Dec. 10, 1940. A. C. STRATTON 2,224,615

PRIMING MEANS FOR SELF-PRIMING PUMPS

Filed Jan. 30, 1939 2 Sheets-Sheet 1

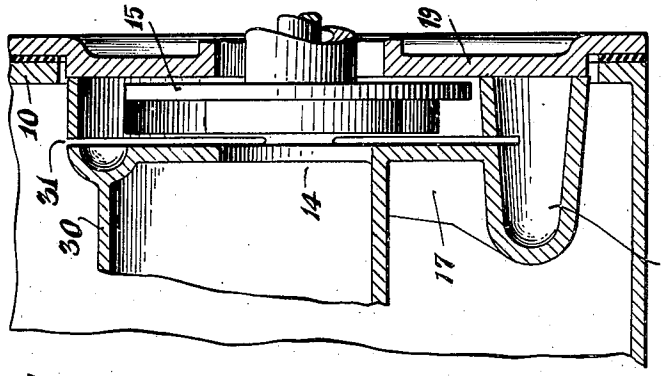

Fig. 4

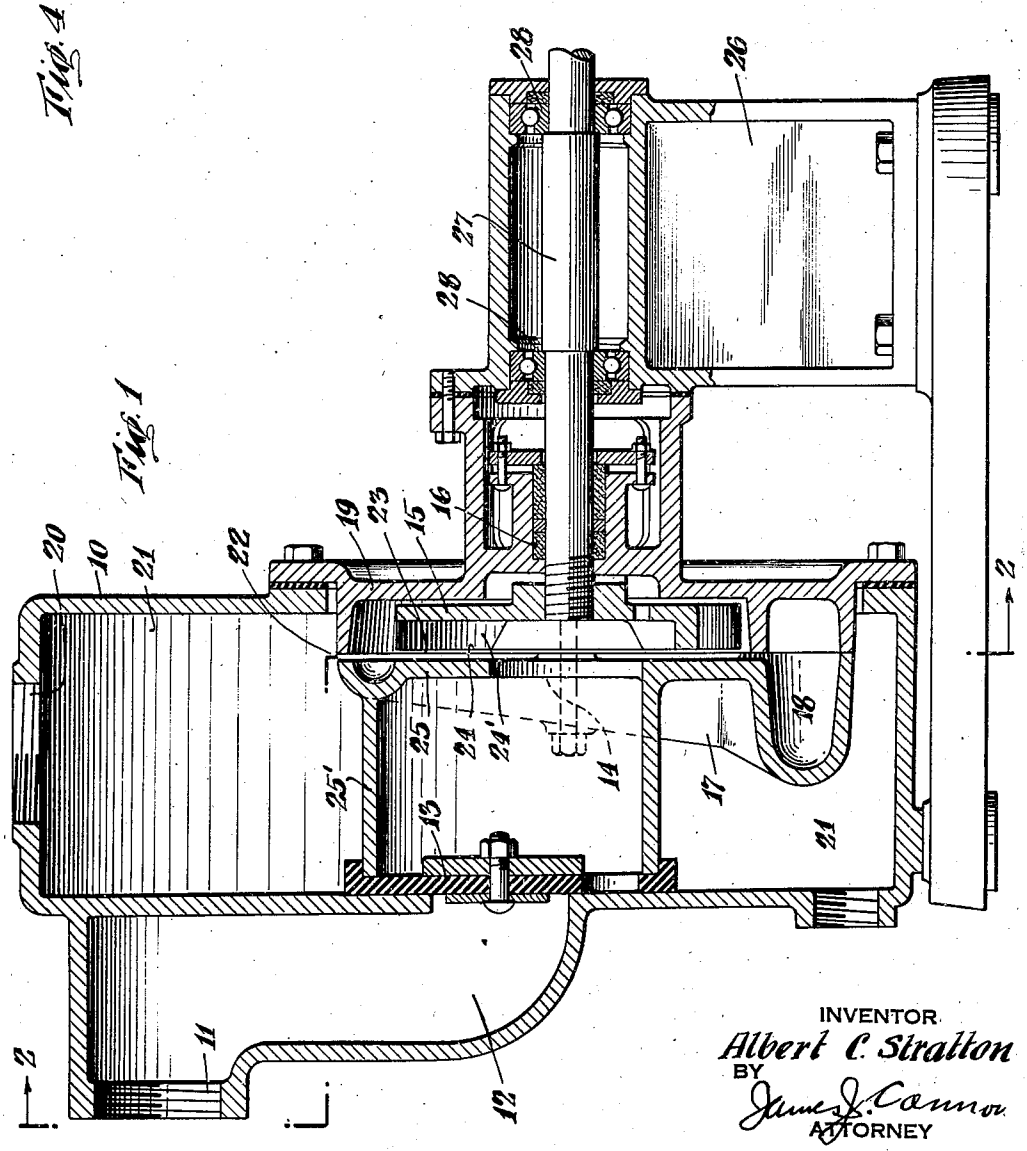

Fig. 1

INVENTOR
Albert C. Stratton
BY
James J. Cannon
ATTORNEY

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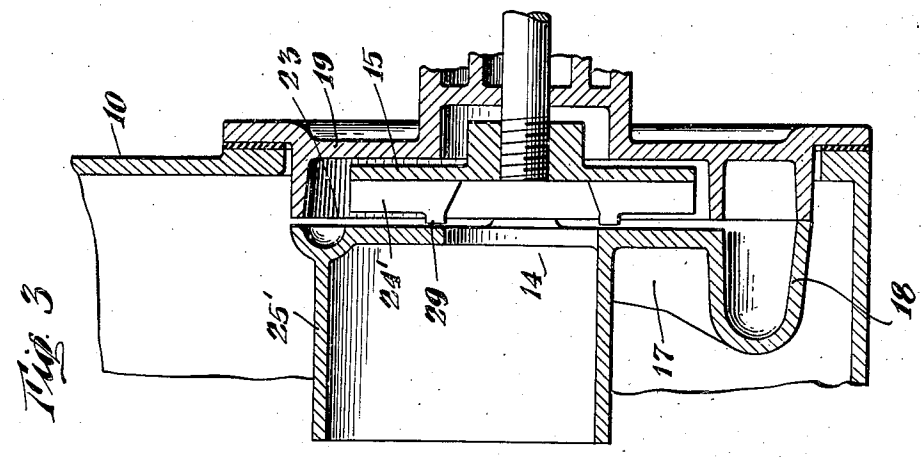

Fig. 3

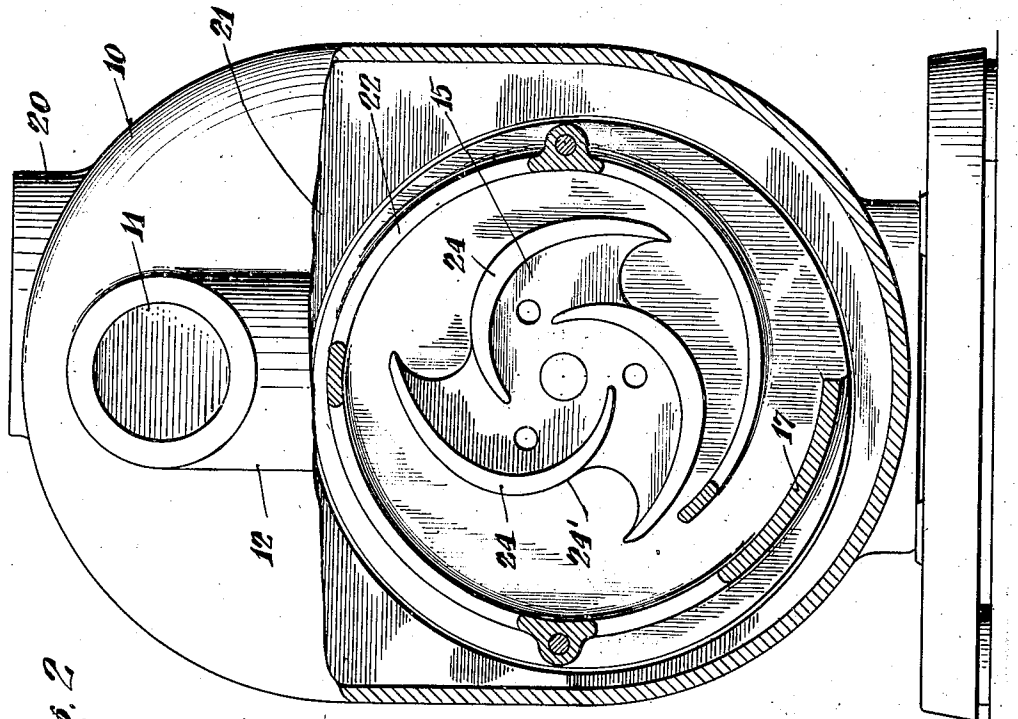

Fig. 2

INVENTOR
Albert C. Stratton
BY James J. Cannon
ATTORNEY

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UNITED STATES PATENT OFFICE

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PRIMING MEANS FOR SELF-PRIMING PUMPS

Albert C. Stratton, Ridgewood, N. J., assignor to Alfred S. Mariow, Ridgewood, N. J.

Application January 30, 1939, Serial No. 253,540

2 Claims. (Cl. 103—113)

My invention relates to improvements in a priming means for self-priming pumps. It relates more particularly to impeller type pumps. Such pumps are constructed so as to pump and operate at levels higher than the level of the liquid to be pumped. Such pumps must therefore prime themselves without external means and do so by automatically exhausting all air and/or gas from the suction line.

The first object accomplished by my said invention is that it simplifies the present construction of said types of pumps, thus permitting an unusually small pump case and other parts, which make for better portability and low manufacturing costs. A second object is that it exhausts the air from the suction line much more rapidly than is presently accomplished, and thus the pump is put in operation in a minimum amount of time. A third object is that it develops within itself a high vacuum thus enabling the pump to prime itself when operating on unusually deep suction lifts. A fourth object is to enable the pump to prime and to reprime itself automatically, repeatedly, as may be required when the supply to the pump suction is less than the pump capacity. A fifth object is to pump a maximum amount of air during the priming period and also deliver the full capacity of the impeller when pumping. A sixth object is the elimination of adjustable or moving parts other than the pump impeller and its driving shaft.

My invention applies to all types of suction pumps of the centrifugal or impeller type and may supplant the present pumps of said types. It is also applicable to the class of pumps known as "Construction pumps" as covered by my former patents #2,059,288 and #2,100,365. Said latter class of pumps calls for a high capacity performance, dependability, and light weight for portability.

One form of my invention is illustrated in the accompanying drawings in which Figure 1 shows a longitudinal section through pump unit. Figure 2 is a section on line 2—2 of Figure 1. Figure 3 is a fragmentary section of a modification showing a different form of the impeller. Figure 4 is a fragmentary section showing a modified form of the impeller housing.

Reading on Figures 1 and 2 of my drawings they consist of pump housing 10, having a suction inlet 11, and a suction passage 12, a check valve 13 and an impeller entrance 14. Impeller 15 is supported and driven by shaft 27 and rotates within volute 17. Volute 17 has a discharge opening 18 connecting to the interior of pump housing 10. A case closing flange 19 forms a portion of the pump volute. Slots 22 extend substantially all around the outer periphery of the volute wall and are constructed to be in radial alignment with clearance 23 at the forward face 24 of impeller 15. The impeller housing 25 has an extended box-shape connection 25' extending to connect with the suction inlet at check valve 13. Impeller 15 is supported and rotated by shaft 27 which may be connected to any convenient power. Shaft 27 is supported on suitable bearings 28 in bearing housing 26. Shaft 27 is sealed at its entrance into end closing flange 19 by conventional stuffing box 16.

Figures 3 and 4 illustrate two modifications of my invention. Figure 3 shows a section of the impeller with volute closing case 17. The impeller vane faces 24 have projecting edges 29. Figure 4 shows a section of the impeller with closing case as one piece abutting directly the cover plate 19 and carrying slots 31 within itself. In all the forms shown it is understood that the slots 22 and 31 can be substituted by port openings of other shapes located in the outer periphery of the volute housing. Furthermore, while for purposes of construction it is desirable to provide clearance 23 at the front of impeller 15, tests have shown that clearance 23 may be provided at the back face of the impeller 15 with slots 22 arranged in alignment with clearance 23.

In the operation casing 10 is filled through opening 20 with water or other liquid so that all of volute 17 is submerged. The impeller 15 is caused to rotate, developing a centrifugal action which causes the liquid in impeller entrance 14 and suction passage 12 to be discharge through volute outlet 18 into chamber 21 of pump housing 10. The interior of volute 17 having been emptied of liquid the rotating impeller will not permit the liquid to flow back into volute outlet 18. At this time slots 22 are subject to the pressure of liquid on the outside of the volute 17, and also a lower pressure of air or gas within volute 18, with a resulting flow of liquid through slots 22 inward radially toward the clearance 23 at the front of impeller 15. The combined spray action of the liquid flowing inwardly through slots 22 together with the intense spray induced as the radial flow of liquid strikes the spinning face 24 of impeller 15 produces a mixture of air and/or gas and liquid which is caught by the rotating impeller 15 and thrown outward by centrifugal force into volute 17 and discharged through opening 18 of volute 17. This action rapidly exhausts the air and/or gas from entrance 14, and

suction passage 12, and also from the suction hose or piping which may be connected to inlet 11, thus creating a partial vacuum within said passages. As the vacuum increases, due to the continual exhausting of air as just described, liquid will be raised up the suction hose, or pipe until it flows down passage 12, through check valve 13 and into impeller 15. When all air and/or gas is thus exhausted from the suction line the pump is "primed," and will continue to pump liquid until air and/or gas is admitted to the foot of the suction line. When the pump is primed liquid will then flow outward through the vane passages 24' of impeller 15, filling the interior of volute 17. The water and/or liquid filling volute 17 forms a barrier to the inflow of priming liquid through priming slots 22, and as the pump builds up to full discharge pressure, the flow of liquid inwardly through slots 22 is stopped and reversed by reason of the pressure within volute 17, resulting from the velocity of liquid flow imparted by impeller 15 and the liquid drafted by the pump through suction inlet 12 is discharged into the interior 21 of pump housing 10, through both slots 22, and volute outlet 18. Simultaneously pressure is built up within pump housing 10 and liquid is discharged through outlet 20. The pump, having thus automatically exhausted the air from the suction connection and pump interior, will continue to discharge liquid until air and/or gas is again admitted to the suction connection. Immediately upon the admission of sufficient air and/or gas to cause the liquid passages 24' of impeller 15 and the interior of volute 17 to be occupied by air and/or gas instead of liquid the pump will temporarily cease discharging and the lower pressure of the air and/or gas within volute 17 causes an inward flow of the liquid within chamber 21 through slots 22 as just described, to reestablish the prime.

This automatic cyle of operation to establish the prime will occur whenever the pump is started up, after which the pump will discharge liquid as long as the supply is adequate, or will occur at frequent intervals if the supply is less than the capacity of the pump.

Referring again to Figure 1 the faces 24 of impeller 15 face the enclosing wall 25 with clearance space 23 interposed. It will be seen that when the interior of volute 17 and impeller passages 24' are occupied by air and/or gas, the priming liquid jettied through slots 22 will be free to enter clearance 23, as before described, and as the total open area of slots 22 is proportioned to permit a flow of liquid substantially less than the capacity of the impeller, the flow inwardly through slots 22 cannot alone fill the vane passages 24 or interior of volute 17 during the priming cycle. However, when all air and/or gas has been exhausted and the impeller is delivering liquid, wall 25 forms a portion of impeller passage 24' and by reason of the centrifugal action of impeller 15, liquid will flow outwardly in clearance 23. Thus when the pump is discharging there is no appreciable loss of pumping efficiency. Referring again to Figure 3 the impeller may be provided with the front faces 24 of impeller 15 having projecting edges 29 on the inner periphery to aid in providing a finely divided spray of the liquid entering through slots 22 and flowing through clearance 23 during the priming cycle. This action increases the ability of the pump to exhaust air and/or gas and therefore shorten the time required by the pump to prime automatically.

My invention therefore provides a new and useful means for constructing a centrifugal pump, capable of automatically discharging liquid, or air and/or gas or a mixture of both, and having within itself no moving, or adjustable parts, other than the pump impeller, for the control, starting and stopping of the priming cycle.

Experiments and preliminary tests have shown that the priming means herein described shows a marked improvement in the speed of automatic priming, as well as an improvement in delivered pump capacity over systems now in use. Tests further show that there is a preferred area of the priming slots 22 which must be determined by experiment for each size of pump constructed.

While I have illustrated my invention in different ways and using different materials and means, still I do not intend to limit myself to those particular means, designs, methods or materials, as it is apparent that other means, designs, methods, and materials may be employed for obtaining the same results within the scope of any claim without departing from the scope or spirit of my invention.

I claim:

1. A priming means, for self-priming pumps, as herein described, comprising an enclosing case, a volute housing within said enclosing case, an impeller having vanes arranged to rotate within said volute housing, the forward edges of said impeller vanes having portions extending into a clearance space adjacent the forward edge of said impeller vanes, ports in the outer periphery of said volute housing to permit liquid within said enclosing case to be jettied into and across the open passage of said volute, and into said clearance to create a finely divided mixture of gas and liquid within said impeller, to effect the priming of said pump.

2. A priming means for self-priming pumps, as herein described, comprising an enclosing casing, a volute housing within said enclosing casing, an impeller arranged to rotate within said volute housing and openings in the outer periphery of said volute housing in alignment with a clearance space between the face of said impeller and said volute housing through which liquid retained within said enclosing casing is sprayed radially into and across the open passage of said volute and into said clearance space for reentry into the impeller passages as a finely divided mixture of gas and liquid.

ALBERT C. STRATTON.