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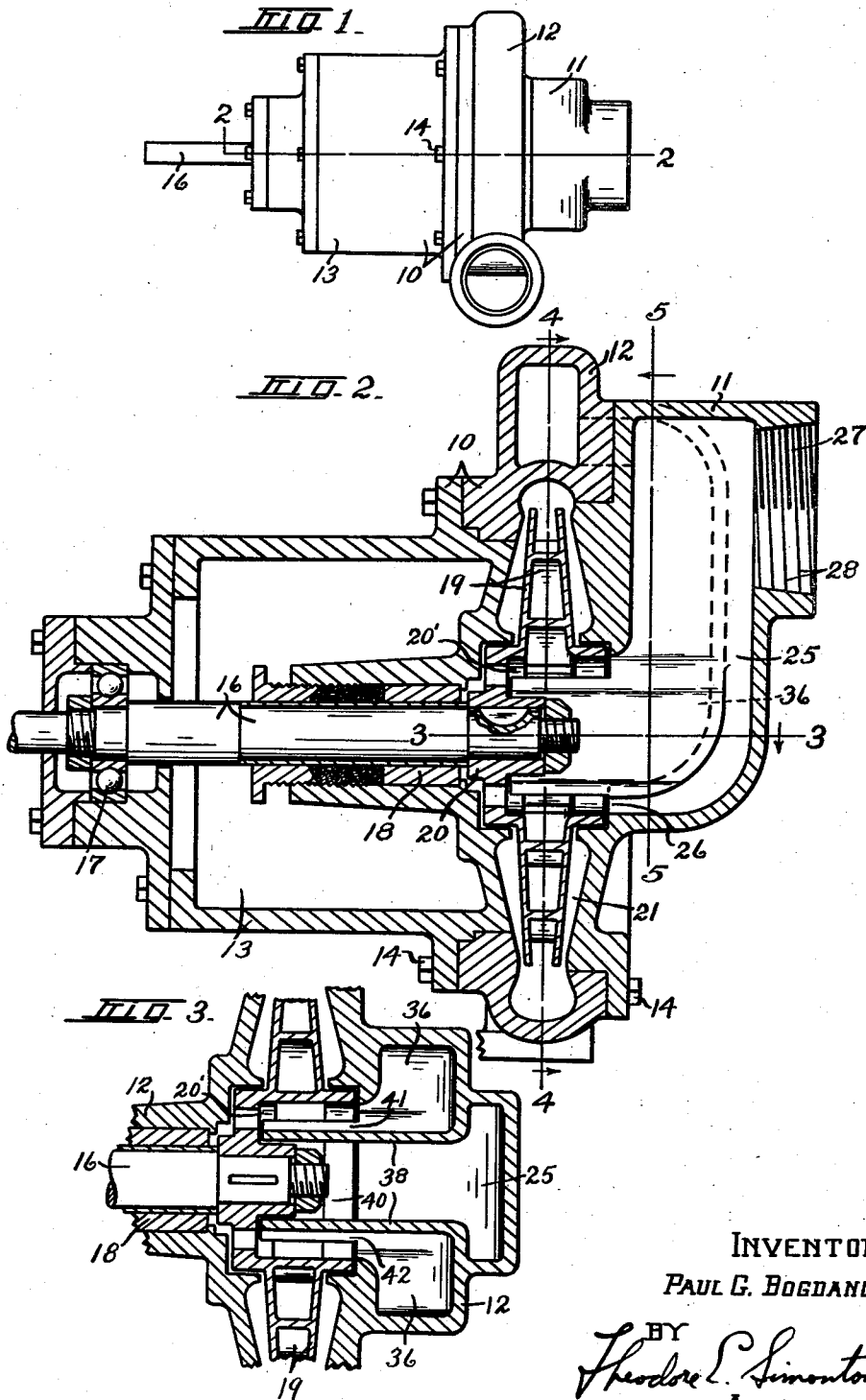
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SELF-PRIMING CENTRIFUGAL PUMP

Filed Nov. 12, 1938

2 Sheets-Sheet 1



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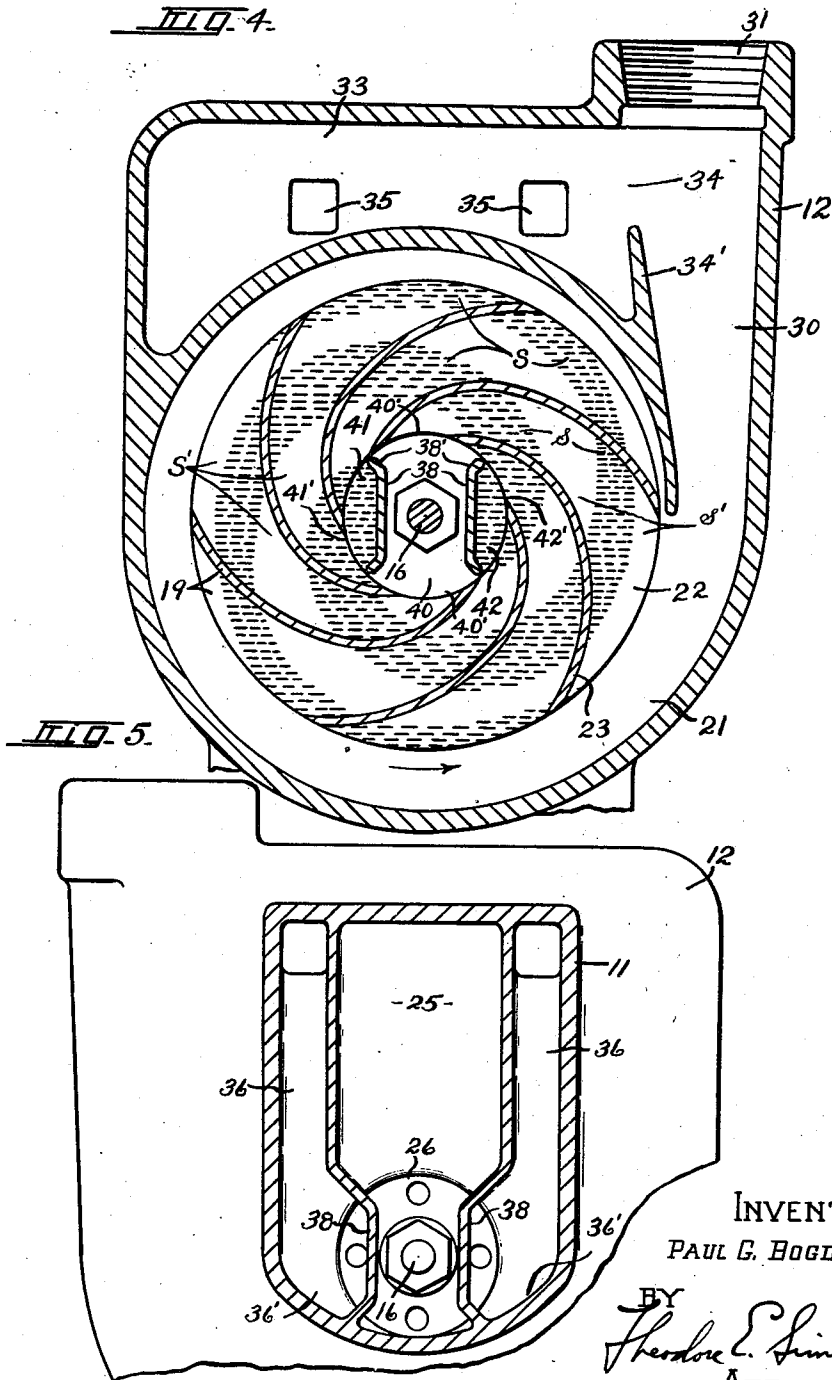
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UNITED STATES PATENT OFFICE

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SELF-PRIMING CENTRIFUGAL PUMP

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1 Claim. (Cl. 103—113)

This invention relates to a self-priming centrifugal pump in which a vane impeller is rotatably mounted in a circular pump chamber, having an inlet passage arranged substantially in alignment with the axis of rotation of the impeller and a discharge passage leading from the chamber in more or less tangential relation therewith.

Centrifugal pumps of the above mentioned class have heretofore been provided with a self-priming feature but, insofar as applicant is aware, these pumps have been so constructed that the priming liquid is introduced to the impeller in such a manner that this liquid becomes impregnated or more or less mixed or diluted with the air being drawn into the pump or impeller chamber during the priming operation. This diluting the priming liquid with a compressible fluid reduces the efficiency of the liquid and thereby prolongs the priming operation.

The main object of this invention is to produce a self-priming fluid pump of the centrifugal type wherein the priming liquid will be introduced to the vanes of the impeller in an improved manner so as to obtain maximum action of the priming liquid without decreasing the efficiency of the pump an excessive amount.

Another object of the invention is to produce a pump of the above mentioned class which is simple, inexpensive and durable in construction and which does not require attention or adjustment during operation.

A more specific object of the invention is to provide means for delivering the priming liquid to the impeller in substantially the same efficient manner as the fluid being pumped so as to eliminate to a maximum degree resistance to the operation of the impeller and thereby contribute to the maximum efficiency of the pump.

Another object of the invention is to maintain the priming fluid and the fluid being pumped separate and distinct from each other during the entrance of said latter fluid into the impeller chamber and until after the priming fluid has entered the space between the impeller vanes.

A further object of the invention resides in so constructing the pump that the priming fluid and the fluid being pumped will be intermittently introduced into the spaces between the impeller vanes in alternate relation with each other so that each space defined by the impeller vanes will contain alternate quantities of priming fluid, as water, and the fluid, as air, being pumped through the intake conduits of the pumping system. In other words, I have produced a pump-

ing mechanism wherein the priming fluid, as water, and the air being drawn into the pump chamber enter between the impeller vanes in slugs, and the slugs of water alternate with the slugs of air and these slugs of water function as incompressible pistons as they move outwardly through said passages to create a suction at the rear thereof which draws the air from the intake conduits of the pumping system and produce a rapid priming action.

I attain these objects by mechanism illustrated in the accompanying drawings, in which:

Figure 1 is a plan view of a centrifugal pump embodying the various features of this invention.

Figure 2 is a longitudinal transverse sectional view taken on line 2—2, Figure 1, illustrating the pump on a larger scale.

Figure 3 is a detail horizontal sectional view taken on line 3—3, Figure 2.

Figure 4 is a vertical sectional view through the impeller chamber taken on line 4—4, Figure 2.

Figure 5 is a detail vertical sectional view taken on line 5—5, Figure 2.

As illustrated in the drawings, the pump comprises a casing 10 composed of sections 11, 12 and 13 secured together, as by bolts 14. The drive shaft 16 is mounted in suitable bearings 17 and 18 carried by the case section 13 and has secured to the inner end thereof an impeller or rotor 19. The impeller 19 operates in a volute pumping chamber 21 formed, as shown in Figure 2, between the case sections 11, 12 and 13. The impeller 19 is of the closed type having the usual spiral passages 22 separated by the spiral walls or vanes 23, as shown more particularly in Figure 4. The base or inner ends of the impeller vanes are arranged in registration with the peripheral surface of an annular recess 20' formed in the outer or inlet side of the hub 20 of the impeller 19.

The pump is provided with a vertically disposed inlet chamber 25 formed in the case section 11. Chamber 25 is provided with a circular outlet opening or passage 26 of substantially the same diameter as the recess 20' provided in the hub of the impeller 19 and which communicates with the pump chamber 21 in substantial alignment with the axis of rotation of the shaft 16 and impeller 19. The upper end of the inlet chamber 25 is provided with an inlet opening 27 arranged above the opening 26 and eye of the impeller. The inlet opening 27 may, as shown in Figure 2, be provided with internal screw threads 28 by which a suitable intake conduit

(not shown) may be secured to the pump case 10.

The pump is provided with a vertically disposed discharge passage 30 formed in the case section 12 to extend from one side of the pump chamber 21 in substantial tangential relation thereto. The discharge passage increases in cross sectional area from the chamber 21 upwardly and has the upper end thereof provided with an outlet opening 31 which, as indicated in Figure 4, may be provided with internal screw threads whereby a discharge conduit may be readily connected with the pump case. The pump case section 12 is also provided with a substantially horizontally disposed storage chamber 33 for priming fluid formed therein over the pump chamber 21, as illustrated in Figure 4. The chamber 33 is maintained in communication with the discharge passage 30 by an inlet port 34 formed in the case wall 34' separating said chamber from the discharge passage. The chamber 33 is also provided with a pair of outlet ports 35 arranged at opposite sides of the vertical plane passing through the axis of the drive shaft 16 and impeller 19.

The outlet ports 35 are in communication with the upper ends of a pair of outlet passages 36 formed in the case section 11 at opposite sides of the inlet chamber 25. The passages 36 extend downwardly from the ports 35 in substantially parallel relation with each other and have the lower ends thereof provided with laterally disposed portions 36' extending inwardly toward each other at diametrically opposite sides of opening 26, as shown more particularly in Figure 5.

The casing section 11 is provided with a pair of substantially flat fins 38 arranged adjacent the opening 26 at the inner adjacent sides of passages 36', and extend forwardly from said opening in substantially parallel relation into the pump chamber 21 or rather into the impeller recess 20' at diametrically opposite sides of the shaft 16 to a position beyond the base or inner ends of the impeller passages 22, as indicated in Figures 2 and 3. These fins 38 cooperate with the peripheral wall of recess 20' to divide the outlet opening 26 of the inlet chamber 25 into three separate and distinct compartments or passages 40, 41 and 42. The compartment 40 is in communication with the inlet chamber 25 and is arranged between the compartments 41 and 42 for guiding the fluid entering the pump chamber 21 from the inlet chamber 25 to the base portion of the impeller passages 22. The compartments 41 and 42 are arranged at diametrically opposite sides of the compartment 40 and are adapted to maintain the passages 36 in communication with the base portions of the impeller passages 22.

The longitudinal side portions of the fins 38 are preferably slightly curved upwardly, as at 38', Figure 4, so as to extend substantially radially from the axis of the shaft 16. These portions 38' are arranged with their outer edge surfaces in substantially the plane of the adjacent peripheral surfaces of the opening 26 and impeller recess 20' so as to be in close proximity to the path of movement of the inner ends of the pump vanes 23 during rotation of the impeller. In other words, the inner disposed compartment 40 formed by the fins 38 provides a passage for the fluid being drawn into the pump chamber 21 and is separate from the passages or compartments 41 and 42 for the priming fluid passing through the passages 36 from the chamber 33.

This structure of the compartments 40, 41 and 42 provides the compartment 40 with two outwardly facing discharge openings 40' arranged at diametrically opposite sides of the impeller recess 20', while compartments 41 and 42 are each provided with one outwardly facing discharge opening 41' and 42', respectively. Openings 41' and 42' are also arranged at diametrically opposite sides of the recess 40' and in substantially right angular relation to the openings 40'. The circumferential lengths of openings 40' and 40', 41' and 42' may, as shown in Figure 4, be substantially equal although it will be understood that these lengths may be changed if desired by varying the positions of the outer deflected longitudinal edge portions 38' of the fins 38 so that openings 40' and 40' will be of greater or less circumferential length than openings 41' and 42'. It will now be observed that the discharge openings 40' and 40', 41' and 42' are arranged in series and to face the inner or butt ends of impeller vanes 23 so as to be swept in succession by said vanes during rotation of the impeller.

Before being operated the pump is substantially filled with priming fluid, as water, which may be supplied to the pump in any suitable manner as through a suitable filler passage provided in the outlet pipe or conduit (not shown) connected with the opening 31 or the priming fluid may consist of the water remaining in the pump after the completion of the previous pumping action. This priming water substantially fills the chamber 33, discharge passage 30, passages 36, pump chamber 21 and the inlet chamber 25 so that when the shaft 16 is rotated the impeller 19 withdraws the water from the compartments 40, 41 and 42 and forces it through the impeller passages 22 into the pump chamber 21 and thence upwardly through the discharge passage 30. As the water thus passes up through the passage 30 it increases in volume and overflows into storage chamber 33. Any excessive amount of water which may have been in the pump will be discharged through the outlet opening 31. As soon as the water in the inlet chamber 25 has been drawn below opening 26, air is sucked in through the pipe connected to the inlet 27 and through the chamber 25 and compartment or passage 40 into the impeller passages 22 during the registration of said passages with the discharge openings 40' and 40'. At the same time, the priming water entering the compartments 41 and 42 from the chamber 33 through the passages 36 will enter the impeller passage 22 passing over the discharge openings 41' and 42' of the compartment 41 and 42. These quantities of water and air in the impeller passages 22 will be moved outwardly through said passages in spiral paths, as indicated at S and S', respectively, in Figure 4, due to the centrifugal and circumferential action produced thereon by the impeller vanes.

It will thus be seen that the quantities of water and air in each impeller passage 22 will be in the form of slugs s and s' arranged in alternate relation with each other so that as the slugs of water are thus moved outwardly through the passages 22 they function as incompressible pistons to produce a partial vacuum at the rear sides thereof as the passages register with the discharge passages 40' and 40' of the compartment 40 and suck air from said discharge passages and compartment and, consequently, draw the air from the inlet pipe or conduit (not shown) connected

with the inlet opening 27 and inlet chamber 25.

It will thus be seen that the impeller passages 22 will be provided with alternate slugs s and s' of water and air and as the slugs pass outwardly between the vanes of the impeller into the peripheral portion of the pump chamber 21 they will then be forced upwardly through the discharge passage 30. As the air and water approach the outlet opening 31, the air is separated from the water and escapes through the outlet 31. The water, due to the atmospheric pressure contained in outlet opening 31, will overflow through port 34 into the storage chamber 33. The water thus collected in the chamber 33 is re-circulated through the passage 36 and compartments 41 and 42 to be again picked up by the action of the impeller as the blades sweep across the discharge passages 41' and 42' of said compartments to form additional slugs s which function in the above described manner for drawing the air from the inlet conduit until such air is completely withdrawn and the conduit and the pump are entirely filled with water. Water will thereafter continue to be re-circulated from the chamber 33 through the impeller which will decrease the efficiency of the pump to a slight degree, but this loss in efficiency of the pump is unimportant in comparison with the desirability of having a simple, self-priming pump which will automatically function without requiring attention of an operator or the manipulation of certain control elements or valves as is often the case with pumps

of this character which are of conventional construction.

Although the construction and operation are particularly simple, practical and efficient, I do not wish to be limited to the exact details of said construction shown as it is evident that various changes may be made therein without departing from the spirit of the invention as set forth in the appended claim.

I claim:

In a centrifugal pump, a casing provided with a pump chamber having an inlet eye at its center and a volute surrounding said pump chamber with an upright outlet passage leading therefrom, a vane impeller rotatably mounted in the pump chamber with its axis of rotation in line with said inlet eye, an inlet passage communicating with said inlet eye at diametrically opposite sides of said axis of rotation of the impeller, a storage reservoir in said casing for priming liquid spaced from and arranged above said pump chamber and having a restricted inlet passage communicating with the outlet passage above the volute for receiving priming liquid from said latter passage, said case having additional passages extending downwardly from the reservoir at opposite sides of the inlet passage separated therefrom and from said discharge passage and communicating with said inlet eye at opposite sides of said inlet passage for the purpose set forth.

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