No. 788,032. PATENTED APR. 25, 1905.

G. H. ELLITHORPE.

ROTARY PUMP.

APPLICATION FILED APR. 2, 1903.

Fig. 1.

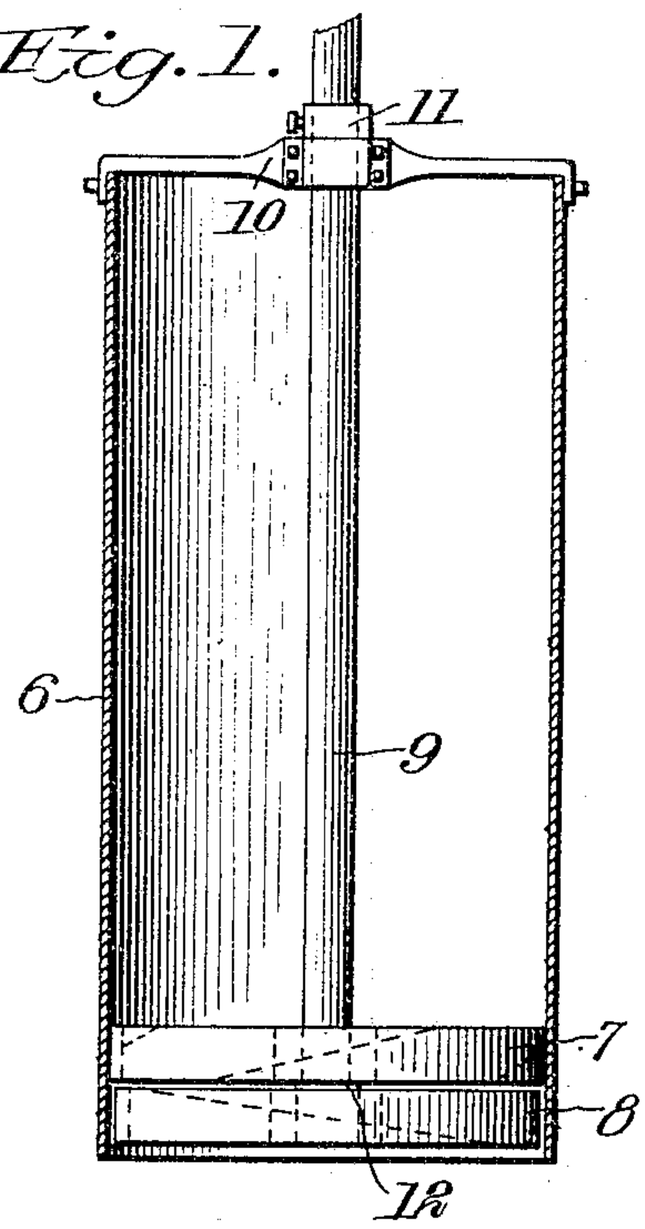


Fig. 2.

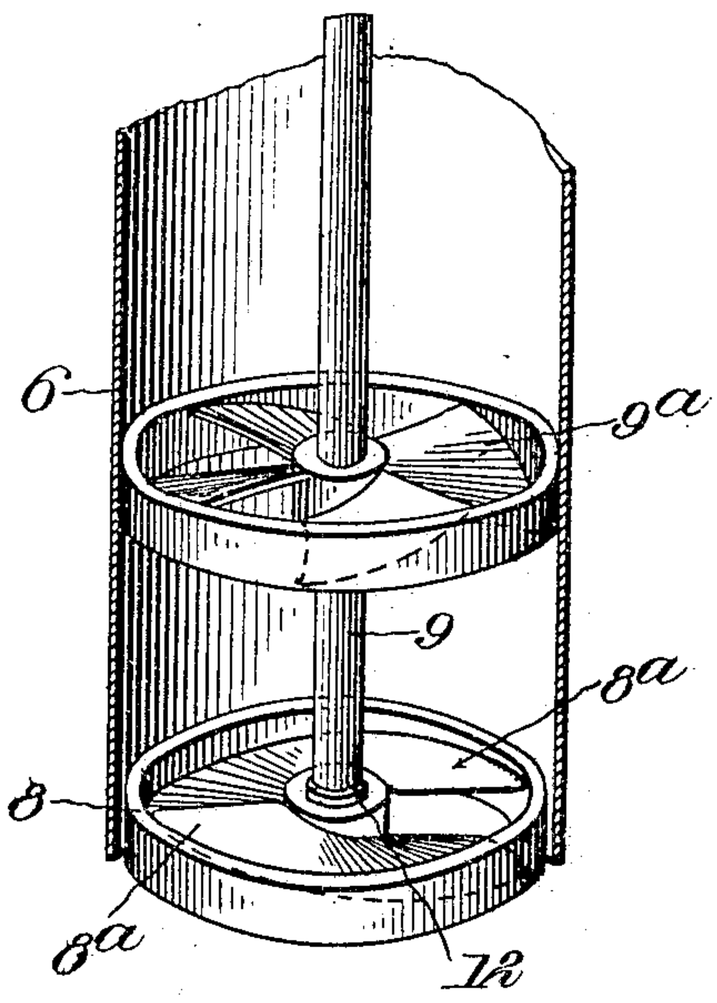


Fig. 3.

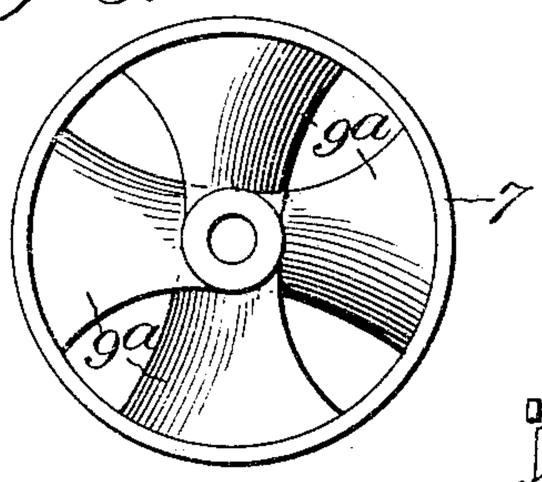


Fig. 4.

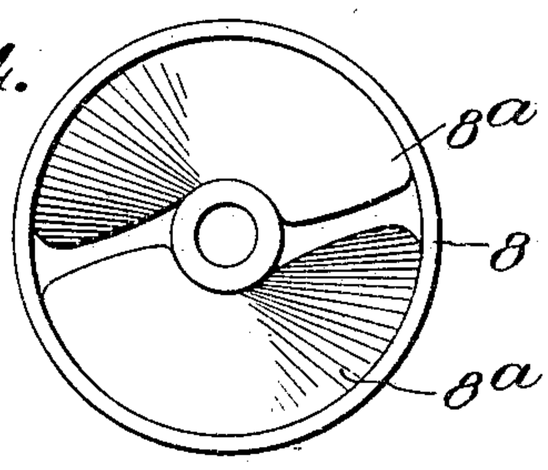
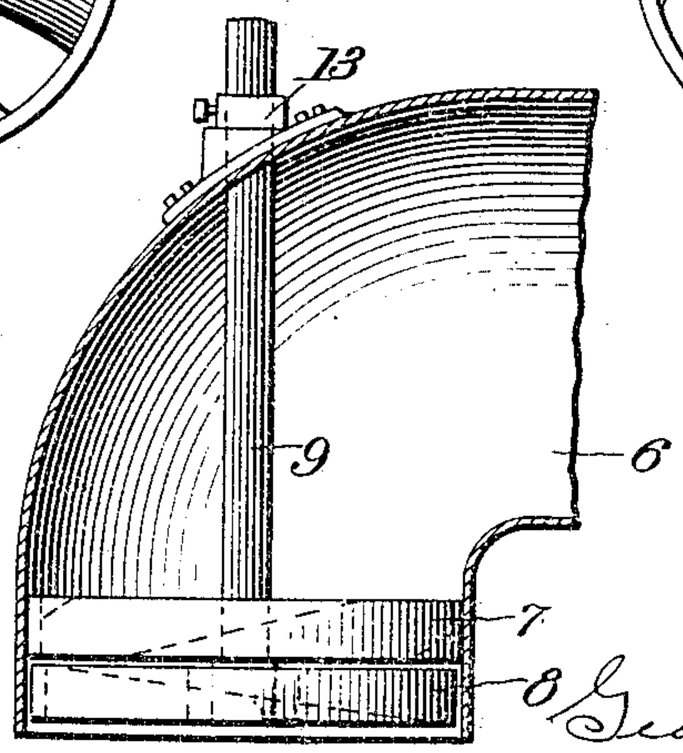


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

GEORGE H. ELLITHORPE, OF PORT CLINTON, OHIO.

ROTARY PUMP.

SPECIFICATION forming part of Letters Patent No. 788,032, dated April 25, 1905.

Application filed April 2, 1903. Serial No. 150,765.

To all whom it may concern:

Be it known that I, GEORGE H. ELLITHORPE, a citizen of the United States, residing at Port Clinton, in the county of Ottawa and State of Ohio, have invented certain new and useful Improvements in Rotary Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

This invention relates particularly to that class of rotary pumps known as "propeller-pumps" in which a rotating wheel having inclined blades is placed at the lower end of a cylinder which is placed in the liquid to be lifted.

The object of the invention is to form an improved pump of the kind stated having advantages with respect to construction and operation, as will more fully appear hereinafter.

Further advantages are contained in the specific construction of the two wheels.

Referring to the accompanying drawings, Figure 1 is a side elevation of the pump with the cylindrical casing in section. Fig. 2 is a perspective view with the wheels separated, so as to expose the lower one. Figs. 3 and 4 are respectively plan views of the upper and lower wheels, and Fig. 5 is a view showing a form of application to a curved casing.

Referring specifically to the drawings, 6 indicates a cylindrical casing, at the lower end of which is placed the upper stationary wheel 7 and the lower rotating wheel 8, the latter being fast on a shaft 9, which finds its bearings in the upper wheel 7 and in a spider 10 at the top of the cylinder. The collar 11 holds the shaft as set in desired vertical position. The wheel 7 fits and is fast within the cylinder. The movable wheel 8 is a trifle smaller to avoid friction against the cylinder, and the wheels are separated slightly—say one-sixteenth of an inch—to avoid friction-contact. This separation is conveniently effected by a step in the shaft at 12, forming a shoulder upon which the wheel 7 rests, the lower wheel being keyed to the larger diameter slightly below the shoulder. The lower wheel has a pair of spiral blades 8^a, and the upper wheel has a greater number of blades 9^a, preferably four, inclined in reverse direction to the lower blades. This construction is advantageous. The pair of blades in the rotary wheel, each of which extends one-half around the rim, as shown in Fig. 4, take and support the water well without slip, and the several blades of the upper stationary wheel are of less circumferential extent than the rim, leaving space therebetween, as shown in Fig. 3, giving a greater free way for the escape flow of the water. The lower wheel being rotated in proper direction, the water taken thereby acquires a certain whirl in the same direction, and this motion effects a lifting force by contact with the opposing blades 9^a of the stationary wheel. The wheels run close together, so there is no chance for slip of water therebetween nor for centrifugal force friction against the sides of the casing.

In Fig. 5 the casing is bent, and the shaft finds its upper bearing in a box 13, bolted to the casing.

Through practical experience with various constructions of rotary lift-pumps of the spiral blade or propeller-wheel type I have found that to economically gain high efficiency—that is, to attain a maximum lifting capacity with a minimum expenditure of power—it is necessary to keep surface friction, slippage, and whirl or rotary movement of the water at the minimum and to handle the vertically-moving column of water in as compact a stream and with as direct a flow as possible. The vertically-moving column of water must be maintained as free from obstructions as possible, so as to keep the stream, so far as possible, solid and undivided. It is desirable that the water enter the rotary driving wheel or head in a direction parallel with the longitudinal axis of the pump-casing or with the axis of rotation of said driving-head and that the whirling or rotary movement of the water with said head be reduced to the minimum to attain the

maximum forcing or lifting action of said head on the water. To attain maximum efficiency, the water must pass through the driving wheel or head, the stationary or guide wheel or blades, and the pump pipe or casing with a minimum amount of surface friction and obstruction and without appreciable slippage by reason of centrifugal force acting on the water passing through the driving-head, and the whirling water delivered from said head must be removed therefrom as rapidly as it is delivered thereby, hence keeping at the minimum the body of water under the direct whirling influence of said driving-head.

My invention successfully meets the foregoing requirements in that I combine a peculiar rotary drive head or wheel with peculiar means arranged closely adjacent to the delivery or discharge end of said wheel for the purpose of directing the whirling water away from said wheel as rapidly as said water is delivered by the wheel, said wheel and means being so arranged as to avoid, so far as possible, changing the direction of movement of the water while in the wheel and of the water while passing through said means.

My rotary drive-wheel attains a maximum forcing or lifting power with minimum surface friction and tendency to cause whirling of the water, because said wheel, while maintaining its maximum forcing efficiency, is formed with a minimum number of water-passages of a maximum capacity, hence offering a minimum resistance to the passage of the water in a solid or compact stream, because said wheel is incased or formed with a cylindrical rim, thereby preventing the water within the wheel being thrown by centrifugal force against the wall of the pump-casing, which would cause slippage and excessive loss of power, and because the series of elongated spiral blades, each of the same pitch or curvature from end to end, approximately extend completely around the space within the rim and form the water-inlet openings, each between the upper end of one blade and the lower end of another blade and of a maximum length from center to rim, and arranged so that the discharge of water from the top or rear ends of the blades will not interfere with the free passage of water into said openings.

The guide or stationary wheel arranged closely above the rotary drive wheel or head is an essential element in my combination, because it serves to direct the whirling water delivered from said drive-wheel upwardly from said drive-wheel and out of the direct whirling influence of said wheel, and hence tends to reduce and effectively minimize the objectionable rotary or whirling movement of the water above the drive-wheel. It is hence essential that said guide or stationary wheel be arranged closely adjacent to the drive-wheel and that the water-passages and blades of the stationary wheel be so arranged and proportioned with respect to the driving-wheel as to cause the stationary wheel to force the water away from the drive-wheel as rapidly as the water is delivered thereto by the drive-wheel. I hence provide the guide or stationary wheel with a greater number of blades set at a sharper angle and forming a greater number of water-passages than in the drive-wheel and with the series of blades in the stationary wheel extending approximately completely around the space within the rim of said wheel. Each blade of the guide or stationary wheel is of the same pitch or curvature from end to end to avoid, so far as possible, changing the direction of movement of the water while in said wheel, and the drive-wheel blades are also formed to attain the same end, thereby avoiding the loss of power and friction which results where the direction of movement of the water is changed while in the drive-wheel and while in the guide-wheel. I prefer to provide the guide-wheel with the rim closely adjacent to the rim of the drive-wheel to keep the whirling water from the surface of the pump-casing and completely under the influence of the blades 9^a. Said guide-blades increase the efficiency of the drive-wheel by reducing the whirling or rotary motion of the water with said wheel. The forcing efficiency of the drive-wheel decreases as the division of the water therein increases and as the speed and quantity of water whirling therewith increases.

In the specific example illustrated I have shown the drive-wheel in its most simple form, comprising only two blades, each extending one-half around the wheel, and I have shown the guide or stationary wheel with twice the number of blades, each extending one-quarter around the wheel and set at a sharper angle or with a greater pitch than in the drive-wheel, thereby forming the guide-wheel with twice the number of outlets than in the drive-wheel. I have found that this two-blade drive-wheel, having blades of the proper length and pitch, attains a high efficiency with a minimum friction; but I do not wish to limit my invention strictly to a two-blade drive-wheel and a four-blade guide-wheel, particularly in wheels of large diameter; but I find it essential that the drive-wheel have as few blades as possible to attain the maximum forcing power and that the guide-wheel have as small a number of blades as possible to perform the function desired, yet that the guide-wheel have a greater number of blades than the drive-wheel.

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

1. In a rotary pump, of the character, substantially as described, the combination of a pump-casing, a rotary drive-wheel arranged

therein, means for rotating the same, said wheel comprising a rim and spiral blades extending from the center of the wheel to the rim, and each of the same pitch from end to end and forming the inlet-openings from center to rim between the ends of said blades, and a series of inclined stationary blades approximately extending completely around the space within said casing and arranged closely adjacent to the delivery end of said wheel, to deflect from said wheel the whirling water delivered thereby, said stationary blades being greater in number than and inclined in an opposite direction to and at a different angle from the blades of said wheel, and forming the water-outlets between their receiving and delivery ends.

2. In combination, in a rotary pump, a pump-casing, a rotary drive-wheel therein comprising a rim and several similar spiral blades extending from the wheel center to said rim and approximately completely around the space within the rim and forming the water-inlets between the ends of said blades and from the center to the rim of said wheel, each blade being of approximately the same pitch from its receiving to its discharge end, a stationary wheel arranged closely adjacent to the delivery end of said drive-wheel and comprising a rim and a series of inclined blades extending from the center to the rim of said wheel and forming a number of water-passages between the ends of said blades, said stationary blades being greater in number than the blades of said drive-wheel and inclined in an opposite direction therefrom to deflect from the drive-wheel the water delivered thereby, each stationary blade being of the same pitch from end to end, and a drive-shaft for the drive-wheel passing through the center of said stationary wheel, substantially as described.

3. In a rotary pump, in combination, a pump-casing, a rotary drive-wheel therein, means for rotating said wheel, and a stationary wheel arranged closely adjacent to the delivery end of said drive-wheel to deflect therefrom the whirling water delivered thereby, said wheels comprising rims and inclined blades extending from the centers to the rims of the wheels and approximately completely around the spaces within said rims and forming the water-passages between the receiving and delivery ends of the blades, the blades of the drive-wheel extending, each, approximately one-half around the wheel, and the blades of the stationary wheel extending each, approximately, one-quarter around the wheel, substantially as described.

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

GEORGE H. ELLITHORPE.

Witnesses:
RUEL H. CRANFORD,
GEO. A. TRUE.