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R. CONRADER.

APPARATUS FOR ACTUATING LIQUIDS.

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Fig. 1.

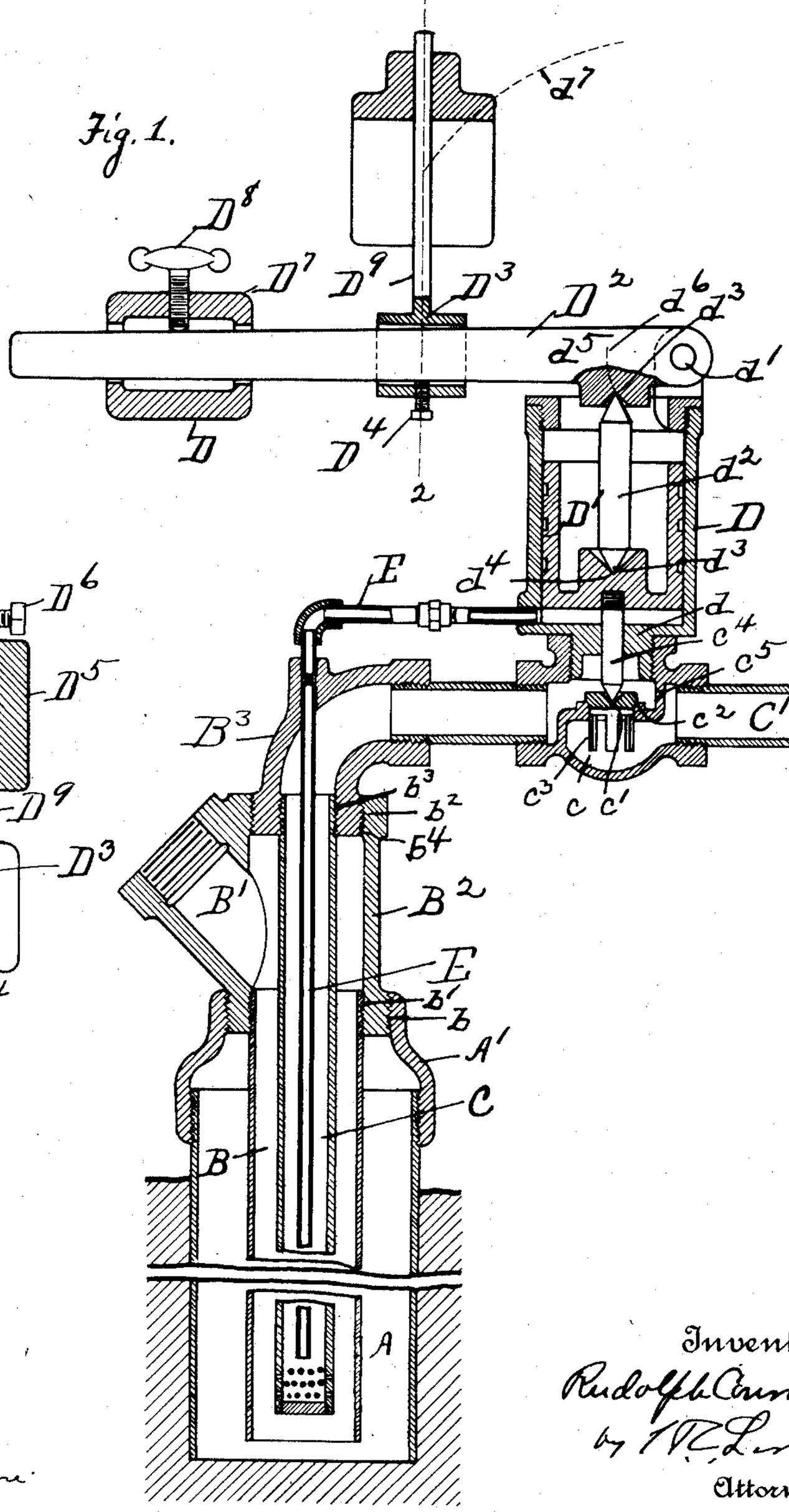
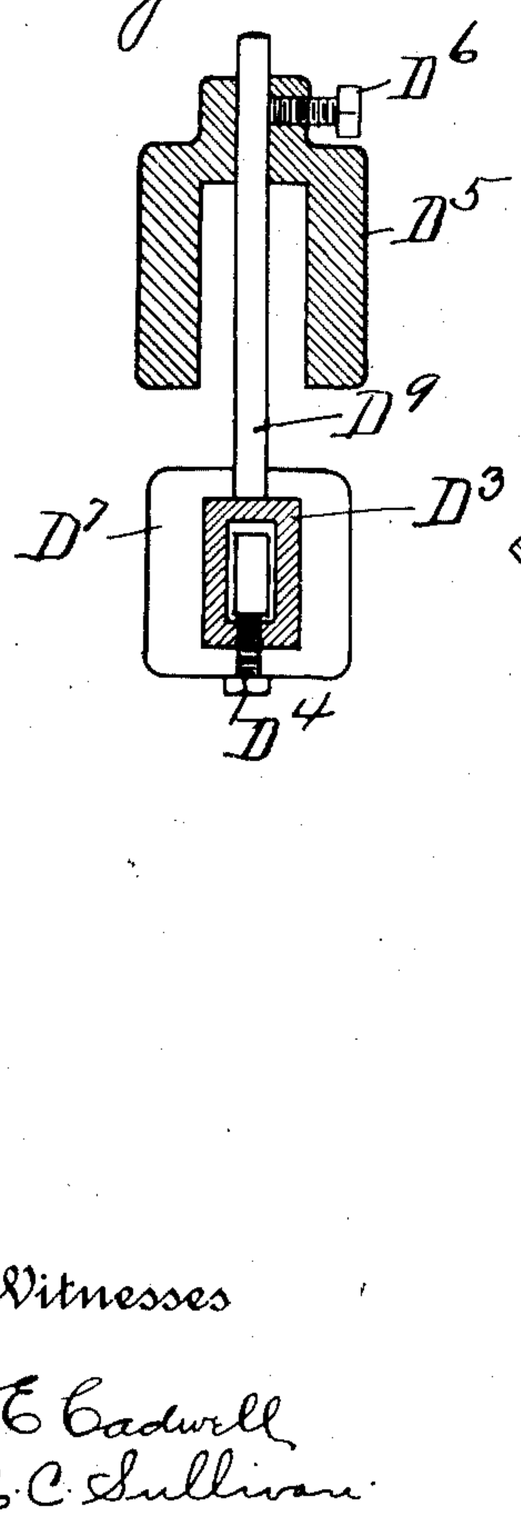


Fig. 2.



Witnesses

H. E. Cadwell
M. C. Sullivan

Inventor
Rudolph Conrader
by W. C. Lord
Attorney

UNITED STATES PATENT OFFICE.

RUDOLPH CONRADER, OF ERIE, PENNSYLVANIA.

APPARATUS FOR ACTUATING LIQUIDS.

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To all whom it may concern:

Be it known that I, RUDOLPH CONRADER, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented new and useful Improvements in Apparatuses for Actuating Liquids, of which the following is a specification.

This invention relates to apparatuses for actuating liquids, and consists in certain improvements in the construction thereof as will be hereinafter fully described and pointed out in the claims.

More particularly the invention relates to an automatic means for controlling air lifts so as to turn in the actuating fluid, ordinarily air, with a predetermined level of liquid in the well and cut off the same when the level of liquid falls below this point. The broader phases of the invention may be applicable to other mechanisms for actuating liquids but it is particularly adapted to raising liquids where there is a direct application of the actuating fluid to the liquid and where this application is continuous during the pumping action as particularly exemplified in the patent to J. G. Pohle #487,639, Dec. 6, 1892. With apparatuses of this class the greatest efficiency is obtained where the depth of liquid is about two-thirds of the entire length of the eduction tube. Where the level of liquid in the well falls below this, that is when the volume in the lift decreases so as to produce a lower level when at rest, the efficiency of the apparatus decreases quite materially. It is desirable therefore to have some means for controlling the supply of air, so that it may be cut off when the level of liquid falls below a predetermined one, and thus obtain with the actuating fluid used the greatest efficiency. It is also desirable to prevent numerous actions of the valve controlling mechanisms, that is to so form it that when the actuating fluid is turned onto the well, the liquid must drop some distance before the actuating fluid is cut off, and then after it is cut off must rise in the well an appreciable distance before it is again turned on. All of these objects are accomplished with the apparatus herein disclosed and claimed.

The other features and objects of the invention will appear from the specification and claims.

The invention is illustrated in the accompanying drawings as follows:—Figure 1 shows a central section of the apparatus. Fig. 2, a section on the line 2—2 in Fig. 1.

A marks the well, B the eduction tube. The eduction tube is secured in a fitting B^2 from which the eduction tube passes by the passage B′. The air tube C, as shown, extends into the well through the eduction tube. It is connected with any desirable source of supply through a pipe C′. The supply is controlled by a valve *c*. The valve disk *c′* of this valve operates upon a seat c^2 The webs c^3 act as guides for directing the valve to its seat. A stem c^4 extends from the valve through the head *d* of a cylinder D and is secured to a piston D′ in this cylinder. A pipe E leads from the bottom of the eduction tube to the cylinder D below the piston D′. A pin d^2 extends between the piston D′ and a lever D^2, the lever forming a counter pressure device for the piston.

In the operation of the device, the lever D^2 is sufficiently weighted to require a pressure to move the piston D′ that will balance the column of liquid in the well at its maximum height. A leak c^5 extends through the valve *c*. Through it actuating fluid passes continuously and so long as the liquid in the well is below the predetermined level the valve *c* remains closed and the actuating fluid forces its way through the liquid in the well. It will be noted that the tube C traps the air so that there is in the tube C at all times, a pressure of air that will balance the column of liquid in the tube B above the end of the tube C. When the level of liquid reaches the desired maximum level, it so traps this air in the tube C as to create a back pressure therein sufficient to raise the piston D′ through the action of the air passing through the pipe E. As soon as this occurs, the upward movement of the piston D′ permits the opening of the valve *c* and a consequent inrush of air which, through its direct action on the liquid, effects a continuous pumping action similar to that described in the Pohle patent referred to. As long as the level of liquid remains above a point that will create a pressure sufficient to hold the piston D′ in its upper position, the pumping action will continue, but as soon as the volume decreases so that the level of liquid in the well falls to a lower point when at rest, the pressure on the piston D′ will so decrease as to permit of its

falling and a consequent closing of the valve and this will remain closed until the liquid again reaches the maximum level.

In order to prevent too numerous actions of the valve, I have arranged the counter-pressure device so that it will decrease in power or force as the piston moves upwardly. This may be accomplished with numerous expedients. As shown, the pin d^2 is provided at its ends with the points d^3. The lower point is arranged in the socket d^4 of the piston. The socket d^5 is arranged below the pivot d' of the lever, so that as the lever moves upwardly the point describes the arc d^6 so that the fulcrum of the lever is increased and the force of the counter-pressure device consequently decreased. Arranged on the lever is the sleeve D^3 which is locked in adjustment by the set screw D^4. It has the upwardly extending posts D^9 on which is arranged the weight D^5. This is adjustably secured by the set screw D^6. It will be noted that the center of gravity of this weight describes the arc d^7 and the arm of the lever relative to this center of gravity rapidly decreases as the lever is moved up through the action of the piston, so that the force incident to this weight rapidly decreases. A fixed weight D^7 with the set screw D^8 is also provided for varying the pressure at which the piston acts and consequently the height of liquid in the well. From this construction it will be noted that when the piston is raised with a predetermined pressure it will remain in its open position until the pressure is below that which raises the piston. The fitting B^2 is peculiarly adapted to this style of well. It is provided with the threads b and b' at the bottom and the thread b^2 at the top. The fitting B^3 is provided with double threads b^3 and b^4, the thread b^4 screwing into the thread b^2. The thread b engages a thread on the casing A' and the inner thread b' engages the thread on the eduction tube B. The air tube is screwed into the tube b^3.

What I claim as new is:—

1. In an apparatus for actuating liquids, the combination of the lift in which liquids are raised, means for delivering air to the column in the lift, and devices subjected to a pressure varying with the head in the lift and acting under the influence of said pressure to turn in a supply of air to the column in the lift when the devices are subjected to the pressure from a predetermined head.

2. In an apparatus for actuating liquids, the combination of the lift in which liquids are raised, means for delivering air to the column in the lift, and devices subjected to a pressure varying with the head in the lift and acting under the influence of said pressure to automatically cut off the supply of air to the column in the lift when the devices are subjected to the pressure incident to a predetermined head.

3. In an apparatus for actuating liquids, the combination of the lift in which liquids are raised, means for delivering air to the column in the lift, and devices subjected to a pressure varying with the head in the lift and acting under the influence of said pressure to automatically turn in a supply of air to the column in the lift when the devices are subjected to the pressure incident to a predetermined head and to cut off said supply when said devices are subjected to the pressure incident to a predetermined lower head.

4. In an apparatus for actuating liquids, the combination of an eduction tube; a fluid tube for conducting actuating fluid to a point of application to the liquid; means for maintaining the air pressure in the fluid tube equal to the head of liquid in the eduction tube above the point of application; and means operated by said actuating fluid for opening a connection in the fluid tube.

5. In an apparatus for actuating liquids by the direct application of the actuating fluid, the combination of an eduction tube; a tube for conducting actuating fluid to a point of application to the liquid; means for delivering continuously a minute supply of actuating fluid, said means and actuating fluid tube being arranged to trap the fluid so delivered and thus raise its pressure with a rise of level of liquid; and mechanism subjected to the action of said fluid and arranged to be operated at a predetermined pressure to turn in a supply of actuating fluid.

6. In an apparatus for actuating liquids by the direct application of the actuating fluid, the combination of an eduction tube; a tube for conducting actuating fluid to a point of application to the liquid; means for delivering continuously a minute supply of actuating fluid said means and actuating fluid tube being arranged to trap the fluid and thus vary its pressure to balance the column of liquid; and mechanism subjected to the action of said fluid and arranged to be operated at a predetermined pressure to turn in a supply of actuating fluid.

7. In an apparatus for actuating liquids by the direct application of the actuating fluid, the combination of an eduction tube; a tube for conducting actuating fluid to a point of application to the liquid; means for delivering continuously a minute supply of actuating fluid said means and actuating fluid tube being arranged to trap the fluid so delivered and thus raise its pressure with a rise of level of liquid; a fluid actuated motor subjected to the action of said fluid so trapped; a valve actuated by said motor for controlling actuating fluid passing to the tube for conducting actuating fluid; and a counter-pressure device operating upon said motor.

8. In an apparatus for actuating liquids by the direct application of the actuating fluid, the combination of an eduction tube; a tube

for conducting actuating fluid to a point of application to the liquid; means for delivering continuously a minute supply of actuating fluid, said means and actuating fluid tube being arranged to trap the fluid so delivered and thus raise its pressure with a rise of level of liquid; a fluid actuated motor subjected to the action of said fluid so trapped; a valve actuated by said motor for controlling actuating fluid passing to the tube for conducting actuating fluid; a counter-pressure device operating upon said motor; and a separate tube leading from the point of application of the actuating fluid to the liquid to said motor.

9. In an apparatus for actuating liquids, the combination with the eduction tube B; the fluid supply tube C arranged to deliver actuating fluid near the bottom of the tube B; valve *c* controlling the actuating fluid; a leak passage c^5; and mechanism controlling the valve *c* whereby it is opened with a predetermined pressure of fluid delivered through the leak.

10. In an apparatus for actuating liquids, the combination with the eduction tube B; the fluid supply tube C arranged to deliver actuating fluid near the bottom of the tube B; valve *c* controlling the actuating fluid; a leak passage c^5; fluid controlled motor connected with the pipe C and arranged to control the valve *c*; and a counter pressure device on said motor.

11. In an apparatus for actuating liquids, the combination of the lift in which liquids are raised, means for delivering air to the column in the lift, and devices subjected to a pressure varying with the head in the lift and acting under the influence of said pressure to turn in a supply of air to the column in the lift when the devices are subjected to the pressure incident to a predetermined head and to cut off said supply when the head reaches a predetermined smaller head, the said device being arranged to act for turning in a new supply of air only when the liquid again reaches a predetermined higher head.

12. In an apparatus for actuating liquids by the direct application of the actuating fluid, the combination of an eduction tube; a tube for conducting actuating fluid to a point of application to the liquid; means for delivering continuously a minute supply of actuating fluid, said means and actuating fluid tube being arranged to trap the fluid so delivered and thus raise its pressure with a rise of level of liquid; and mechanism subjected to the action of said fluid and arranged to be operated at a predetermined pressure to turn in a supply of actuating fluid, and to be operated only at a predetermined lower pressure to cut off the supply of actuating fluid.

13. In an apparatus for actuating liquids by the direct application of the actuating fluid, the combination of an eduction tube; a tube for conducting actuating fluid to a point of application to the liquid; means for delivering continuously a minute supply of actuating fluid said means and actuated fluid tube being arranged to trap the fluid so delivered and thus raise its pressure with a rise of level of liquid; a fluid actuated motor subjected to the action of said pressure and arranged to be actuated at a predetermined pressure; a counter-pressure device operating upon said motor, and decreasing in force as said motor is operated and a valve in said tube controlled by said motor.

14. In an apparatus for actuating liquids by the direct application of the actuating fluid, the combination of an eduction tube; a tube for conducting actuating fluid to a point of application to the liquid; means for delivering continuously a minute supply of actuating fluid said means and actuating fluid tube being arranged to trap the fluid so delivered and thus raise its pressure with a rise of level of liquid; a fluid actuated motor subjected to the action of said fluid and arranged to be actuated at a predetermined pressure; and a counter-pressure device comprising the pivoted lever D^2 having the point of application on the fluid actuated motor below the center of the pivot of the lever, and having a weight arranged above the horizontal plane including the pivot of said lever.

15. In an apparatus for actuating liquids, the combination with the eduction tube and actuating fluid tube; of the fitting B^2 having the threads *b* and *b'* at the bottom, the thread b^2 at the top, and the fitting B^3 having the double threads b^4 and b^3; the thread *b* engaging the casing, the thread *b'* the eduction tube, the thread b^2 the thread b^4 on the fitting B^3, and the thread b^3 the actuating fluid tube.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

RUDOLPH CONRADER.

Witnesses:
C. D. HIGBY,
M. C. SULLIVAN.