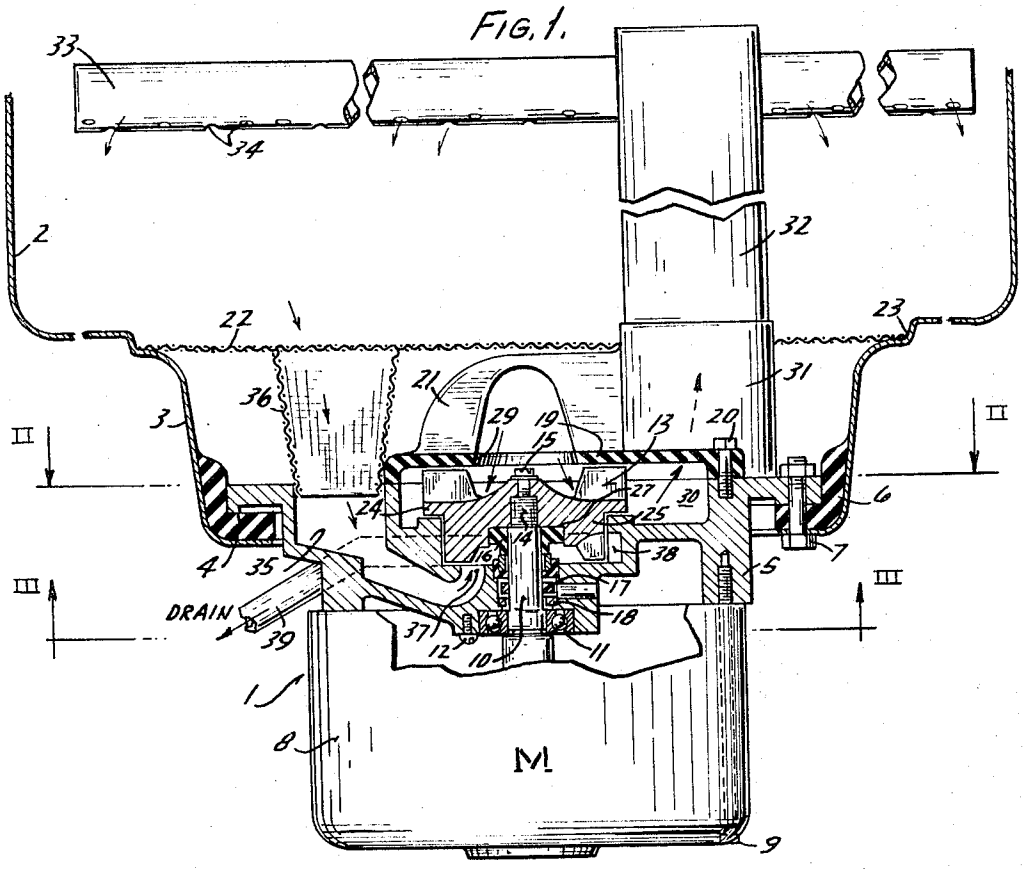
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FIG. 1.



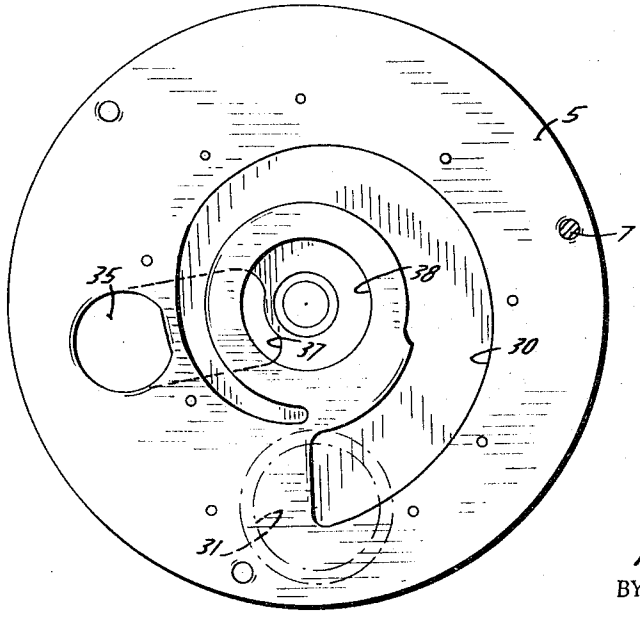


FIG. 2.

INVENTOR.
ROBERT L. BELONGER
BY
ANDRUS & STARKE
ATTORNEYS.

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FIG. 3.

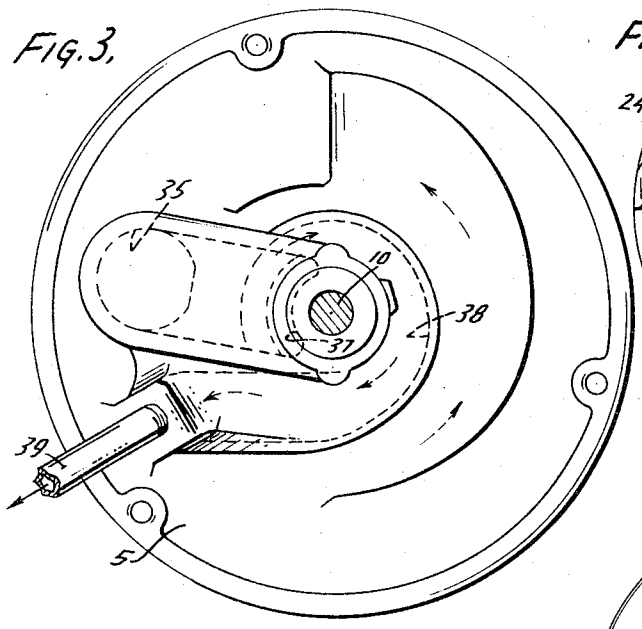


FIG. 4.

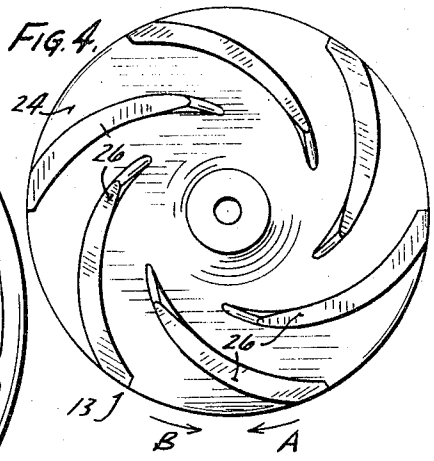


FIG. 5.

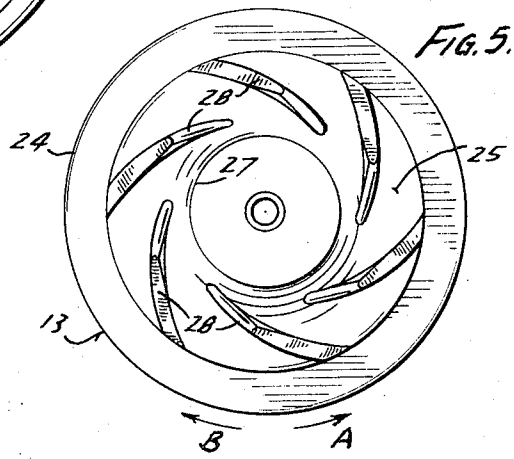
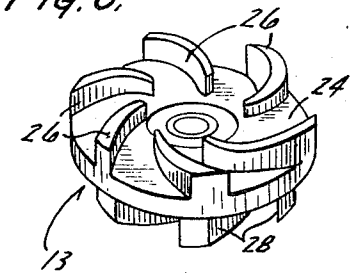


FIG. 6.



INVENTOR.
ROBERT L. BELONGER
BY
ANDRUS & STARKE
ATTORNEYS.

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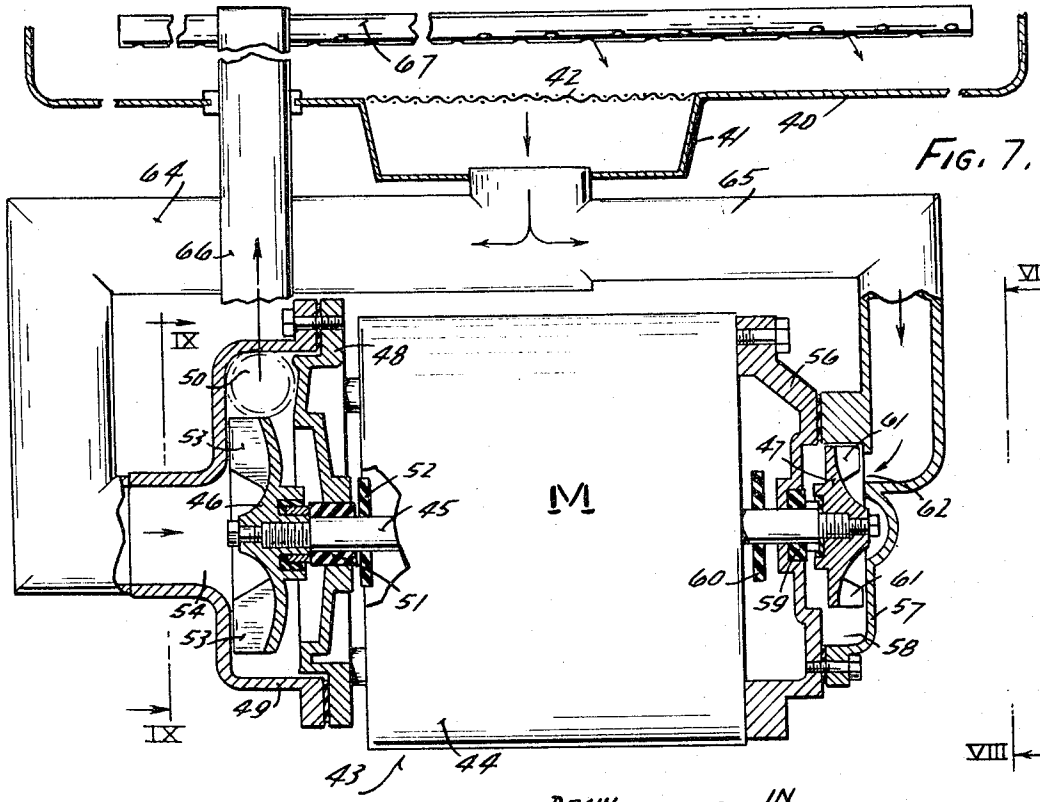


FIG. 7.

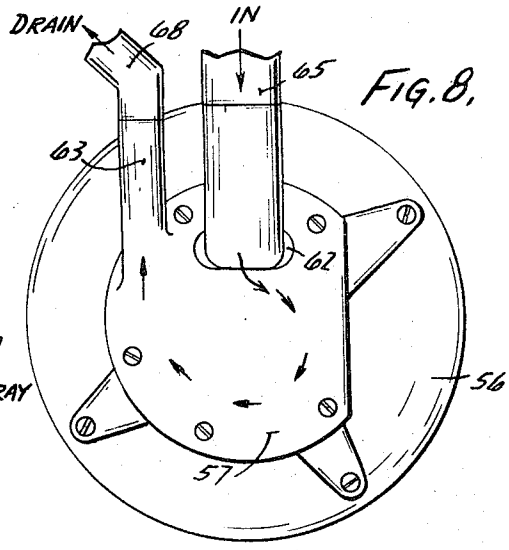
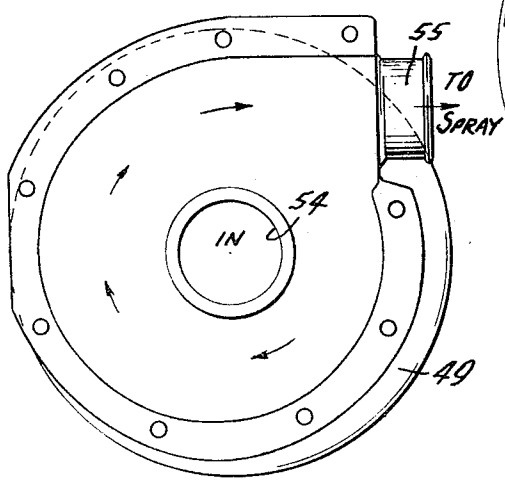


FIG. 8.

FIG. 9.



INVENTOR.
ROBERT L. BELONGER
BY
ANDRUS & STARKE
ATTORNEYS.

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Robert L. Belonger, Delavan, Wis., assignor to Sta-Rite Products, Inc., Delavan, Wis., a corporation of Wisconsin

Filed June 18, 1964, Ser. No. 376,008
4 Claims. (Cl. 103—3)

This invention relates to a pump construction and more particularly to a dual impeller pump designed to perform two separate pumping operations.

In a dishwashing machine or clothes washing machine, two pumps and two motors are generally used. One pump is employed to circulate water to the tub during the wash and rinse cycles, while a second pump is used to drain the water from the tub after the wash and rinse cycles are completed.

The present invention is directed to a single motor, dual-purpose pump for use in a dishwashing machine, or the like, which not only circulates water to the tub during the wash and rinse cycles, but also drains the water from the tub at the end of the washing operation. More specifically, the pump construction of the invention includes a double impeller unit which is secured to the motor drive shaft and located within an impeller housing. The double impeller unit is formed of two integral back-to-back impellers, a circulating-water impeller and a drain impeller. A series of blades or vanes are mounted on each impeller and the blades of each impeller are curved in the opposite direction.

An inlet is provided in the impeller housing which provides communication between the sump of the tub and the center of the circulating-water impeller and, during the wash and rinse cycle, water is drawn from the sump and discharged by the circulating impeller under a substantial pressure head to the spray arm of the dishwasher. The housing is also provided with a drain inlet which provides communication between the sump of the tub and the drain impeller. Water from the sump is introduced to the drain impeller at a location between the axis of the drain impeller and the periphery and, during the drain cycle, water is discharged by the drain impeller through a drain line and a trap to the sewer line.

During the wash and rinse cycles, the impeller unit is rotated in a direction such that the circulating-water impeller acts to develop a positive pumping force to circulate water through the spray arm into the tub. During this period, the drain impeller is operating in a direction which develops only a small pressure head insufficient to discharge water through the trap to the sewer.

When the washing cycle is completed, the motor is reversed so that the drain pump then operates in a direction to provide a positive pumping action with a substantial pressure head so that water will then be drawn from the sump and discharged through the trap to the sewer. During the drain period, the circulating-water impeller is rotating in a direction which acts to develop only a small pressure head so that only a negligible quantity of water will be discharged through the spray arm during the time when the tub is being drained by the drain impeller.

The present invention provides a pumping structure utilizing a single motor which performs the dual function of circulating water during the washing cycle, as well as draining water from the tub at the completion of the washing operation. The use of a single motor substantially reduces the overall cost of the dishwashing machine or other appliance. A further cost advantage is that the drive shaft of the motor is directly coupled to the double impeller unit which eliminates the more complicated drive systems that are frequently used in appliances of this type.

The motor-pump unit is an integral structure and can be

readily disconnected from the tub for replacement or service.

The use of the one-piece impeller, having oppositely curved vanes or blades on opposite faces, provides a stronger and easier to balance impeller construction. Furthermore, by making the two impellers integral, only a single shaft seal is required and the problem of leakage between the impellers is eliminated.

Other objects and advantages will appear in the course of the following description.

The drawings illustrate the best mode presently contemplated of carrying out the invention.

In the drawings:

FIG. 1 is a fragmentary, vertical section of the motor-pump unit of the invention, as incorporated in a dishwashing machine;

FIG. 2 is a horizontal section taken along line 2—2 of FIG. 1;

FIG. 3 is a horizontal section taken along line 3—3 of FIG. 1;

FIG. 4 is a plan view of one face of the impeller unit showing the blades of the circulating-water impeller;

FIG. 5 is a plan view of the opposite face of the impeller unit showing the blades of the drain impeller;

FIG. 6 is a perspective view of the impeller unit;

FIG. 7 is a fragmentary side elevation with parts broken away showing a modified form of the pump construction as associated with a dishwashing machine;

FIG. 8 is a view taken along line 8—8 of FIG. 7; and

FIG. 9 is a view taken along line 7—7 of FIG. 7.

The drawings illustrate a motor-pump unit 1 associated the impeller housing 5 of the motor-pump unit 1. The tub 2 is provided with a well or sump 3 and the sump terminates in a horizontal flange 4 which serves to support the impeler housing 5 of the motor-pump unit 1. The housing 5 is sealed to the flange 4 by an annular gasket 6 and is secured to the flange by a series of bolts 7.

The motor-pump unit 1 includes a reversible electrical motor 8 which is secured to the lower surface of the impeller housing 5 by a series of bolts 9. The drive shaft 10 of the motor 8 extends upwardly and is journalled within a bearing assembly 11 mounted within a recess in the housing 5. The bearing assembly 11 is retained within the recess in the housing by a series of retaining screws 12.

A double impeller unit 13 is located within the housing 5 and is secured to the upper end of the motor drive shaft 10. As best shown in FIG. 1, the upper end 14 of drive shaft 10 is threadedly engaged within an opening in the impeller unit 13, and a screw 15 is threaded within an opening in the upper end of the impeller unit. In order to prevent the impeller unit 13 from loosening on reversible rotation of the motor, the upper threaded end 14 of the drive shaft 10 has a lefthand thread, while the screw 14 is provided with a righthand thread.

To prevent water and other foreign material from entering the motor, a conventional seal assembly 16 is disposed around the motor shaft 10 beneath the impeller unit. In addition to the seal assembly, a sand slinger 17 is secured to the shaft 10 beneath the seal, and a felt packing 18 is mounted on the wall of the housing 5 around the shaft 10. The sand slinger 17 tends to sling water or other foreign material outwardly against the wall of the housing where it falls downwardly and is absorbed in the felt pad 18. The seal 16, sand slinger 17 and felt packing 18 are of conventional construction.

The upper end of the impeller housing 5 is enclosed by a plastic cover plate 19 which is secured to the housing by a series of bolts 20.

As best shown in FIG. 1, a support arch 21 extends upwardly from the housing 5 and supports a screen 22 which extends across the upper end of the sump 3 and

is supported on an annular shoulder 23 formed in the tub 2.

According to the invention, the double impeller unit 13 is formed of two integral impellers, an upper circulating-water impeller 24 and a lower drain impeller 25 which has a smaller diameter than the upper impeller 24. As best shown in FIGS. 4 and 6, the upper impeller 24 is provided with a series of generally curved blades 26 or vanes which terminate at the periphery of the impeller 24. As shown in FIG. 5, the lower impeller 25 is provided with a central recess 27 which receives the seal assembly 16 and a series of generally curved blades 28 or vanes are mounted on the lower surface of the impeller 25. The blades 28 extend from adjacent the recess 27 to the periphery of the lower impeller 25 and are curved in the opposite direction from the blades 26.

As best shown in FIGS. 4 and 5, when the impeller is rotated in the direction A, the blades 26 of the circulating-water impeller 24 operate to develop a substantial pressure head, while the blades 28, when rotated in the direction A, operate to produce a negligible pressure head. Conversely, when the impeller unit 13 is rotated in the direction B, the blades 26 will develop only a small pressure head, while the blades 28, when moving in the direction B, will operate to produce a positive pumping force.

Water is drawn to the impeller 24 through an inlet opening 29 formed in the cover plate 19. The inlet opening 29 is disposed axially with respect to the impeller unit 13. The blades 26 act to discharge the water tangentially through a discharge chamber or volute 30 and then through a vertical outlet 31 formed in the housing 5. Outlet 31 is connected by a vertical pipe 32 to spray arm 33 located in tub 2, and the water is discharged into the tub through a series of openings 34 in the spray arm and then returns to the sump 3 where it is recirculated by the impeller 24.

Water is drawn to the drain impeller 25 through a drain passage 35 formed in the housing 5. A generally conical screen 36 is located within the open upper end of the passage 35 and prevents foreign material from passing downwardly into the drain passage.

The drain passage 35 terminates in an inlet opening 37 which is located between the axis and the periphery of the impeller 25. The water is discharged by the blades 28 through a volute or discharge chamber 38 to a drain-pipe 39 which extends through a trap, not shown, to the sewer line.

Generally, the inlet 37 is positioned approximately midway between the axis and periphery of the impeller 25. With the inlet opening in this position, the impeller 25 has an efficiency of about 3% when rotating in direction A. If the inlet opening 37 is located axially of the drain impeller 25, the impeller will be about 10% efficient and may develop a sufficient pressure head during the wash and rince cycle (when rotating in the direction A) to cause the water to spill over through the trap to the sewer. Conversely, if the opening 37 is positioned adjacent the periphery of the blades 28, an insufficient pressure head will be developed during the drain cycle (when rotating in direction B) so that water will not be drained through the trap.

The volute portion of the discharge chamber 38 extends only approximately 180°. Normally, a volute section will extend 360°, but only a 180° volute section is employed with drain impeller 25 so that the velocity of the water will be reduced.

During the wash and rinse cycle, the impeller unit 13 rotates in the direction A and water is drawn from the sump 3 through the opening 29 by the upper or circulating-water impeller 24. The water is discharged outwardly by the blades 26 with a head of approximately 35 to 38 feet of water through the volute 29 and passes an outlet pipe 31 to the spray arm 33. The water is sprayed through the openings 34 in spray arm 33 and is returned to the sump 3 where it is recycled by the impeller 24.

During the washing and rinsing cycles, water from the sump fills the inlet passage 35 to the drain impeller 25. As the inlet opening 37 is located intermediate the axis and periphery of the impeller 25, and as the impeller unit is operating in the direction A, as shown in FIG. 5, the lower impeller 25 will not develop a sufficient head to drive the water through the trap to the sewer. However, sufficient pressure is developed by the impeller section 25, when rotating in direction A, to prevent sewer odors from backing up into the dishwashing machine.

After the washing cycle has been completed, the motor is reversed for the drain cycle and the impeller unit 13 will then operate in the direction B, as shown in FIGS. 4 and 5. This rotation causes the lower or drain impeller 25 to develop a substantial pressure head, generally about 18 feet of water, and discharge the water through the trap to the sewer drain. During the drain cycle, the impeller 24 is being rotated in the direction B in an inefficient manner, so that water from the sump, for the most part, merely swirls around within the housing 5 and only a negligible head is developed. The head developed during this drain period by the upper impeller 24 may be sufficient to force a small amount of water upwardly through the spray arm 33, but as the water in the sump 3 is being drained to the sewer by impeller 25, this small amount of water passing through the spray arm is of no consequence.

FIGS. 7, 8 and 9 illustrate a modified form of the invention in which the impellers are separated and are mounted on opposite ends of the motor drive shaft. In this embodiment, the tub 40 of a dishwashing machine, clothes washing wachine, or the like, is provided with a sump 41, and a screen 42 is positioned across the sump to prevent foreign material from entering the sump.

A motor-pump unit 43 is located beneath the tub 40 and includes a motor 44 having a drive shaft 45 which extends out the opposite ends of the motor 44. An impeller 46 is secured to one end of the drive shaft 45, while a second impeller 47 is secured to the opposite end of the drive shaft.

The impeller 46, which is the circulating water impeller, corresponds to impeller 24 of the first embodiment and is located within a housing which is composed of a base section 48 secured to the motor 44 and an outer housing section 49 which defines a discharge chamber or volute 50.

To seal the shaft 45 against leakage of water inwardly to the motor, a seal 51 is disposed around the shaft 45 and a sand slinger 52 is secured to the shaft inwardly of the seal. The seal 51 and sand slinger 52 are similar to the seal 16 and sand slinger 17 described with respect to the first embodiment.

The impeller 46 is provided with a series of generally curved blades 53 which are similar in construction and shape to the blades 26 of the first embodiment. Water is drawn to the impeller 46 from the sump 41 through an inlet 54 in housing section 49 which is disposed in axial alignment with the impeller 46, and the water is discharged by blades 53 through volute 50 to a discharge outlet 55.

The impeller 47 is the drain impeller and corresponds to impeller 25 of the first embodiment. Impeller 47 is located within an impeller housing composed of a base section 56 secured to the motor 44 and an outer impeller housing section 57 which is secured to the base 56 by bolts or the like. The housing section 57 defines a discharge chamber or volute 58 which is similar in shape to the discharge chamber 38, previously described. Water is prevented from moving inwardly toward the motor along the shaft 45 by a seal 59 and a slinger 60 similar to the seal 51 and slinger 52.

The impeller 47 carries a series of curved blades 61 which are similar to the blades 28 previously described. Blades 61 are curved in the opposite direction from the

blades 53 of impeller 46, so as the motor drive shaft 45 rotates in one direction, one of the impellers will be operating in an efficient manner, while the other impeller will be operating in an inefficient manner, as previously described. As in the case of the first embodiment, water from the sump is drawn to the drain impeller 47 through an inlet passage 62 which communicates with the housing section 57 at a location between the axis and the periphery of the impeller 47. The blades 61 discharge the water through volute chamber 58 to the drain outlet 63.

As in the case of the first embodiment, the inlet 54 to the water circulating impeller 46 is connected by a pipe 64 to the sump and similarly, the inlet 62 of the drain impeller 47 is connected by a pipe 65 to the sump. Outlet 55 from the impeller 46 is connected by a pipe 66 to a spray arm 67, similar to spray arm 33, while drain outlet 63 is connected by a drainpipe 68 through a conventional trap, not shown, to the sewer.

The pump shown in FIGS. 7–9 operates in a manner previously described with respect to the first embodiment. During the wash and rinse cycle, impeller 46 is rotated in a direction acting to develop a substantial pressure head and water is discharged from the impeller 46 through the spray arm 67 and recirculated to the impeller 46. During the wash cycle, the water from the sump 41 also fills the line 62, but due to the fact that the drain impeller 47 is rotating in a direction opposite to its normal pumping characteristics, the drain impeller 47 will not develop sufficient head to move the water through the trap to the sewer.

When the washing cycle is completed and the drain cycle starts, the motor is reversed thereby causing the drain impeller 47 to operate in a direction acting to develop a sufficient head to discharge water through pipe 68 to the sewer. During the drain cycle, the impeller 46 is operating in the opposite direction from its normal pumping rotation and thereby develops only a small head which is sufficient only to discharge, at the most, small quantities of water through the spray arm 67 as the water is being drained from the sump 41 by drain impeller 47.

The present pumping construction utilizes a pair of impellers which are driven by a single reversible motor. By operating the motor in one direction, one of the impellers operates in an efficient manner to develop a positive pumping force, while the other impeller operates to develop only an insignificant pressure head. Similarly, when the motor is reversed, the second impeller delivers a positive pumping force while the first impeller is relatively inactive. This construction reduces the overall cost of the unit in that only a single motor is employed to drive the two impellers and as the motor is directly connected to the impellers, costly drive mechanisms are eliminated.

The use of the one-piece impeller, as shown in FIGS. 1 and 6, provides a strong and easy to balance unit and eliminates the problem of leakage between the impellers. Moreover, only a single seal assembly is required when using the one-piece impeller and this reduces the cost and maintenance of the unit.

While the above description is directed to the use of the pump in a dishwashing machine, it is contemplated that the pump can be used in any situation where a dual pumping operation is required, such as in applications where water or other liquid is to be circulated in one portion of a cycle and drained in another portion of the cycle.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A pump assembly, comprising a liquid-containing member having an opening in the lower portion thereof, a pump casing mounted in the opening of said liquid containing member, a reversible motor connected to the casing and located on the exterior of said liquid containing member and having a drive shaft extending into said pump casing, journaling means connected to the pump casing for journaling said shaft for rotation, said pump casing defining an upper pumping chamber and a lower pumping chamber and said casing having a first inlet opening disposed generally axially of said shaft and communicating with said upper pumping chamber for supplying a liquid from said liquid-containing member to said first pumping chamber, first outlet conduit means providing communication between the periphery of said upper pumping chamber and said liquid-containing member, an impeller unit secured to the shaft and including a body having upper and lower faces, said impeller unit having a first series of blades mounted on the upper face and located within said upper pumping chamber and shaped to develop a high pressure head when said impeller unit is rotated in a first direction and shaped to develop a low pressure head when the impeller unit is rotated in the opposite direction, said impeller unit also having a second series of blades mounted on the lower face and located within said lower pumping chamber, inlet conduit means providing communication between the liquid-containing member and the lower end of the pumping chamber at a location between the shaft and the periphery of said second series of blades and cooperating with said second series of blades to develop a low pressure head when said impeller unit is rotated in said first direction and develop a relatively high pressure head when said impeller unit is rotated in the opposite direction, and drain conduit means connecting the periphery of said lower pumping chamber to a drain line.

2. The structure of claim 1 in which the trailing edges of the blade of the first series are located adjacent the periphery of the body when said impeller unit is rotated in said first direction and the trailing edges of the second series of blades are located adjacent the axis of said body when said impeller unit is rotated in said first direction.

3. The structure of claim 1 in which the circle inscribed by the outer tips of said second blades as said impeller unit is rotated is smaller than the circle inscribed by the outer tip of said first blades.

4. The structure of claim 1 in which the peripheral portion of said lower pumping chamber defines a volute extending approximately 180°.

References Cited by the Examiner

UNITED STATES PATENTS

427,060	5/1890	Edwards et al.	103—103
1,229,274	6/1917	Jack	103—104
2,814,254	11/1957	Litzenberg	103—107
2,916,997	12/1959	Terrie	103—104
3,099,992	8/1963	La Flame	134—186
3,117,523	1/1964	Jacobs	134—186
3,127,839	4/1964	Pinder	103—3

FOREIGN PATENTS

678,531	1/1964	Canada.
792,725	1/1936	France.
678,669	9/1952	Great Britain.

MARK NEWMAN, *Primary Examiner.*

SAMUEL LEVINE, *Examiner.*

W. L. FREEH, *Assistant Examiner.*