Dec. 27, 1966 J. G. RUSPINO ETAL 3,294,102

DISHWASHING APPARATUS HAVING IMPROVED PUMP MEANS

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Fig. 1

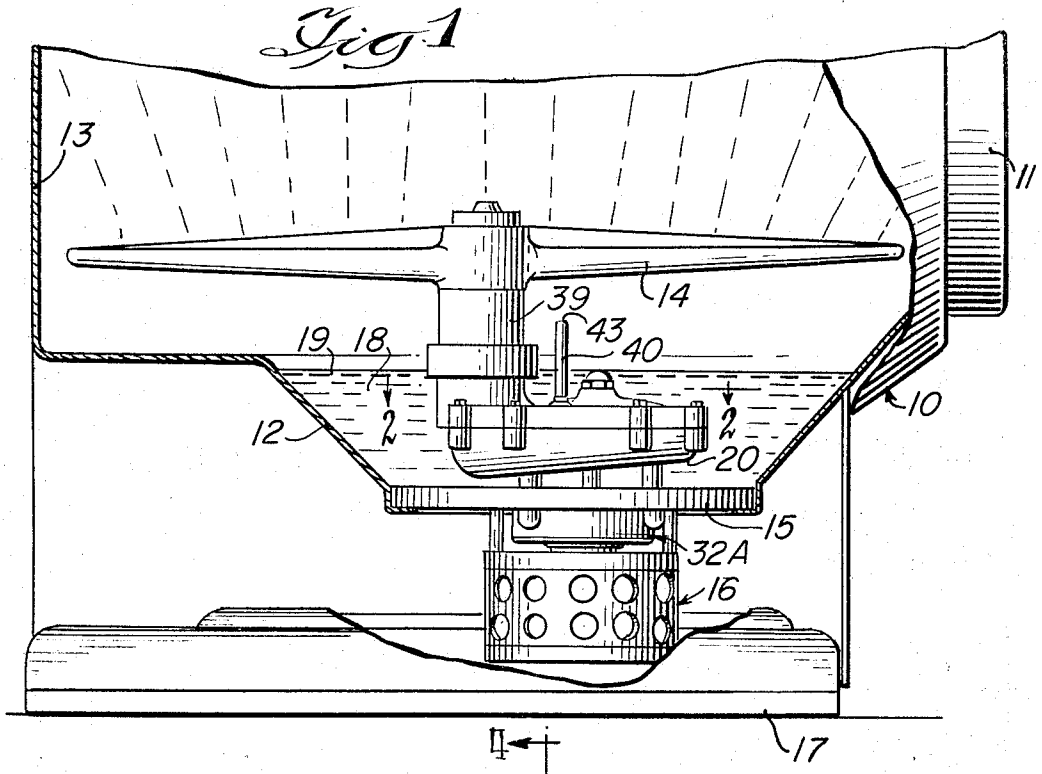
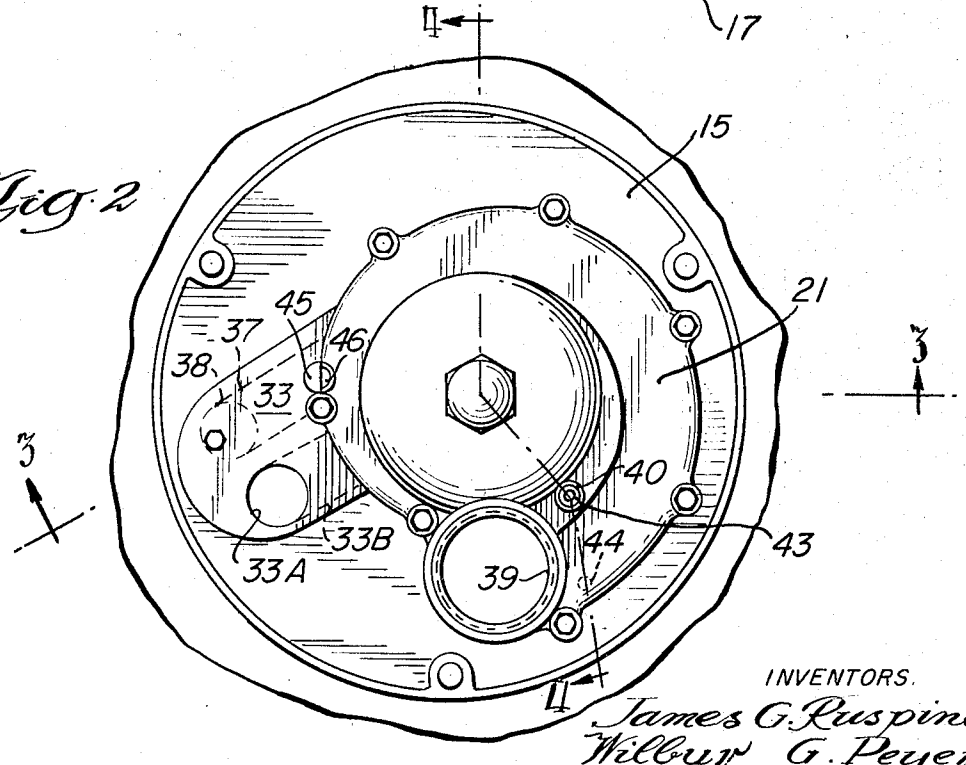


Fig. 2

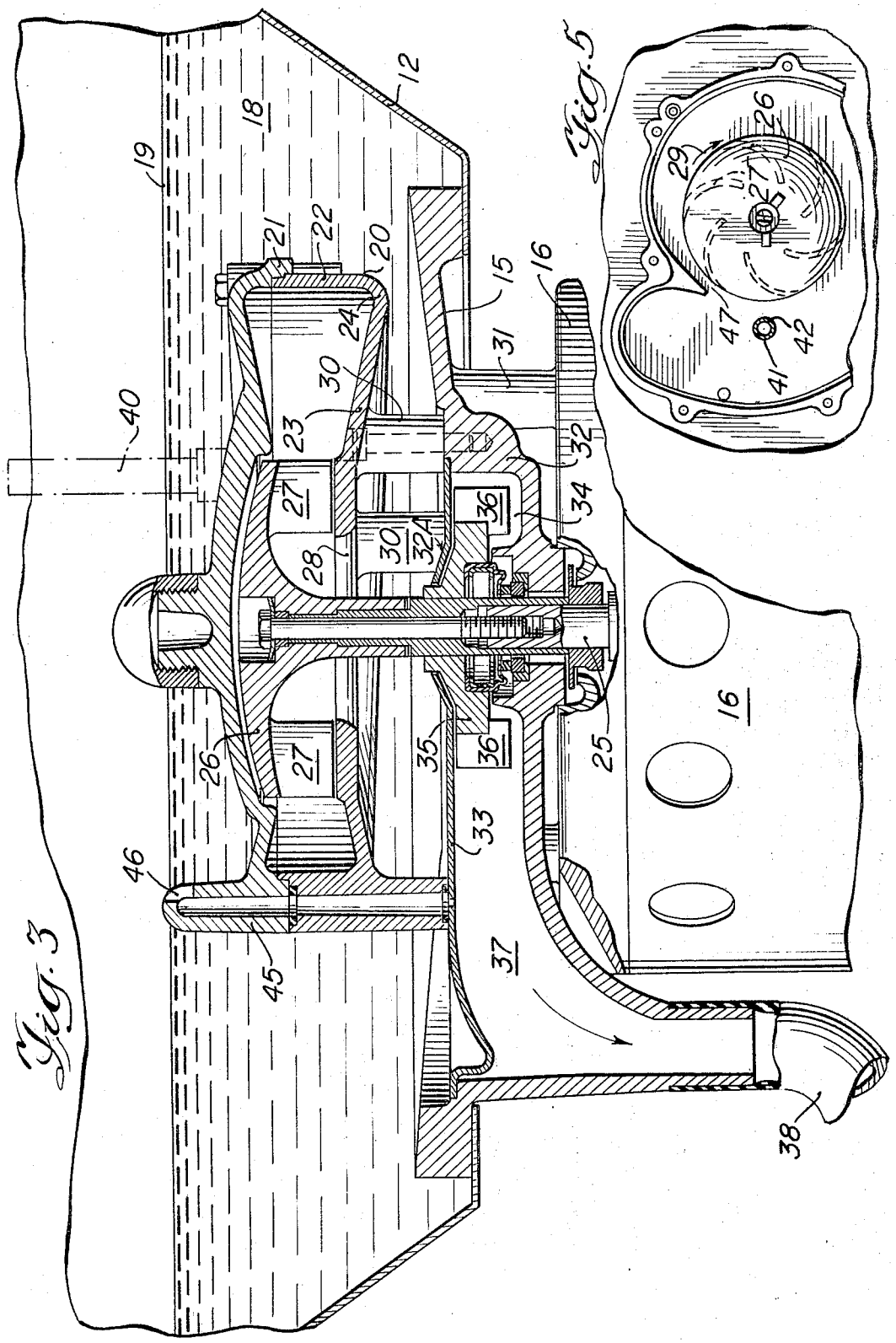


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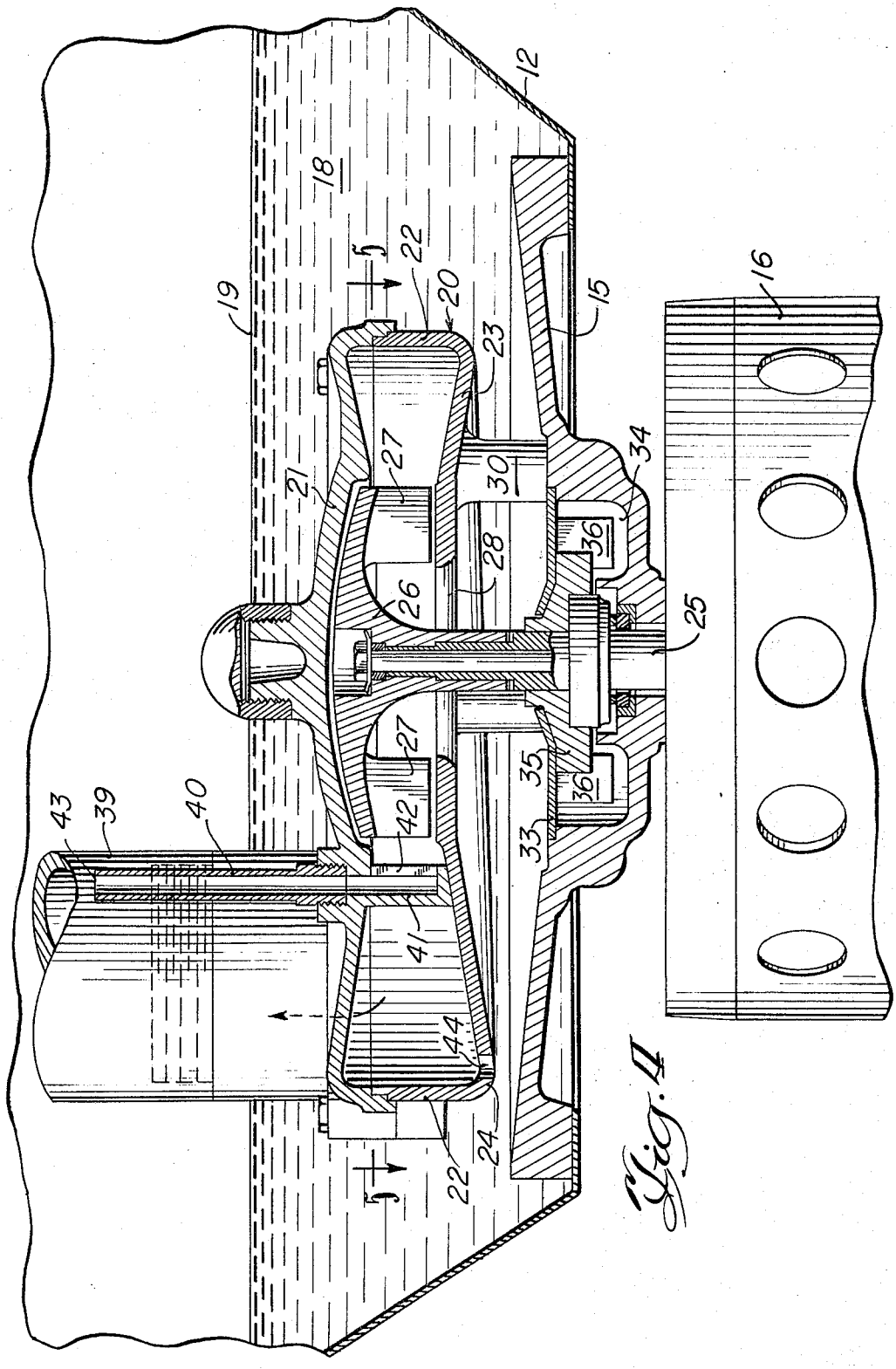


Fig. 4

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DISHWASHING APPARATUS HAVING IMPROVED PUMP MEANS

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This invention relates to a dishwasher and particularly to a pump having characteristics especially applicable for use in a dishwasher.

In apparatus such as dishwashers, liquid washing and rinsing solutions are circulated through the apparatus during a portion of the normal operation. Then, at the end of each washing and rinsing operation the liquid is forced from the apparatus as to a drain.

In such an apparatus it is customary to use two centrifugal pumps, the impellers of which are connected to a common rotatable shaft to effect simultaneous rotation of the impellers in either of the two directions. When rotated in one direction, one pump circulates the liquid through the apparatus for washing or rinsing. Then, when rotation of the common shaft is reversed, the second pump pumps the liquid from the apparatus as to a drain. One of the difficulties in a pumping system of this type is that a loud and objectionable noise is created in the recirculating pump, caused by liquid therein striking the impeller and pump housing and by cavitation as the liquid is drained from the apparatus by the drain pump.

One of the features of this invention is to provide an apparatus such as a dishwasher having a pump for circulating liquid therein when rotated in one direction and that is rotated in the opposite direction during drainage of liquid from the apparatus, together with means for venting air into the recirculating pump during the reversal to substantially prevent noise caused by the presence of liquid therein and to reduce the power requirement of the pump.

Other features and advantages of the invention will be apparent from the following description of the invention taken in conjunction with the accompanying drawings. Of the drawings:

FIGURE 1 is a fragmentary side elevational view partially in section of the lower portion of a dishwasher including a pumping system embodying the invention.

FIGURE 2 is a horizontal sectional view taken along line 2—2 of FIGURE 1.

FIGURE 3 is a fragmentary vertical sectional view taken along line 3—3 of FIGURE 2.

FIGURE 4 is a fragmentary sectional view taken along line 4—4 of FIGURE 2.

FIGURE 5 is a horizontal sectional view taken along line 5—5 of FIGURE 4.

In FIGURE 1 there is illustrated the lower portion of a dishwasher **10** having a conventional front access door **11**, liquid collecting sump **12** at the bottom of a dishwashing tub **13** and a rotatable spray arm **14** for spraying liquid over dishes (not shown) during the washing and the rinsing operation.

The sump **12** is provided with a liquid tight bottom **15** beneath which is located an electric motor **16**. The motor **16** is positioned between the bottom **17** of the dishwasher and the elevated bottom **15** of the sump.

The sump **12** is adapted to contain liquid **18** having a normal liquid level **19**. This liquid during washing of the dishes will normally be a detergent solution and during the rinsing will be water. Positioned in the sump **12** and normally completely immersed in the liquid **18** is a first centrifugal pump **20** which is a recirculation pump (see FIGURE 3) that includes a housing **21** having a peripheral wall **22** and a bottom **23** whose outer portion slopes

outwardly and downwardly to adjacent the peripheral wall **22**. This bottom **23** has a substantially lowest area **24** adjacent the peripheral wall **22**.

Extending upwardly from the motor **16** through the bottom **15** of the sump **12** is the motor shaft **25**. Mounted on the top of this shaft **25** is the impeller **26** that is located within the housing **21** of centrifugal pump **20**. This impeller **26** as is shown in FIGURE 5 has the usual plurality of spaced curved blades **27** that tend to force the liquid outwardly toward the peripheral wall **22** during regular rotation of the impeller which is the direction indicated by the arrow **29**.

The bottom **23** of the pump housing **21** is provided with an inlet opening **28** of the usual type arranged substantially concentrically with the motor shaft **25** and impeller **26**. The opening **28** is generally circular and is of the diameter slightly smaller than the diameter of the circle defined by the inner edges of the impeller blades **27**. The pump housing **21** is mounted above the bottom **15** of the sump on spaced studs **30**. The motor **16** is suspended from spaced downwardly extending studs **31** from the bottom **15** of the sump **12**.

The sump bottom **15** is shaped to define a second pump housing **32** for a second pump **32A** for draining the dishwashing apparatus **10**. Metal plate **33** is located across the top of housing **32** to define chamber **34**. The motor shaft **25** extends through this chamber **34**, as shown in FIGURE 3, and has mounted thereon within the chamber an impeller **35** with a plurality of radial blades **36** extending therefrom. The auxiliary pump chamber **34** communicates with the bottom of the sump **12** by inlet **33A** and passage **33B** (FIGURE 2) that empties into the chamber **34** at a point (not shown) adjacent the outer diameter of impeller **36**.

Leading from the drain pump chamber **34** is an exit conduit **37** which empties into a drain **38**. The conduit **37** is defined in part by an extension of the sump bottom **15** and drain pump housing **32** and by the top metal plate **33**.

In this arrangement of the two pumps, the motor when used to rotate the two pumps in one direction, which is the direction indicated by the arrow **29** in FIGURE 5, causes the recirculation pump **20** to draw liquid **18** in from the sump **12** through the inlet opening **28** and to force the liquid outwardly against the peripheral wall **22** in the usual manner. Leading from the top of the pump housing **21** is a recirculation conduit **39** which directs liquid into the spray arm **14** in the customary manner. Then, when the motor is rotated in the opposite direction, or the direction opposite to the arrow **29** in FIGURE 5, the curved nature of the impeller blades **27** of recirculation pump **20** prevents the liquid **18** being pumped from the sump **12** up the recirculation conduit **39** and causes the drain pump impeller **35** of drain pump **32A** to draw liquid **18** from the sump **12** and discharge it out the conduit **37** and drain **38**.

During this "pump out" period when the recirculation pump impeller **26** is rotated in a reverse direction (reverse to the arrow **29** in FIGURE 5) the liquid level **19** in the sump **12**, of course, falls. During this reverse rotation and without the corrective features of our invention, the impeller blades **27** of the recirculation pump **20** will cavitate and produce high shear forces on the water in housing **21** causing impact on the impeller and housing **21**, thereby creating a loud and objectionable noise. However, with the addition of our vent means **40** (FIGURE 4) air is drawn into the impeller area of housing **21** during reverse rotation of impeller **26** to displace the water in the impeller area to around the periphery of housing **21**.

When the liquid level **19** in sump **12** falls below the bottom of the recirculation pump impeller **26** during

pump out, without the corrective features of our invention there would be liquid in the pump housing 21. Reverse rotation of the impeller 26 under these circumstances would cause a considerable amount of objectionable noise in the recirculation pump 20 and thus in the dishwasher because the impeller blades 27 would be striking this liquid.

In order to substantially eliminate this noise the present invention provides the means 40 for venting air into the pump housing 21 during the drainage of liquid 18 from the sump 12 which forces the water in pump 20 away from blades 27 of impeller 26. When the water level 19 in sump 12 reaches a level below the inlet opening 28 of pump 20 the vent means 40 becomes ineffective and opening 44 drains housing 21 of further quantities of water to prevent collision of the blades 27 and the water. This venting means in the illustrated embodiment comprises the vertical open end tube 40 which leads into the pump housing 21 to a point adjacent the outer edges of the blades 27. The bottom of the tube 40 communicates with a downward extending projection 41 within the pump housing having on its inner edge adjacent the blades 27 an elongated slot 42 (see FIGURE 4). The tube 40 is long enough so that its open upper end 43 is always above the maximum level 19 of the liquid 18 in the sump 12. With this arrangement, as the liquid level 19 falls and as the liquid level within the housing 21 falls correspondingly, air is bled into the pump housing 21 by way of the tube 40 and projection 41 and opening 42. When impeller 26 is rotated during pump out in a direction reverse to its pumping direction, it forces a high speed stream of water through the cut-water clearance area 47 toward projection 41 (FIG. 5). The low pressure area adjacent the high velocity stream induces air through tube 40, projection 41 and slot 42 into the pump housing 21. The centrifugal field and water recirculation paths between impeller blades 27 during this reverse rotation thereof provides the means for the induced air to migrate to the center of the impeller 26. In this manner water is displaced from the impeller 26. Now, the impeller blades 27 no longer rotate in water and cavitation is eliminated. Therefore, the water in the pump housing 21 slows down so impact and shear forces are reduced. The power consumption of the pump is reduced and the objectionable noise is eliminated.

During normal operation of the pump impeller 26 in the direction shown by the arrow 29, some liquid is forced by the impeller 26 up through the tube 40 and projected toward the articles being cleaned, such as dishes (not shown) to aid the washing operation.

In FIGURE 3 there is illustrated a conventional air bleed tube 45 to the exit conduit 37 to prevent any siphoning of liquid from the drain 38 to sump 12 during the dishwashing operation. This tube 45 is provided with the usual top inlet opening 46 for inflowing air.

Having described our invention as related to the embodiment shown in the accompanying drawings, it is our intention that the invention be not limited by any of the details of description, unless otherwise specified, but

rather be construed broadly within its spirit and scope as set out in the accompanying claims.

We claim:

1. A dishwashing apparatus, comprising: means forming a liquid sump; means for removing liquid from said sump; pump means in said sump rotatable in one direction during normal dishwashing to pump liquid through the dishwashing apparatus and rotatable in the opposite direction during removal of liquid from said sump; and means cooperating with said pump means for venting air into said pump means during said opposite direction rotation to substantially prevent noise caused by liquid in said pump means and to substantially reduce the power requirements of said pump means during said liquid removal, said pump means including a pump housing having an impeller means and a cut-water clearance area therein, said air venting means leading to adjacent both said impeller means and said cut-water clearance area.

2. The apparatus of claim 1 wherein said means for removing liquid from said sump includes drain pump means operatively associated with said sump, said circulating pump means having an outlet; means for jointly rotating both said pump means in one direction to cause said circulating pump means to pump liquid through said dishwashing apparatus and in the reverse direction to cause the drain pump means to remove said liquid from said dishwashing apparatus; and said air venting means venting air to said circulating pump means adjacent said outlet thereof during said reverse direction rotation to substantially prevent noise caused by liquid in said circulating pump means and to substantially reduce the power requirement of said drain pump means during said liquid removal.

3. A dishwashing apparatus, comprising: means forming a liquid sump; means for removing liquid from said sump; pump means in said sump including a pump housing having an impeller means therein, said impeller means being rotatable in one direction during normal dishwashing to pump liquid through the dishwashing apparatus and rotatable in the opposite direction during removal of liquid from said sump; and means for venting air into said pump housing and said impeller means to displace liquid from said impeller means during said opposite direction rotation to substantially prevent noise caused by liquid in said pump housing impinging on said impeller means during said liquid removal, said pump housing including a cut-water clearance area therein, said air venting means leading to adjacent both said impeller means and said cut-water clearance area.

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