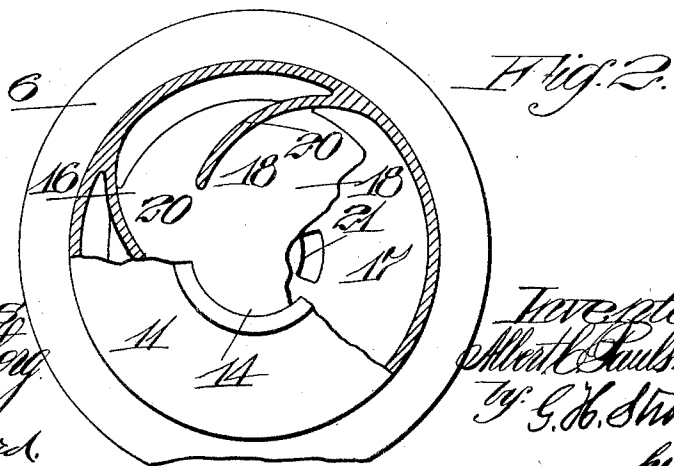
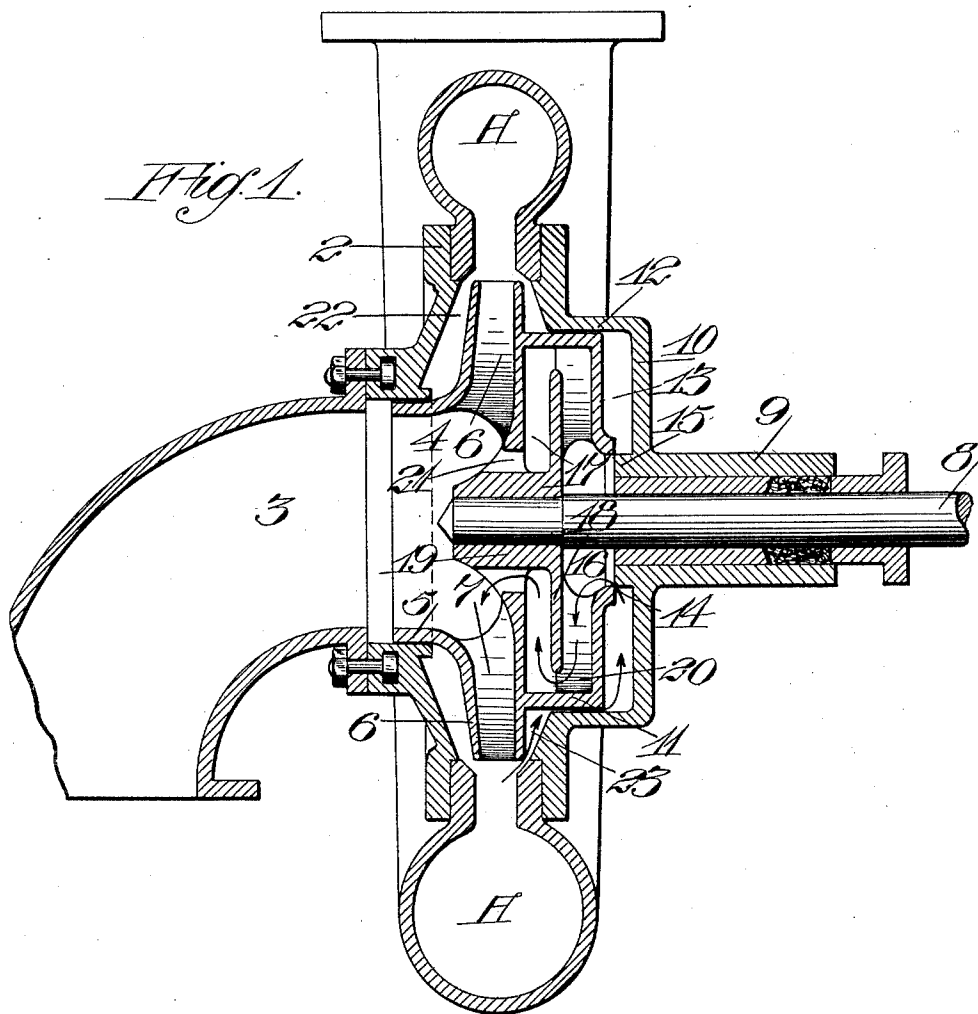


A. C. PAULSMEIER.
 END THRUST COUNTERBALANCE FOR CENTRIFUGAL PUMPS.
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END-THRUST COUNTERBALANCE FOR CENTRIFUGAL PUMPS.

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To all whom it may concern:

Be it known that I, ALBERT C. PAULSMEIER, a citizen of the United States, residing in the city and county of Alameda and State of California, have invented new and useful Improvements in End - Thrust Counterbalances for Centrifugal Pumps, of which the following is a specification.

This invention relates to pumps and pertains especially to high-pressure turbine pumps.

The object of this invention is to provide a simple, compact, efficient and practical means for automatically counterbalancing the end thrust of the runner or impeller in turbine pumps so as to tend to constantly maintain the impeller in a central position between the walls of the pump; and also to provide an automatic balancing structure for centrifugal pumps designed especially to prevent the creation of skin friction between the impeller and the pump case and thus economize in the amount of power required to drive the pump and thus relieve the parts from wear to the greatest extent; and particularly to provide a pump adapted to automatically adjust the runner during all variations of pressure or head in the pump, and to reduce the action of skin friction and jet action in the pump; and to enhance or quicken the relief from variable pressure so as to restore equilibrium in the pump.

The invention consists of the parts and the construction and combination of parts, as hereinafter more fully described and claimed, having reference to the accompanying drawings in which—

Figure 1 is a central longitudinal section through the pump. Fig. 2 is a side elevation of the pressure balancing runner partly broken away.

It is desirable to construct and erect pumps of the centrifugal or turbine class of strong, practical, reliable and effective design and with a minimum number of elements so that the pumps may be shipped and erected with the best facility in different regions and particularly in localities and positions where access to the pump when once erected may be difficult. To this end I have provided a centrifugal pump involving a combination of elements, each of which are simple in design and in which the

runner or impeller particularly is so designed and constructed as to avoid the necessity of frequent manual adjustment during its operation to compensate for variations of head or pressure against which the pump must work, and which embodies details operative to automatically maintain the impeller in a position substantially central within the pump chamber and thereby overcome the end thrust of the impeller during the operation of the pump.

In the illustrated embodiment of my invention A represents a circular pump casing forming a discharge passage, to one side of which is appropriately secured a flanged head 2, to which is attached a suction pipe 3, the inner end of which communicates with a suction or vacuum chamber 4 formed within an annular flange or hub portion 5 of an impeller 6, which has a running fit with the member 2, provided with a plurality of curved blades 7, which, when the impeller is running, creates a suction in the pipe 3, chamber 4, and forces the water or fluid being pumped outwardly and into the discharge passage in the annular casing A. The impeller 6 is suitably secured upon a driving shaft 8 journaled in a bearing 9 formed upon a casing or bearing plate 10 secured to one side of the pump casing A. I have shown as cast upon one side of the impeller a relatively flat, cylindrical, hollow hub portion 11; the outer periphery of which is turned down to have a running fit with a contiguous wall 12 of the bearing plate 10, which is shown as being provided with a variable pressure chamber 13, in which the hollow hub 11 may rotate and reciprocate and in which chamber accumulates the fluid which leaks past the running joint formed by the hub 11 with the wall 12 and which fluid is subjected to a variable pressure as will be hereinafter described.

The face of the hub 11 is provided with a central circular port 14 turned to have a running fit or joint upon an inwardly projecting boss or "plug" portion 15 formed upon the inside of the casing plate 10. The interior of the cylindrical hub 11 is divided substantially into two intercommunicating chambers 16 and 17 respectively, forming a sinuous relief passageway between the variable pressure chamber 13 and the suction or vacuum chamber 4 by a central web or dia-

phragm 18 cast upon the central hub 19 of the runner. The chamber 16 is adjacent to the plug 15, and when the impeller moves toward the suction side of the pump a communication is established between the chamber 13 and the chamber 16 in the hub 11, through the port 14, and the water or fluid which is drawn into the chamber 16 is discharged therefrom by means of a plurality of suitably curved vanes or ribs 20 formed between the wall or diaphragm 18 and the outside face of the hub 11. The chamber 16 thus constitutes a vacuum chamber within the hub of the impeller and between the suction chamber 4 and the variable pressure chamber 13.

When the pump is in operation the vanes 20 impel the water from the chamber 16, through the sinuous passageway formed by the wall 18, and into the continuous circular chamber 17 from which the water may flow unobstructed through ports 21 located adjacent the impeller hub 19.

The chamber portion 17 of the hub 11 is not provided with vanes, or ribs, or projections of any kind whatsoever, so that the water which is discharged by the ribs 20 from the chamber 16, may pass into the chamber 17 and be forced through it toward the central ports 21 which are in direct communication with the suction chamber 4 of the impeller. This particular construction of the auxiliary balancing runner or hub 11 is the distinctive feature of the present invention, and the location of the ports 21 as near the center of the impeller as it is practical to make them facilitates the discharge of fluid from the chamber 16 into the annular chamber 17. Since there are no impeding obstructions of any kind in the chamber 17 the water impelled by the vanes 20 flows into the chamber 17 and is then subjected to the suction in the chamber 4 through the ports 21. On the opposite side of the impeller, that is, on the suction side, there is provided a pressure chamber 22, the central portion of which is substantially closed by the running joint formed by the periphery of the hub or flange 5 with the contiguous annular wall of the casing head 2. There is also formed on the side of the impeller adjacent the periphery of the balancing runner hub 11, another pressure chamber 23, and when the pump is in operation and there is a suction in the chamber 4, pressure is created in the annular casing A due to the discharge of water by the blades 7 of the impeller, and there is a pressure created in the chambers 22—23 due to the "head" of water against which the pump is working.

It is well known that in centrifugal pumps the impeller tends to shift axially from side to side within its casing, and I have succeeded by the provision of my auto-

matic balancing runner on the hub 11, to maintain the impeller in a central position in equilibrium between the two pressure chambers 22—23 by the introduction of the chamber 13 in which the pressure is variable.

The operation of the pump is as follows: Due to the rotation of the impeller 6 a pressure is created in the volute housing, commonly known as the pump case, so that the fluid under pressure tends to pass around both sides of the impeller 6 and pass into the chambers 22—23, to leak past the running joint formed by the periphery of the hub 11 and into the chamber 13. Should there become an accumulation of pressure in the chambers 23—13 which would more than offset the pressure in the chamber 22, the impeller would be thrust toward the suction side of the pump. When the impeller has moved toward the suction inlet there is formed an opening between the impeller hub 11 at the port 14 and the adjacent end of the projecting plug 15, and the pressure in the chamber 13 is then pumped out of chamber 13 by the vanes 20, in the runner hub 11, from the chamber 16 into the chamber 17, and thence the water is pumped back into the suction side of the pump through the central ports 21 of the impeller 6. The pumping action of the vanes 20 in the chamber 16 will tend to reduce the pressure in the chamber 13 to such an extent that the pressure in the chamber 22 will then more than offset the sum of the pressures in the chambers 23—13, and the impeller will be moved toward the plug 15 so that it will close the port 14 in the runner hub 11. This movement of the impeller toward the suction and from the suction either builds up or reduces the pressure in the chamber 13 by permitting or not permitting the chamber 16 to be in communication with the chamber 13 on account of the plug 15 which has no movement. The chamber 16 is separated from the chamber 17 by means of the circular diaphragm 18, and since there are no ribs in the chamber 17 the water impelled by the ribs or vanes 20 flows freely from the chamber 17 inwardly toward the central ports 21, communicating with the suction chamber 4 of the pump.

The purpose of placing the ports close in around the hub of the impeller is to get the same into communication with that part of the impeller in which there is a vacuum, therefore, obtaining the least resistance to the water as it passes from the chamber 16 through the chamber 17 and through the central ports 21. Had the ports 21 been placed at the outer portion of the chamber 17 in the wall or hub 11, the water as it would pass from the chamber 17 would be subjected to a back pressure in the chamber 23 which would tend to offset the pumping

effect of the ribs 20 placed in the automatic balancing runner 11. It is to overcome this reaction of the fluid under pressure in the chamber 23 upon the fluid from the chamber 17 that I have placed the ports 21 as close to the center of rotation as it is practical to put them, as at this point there is no back pressure and the ports are directly in communication with the suction chamber of the pump. In order to take advantage of this position of the ports 21 it becomes necessary to form the chamber 17 without any ribs which would create centrifugal force. Therefore the ribs in the chamber 16 have only to pump against such pressure as is induced in the chamber 17 by the skin friction acting on the water. It will readily be seen that given these conditions the ribs in chamber 16 can more readily and easily reduce the pressure in chamber 13 than could be possible if the discharge ports 21 were located in the periphery of the automatic balancing hub 11. Obviously the automatic balancing runner compressing the hub 11 and the diaphragm 18 with the vanes or ribs 20 may be formed in a separate piece and secured to the impeller 6, if so desired.

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

1. In a centrifugal pump the combination of a case having a central inlet and a peripheral discharge, a shaft, an impeller in the case on the shaft and having a running joint with the case, means on the case and on the side of the impeller opposite the suction inlet to inclose a variable pressure chamber receiving leakage water under pressure from the discharge through the running joint between the impeller and the case, a hub member on one side of the impeller forming a vacuum chamber between the suction side of the pump and the variable pressure chamber, and means whereby on the accumulation of an excess pressure in the variable pressure chamber the excess of water therein may be discharged through the vacuum chamber into the inlet chamber of the pump, said means including runner vanes in the hub member to impel the fluid from the chamber into the inlet side of the pump.

2. The combination in a centrifugal pump of a suitable casing having a discharge chamber and a suction chamber, an impeller within the pump casing, a shaft upon which said impeller is secured, and means for automatically counterbalancing the impeller un-

der varying heads, said means including a wall on one side of the pump casing forming a variable pressure chamber, and an auxiliary runner secured to one side of the impeller and having a running joint with said wall and past which joint fluid under pressure may leak from the discharge chamber of the pump into the variable pressure chamber, said auxiliary runner having a vacuum chamber into which water may flow from the variable pressure chamber and from which runner the fluid may be discharged through ports communicating with the suction chamber of the pump.

3. The combination in a centrifugal pump of a suitable casing having a discharge chamber and a suction chamber, an impeller within the pump casing, a shaft upon which said impeller is secured, and means for automatically counterbalancing the impeller under varying heads, said means including a wall on one side of the pump casing forming a variable pressure chamber and an auxiliary runner secured to one side of the impeller and having a running joint with said wall and past which joint fluid under pressure may leak from the discharge chamber of the pump into the variable pressure chamber, said auxiliary runner having a vacuum chamber into which water may flow from the variable pressure chamber and from which runner the fluid may be discharged through ports communicating with the suction chamber of the pump, said discharge ports from the auxiliary runner being located adjacent the center of rotation of the impeller.

4. An automatic balancing means for turbine pumps comprising a pump casing having a suction chamber and a variable pressure chamber, an impeller mounted upon a shaft and revoluble within the pump, said impeller being provided with a vacuum chamber adapted to communicate with the variable pressure chamber in the casing and having sinuous relief passages discharging into the suction chamber of the pump, and vanes in said passages to impel the water therefrom.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ALBERT C. PAULSMEIER.

Witnesses:

G. A. DU BOIS,
W. H. CARR.