UNITED STATES PATENT OFFICE.

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AIR-LIFT FOR ELEVATING LIQUIDS.


Application filed October 7, 1913. Serial No. 703,794.

To all whom it may concern:

Be it known that I. BENJAMIN ANDREWS, a citizen of the United States, residing in the city of Houston, county of Harris, State of Texas, have invented or discovered certain new and useful Improvements in Air-Lifts for Elevating Liquids, of which the following is a clear and complete disclosure.

My invention relates to pneumatic lifts, such as have heretofore been employed to elevate water and other liquids. Arrangements of this kind now in use, of which there are a number of systems, usually comprise an induction or discharge pipe extending into the liquid to be elevated, and means for supplying air under pressure into the lower end of the induction pipe. This air mixes with the liquid in the induction pipe, thereby increasing the weight of the column of liquid in the pipe, causing it to rise, due to the greater hydrostatic pressure below. Arrangements of this kind are now extensively used for pumping water from artesian wells. They are also used in some instances in industrial purposes for elevating liquids of various kinds. The efficiency of an arrangement of this kind depends upon the degree of diffusion of the air in the liquid, since, if the air is finely divided throughout the liquid, the slippage will be relatively small. This has been observed and numerous devices have been devised for emulsifying air in the liquid at the point where it is introduced, the object being by such means to reduce the slippage of the air through the liquid. These devices, however, proved of little value due to the tendency of the small bubbles of air to reunite shortly after leaving the emulsifying device.

The object of my invention is to provide an arrangement adapted to maintain the air in a finely divided condition from the point where it is introduced to the top of the induction pipe, and further, to do this without materially increasing the resistance to the flow of the liquid through the induction pipe. I accomplish this object by an arrangement, one embodiment of which is shown in the drawing accompanying and forming a part of this specification.

The single figure shown in this drawing shows a section of an induction or discharge pipe with my improved arrangement incorporated therein.

Referring in detail to the drawing, the numeral 1 designates the discharge or induction pipe or conduit. This is shown broken away at such end, but it is to be understood that at its lower end it terminates in the body of liquid to be elevated at a depth allowing suitable submergence, and at its upper end in a suitable discharge orifice or at a suitable receiving tank.

The numeral 2 designates a small, compressed air pipe centrally disposed in the pipe 1 and through which compressed air is supplied by any suitable means into the liquid in the pipe 1.

The numeral 3 designates a perforated diaphragm disposed in the pipe 1 and coiled around the air pipe in a spiral manner. The diaphragm is preferably arranged so as to fit the pipe 1 closely at its outer edge and the air pipe 2 at its inner edge, and forms a screw-like passage for the liquid as it moves upwardly through the pipe 1. Perforations 4 are formed in the diaphragm 3 and are spaced throughout its length so as to subdivide the bubbles of air in the water as they are formed during the upward movement of the column of water in the manner hereafter described.

The operation of the arrangement described is as follows: Compressed air is introduced into the pipe 2 and is discharged into the liquid at the lower end of this pipe. The weight of the column of liquid is thereby decreased and the column of liquid moves upwardly following the screw-like path formed by the diaphragm. As the liquid ascends the bubbles of air tend to grow in size and to ascend in a vertical direction. This tendency brings the bubbles in contact with the lower surface of the diaphragm 3 and therefore opposite the small perforations 4. The bubbles pass through these openings and are broken up into small bubbles. This operation continues as the column rises. The bubbles as they grow in size are repeatedly broken up and the air and water are maintained in the emulsifying condition.

In practicing my invention the diaphragm 3 may be constructed in any suitable manner and of any suitable material, and the pitch of the screw-like spiral may be varied within wide limits. It is desirable, however, that the pitch be quite steep in order that it may offer as little resistance as possible to the flow of the liquid.

While my invention is particularly adapted for elevating water, yet it is obvious that
it may be used for elevating liquids of many kinds, and while I have illustrated only one embodiment of my invention, I am aware that modifications may be made by those skilled in the art without departing from the scope of my invention as defined by my claims.

What I claim is:

1. In apparatus of the kind described, the combination of an eduction pipe and a spiral shaped perforated diaphragm disposed therein in position to direct a stream of fluid passing therethrough in a spiral direction, for the purpose described.

2. In apparatus of the kind described, the combination of an eduction pipe, an air pipe disposed therein and a spiral-shaped perforated member surrounding said air pipe, for the purpose described.

3. In apparatus of the kind described, the combination of a fluid eduction pipe, a perforated diaphragm disposed therein and arranged in the form of a spiral, and means for introducing compressed air into said eduction pipe, for the purpose described.

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Witnesses:

WILLIAM F. KEYES,
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