M. J. FINN.

CENTRIFUGAL PUMP.

APPLICATION FILED JAN. 21, 1921.

1,397,273.

Patented Nov. 15, 1921.

2 SHEETS—SHEET 1.

Fig. 2.

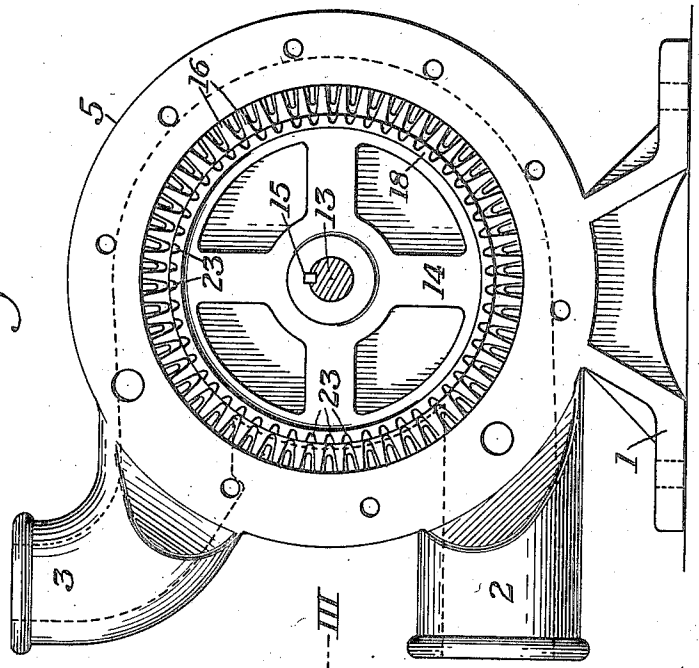
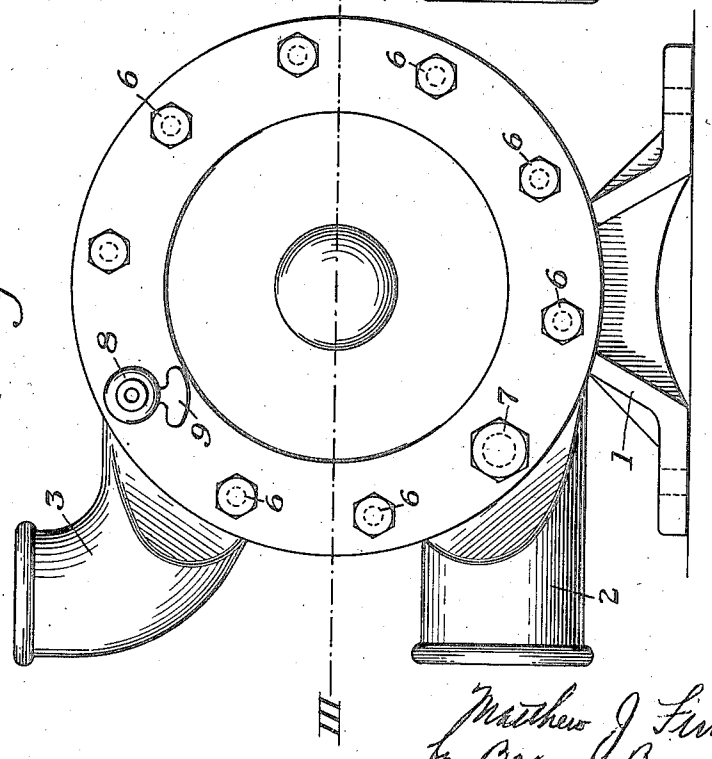


Fig. 1.



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his Attorneys

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2 SHEETS—SHEET 2.

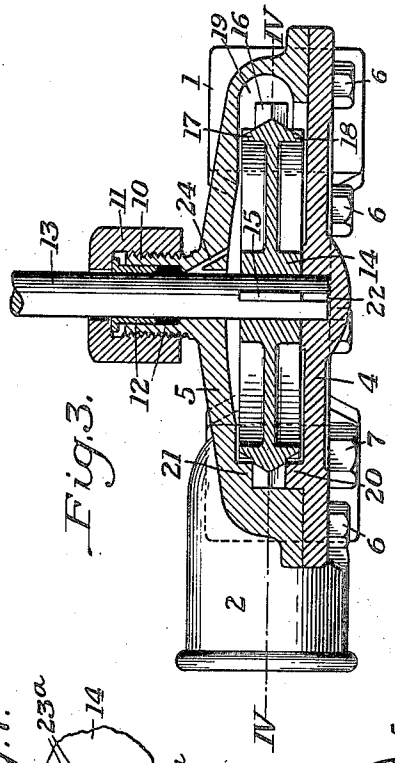

Fig. 3.

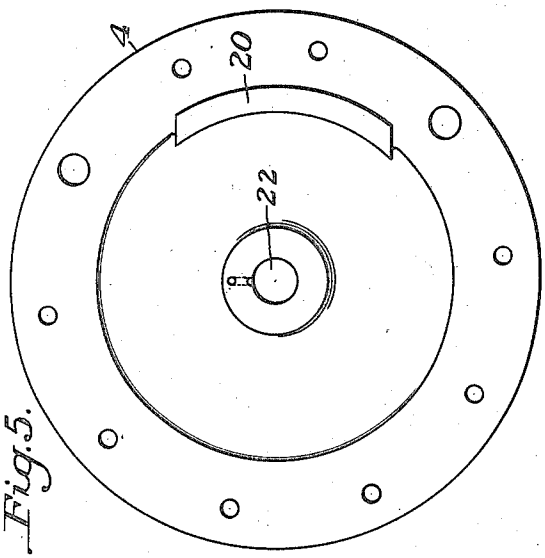

Fig. 5.

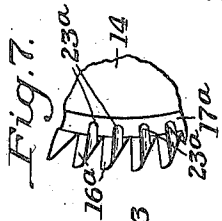

Fig. 7.

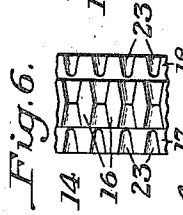

Fig. 6.

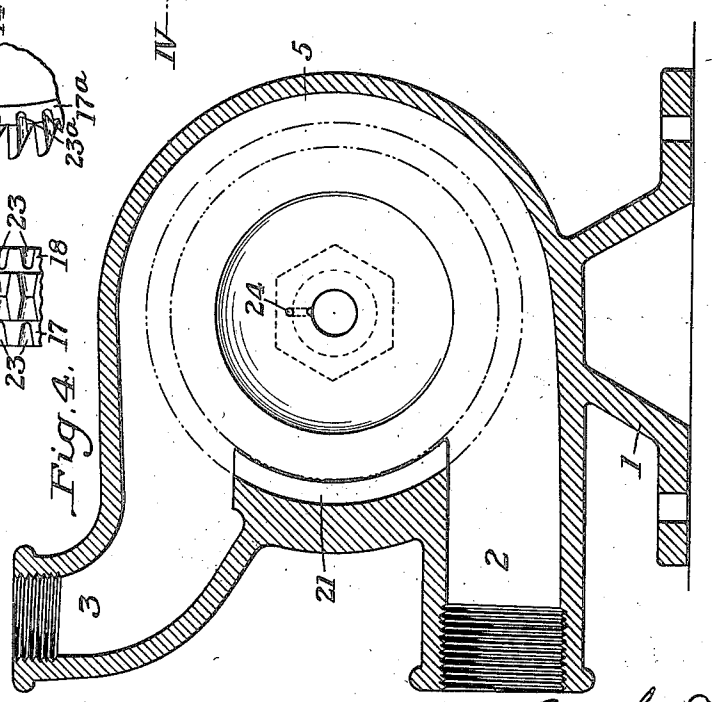

Fig. 4.

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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL PUMP.

1,397,273. Specification of Letters Patent. Patented Nov. 15, 1921.

Application filed January 21, 1921. Serial No. 438,837.

To all whom it may concern:

Be it known that I, MATTHEW J. FINN, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Centrifugal Pumps, of which the following is a full, clear, and exact description.

My invention relates to pumps and particularly to pumps of the centrifugal type.

An object of my invention is to produce a fluid pump of the centrifugal type having few parts. A further object is to simplify the construction of the pump and thereby reduce the maintenance cost of the same in operation.

A still further object is to produce a pump which will be flexible in operation and in which the power consumption for operating the same will be substantially constant regardless of the head against which the pump works from minimum to maximum and which will also deliver a volume of liquid which will vary substantially inversely proportional to the variation of the head against which the pump operates.

Further objects and advantages will be better understood from the following description taken with the attached drawings, and in which:

Figure 1 is a side elevation of a pump embodying my invention;

Fig. 2 is a similar view with one side of the casing removed;

Fig. 3 is a section on the line III—III of Fig. 1;

Fig. 4 is a sectional elevation on the line IV—IV of Fig. 3;

Fig. 5 is an interior view of one side of the casing;

Fig. 6 is a plan view of part of the impeller; and

Fig. 7 is a side elevation of an impeller showing a modification.

Referring to the drawings, 1 is a base of any suitable design, and 2 is the inlet and 3 is the outlet. The casing is composed of two parts 4 and 5, held together by bolts 6. The bolt 7 acts also as a drain, the opening into which the bolts screws, leading into the interior of the inlet 2. A valve 8 is screwed into the upper part of the casing and extends into the interior of the outlet. The stem of this valve has the further function of acting in the same capacity as the bolts 6. The valve 8 has a member 9, which, when in the position shown in Fig. 1, closes the valve, and when turned 90°, opens the same. The contour of the outlet 3 is such that during the operation of the pump, when the member 9 is in the proper position, air will be admitted through the valve 8 into the fluid being pumped.

The part 5 of the casing is provided with a hub 10, which is screw-threaded and on which a nut 11 is placed and within which suitable packing material 12 is placed, thus forming a stuffing box. The material 12 fits snugly around a shaft 13, which extends through the portion 10, and on the inner end of which is placed the impeller 14. The impeller is provided with a keyway in which is positioned a key 15.

The impeller is of the construction shown in Figs. 2 and 3, and is provided on its periphery with a plurality of vanes 16. The number and width of the vanes, as well as their length, is determined by the capacity of the pump. This impeller is provided near its periphery and preferably at the base of the vanes with wings 17 and 18, one on each side, which extend laterally therefrom into juxtaposition with the side walls of the casing members 4 and 5, it being understood that there is a small clearance between the wings and the casing, which is sufficient to prevent actual mechanical contact. Connecting the inlet with the outlet is a peripheral chamber 19, in which the vanes 16 operate upon the fluid being pumped.

Separating the inlet and outlet is a bridge or partition, a part 20 of which is on the member 4 of the casing and another part 21 of which is on the member 5 of the casing. The arrangement is such that the chamber in the casing at this point closely fits the impeller vanes. This bridge therefore has the function of directing the fluid out at the outlet and preventing it from circulating around with the impeller as it might otherwise do. The part 4 of the casing is provided with a thickened portion having an opening 22 therein to receive the end of the shaft 13. The outer end of the shaft 13 may be connected to any suitable source of power for driving the pump.

The cross sectional shape or the arrangement of the surfaces of the vanes which are on the periphery of the impeller is important, in order that the maximum efficiency

may be secured from the pump. Fig. 6 shows the preferred form of the impeller vanes, the same having sides diverging from each other in a direction toward the center line of the vanes and forming a vane having a cross sectional area that might be said to be diamond shaped.

The wings 17 and 18 are provided with notches 23, which are placed between adjacent vanes. The function of these notches in the wings is to throw the fluid outwardly and into the path of the vanes, the wings with the notches therein acting to prevent the fluid in any substantial quantity from passing down between the inner side of the casing and the impeller into the chamber immediately surrounding the hub of the impeller, although this chamber will be usually filled with water during the operation of the pump; and advantage is taken of this fact by connecting this chamber through the passage 24 with the stuffing box 10, so as to lubricate the shaft bearing and thereby render the pump self-lubricating.

Another important feature of the design of my pump is that the center line of the impeller is in alinement with that of the inlet, so that the fluid coming into the pump does not act to hydraulically unbalance the impeller, but by reason of that arrangement and the fact that the fluid does get into the chamber around the hub of the impeller, the impeller is hydraulically balanced, and all side thrusts are therefore avoided. The center line of the outlet is also in line with that of the impeller and the inlet, and by reason of this arrangement and the particular form of the impeller vanes, a larger volume at a given pressure is produced by my pump than has been effected with any such style of centrifugal pumps of the same size, of which I have knowledge.

Fig. 7 shows a portion of an impeller which has different shaped vanes from that shown in Fig. 6. These vanes are straight on one side and sloping on the other, somewhat in the form of ratchet teeth. This impeller, like that of Fig. 6, is provided with rings, one of which is shown at 17^a, the side wings having notches 23^a therein between the vanes 16^a.

Other modifications of the shape and arrangement of the vanes may be made and certain advantages secured, and the notches may be omitted from the wings and still many of the advantages of my invention retained.

Furthermore, one of the essential features of my invention is that there should be a relatively close fit between the impeller and the casing in the region of the base of the vanes, and this may be secured by other arrangements than that shown in the accompanying drawings, although the construction shown is the preferred form, and my experience has been that it has several advantages over any other construction of which I have knowledge.

My pump has many advantages over the ordinary piston pump wherein the volume is constant regardless of the head and therefore the power necessary to operate such a piston pump would increase proportionately with the head.

My pump also has many advantages over the ordinary centrifugal pump in that in such pumps the volume increases upon a reduction in the head and in a much greater proportion than the reduction, so that with a comparatively small reduction of the head the volume greatly increases. This characteristic results in the necessity of predetermining very accurately the head against which said pump must operate in order to properly decide the size of the motor to operate the pump. This is a serious disadvantage because it frequently happens that the head is not accurately estimated and if it is over-estimated the increase of volume due to the actual head, which is less than the estimated, is frequently so large as to greatly overload the motor or necessitate a change from that originally calculated and installed, whereas with a pump of my construction under similar circumstances, the increase of volume would be proportionate to the decrease of the head which would result in a constant load upon the driving motor.

Furthermore, my invention has the advantage over a piston pump in an ordinary system of supply in that it is unnecessary to store the water in a tank to get automatic control, the pump being flexible enough in its operation to automatically take care of that feature.

Many changes in details of the parts and the arrangement thereof may be made, without departing from the spirit of my invention.

I claim:

1. An impeller for centrifugal machines, having a plurality of peripheral vanes, a lateral wing on each side thereof near the base of said vanes, and notches in said wings substantially as described.

2. An impeller for centrifugal machines, comprising lateral means for throwing the fluid outwardly and radial means for transmitting the fluid circumferentially, and notches in said lateral means, substantially as described.

3. In a centrifugal machine, the combination of a casing having a chamber therein, an inlet and an outlet for said chamber, an impeller in said chamber, wings near the periphery of said impeller and vanes on the periphery of said impeller for forcing the

fluid operated upon out at said outlet and means separating said inlet from said outlet except through said chamber, substantially as described.

4. In a centrifugal machine, the combination of a casing having an inlet near the base thereof, an outlet near the top thereof, a peripheral chamber connecting said inlet and outlet, means separating said inlet from said outlet, and an impeller in said casing having vanes operating in said peripheral chamber and a wing on each side of the impeller at the base of the vanes, substantially as described.

5. In a centrifugal machine, the combination of a casing having an inlet at the base and an outlet at the top thereof, a peripheral chamber connecting said inlet and said outlet, means separating said inlet from said outlet except through said chamber, an impeller in said casing having vanes with sides diverging from the edges to the middle of the vane, and a wing at the base of said vanes extending outwardly in proximity to said casing, substantially as described.

6. A centrifugal pump, comprising an impeller having lateral means near the periphery thereof for throwing the fluid outwardly and radial means on the periphery thereof for transmitting the fluid circumferentially, and a casing surrounding said impeller, substantially as described.

7. A centrifugal pump comprising an impeller with radial means on the periphery thereof for transmitting the fluid circumferentially, and lateral means on said impeller near the base of said radial means for throwing the fluid outwardly, and a casing inclosing said impeller and being in juxtaposition to the lateral means on said impeller, substantially as described.

8. A centrifugal pump, comprising an impeller having vanes on the periphery thereof, means extending laterally therefrom near the base of said vanes for throwing the fluid outwardly, a casing surrounding said vanes and in juxtaposition to said lateral means and having an inlet and an outlet and means between said inlet and outlet for separating said inlet and outlet and closely inclosing said vanes, substantially as described.

9. A centrifugal pump, comprising an impeller having lateral means near the periphery thereof for throwing fluid outwardly and radial means on the periphery thereof for transmitting said fluid circumferentially, and notches in said lateral means between said radial means, substantially as described.

10. A centrifugal pump, comprising an impeller with radial means on the periphery thereof for throwing the fluid outwardly and lateral means on said impeller near the base of said radial means for transmitting said fluid circumferentially, and notches in said lateral means between said radial means, substantially as described.

11. A centrifugal pump, comprising an impeller having vanes on the periphery thereof for transmitting the fluid circumferentially, means extending laterally therefrom near the base of said vanes for throwing said fluid outwardly, and notches in said lateral means between said vanes, substantially as described.

In testimony whereof I have hereunto set my hand.

MATTHEW J. FINN.