

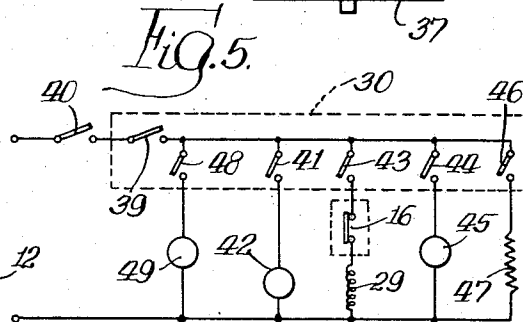
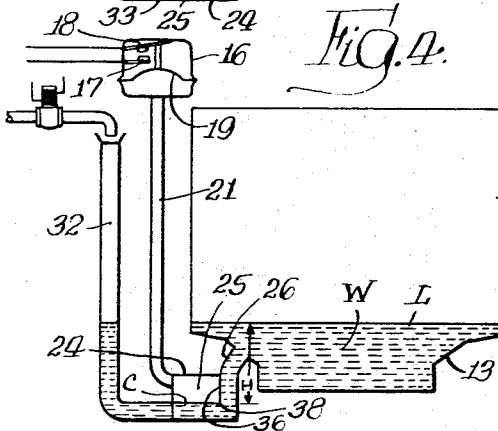
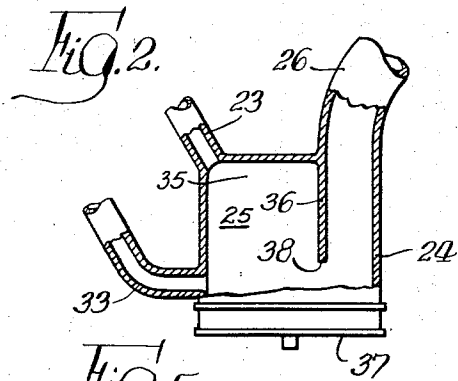
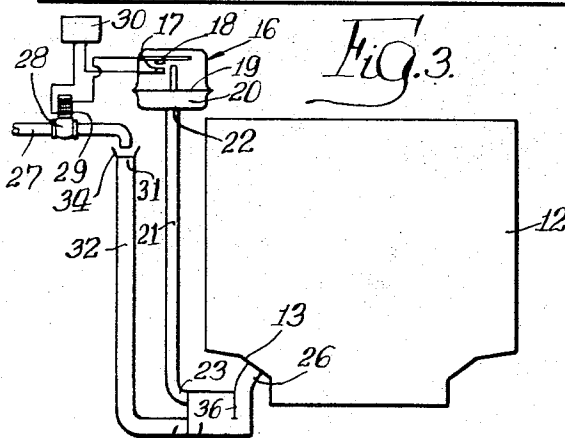
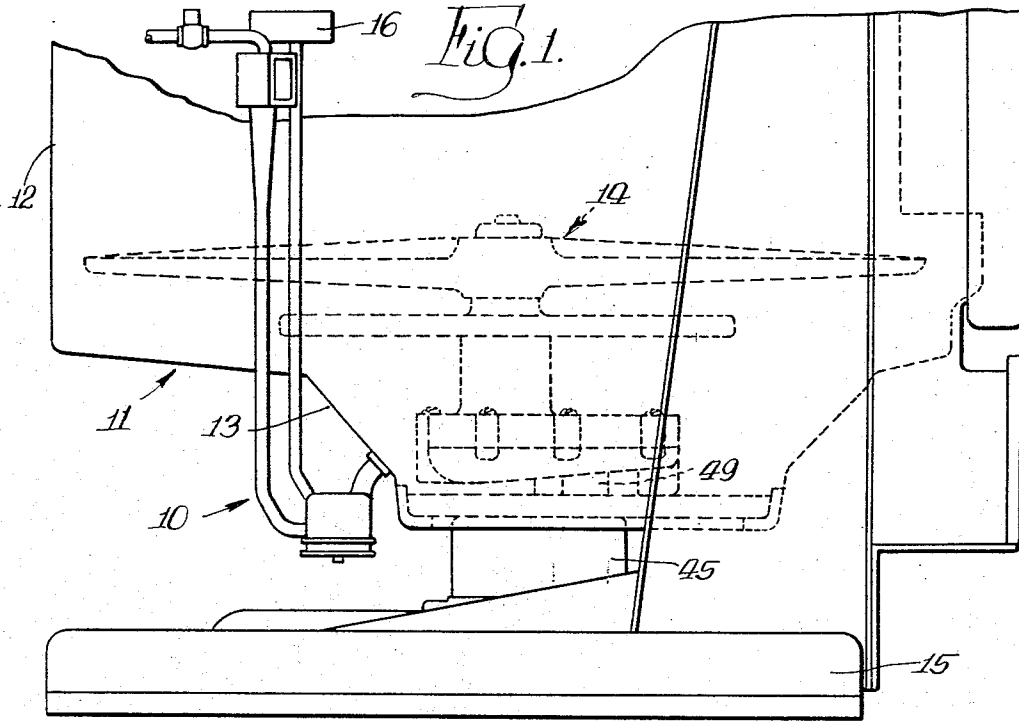
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LIQUID LEVEL CONTROL

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1

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LIQUID LEVEL CONTROL

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ABSTRACT OF THE DISCLOSURE

A liquid level control for use in an apparatus such as a dishwasher wherein the head of the liquid therein is relatively small. The control utilizes a pressure responsive sensor and includes a device for entraining air in the supply water and delivering it to the duct leading to the sensor to prevent false readings as by the presence of liquid in the duct.

This invention relates to liquid control means and in particular to means for controlling the level of liquid in apparatus such as a dishwasher apparatus where the head is relatively small.

In one form of known liquid level control means is provided a control mechanism responsive to air pressure for selectively controlling an electric switch which in turn controls the filling operation. The conventional control mechanisms of this type require, however, a relatively large liquid head for actuation of the switch as they are relatively insensitive. Thus, heretofore, such controls have not proven completely satisfactory for use in such low head apparatus as dishwashers, use thereof being restricted primarily to apparatus where a relatively large head of water is available such as in laundry apparatus and the like.

The present invention comprehends an improved control system utilizing such a control mechanism in a novel manner so as to permit use of the conventional control mechanisms in apparatus such as dishwashers having such low operating heads.

Thus, a principal feature of the present invention is the provision of a new and improved liquid level control.

Another feature of the invention is the provision of a new and improved water fill control for use in apparatus utilizing a relatively low liquid head.

A further feature of the invention is the provision of such a water fill control arranged for use in dishwasher apparatus and the like.

Yet another feature of the invention is the provision of such a water fill control having an air pressure responsive mechanism and new and improved means for maintaining a desired air pressure-transmitting medium in the association with the mechanism.

Still another feature of the invention is the provision of such a fill control including a container for holding liquid and having a bottom, means defining a chamber at a level lower than the bottom, means providing a communication between the chamber and the container through the bottom, control means responsive to air pressure for providing communication between the chamber and the control means for transmitting to the control means the head pressure of the liquid in the container and above the point of communication between the duct means and the chamber, means controllably operable to deliver liquid into the container, and means providing serially quantities of air to the duct means.

A yet further feature of the invention is the provision of such a fill control including means for entraining air in the liquid being delivered for passage through the chamber to the duct means concurrently with the delivery of the liquid through the chamber into the container.

Other features and advantages of the invention will be

2

apparent from the following description taken in connection with the accompanying drawing wherein:

FIGURE 1 is a fragmentary side elevation of a dishwasher apparatus provided with a water fill control means embodying the invention;

FIGURE 2 is a fragmentary enlarged vertical section of the control chamber of FIGURE 1;

FIGURE 3 is a reduced schematic side elevation illustrating the arrangement of the control prior to delivery of water to the dishwasher tub;

FIGURE 4 is a reduced schematic side elevation illustrating the arrangement of the control upon filling of the dishwasher tub to the operating level; and

FIGURE 5 is a schematic electrical diagram of the control.

In the exemplary embodiment of the invention as disclosed in the drawing, a fill control generally designated 10 is shown in association with a dishwasher apparatus generally designated 11, it being understood that the control is equally adaptable to other apparatuses having relatively low liquid heads in use. The apparatus 11 includes a container, or tub, 12 having a bottom 13. In the illustrated dishwasher embodiment, the apparatus 11 further includes a spray mechanism 14 carried on the bottom 13 for throwing the liquid upwardly in washing dishes and the like (not shown) in the container 12. The apparatus may be carried on a suitable support 15 as shown in FIGURE 1.

Control 10 includes a conventional air pressure responsive switch mechanism 16 which as shown in FIGURE 3 is provided with a fixed contact 17 and a moving contact 18 selectively engageable with the fixed contact 17 by means of a flexible diaphragm 19 extending across the interior of a housing 20. A duct 21 is connected to an inlet 22 opening into the housing below the diaphragm 19 and is connected at its lower end 23 to an enclosure 24 defining a chamber 25. The switch mechanism 16 herein comprises a conventional pressure responsive switch mechanism requiring a relatively high pressure head such as approximately five inches of water for moving the switch contact 18 away from the contact 17.

As the water level within the tub 12 during the normal dish washing operation is conventionally lower than five inches above the lowermost portion of the bottom 13, the head sensed by the switch mechanism 16 must include an additional liquid head below the bottom 13. Thus, the enclosure 24 herein is preferably disposed below the bottom 13 and communicates with the interior of the tub by means of an outlet conduit 26 therebetween. Thus, as shown in FIGURE 4, when sufficient dish washing liquid W is delivered to the tub to reach the preselected level L, the head of liquid sensed by the switch 16 through the duct 21 and chamber 25 comprises the head H between the level L and level C in chamber 25 which is substantially greater than the head of the liquid above the tub bottom 13, being in this instance at least approximately five inches.

Water is delivered to the tub 12 from a supply line 27 including a valve 28 having a solenoid operator 29 connected through switch contacts 17 and 18 to a suitable control 30 of conventional construction for use in controlling the dish washing cycle. As best seen in FIGURES 3 and 4, the water is delivered from supply line 27 into an upwardly open end 31 of a delivery conduit 32 having a lower end 33 connected to the housing 24 for delivering the supply water into the lower portion of chamber 25 for passage through the chamber and upwardly through conduit 26 into the container, or tub, 12. The upper end 31 of the conduit is provided with a funnel means 34 to provide an air gap and for guiding the incoming water into the conduit 32 while entraining bubbles of air therein

from the ambient atmosphere. Other suitable air entraining means may be employed within the scope of the invention, the illustrated means being exemplary only. A portion of the air entrained in the supply water is released therefrom in chamber 25 to fill the upper portion 35 of the chamber communicating with the duct 21, space portion 35 being defined internally within chamber 25 by means of a depending wall 36 spaced inwardly from the outer enclosure 24 and extending downwardly to a preselected level spaced above the bottom 37 of the enclosure 24. As shown in FIGURE 4, the lower end 38 of the wall 36 defines liquid level C in chamber 25 and with the liquid level L, the liquid level C thus defines the liquid head H available for operation of the switch 16.

As the air passes upwardly from the water into space 35 during each delivery of the supply water into tub 12, any water which may have moved upwardly into the space 35 and/or lower end 23 of the duct 21 is effectively dispelled therefrom during operation of the apparatus 11 so as to maintain highly accurate the control effected by control 10. Such water may have previously passed upwardly into the chamber space 35 and duct end 23 as by absorption of the air therein into the subjacent water at the bottom of the chamber 25 whereby the resultant vacuum condition draws the water upwardly into the air space. Such undesirable presence of the water in the air space above the level of the wall edge 38 would seriously affect the accuracy of the control 16. Thus, the improved prevention of such presence of the water in the air space during the operation of the apparatus is a highly desirable feature of the present invention.

The operation of the apparatus 11 and control 10 is best seen with reference to the wiring diagram illustrated in FIGURE 5. More specifically, the control 30 is shown to include a normally open single pole push-pull timer switch 39, connected in series with a conventional single pole normally open door switch 40 for precluding operation of the dishwasher as during loading thereof. The user firstly manually closes the timer switch 39 after having loaded the apparatus 11 whereupon the timer is manually operated to close a first normally open cam switch 41 controlling the timer motor 42. Subsequently, a second normally open timer switch 43 is closed which is connected through the normally closed switch 16 to the valve solenoid 29 thereby energizing the solenoid to open the valve 28 and effect delivery of water into the tub 12. As discussed above, this delivery of the water to the tub automatically assures that the duct 21 and the chamber space 35 are filled with air down to the lower end 38 of the housing wall 36. When the level of the water W delivered into the tub 12 reaches the level shown in FIGURE 4, the head H of the water from the level L down to the level C of chamber 25 is sufficient to act through the column of air in chamber portion 35 and duct 21 to operate the diaphragm 19 of switch 16 to open the normally closed switch and thereby de-energize the solenoid 29.

The timer 30 further includes additional switches 44 for controlling the circulation pump motor 45 of the apparatus 11 and switch 46 for controlling the electric heater 47 of the apparatus during the dish drying cycle. Still further, the switch 30 includes a switch 48 for controlling the drain pump 49 for draining the tub 12 in conventional manner at suitable times in the dish washing cycle.

Thus, the invention comprehends an improved simplified water fill control for use in controlling the level of water or similar liquid in a container such as a dishwasher tub wherein the desired operating head is relatively low. The invention permits the use of a relatively inexpensive and simple control switch adapted for use with systems

having a substantially greater head of liquid than is conventionally employed in the dish washing operation. Thus, the invention comprehends the provision of means for increasing the head sensed by the switch while yet providing only the normal relatively low dish washing head of liquid in the dish washing apparatus itself. Still further, the invention comprehends arranging the control in a novel and simple manner to effectively maintain the accuracy of the level sensing by effectively precluding undesirable presence of liquid in the air column provided for transmitting the head pressure to the sensing switch.

While I have shown and described one embodiment of my invention it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

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

1. Apparatus comprising: a container for holding a preselected volume of liquid and having a bottom; means defining a space having a lower portion at a level lower than said bottom; means defining a liquid flow passage communicating with said lower space portion and the bottom of said container; control means responsive to air pressure for providing a signal; duct means communicating with an upper portion of said space and said control means for transmitting to the control means the head pressure of the liquid in said passage and said container above said lower portion of said space; means for delivering liquid through the lower portion of said space and said flow passage into said container; and means for providing a supply of air to said liquid prior to the delivery thereof through said space, whereby a portion of the air in said liquid rises upwardly therefrom in said space to said upper portion thereof to cause said duct means and said upper portion of the space to be substantially fully air filled as an incident of the delivery of said preselected volume of liquid to said container and provide to said control means an air pressure accurately corresponding to said liquid head pressure.

2. The apparatus of claim 1 wherein said space defining means comprises a housing to which each of said flow passage means, duct means, and liquid delivering means are connected.

3. The apparatus of claim 1 wherein said control means comprises a pressure responsive switch mechanism requiring at least approximately five inches water head pressure for actuation and said preselected volume of liquid provides a head in said container of less than said switch requirement.

4. The apparatus of claim 1 wherein said air supply means provides a supply of air to said space substantially the entire time during which said liquid is being delivered into the container.

5. The apparatus of claim 1 including means for causing the liquid being delivered to the container to suck the air thereinto.

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