No. 696,655. Patented Apr. 1, 1902.

F. RAY.

BALANCE ATTACHMENT FOR CENTRIFUGAL PUMPS.

(Application filed Aug. 3, 1901.)

(No Model.)

Fig. 1.

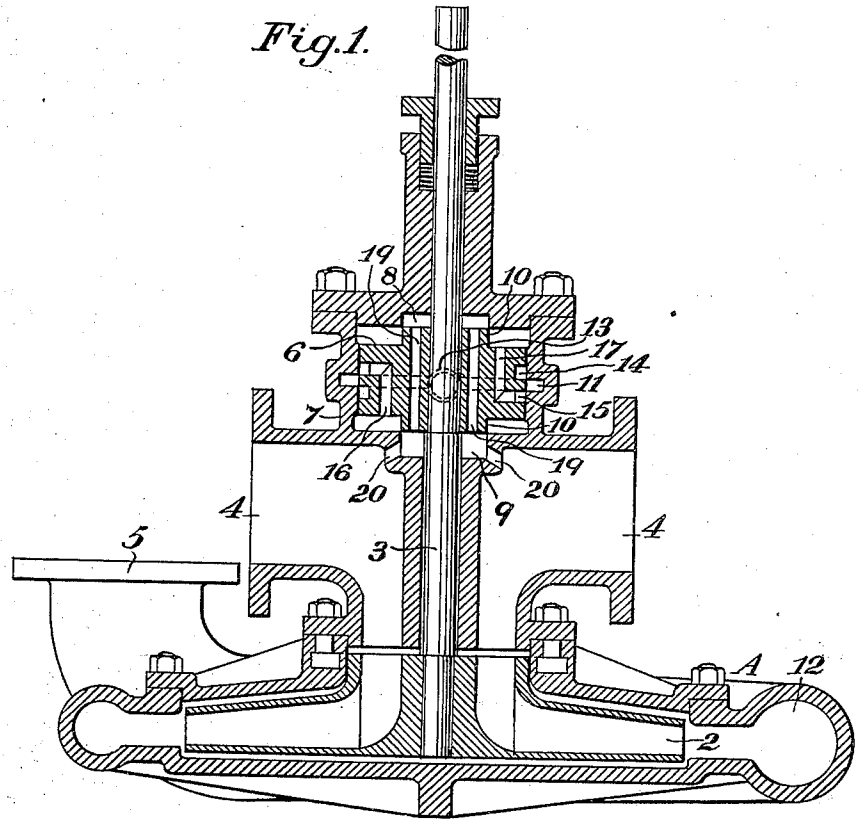
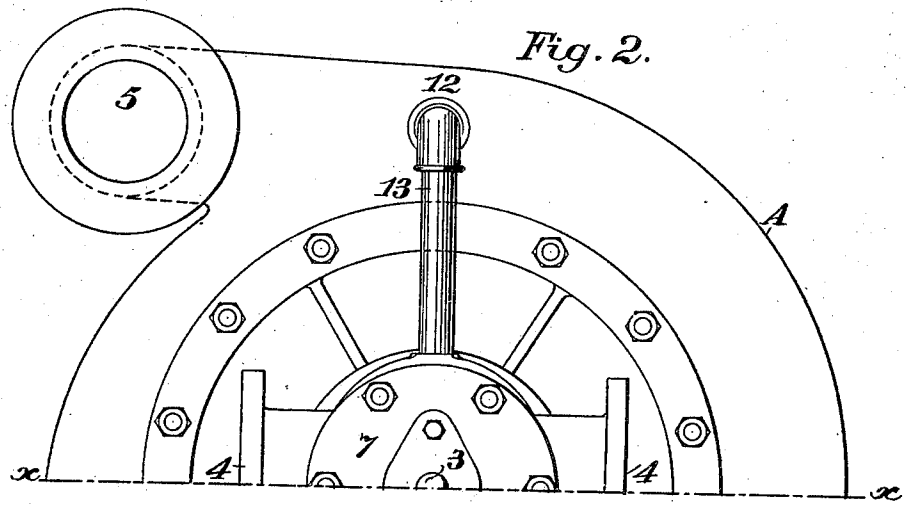



Fig. 2.




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# UNITED STATES PATENT OFFICE.

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## BALANCE ATTACHMENT FOR CENTRIFUGAL PUMPS.

SPECIFICATION forming part of Letters Patent No. 696,655, dated April 1, 1902.

Application filed August 3, 1901. Serial No. 70,730. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERICK RAY, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Balance Attachments for Centrifugal Pumps; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to a device for balancing centrifugal pumps.

It consists of a closed runner revoluble within the casing and suction and discharge pipes connected with the casing and a disk or plunger fitting and movable in a chamber and having passages connecting with the suction and discharge of the pump, whereby variations in the pressure act to balance the runner and the parts carried thereby.

My invention also comprises details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a vertical section of my invention, taken on the line *x x*, Fig. 2. Fig. 2 is a half-plan.

As shown in the accompanying drawings, A is a casing having a chamber within which the runner 2 is revoluble, being mounted upon a shaft 3, through which power is communicated to revolve the runner within the casing. This runner is what is known as the "closed" type, having disks above and below and radial vanes fixed between the disks, so that when the device is rapidly revolved after being primed with water the centrifugal force of the runner acts to draw the water in through the suction pipe or pipes 4 and to discharge it through the pipe 5, through which it may be carried to any desired height possible within the power of the pump. Pressure on the suction side of the runner is equal to the pressure of the atmosphere minus the weight of the column of water in the suction-pipe above the level from which it is drawn. Upon the opposite side there is a pressure on the runner 2, caused by the pressure of the water from the discharge side leaking past the edge of the runner. This pressure is equal to the head of water above the center line of the runner, thus making a total and unbalanced pressure acting upon the runner in an upward direction approximately due to the column of water extending from the level from which the pump draws to the top of the discharge-pipe, and in the opposite direction or downward there is the weight of the runner-shaft and any attachments carried thereby, which tend to balance the upward pressure referred to, but which in the case of low heads would be too much and in the case of high heads never enough. Therefore if the weight and pressure were balanced in one case they would not be balanced under any other conditions. It is the object of my invention to overcome this difficulty and to automatically regulate the balance for the varying conditions under which the pump is being operated. To effect this, I have shown a piston 6, fixed to the shaft 3, and, as here shown, it is located above the suction-openings of the pump. This piston is revoluble within a cylindrical case 7, in which it has an easy working fit. The upper and lower ends of the cylinder have cylindrical chambers or counterbores made in them, as shown at 8 and 9, and the piston has corresponding cylindrical extensions 10 at each end fitting these chambers and movable easily within them as occasion requires. Around the interior of the cylinder is an annular groove or channel 11, and this groove is connected directly with the discharge-pipe 12 by a pipe or passage, as shown at 13, so that the pressure in this groove or channel corresponds approximately with the pressure in the discharge-pipe and will vary with that pressure. Around the piston 6 are made two grooves 14 and 15, these grooves being so located with relation to the annular groove 11 that one is just above and the other just below when the parts are in their normal position. The groove 14 is connected with the lower part of the cylinder by drill-holes or passages 16, and the groove 15 in the piston is connected with the chamber at the upper end of the cylinder by similar drill-openings 17. The upper and lower chambers 8 and 9 are connected together by drill-holes 19, and the lower chamber is connected with the suction of the pump by holes or openings, as at 20, so that the pressure in both these chambers will always be the same as in the suction-pipe.

The operation of the apparatus will then be as follows: If the pressure upward be greater than the weight of the shaft and parts carried thereby, the shaft will move up. This will cause the passage 15 to connect more or less with the annular groove 11, which surrounds the interior of the cylinder, while the groove 14 will be correspondingly moved up and away from the groove 11. This allows the greater pressure to enter the groove 15 of the piston and thence to pass up into the upper part of the cylinder, within which the piston is movable. At the same time the extension at the upper end of the piston will have moved into the chamber 8 at that end, while the extension 10 at the lower end will have correspondingly moved out of the chamber 9 at the lower end of the cylinder. The effect of this is to allow the water under pressure which is within the groove or channel 11 to enter the groove 15 of the piston faster than it can enter the groove 14 by leakage, and the water thus entering the groove 15 passes up through the holes 17 into the space above the piston, thus providing a pressure at that point which acts upon the piston to force it down. Whatever water may find its way by leakage through the groove or channel 14 and the passage 16 into the lower end of the cylinder will escape through the passages 20 into the suction and will thus cause no pressure from below. The parts being thus balanced by this pressure disposed as above described may remain in that condition until a reverse of the pressure takes place, when the groove or channel 14 will be brought into direct communication with the pressure-groove 11, and the passage 15 will be correspondingly carried out of line with it. The water under pressure then entering the groove 14 more rapidily than it enters the groove 15 will be carried into the lower chamber or end of the cylinder by the holes 16, and pressure will be brought upon the lower side of the piston to raise it. As this depression of the piston has carried the extension 10 at the lower end into the chamber 9 at that point and has correspondingly withdrawn the extension at the upper end of the piston in the chamber 8 it will be seen that any leakage through the passage 15 and hole 17 into this chamber will pass into the depression 8, thence through the holes 19, connecting the upper and lower chambers, and thence escape into the suction-chamber, as before described. In this manner the varying pressures within the pump will constantly act to balance the runner, its shaft, and the parts carried thereby and maintain the runner in a central position within the casing. The same arrangement serves in the case of what is known as a "compound centrifugal-pump," having two casings and their runners mounted upon the same shaft in parallel planes. In such construction the suction for one pump connects therewith opposite to the suction for the other, and thus they balance each other, and the balance-piston is only to balance the shaft, runners, &c. The operation is the same as with a single pump. The annular passage in the cylinder may connect with either of the pumps, but it is preferable to connect it with the lower one on account of the greater pressure within that pump.

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

1. An automatic balancing device for centrifugal pumps, consisting of a piston fixed upon the revolving shaft, and having annular grooves or channels around its periphery connected respectively with the upper and lower ends of the piston, a chamber within which the piston is revoluble, said chamber having an annular groove or channel connecting with the discharge of the pump, and so located that the rise or fall of the shaft and parts carried thereby will open communication through the grooves to either end of the cylinder.

2. A balancing device for centrifugal pumps consisting of a cylinder having an annular groove around the interior and connections between said groove and the discharge of the pump, a piston or disk revoluble within the cylinder having annular parallel grooves located respectively above and below the groove in the cylinder, connections between one of said piston-grooves, and the upper end of the cylinder, and between the other groove and the lower end whereby movement of the piston in either direction opens communication between the corresponding end of the cylinder and the pressure-groove.

3. A balancing device for centrifugal pumps consisting of a cylinder concentric with the revoluble runner-shaft, a disk or piston carried by said shaft revoluble within the cylinder, chambers surrounding the shaft at opposite ends of the cylinder, corresponding extensions of the piston slidable within said chambers, an open connection between the chambers and with the suction of the pump, an annular groove around the interior of the cylinder connected with the discharge of the pump, parallel grooves made around the piston above and below the groove of the cylinder, one of said grooves having connection with the upper end of the cylinder, and the other with the lower end whereby either of said grooves may be caused to overlap the pressure-groove of the cylinder and communicate pressure to the end of the cylinder with which it is connected.

In witness whereof I have hereunto set my hand.

FREDERICK RAY.

Witnesses:
S. H. NOURSE,
JESSIE C. BRODIE.