Dec. 25, 1951 G. K. EGGLESTON 2,580,347

CENTRIFUGAL PUMP

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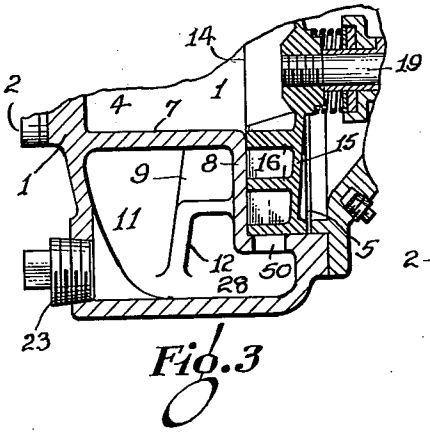


Fig. 3

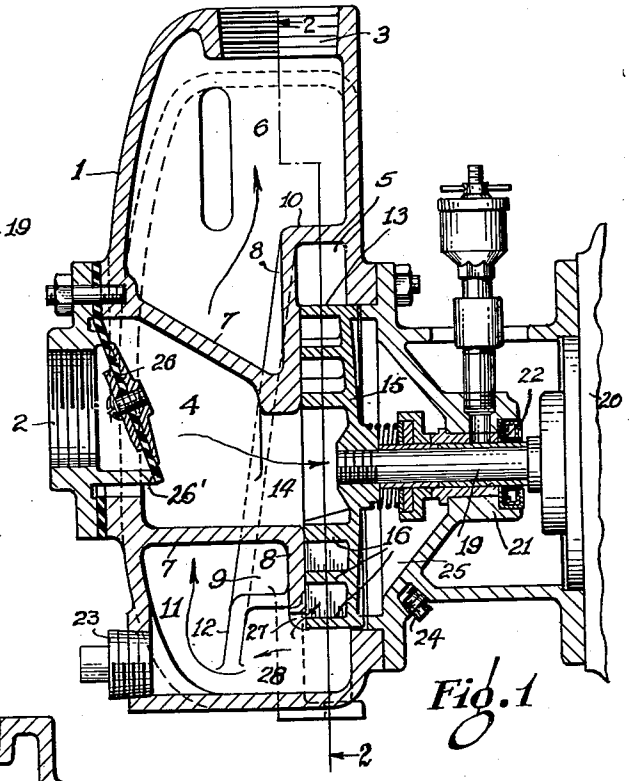


Fig. 1

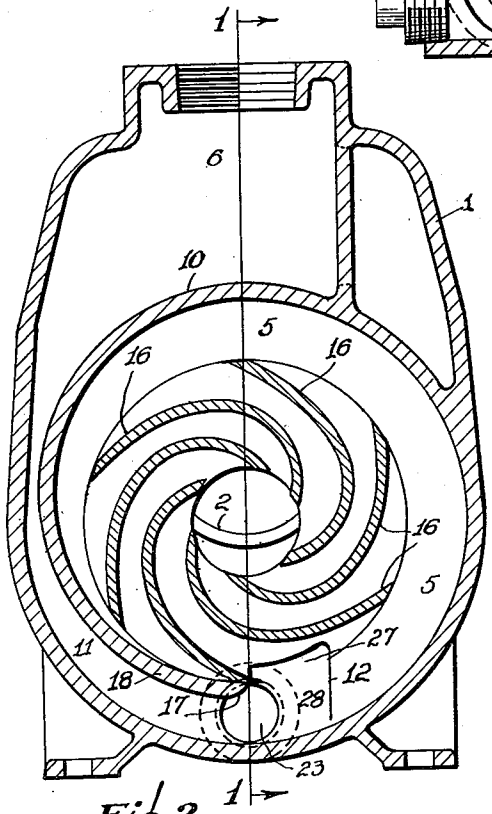


Fig. 2

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CENTRIFUGAL PUMP

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1 Claim. (Cl. 103—113)

1

My invention relates to self-priming centrifugal pumps and more particularly to centrifugal pumps of the suction lift type, in which the inlet to the pump rotor or impeller chamber is substantially coaxial therewith.

An object of the present invention is to provide self-priming means which is substantially anti-clogging, that is, which is so located with respect to the periphery of the impeller and the liquid chamber of the pump that foreign matter drawn in with the liquid into the impeller chamber will have unobstructed and free access to the liquid discharge or air separating chamber and will be prevented from stopping or clogging the priming opening to the impeller chamber.

Another object of the invention is simplicity in construction and efficient operation under all conditions of operation, including heavy duty service.

A further object of the invention resides in the provision of a pump of the above named character which is automatically self priming in use, the priming function being automatically effective in starting and ineffective when the pump is primed and pumping liquid.

Other objects of the invention will become more apparent from the following description of several embodiments thereof, reference being made to the accompanying drawings in which like reference characters are employed to designate like parts throughout the same.

In the drawings:

Figure 1 is a vertical section through a pump embodying one form of the invention as taken on line I—I of Figure 2,

Figure 2 is a sectional view taken on line II—II of Figure 1, and,

Figure 3 is a fragmentary section of a lower part of the impeller chamber wall illustrating a modified form of my invention in which the priming opening opens downwardly and radially of the impeller chamber and communicates with the liquid and air separating chamber therebeneath.

In carrying out my invention, I have overcome and eliminated one of the most objectionable faults of self priming pumps, that i the fault of clogging or stoppage of the priming opening by foreign matter drawn into the pump at its inlet and then into the impeller chamber. Some of such material will, of course, seek an exit through the priming opening or port during the priming cycle while some will pass along the volute and into the liquid chamber.

Referring first to Figures 1 and 2 in which I have illustrated a pump embodying one form of the invention, the pump casing is shown at 1, there being an intake opening at 2 and a delivery opening at 3. The casing is preferably cast in one piece, as shown, and comprises an intake chamber 4 communicating with the intake opening 2 and the volute or impeller chamber 5, and liquid chamber 6 communicating with the outlet 3.

2

The impeller chamber or volute 5 is separated from the liquid chamber 6 by means of the wall 7 of the intake chamber and a wall 8 which extends radially outwardly of the intake chamber wall to merge with the wall 9 of the volute and forming with the casing wall 10 the lower portion 11 of the liquid chamber 6. As shown in Figure 1, the volute 5 opens at 12 directly into the chamber 6 in the lower region of the casing which also serves as an air separation chamber.

An impeller 13 is mounted to rotate in the impeller chamber 5, its rotating axis and that of the inlet opening 14 being in substantial alignment. This impeller comprises a body or back plate 15 having a plurality of curved blades 16 arranged on its forward face in spiral-like fashion and preferably formed integral with the impeller body 15. These blades are curved from the periphery toward the axis of the impeller and may overlap each other in spaced relation as shown in Figure 2, the outer ends of the blades sweeping close to the free end or cutoff 17 of the volute wall 18. As shown in this figure, the impeller is driven to rotate in a clockwise direction. The impeller is mounted on, and rotates with, the driven shaft 19 which, in the present instance, is a continuation of the shaft of a prime mover 20. The projecting end of the shaft carrying the impeller is carried in the boss 21, there being a suitable lubricant packing 22.

Drain or cleaning plugs may be provided at 23 and 24 for the chambers 11 and 25 respectively.

The intake 2 is provided with a check valve 26 seating on the seal 26' to close the opening 2 against back flow f. om the pump.

In the embodiment of my invention shown in Figures 1 and 2 the priming opening is formed in the lower region of the wall 8 at the periphery of the impeller 13 opening downwardly as shown in Figure 2 to afford lateral communication between the volute or impeller chamber 5 adjacent the tips of the blades and the air separation chamber 28.

The operation of this embodiment of my invention may be described as follows.

The pump body is first filled with the liquid to be pumped. This may be done by supplying the same through the opening 3 or the pump may be filled from prior operation. Since the check valve 26 normally seats on the seat 26', the intake opening 2 is closed when the pump is not in operation, preventing a back flow of liquid out of the pump body through this opening. When the impeller 13 is rotated or driven by the power source 20 it rapidly comes up to rotation at high velocity in a clockwise direction as in Figure 2.

The liquid in the volute 5 and between the impeller blades is first expelled outwardly by centrifugal force moving around the volute and discharging into the separation chamber 28. Such action causes the liquid in the inlet chamber 4 to flow or be drawn axially toward the impeller, simultaneously causing the valve 26 to open to

permit liquid to be pumped to a higher level to be drawn into and through the inlet 2. This liquid by continued rotation of the impeller at high velocity is drawn between the whirling impeller blades 16 and is likewise expelled outwardly into the volute by centrifugal force. The column of liquid is thus brought into increasingly rapid rotation around the volute and into separation chamber 28 causing the liquid in the liquid chamber 11 to rise in the pump body and pass out the discharge opening 3 to which a hose or pipe (not shown) may be connected.

As liquid is expelled from the inlet chamber 4, air from a suction pipe or hose connected with the inlet 2 together with liquid to be pumped will be drawn into the pump body and into the impeller chamber or volute 5 passing first between the impeller blades 16 and then outwardly between the blades by centrifugal force. Rapid rotation of the blades tends to beat or break up the air in the liquid body within the impeller chamber and causes the air to be enveloped in the liquid in the form of bubbles. This aerated liquid is carried off and out of the volute discharge 12 into the separation chamber 28. At the same time liquid in the chamber 11 will flow into the impeller chamber 5 through the elongated opening 27 formed in the wall 8 and extending from the free end 17 of the volute wall in a direction counter to the direction of rotation of the impeller as shown in Figure 2. This liquid and some of the aerated liquid in the separation chamber 28 flows in a direction facing the rotational field of the impeller and is drawn between the rotating impeller blades and is again driven off into the volute. In its travel, this liquid may pick up and entrap additional air entering the impeller chamber through inlet 14 and so promotes further aeration of the liquid by entrapping the air therein. In this manner the liquid is recirculated from the volute mouth through the separation chamber, laterally through the opening 27 opposite the tips of the blades 16 and into the volute. This recirculation of the liquid and entrapped air will continue until all of the air has been exhausted from the suction pipe and the inlet chamber 4 and is forced upwardly in the liquid chamber 11 and the upper chamber 6 and out through the outlet 3.

The liquid in the volute is kept in a continuous state of rapid rotational movement therein, there being no point in the volute where air can be entrapped so as to prevent efficient operation of the pump or its self-priming action.

When all the air has been evacuated from the volute, suction is established to the intake opening and the valve thus drawing up liquid into the pump and axially into the impeller. The rapidly rotating impeller throws off the liquid peripherally into the volute channel in rapid movement past the opening 27 which cuts off or arrests the flow of liquid through this opening from the separation chamber to the impeller chamber thus stopping recirculation. Under such conditions the pump will function as a standard centrifugal pump, that is, the liquid discharged from the mouth of the volute into the chamber 28 will be forced up through the chambers 11 and 6 and discharged through the outlet 3 as indicated by the arrows in Figure 1.

So long as the liquid and the path of circulation remain sealed against air the pump maintains its prime and operates with full pumping effect immediately the impeller is driven. Under

these conditions, there will be no recirculation of the liquid through the opening 27 as explained above, but if the pump loses its prime recirculation is restored until the pump has reprimed itself.

In order to prevent syphoning or loss of liquid when the pump is stopped, the check valve 26 will close on its seat to prevent the escape of any liquid past the inlet opening from the chamber 4.

I have found that by locating the opening 27 so that one end is contiguous with the cutoff 17 so that the opening lies along the periphery of the impeller, the tendency of foreign matter drawn in with the liquid through the inlet to clog or obstruct the priming opening 27 is reduced and generally eliminated. This undoubtedly is due to the form of the opening 27, which as illustrated, results from interrupting the periphery of wall 8 at a point contiguous with the cutoff 17 in the form of an arcuate slot opening downwardly into the chamber 28 and laterally into the volute 5. As such, there is no restricted passage in which foreign matter may lodge or build up to the extent that recirculation, when desired, becomes impaired.

In Figure 3 I have illustrated a modified form of the invention in which the priming opening 50 is shown as a slot communicating the impeller chamber 5 with the separation chamber 28. The slot is formed in the bottom wall of the volute and opens downwardly radially of the impeller chamber. The opening 50 is elongated and, like the form shown in Figures 1 and 2, is located so that one end thereof is contiguous with the cutoff 17.

Various changes may be made in the details of construction and arrangement of parts without departing from the spirit of the invention or the scope of the appended claim.

I claim:

A self-priming centrifugal pump comprising a pump casing having a liquid separation chamber and an impeller chamber of volute form separated by a wall therebetween, said wall having a peripheral portion and a radial portion with respect to the rotational axis of an impeller in said impeller chamber, an impeller rotatable in the impeller chamber, a liquid inlet passage through said liquid separation chamber and communicating with said impeller chamber, the peripheral and radial portions of said wall extending at one end from a point defining a blade cut-off, said peripheral wall terminating at its other end at a point spaced from said blade cut-off, the radial portion of said wall between said cut-off and said other end of said peripheral wall being relieved radially inwardly thereof to form a priming opening directed radially downwardly in the plane of the radial wall and communicating said impeller chamber directly with the separation chamber.

GILBERT K. EGGLESTON.

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