F. W. KROGH.

TURBINE PUMP.

APPLICATION FILED FEB. 10, 1914.

1,163,243.

Patented Dec. 7, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

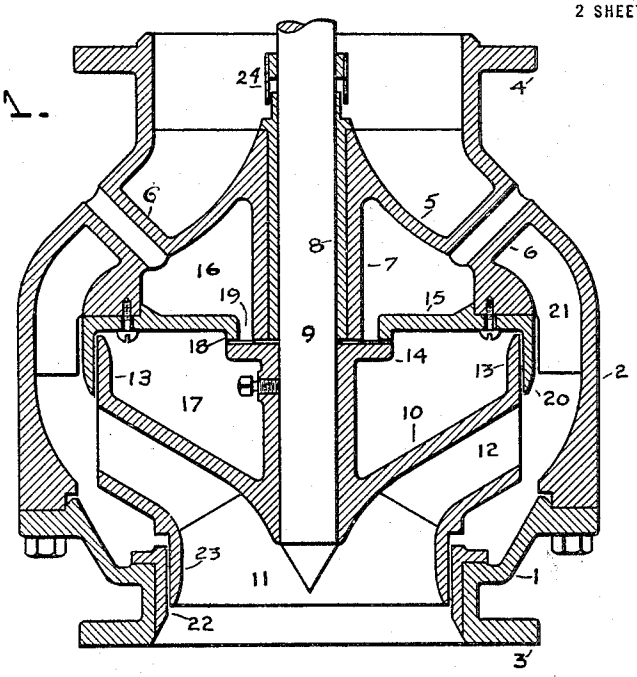
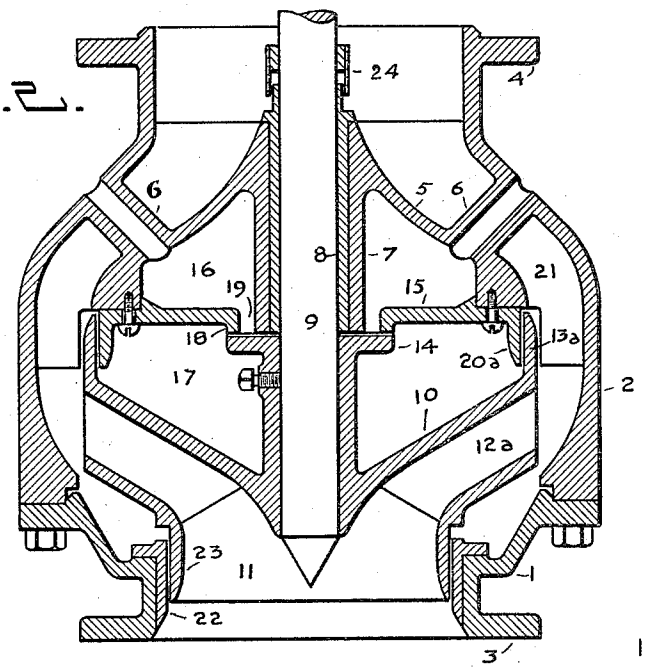


Fig. 2.



WITNESSES.

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2 SHEETS—SHEET 2.

Fig. 3.

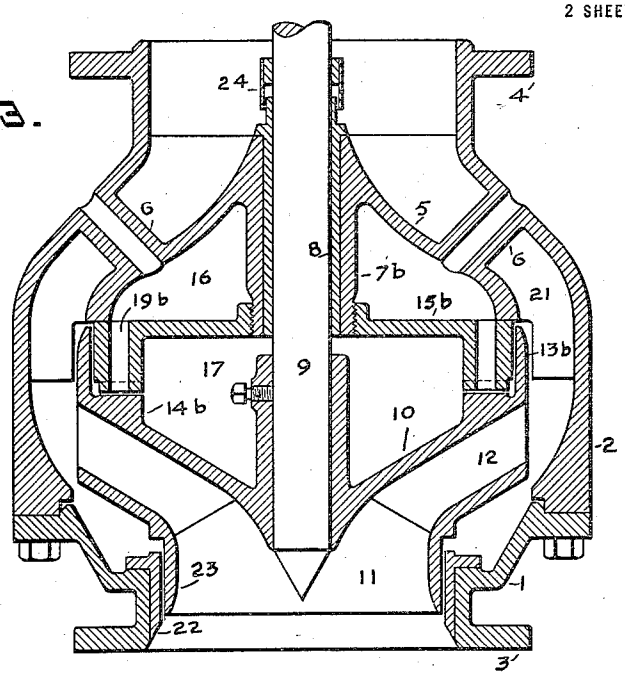
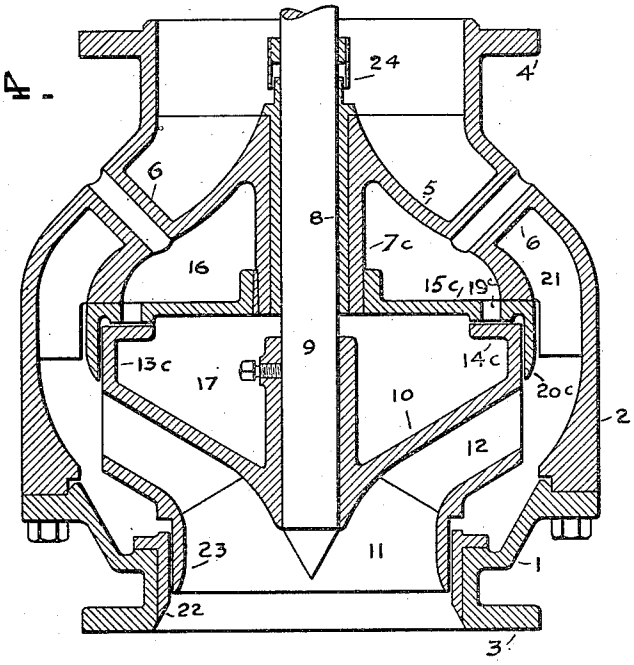


Fig. 4.



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UNITED STATES PATENT OFFICE.

FERDINAND W. KROGH, OF SAN FRANCISCO, CALIFORNIA.

TURBINE-PUMP.

1,163,243. Specification of Letters Patent. Patented Dec. 7, 1915.

Application filed February 10, 1914. Serial No. 817,811.

To all whom it may concern:

Be it known that I, FERDINAND W. KROGH, of San Francisco, California, have invented certain new and useful Improvements in Turbine-Pumps, whereof the following is a specification.

This invention relates to centrifugal pumps, more particularly to the vertical type, wherein the impeller is balanced by the equalizing pressure on both ends thereof, and also relates to certain features disclosed in my application filed July 17, 1913, Serial No. 779,410.

Among the objects of this invention are to provide means for controlling the balancing pressure on the suction side of the impeller; to construct the members subject to the greatest wear so that they may be readily replaced when excessive wear makes it desirable; to so design the pump that the parts subjected to the greatest wear may be formed of the most suitable material to resist wear, while the permanent parts may be formed of baser and more economical material.

Other objects and advantages will appear in the accompanying two sheets of drawings and in the description thereof.

In the drawings, Figure 1 is a vertical cross section of a centrifugal pump, having this invention incorporated therein. Figs. 2, 3 and 4 illustrate modifications in the design and application of this invention as combined in the structure of centrifugal pumps.

Construction.—In detail the construction of this invention as illustrated in Fig. 1 includes the base 1, hermetically attached to the casing 2. The casing and base are provided with the flanges 3 and 4 surrounding the lower suction opening and the upper discharge opening respectively. The casing supports an internally spaced chamber wall 5, preferably cast integral with the casing to which it is attached by the hollow cored struts 6. The depending neck 7, provides a vertical bearing provided with the bushing 8, to receive the vertical shaft 9, journaled therein. The impeller 10 is fixed to the lower end of the shaft in any suitable manner and includes in its structure the open suction throat 11, having impelling planes 12, radiating therefrom in the usual manner. The annular flange 13 extends upwardly around the periphery of the impeller. The hub of the impeller is provided with the outwardly extending flange 14. The dividing diaphragm 15 is attached to the annular base of the wall 5; this combination forming the upper chamber 16 and the lower pressure chamber 17. The diaphragm 15 is provided with the annular depending central rim 18, leaving the annular space or port 19 between it and the neck 7. The circumference of the diaphragm 15 is provided with the depending annular flange 20. This flange 20 coöperates with the flange 13, to partially seal the lower chamber 17, from the space 21, within the casing. The relative positions of these two flanges may be varied as indicated in these several modifications illustrated. To maintain the suction within the casing in operation it is necessary to pack or seal its lower opening around the throat 11 of the impeller. This is accomplished by the bushing 22 of suitable antifriction bearing metal, fixed within the base 1 and approximating contact with the neck 23 of the impeller; whereby the inrushing liquid is forced to flow through the impeller only.

Operation.—The pump operates substantially as follows: These pumps are usually submerged, or other means are provided for priming, or filling them with water or the liquid to be pumped; when used in stages or tandem the lower pump is submerged and those above discharge upward from one to the other. Obviously the weight of the shaft and attached mechanisms tends to force the impeller downward, which tendency is counteracted by the disposition of the impeller to rise in cutting through the liquid in which it is rotating, other forces enter into the practice of this art, that are sufficiently well known to those skilled therein to render superfluous a lengthy description of the necessity for balancing the pressure on both sides of the impeller. The hydrostatic head or pressure in the casing 21 leaks between the flanges 13 and 20 into the chamber 17, until the pressure therein equals the pressure in the casing, restoring the normal tendency of the propeller to descend, which opens a space between the rim 18, and the flange 14, permitting the escape of the pressure within the chamber 17 through the annular space 19 into the upper chamber 16, that is open to atmospheric pressure or to the medium within which the pump is submerged through the hollow struts 6. The tendency of the impeller to drop is counteracted by its lifting tendency in cutting

through the liquid, and also by the lifting tendency of the hydrostatic head confined within the base 1, displacing the impeller upward. The gradual accumulation and release of the pressure of the chamber 17 tends to equalize all counter forces; whereby the impeller is caused to "float" in its operation, removing end thrust in either direction. Frictional contact between the rim 18 and the flange 14, the flanges 13 and 20, and the bushing 22 and the throat 23 represent the wearing parts upon which the balance pressure system depends and all these parts are readily removable for replacement. The sand cap 24 overhangs the upper end of the bushing 8 to prevent the entrance of sand at this point into the main bearing of the drive shaft.

The modification in Fig. 2 shows the depending flange 20^a and 13^a transposed, as compared in the structure illustrated in Fig. 1; the advantage in this transposition is the attainment of greater length of the vanes 12^a.

The modification illustrated in Fig. 3 shows a variation in the diaphragm 15^b which is screwed into the neck 7^b and has the openings 19^b located near the periphery. These openings or ports comprise depending tubes formed integrally with the diaphragm at the proper intervals; the opening 19^b being closed by the flange 14^b formed adjacent to the flange 13^b on the impeller.

The modification shown in Fig. 4 comprises the diaphragm 15^c keyed onto the neck 7^c and provided with a depending flange 20^c having the ports 19^c located adjacent thereto at intervals; these ports are closed by the flange 14^c projecting inward from the lines 13^c on the periphery of the impeller.

Having thus described my invention, and an embodiment of it, in the full, clear and exact terms required by law, and knowing that it comprises novel, useful and valuable improvements in the art to which it pertains, I here state that I do not wish to be limited to the precise construction and arrangement of the several parts, as herein set forth, as the same may be variously modified by a skilled mechanic without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent of the United States is the following, to wit:

1. A centrifugal pump including a casing having an upper chamber therein closed by a removable diaphragm having a central opening, a flange on the impeller of the pump adapted to close said opening, flanges on said impeller and said diaphragm, cooperating to form a pressure chamber in said impeller.

2. Centrifugal pump including a casing having an upper chamber therein, closed by a removable diaphragm having a central opening, a flange on the impeller of the pump surrounding the shaft thereof adapted to close said central opening and forming thereby a pressure chamber in said impeller.

3. A centrifugal pump including a casing having an upper chamber therein, closed by a removable diaphragm having a central opening, a flange on the impeller of the pump surrounding the shaft thereof adapted to close said central opening, oppositely projecting flanges on said impeller and said diaphragm, coöperating to form a pressure chamber in said impeller.

In testimony that I claim the foregoing I have hereto set my hand this 20th day of January 1914, in the presence of witnesses.

FERDINAND W. KROGH.

Witnesses:
L. M. WILLIAMS,
M. MARKEL.