J. SCHNEIBLE.

CENTRIFUGAL PUMP.

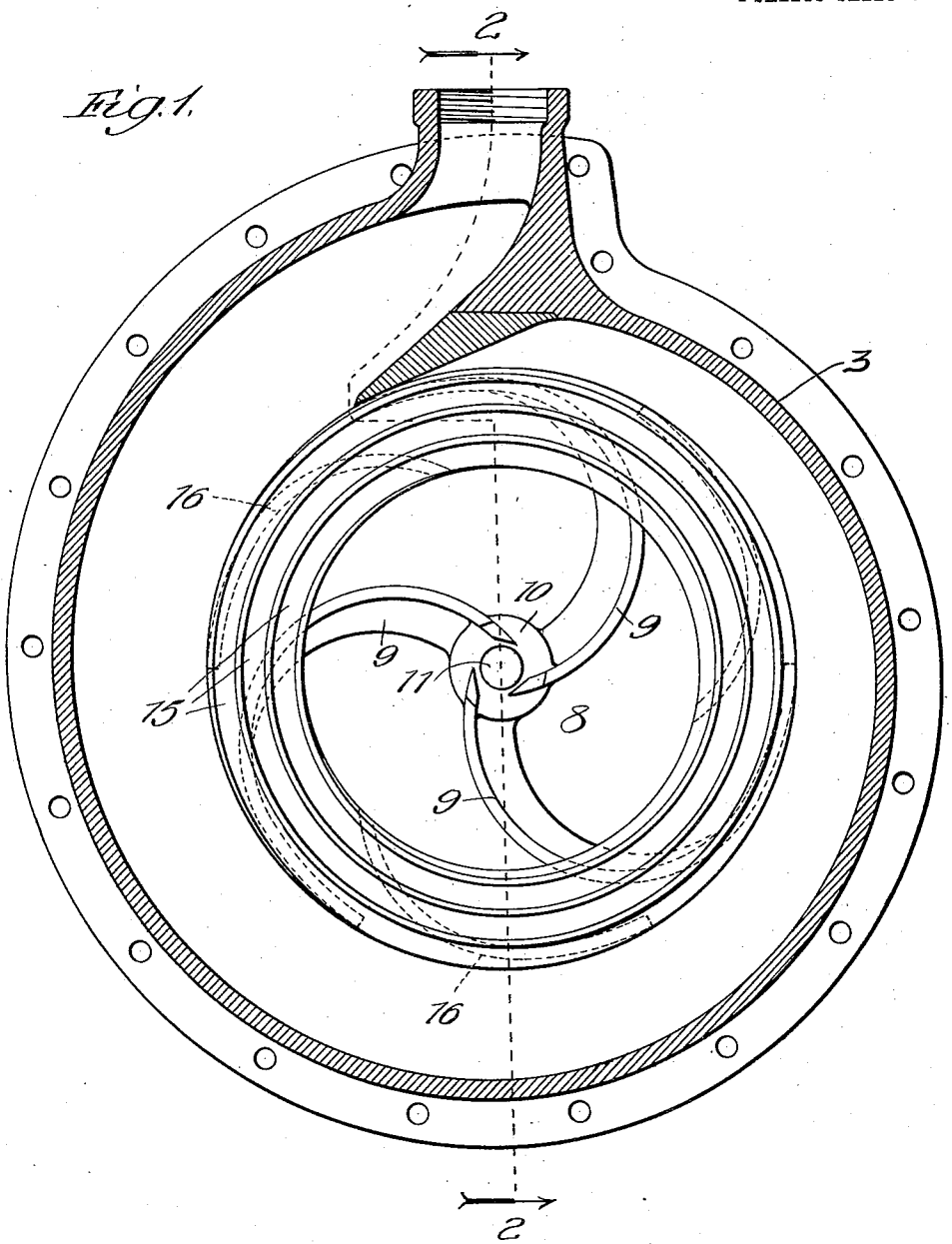
APPLICATION FILED JUNE 18, 1912.

**1,065,732.**

Patented June 24, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

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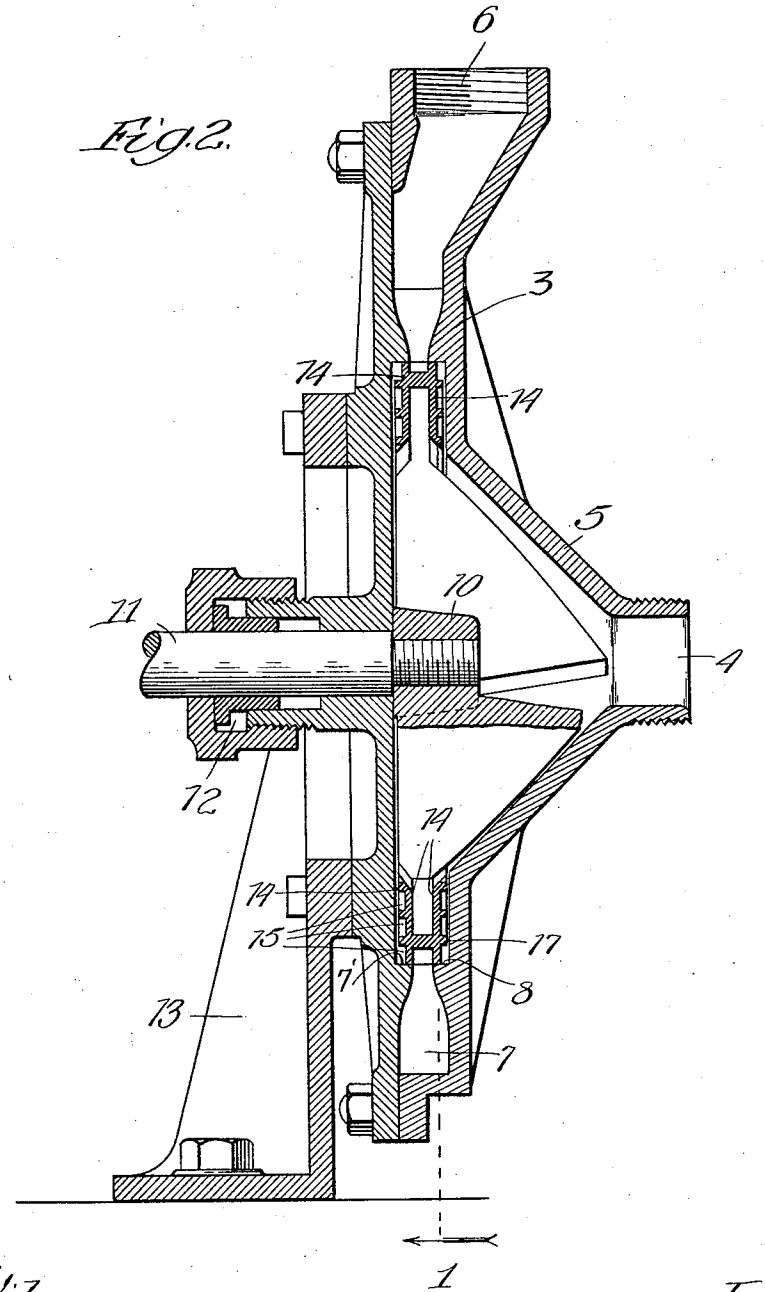
2 SHEETS—SHEET 2.

Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## CENTRIFUGAL PUMP.

1,065,732. Specification of Letters Patent. Patented June 24, 1913.

Application filed June 18, 1912. Serial No. 704,381.

*To all whom it may concern:*

Be it known that I, JOSEPH SCHNEIBLE, a citizen of the United States, residing at 122 South Michigan avenue, Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Centrifugal Pumps, of which the following is a specification.

My invention relates to an improvement in the class of centrifugal pumps employing closed or shrouded impellers for preventing leakage through the clearance-space between the impeller and side-walls of the pump-casing from the outer circumference of the impeller inwardly toward the intake or suction-pipe of the pump.

The closed impeller, as hitherto constructed, is not adequately effective for the aforesaid anti-leakage purpose excepting in pumps of large capacity. The attempt heretofore made, in centrifugal pumps of smaller capacity, to accomplish the aforesaid purpose of reducing to the minimum the quantity of such leakage, has been by providing between the impeller-shrouding and sides of the pump-casing a very close clearance-space leading to the suction-pipe connection and requiring the fluid, after passing through that space, to flow through a labyrinth of rims or rings provided to reduce it. However, even with that construction the clearance-space loss is so great, that in determining the dimensions of the impeller for any given pump, the quantity of such loss has to be taken into account, because that quantity passes through the impeller in addition to the fluid being discharged by the pump. Moreover, that construction renders multi-staging necessary, even though the pressure sought might readily be attained by the action of a single impeller, were it not for the fact that the greater the difference between the pressure at the impeller-rim and the suction-pressure the greater will be the quantity of leakage.

The object of my invention is to provide a simple construction of impeller-shrouding which shall effectively overcome the difficulty in preventing the leakage referred to; and this I accomplish by providing the side-walls on the impeller-blades, forming the impeller-shroud, with spiral passages about their outer faces, with the effect hereinafter explained.

In the accompanying drawings, Figure 1 shows a centrifugal pump embodying my improvement by a section on line 1 Fig. 2, with the impeller in elevation, and Fig. 2 is a diametrical section through the pump on line 2, Fig. 1.

The pump-casing 3, which may be of the construction illustrated or of any other desired construction, need involve no features of novelty. It has the intake 4 at the apex of the conical section 5 of one of its heads, and the peripheral outlet 6, as usual in such pumps; and between the annular outlet chamber 7 and impeller the inner surfaces of the casing-heads are formed with corresponding annular shoulders $7^1$. The impeller 8, formed with a series of curved blades 9, is secured at its hub 10 to the drive-shaft 11 journaled in a head of the casing provided with a stuffing-box 12 and a standard or leg 13 to be bolted to a suitable bed for stably supporting the pump in its operative position.

On opposite sides of the impeller-blades are provided, or cast integral therewith, annular walls 14, 14, to form the impeller-shroud; and they extend inwardly from the blade-tip extremities a comparatively-short distance toward the hub, or to any distance most suitable for their purpose. Similar spiral channels or passages 15, 15 extend about the walls 14 on their outer surfaces, describing courses running from the inner edges of the walls outwardly and in the direction opposite to the direction of rotation of the impeller, to form fluid-ways between the smooth sides of the casing-heads.

Relatively short vanes 16 are shown by dotted lines in Fig. 1 to be provided between the impeller-blades on the inner faces of the walls 14, but they are not novel and are not necessary for use with my improvement.

In operating the pump, the impeller, which revolves freely in the casing, in producing outward motion of the fluid, generates by the action of the entire cross-section of both outer surfaces of the shrouding sufficient force thereon between the pump-casing and impeller-shroud to counteract and thus prevent back-flow, (due to difference in pressure within the clearance-space between the shrouding and pump-casing) of the fluid through the clearance-space 16 from the periphery of the impeller toward the center of the pump, while at the same time maintaining a counter-pressure

throughout the clearance-space corresponding to the pressure set up by the impeller-action.

As will be understood, in the operation of a centrifugal pump a constant increase of pressure is produced on the fluid as it moves radially from the axis toward the impeller-rim, where the pressure reaches its highest point. This is due to the constantly increasing rotating velocity of the outwardly, and, comparatively, slowly moving fluid; and in consequence of this difference in pressure, the fluid tends to flow through the clearance-space backwardly toward the suction-pipe, causing the loss referred to, which impairs the efficiency of the pump and constitutes the so-called clearance-space loss. This my improvement prevents, as aforesaid, because it renders unnecessary close clearance between the rotating impeller and the suction-pipe; and since the outwardly-impelling force set up in the clearance-space at both sides of the impeller necessarily takes place near the impeller-rim, the walls 14 need not extend inwardly farther than is required to properly shroud the blade-tips, and a wholly unobstructed entrance to the impeller is afforded, which leaves the inner portion of the pumping chamber free from any impeller-casing and thereby almost totally avoids axial thrust, because of the equal pressure within the part of the pump-casing in which the impeller rotates.

It should be emphasized that the shrouded impeller, in the present case, is not, in effect, a supplementary pumping medium operating to force the fluid in the clearance-space into the discharging fluid by overcoming the back-pressure resistance of the latter; but that it operates to create and maintain in the clearance-space a practically constant pressure, as an equilibrium to the back-pressure of the discharging fluid, presenting a statical pressure-force between the clearance-space and discharge of the pump to shut off the clearance-space against being overcome by back-pressure from the discharge. In the particular means I have provided for my purpose, the pitch-angle of the spiral-shaped vanes is sufficiently flat to set up this statical pressure within the clearance-space without causing radial outward flow therein. That pitch, of course, as will be understood, should be changed to adapt it to the physical condition of the fluid to be pumped, meaning that for viscous liquids the pitch-angle should be flatter than for mobile liquids.

I realize that considerable variation is possible in the details of construction thus specifically shown and described, and I do not intend by illustrating a single, specific or preferred form to limit my invention thereto, my intention being in the following claims to claim protection upon all the novelty there may be in my improvement as broadly as the state of the art will permit. Thus, while the spiral form of the counter-pressure-producing means herein described is believed to best serve my purpose, the purpose being to provide such counter-pressure, any other means on the outer faces of the annular shroud-walls that will effect the same result are within my invention.

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

1. In a centrifugal pump, an impeller adapted to prevent back-leakage of fluid through the clearance-space in the pump, comprising annular shroud-forming walls on opposite sides of the impeller-blades, provided on their outer faces with means producing and maintaining, by the rotation of the impeller, statical counter-pressure of fluid in the clearance-space for resisting back-flow without producing a radial outward flow through said space of the fluid discharging from the pump.

2. In a centrifugal pump, an impeller provided with means for preventing back-leakage of fluid through the clearance-space in the pump, said means comprising annular shroud-forming walls on opposite sides of the impeller-blades, having on their outer faces spiral runways constructed and arranged to produce and maintain, by the rotation of the impeller, statical counter-pressure of fluid in the clearance-space for resisting back-flow without producing a radial outward flow through said space of the fluid discharging from the pump.

3. In a centrifugal pump, the combination with the casing, of an impeller journaled therein, provided with means for preventing back-leakage of fluid through the clearance-space in the pump, said means comprising annular shroud-forming walls on opposite sides of the impeller-blades extending inwardly from the outer blade-extremities and having on their outer faces spiral run-ways extending from the inner edges of said walls outwardly and in the direction opposite the direction of rotation of the impeller to produce and maintain, by the rotation of the impeller, statical counter-pressure of fluid in the clearance-space for resisting back-flow without producing a radial outward flow through said space of the fluid discharging from the pump.

JOSEPH SCHNEIBLE.

In presence of—
JOHN WILSON,
RALPH A. SCHAEFER.