No. 865,900. PATENTED SEPT. 10, 1907.

A. W. HUNSAKER.

AUTOMATICALLY BALANCED VERTICAL SHAFT CENTRIFUGAL PUMP.

APPLICATION FILED APR. 19, 1905.

Fig. 1

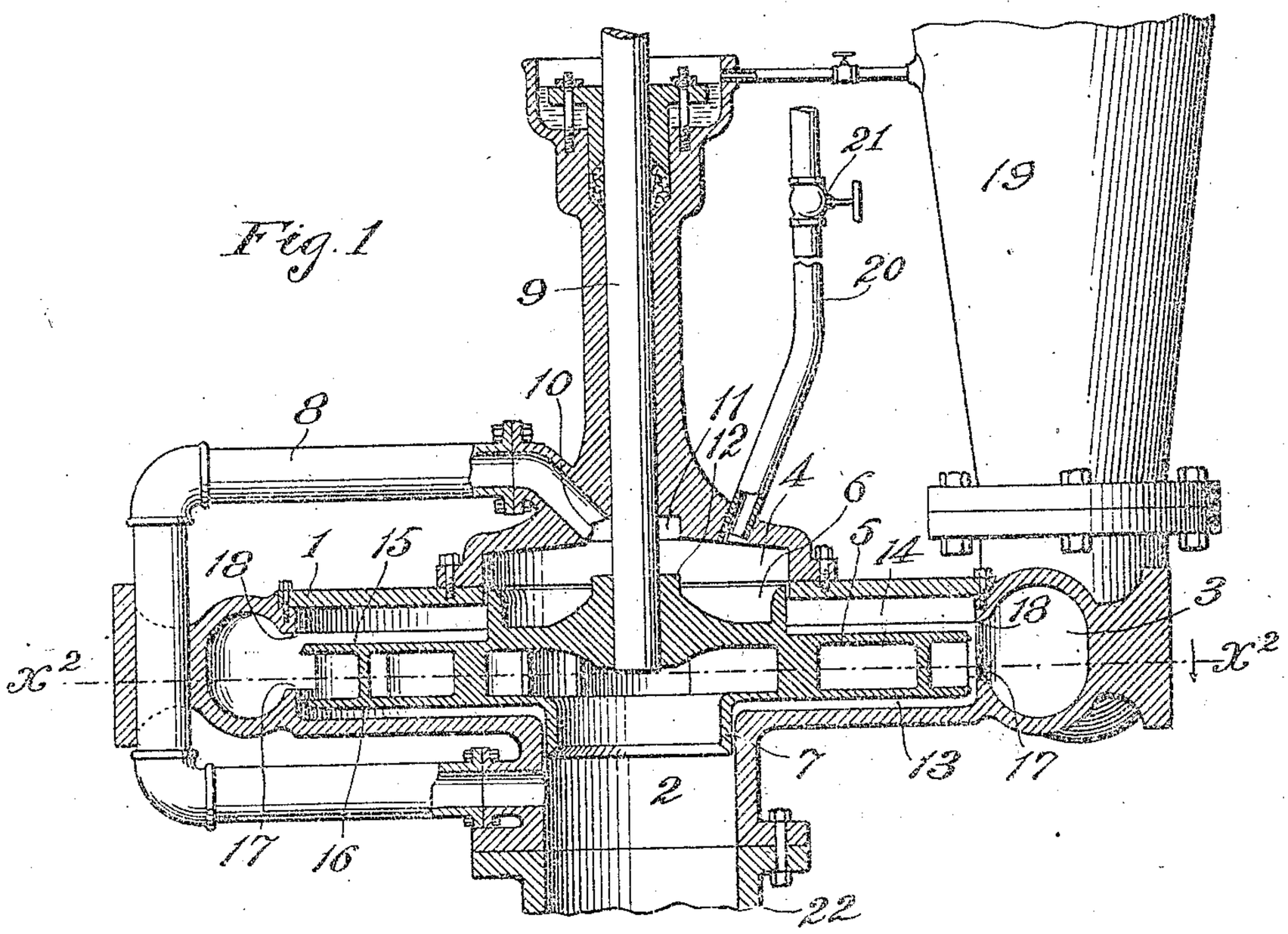
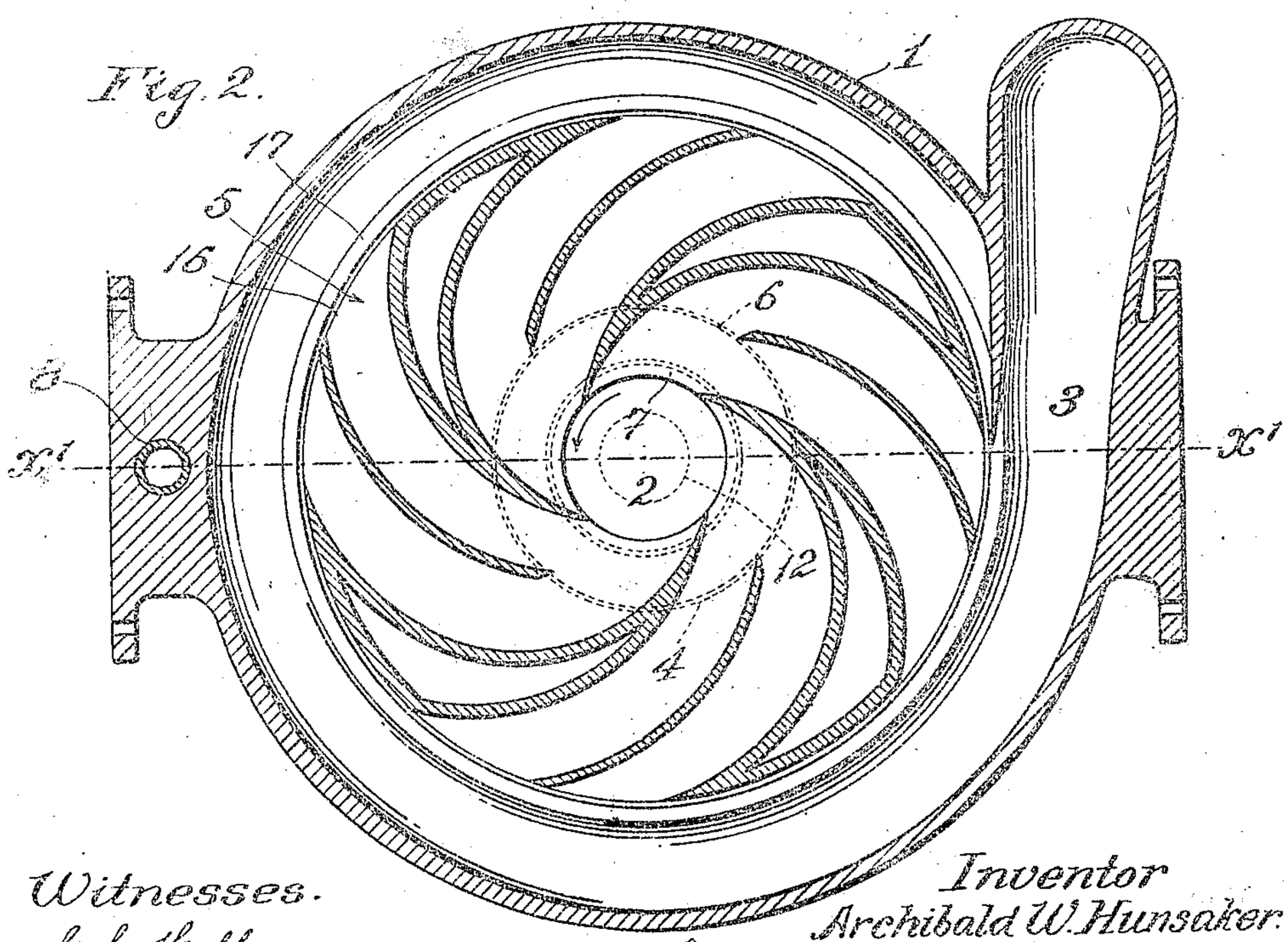


Fig. 2.



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UNITED STATES PATENT OFFICE.

ARCHIBALD W. HUNSAKER, OF POMONA, CALIFORNIA.

AUTOMATICALLY-BALANCED VERTICAL-SHAFT CENTRIFUGAL PUMP.

No. 865,900. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed April 19, 1905. Serial No. 256,473.

To all whom it may concern:

Be it known that I, ARCHIBALD WIGHTMAN HUNSAKER, a citizen of the United States, residing at Pomona, in the county of Los Angeles, in the State of California, have invented an Automatically-Balanced Vertical-Shaft Centrifugal Pump, of which the following is a specification.

An object of the invention is to provide novel improved means to balance the impeller and shafting against end thrust in a centrifugal pump in which the suction or intake enters at the bottom of the pump shell.

Another object is to provide a water bearing for limiting the upward movement of the impeller.

An object of this invention is to avoid the trouble which arises from the admission of air to the impeller in that form of balanced centrifugal pumps in which the suction is taken in at the top.

An object of this invention is to provide an automatically balanced centrifugal pump which will keep itself free from accumulations of sand, and in which the suction is so arranged as to draw the sand away from the working parts.

Another object is to provide a balancing device for centrifugal pumps free from complicated valves, piston leathers, packing rings, or other close fitting bearings; also to provide a pump that obtains its balance from either the pressure of the water in the discharge pipe, or from the vacuum pressure created by the suction, or from both, and in which the balance remains effectual whether the pump is working to its full capacity or not.

This invention relates to a vertical pump, and in practice, the impeller of such a pump is driven by power received from a shaft extending downwardly to the impeller from power which, in the case of pumps used in wells, is located at the surface of the ground, while the pump is located below the surface of the ground. In the following specification, therefore, it is to be understood that by the term "top" I mean that side of the runner or impeller into which the shaft extends from the motor, not shown; and that by the term "bottom" I mean that side of the runner or apparatus underneath or opposite that portion of the driving shaft through which the power is applied to the impeller.

Heretofore, there have been bottom intake pumps in which external devices, such as valves or pistons, have been employed to assist in balancing or carrying the weight of runner and shafting. Other centrifugal pumps have been provided with an intake around the shaft through which the power is applied to the impeller, and on the same side of said impeller with the motor which drives the impeller; that is to say, on the top of said impeller when said pump is installed, so that the shaft stands vertically above the impeller. In other instances, centrifugal pumps have been installed with the power shaft horizontal and the intake entering at the side of the impeller, as distinguished from the bottom of the impeller. This invention is distinguished from all such constructions by having the intake vertically below the vertical shaft through which the power is received from above.

The accompanying drawings illustrate the invention.

Figure 1 is an axial section on line X^1—X^1, Fig. 2. Fig. 2 is a plan section on line X^2—X^2, Fig. 1.

The outlines of the several heads are indicated by dotted lines.

1 is a shell having a bottom intake 2 and a peripheral outlet 3, and provided at the top with a suction-chamber 4, connected with and of greater cross-sectional area than the intake 2.

5 is a centrifugal impeller of the closed type, furnished with a head 6 working in the suction-chamber 4, and with a head 7 working in the intake 2, the impeller being imperforate throughout the portion thereof within the periphery of the last-named head 7. The suction-chamber 4 and the intake 2 are connected by a by-pass 8. The lower head 7 of the rotary impeller is open-ended, is mounted axially above the open intake 2, and is open axially directly from the intake 2 and into the interior of the impeller communicating with the peripheral outlets thereof.

9 is a shaft which carries and drives the impeller 5, said shaft being ordinarily (when not running) supported at the top by a collar (not shown) in the usual way to hold the impeller clear from the bottom of the shell when not in operation, and before the balance takes effect. The by-pass 8 enters the suction-chamber 4 at a port 10, which opens into an upwardly-extending annular offset 11 of the top of the chamber 4. Said offset is concentric with the shaft 9.

12 is an upwardly-extending throttling offset on the head 6, adapted to enter the offset 11, thus regulating the size of the passage leading into by-pass 8 between the pressure-chamber 4 and the intake 2 before the head 6 comes to the top of the suction-chamber 4 on the up-thrust of the impeller. 12 practically forms a valve head or throttle for controlling the by-pass 8 to automatically establish an equilibrium between the weight of shafting and impeller and the weight of suction and discharge water. The shell 1 is also provided between the intake 2 and the outlet 3 with a lower pressure-chamber 13, and is provided in its top with a pressure-chamber 14. Said pressure-chambers are connected with the outlet 3, and the upper one, 14, is of less cross-sectional area than the lower one, 13. The impeller 5 is provided with heads 15 and 16 work-

ing respectively in the pressure-chambers 14 and 13. The chambers 13 and 14 open to the peripheral outlet 3 as indicated at 17 and 18, so that whenever the pressure of water rises in the discharge pipe 19 that pressure is applied to the top and bottom heads 15 and 16 of the impeller. Since the bottom head 16 is of greater superficial area than the top head 15 there is an excess of upward pressure applied to the head 16 to serve toward counterbalancing the weight of the shaft 9 and impeller 5.

20 is a priming pipe with valve 21 for closing the same, which will be conveniently placed within reach of the operator.

In starting the pump into operation it will be primed in the usual way, and when the suction becomes effective it operates through the by-pass 8. Since the superficial area of the head 6 is greater than that of suction pipe 22, the effect, as is well known, is to counterbalance the weight of the impeller and its shaft 9 to the extent of the difference of areas multiplied by the pressure per square inch. Whenever the impeller is raised sufficiently to bring the offset or valve-head 12 into the offset 11 of chamber 4 the by-pass passage 8 is cut off and the water in the chamber 4 serves as a bearing to prevent further upward thrust of the impeller.

The heads 6, 12 and 7 have a working fit in the shell, but allow a small leakage of water. This leakage into chamber 4 will tend to bring the pressures on the impeller to equilibrium whenever the offset or head 12 cuts off the suction through by-pass 8. The leakage from chamber 13 past the head 7 into the suction 2, will simply pass through the impeller again.

What I claim is:—

1. A vertical centrifugal pump comprising an axially-movable rotary impeller, a shaft therefor, a shell having a bottom intake and peripheral outlet and provided at the top with a suction chamber of greater cross-sectional area than the intake, said chamber having an upwardly-extending offset concentric with said shaft; there being a passage connecting said offset with the intake; said impeller being furnished with a head working in said offset, a head working in the intake, and a head working in the chamber having the offset; the impeller being imperforate throughout the portion thereof within the periphery of said last-named head.

2. A vertical centrifugal pump comprising an axially-movable rotary impeller, a shaft therefor, a shell having a bottom intake and peripheral outlet and provided at the top with a suction chamber of greater cross-sectional area than the intake, said chamber having an upwardly-extending offset concentric with said shaft; there being a conduit external to the shell of the pump connecting the top of said offset with the intake; said impeller being furnished with a head working in said offset, a head working in the intake, and a head working in the chamber having the offset; the impeller being imperforate throughout the portion thereof within the periphery of said last-named head.

In testimony whereof, I have hereunto set my hand at Los Angeles California this 10th day of April 1905.

ARCHIBALD W. HUNSAKER.

In presence of—

JAMES R. TOWNSEND,

JULIA TOWNSEND.