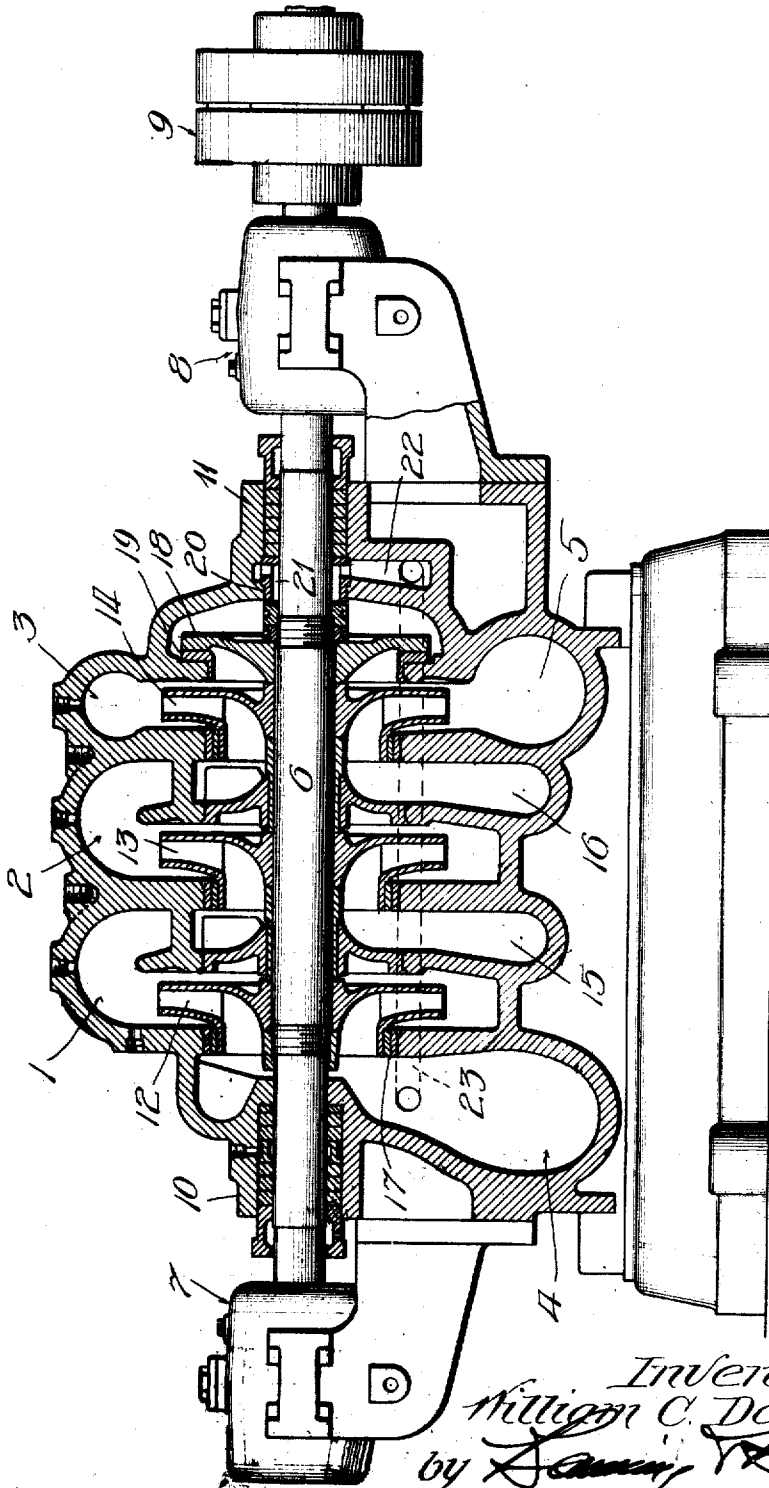


W. C. DOWD.
CENTRIFUGAL PUMP AND THE LIKE.
APPLICATION FILED APR. 24, 1919.

1,348,633.

Patented Aug. 3, 1920.



Inventor:
William C. Dowd
by *Lawson, T. Lawson*
Attys

UNITED STATES PATENT OFFICE.

WILLIAM C. DOWD, OF QUINCY, ILLINOIS.

CENTRIFUGAL PUMP AND THE LIKE.

1,348,633.

Specification of Letters Patent.

Patented Aug. 3, 1920.

Application filed April 24, 1919. Serial No. 292,443.

To all whom it may concern:

Be it known that I, WILLIAM C. DOWD, a citizen of the United States, residing at Quincy, in the county of Adams and State of Illinois, have invented certain new and useful Improvements in Centrifugal Pumps and the like, of which the following is a specification.

The present invention has to do with certain improvements in centrifugal pumps and the like, and has particular reference to improvements in balancing devices or arrangements for said pumps. When a centrifugal pump or the like is in operation, there is created an end thrust on the impeller due to the difference in pressure between the intake and discharge sides of the impeller. This end thrust tends to shift the impeller and shaft lengthwise of the shaft in the bearings, and it must be either neutralized or balanced in some manner. The use of mechanically balancing devices such as thrust bearings, etc., in some cases, is undesirable owing to the cost of such bearings and to the fact that they occupy considerable space and are subjected to wear and liable to get out of adjustment.

The main object of the present invention is to provide an automatic pressure operated balance for the roller or impeller so arranged that the balancing or neutralizing effect will at all times be exactly proportional to the difference in pressure to be neutralized. That is to say, as the difference in pressure between the intake and discharge sides changes, the balancing effect will simultaneously change so as to maintain the machine under proper balance at all times.

Another object of the invention is to so arrange the balancing device that it can be used in a pump or machine of this type regardless of the number of stages of increase of pressure. That is to say, it can be used in conjunction with single or multi-stage machines with equal advantage and satisfaction.

Other objects and uses of the invention will appear from a detailed description of the same which consists in features of construction and combinations of parts herein-after described and claimed.

In the drawing:

The figure shows a longitudinal sectional view through a three-stage pump having applied to it the balancing device of the present invention. Portions of this figure are

shown in elevation for the purpose of simplifying the drawing and an understanding of it.

In the construction shown in the drawing, there are provided low, intermediate and high pressure stages 1, 2, and 3, respectively. The water or fluid inlet is shown at the point 4 and the discharge chamber at the point 5. The main shaft 6 is journaled in the bearings 7 and 8 in the usual manner, and is driven through a coupling 9 or in any other suitable manner. The stuffing boxes or the like 10 and 11 provide water seals at the points where the main shaft passes through the casing. These stuffing boxes may be of any suitable construction, and I will, therefore, not concern myself particularly with a detailed description of them.

Connected to and driven by the shaft 6 are the low, intermediate and high pressure impellers 12, 13, and 14, respectively, said impellers working in the low, intermediate and high pressure stages, respectively. The impeller 12 draws water from the low pressure chamber 4 and delivers it at increased pressure into the stage 1. The water of the stage 1 collects in the annular passage 15, and the impeller 13 draws water from this passage 15 and delivers it into the intermediate stage 2. This intermediate stage 2 communicates with an annular passage 16, and the impeller 14 draws water from the passage 16 and delivers it to the high pressure stage 3. Thence it is delivered from the pump.

It will be observed that there is an end thrust created and which must be taken up, said end thrust being equal to the overall difference in pressure between the inlet and discharge sides 4 and 5, respectively, multiplied by the effective area exposed to said pressure. This effective area is substantially equal to the area of the openings of the impellers working in their respective cases, and is substantially equal to the area of the circle designated by the numeral 17 in the figure.

I will now describe in detail the particular balancing device illustrated in the drawing in this case. The same includes a disk 18 mounted upon and secured to the shaft and having one face normally subjected to high pressure fluid, and the other face normally subjected to low pressure fluid, so that the difference in pressure on the two faces of this disk will at all times depend upon the

overall difference in pressure existing in the pump. By making the area of the disk of proper size the difference in pressure operating on the disk will bring about an exact balancing effect.

This result is secured by the provision of a fixed seat 19 adjacent to the high pressure stage, and another fixed seat 20 adjacent to the other side or face of the disk, there being a slight play permissible between the two faces just mentioned, so that in operation the shaft is allowed to shift endwise a very slight amount sufficient to uncover the seat 19 and simultaneously to either cover the seat 20 or leave the same slightly uncovered. The bearing or seat 20 is provided with one or more axial passages 21 communicating with a chamber 22, so that when the seat 20 is uncovered, water can flow through these passages and into the chamber 22. This chamber 22 in turn is in direct communication with the low pressure chamber 4 through a pipe or connection 23, so that the pressure within the chamber 22 is equal to that on the low pressure side of the pump.

It is believed that the operation of this balancing device will be readily understood from the foregoing description. I will state, however, that as soon as a difference in pressure is created, the disk 18 will be forced over a slight distance so as to uncover the seat 19, thereby permitting a slight flow of water past said seat, and this water will find its way through the passages 22 and back to the low pressure side of the machine. It is to be observed that the area of the seat 19 should be slightly greater than the area to be balanced, so that when the disk 18 is firmly up against the seat 19, the high pressure acting on one face of the disk 18 will slightly overbalance the end thrust, thus forcing the disk 18 and shaft a slight distance endwise even against the end thrust which is to be balanced. This slight movement will cease as soon as the seat 20 has been so nearly covered or closed as to partially shut off the flow of water through the passages 21.

In practice it will be found that when a pump embodying the features of the present

invention is brought into operation, the shaft with the impellers and balancing disk 18 will shift over a slight distance and will assume and maintain an intermediate position practically without variation during the operation of the machine. The amount of water which is allowed to leak back through the passage 21 and connection 23 is so slight that it may be practically ignored as far as the efficiency of operation of the machine is concerned.

It is to be observed that in the construction shown in the drawing the seat 20 constitutes in effect a valve which is closed in a more or less perfect manner by the end movement of the disk 18 and so as to either wholly or partially shut off the return of water to the low pressure side of the machine. Manifestly any other convenient or suitable arrangement might be adopted for controlling this return of water, and, therefore, the seat 20 may be considered as constituting in effect a valve operable according to the position of the disk 18.

I claim:

In a machine of the class described the combination of a multi-stage centrifugal pump, a shaft extending through the same, a plurality of impellers located on said shaft and working in tandem, an end balancing chamber surrounding said shaft, an axial passage connecting the last stage with said balancing chamber, a circular valve seat in the balancing chamber surrounding said passage, a balance disk on the shaft in the balancing chamber, a peripheral seat on said disk adapted to engage the valve seat aforesaid when the balancing disk is forced thereagainst, another axial passage leading from the opposite side of the balancing chamber to a point of discharge, a relatively small valve seat surrounding said passage and facing the balancing chamber, a relatively small disk on the shaft adjacent to said seat, and a peripheral seat on said relatively small disk adapted to engage the seat surrounding the discharge passage when the shaft moves in said direction, substantially as described.

WILLIAM C. DOWD.