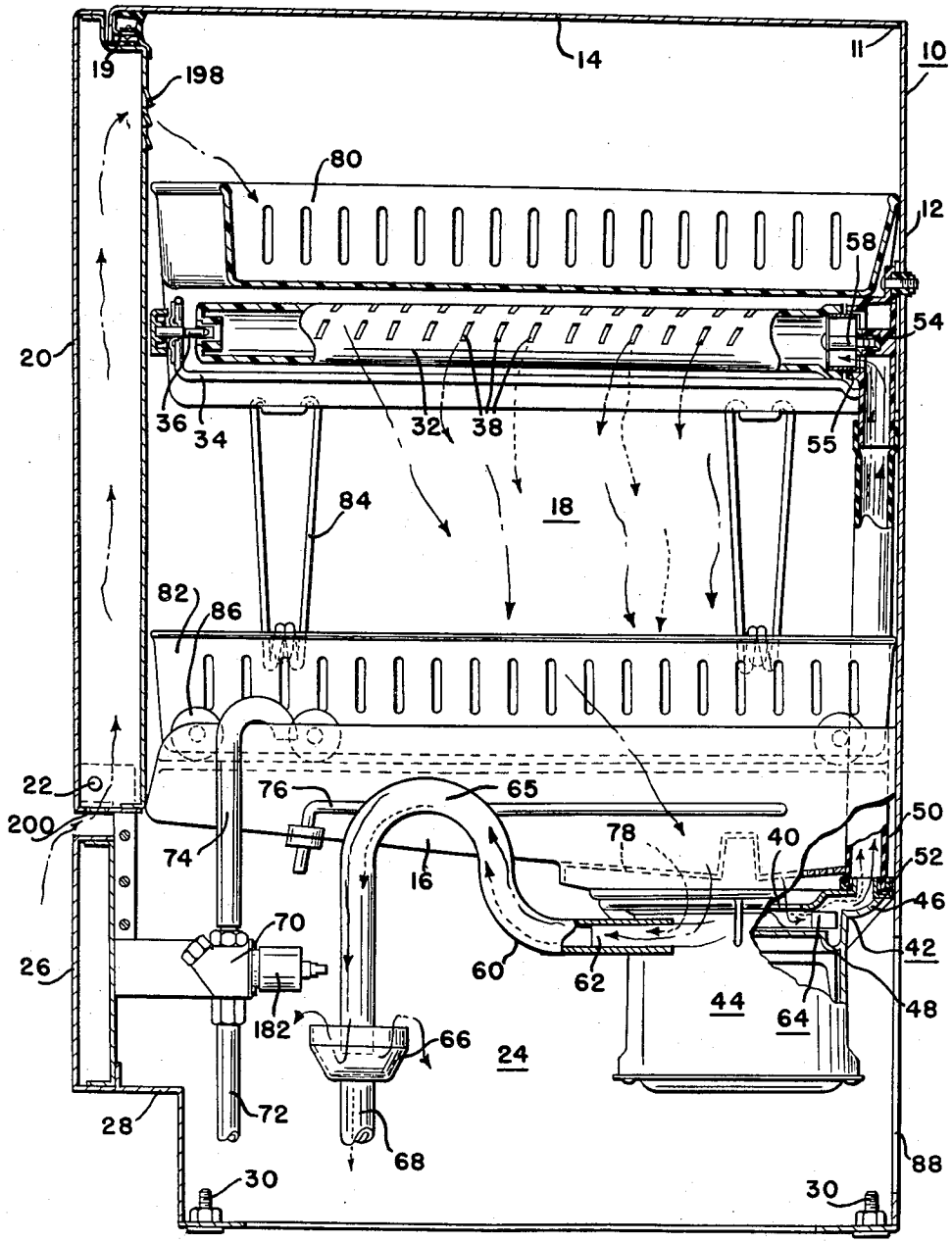
Jan. 14, 1964 J. W. JACOBS 3,117,523

FLUID DISTRIBUTION PUMP

Original Filed Feb. 9, 1959 5 Sheets-Sheet 1



--------- Water
——— Air or vapor

Fig. 1

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FLUID DISTRIBUTION PUMP

Original Filed Feb. 9, 1959 5 Sheets-Sheet 2

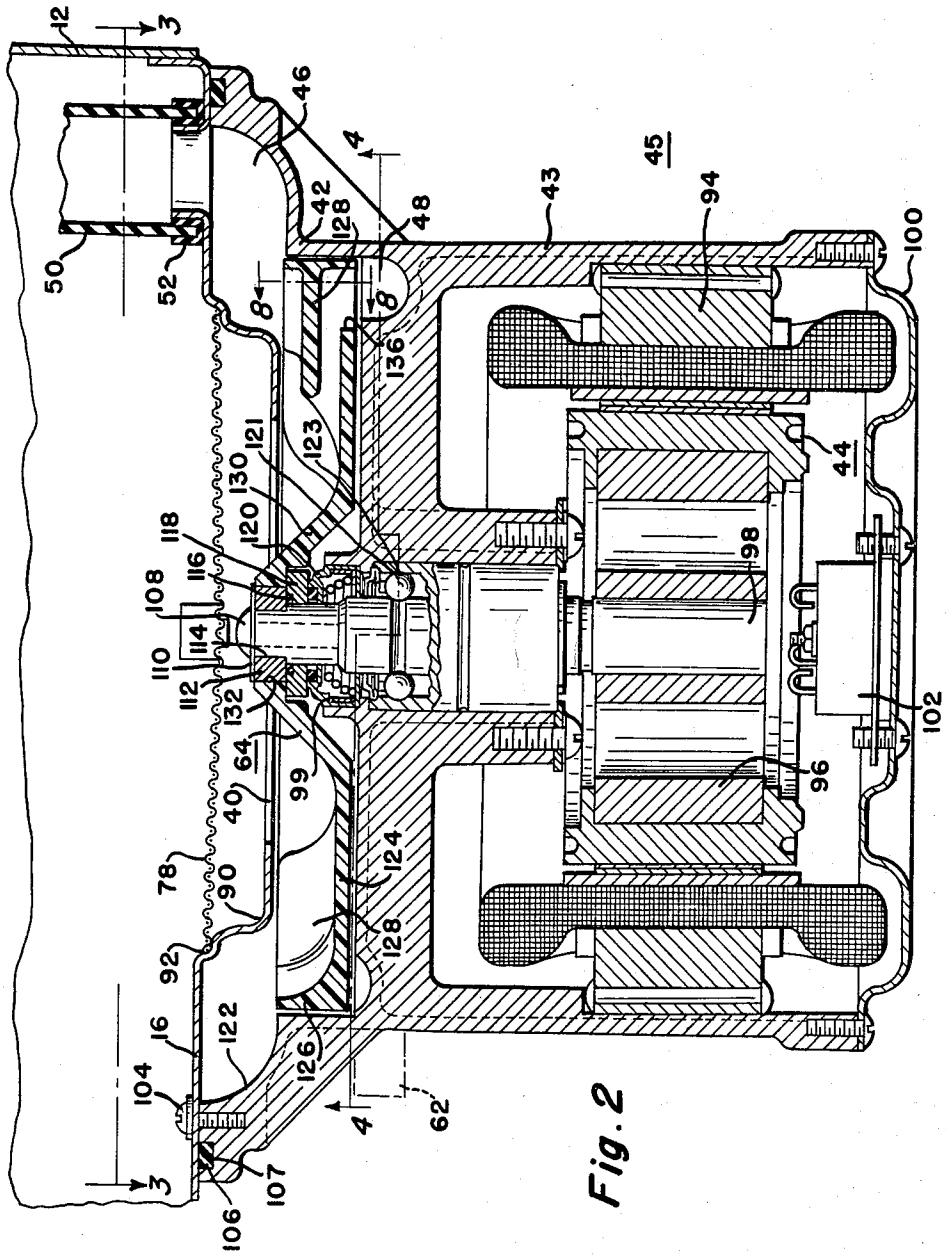

Fig. 2

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FLUID DISTRIBUTION PUMP

Original Filed Feb. 9, 1959 5 Sheets-Sheet 3

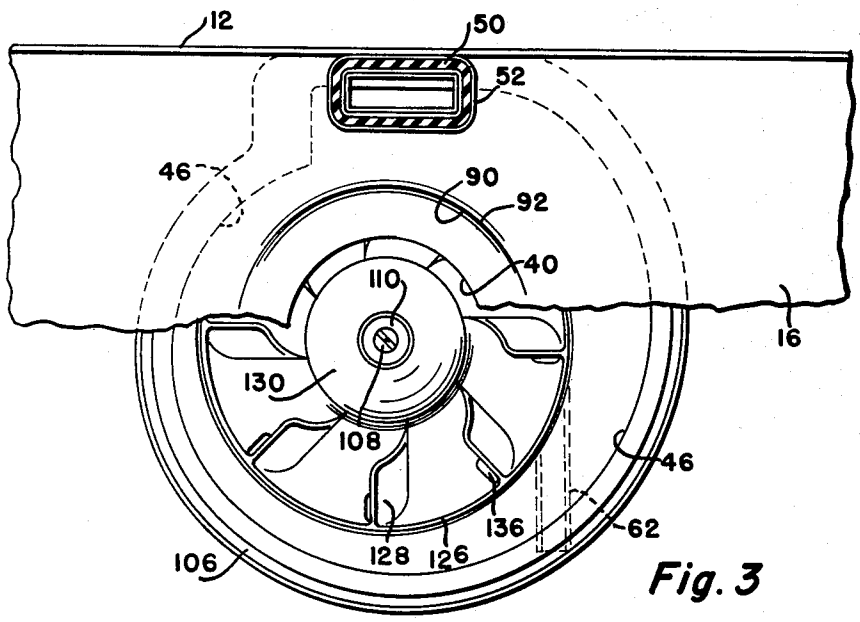

Fig. 3

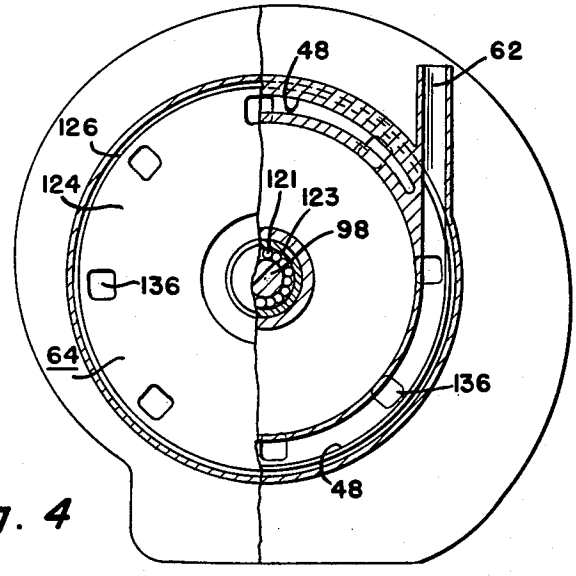

Fig. 4

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FLUID DISTRIBUTION PUMP

Original Filed Feb. 9, 1959 5 Sheets-Sheet 4

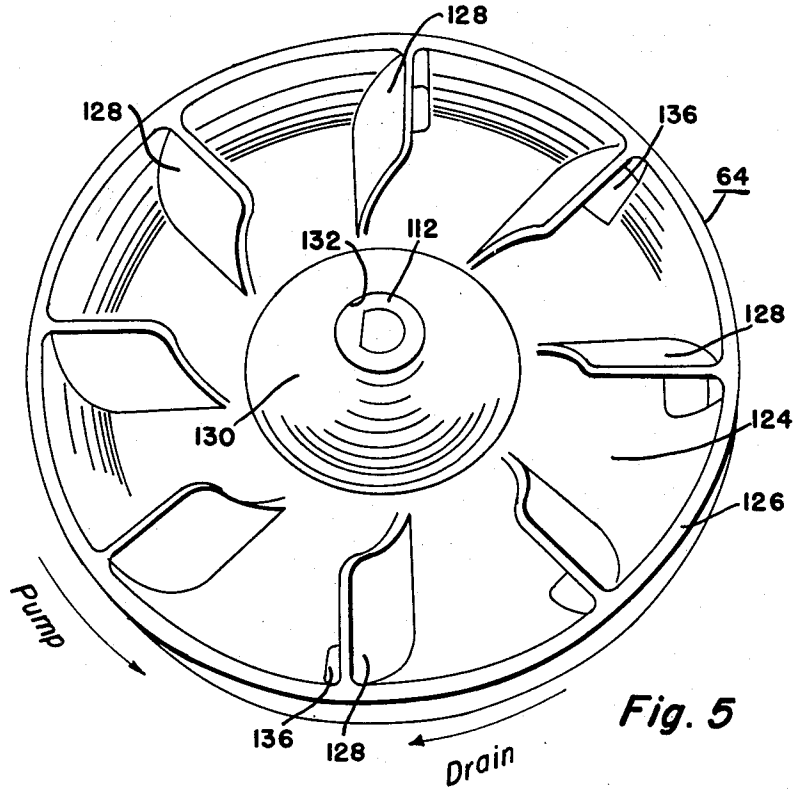

Fig. 5

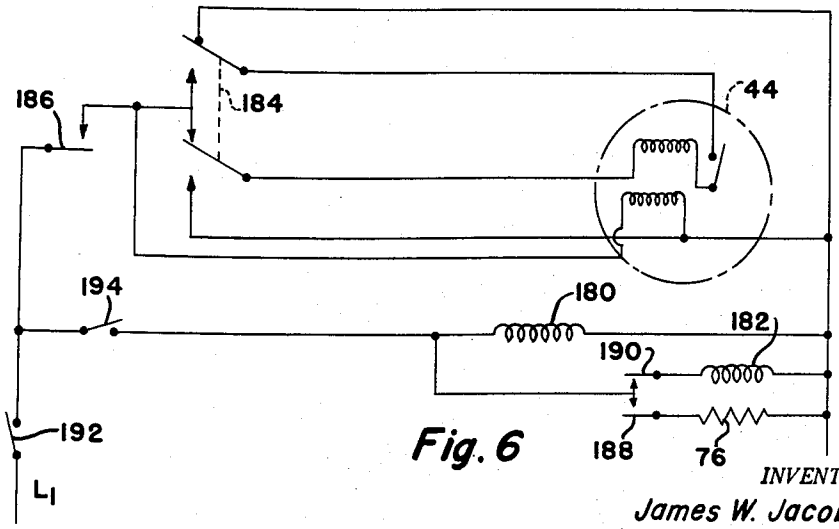

Fig. 6

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FLUID DISTRIBUTION PUMP

Original Filed Feb. 9, 1959 5 Sheets-Sheet 5

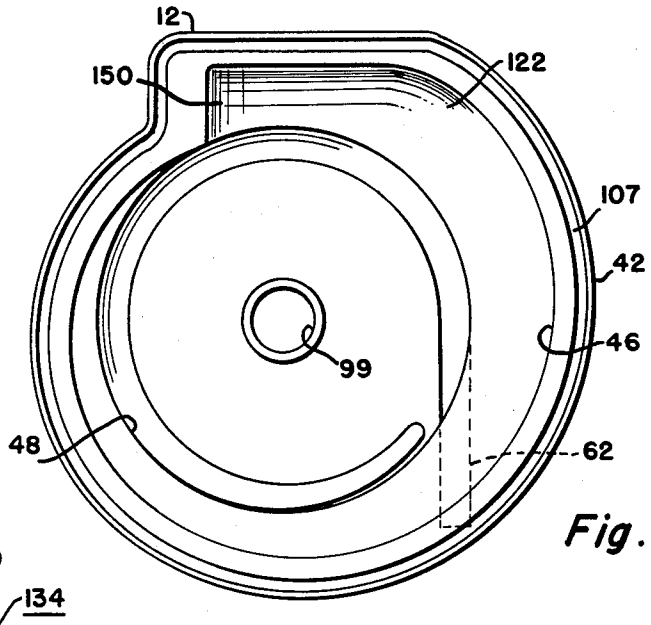

Fig. 7

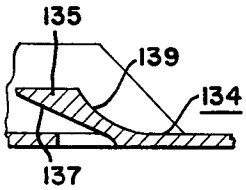

Fig. 11

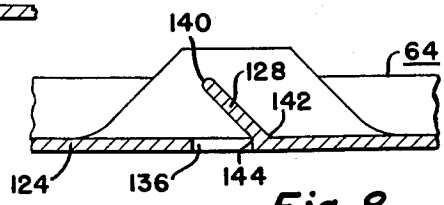

Fig. 8

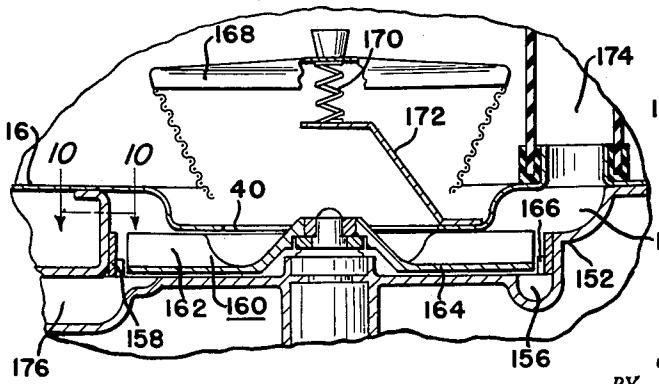

Fig. 9

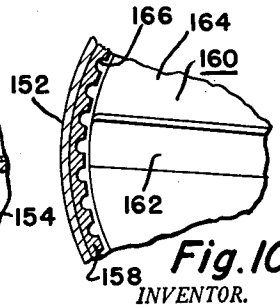

Fig. 10

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3,117,523

FLUID DISTRIBUTION PUMP

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Original application Feb. 9, 1959, Ser. No. 792,158, now Patent No. 3,082,779, dated Mar. 26, 1963. Divided and this application July 5, 1962, Ser. No. 207,740

5 Claims. (Cl. 103—2)

This invention relates to a domestic appliance and more particularly to an improved fluid distribution system therefor. This is a division of my copending application Serial No. 792,158, filed February 9, 1959, now Patent 3,082,779 issued March 26, 1963.

Current design of appliances in which pumps are utilized includes a system of selectively actuated valves which control the directional flow of fluids pumped during an appliance cycle. The inclusion of such valves adds cost to the manufacture of the appliance and gives rise to potential servicing problems. In addition conventional appliance water distribution systems include many connections and flexible conduits which create leakage problems.

Accordingly it is an object of this invention to provide a pump with an impeller which serves as a means for recirculating fluid and for eliminating auxiliary fluid valves in an appliance.

It is also an object of this invention to provide an appliance having a cleansing chamber with internal fluid conduits to eliminate the need for conduit connections outside of the cleansing chamber.

Another object of this invention resides in a cleaning and drying appliance having a fluid distribution system wherein a single impeller serves to circulate a cleaning fluid during a wash cycle and a drying fluid during a drying cycle.

A further object of this invention is the provision of a reversible impeller which is effective to pump fluid when rotated in either direction and which serves additionally as a shut-off valve when rotated in one of said directions.

Still another object of this invention is the provision of a triturating element in the housing of a pump to comminute or triturate small particles of waste passing through the pump housing.

Another object of this invention is to provide a pump housing with a first volute configuration for directing a fluid in one direction, a second volute configuration for directing a fluid in a second direction and a single impeller adapted for reversible operation to selectively direct the fluid being pumped.

A more specific object of this invention is in the provision of a drying system for a dishwashing chamber having an air inlet, an air and water outlet, a pump connected to said outlet, a drain conduit leading from said pump, an air gap in said drain conduit and a reversible impeller for said pump to selectively draw air through said chamber.

A further object of this invention is to provide a dishwasher with removable upper and lower dish-supporting racks, the upper rack being carried by said lower rack.

It is also an object of this invention to form an appliance cabinet with a single wall, wrap-around construction to achieve maximum interior dimensions without increasing exterior dimensions.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein preferred forms of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a side sectional view of a dishwasher adapted to include the novel fluid distribution system of this invention;

FIGURE 2 is a side sectional view of the impeller, pump and motor housing of this invention;

FIGURE 3 is a fragmentary sectional view with parts broken away taken along line 3—3 of FIGURE 2 to show the impeller top surface in relation to the water recirculating side of the pump of this invention;

FIGURE 4 is a sectional view taken along line 4—4 of FIGURE 2 with parts broken away to show the impeller bottom surface in relation to the exhaust or drain side of the pump of this invention;

FIGURE 5 is a perspective view of the impeller of this invention;

FIGURE 6 is a schematic wiring diagram for operating a dishwasher in accordance with the concepts of this invention;

FIGURE 7 is a top plan view of the pump and motor housing with the impeller removed;

FIGURE 8 is a fragmentary side sectional view of the impeller and one of the impeller vanes taken along line 8—8 in FIGURE 2;

FIGURE 9 is another embodiment of this invention wherein the pump housing is provided with a triturating means;

FIGURE 10 is a fragmentary sectional view taken along line 10—10 in FIGURE 9 to show the triturating element in said pump housing; and

FIGURE 11 is a fragmentary sectional view similar to FIGURE 8 of a modified impeller.

In accordance with this invention and with reference to FIGURE 1 a dishwasher 10 is provided with a cabinet 11 having a rear wall 12, a top wall 14, side walls 13 and 15, and a sump or bottom wall 16. Wall members 12 to 16 serve to partially define a dishwashing chamber 18 having a front opening 19 closed by a door 20 hingedly mounted at 22 for horizontal pivotal opening movement. Since the chamber 18 is formed of single wall construction, a coating of vinyl plastic (to be explained more full hereinafter) may be sprayed over the exterior and/or the interior thereof to waterproof the welded seam and to aid in deadening sound during operation. In addition to the dishwashing chamber 18 the dishwasher or appliance 10 includes a machine or motor compartment 24 beneath the sump 16. A cover panel 26 closes the front portion of the machine compartment 24 and is supported on a panel 28 which defines a toe space at the bottom front of the appliance. Conventional leveling bolts 30 may be provided for leveling the appliance 10 during installation thereof. Within the dishwashing or cleansing chamber 18 a spray tube 32 is rotatably supported. A bracket 34 attached at one end to the rear wall 12 of the dishwasher carries a pin 36 which rotatably journals one end of the spray tube 32. A plurality of ports 38 are formed in the spray tube 32 for distributing water or any circulated fluid in a selected pattern within the chamber 18. The bottom wall or sump 16 is sloped or tapered to direct fluid within the dishwashing chamber 18 to an opening 40 in one portion of the sump wall 16. Underlying the opening 40 is a pump shown generally at 42 which is powered by a reversible motor 44. The pump 42 has a fluid recirculating or supply portion 46 and a fluid drain portion 48. The fluid recirculating portion 46 connects to a conduit 50 within the dishwashing chamber 18. To facilitate a vibration-free and water-tight connection a U-shaped channel seal 52 is interposed between the sump wall 16 and the lower end of conduit 50. The conduit 50 extends upwardly along the rear wall 12 of the dishwashing cham-

ber 10 and connects at its upper end with a spray tube support housing portion 54 having a cylindrical flange 55. Within the housing 54 may be located a swirl device such as a set of vanes (not shown) which serves to impart a swirling motion to fluid traversing the conduit 50 prior to the time that the fluid enters the spray tube 32. With the spray tube 32 rotatably journalled at 58 in the housing 54 the water swirl imparts a rotating motion to the spray tube 32, thereby effecting a thorough distribution pattern for any fluid being ejected from the spray tube openings 38.

The drain system of the dishwasher 10 includes a drain conduit 60 connected to a drain outlet 62 which is in turn connected to the drain portion or volute 48 of the pump housing 42. Interposed between the supply portion or volute 46 of the pump 42 and the drain portion 48 is an impeller 64 which may be operated either clockwise or counter-clockwise to selectively direct fluid to drain conduit 60 or to recirculating conduit 50. The drain conduit 60 is formed with a loop portion 65 which extends above the normal level of water in sump 16 and terminates in an air gap receptacle 66. Receptacle 66 is then connected to a drain outlet 68 which leads to any domestic sewage system.

Water is supplied to the dishwashing chamber 18 by means of selectively actuated water supply valve 70 which is connected to any convenient domestic water supply by means of a conduit 72. Water is carried from the valve 70 by means of a conduit 74 which extends through the sump wall 16 in any water-tight fashion to direct the supply of water to the sump 16. The amount of water supplied will be determined in accordance with the timing operation of a conventional dishwasher timer (not shown). To supply heat for sterilizing and drying within the dishwashing chamber 18, a heater 76 may be utilized. Also desirable within the apparatus 10 is a strainer 78 which overlies the outlet opening 40 from the sump to restrain large pieces of refuse from entering the pump housing 42.

Items to be washed within the chamber 18 may be supported on a dish support structure having an upper basket 80 and a lower basket 82. Brackets such as 84 may be utilized to support the basket 80 on the basket 82, rolling members such as wheels 86 then serving to provide easy simultaneous removal of both baskets 80 and 82 onto the door 20 when the door is in a horizontally open position. Of course, the baskets 80 and 82, shown as plastic in this instance, must be highly perforated to permit free flow of the washing fluid being sprayed from the spray tube 32.

In the design just described for the dishwasher 10 it should now be seen that the water conveying conduits such as 50 are contained within the dishwashing chamber 18. There are no fluid connections in the water recirculating system outside of the chamber 18. Consequently service problems relating to leakage are reduced and a more dependable dishwasher design is accomplished. Further a reduction in the cost of manufacture is possible when the chamber 18 is formed by a single wall construction—a construction which eliminates additional parts such as outside panels, and which enlarges the capacity of the dishwashing chamber 18 without enlarging the size of the appliance 10. To further simplify the servicing of the dishwasher 10 an opening 88 is formed in the rear wall 12 adjacent the machine compartment 24.

Reference may now be had to FIGURE 2 wherein a complete understanding of the novel pump of this invention will be set forth. The sump portion 16 of the dishwasher 10 is shown with an inset 90 having a shoulder 92 for supporting the strainer 78 in a position overlying the pump inlet opening 40. It should be noted that the pump housing 42 and motor housing 43 form an integral pump-motor unit 45. However, it is within the purview of this invention tom ake the housings 42 and 43 separate. The motor 44 is installed within the motor housing portion 43 of the combination housing 45. The motor 44 has a stator 94 press-fit within the motor housing portion 43 and a rotor 96 which is press-fit on a shaft 98. At the lower end of the motor housing 43 a cover plate 100 is utilized to close the open end of the housing 43 and to support a motor overload protector of conventional design such as 102. The combination housing 45 is attached to the sump 16 adjacent the outlet opening 40 as by any conventional fastening means such as a bolt 104 fastened into the combination housing or pump-motor unit 45. A ring seal 106 is placed in a groove 107 of the pump housing 42 and interposed between the sump 16 and the pump housing to affect a water-tight connection of the pump and motor assembly to the sump 16 of the dishwasher 10. With the motor 44 mounted in a vertical position the shaft 98 extends upwardly through a cylindrical opening 99 into the pump housing 42 where the impeller 64 is attached by means of a bolt 108 and a clamp washer 110. The impeller 64 is formed with a bronze insert 112 which has a flat sided central opening 114 which fits over a complementarily formed upper end of the shaft 98. Completing the impeller shaft assembly is an O-ring 116, a sintered bronze seal washer 118 and a seal assembly 120 of conventional design. In this relationship a water-tight connection is effected between the sump 16 and the pump housing 42 by the seal 106, whereas water is sealed from the motor itself through the sealing arrangement at 120. Beneath the seal 120 a thrust bearing 121 is carried in an outer race 123 to complete the assembly of pump impeller to pump motor 44.

In accordance with one aspect of this invention the impeller 64 is interposed between a large water supply or recirculating volute portion 46 and a smaller drain volute portion 48. The supply volute 46, it should be noted, is formed with arcuately formed radially outer peripheral edge portions 122 and 150 which aid in reducing duct resistance to the recirculating water being forced by the impeller 64 to the conduit 50. With this arrangement the impeller 64 when rotated in one direction by motor 44 serves to force water from the sump 16 around the upper volute supply portion 46 through the supply conduit 50 to the spray tube 32. At the same time water is prevented from entering the drain conduit 60 by a slight suction placed thereon by the rotation of impeller 64. This double action of a single impeller thereby effectively blocks outflow of the circulating fluid to drain. This novel valving action eliminates the need for any auxiliary solenoid or mechanically operated drain valve.

The novel configuration of the impeller 64 of this invention is best seen in FIGURE 5. In this view the impeller 64 is shown with a dished-out portion having a bottom wall 124 and an upstanding peripheral edge wall 126. Formed integral with the wall portions 124. 126 are a plurality of vanes 128. A raised central portion or hub 130 has an opening 132 in which the bronze hub insert 112 is press-fit. Beneath each of the vanes 128 is a drain outflow port 136. The perspective of FIGURE 5 shows the vanes 128 lying at an acute angle overlying the drain outflow ports 136. As noted on FIGURE 5 a clockwise rotation of the impeller 64 will force fluid downwardly through outflow drain ports 136. On the other hand a counter-clockwise rotation of the impeller 64 will cause the fluid being impelled to lift upwardly. When the impeller 64 is placed between the supply volute 46 and the drain volute 48 the selective rotation of the impeller 64 will set up either a water recirculating and valve action to conduit 50 or a drain operation to conduit 60.

A more detailed description of the impeller 64 is seen in FIGURE 8. In a 6-inch diameter impeller 64 the vane 128 is formed with a 3/64 inch radius at 140, a 1/8 inch radius at 142 and a 1/4 inch radius at 144. The outflow drain port 136 is approximately 1/2 inch square while the angle which the vane 128 makes with the bottom wall 124 is 45°. It has been found that an impeller formed as described hereinabove will provide a satisfac-

tory pumping operation in either direction in a dishwashing appliance. However the angular relationship and the configuration of the vane 128 may be changed to alter the pumping pressure without departing from the teachings of this invention. A changed blade configuration may be desired when it is required to pump the drain water to a higher adjacent sink, i.e. the loop 65 would be above the level of the sink and would require a greater pumping pressure to be exerted by the impeller 64 than would be necessary in the arrangement of FIGURE 1. It is well within the purview of this invention to achieve any desired performance characteristics for the impeller 64 by selective adjustment of the size and angles of the impeller components. For instance, a high pressure, low volume pump would result from the use of the impeller 134 of FIGURE 11 wherein an impeller blade 135 is formed with a gradual drain side slope 137 and a steeper recirculating side slope 139.

A clear understanding of the volute configuration of the pump housing 42 will now be gained with reference to FIGURES 3, 4 and 7. In FIGURE 7 for instance a top view of the pump-motor housing 45 shows how the drain or outlet volute 48 is formed in the casting in the pump housing 42 to connect with the outlet 62. The water recirculating or supply volute 46 is also formed in the integral casting 45, thus comprising a novel double pump housing casting. Note how the peripheral edge walls are curved at 122 to aid in the smooth movement of the fluid about the volute 46. A curved section 150 is also formed in the recirculating or supply volute 46 to aid the flow transition from the volute 46 upwardly into the conduit 50. The configuration of the pump housing is combined effectively with the novel design of a single impeller 64 to effect a pumping operation in both directions.

FIGURE 4 shows a view looking upwardly at the impeller 64 from the drain volute 48. With the casting broken away the drain outlet openings 136 are seen from the underside of the impeller 64. Note how the openings 136 overlie the drain volute 48 throughout its length. This arrangement provides for smooth pumping action to drain.

Another embodiment of this invention is seen in FIGURES 9 and 10 and adds to the described invention a triturating arrangement to disintegrate pieces of waste suspended in the water being directed to drain. The elimination of particles from the water being drained will serve to minimize drain stoppages and thus aids in dependable appliance operation. In this arrangement a pump housing 152 is provided with an upper supply volute portion 154 and a drain volute portion 156. A triturating element 153 is attached to a vertical wall portion of the housing 152 radially outwardly of the impeller 160. The impeller 160 is formed with a plurality of vanes 162 which are supported on a base portion 164 of the impeller 160. The triturating element 158 has teeth 166 which serve to triturate solid particles being thrown radially outwardly by the rotation of impeller 160. The opening 40 of the sump 16 may include a strainer basket 168 which is spring biased upwardly at 170 and supported on a bracket 172. In this relationship a rotation of the impeller 160 in a counterclockwise direction will pull the strainer 168 downwardly to place the strainer in straining relationship to the opening 40. This same rotation can cause fluid moving through the opening 40 to be pumped upwardly through a conduit 174. At the same time a slight vacuum is pulled on a drain conduit 176 to serve as a valve against permitting fluid to move to drain. In a clockwise rotation of the impeller 160 the pumping volume is less and the strainer 168 will be biased upwardly. The water is thrown radially outwardly with a downward component of pumping pressure. This movement causes any solid matter washed from the surface of the strainer 168 and being pumped to drain to be impaled upon the teeth 166 of the triturating element 158 and a thorough disintegration of the matter is accomplished. This action will thus eliminate the possibility of drain stoppage.

In operation the dishwasher 10 may be provided with the control circuit of FIGURE 6 for sequentially controlling the components of the dishwasher. These components may include the reversible motor 44, a timer motor 180, a solenoid 182 for the supply valve 70 and the heater 76. A conventional timer may be utilized having a set of reversing contacts 194 for the motor 44, a motor energizing contact 186, a heater switch 188 and fill valve switch 190. As a safety measure on the dishwasher 10 a door interlock switch 192 may be included in conjunction with a main line switch 194. To initiate the washing operation the racks 80, 82 may be removed from the dishwashing chamber 18 on the hingedly opened horizontally arranged door 20. After loading the baskets they may be returned to the chamber 18 and the door 20 closed thus effecting a closure of the door interlock switch 192. The initiation of the wash cycle is started after a manual closing of the line switch 194 which starts the timer motor 180. As the cam actuated switches are selectively positioned the fill valve switch 190 will be closed to supply a predetermined amount of water to the sump 16 by way of conduit 74. At the same time or shortly before the motor 44 will be energized to rotate the impeller 64 in the direction for recirculating fluid placed within the sump 16. Motor 44 will be energized continuously during the washing process. In this way water will be picked up from the sump 16 by way of opening 40 in the pump housing 42. The impeller will pump water upwardly through the interior conduit 50 to the spray tube 32. As the water passes the swirl inducer the rotating motion imparted to the water will cause a rotation of the spray tube 32 and a thorough distribution of the water ejected from ports 38 throughout the washing chamber 48.

The novel pump arrangement of this invention eliminates the need for a valve on drain line 60. To effect this the rotation of impeller 64 in the recirculating direction draws a slight vacuum on the drain line 60 through the impeller ports 136. This slight vacuum prevents any of the water in sump 16 from being directed to drain during the washing portion of the cycle. At the conclusion of the wash cycle the timer will reverse the contacts 184 to reverse the operation of motor 44. In this fashion the impeller 64 is rotated in an opposite or drain direction. The vanes 128 urge the water remaining in the sump 16 downwardly through the ports 136 to the lower drain volute 48 and outwardly through the drain outlet 62 to the drain conduit 60. At the air gap 66 the water continues downwardly to drain line 68 by gravity. Another wash cycle or a rinse cycle may follow.

Subsequent to the wash cycle a drying cycle is initiated by the timer actuated switch 188 to energize the heater 76. It is at this time that another aspect of this invention is utilized. The pump impeller 64 is used when rotated in one direction to recirculate heated air throughout the dishwashing chamber 18 to speed the drying cycle and to sterilize the dishes. With counter impeller rotation air is supplied through an opening 200 in the bottom of door 20 and the louvers 198 by the sucking action of the impeller 64 as it is being rotated in its drain direction (see dot-dash arrows in FIGURE 1). The moisture-laden air is pumped outwardly by means of the conduit 60 to the air gap 66 fitting where the air discharges into the machine compartment 24. This multiple action of the single pump impeller 64 is seen to provide a water recirculating system, a forced drain system and an air drying system without the need for valves. Further the single wall construction in a dishwasher encloses the interior water conduits to eliminate connections outside of the dishwasher and to minimize leakage.

While the forms of embodiment of the invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A fluid distributing pump comprising a housing, said housing having only a single fluid inlet and first and second fluid distribution channels, a supply outlet from said first channel, a drain outlet from said second channel, and a single reversible impeller between said channels in sandwiched relationship to separate said outlets and adjacent said fluid inlet, said impeller having a base portion, a peripheral edge portion, a raised central portion and a plurality of vanes affixed to said base portion and said peripheral edge portion only on the side of said base portion adjacent said fluid inlet, said vanes being rotatably selectively adapted for pumping relationship with said channels, said base portion having a plurality of drain flow openings beneath said vanes for conditioning said vanes for pumping relationship with said second channel when said impeller is rotated in one manner, said vanes being adapted to prevent fluid flow through said drain flow openings when said impeller is rotated in another manner, and means for selectively rotating said impeller.

2. A fluid distribution pump comprising a housing, said housing having only a single fluid inlet and first and second fluid distribution channels, a supply outlet from one of said channels, a drain outlet from the other of said channels, and a single multiaction impeller in cooperative relationship to said channels, said impeller having a base portion interposed in sandwiched relationship between said channels as the wall means for substantially separating said outlets, and a vane carried on the one side only of said base portion and extending toward said fluid inlet, said base portion defining an opening in juxtaposition with said vane, said vane disposed at an acute angle relative to said base portion in a manner to overhang said opening, and means for selectively motivating said impeller.

3. A fluid distribution pump comprising wall means defining a pump chamber having an axial inlet opening, a first fluid distribution channel in communication with said inlet opening and a second fluid distribution chamber in spaced relationship to said first channel, and means in said chamber rotatable about the axis of said inlet opening for impelling fluid selectively through one of said channels, said impelling means including a base means interposed in sandwiched relationship between said channels and substantially perpendicular to said axis in a manner substantially to separate said channels, port means in said base means for selectively interconnecting said second channel and said inlet opening and vane means extending from one side only of said base means toward said inlet opening, said vane means extending from a point adjacent one side of said port means at an acute angle to said base means in a manner to overlie said port means whereby said impelling means when rotated with said port means trailing said vane means impels fluid through said first channel and effectively restrains flow through said second channel and when rotated with said port means leading said vane means impels fluid through said second channel.

4. A fluid distribution pump comprising wall means defining a pump chamber having an inlet opening, a first fluid distribution channel, in communication with said inlet opening and a second fluid distribution channel in spaced relationship to said first channel, and means in said chamber rotatable for impelling fluid selectively through one of said channels, said impelling means including a base means interposed in sandwiched relationship between said channels in a manner substantially to separate said channels, port means in said base means for selectively interconnecting said second channel and said inlet opening and vane means extending from one side only of said base means toward said inlet opening, said vane means extending from a point adjacent one side of said port means at an angle to said base means in a manner to shield said port means whereby said impelling means when rotated with said port means trailing said vane means impels fluid through said first channel and effectively restrains flow through said second channel and when rotated with said port means leading said vane means impels fluid through said second channel.

5. A fluid distribution pump comprising wall means defining a pump chamber having an inlet opening, a first fluid distribution channel in communication with said inlet opening and a second fluid distribution channel in spaced relationship to said first channel, and means in said chamber rotatable for impelling fluid selectively through one of said channels, said impelling means including a base means interposed in sandwiched relationship between said channels in a manner substantially to separate said channels, port means in said base means for selectively interconnecting said second channel and said inlet opening and vane means extending from one side only of said base means, said vane means extending from a point adjacent one side of said port means at an angle to said base means in a manner selectively to shield said port means in accordance with the rotation of said impelling means whereby said impelling means when rotated in one direction impels fluid through said first channel and effectively restrains flow through said second channel and when rotated in the reverse direction impels fluid through said second channel.

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