W. K. RICHARDSON.

CENTRIFUGAL PUMP.

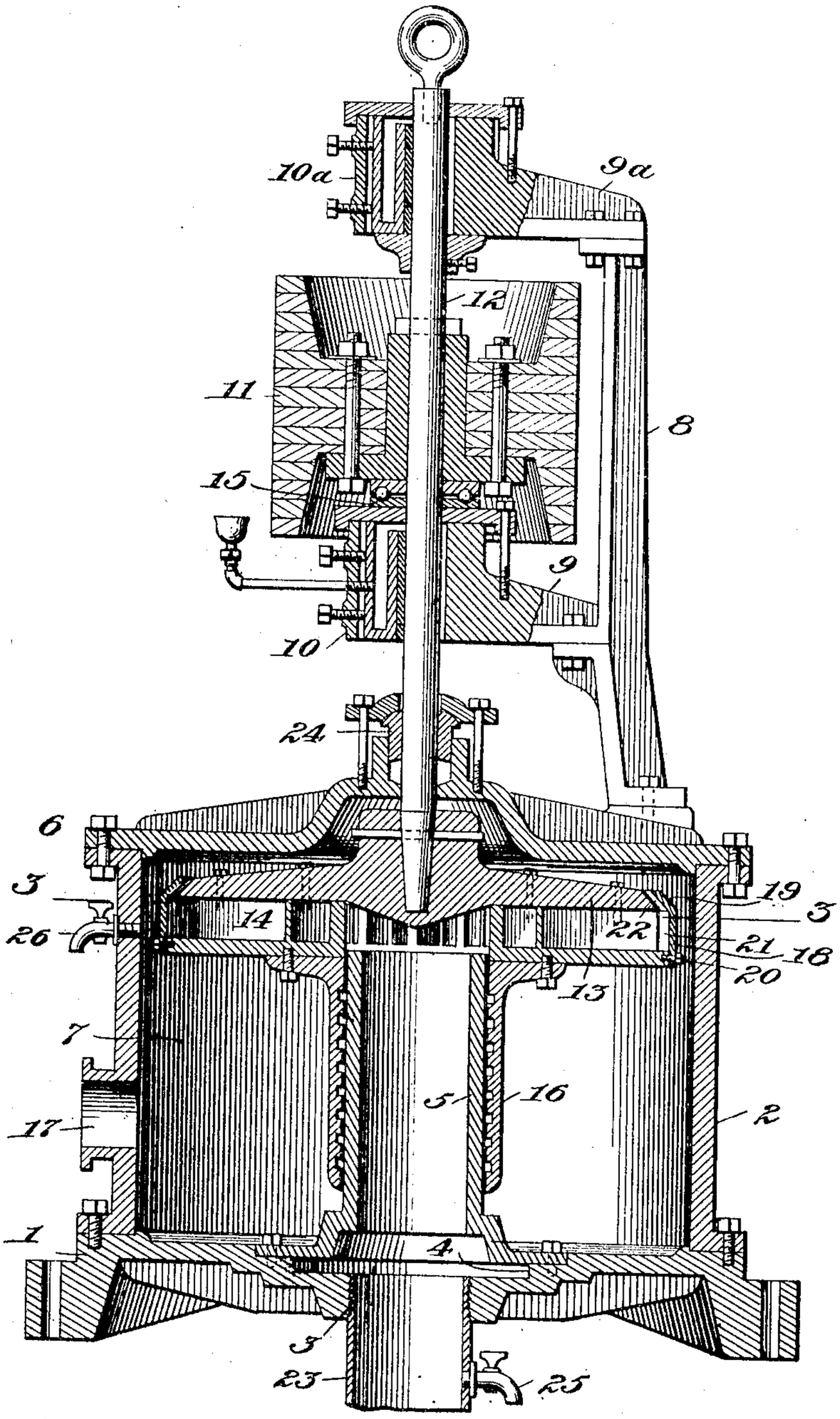
APPLICATION FILED NOV. 11, 1907.

**916,370.**

Patented Mar. 23, 1909.

2 SHEETS—SHEET 1.

*Fig. 1.*

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2 SHEETS—SHEET 2.

*Fig. 2.*

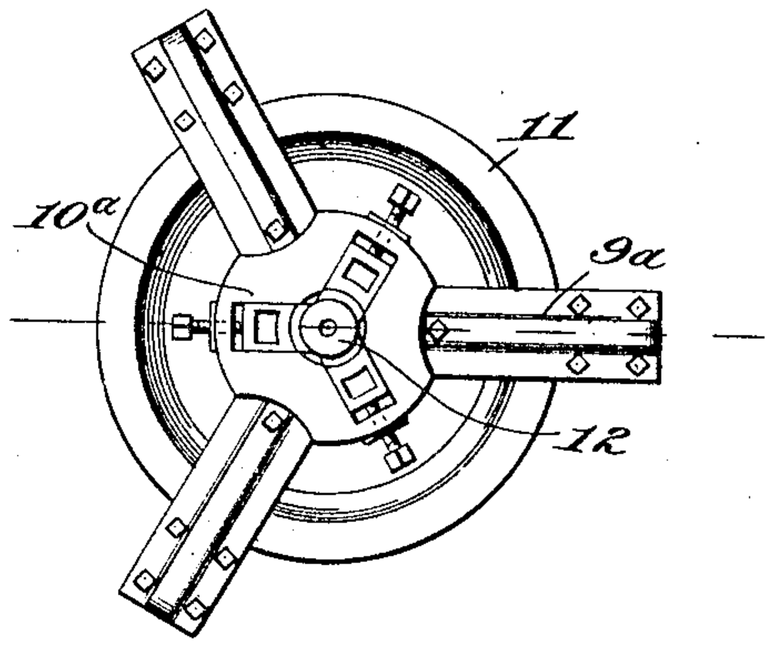
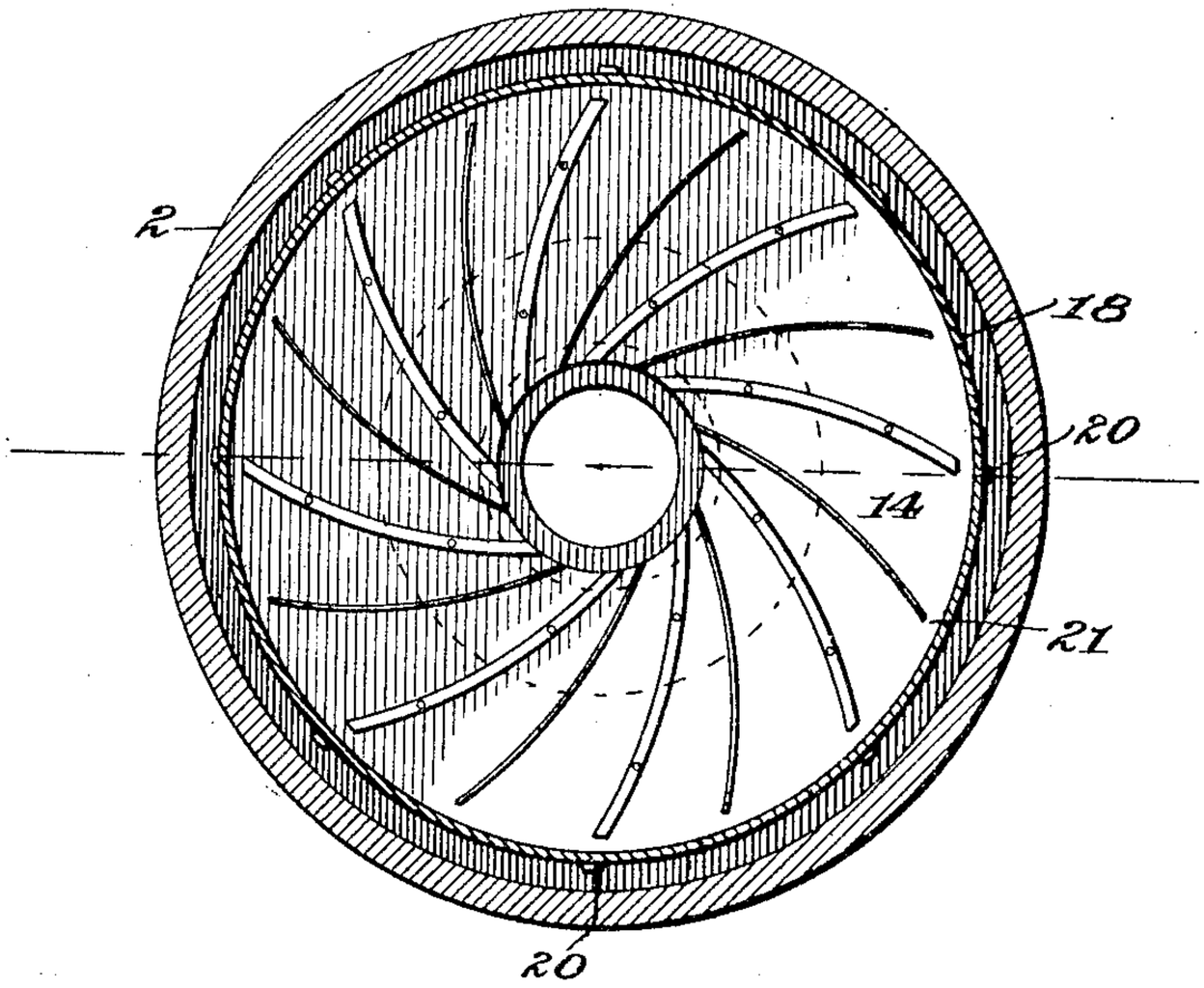



*Fig. 3.*

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# UNITED STATES PATENT OFFICE.

WILLIAM KING RICHARDSON, OF LEAVENWORTH, KANSAS.

## CENTRIFUGAL PUMP.

No. 916,370. Specification of Letters Patent. Patented March 23, 1909.

Application filed November 11, 1907. Serial No. 401,777.

*To all whom it may concern:*

Be it known that I, WILLIAM K. RICHARDSON, a citizen of the United States, residing at Leavenworth, in the county of Leavenworth and State of Kansas, have invented a new and useful Centrifugal Pump, of which the following is a specification.

This invention relates to certain improvements in centrifugal pumps, and has for its object the construction of a machine capable of working against high pressures under variable heads and volume, at a constant speed, and at high efficiency, together with advantages hereinafter set forth.

In a centrifugal pump with the impeller revolving in the fluid pumped, a relatively high speed of the impeller is required to operate against any given head or pressure. The reason of this is; the racing of the fluid in the annular or volute casing causes centrifugal force, and as the velocity increases in the volute chamber, the pressure upon the ports of the impeller diminishes, allowing the fluid pumped an easier egress from the impeller, causing a less depth of the fluid in the impeller as the speed increases, which diminishes the capability of the pump to operate against high heads or pressures. As the pressure upon the ports of the impeller on the exterior or in the volute chamber diminishes with the increased speed, the excesses of pressure on the ports within the impeller chamber increases, causing the impeller to rotate only partly filled, therefore, what is gained in increased velocity is partly lost in weight or volume, thereby reducing the duty of the pump to operate economically against high heads or pressures.

To remedy these defects is the object of this invention, which is accomplished by utilizing the potential energy of the water under static pressure: and that this may be understood reference is to be had to the accompanying drawings, in which—

Figure 1 is a vertical section. Fig. 2 is a top plan of trampot. Fig. 3 is a section on line 3—3 of Fig. 1.

In said drawing, 1, designates the base plate of this apparatus, which is bolted or otherwise secured to annular casing 2, the base plate having a central threaded opening 3, and an internal central opening 4, of greater diameter than 3, formed by an off-set or step as shown. Secured to step of opening 4, is a semi steel or strong cast iron water-column 5, the flange of which is faced and turned, the outside perpendicular wall of water-column being turned and polished.

6 indicates the top plate, bolted or otherwise secured to casing 2, and with base plate 1, forms the air and water chamber of the pump 7.

8, indicates one of the three bridge-posts, 9, and 9ª, each one of the three bridge arms which are cast integral with tram-pot 10 and 10ª.

11 indicates a driving pulley, which is keyed to the shaft 12, which supports the driver 13, and impeller 14.

15 indicates a thrust ball bearing, which supports the shaft 12 on top of tram-pot 10.

16 indicates a cast steel water-seal sleeve, which should be turned all over, with water-seal grooves cut as shown in Fig. 1. This water-seal sleeve is bolted to impeller 14, and is to prevent water from entering the impeller from the air and water chamber 7, its lower end always being immersed below the surface of the water.

17 indicates the outlet or discharge.

18 indicates a cylindrical casing arranged concentrically around and spaced from the periphery of the impeller 14 and driver 13 and secured to and forming a water-tight joint with bottom of impeller 14 and provided with an upwardly tapering or conical portion 19, and paralleling the tapered edge of driver 13, bolts 20, extending through said casing and into the outer ends of a number of the vanes in order to provide and maintain at the periphery of the impeller 14 and driver 13, an annular water chamber 21, with a deflected upper and inward portion terminating in port 22, the form of the water chamber being such as to maintain water over the periphery of the impeller during the working of the pump, thereby preventing the air from chamber 7, from entering at the periphery of the impeller, and thus obviating the necessity of immersing the impeller in the water, and further to maintain an equilibrium between the force produced by the centrifugal action of the water in the impeller and the pressure of the air in the air and water chamber 7, as hereinafter referred to.

The driver 13 has its periphery beveled upward and outward as shown in Fig. 1, with its central portion opposite the water column 5 conical, for the purpose of preventing air from collecting or remaining over the intake and thus injuring the suction. By this construction air which is admitted with the water

is deflected by the force of the water into the impeller and ejected into the air and water chamber.

The impeller 14 is a disk centrally perforated to fit around water column 5, having a plurality of curved vanes which extend from the central opening to the periphery of the disk, the bottom portion of the disk however extending beyond the vanes sufficient to form the bottom of the water discharge casing, to which is bolted the casing 18. By bolting or otherwise securing impeller 14 to driver 13 the chamber of the impeller is formed.

23 indicates the suction or intake pipe, 24 a stuffing-box.

25 indicates an air valve in suction 23, and 26, an air valve which communicates with the air and water chamber 7, through casing 2.

Having thus described the several parts of this machine I will describe its operation, and results obtained therefrom: This pump is primed in the usual way: The suction pipe is filled with the fluid to be pumped to a level of the impeller, power is applied to the impeller through the medium of the belt pulley, the revolving impeller forces the fluid to the periphery and fills the water discharge casing to over-flowing, the water discharge casing being so constructed that no fluid is discharged from the port 22 until the fluid has flooded the periphery of the impeller, rendering the chamber of the impeller air tight in relation of backward flow of the air in the air and water chamber 7. As the fluid is forced into the chamber 7 the air which is confined becomes compressed in ratio to the resistance of head or pressure pumped. Should the head be such as to compress the air to such a density that the water rises to the level of the impeller, by opening the air valve 25 in the suction, air is introduced into the chamber, and the water is forced to a lower level. Should the air valve 25 remain open the confined air would force the water level to remain just below the top part of water discharge pipe 17, at which point the air would then escape with the water as it was being forced out of the pump. By the use of this water discharge casing, which forms an inwardly deflected port, it obviates the necessity of immersing the impeller below the surface of the water, and the relative loss of power due to resistance of revolving the impeller in the air in one case, and of revolving the impeller in the water in the other case, is as the square root of their density. As the fluid is discharged from the port 22, against a pneumatic pressure corresponding to the hydraulic head or pressure this air cushion is the potential energy which expels the fluid from the pump, thus avoiding or obviating the necessity of high velocity of the fluid in the volute chamber incurring friction, and eddy currents and resistance as herein before mentioned.

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

1. A rotary impeller for a pump, having a chamber, an inlet and an outlet passage communicating with said chamber, the outlet passage being an inwardly deflected port, having some point in its exterior wall closer to the center of rotation than its interior wall at the point of direct communication with the chamber of the impeller.

2. A rotary impeller for a pump, having a chamber, an inlet and an outlet passage communicating with said chamber, the outlet passage having some point in its exterior wall closer to the center of rotation than the farthest point, in the interior wall of said passage, from the center of rotation.

3. In a centrifugal pump, the combination with a closed casing having an outlet passage, of an impeller within said casing and provided with a chamber, an inlet, an outlet passage communicating with said chamber, the outlet passage having some point in its exterior wall closer to the center of rotation than the farthest point in the interior wall of said passage from center of rotation.

4. An impeller having a chamber, an inlet, and a discharge passage which constitutes a liquid seal to the chamber of the impeller for the purpose of preventing air entering the impeller at its discharge end when the impeller is operated above or out of the fluid pumped, and which consists substantially of a passage leading directly out of said chamber of the impeller in a direction which approaches the center, sufficiently far that the outer wall of said passage at some point will be less removed from the axes of rotation than the inner wall of said passage at its greatest radius, for the purpose specified.

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