures 2 and 3 the lower end of the pipe 4 is connected to a rectangular shaped air chamber 2 which is formed with two flat plates having very fine perforations extending continuously throughout the area thereof and as the air is fed to the lower end of this chamber it will be discharged through the small openings and into the cylinder. This flat air chamber 2 may also be twisted, as shown in Figure 10, or otherwise positioned to cause a spiral action in the head or pipe. It will be understood that this may be of any other type or design and may be arranged in any manner.

This chamber may be made, as shown in Figures 8 and 9, with side plates 10 which may be of steel or any material and these are lined with copper or brass plates 11, as shown in Figure 8. Comparatively small openings 12 may be drilled in the plate 10 to such a depth that the points of the drill just penetrate the inner surface of the plate and then the lining plates 11 are placed against the plates 10 and with these plates placed upon a block of wood a punch may be placed through the opening 12 so that it will barely penetrate the lining plate 11. It is thereby possible to provide extremely fine openings 13 in the lining plate, and these minute openings break the air up to such a degree that a churning action is obtained and the product is foamy. It will be understood, however, that these openings may be formed in any other manner and also that the air chamber may be formed in any manner or by any means. These plates may be bolted together with gaskets between them, as shown in Figure 9, or may be assembled, held together, or arranged in any other manner, and any other means may also be used for forming the sides or edges of this chamber. The lining plates may also be omitted and the openings formed only in the side plates. The pipe 4 may also be connected to the lower end of the chamber 2, as shown in Figure 7, or in any other manner.

The water is forced downward to the cylinder through a pipe 14 and this may be provided with a connection 15 through which water may be supplied to the chamber 3 through a connecting pipe 18. When it is desired to agitate the river bed the lower end 17 of the pipe 14 is bent outward and then inward at an angle of approximately 45° so that it will discharge below the lower end of the cylinder 1, as shown in Figure 1. The end of this pipe may be provided with a nozzle 16, as shown in Figure 3, however, it will be understood that the nozzle may be omitted, or the end of the pipe formed in any manner, or a nozzle of any other type or description may be used.

The water chamber 3 may be formed with a bevelled upper surface 19 which is provided with small perforations through which water will be discharged in an upward direction and the chamber is positioned in the cylinder in such a manner that the water will be discharged toward the center thereof by forcing materials therein toward the center and upward. It will be understood, however, that this chamber may be of any other type or design and may be arranged in any manner. In the design shown in Figure 6 the upper surface of this chamber is curved instead of flat, as shown in Figures 1 and 3, and it will be understood that this surface may be flat or curved or of any shape.

In actual construction the device is made as shown in Figures 11 to 14 in which the lower end of a pipe 20 similar to the pipe 1 is provided with a flange 21 which is attached to a flange 22 on the upper end of a nipple 23 by bolts 24 and the lower end of the nipple 23 is also provided with a flange 25 which is attached to a flange 26 on a shell 27 by bolts 28. These parts form air and water chambers around a central column and are arranged so that the air and water are injected into the column with the air injected in the form of minute bubbles reducing the weight of the water in the column and the water injected in an upward direction tending to form jets which assist in forcing the water column upward.

The water column which is indicated by the numeral 29 is formed in the center of the pipe 20 and extends downward through a similar pipe section 30 in the nipple 22 and also downward.
through an inner cylinder 31 formed by slightly separated rings 32 with a mixing chamber 33 in the center and with the lower end open as shown at the point 34 thereby providing a continuous column extending straight upward in the device. A construction of this device, as shown in Figure 11, is made with a disc 35 in the lower end of the shell 27 and the opening 34 is formed in the member 35 and positioned at one side of the center thereof. Member 35 is provided with a recess 36 around the opening 34 and the lower member 37 of the cylinder 31 rests in this recess with a plurality of similar members or rings resting thereon and these rings are provided with relatively small upwardly inclined openings so that air passing therethrough from a surrounding air chamber 38 will be directed upwardly. The chamber 38 is comparatively sealed and this chamber may be supplied with air under pressure through pipe connection 39 which may extend to any means for supplying air under pressure. The individual members or rings 32 of the member 31 are preferably made as shown in Figure 11 to be supplied with upwardly directed air and with their lower surfaces 41 similarly shaped so that one ring may readily be placed upon the other and it is preferred to use thin spacers between the rings or the upper surfaces of the rings may be provided with ribs 42 as shown in Figure 11. It will be understood however that any means may be used for providing a slight air space between these rings. The upper ring which is indicated by the numeral 43 is made with a flat portion 44 at the upper end thereof which rests against the lower surface of the flange 26. This device may therefore be installed in the shell 27 and permanently held between the flange 26 and the member 35 and the lower surface of the member 35 may be provided with openings 45 by which it may be rotated as it is screwed into the threads 46 at the lower end of the shell 27.

The water column is positioned toward one side of the center as hereinbefore described and as shown in Figure 14, and at one side of this column is a small water pipe 48 the outer surface of which is threaded and the lower end of which is threaded into the flange 25 as shown at the point 47. This pipe extends upward through the sections 23 and through the flanges 21 and 22 and the upper part is provided with lock nuts 48 and 49 which seal the opening through which the pipe passes. This pipe may be provided with an opening 50 in the side thereof as shown in Figure 11, however it will be understood that as many openings as may be desired may be provided between the pipe and the chamber 51 formed on the inside of the nipple 23. The pipe 50 is threaded in the flange 25 and extends upward to a point a short distance from the flange 22. The upper end is beveled to correspond with the lower end of a section extending downward from the flange, and an opening 52 between the sections of pipe may be adjusted by screwing the section 50 in the flange 25. The opening 52 provides communicating means between the chamber 51 and the interior of the threaded section supplied to the pipe 48 it will pass through the opening 50 into the chamber 51 and through the opening 52, and as it is under pressure it will have a tendency to move the water column upward.

Below the pipe 48 is another pipe 53 the lower end of which is threaded and passing in the member 35 and a plug 55 may be provided below the lower end thereof. This plug may be removed and jets 56 as shown in Figure 12 may be inserted therein so that when desired the water under pressure will be forced downward and through the jets 56 so that it will agitate the sand or the like on the river bed and it will therefore pass upward through the water column more readily. It will be understood that one or any number of the jets 56 may be used and these may be located at any point or points.

It will be understood that other changes may be made without departing from the spirit of the invention. One of which changes may be in the use of this method of elevating, raising or pumping in combination with a casing or device of any other nature or description, another may be in the use of other means for conveying water and air under pressure to the cylinder, another may be in the use of other means for attaching the water and air pipes to the cylinder or pipe extending therefrom, and still another may be in the use of a device of this type for any other purpose.

The construction will be readily understood from the foregoing description. In use the device may be provided as shown and described and it will be noted that the cylinder 1 may be attached to the lower end of a pipe which may extend upward through a body of water and any means may be provided at the upper end for receiving the discharge therefrom. The pipes 4 and 14 may be connected to any suitable pumps on the shore, or on a boat or barge, or any means may be provided for supplying air and water under pressure.

The cylinder 1 may be lowered in a body of water until it arrives at a position slightly above the bed thereof, where it will fill with a column of water, and as air is provided under pressure, it will be discharged into the lower end of the water column and as it is discharged into the water, the displacement of the water thereby and the expansion thereof will raise all materials therein. The water may then be supplied through small openings above the air openings and as this is discharged under pressure it will form jets and cooperate with the buoyancy of the air in the water and further urge the water and everything therein upward.

When it is desired to agitate the sand, dirt or other material under the device, the nozzles may be used and when the water is forced through them, it will agitate the material and as the material is agitated, it will be drawn upward by the action in the head and thereby conveyed above the surface of the water. The device, therefore, forms a complete elevator to force, raise, or convey material upward from a river bed, submerged vessel, or the like, and at the same time has no working, moving, or operating parts with the exception of the fluids passing therethrough.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. A dredging apparatus of the type comprising a vertical pipe of relatively large diameter with injecting means at the lower end in which the injecting means are secured and supplied to the pipe 48 it will pass through the opening 50 into the chamber 51 and through the opening 52, and as it is under pressure it will have a tendency to move the water column upward.

2. A dredging apparatus of the type comprising a vertical pipe of relatively large diameter with injecting means at the lower end in which the injecting means are secured and supplied to the pipe 48 it will pass through the opening 50 into the chamber 51 and through the opening 52, and as it is under pressure it will have a tendency to move the water column upward.
chamber surrounding said pipe and communicating with said slot and water supply means connected to said water chamber.

2. Dredging apparatus as described in claim 1 further characterized in that the air and water chambers are formed in a surrounding casing in which the pipe and rings are eccentrically positioned, and a water pipe also extending through said chambers to the lower end of the chamber surrounding said rings and having a nozzle connection in the lower end thereof.

3. Dredging apparatus as described in claim 1 further characterized in that a relatively large number of rings are used providing an extended surface through which air is upwardly injected into the inner circular passage from the periphery thereof.

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