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LIQUID ELEVATING APPARATUS.

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1,284,594.

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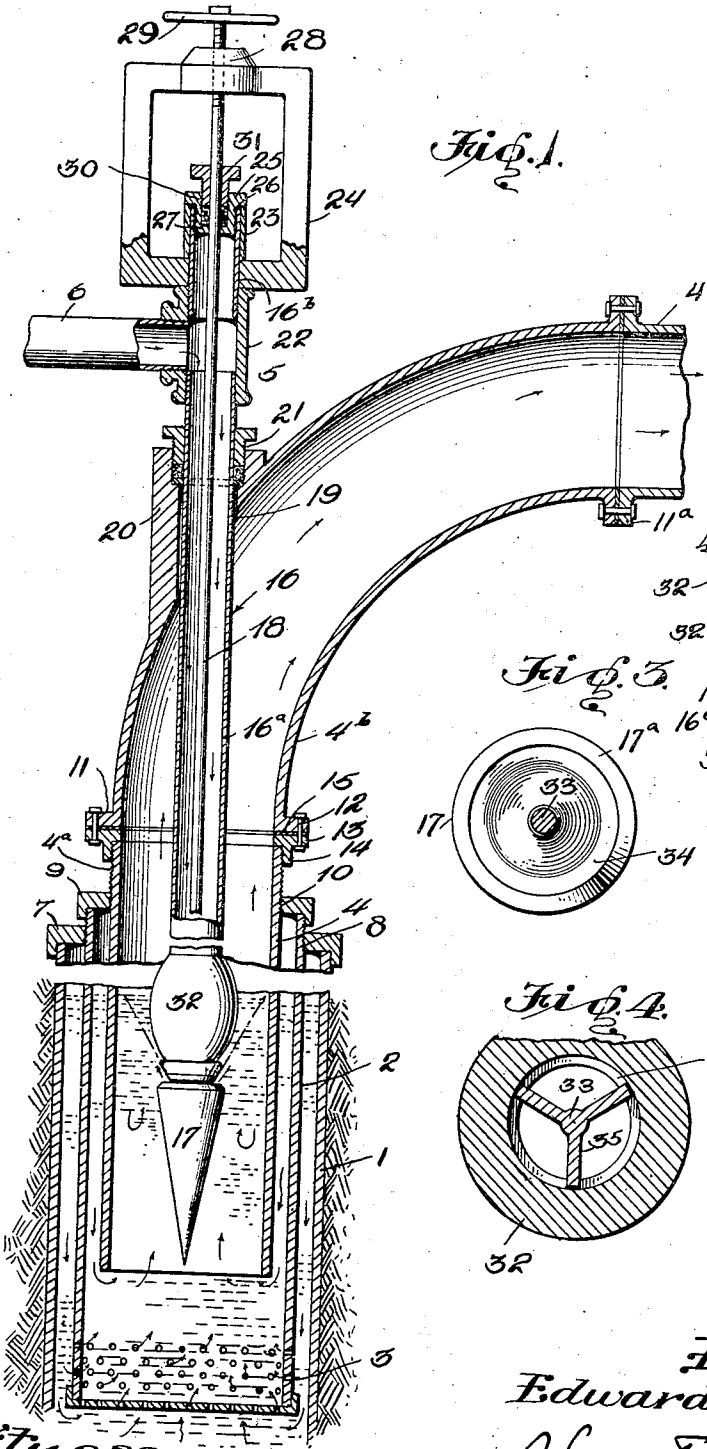


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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LIQUID-ELEVATING APPARATUS.

1,284,594. Specification of Letters Patent. Patented Nov. 12, 1918.

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To all whom it may concern:

Be it known that I, EDWARD CHRISTMAN, a citizen of the United States, residing at Massillon, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Liquid-Elevating Apparatus, of which the following is a specification.

The invention relates to improvements in liquid elevating apparatus of the type in which compressed air or the like is employed as the operating medium, the air being discharged into the lower end of a column of liquid in an eduction tube suspended within a well casing, and by natural expansion and pressure, forcing the liquid upward and outward through the tube; and the object of the invention is to provide improved liquid elevating means, hereinafter called the air-lift, for controlling the discharge and for directing the flow of air as it is discharged into the column of liquid to be elevated, for effectively entraining the liquid.

The object of the invention thus generally stated is attained in the present instance by means of an air-lift comprising an air pipe line suspended centrally within an eduction tube which projects downwardly into a well casing, and a deflecting member supported at the lower end of the air pipe line by means of a rod which may be adjusted upward or downward from the top of the well; a nipple being provided at the lower end of the air pipe line having its lower end beveled outwardly and upwardly to form in conjunction with the reversely beveled peripheral edge of the deflecting member, an annular slot through which the air is discharged upwardly and outwardly toward the inner surface of the eduction tube.

A preferred embodiment of the invention is illustrated in the accompanying drawings forming part hereof, in which—

Figure 1 is a fragmentary elevation section of the apparatus;

Fig. 2, an enlarged central sectional view of the lower portion of the air lift;

Fig. 3, a sectional view on line 3—3, Fig. 2; and

Fig. 4, a sectional view on line 4—4, Fig. 2.

Similar numerals refer to similar parts throughout the drawings.

The apparatus comprises an outer well casing 1, projecting downward into a source of liquid supply, an inner casing 2 suspended within the outer casing and having a strainer 3 at its lower end, an eduction tube 4 projecting downward into the inner casing 2, and leading upward out of the well, and an air-lift 5 suspended within the eduction tube and communicating at its upper end with an air supply pipe 6 which is connected to a convenient source of supply.

The well casings 1 and 2 may be of any suitable and well known construction, in this instance, the outer casing 1 being provided with a cap 7 having a central aperture 8 therein into which the upper end of the casing 2 is threaded; and the inner casing 2 being provided with a cap 9 having a central aperture 10 therein, adapted to receive the threaded upper end of a vertical pipe section 4^a, which together with a curved intermediate section or elbow 4^b and a horizontal upper section 4^c, are connected together to form the eduction tube 4; and for this purpose the elbow 4^b is provided at its opposite ends with outwardly extending rim flanges 11, which are adapted to be clamped together by means of bolts 12 to a similar flange 11^a formed on the inner end of the horizontal section 4^c, and to an outwardly extending rim flange 13 formed on a cap 14 which is screw threaded on the upper end of the vertical section 4^a; suitable gaskets 15 being provided for the several joints.

The air lift 5 comprises a pendent pipe line 16, which is connected near its upper end with the air supply pipe 6, and is preferably formed from a main or intermediate pipe section 16^a, an upper pipe section 16^b, and a lower pipe section or nipple 16^c; and a deflecting member 17, which is supported at the lower end of the pipe line by means of a rod 18 extending therethrough and adjustably mounted at its upper end.

The elbow 4^b, forming the intermediate section of the eduction tube, is provided in its upper side axially of the well, with an opening 19 for receiving the intermediate pipe section 16^a of the pipe line 16, and on the outer side of the elbow the opening 19 is provided a bushing 20 the upper end of which bushing is adapted to receive a screw plug 21 to form a packing box around the pipe section.

By this construction it will be apparent that the air-lift is thus mounted for movement independently of the liquid eduction

tube so that it may be used or lowered as the level of the liquid in the well changes.

The intermediate pipe section 16[a] and the upper pipe section 16[b] of the pipe line are connected together by means of a T-fitting 22 which is also connected to the air supply pipe 6, and around the upper pipe section between the lower end of a sleeve 23 thereon and the T-fitting is mounted a supporting bracket 24 for the adjusting rod 18 of the air lift. The upper end of the pipe 16[b] is provided with a screw plug 25 having an outwardly extending flange 26 thereon which serves to lock the sleeve and thereby the supporting bracket against upward movement, said plug also having a central aperture 27 through which the upper end of the adjusting rod extends and is threaded into a bearing 28 in the upper end of the bracket 24 to be supported thereby, a hand wheel 29 being provided on the upper end of the rod by means of which the rod may be readily adjusted upward or downward; and the plug 25 is provided in its upper end with a central socket 30 adapted to receive a screw plug 31 to form a packing box around the rod.

At the lower end of the pipe line 16, means are provided for controlling the discharge of air into the eduction tube, comprising the nipple 16[c] of the pipe line, and the deflecting member 17. The nipple is preferably connected to the lower end of the pipe section 16[a] by means of a sleeve 32, so that it may be adjusted with reference to the pipe section; and the deflecting member is supported immediately below the nipple by means of a shank 33 extending upwardly from its center into the pipe line where it is connected to the lower end of the adjusting rod 18.

The deflecting member is preferably in the shape of an inverted cone and in its upper portion, which is of slightly greater diameter than the diameter of the nipple, it is provided with a central conical cup shaped cavity 34 which is also of slightly greater diameter at its upper edge than the nipple; and the nipple 16[c] is provided on its lower end with an enlarged portion or head 16[d], which is conically beveled upwardly and outwardly from its lower peripheral edge, to form the outer deflecting surface 16[e]. Preferably the upper peripheral edge of the member 17 is conically beveled outwardly and downwardly to form a lip 17[a]; and the sleeve 32 is provided on its outer side with a convex deflecting surface 32[a].

The deflecting member 17 is maintained in axial alinement with the pipe line 16 by means of a spider 35 formed on the shank 33 and slidably engaging the interior of the sleeve 32, and the member is so supported with respect to the pipe line that the upper peripheral edge thereof forms in conjunction with the lower peripheral edge of the nipple, an annular slot 36 of uniform width throughout its length. The spider 35 also serves to limit the upward and downward adjusting movements of the rod 18, by abutting against the upper end of the nipple 16[c] and the lower end of the pipe section 16[a].

By these means it will be evident that the size of the annular slot 36 may be varied at will from the top of the well, the deflecting member 17 being movable independently of the air pipe line 16 by means of the hand wheel 29; and by reason of the peculiar shape of the cavity 34 in the deflecting member, and of the relative position of the parts, air under pressure striking the deflecting member will be deflected upward through the slot whereupon it will strike the deflecting surfaces formed by the beveled edge 16[e] on the lower end of the nipple, and the lower portion of the concave surface 32[a] of the sleeve, and be positively directed outward toward the inner surface of the eduction tube.

The direction thus imparted to the air as it escapes through the slot and rises by natural expansion and pressure, enables it to more effectually overcome friction and entrain the liquid in the tube, and by virtue of the shape of the slot, the air is discharged from all sides of the air lift so that it is distributed evenly throughout the inner surface of the eduction tube.

Furthermore, on account of the peculiar construction and arrangement of the parts, the discharge of air into the eduction tube is entirely free and unobstructed, thus not only facilitating the elevating operation, but tending to make the lift self-cleaning.

I claim:

1. A liquid elevating apparatus having in combination an air lift including a pipe line the lower end of which is beveled upwardly and outwardly, a deflecting member having an unobstructed central cup-shaped cavity in its upper portion, the upper peripheral edge of the deflecting member being beveled outwardly and downwardly and being of slightly greater diameter than the peripheral edge of the pipe line, and means extending through the pipe line for adjustably supporting the deflecting member to form an annular slot between its peripheral edge and the peripheral edge of the pipe line.

2. A liquid elevating apparatus having in combination, an air lift including a pipe line the lower end of which is beveled upwardly and outwardly, a deflecting member having an unobstructed central cup-shaped cavity in its upper portion the upper peripheral edge of which is of slightly greater diameter than the peripheral edge of the pipe line, means extending through the pipe line for adjustably supporting the deflecting member at the end of the pipe line, and means for maintaining the deflect-

ing member in axial alinement with the pipe line.

3. A liquid elevating apparatus having in combination an air lift including a pipe line, a deflecting member having an unobstructed central cup-shaped cavity in its upper portion, a rod adjustably mounted at the upper end of the pipe line and extending through the same for supporting the deflecting member at the lower end thereof, and means for maintaining the pipe line and deflecting member in axial alinement.

4. A liquid elevating apparatus having in combination an air lift including a pipe line having a nipple on its lower end, a deflecting member having an unobstructed central cavity in its upper portion, the upper peripheral edge of which is of slightly greater diameter than the nipple, and means extending through the pipe line for adjustably supporting the deflecting member at the end of the nipple to form an annular slot in conjunction therewith.

5. A liquid elevating apparatus having in combination an air lift including a pipe line having a nipple on its lower end, an adjusting rod suspended within the pipe line, and a deflecting member connected to the adjusting rod having an unobstructed central cup-shaped cavity in its upper portion and a lip on its peripheral edge forming a slot in conjunction with the lower end of the nipple, said adjusting rod and deflecting member being movable independently of the pipe line.

6. A liquid elevating apparatus having in combination an air lift including a pipe line, an adjusting rod suspended within the pipe line, and a deflecting member connected to the adjusting rod having a peripheral edge in its upper portion forming in conjunction with the end of the pipe line an annular slot, said adjusting rod and deflecting member being movable independently of the pipe line.

7. A liquid elevating apparatus, having in combination a well casing, an eduction tube suspended within the well casing, an air lift adjustably suspended within the eduction tube including a pipe line, a deflecting member, and a rod adjustably mounted at the upper end of the pipe line and extending through the same for supporting the deflecting member at the lower end thereof, said member forming an annular slot in conjunction with the lower end of the pipe line.

8. A liquid elevating apparatus having in combination a well casing, an eduction tube suspended within the well casing, and an air lift suspended within the eduction tube including a pipe line, a deflecting member at the lower end of the pipe line forming an annular slot in conjunction therewith, and means extending through the pipe line operable from the upper end of the pipe line for varying the width of the slot in either direction.

9. A liquid elevating apparatus having in combination a well casing, an eduction tube within the well casing, and an air lift within the eduction tube communicating with a source of air supply at its upper end and having an annular outlet slot at its lower end, with means extending through the air lift for controlling the area of the slot from the top of the well.

10. A liquid elevating apparatus having in combination a well casing, an eduction tube within the well casing, and an air lift pipe line within the eduction tube communicating with a source of air supply at its upper end and having an annular outlet slot at its lower end in unobstructed communication with the pipe line adapted to direct the flow of air upwardly and outwardly from the lift, with means extending through the air lift for controlling the area of the slot from the top of the well.

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