

R. A. PITMAN.
CENTRIFUGAL PUMP BALANCING MEANS.
APPLICATION FILED MAR. 18, 1920.

1,360,576.

Patented Nov. 30, 1920.
2 SHEETS—SHEET 1.

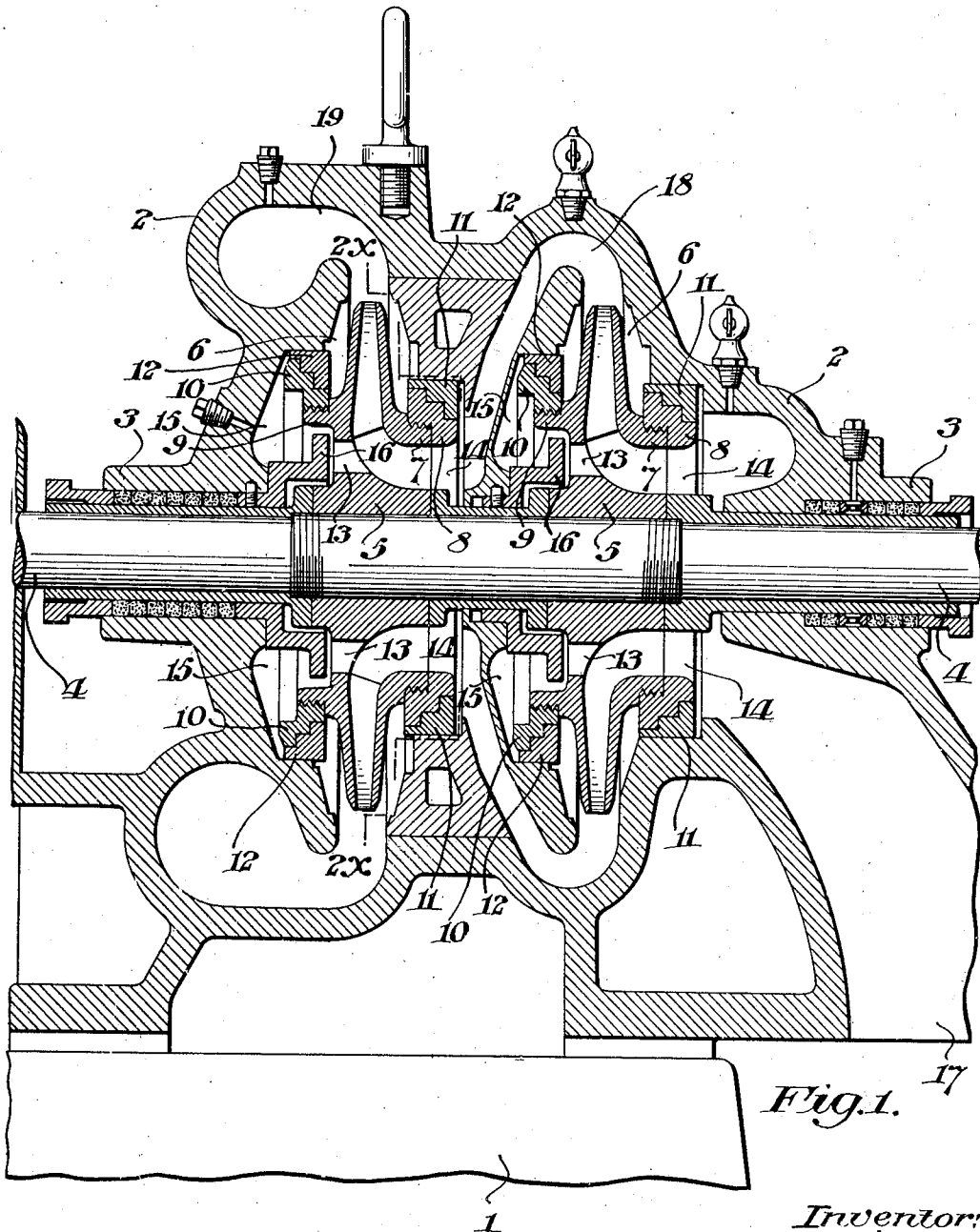


Fig. 1.

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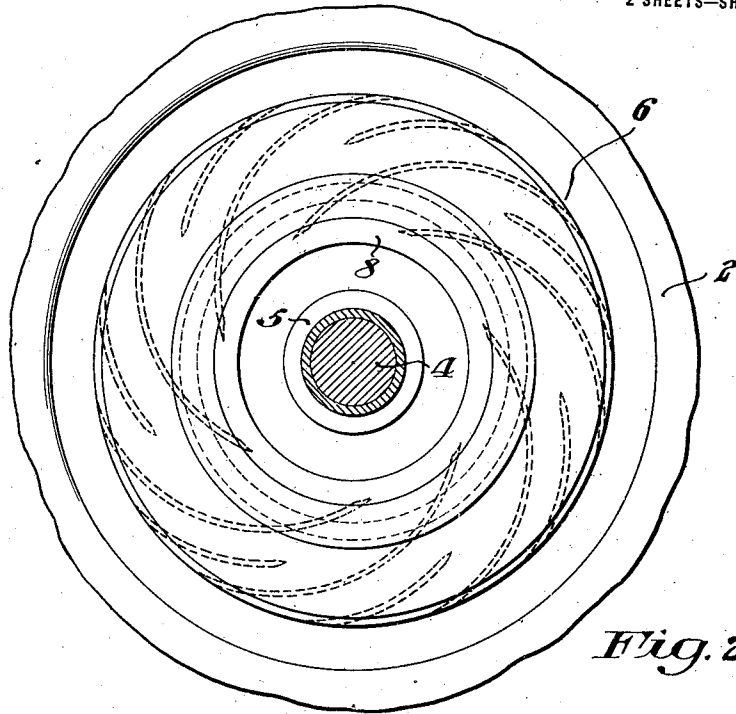


Fig. 2.

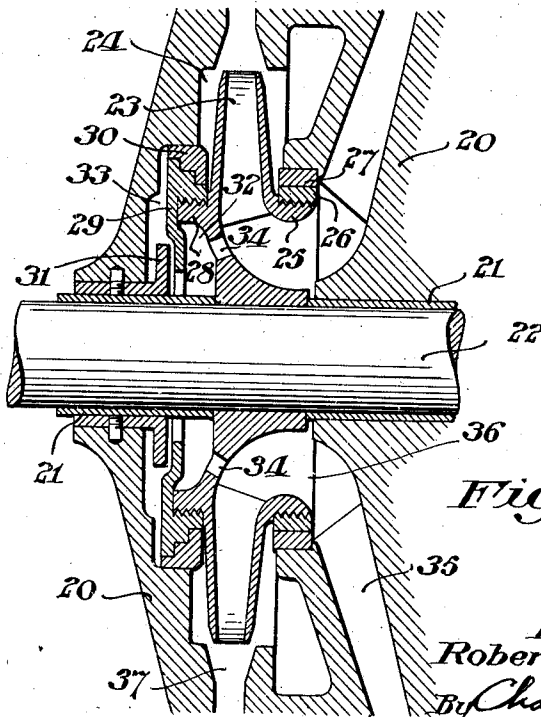


Fig. 3.

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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL-PUMP BALANCING MEANS.

1,360,576.

Specification of Letters Patent. Patented Nov. 30, 1920.

Application filed March 18, 1920. Serial No. 366,852.

To all whom it may concern:

Be it known that I, ROBERT A. PITMAN, a citizen of the United States, residing in the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain Centrifugal-Pump Balancing Means, of which the following is a specification.

This invention relates especially to centrifugal pumps or water turbines having impellers of side or single suction type whether involving one or several stages and its primary object is to provide means for automatically balancing such impellers.

This object is attained by using sealing rings at the back of the impeller of diameters substantially larger than those of sealing rings at the front or eye of the impeller; making the back sealing rings of such form that any movement of the impeller forward or toward the suction side will decrease the clearance between the fixed and movable rings and vice versa.

The sealing rings at the back are made substantially larger than those at the front or eye of the impeller in order that the areas of the impellers' sides, outside of the periphery of the rings, shall be unequal, the larger area being on the front or suction side. Inasmuch as these areas outside the rings are subject to approximately the discharge pressure of the impeller, there will be a tendency of the impeller due thereto to move rearwardly thereby increasing the clearance and leakage through the rings.

In addition to the sealing rings, one or more holes are provided in the back of the impeller for connecting the interior thereof with the exterior lying within the back sealing rings, the openings being for the purpose of allowing the leakage between these sealing rings to find its way back to the suction side and equalize the pressure. Means are provided for closing the equalizing hole or holes in the impeller when the latter is moved backward, which movement simultaneously increases the clearance and leakage between the back sealing rings, thereby providing resistance to the rearward movement of the impeller. On the other hand a movement of the impeller in the opposite direction will reduce the clearance

and leakage between these rings and open or further open the hole or holes, thereby providing for the equalization of the pressures on opposite sides of the impeller.

In the accompanying drawings, Figure 1 is a broken sectional view taken through the axis of a two stage centrifugal pump provided with my improvements; Fig. 2 is a sectional view taken on the line 2-2 of Fig. 1, and Fig. 3 is a broken sectional view taken through the axis of a single stage centrifugal pump embodying a modified form of the improvements.

As illustrated in Figs. 1 and 2, the pump comprises a base 1 which carries a twin shell or case 2 provided with bearings 3 having the shaft 4 journaled therein.

Impellers 5 are fixed on the shaft and revolve within respective chambers 6 of the case. Each impeller is provided at its forward or suction side with a hub 7 having screwed thereon a bearing ring 8 with stepped peripheral surfaces concentric with the shaft, the steps tapering from the hub, and each impeller is provided at its rear side with a hub 9 having screwed thereon a bearing ring 10 (of larger diameter than the ring 8) with stepped peripheral surfaces concentric with the shaft, the steps tapering toward the hub. Bearing rings 11 and 12, fixed in the case on opposite sides of the respective impellers, have stepped internal surfaces conforming to the surfaces of the respective rings 8 and 10.

Each impeller 5 is provided with one or more passages 13 opposite to its eye or inlet 14 and connecting its interior with a space or chamber 15 in the case to the rear of the impeller. Each chamber 15 contains a circular bearing member 16 in the form of a stepped cone or flanged tube against which the impeller is adapted to move and close the passage or passages 13.

In operation, water flowing through the passage 17 enters the first impeller 5 through its eye 14 and is discharged therefrom through the passage 18 to the eye 14 of the second impeller 5, being discharged from this impeller through the passage 19. The impulse communicated by the incoming water to each of the impellers moves it axially therewith and opens a space between

the rings 10 and 12, simultaneously closing the passage or passages 13 by moving the same against the member 16. The water which has been admitted to the chambers 5 6 and 15, back of the impeller, now acts upon a larger surface thereof and exerts a greater pressure thereon than the water acting on the opposite or front exterior surface of the impeller, which is thereby moved 10 in the opposite or backward direction so that the passage or passages 13 are withdrawn from the member 16 and uncovered, thus relieving the pressure back of the impeller. The desired condition of balance or equilibrium is thus attained.

In the modified construction shown in Fig. 3, a case or shell 20 is provided with the bearings 21 in which is journaled a shaft 22 having a single impeller 23 fixed thereon 20 and revoluble in the chamber 24. The impeller is provided with a hub 25 projecting from its front side and having screwed thereon a ring 26 which is journaled in a bearing ring 27 set in the case. A hub 28 on 25 the rear of the impeller has screwed thereon a ring or plate 29 of larger diameter than the ring 26, having a stepped conical periphery which expands outwardly and is journaled in a similarly stepped bearing ring 30 set in 30 the case. The inner part of the ring 29 is adapted to be lapped by a flanged collar or member 31 fixed to the case so as to close the passage through the ring between the spaces or chambers 32 and 33 on opposite sides 35 thereof, the space 32 communicating through the passage or passages 34 in the back of the impeller with the interior thereof and the space 33 communicating through the space 40 between the separated rings 29 and 30 with the chamber 24 in which the periphery of the impeller revolves.

In operation, the water flows through the passages 35 in the case 20 and through the eye or inlet 36 of the impeller, whence it 45 discharges through the casing passage 37 having the chamber 24 in communication therewith.

Initially the impeller is moved rearwardly so that the ring 29 is separated from the ring 50 30 and engages the ring or flange 31. Water now leaks from the chamber 24 between the rings 29 and 30 to the chamber 33, with the result that the total pressure now acting on the rear surfaces of the impeller is greater 55 than that acting on the front surfaces and the impeller is moved in the reverse direction along its axis. The ring 29 being thereby withdrawn from the ring 31, the pressure in the chamber 33 is relieved by water flowing therefrom through the ring 29 to the 60 chamber 32 and thence through the passages 34 to the interior of the impeller. Thus equilibrium and the balancing of the impeller are attained.

Having described my invention, I claim: 65

1. In a centrifugal pump, the combination of a shell provided with an impeller chamber, of an impeller having an inlet in its front side and a passage in its rear side journaled in said shell and revoluble in said 70 chamber, and mechanism for balancing said impeller, said mechanism comprising a stationary circular bearing in said shell at the front side of said impeller, a stationary circular bearing of larger diameter in said shell 75 at the rear of said impeller, bearings fixed to said impeller and adapted to coact with the respective bearings aforesaid, the coacting bearings at the rear of said impeller adapted to open and close a passage between 80 them when said impeller is moved axially in opposite directions, and means whereby the open passage between said bearings last named is cut off from said passage first 85 named.

2. In a centrifugal pump, a shell containing an impeller chamber with fluid supply and discharge passages, an impeller of the side suction type journaled in said shell and revoluble in said chamber, and means for 90 balancing said impeller, said means comprising sealing members of different diameters at the back of said impeller so arranged that the rearward movement of the impeller opens the seal of larger and closes the seal of 95 smaller diameter, and the reverse movement of the impeller closes the seal of larger diameter and opens the seal of smaller diameter.

3. In a centrifugal pump, a shell provided with an impeller chamber having 100 fluid supply and discharge passages, an impeller of the side suction type journaled in said shell and revoluble in said chamber, and means for balancing said impeller, said means comprising coacting surfaces 105 in said chamber at the opposite side of said impeller from the eye thereof whereby a passage of larger diameter than the eye is opened and of smaller diameter than the eye is closed when the impeller moves 110 rearwardly, and the passage of smaller diameter is opened and of larger diameter is closed when the impeller moves oppositely.

4. In a centrifugal pump, a shell containing an impeller chamber with fluid supply and discharge passages, an impeller 115 having an inlet in a side thereof journaled in said shell and revoluble in said chamber, sealing means comprising a ring on the inlet side of said impeller and sealing 120 means comprising a ring of larger diameter and a bearing on the opposite side of said impeller, said sealing ring second named having a periphery expanding from said impeller and said bearing having a coacting 125 similarly expanding interior.

5. In a centrifugal pump, a shell containing an impeller chamber with fluid dis-

charge and supply passages, an impeller
with an inlet in a side thereof journaled
in said shell and revoluble in said chamber,
sealing means comprising a ring and a
5 bearing on the inlet side of said impeller,
and sealing means comprising a bearing
and ring of larger diameters on the oppo-

site side of said impeller, said bearing and
ring second named having coacting stepped
surfaces expanding from said impeller. 10

In testimony whereof, I have hereunto
set my name this 15th day of March, 1920.

ROBERT A. PITMAN.