

[54] **LIQUID LEVEL CONTROL**

[75] Inventors: **Wilbur W. Jarvis, Jr.**, St. Joseph;
Leslie Toth, Benton Harbor, both of
Mich.

[73] Assignee: **Whirlpool Corporation**, Benton
Harbor, Mich.

[22] Filed: **Mar. 15, 1973**

[21] Appl. No.: **341,342**

[52] U.S. Cl. **417/211.5; 134/186**

[51] Int. Cl. **F04b 49/00; B08b 3/00**

[58] Field of Search..... 134/186, 57 D, 58 D;
417/36, 40, 211.5; 415/24, 143, 198; 137/510

[56] **References Cited**

UNITED STATES PATENTS

3,050,003 8/1962 Edwards 417/12

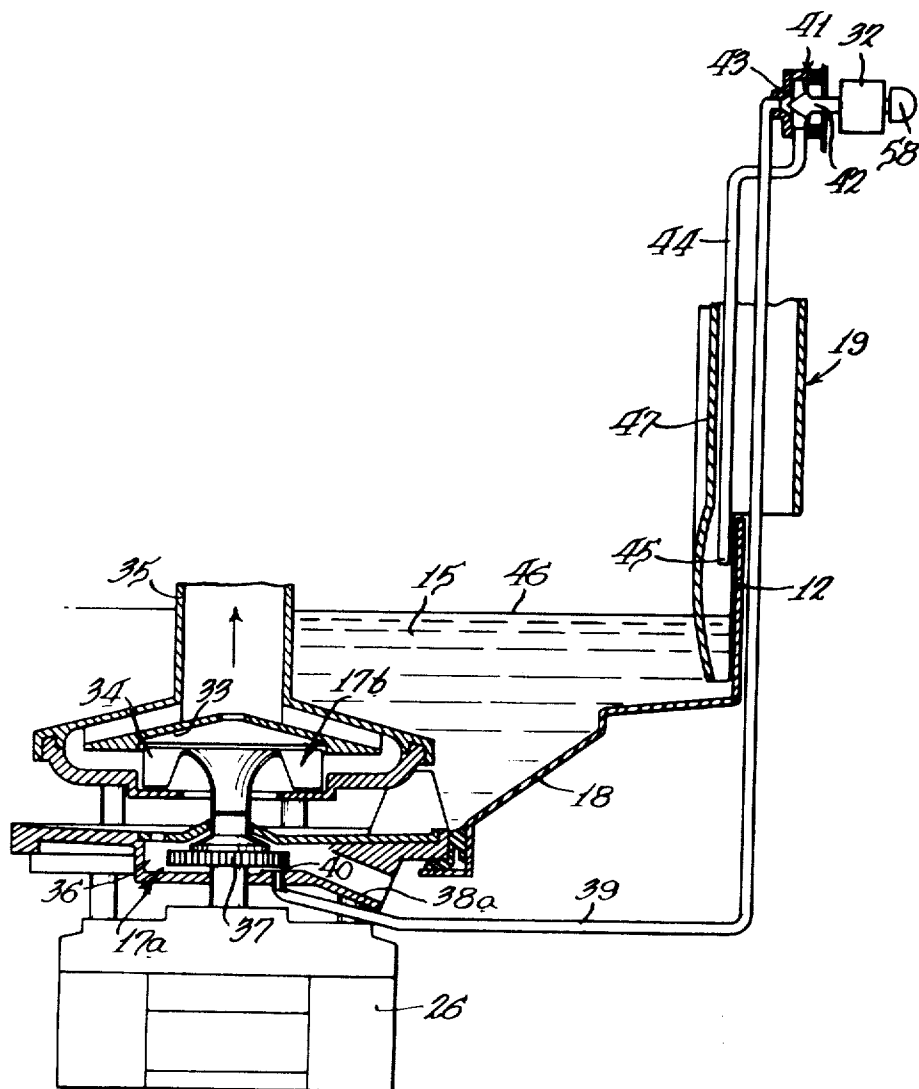
3,324,796 6/1967 La Flame 415/198
3,344,804 10/1967 Lyman 134/57 D
3,353,553 11/1967 Lind 137/567

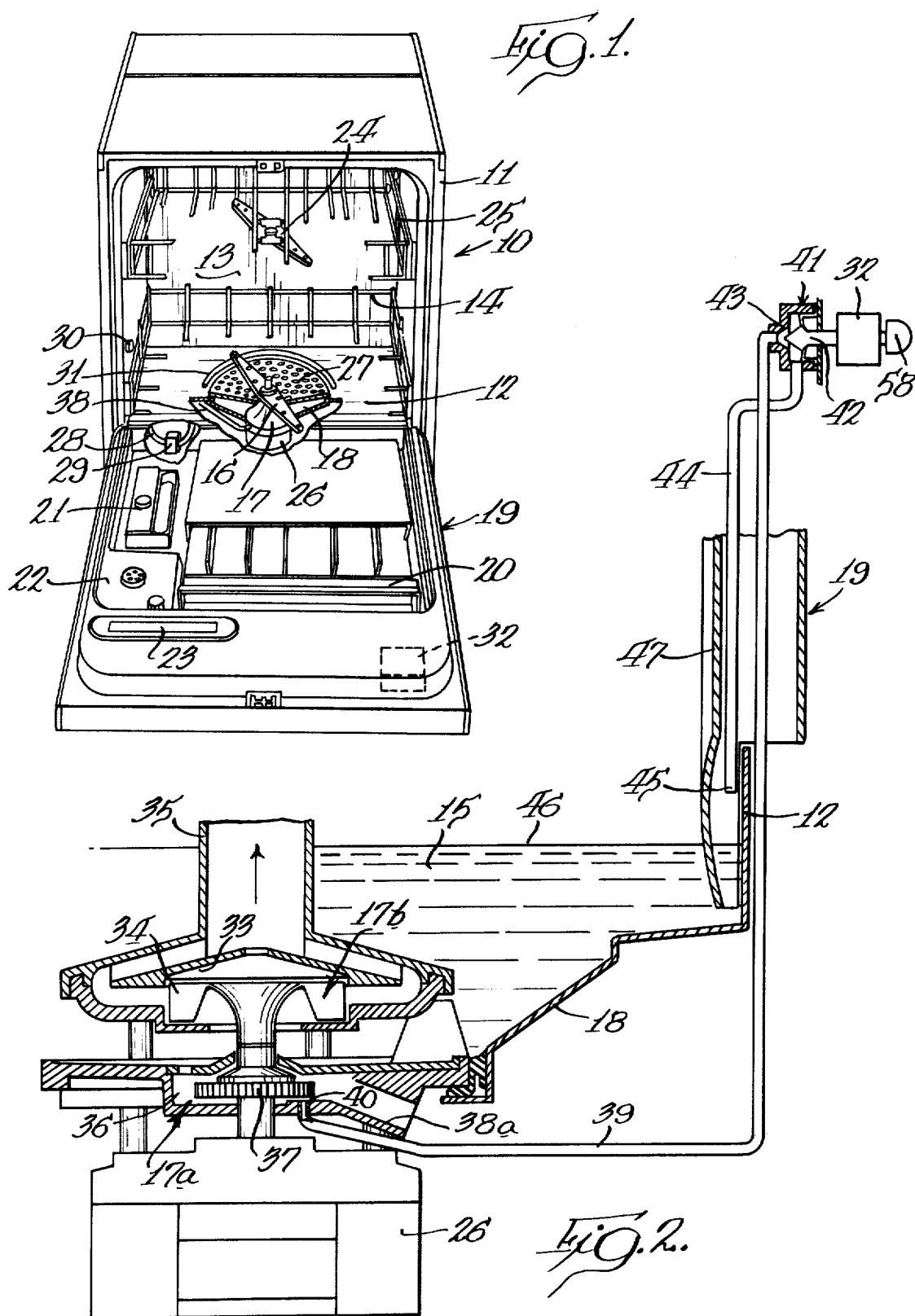
Primary Examiner—William L. Freeh
Attorney, Agent, or Firm—Hofgren, Wegner, Allen,
Stellman & McCord

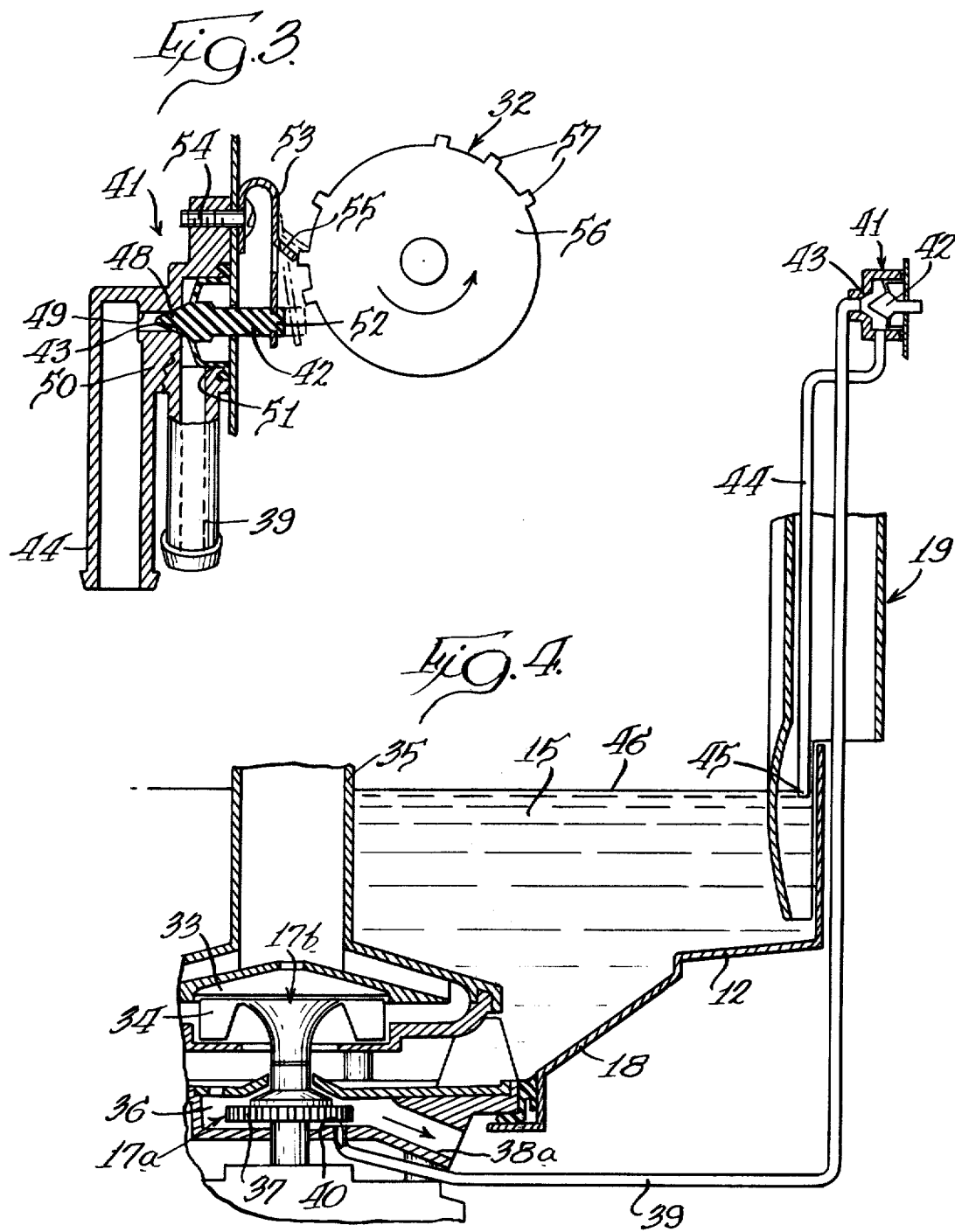
[57] **ABSTRACT**

A control for preventing overflow of fill liquid in a liquid receiver such as a dishwasher tub. The control automatically effects an operation of drain means associated with the tub whenever the level rises above a pre-selected full level. The control utilizes a unidirectional pump system for both a recirculation and drain function by selectively air locking the drain pump during the recirculation operation to prevent draining of the tub at that time.

10 Claims, 4 Drawing Figures







LIQUID LEVEL CONTROL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to liquid level controls and in particular to controls for selectively operating a drain pump.

2. Description of the Prior Art

In one conventional form of drain pump for use in dishwashers and the like, a reversing motor is provided for driving the pump means in one direction to effect recirculation of the washing liquid through the washing space as by a spraying action therethrough. When it is desired to drain the tub, the drive motor is reversed and the reverse pumping action effects the desired draining.

Such reversible liquid recirculating and draining pumps are relatively expensive. Examples of such dishwashers are shown in Ruspino U.S. Pat. No. 3,612,714 for a Dishwasher and Ruspino et al. U.S. Pat. No. 3,294,102 for a Dishwashing Apparatus Having Improved Pump Means, each owned by the assignee hereof.

It is also known in dishwashing apparatuses to provide means for permitting selective operation of a drain pump wherein the drive is maintained unidirectional at all times. An example of such a dishwashing apparatus is shown in Lind et al. U.S. Pat. No. 3,353,553 for a Dishwashing Apparatus, owned by the assignee hereof.

SUMMARY OF THE INVENTION

The present invention comprehends an improved liquid level control which provides selective operation of a unidirectionally operating pump so as to effect draining and nondraining operations selectively as a function of the liquid level in the receptacle to be drained. The present invention is considered in connection with a dishwashing apparatus, it being understood that the invention is applicable to other forms of liquid handling systems.

The present invention comprehends the control of the liquid level in the system by means of the unidirectional pump so as to prevent overflow of the liquid holding receptacle means which, illustratively, in a dishwasher, comprises a tub. The invention also comprehends that the liquid level control be operated automatically to effect the desired washing cycle and also to be used during the fill cycle to prevent overflow of the tub.

The invention comprehends the control of a unidirectional drain and recirculation pump to effect the selective drain operation by selectively air locking the pump. Thus, to effect a draining operation, the air lock is removed and the drain pump functions in a normal pumping manner. Upon completion of the desired draining operation, air is introduced to the drain pump so as to effect an air lock thereof, to thereby prevent further draining operation and correspondingly permit the tub to refill. The invention comprehends an air bleed control which is responsive to the level of the liquid in the tub to prevent air locking of the pump when the level rises above the preselected full level and thereby automatically initiate a draining operation to maintain the level at the desired full level.

The air locking of the pump may further be controlled by a timer means normally effecting cyclical operation of the apparatus so as to effect the selective air

locking of the pump as a function of the operation cycles.

Thus, the flow control means of the present invention is extremely simple and economical of construction while yet providing the highly desirable features discussed above.

BRIEF DESCRIPTION OF THE DRAWING

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIG. 1 is a front perspective view of a dishwasher embodying the invention;

FIG. 2 is a fragmentary vertical section of the dishwasher showing the relationship of the pump, door, and overflow protector;

FIG. 3 is a fragmentary enlarged vertical section of the air valve of FIG. 2;

FIG. 4 is a fragmentary vertical section similar to FIG. 2 and illustrating the functioning of the apparatus in preventing overflow of the dishwasher tub.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the exemplary embodiment of the invention as shown in FIGS. 1 and 2, a dishwasher generally designated 10 is shown to include a cabinet 11 having a tub 12 defining a dishwashing space 13 in which dishes are carried by suitable wire rack means 14. The dishes carried by the rack are washed by means of washing liquid 15 sprayed upwardly by a spray arm 16 with the washing liquid being pumped upwardly through the spray arm by a recirculation pump 17b in a sump portion 18 of the tub.

Space 13 may be selectively closed by a front door 19. The door is provided with silverware baskets 20, a detergent dispenser 21, a rinse additive dispenser 22, and a vent 23 for discharging humid air during the drying portion of the cycle. In the illustrated dishwasher, an upper spray arm 24 is provided on an upper rack portion 25 which receives a jet of washing liquid from the pump 17b through spray arm 16 to provide a further spraying of the liquid against dishes in the upper rack 25.

A unidirectional motor 26 drives the combination recirculation and drain pump 17. A screen 27 may be provided for filtering food particles from the washing liquid before the washing liquid passes to the pump 17.

Washing liquid is introduced into the tub 12 from a supply conduit 28 provided with an inlet valve 29. The liquid passes into the tub from an opening 30. A heater element 31 is provided in the chamber 13 to heat the washing liquid during wash and rinse portions of the cycle and to heat the air during the drying portion of the cycle. A control or timer 32 may be mounted in door 19 for controlling the automatic operation of the dishwasher.

Pump 17 defines a recirculation pump 17b and a drain pump 17a. Recirculation pump 17b has a pump chamber 33 having an impeller 34 therein driven by the motor 26 for pumping the washing liquid upwardly through the outlet 35 to the spray arm 16 as discussed above. Drain pump 17a has a pump chamber 36 having an impeller 37 therein also driven by the motor 26 which pumps the washing liquid through an outlet 38a through drain hose 38 to a drain during the draining cycle. An air duct 39 communicates with drain pump

chamber 36 through an opening 40 to deliver air selectively to the chamber 36 for selectively air locking, or blocking, the drain pump.

Duct 39 is provided with an air valve 41 which controls the delivery of air to opening 40 for selectively air locking the drain pump. Air valve 41 includes a movable valve member 42 for seating on a valve seat 43, valve member 42 being selectively movable by the timer 32. Air is delivered to valve 41 through a supply duct 44 which, as shown in FIG. 2, defines an inlet end 45 spaced slightly above the normal full level 46 of the washing liquid 15 in tub 12. As shown in FIG. 2, door 19 includes an inner panel 47 which overlies the inlet end 45. Valve 41 and timer 32 are preferably also mounted in the door.

When air is delivered through duct 39 to opening 40, drain pump 17a is air locked and, thus, pump 17a cannot drain liquid 15 from tub sump 18. For a more detailed description of the operation of such pump air lock means, reference may be had to said U.S. Pat. to Lind et al, U.S. Pat. No. 3,353,553, and Ruspino, No. 3,612,714.

Timer 32 may cyclically control the draining of tub 12 by positioning valve member 42 selectively in seated and unseated relationship to the valve seat 43. Thus, motor 26 may comprise a unidirectional motor with the selective draining operation being controlled simply by the delivery or nondelivery of air to pump chamber 36 through opening 40.

During the fill portion of the cycle, movable valve member 42 is disposed in the valve open position, as shown in FIG. 4. Thus, during the filling of tub 12 through conduit 28 and delivery opening 30, air may be delivered to drain pump 17a through the uncovered end 45 of supply duct 44 above the upper level of the liquid in the tub. Should, however, the level rise to cover end 45 of duct 44, as shown in FIG. 4, air is no longer permitted to pass through duct 44 and duct 39 to pump 17a thus removing the air lock of pump 17a and permitting the pump to drain liquid from the tub 12 thereby lowering the level and preventing overflow of the tub. When the level of liquid 15 drops below the level of duct end 45 of supply duct 44, pump 17a is again air locked and draining of the liquid is terminated.

Referring now to FIG. 3, movable valve member 42 of air valve 41 is shown to comprise a rubber valve plunger having a conical tip 48 seating on valve seat 43 to sealingly close the passage 49 through the valve body 50. The movable valve member is movably sealed to the valve body by a diaphragm 51. Valve member 42 includes a stem portion 52 connected to a leaf spring 53 secured to the valve body by suitable screw 54 and having a cam follower tab 55 engaged by a cam 56 of timer 32. Cam 56 may include a plurality of projecting portions 57 which, when engaging the cam follower portion 55 of spring 53, urge the spring to the left as seen in FIG. 3 to close the valve and thereby effect a drain operation by pump 17a. When the cam follower is disposed between the projecting cam portions, the spring is relaxed to the dotted position of FIG. 3, permitting the air valve to be open and thereby air lock the pump 17a to prevent the draining operation.

The control 32 may comprise a conventional solenoid operated means for effecting translation of the valve member 42, as will be obvious to those skilled in the art. Further, alternatively the control may comprise

a bimetallic-transducer operated means for translating the valve member 42. Broadly, the control defines electrical means for driving the air valve which cooperate with the control afforded by the location of the duct end 45 superjacent the normal full level of the tub to provide an improved overall control of the dishwasher operation.

More specifically as shown in FIG. 2, control of dishwasher 10 may be initiated by manipulation of a control knob 58 associated with the timer 32. Initially, tub 12 is filled to the normal full level 46 by the opening of water supply valve 29 for a preselected period of time to introduce the washing liquid through conduit 28 into the tub. Prior to completion of delivery of the washing liquid to the tub, motor 26 is energized by control 32 to initiate spray washing of the dishes in the apparatus. Concurrently, control 32 positions air valve 41 in the open position so that air delivered through ducts 44 and 39 is introduced to drain pump chamber 36 thereby effectively air locking the pump and preventing draining of the liquid from the tub 12 even though there is rotation of impeller 37 by motor 26 at this time. At the end of the preselected fill period, control 32 maintains air valve 41 open to continue the prevention of the drain operation until completion of the washing cycle. At the end of a recirculation portion of a cycle (wash or rinse), control 32 closes air valve 41 and, thus, terminates air locking of drain pump 17a, whereupon liquid is pumped from tub 12 to drain the tub. Timer 32 may selectively repeat the fill, wash and drain cycles as discussed above in conformity with the program of the dishwasher.

If at any time during operation of motor 26 the liquid level in tub 12 rises to the level of the air duct end 45, air delivery to the drain pump 17a is prevented and, thus, the pump will function to lower the level of liquid so as to effectively prevent overflow of the tub. Such rising of the liquid level may, for example, occur because of a temporary failure of valve 29 or accidental double filling of the tub, and in the past, such overflowing has caused substantial damage by overflow of the liquid onto the electrical components of the apparatus or onto a floor. The overflow control is provided by the simple arrangement of the delivery air duct as described and, thus, is extremely simple and economical of construction. The device functions whenever pump motor 26 is energized and effectively eliminates the requirement for a reversing motor to further minimize the cost of the apparatus.

The foregoing disclosure of specific embodiments is illustrative of the broad inventive concepts comprehended by the invention.

Having described the invention, the embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a dishwasher, a liquid flow control comprising: a receptacle adapted to hold liquid; a pump; means for providing liquid to said receptacle; means connecting said pump to said receptacle in liquid transfer association therewith; and means for selectively operating said pump to pump said liquid from said receptacle including means sensing the liquid level in the receptacle and responsive thereto for selectively delivering gaseous fluid to the pump to cause an air lock thereof when the level of liquid in said receptacle is below a preselected level, and for preventing the delivery of said gaseous

5

fluid to the pump to prevent said air lock when the level reaches said preselected level.

2. The dishwasher of claim 1 wherein said pump comprises a unidirectional, rotary pump.

3. The dishwasher of claim 1 wherein said air lock providing means includes a timer for effecting air lock of the pump at preselected times.

4. The dishwasher of claim 1 wherein said air lock providing means includes a bimetallic-transducer operated air valve.

5. The dishwasher of claim 1 wherein said air lock providing means includes an electrically driven air valve.

6. In a dishwasher having a tub for holding a quantity of washing liquid, and means for delivering washing liquid to the tub, a liquid level control means comprising: a unidirectionally driven pump having first pumping means for forcibly circulating the liquid for washing objects in the tub, and a second pumping means for pumping liquid from the tub for draining the tub; and air lock means including means sensing the liquid level in the tub and responsive thereto for selectively delivering gaseous fluid to said second pumping means to cause an air lock of said second pumping means for selectively preventing draining of the liquid from the tub

6

when the level of washing liquid in the tub is below a preselected overflow level.

7. The dishwasher of claim 6 wherein said air lock means includes a timer and means operated by the timer for controlling the initiation and duration of operation of the pumping means for draining the tub at a preselected time during the operating cycle of the washing apparatus.

8. The dishwasher of claim 6 wherein said air lock means includes an air duct having an inlet disposed superjacent said overflow level, and an outlet to said second pumping means.

9. The dishwasher of claim 6 wherein said air lock means includes an air duct having an inlet disposed superjacent said overflow level, an outlet to said second pumping means, and an air valve for controlling passage of air from said inlet to said outlet.

10. The dishwasher of claim 6 wherein said air lock means includes an air duct having an inlet disposed superjacent said overflow level, an outlet to said second pumping means, an air valve for controlling passage of air from said inlet to said outlet, and means for cyclically closing said air valve.

* * * * *

30

35

40

45

50

55

60

65