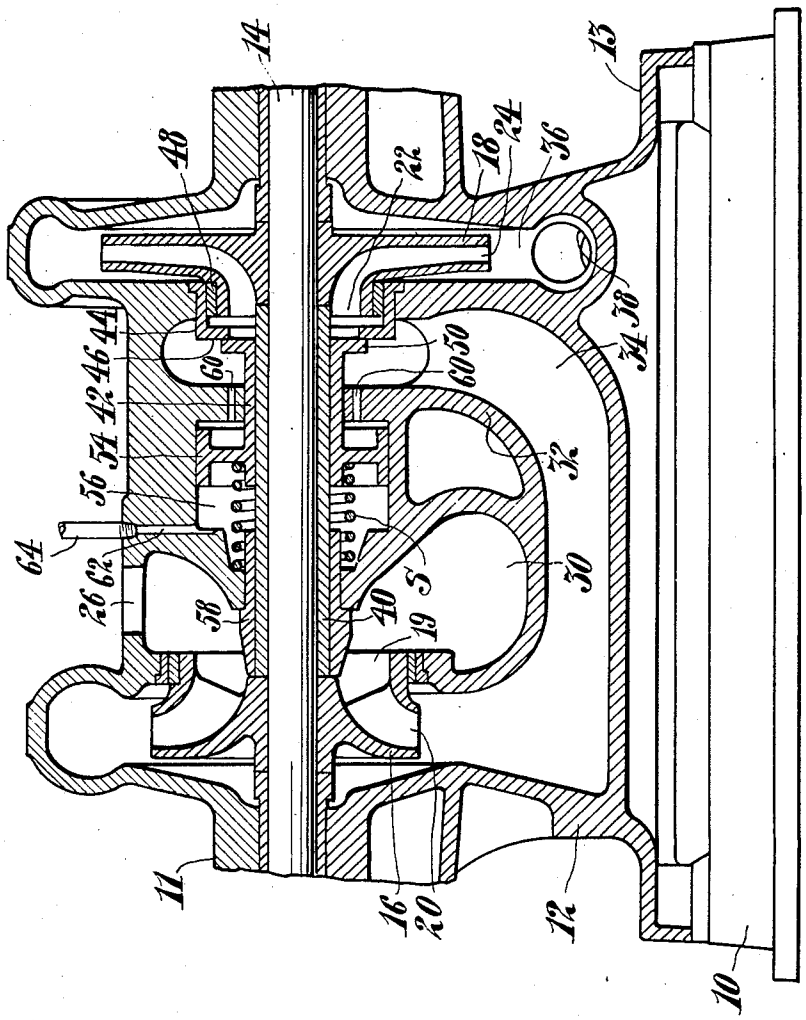
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CENTRIFUGAL PUMP

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# UNITED STATES PATENT OFFICE

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## CENTRIFUGAL PUMP

Application filed December 20, 1928. Serial No. 327,393.

This invention relates to centrifugal pump, more particularly to an improvement in hotwell pumps of the general type disclosed in the patent to James K. McIntyre, No. 1,680,057, filed September 23, 1926 and bearing Serial No. 137,297.

The principal object of the invention is to increase the efficiency of a two stage centrifugal pump in which the suction pressure may at times become extremely low and toward this end the invention contemplates the interposition of a valve between the two stages of the pump, which valve is operable by the rising characteristic on the first stage to admit fluid to the second stage proportionately to the pressure developed in the first stage. It has been found in actual practice that when a two stage pump of the character disclosed above is in operation, at intermediate and full loads, the second wheel of the pump actually performs the entire work to be done while the first wheel is deprived of its load so that it merely cavitates and churns the fluid within the casing, by virtue of the fact that there is an insufficient head on the wheel. This is disadvantageous if not a dangerous situation for the first wheel acting on less than full head is subjected to a deleterious effect and wears rapidly. This situation has been corrected by me, in my copending application Serial No. 327,392, filed December 20, 1928 for a centrifugal pump and this invention proposes another remedy.

Other objects of the invention are to provide a pump which is extremely simple in its construction, which is unlikely to get out of order, which is automatic in its operation, and which is well adapted to perform the services required of it.

With these and other objects in view, which will more readily be perceived as the nature of the invention is better understood, the same consists of the novel construction, combination and arrangement of parts to be more fully described, illustrated and claimed.

In the accompanying sheet of drawing, the figure is a sectional view taken longitudinally through the pump.

In the drawing, a pump is shown as being mounter on a suitable support 10 upon which there is a casing formed of an upper part 11 and a lower part 12. The lower part 12 is provided with a base 13. A drive shaft 14 extends between the upper and lower parts 11 and 12 and is suitably mounted on bearings (not shown), so as to permit the same to rotate within the casing.

The pump is of the two stage type, there being provided a first stage wheel 16 and a second stage wheel 18, the second stage being commonly known as the "high pressure" wheel. Both stage wheels are supported and driven by the single central shaft 14.

The first stage wheel 16 is shown as being provided with relatively large inlets 19, in order that the velocity set-up may be relatively low. Similarly the outlets 20 from the first stage wheel, are relatively large and the diameter of the wheel is comparatively small in order that the peripheral, relative and absolute velocities may be kept low in this stage. The pump as shown is designed to bring the pressure up to at least atmospheric pressure. The second stage wheel or impeller 18 is provided with a comparatively small inlet 22 and a small discharge opening 24. This second impeller is designed to work with a slight pressure at its inlet.

The casing 13 of the pump is provided with an inlet 26 leading to the first stage wheel and this inlet is located between the two impellers 16 and 18. The passage 30 leading to the impeller inlets 22 is formed by webs 32, cast integrally with the upper and lower parts 11 and 12, respectively, of the casing. These webs also serve as a partition to form part of the discharge passage 34 leading from the first stage impeller outlets to the second stage impeller inlets. The second stage impeller 18 is surrounded by a passage 36 leading to a

discharge opening 38 for connection with a suitable delivery pipe.

The above mentioned parts, thus far described, are purely conventional, having been patented by McIntyre as cited above and no claim is made as to their novelty. The novelty of the invention rather resides in the arrangement of parts now to be more fully described and whereby a full head is maintained on the first stage impeller at all times. Toward this end the shaft 14 is provided with a central bushing 40 upon which is mounted a valve member 42. An external bushing 44 is mounted within the casing and this bushing is provided with an inwardly extending valve seat 46. The bushing 44 is separated from the second stage impeller by a ring 48 and these parts are capable of relative rotation with respect to each other. The valve member 42 is provided with an outwardly extending flange 50, providing a valve to seat upon the member 46 to control the admission of fluid to the inlet 22 of the second stage impeller. The valve member 42 adjacent one end is provided with a piston 54 formed integrally therewith and which is slidable within a chamber 56 between the casings 11 and 12. A stop is shown at 58 and interposed between this stop 58 and the piston, and surrounding the shaft 14, is a coil spring which normally urges the valve member toward the valve seat 46 to close the inlet to the second stage impeller. Suitable ports 60 communicate with the interior of the chamber 56 from the passage 34 adjacent the inlet to the second stage impeller, and an additional passage 62 extends from the interior of the chamber 56 and rearwardly of the piston 54 to the condenser upon which the pump is operating, or to a suitable point on the inlet supply to the pump.

When the pump is in actual operation it will be seen that the impellers 16 and 18, being opposed to each other on their faces, will be neutralized so that there is no axial thrust, since the pressure on the back of the high pressure impeller is approximately twice the pressure on the back of the low pressure impeller, and since the unbalanced area of the high pressure impeller is approximately one-half the unbalanced area of the low pressure impeller.

Referring now to the valve which is interposed between the first stage impeller and the second stage impeller, it will be seen that when the first stage impeller is working against a full head, the pressure developed in the passage 34 leading to the inlet 22 of the second stage impeller 18 is transmitted through the passage 60 and will operate to force the piston 54 rearwardly toward the first stage impeller, thereby opening the valve 50 and permitting the second stage impeller to pick up the fluid in the passageway 34 to prevent any increased pressure therein. Should any variation in the load occur tending to decrease the pressure within the passage 34, which would ordinarily permit the first stage impeller to cavitate, this decreased pressure will be transmitted through the passage 60 and the action of the coil spring S will force the piston 54 forwardly toward the second stage impeller so that the valve 50 will approach its seat 46 and cut off or decrease the supply of fluid to the second stage impeller until the first stage impeller is working against a full head again.

The port 62 and the pipe 64 which may lead to the condenser or to the inlet supply line act as a bleeder port from the cylinder 56 to permit free movement of the piston. In addition to this, should any fluid leak past the piston 54, this fluid will be recovered into the condenser or into the pump, according to the respective part to which the pipe 64 is attached.

Having thus described my invention, it will be seen that I have provided a device which is entirely automatic in its operation, which is unlikely to get out of order and which is not likely to wear. Such a device will maintain a constant head on the first stage impeller and will ordinarily increase the efficiency of the pump.

I claim:

1. A two stage pumping system including a first stage impeller and a second stage impeller, each impeller operating to receive fluid from a fluid inlet and to discharge the same with increased head through a fluid outlet, a casing for the impellers having a passage extending from the outlet of the first stage to the inlet of the second, a valve in the casing having one end adapted to close the inlet of the second stage impeller, a piston on the other end of the valve, said casing having ports therein through which a portion of the fluid from the first stage impeller may flow to act upon the piston and move the valve, said movement of the valve opening the inlet of the second stage impeller and being controlled by the pressure developed by the first stage impeller, and resilient means for closing the valve.

2. A two stage pumping system including a first stage impeller and a second stage impeller, each impeller operating to receive fluid from a fluid inlet and to discharge the same with increased head through a fluid outlet, a casing for the impellers having a passage extending from the outlet of the first stage to the inlet of the second, a valve in the casing having one end controlling the inlet of the second stage impeller, a piston on the other end of the valve, resilient means normally holding the valve against the inlet of the second stage impeller and preventing the flow of fluid therethrough, and a flange on the casing extending between the ends of the valve and having ports therein through

which a portion of the fluid from the first stage impeller may flow to act upon the piston and move the valve, said movement of the valve opening the inlet of the second stage impeller and being controlled by the pressure developed by the first stage impeller to overcome the pressure of the resilient means.

In testimony whereof I have signed this specification.

JOHN KIRGAN.