Dec. 20, 1927. 1,653,189

J. OLIPHANT

AIR LIFT PUMP

Filed Dec. 17, 1923

Fig. 1.

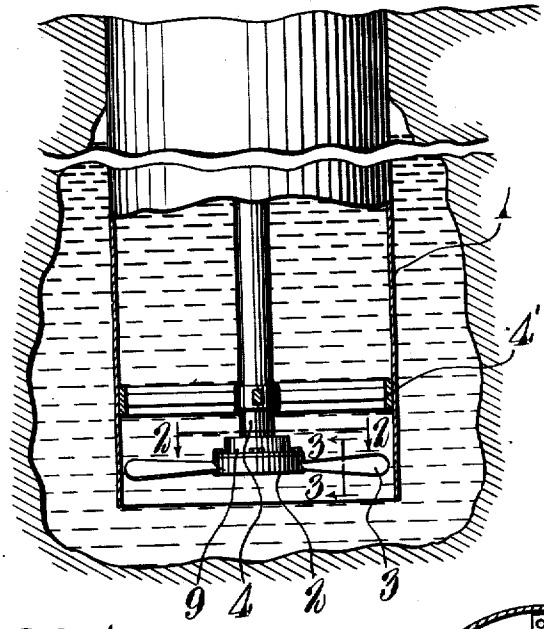


Fig. 4.

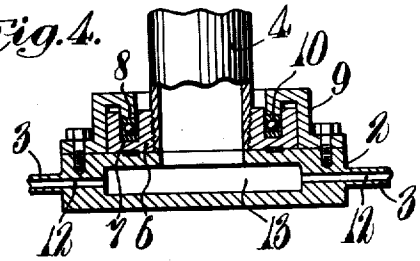


Fig. 5.

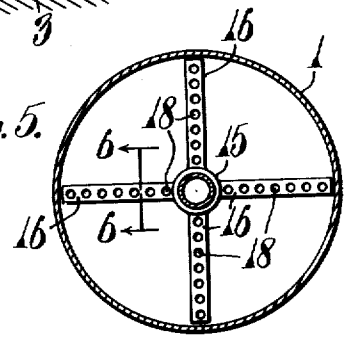


Fig. 6.

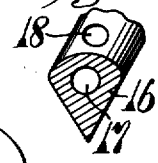


Fig. 7.

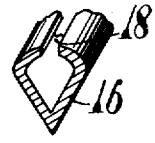


Fig. 2.

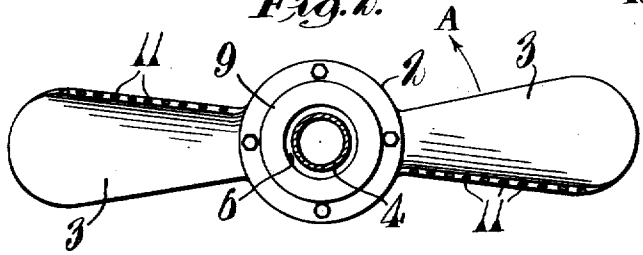
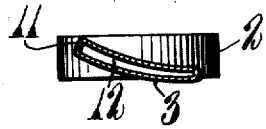


Fig. 3.



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Patented Dec. 20, 1927. 1,653,189

UNITED STATES PATENT OFFICE.

JOHN OLIPHANT, OF CHICAGO, ILLINOIS, ASSIGNOR TO SULLIVAN MACHINERY COMPANY, A CORPORATION OF MASSACHUSETTS.

AIR-LIFT PUMP.

Application filed December 17, 1923. Serial No. 681,132.

My invention relates to liquid pumps, and more particularly to that class of pumps known as air lifts.

It has for an object to provide an improved air lift pumping mechanism. Another object of my invention is to provide an improved air lift pump providing an improved means for distributing the pumping fluid at the base of a column of liquid in such manner as to reduce the required submergence. A further object of my invention is to provide means whereby the actuating fluid will assist in the actuation of the distributing means so that a relatively simple distributing member may be used, but which will distribute the fluid through a relatively large column of water. A still further object is to provide an improved structure wherein the actuating fluid will, aside from directly assisting in the lifting of the liquid to be pumped, also provide, due to its reaction on the fluid pumped, a certain amount of mechanical energy to assist in lifting the column of fluid. Still another object is to have the improved distributing means so constructed that the water flowing into the well may if desired assist in distributing the actuating fluid.

In the accompanying drawings I have for purposes of illustration shown a plurality of forms which my invention may assume in practice.

In these drawings,—

Fig. 1 is an elevational view shown partly in section of the improved distributing means positioned within a well casing.

Fig. 2 is an enlarged plan view of the improved distributing means taken on line 2—2 of Fig. 1.

Fig. 3 is an enlarged transverse section of the propeller blade taken on line 3—3 of Fig. 1.

Fig. 4 is an enlarged vertical sectional detail of the supporting means for the propeller.

Fig. 5 is a plan view of a modified form of the invention.

Fig. 6 is a perspective view partly in section and taken substantially on line 6—6 of Fig. 5.

Fig. 7 is a modified form of the discharge ports.

In my improved type of air lift I propose to distribute the actuating fluid throughout the column of water within the well casing 1 by a movable member 2 which in one illustrative embodiment of my invention consists of a propeller having blades 3, this propeller being rotatably mounted upon the lower end of the air supply line 4 positioned centrally in the casing 1 and held therein by suitable bracket means 4'. The member 2 can if desired be disposed above the natural flow inlet to the casing 1 as shown in Fig. 1, in which case the in-flow of the water will tend to assist in the rotation of the member 2. It will be noticed that this member is shown as comprising two vanes shaped similarly to ordinary propeller blades, but it will be of course understood that any number of blades may be used that is desired.

Any suitable means may be employed to rotatably support the propeller upon the end of the pipe. One construction among others which can be employed is shown in Fig. 4 as comprising a collar 6 screw threaded on the pipe 4 and having an annular groove 7 to receive the annulus 8 of the sleeve member forming a hub 9 which is fastened to the propeller by any suitable means. Obviously the sleeve member or hub 9 can be split or so constructed as to be readily positioned within the annular space. If desirable, in order that the propeller might easily rotate, ball bearings 10 can be disposed between the collar 6 and the hub. To prevent excessive air leakage between the joints of the members suitable packing may be employed between any of the adjacent surfaces.

In order that the actuating fluid might assist in making a more perfect emulsion and also to cause some of its pressure energy to be transformed into mechanical lifting power, a plurality of ports 11 are disposed in the rearward edge of the propeller blades. These ports communicate with longitudinal passages 12 disposed one in each blade, which passages terminate at their inner ends in a chamber 13 that communicates with the hollow supply pipe 4.

In the operation of this device the actuating fluid will flow through the passages 12 and out through the ports 11, thereby causing rotation of the blades due to the reaction of the actuating fluid issuing from the ports 11 which act as jets. It will be noted in Fig. 2 that these ports are disposed on opposite sides of the blades, whereby the reaction force from each blade will tend to rotate the propeller in the same direction as

indicated by the arrow A. It will thus be seen that as the propeller rotates the actuating fluid will be distributed throughout the column of water and will at the same time cause the blades to assist in the lifting of the fluid. It is thereby possible to transform part of the pressure energy of the actuating fluid into mechanical energy, which latter energy is not totally lost for it in turn performs two functions, namely, assisting in the lifting of the water to be pumped due to the inclination of the blades and also due to the rotation the actuating fluid is distributed throughout the column of water.

It may be desired to cause the propeller blade to have different speeds of rotation depending upon the viscosity of the liquid to be pumped. For instance, in a liquid of high viscosity, the jets 11 might be disposed so that they would discharge in substantially a horizontal direction which would impart to the propeller the maximum horizontal force possible to cause rotation. In a liquid of low viscosity the ports could be directed so that they would discharge in an inclined direction in which case the reaction force would have a horizontal component of force to cause rotation of the propeller which would be less than the original force. The speed of rotation would be reduced. The speed of rotation of the propeller can of course be changed by varying the inclination of the blades. It will be obvious also that vertically discharging jets might be provided and that advantage might be taken of the reaction of the rising column of the liquid pumped on the lower sides of the distributing members to cause rotation of the latter.

In the modified illustrative forms of construction, the distributing means for the actuating fluid is shown as a stationary spider 15 having four arms 16 and disposed centrally within the well casing and being supplied with actuating fluid from the central supply pipe 4. This spider is placed, as was the case with the propeller, very near the bottom of the well so that complete pumping action is obtained from the lowest possible point of discharge and thus none of the submergence is lost as with the usual discharge means. The arms of this spider are, as shown in Fig. 6, of substantially triangular shape having the apex of the triangle disposed in a downward direction so that the upward flow of the liquid will not be materially reduced, the upper part of the arms being rounded off so that very little loss will be had due to eddy currents. These arms have longitudinal passages 17 which communicate with the pipe 4 in the same manner as in the propeller construction. It will be obvious that the arms of the spider might be made of "streamline" cross section, if desired. Ports 18 allow the actuating fluid to be discharged in an upward direction by having communication with the passages 17. These ports can of course be replaced by a longitudinal slot 18', in which case there would be a continuous stream of fluid substantially from the hub out to the end of the arms. It will be noted that in either construction the air is discharged directly into the liquid without the necessity of coming into contact with some dispersing surface such as may discharge means require.

While I have in this application specifically described a plurality of forms which my invention may assume in practice, it will be understood that these forms of the same are shown for purposes of illustration and that the invention may be modified and embodied in other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. An air lift pump comprising a riser pipe and aerating means comprising blade members rotatable and disposed in a horizontal plane within said riser pipe and provided with means for discharging fluid from the trailing edge of said blades to cause rotation thereof.

2. In an air lift pump, pumping fluid discharge means comprising a member rotatable in planes transverse to the flow of the rising liquid column and having discharge orifices whose jets effect rotation of said member and aid the flow of liquid, said member having a surface operative on rotation of said member to impart an upward force to said column.

3. In an air lift pump, pumping fluid discharge means comprising a member rotatable in planes transverse to the flow of the rising liquid column and having discharge orifices whose jets effect rotation of said member and aid the flow of liquid, said member having a surface operative on rotation of said member to impart an upward force to said column, and a surface upon which the rising column acts to impart a rotative force to said member.

4. An air lift pump comprising a riser pipe and aerating means comprising at least one blade member rotatably mounted and disposed transversely within the riser pipe and provided with means for discharging pumping fluid from said member in a direction to effect rotation thereof and at points variously spaced from the axis of rotation, said discharge means acting on rotation of said member to distribute fluid over substantially the total effective area of said riser pipe.

5. In an air lift pump, a riser pipe and means for distributing actuating fluid in said pipe comprising a member mounted for

freely rotatable movement and on rotation sweeping through substantially the whole transverse area of said pipe, means for conducting pumping fluid to said member, said member providing means for continuously discharging pumping fluid therefrom during rotation thereof at numerous points spaced different distances from its axis of rotation, and means for effecting rotation of said member.

In testimony whereof I affix my signature.

JOHN OLIPHANT.

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CERTIFICATE OF CORRECTION.

Patent No. 1,653,189. Granted December 20, 1927, to

JOHN OLIPHANT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 76, for the word "may" read "many"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 31st day of January, A. D. 1928.

Seal.

M. J. Moore,
Acting Commissioner of Patents.

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