No. 715,441. Patented Dec. 9, 1902.

W. C. VANDEGRIFT.

FLUID PUMPING AND FLUID ACTUATED MACHINE.

(Application filed May 31, 1901.)

(No Model.) 2 Sheets—Sheet 1.

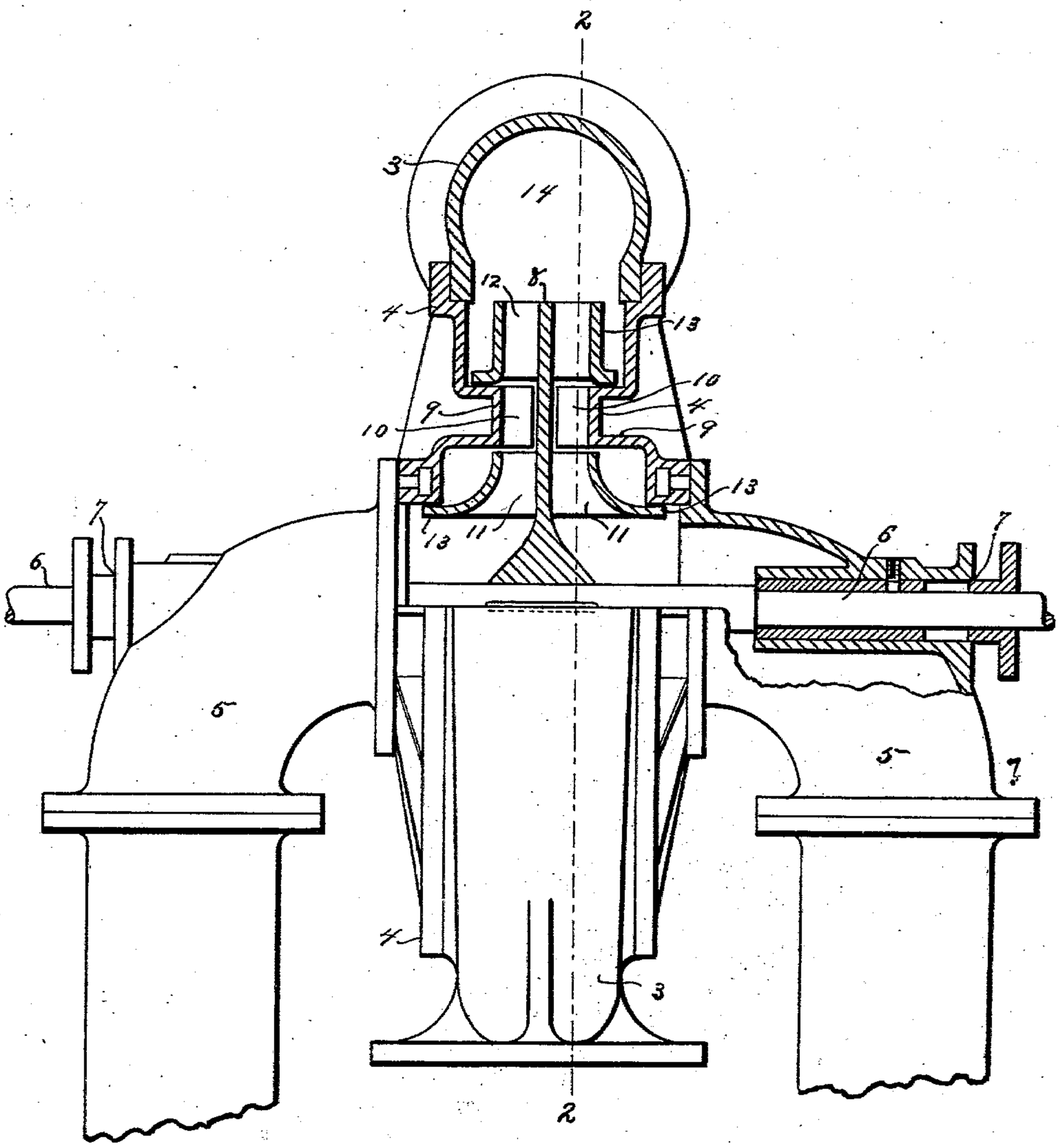

Fig. I.

WITNESSES,
F. E. Gillmore
Pearl B. Garrett

INVENTOR,
William C. Vandegrift,
By S. E. Foulke Atty.

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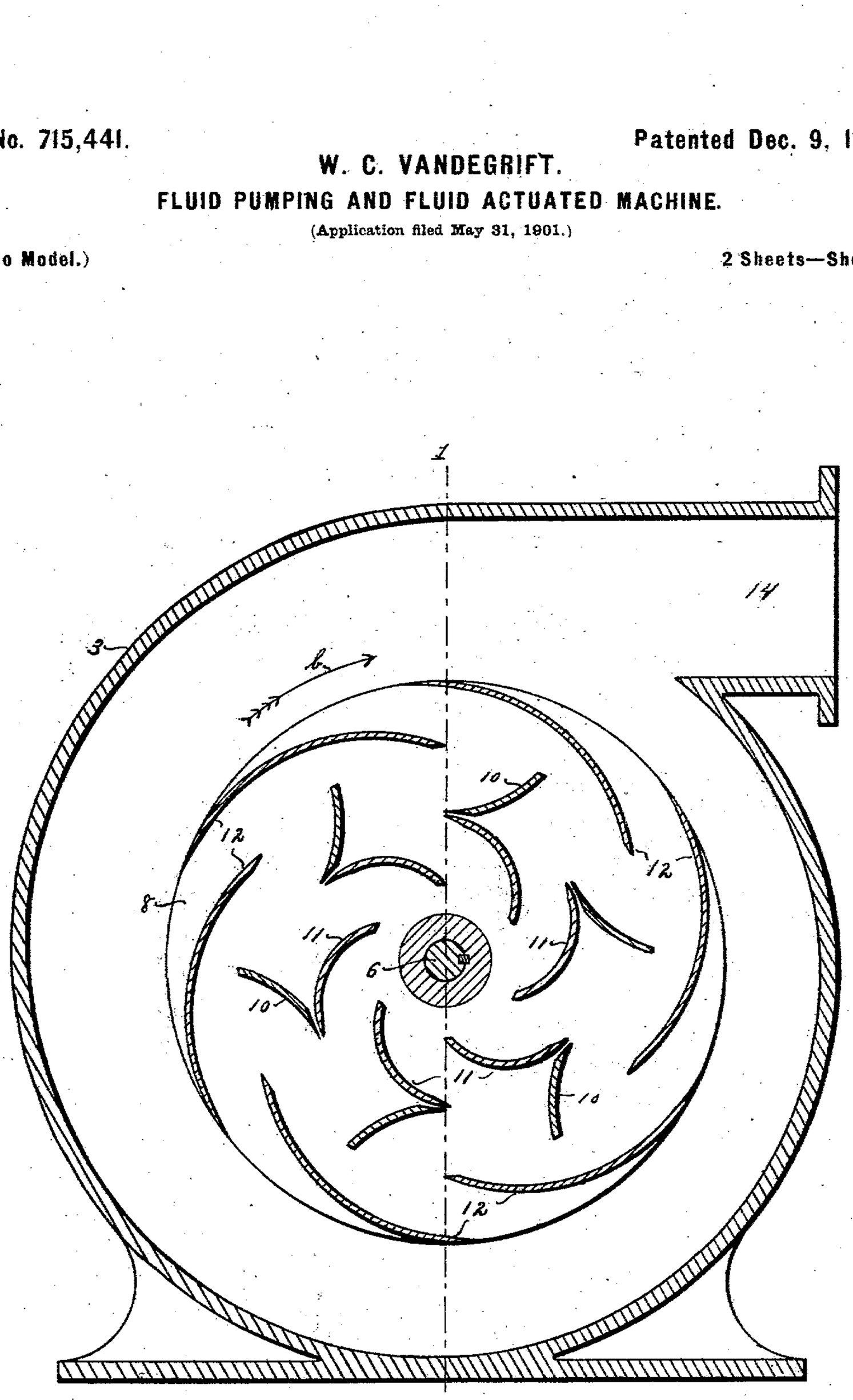

Fig. 2.

WITNESSES,

F. E. Gillmor.

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By S. E. Foulds Atty.

UNITED STATES PATENT OFFICE.

WILLIAM C. VANDEGRIFT, OF SAN FRANCISCO, CALIFORNIA.

FLUID-PUMPING AND FLUID-ACTUATED MACHINE.

SPECIFICATION forming part of Letters Patent No. 715,441, dated December 9, 1902.

Application filed May 31, 1901. Serial No. 62,466. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM C. VANDEGRIFT, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented a new and useful Improvement in Fluid-Pumping and Fluid-Actuated Machines, of which the following is a specification.

This invention relates to machines which may be used for pumping fluids or for developing power by having the fluids forced through them, and has for its objects the production of a machine of this character which has greater efficiency than those heretofore employed. In fact, my invention is designed to do work which has heretofore required two or more of such machines, and this being the case it must necessarily be more compact, the space which has been taken up by the additional machines being entirely saved. Moreover, my device is very little, if any, more costly than the machines of this character heretofore made, and as but one is needed where two or more have been previously required I am able to effect a large saving in first cost. These objects and advantages I attain by the construction illustrated in the accompanying drawings, in which—

Figure 1 shows a front view, partly in section and partly in elevation, of my improved machine, the sectional part being taken on line 1 1 of Fig. 2; and Fig. 2 is a transverse sectional view taken on the line 2 2 of Fig. 1.

Similar reference characters designate corresponding parts throughout the specification and drawings.

It is well known that in order to lift a liquid to a given height by means of a centrifugal pump it is necessary to drive the pump so that its rim will revolve with a velocity equal to that of a falling body if it were dropped from that height. Inasmuch as the acceleration of falling bodies is very rapid it will be evident that the speed of rotation of the pump must also increase very rapidly as the head increases, so that the limit of practicable speeds is very soon reached. Where the liquid is to be lifted to a height that is too great for a single pump when run at a practical and economical speed, it has been customary to interpose a second pump near the point to which the first pump will economically lift the liquid, thus running the two pumps in series. This, however, forms an expensive system, and it is to obviate the necessity of using a plurality of pumps in this way that my present device is intended.

While I have referred specifically to pumps for pumping liquids in the above description, I desire it to be understood that my invention is equally applicable to the pumping of air or any other fluid, or it is also adapted to be used as a motor when the fluid is forced through it under pressure.

The basic principle in my invention resides in the arrangement of the rotary and stationary blades, so that a plurality of impulses will be given to the object that is being acted upon, as the liquid when my device is used as a pump or to the main shaft when the device is used as a motor. This principle is embodied, preferably, in the form of machine illustrated, in which 3 shows the outer casing, which may be of any convenient shape, but which is preferably of the volute form shown. This case is open at its sides; but in the finished machine these openings are closed by cover-plates 4, which extend from the outer casing toward the center, these inner portions forming annular flanges, to which are secured the suction or inlet pipes 5. Journaled in these pipes and passing through the center of the cover-plates is a transverse shaft 6, said shaft projecting beyond the suction-pipes at one or both of its ends in order to support a pulley or pulleys, by means of which the pump may be driven or power transmitted from the shaft. All leakage along this shaft is prevented by the ordinary stuffing-box, as shown at 7 7. At the center of the shaft and midway between the cover-plates 4 is keyed or is otherwise secured the runner 8. This runner consists of a disk which is flat throughout the greater part of its surface, but which flares outwardly on both of its sides as it nears the shaft. This structure affords a rigid connection between the runner and the shaft, but does not interfere with the flow of the liquid past the same. About half-way between their outer and inner circumferences the cover-plates 4 are projected inwardly, as at 9, thus forming an annular flange on each side of the runner. Secured, preferably, to these flanges at suitable and equidistant points are a set of

stationary blades 10, which project inwardly until they almost contact with the surface of the runner 8. These blades are curvilinear in form and extend in a direction such as will offer the slightest resistance to the fluid as it passes over them. Projecting from the opposite faces of the runner 8 are two sets of blades 11 and 12, which rotate with the runner on opposite sides of and close to the stationary blades 10. These blades are also curvilinear in form, but the curve is in the opposite direction to that of the stationary set. The blades in both the outer and inner sets are arranged in directly opposite pairs on the runner, so as to cause the same to be perfectly balanced.

In order to prevent the water from leaking backwardly through the pump or motor, to reduce the internal friction, and, in general, to increase the efficiency of the device, I provide the outer portions of the rotating blades with balance-rings 13, which extend about the central shaft within and without the flanges 9 of the cover-plate 4. These rings are preferably of the form shown and consist of a horizontal portion that moves close to the upper surface of the flange 9 or to the inner part of the cover-plate 4 to prevent the water from escaping backwardly through the pump or motor, and a web that extends inwardly and upwardly from the said horizontal portion and finally assumes a direction substantially parallel with the runner 8. This form of ring directs the fluid into or out of the machine without any sharp turns and by so doing avoids the eddy-currents and consequent friction that would be present if no rings were used. The inward turning of the web of the ring results in the formation of chambers outside thereof, into which the liquid can pass, so as to maintain a balanced pressure on each side of the ring. The inner surfaces of the webs of the rings are substantially in line with the inner part of the flanges 9, so that a straight course for the fluid parallel with the runner is provided.

Assuming the device shown to be a pump and to be rotating in the direction of the arrow *b*, (shown in Fig. 2,) the liquid will be drawn in through the suction or inlet pipes 5 5 on both sides of the runner until it is caught by the inclined blades 11 near the shaft and forced outwardly. As it leaves these blades it will pass between the stationary blades 10, which will prevent its return, and as additional quantities of liquid are consequently being pumped in by the blades 11 the same will be forced outwardly through the outlet-pipe at 14. This is the action of the ordinary device of this character and would be the action of this machine if it were not for the outer sets of rotary blades 12. These blades, however, take up the liquid as it is forced over the outer portion of the stationary blades 10 and give it a second impulse in an outward direction, thus forcing it from the outlet 14 with very much greater pressure than if a single set of rotary blades had been employed. While I have shown but one set of stationary blades, it is evident that any practicable number of such sets may be used, alternating with sets of rotary blades 11, such a number of sets each giving a separate impulse being employed as may be necessary to get the required total impulse for lifting the liquid to the height desired.

As has been previously stated, this device is also applicable as a motor, the fluid passing through the same giving additional impulses as it forces its way past each set of rotating blades. All of the following claims therefore which may be limited in terms to a device of this general character when employed for one purpose are to be construed as covering such a device when applied to its other use.

From this description it will be seen that I have produced a fluid-actuated and fluid actuating device which is simple, compact, economical, and efficient.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a device of the character described, a main shaft, a runner secured to said shaft, a casing surrounding the runner, flanges projecting from the inner surfaces of the casing, stationary blades projecting from said flanges toward the runner, movable blades carried by the runner and projecting from each side thereof toward the casing and on opposite sides of the stationary blades, and rings carried by each set of the movable blades, the inner surfaces of the rings being substantially in line with the inner surface of the flanges.

2. In a device of the character described, a main shaft, a runner secured to said shaft, a casing surrounding the runner, flanges projecting from the inner surface of the casing, stationary blades projecting from said flanges toward the runner, movable blades carried by the runner and projecting from each side thereof toward the casing and on opposite sides of the stationary blades, and rings carried by each set of the movable blades, said rings having horizontal portions that move with a sliding fit next the casing and upwardly-turned webs that become substantially parallel with the runner, the inner surfaces of said webs and the flanges being practically in one continuous line, substantially as described.

3. In a device of the character described, a main shaft, a runner secured to said shaft, a casing surrounding the runner, flanges projecting from the inner surface of the casing, stationary blades projecting from said flanges toward the runner, movable blades carried by the runner and projecting from each side thereof toward the casing and on opposite sides of the stationary blades, and rings carried by each set of the movable blades, said rings having horizontal portions that move with a sliding fit next the casing, and up-

wardly-turned webs that become substantially parallel with the runner, the inner surfaces of said webs and the flanges being practically in one continuous line, and the rear surfaces of the webs and the adjacent portions of the casing being spaced apart to permit the entrance of the fluid behind the rings.

4. In a device of the character described, an outer casing, cover-plates having inwardly-projecting flanges secured to said casing, inlet-pipes secured to said cover-plates, a rotary shaft journaled in said inlet-pipes, a runner secured to the center of said shaft, a plurality of sets of rotary blades carried by said runner, rings connecting the outer portions of said blades, a corresponding number of sets of stationary blades secured to the flanges on the cover-plates and projecting between the rings and the blades on the runner, the arrangement of the blades being such that a plurality of impulses are given to the object acted upon.

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

WILLIAM C. VANDEGRIFT.

Witnesses:

EMMA BLOOM,

F. M. SMITH.