O. H. & A. L. ELIEL.

APPARATUS FOR LIFTING LIQUIDS.

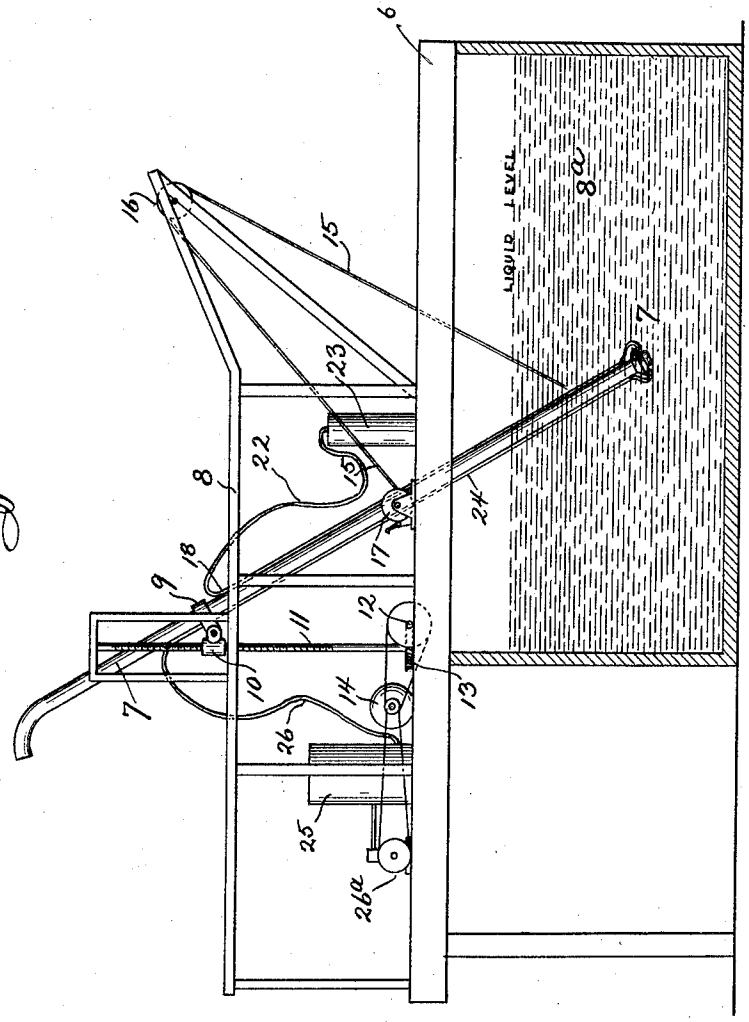
APPLICATION FILED JUNE 8, 1908.

1,005,108.

Patented Oct. 3, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
R. J. Jacker
C. E. Boldt.

Inventors:
Oscar H. Eliel
Albert Lee Eliel
By Jno. H. W. Hipple
Atty.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

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Fig. 3.

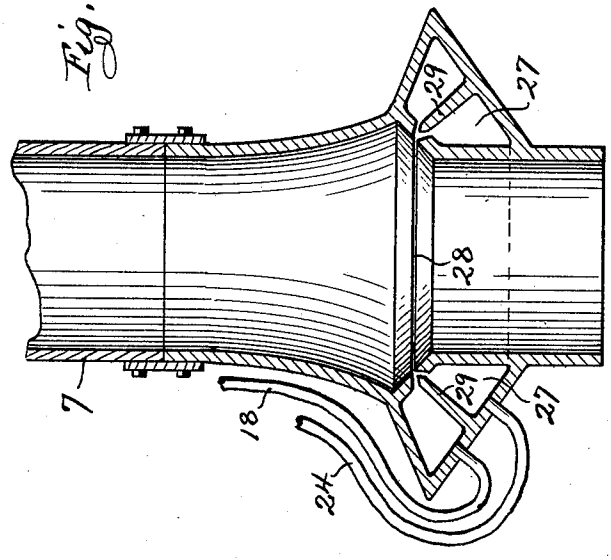
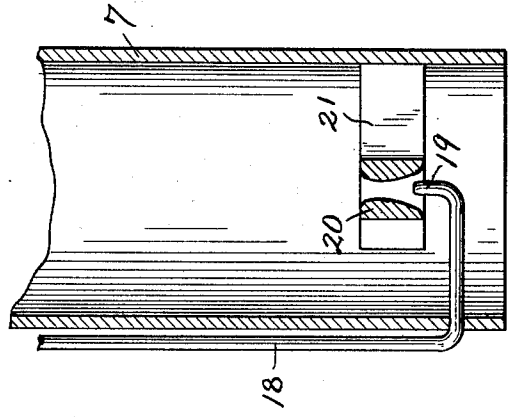


Fig. 2.



Witnesses:
R. J. Jacker
C. E. Boldt,

Inventors:
Oscar H. Eliel
Albert Lee Eliel
By Jno. H. Whipple
Atty.

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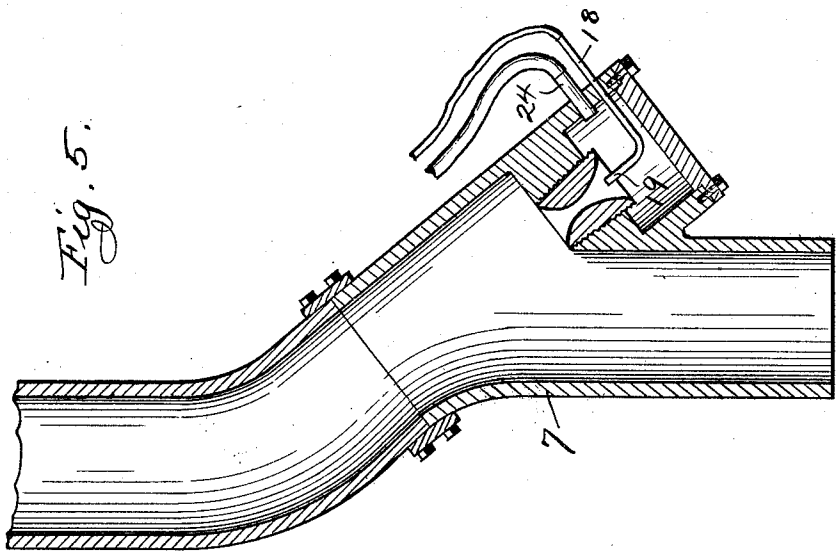
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3 SHEETS—SHEET 3.

Fig. 5.



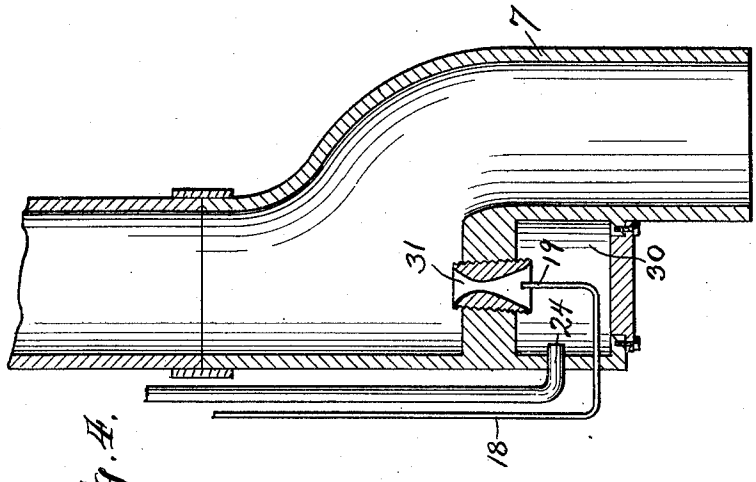


Fig. 4.

Witnesses:
K. J. Jacker
C. E. Boldt.

Inventors:
Oscar H. Eliel
Albert Lee Eliel
By Knott Whipple
Atty

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

OSCAR H. ELIEL, OF LA SALLE, ILLINOIS, AND ALBERT LEE ELIEL, OF SAN FRANCISCO, CALIFORNIA, ASSIGNORS OF ONE-THIRD TO LEWIS E. AUBURY, OF SAN FRANCISCO, CALIFORNIA.

APPARATUS FOR LIFTING LIQUIDS.

1,005,108. Specification of Letters Patent. **Patented Oct. 3, 1911.**

Application filed June 8, 1908. Serial No. 437,298.

To all whom it may concern:

Be it known that we, OSCAR H. ELIEL, of La Salle, in the county of Lasalle and State of Illinois, and ALBERT LEE ELIEL, of San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Apparatus for Lifting Liquids, of which the following is a specification.

Our invention relates to apparatus for lifting liquids by means of an elastic agent under pressure.

We employ an open-ended lifting-tube, designed to have the induction-end submerged in the liquid from which the lifting is to be made, an air tube for introducing compressed air into the submerged lifting-tube, near the induction end, and a liquid atomizer at the induction-end, adapted to jet into the bore of the lifting-tube toward the discharge-end thereof; and the objects of our improvements are: First, to provide means for converting a liquid at normal pressure at the submerged end of the lifting-tube or near the induction-end into a vapor or spray and charging an ingoing current of compressed air therewith in order to produce an elastic lifting agent within the lifting-tube having increased density and lifting effectiveness over compressed air for that purpose; and second, to provide means for introducing liquid near the induction-end of the submerged lifting-tube at a higher pressure than the pressure at the depth of submergence for further increasing the density of the mixture of ingoing air and liquid spray over what it would be when produced from the liquid at the normal pressure of the submergence depth.

We attain these objects by the means illustrated in the accompanying drawings in which—

Figure 1 is a side elevation showing a platform arranged over a vat for holding liquids or treating something in liquid during a manufacturing process and having our lifter mounted thereon, in connection with means for operating same. Fig. 2 is a detail showing an enlarged sectional view at the induction-end of the lifting-tube, illustrating means for attaining the first of the above named objects. Fig. 3 is a view similar to that shown in Fig. 2, illustrating further means whereby the second of the above named objects is attained. Figs. 4 and 5 are views similar to that shown in Fig. 3, but illustrating, respectively, modifications of the structure.

Like signs marked on the drawings refer to like parts throughout the several views.

It is known that air, under suitable pressure and in sufficient quantity, caused to enter in a constant stream into an open-ended tube near its lower end and when submerged while its upper end is above water, will arrange itself in the tube in alternate layers with the water as the latter flows into the lower end of the tube by gravity, and that such layers of water may, by this means, be lifted unbroken in the tube and caused to flow out at its upper end considerably above the water level, the effect varying with the relations of submergence to lift, diameter of tube, temperature, and atmospheric pressure. This applies not alone to water but alike to oils and all liquids.

We have discovered that air or gaseous fluid other than steam charged with an atomized liquid is very much superior to air or gas alone for lifting liquids in eduction-tubes in that it has the required elasticity to expand and form elastic pistons separating the liquid entering such tubes into unbroken sections, and increased density over air for this purpose which adapts it to serve better particularly as a practical means for lifting in induction-tubes, water, acids, syrups, pulp and liquids of all kinds and for dredging purposes in raising coarse gravel, gold nuggets and other suspended substances of greater specific gravity than the liquid used, and also that such elastic pistons having increased density will work in a similar manner when put under a velocity above the velocity at which air will work for raising solid or unbroken sections of liquid. And further, that such elastic pistons of increased density will work in a similar way where the submergence of the eduction-tube is relatively less than the submergence at which air pistons will work for raising unbroken layers of liquid in such tubes. Owing to the great ease with which steam condenses it is not regarded as the equivalent of air for use in forming elastic pistons having increased density and therefore steam is not included as a gaseous fluid which can be charged with an atomized liquid within the meaning of

this specification. To utilize this discovery we provide the lifting-tube near its lower end with suitable means whereby water or other liquid flowing in at the lower end of such tube is brought into contact with ingoing air under pressure and is converted into spray to form such elastic pistons having greater density for so lifting any kind of liquid with disintegrated material of any kind suspended therein including coarse gravel and other gold-bearing deposits through such tube in dredging by producing increased suction power in the same by means of increased velocity and momentum of the ingoing air current and the consequent increase in the movement of the material being lifted through such tube.

In the drawing the numeral 6 designates a slotted platform upon which the lifting-tube 7 is shown as pivotally suspended from an upright frame 8 so that the lower or induction-end can swing and dip into a liquid contained in a vat 8^a. Said lifting-tube is shown as rigidly attached to one member 9 of a hinge whose opposite member is secured to cross piece 10, said cross piece being threaded at its ends upon upright threaded shafts 11 (but one of which is shown) by means of which the upper end of the lifting-tube can be raised and lowered. Said shafts are worked simultaneously by means of a connecting shaft at 12 provided with worm-gears 13 and belt gearing connected with a power shaft at 14.

The lower part of the lifting tube is suspended by a cable 15 which passes over a sheave 16 on the frame and then passes to the drum of a windlass 17 worked by means of a crank. By this means the induction-end of the lifting-tube may be raised and lowered in the vat.

Mounted upon the lifting tube is an air-pipe 18 which passes through the wall of said tube near the induction-end (Fig. 2) and has its inner end provided with a jet 19 arranged at the axis of the tube and pointing upwardly or toward the discharge-end. Arranged over and about the air jet is an annular nozzle piece 20 which is supported centrally in the tube by a spider 21 the perforation of the nozzle piece being over and around the air jet so that a portion of the water or liquid entering the submerged open end of said tube will be blown through said perforation and be thereby atomized and mixed with the compressed air passing in through said jet. In this instance the pressure of the liquid atomized will correspond with that at the depth of submergence. The air-pipe at its upper end has a flexible hose connection 22 with a compressed air reservoir 23 wherein the desired pressure may be maintained by any ordinary means. There is also mounted upon the lifting tube a water pipe 24 which is connected at the upper end with a water tank 25 by means of a flexible hose 26, or with a force pump 26^a for introducing water or any liquid under greater pressure than the pressure at the depth of submergence; and to this end the water pipe is adapted to discharge into a closed water box at or near the induction-end of the lifting-tube from which water-box the water to be atomized passes through the atomizer and into said tube along with the air.

In Fig. 3 is shown an annular water-box 27 provided with an annular slot 28 communicating with the bore of the tube. An annular partition 29 divides this box into two compartments at the line of the slot, and the air-pipe 18 and the water-pipe 24 communicate with the box at opposite sides of the partition so that the water and air introduced into the box will pass together over the top of the partition and issue through the slot into the bore of the tube as an elastic mass of liquid-laden gaseous fluid under the required tension as regulated by the pressure in the air-pipe and water pipe, which will expand in and fill the bore of the tube to form the elastic pistons having greater density as desired than pistons similarly formed of air with the liquid atomized taken at the pressure of the depth of submergence.

In Fig. 4 the line of the tube 7 has a jog and is provided at the angle with a water box 30 whereby liquid under regulated pressure, or cleaner than the roiled liquid entering the open-end of the lifting-tube may be used in the atomizer which has the nozzle-piece 31 set in a threaded perforation through the top of the box and adapted to discharge spray and compressed air into the bore of the tube, directly over the water box.

Fig. 5 shows a similar construction to that shown in Fig. 4, there being less curvature of the tube 7 and the water pipe 24 being a short one designed to admit liquid from near the bottom of the vat into the box but off a little distance from where the deposits are most roiled.

It is noted that the apparatus as described, for raising liquid and with liquid particles of solid materials of greater specific gravity than the liquid raised, comprises, substantially, an open-ended lifting-tube of suitable length and caliber for the work, a short nozzle, perforated part, or ring, arranged at or near the induction-end of the lifting-tube, the caliber thereof being much smaller than that of the lifting-tube and directed into the bore thereof, an air-pipe having a caliber preferably less than that of the nozzle and arranged in proximity thereto and in line therewith, leaving intermediate free space to permit a body or layer of liquid to pass or circulate over the jet and between the jet of the air pipe and the nozzle, and a source of compressed air connected in communication

with the other end of the air pipe, and that such apparatus may have in addition a water box at the induction-end of the lifting-tube and a water supply pipe in connection therewith for supplying liquid to the nozzle under regulated pressure differing from the natural pressure at any given depth of the lifting-tube's submergence.

The term "induction-end" as used in this specification means that end of the lifting-tube which is submerged when the device is in operation and this constitutes a distinguishing feature of our invention over ejectors or siphon pumps which employ steam as the means for propelling liquid through the ejector pipe and apply the steam in the ejector head or double head or at some other point which is not submerged when the device is in operation.

What we claim is:

1. A liquid-lifting apparatus comprising an open-ended lifting-tube of suitable length and caliber, a box for holding liquid mounted at that end of the lifting-tube which is designed to be submerged when the device is in operation, a nozzle having its bore connecting the interior of the box with the bore of the lifting-tube, a liquid-pipe communicating with the interior of the box and with a liquid-supply, the box, liquid-pipe and nozzle being adapted to vary the liquid pressure within the box relatively to the natural submergence pressure at that end of the lifting-tube when submerged and in operation, an air-pipe communicating with the interior of the box and adapted to jet into the nozzle and means for forcing liquid and air through the liquid-pipe and air-pipe, as and for the purpose specified.

2. A liquid-lifting apparatus comprising an open-ended lifting-tube provided with a slot surrounding the tube near its induction-end, an annular water-box mounted on the tube over the slot, an annular partition of the box at the line of the slot, and an air-pipe and a water-pipe in communication with a source of supply, and with the box at opposite sides of the partition, as and for the purpose specified.

3. A liquid-lifting apparatus comprising an open-ended lifting-tube provided with a flaring enlargement near its induction-end and having a transverse slot below such enlargement, in combination with an annular water-box mounted on the tube over such slot and an air-pipe and a water-pipe in communication with the water-box and adapted to jet into said slot, as and for the purposes specified.

4. A liquid-lifting apparatus comprising an open-ended lifting-tube provided with a transverse slot near its induction-end, a water-box mounted on the tube over such slot and an air-pipe and a water-pipe communicating with said water-box and adapted to throw a jet of air or gas other than steam through said slot and form a liquid spray in such manner as to cause the air and spray to form an elastic piston in the lifting-tube, having greater density than elastic pistons formed of air alone, substantially as and for the purpose specified.

5. A liquid-lifting apparatus comprising an open-ended lifting-tube provided with a transverse slot near its induction-end, a water-box mounted on the lifting-tube over said slot, an air pipe connecting such water-box with a source of compressed air and means for maintaining the air pressure to throw a blast through said slot into the lifting-tube in the manner described to produce a liquid spray, and form an elastic piston of air and liquid spray, as and for the purpose specified.

OSCAR H. ELIEL.
ALBERT LEE ELIEL.

Witnesses to the signature of Oscar H. Eliel:

GEO. A. WILSON,
EMIL GEBHARDT.

Witnesses to the signature of Albert Lee Eliel:

E. L. BAILEY,
GEO. A. FITCH.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."