

A. LONG.
LIQUID AIR LIFT.
APPLICATION FILED NOV. 12, 1910.

987,729.

Patented Mar. 28, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

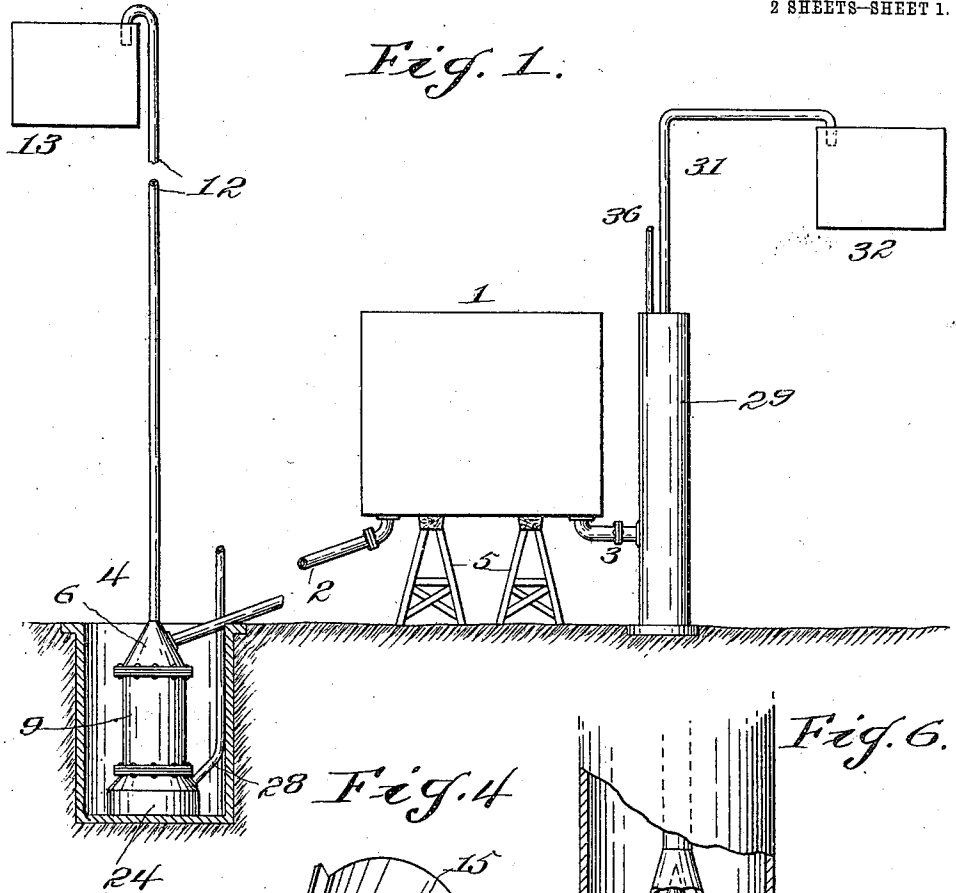


Fig. 4

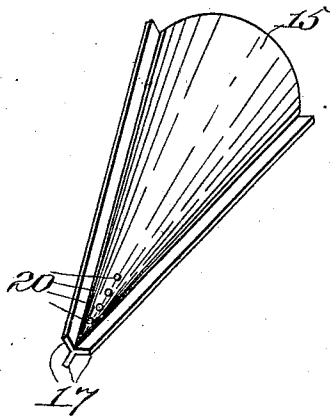
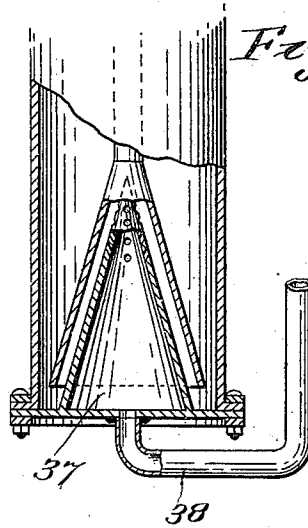


Fig. 6.



Witnesses.

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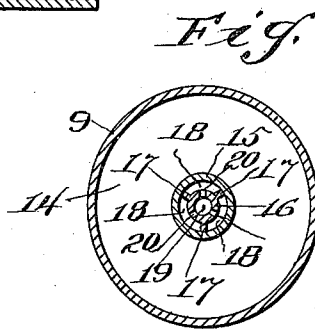
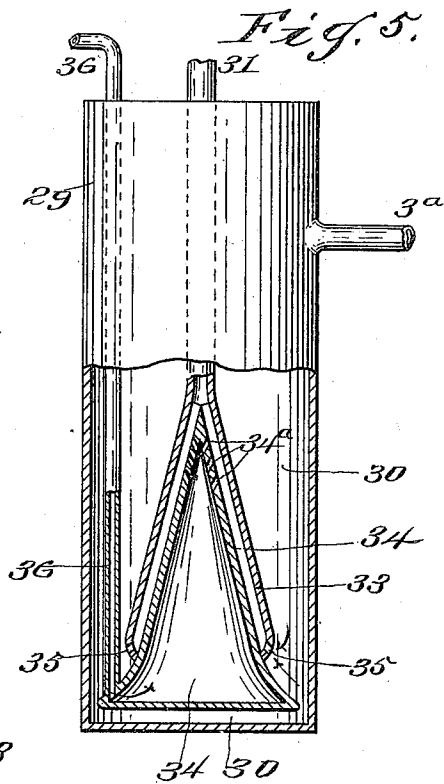
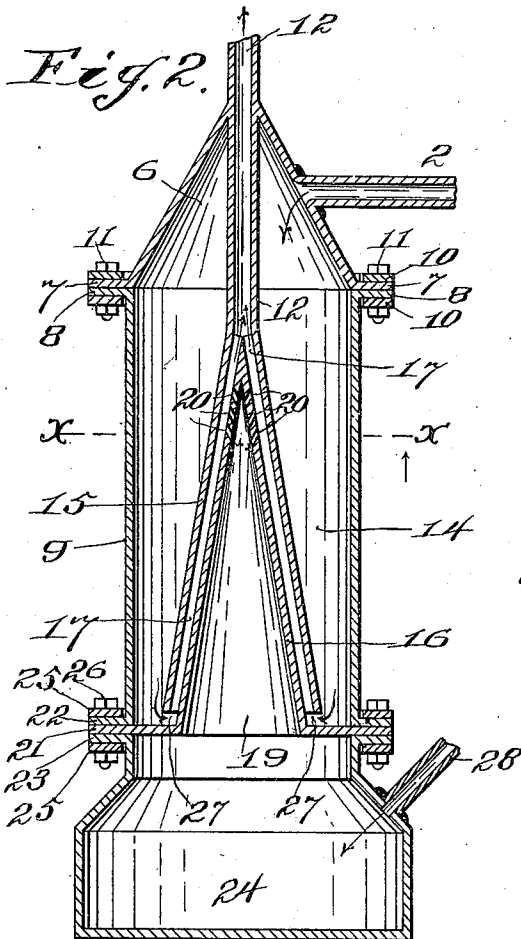
Attorneys

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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

AUGUST LONG, OF RICHMOND, VIRGINIA.

LIQUID AIR-LIFT.

987,729.

Specification of Letters Patent.

Patented Mar. 28, 1911.

Application filed November 12, 1910. Serial No. 592,073.

To all whom it may concern:

Be it known that I, AUGUST LONG, citizen of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful improvements in Liquid Air-Lifts, of which the following is a specification.

This invention relates to apparatus for lifting or raising liquid by compressed air, and pertains especially to means for injecting air pressure into a column of liquid to lift or raise it to various heights as desired or as occasion may demand.

The object of the invention is to provide a pair of telescoping cones, one of which forms an air chamber and is provided with means for ejecting air therefrom into a liquid space formed by and between the said cones, and the other of said cones forming the inner end or mouth of a liquid discharge pipe.

A further object of the invention is to provide in the cones such construction as will permit them to be operated in connection with or as part of either a closed or open top liquid casing or chamber, and with or without such casing having a bottom air chamber.

A still further object of the invention is to provide means for supplying compressed air to one cone simultaneously with the supply of liquid to the other cone, and to make such supply of air either direct to its cone or through an air chamber, or through a pipe leading from the top of the liquid chamber through the latter to the air-cone, in either an open or closed liquid chamber.

A still further object of the invention is to provide a pair of telescopic cones one of which has lengthwise ribs or bars for supporting the other cone and for forming a series of partitions and spaces or channels through which the liquid is raised, and to provide the inner cone with a series of air ducts leading into such channels adjacent the apex or top of said inner cone.

Various other objects, advantages and improved results are attainable in the practical application of the invention.

In the accompanying drawings forming part of this application:—Figure 1 is an elevation showing an application of a short lift apparatus and a high lift apparatus. Fig. 2 is a vertical section of an apparatus embodying the invention for a high lift. Fig. 3 is a cross section taken on the dotted line $x-x$ Fig. 2. Fig. 4 is a perspective view

of the inner or air cone. Fig. 5 is an elevation partly broken away showing a short lift apparatus. Fig. 6 is an elevation partly broken away showing a modification applicable to both apparatus.

The same reference numerals denote the same parts throughout the several views of the drawings.

Inasmuch as the apparatus is especially designed for operating liquid chemicals, the parts thereof, or at least such as come in contact with the liquid are composed of lead, or such parts may be made of other metal or material having a lead lining to protect them from the chemical liquid or the damaging effects of acids, contained in the liquid.

For the purpose of illustrating the application of a high and short lift, these apparatus are shown in Fig. 1 of the drawings as connected to a supply tank 1, by liquid conveying pipes 2 and 3, and in order that the high lift apparatus 4, may be supplied with liquid by its own gravity such apparatus is placed below the surface or plane from which the supply tank 1 is supported by trestles 5, and the liquid inlet pipe 2 extends from a conical top or cover 6 to the bottom of the tank, such top having an annular flange 7 fitting a like flange 8 at the top of a casing 9, and such flanges are secured together by means of metal rings 10, and bolts 11. A lift or discharge pipe 12 extends from the center of the top 6, for conveying liquid to a storage tank 13, at any desired height, and said pipe extends downwardly from the top 6 into the liquid chamber 14, formed by the casing 9, and this portion of the pipe 12 has a cone 15 depending therefrom to near the lower or bottom end of the casing 9. The cone 15 fits over and incloses an air cone 16, so that the cones telescope with the apex of the cone 16, pointing into the pipe 12 at its juncture with the cone 15. The cone 16 is provided with lengthwise ribs or bars 17 upon which the cone 15 rests for separating the cones and which form partitions so as to divide the space between the cones, by reason of such separation, into liquid channels 18. The cone 16 is termed the air cone on account of its forming an air chamber or passage 19, and it is provided adjacent its apex with a series of air ducts 20, leading from the cone chamber or passage upwardly into the channels 18, so that air suction is created in said channels

and such suction is increased or augmented at the intersection of the pipe 12 and the cones by reason of the ducts being brought closer together as they approach the apex of the cone 16. The bottom of the cone 16 has an annular flange 21, which forms the bottom of the chamber 14 and is secured between the casing flange 22 and a like flange 23 of an air reservoir 24, by means of a pair of metal rings 25 and bolts 26. The cone 15 nearly reaches to the flange or bottom 21, so as to leave a liquid passage 27 therebetween from the chamber 14 to the cone channels 18, while the cone 16 is supplied with compressed air from the air reservoir 24 having an air supply pipe 28.

For short lifts of the liquid the apparatus shown in Fig. 2 may be used or an open top cylinder 29, (Fig. 5,) may be employed which forms a liquid chamber 30, connected to the tank 1, by the pipe 3^a, and having a liquid discharge pipe 31, leading therefrom to a storage tank 32, which may be at various distances laterally from the cylinder 29, but only a short distance vertically. The bottom end of the pipe cone 33 is turned inwardly to fit the flaring or bell shaped end of the air cone 34, and such end of the cone 33 has a series of apertures 35 for the passage of liquid between the cones to the pipe 31, from the chamber 30. The bell shaped end of the cone 34 is closed and has an air supply pipe 36 leading thereinto through the chamber 30, from a compressed air supply, and this cone has air ducts 34^a.

Referring to the modification shown in Fig. 6, the air-cone 37 has an air supply pipe 38 leading thereinto at its closed bottom, and the air reservoir hereinbefore referred to is dispensed with, otherwise this form of apparatus is the same as that first described for high lifting of the liquid.

It is obvious that in applying this apparatus, the cones should be placed below the plane of the bottom of the liquid supply tank so as to provide for the gravity fall of the liquid, and that the lifting capacity of the apparatus is governed by the location of the apparatus containing the cones at various distances below the bottom of the liquid supply tank.

In operation, liquid and compressed air being fed to the cones the liquid is forced into and through the liquid discharge pipe by the currents of air ejected from the inner

cone into liquid channels between the two cones, and such operation is stopped by cutting off the air supply to the inner cone.

It will be seen that the outer or pipe cone is supported by the ribs or partitions of the inner cone so that the functions of the partitions are three-fold, in that they form means for supporting the outer cone, they space apart the cones and they form a series of separate liquid channels between the cones.

I do not wish to be understood as confining myself to either closed or open top liquid chambers, to apparatus with or without an air reservoir, nor to any particular size or dimensions of the apparatus or the parts comprising the same.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In a liquid lifting apparatus, the combination, with a liquid chamber having a liquid supply pipe thereto, and a liquid discharge pipe extending into the chamber, of a cone within the chamber and in communication with it and the discharge pipe, an air-cone inclosed by said cone with a liquid passage at the base of the cones for the passage of liquid from the chamber, a series of ribs lengthwise the air-cone for dividing such space into a series of liquid channels, a series of air ducts in the air-cone between the ribs for the passage of air into said channels, and means for supplying the air-cone with compressed air.

2. In a liquid lifting apparatus, a liquid chamber having a liquid induction pipe and a liquid discharge pipe extending from and into the chamber, a liquid cone connected with the discharge pipe and terminating adjacent the bottom of the chamber, an air cone extending from the bottom of the chamber within the liquid cone and having air ducts leading into the liquid cone, partitions extending throughout the length of the cones and dividing the space between the cones into a plurality of liquid and air channels, and means for supplying the air cone with compressed air.

In testimony whereof I affix my signature in presence of two witnesses.

AUGUST LONG.

Witnesses:

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