L. T. EDWARDS.

AIR LIFT PUMP.

APPLICATION FILED DEC. 22, 1916.

1,276,505.

Patented Aug. 20, 1918.

Fig. 1.

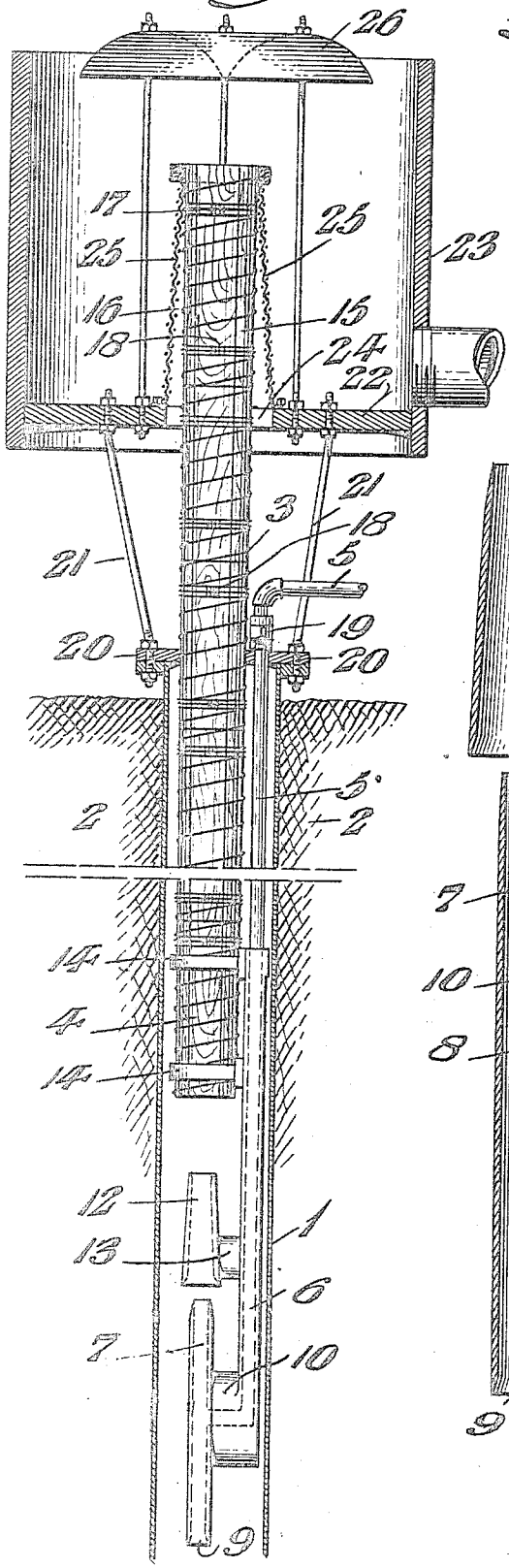


Fig. 4.

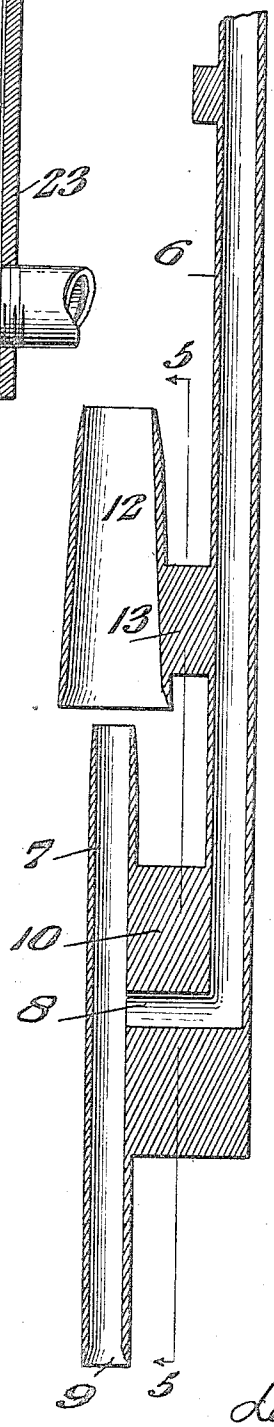


Fig. 5.

ON LINE 5-5. FIG. 4.

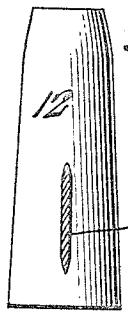


Fig. 2.

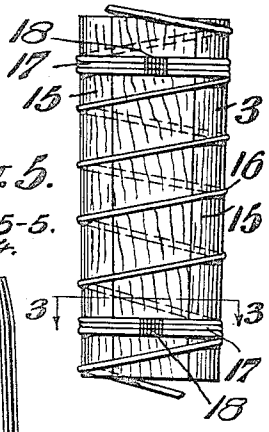
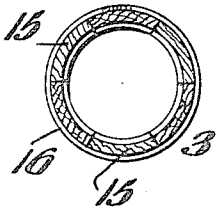
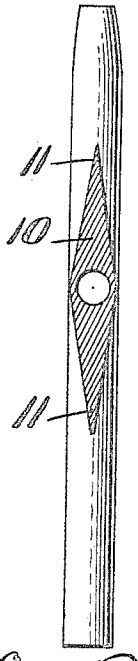


Fig. 3.

ON LINE 3-3. FIG. 2.





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AIR-LIFT PUMP.

1,276,505. Specification of Letters Patent. Patented Aug. 20, 1918.

Application filed December 22, 1916. Serial No. 138,329.

To all whom it may concern:

Be it known that I, LEVI T. EDWARDS, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Air-Lift Pump, of which the following is a specification.

This invention relates to air lift pumps of the type shown in my copending application Serial No. 18,444 filed April 1, 1915, and relates more particularly to the construction of the delivery or eduction pipe and its adjuncts. An object of the invention is to reduce to a minimum the frictional losses incident to the movement of a column of water through the eduction pipe and thereby secure an increased output of water per cubic foot of air supplied to the well. A further object of the invention is to provide means for supporting and maintaining the eduction pipe in operative position in such a manner that it is not subject to the vibration transmitted to the tank by the discharged water. A still further object of the invention is to provide an eduction pipe of wood or the like formed in sections and each section in turn being composed of a plurality of parts arranged in definite relation and all of said sections and parts being bound together to form a complete unitary pipe having a tapered interior channel.

Another object is to provide an eduction pipe having an exterior retaining means for its walls which is so arranged and constructed as to confine a break in said means to a limited position in the length of the pipe.

For the purpose of illustrating my invention, I have shown in the accompanying drawings one form thereof which is at present preferred by me, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of the instrumentalities as herein shown and described.

Referring to the drawings:

Figure 1 represents an elevation partly in section of an air lift pump embodying my invention.

Fig. 2 represents a side elevation of one of the eduction pipe sections on a larger scale.

Fig. 3 represents a section on line 3—3 of Fig. 2.

Fig. 4 represents a sectional elevation of the air supply nozzle and its adjuncts.

Fig. 5 represents a section on line 5—5 of Fig. 4.

1 designates the well in which the air lift of my invention is adapted to be installed and while here shown as a pipe, it may of course be of any suitable construction adapted to pass through the earth wall 2 with its lower end positioned in operative relation to the water chamber or water bearing stratum. 3 designates the delivery or eduction pipe of the pump which is adapted to pass within the well 1, where it terminates in a foot piece or inlet section 4 at its lower end, which is properly submerged in the well water or water stratum.

Located adjacent the eduction pipe 3 is the supply pipe 5 for air which also preferably extends within the well and conducts air from a compressor (not shown) to the discharge member 6. The discharge member 6 while forming a continuation of the air supply pipe 5 is preferably supported from the eduction pipe 3 and carries at its lower end a nozzle 7 which is preferably disposed in substantial alinement with the longitudinal axis of the said eduction pipe 3. The nozzle 7 is preferably tubular in form being open at both ends and receiving air from a lateral channel 8 which has of course communication with the air supply pipe 5. The lower end of the nozzle pipe is open to form an inlet 9 the circumferential edges of which are beveled to provide a relatively sharp edge for the purpose of reducing the friction of the water drawn up and through the nozzle pipe by the action of the compressed air. It will also be noted that the neck part 10 which connects the nozzle to the discharge end of the supply pipe is oppositely tapered forming a substantially V-shaped portion 11 at each side, so that the moving body of water has a comparatively unobstructed flow.

12 designates a mixing tube here shown as fixed to the discharge member by a relatively thin unobstructing web 13 and positioned in close proximity to the outlet of the nozzle 7 and axially alined with respect thereto so that the ejected air enters at the lower end causing a portion of the water to also be drawn into and through the mixing tube. This tube 12 is preferably tapered from end to end, the larger dimension being adjacent the air nozzle while the smaller

dimension is in position to discharge the moving body of air and water into the inlet end of the eduction pipe. In this connection, attention is directed to the preferred relation as to the distance of the tube 12 from the eduction pipe, since I have found in practice that a material increase in efficency is obtained by locating the former at a point some distance below the inlet of the foot piece 4. By this construction the column of water set in motion by the combined action of the air, the nozzle and the mixing tube has a suitable unobstructed area below the eduction pipe to adjust itself with relatively small loss in velocity to the entrance to the eduction pipe. This means that cross currents and eddies are practically eliminated so that the column of moving water is directed into the eduction pipe with greatly reduced frictional losses. The ring members 14 are suitable clamping rings secured to the air pipe and clamped to the eduction pipe 3 whereby the latter is supported and maintained in operative position.

The eduction pipe of my present invention is preferably of wooden construction throughout its length and formed of sections arranged in end to end abutting relation to provide an interior continuous unobstructed channel. One section of this pipe is shown in enlarged detail Fig. 2 and it will be noted that it is of stave construction as indicated at 15, the said staves being arranged longitudinally and suitably jointed edge to edge to provide a tapering channel for the passage of the water. In the present instance, the pipe sections are substantially twelve feet in length, the top opening of the channel being approximately one-eighth of an inch larger in diameter than the lower inlet opening so that the combined taper from the bottom to the top of the eduction pipe is sufficient to produce a negative acceleration of the moving column of water. Of course it will be understood that the foregoing figures of length and diameter are subject to variation without departing from the spirit or scope of my invention and they are merely set forth as satisfactory details of construction. The staves 15 are preferably of a width substantially equal to the radius of the pipe and hence six arranged edge to edge, jointed and suitably clamped make up one of the sections. In order to hold the respective sections in proper jointed and leak proof condition, I have found it desirable to wind the eduction pipe throughout its length with suitable wire 16 or the like, the said winding being substantially of spiral form except at certain spaced intervals where the wire is wound in abutting relation as shown at 17 and the grouped wires then soldered as at 18. This serves as an emergency safeguard in case any section of the spiral wire breaks, since the loose wire is thus confined to a short section of the pipe and the entire winding is not prevented from performing its proper binding function. In connection with the support of the eduction pipe, it will be noted that a coupling 19 connects the meeting ends of the air pipe where it projects from the well and this coupling is arranged to seat on the annular plate 20 which rests upon and is supported by the well 1. This plate 20 also forms a support for the rods 21 which join the bottom 22 of the receiving tank 23 to maintain the latter in operative position. The bottom 22 is preferably provided with an opening 24 of larger diameter than the eduction pipe 3, through which the latter passes to bring its discharge outlet well within the said tank and since the said pipe 3 is out of contact with the tank, it is not subjected to any vibrations or jars transmitted to the tank by the discharging water. This is an important feature for the reason that the weight of the tank and its contents is considerable and the same would place such stresses upon the eduction pipe as to cause weakening of the joints and leakage. To prevent outflow of water through the opening 24, I preferably provide a shield 25 of prepared canvas or some like flexible material impervious to water which is clamped to the pipe 3 and joins the bottom of the tank about the opening thus not only sealing the opening but also serving to take up and destroy vibration before it is transmitted to the pipe 3.

Any well known type of umbrella deflector 26 may be employed above the discharge of the pipe 3 as will be understood.

In the operation of the pump the eduction pipe is positioned within the well 1 and is, of course, sufficiently long to extend a suitable depth below the level of the water in the well so that the foot piece or inlet section 4, together with the nozzle 7 and its adjuncts are located at the most effective submergence for lifting the water. The gravity flow of the water naturally causes it to rise within the well 1 to the level of the surrounding water while the admission of the compressed air through the nozzle structure beneath the column of water contained within the eduction pipe causes the said column to be set in motion and discharged into the tank 23. The action is substantially continuous and in view of the features of my invention the frictional losses heretofore so detrimental to the efficiency of air lifts are materially reduced so that the quantity of water discharged is a maximum as compared to the quantity of air supplied.

In connection with the mixing tube 12, it will be noted that the upper or discharge end is considerably below the inlet section 4 so that a relatively free area is provided below

the mouth of the eduction pipe, whereby the moving body of water both from the well and tube 12 are able to combine in the direction of motion toward the eduction pipe inlet without causing losses due to cross currents and eddies. It will further be noted that the nozzle 7 is formed as an open ended tube which receives the air at an intermediate point and consequently there is a direct suction through the nozzle and the relatively smaller column of water rushing through not only adds to the effectiveness of the lift but maintains the nozzle free from sediment, dirt or the like which is a frequent source of clogging in the usual type of nozzle.

In practice, I have found that the provision of an eduction pipe having wood as a bounding wall for the water conduit affects a considerable saving in friction with an increase of at least ten per cent. in the pumping efficiency. Furthermore, it will be seen that the eduction pipe serves merely as a medium to convey the water to the tank and forms no support for the tank or its adjuncts. The only connection between the tank and eduction pipe is of a flexible non-vibrating character and consequently the pipe is subjected to little strain.

What I claim is:

1. In an air lift pump, an eduction pipe having the bounding wall of its bore formed of wood, said wall being uniformly tapered to provide a bore gradually increasing in cross-sectional area from the inlet end to the outlet end of said pipe.

2. In an air lift pump, an eduction pipe formed of wooden sections, said sections being arranged end to end and each having a bore tapered relatively to the adjacent sections to form in assembled condition a single continuous uniformly upwardly diverging tapered bore and means to maintain said sections in assembled condition.

3. In an air lift pump, an eduction pipe formed of wooden sections, said sections being arranged end to end and each having a bore tapered relatively to the adjacent sections to form in assembled conditions a single continuous uniformly upwardly diverging tapered bore and a binding member wrapped in substantially spiral form about said pipe.

4. In an air lift pump, and eduction pipe formed of wooden sections, each section comprising a plurality of longitudinally disposed staves united in edge to edge relation and forming a gradually tapering upwardly diverging bore, and a binding member spirally wound about all of said sections.

5. In an air lift pump the combination of a receiving tank for the discharged water, an eduction pipe supported out of contact with said tank and a flexible vibration absorbing means between said tank and pipe.

6. In an air lift pump, the combination of a receiving tank for the discharged water having an opening therein, an eduction pipe passing through said opening and out of contact with the walls of said opening, a shield of flexible impervious material connecting said pipe with the tank and independent means for respectively supporting said pipe and tank.

7. In an air lift pump, the combination of a well, a receiving tank for the discharged water having an opening therein, an eduction pipe passing through said opening and out of contact with said tank, a shield of flexible impervious material connecting said pipe with the tank, means to support said tank from said well, an air supply pipe extending into said well and means carried by the air supply pipe for supporting said eduction pipe.

8. In an air lift pump, the combination of a well, an eduction pipe extending into said well and having a submerged inlet, an air supply pipe, a nozzle for said air pipe consisting of a tubular open ended member provided with an air inlet intermediate its ends and a mixing tube interposed between the outlet of said nozzle and the inlet of said eduction pipe, said mixing tube being located entirely below the eduction pipe inlet.

9. In an air lift pump, the combination of a well, an eduction pipe extending into said well and having a submerged inlet, an air supply pipe terminating in a tubular open ended nozzle, said nozzle being located to one side of the air pipe and alined with the eduction pipe and also provided with a laterally disposed channel communicating with the air supply pipe and a mixing tube having an upwardly converging conduit disposed between the outlet of said nozzle and the inlet of said eduction pipe, said mixing tube being located entirely below the eduction pipe inlet.

10. In an air lift pump, the combination of a well, an eduction pipe having the bounding wall of its bore formed of wood and provided with an inlet section terminating in a submerged unobstructed inlet, a nozzle arranged to discharge air under pressure into said eduction pipe, said nozzle being spaced an appreciable distance below said foot piece to eliminate cross currents and eddies and means to supply compressed air to said nozzle.

In testimony whereof I have hereunto signed my name in the presence of a witness.

LEVI T. EDWARDS.

Witness:

ROBERT M. BARR.