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AUTOMATIC DETERGENT, RINSE ADDITIVE AND STERILIZER DISPENSER FOR DISHWASHERS

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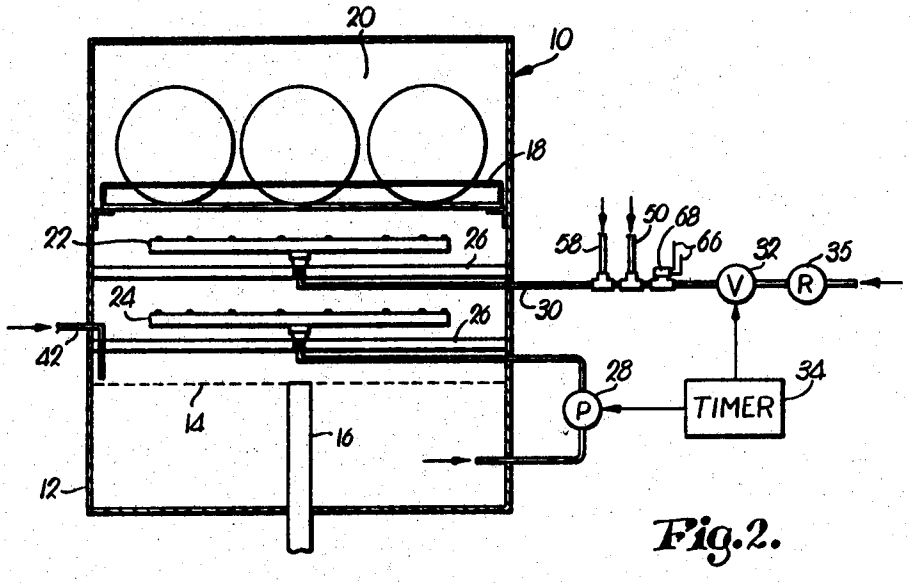


Fig. 2.

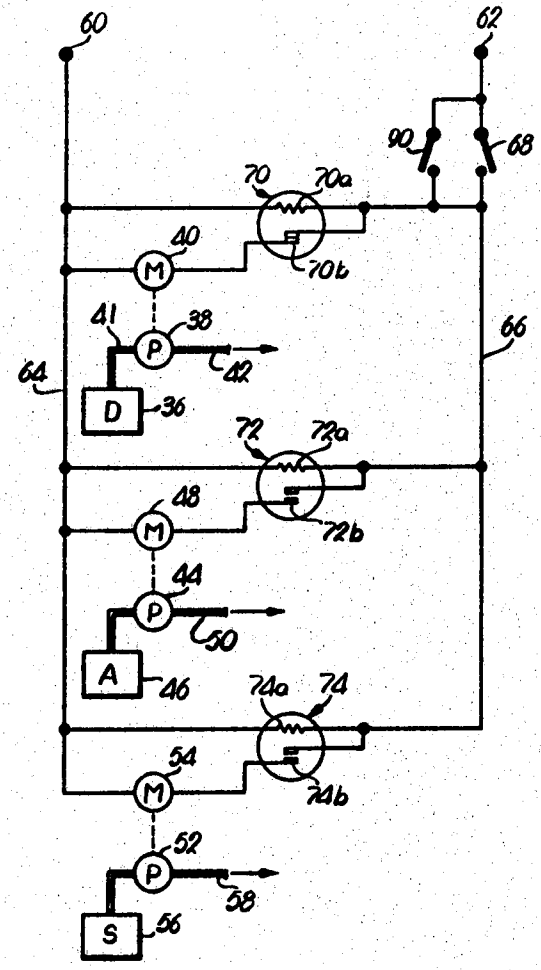
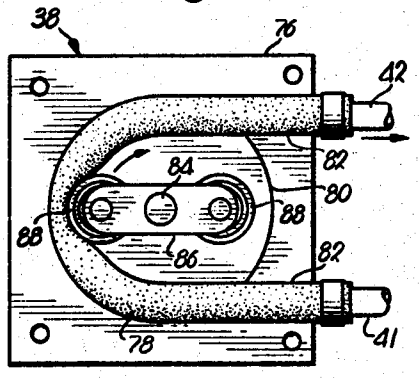


Fig. 1.

Fig. 3.



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AUTOMATIC DETERGENT, RINSE ADDITIVE AND STERILIZER DISPENSER FOR DISHWASHERS

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ABSTRACT OF THE DISCLOSURE

A liquid detergent, a rinse additive, and a sterilizing chemical are automatically introduced into a dishwasher during the rinse period thereof. The rinse additive and the sterilizing chemical are pumped into the rinse line, and the detergent is pumped into the wash water sump beneath the washing and rinsing chamber of the dishwasher. Separate metering pumps are utilized and are individually timed, and the rate of flow of the rinse water is maintained constant to assure that proper, uniform amounts of the three chemicals are discharged during each rinse period.

Particularly in commercial dishwashers, problems are encountered in the dispersing of chemicals used by the apparatus in the processing of tableware. Powdered detergents are subject to preferential solubility difficulties; thus, the use of such detergents may create a variable detergent concentration which is undesirable. Ideally, the detergent should be carefully controlled in accordance with the hardness of the wash water, the degree to which the tableware is soiled, and the usual condition of the soil, i.e. whether it has been allowed to dry on the articles or is still moist.

Furthermore, a rinse additive (a wetting agent to prevent watermarks or spots) is oftentimes admitted to the machine during the rinse period, the purpose of the additive being to form a monomolecular film on the glassware being rinsed. The additive is relatively expensive and is normally needlessly wasted if introduced into the rinse water for the entire duration of the rinse period. It has been customary heretofore to either siphon the rinse additive into the rinse waterline by use of a venturi or to pump the additive into the line. In either case, the additive is added over the entire period of the rinse.

In addition to the above, commercial dishwashers of the so-called "hot water" type have an operational characteristic which further enhances the problems just briefly discussed. The washer structure commonly comprises a housing having a sump at its bottom for the wash water which is recirculated during each washing period. A washing and rinsing chamber for the tableware is spaced above the sump. A discharge head, oftentimes of the rotary type, is employed to direct rinse water supplied by a hot waterline onto the tableware after the washing period, whereupon such water then falls into the sump and increases the water level thereof. The sump is provided with an overflow which maintains the level constant; thus, the concentration of the detergent in the wash water is necessarily reduced during each rinse period by the addition of the rinse water to the water already in the sump and the draining of water through the overflow.

It will be appreciated, therefore, that an important factor in determining the quantity of detergent required, in addition to the considerations set forth above, is the amount of rinse water utilized during the rinsing period, since an equal amount of water will be displaced through the overflow. This amount is subject to variation in proportion to the pressure of the water in the hot water

supply line as the pressure determines the volume of water discharged by the head into the sump during the rinse period. Thus, the water pressure not only affects the detergent concentration, but also governs the amount of rinse additive required to provide a certain additive concentration for a predetermined time duration. Furthermore, it is also desirable to provide a means of introducing a sterilizing chemical such as chlorine into the rinse water for a sufficient period of time to permit the desired sterilization, again with uniform concentration. Local regulations may require the use of chlorine or another specified sterilizing chemical.

It is, therefore, the primary object of this invention to provide a means of obviating the various difficulties discussed above, including the problems of preferential solubility of the detergent, control of the amount of detergent utilized, waste of the rinse additive, the controlled introduction of a sterilizing chemical into the rinse water, and the maintenance of uniform chemical concentrations.

As a corollary to the foregoing object, it is an important aim of the instant invention to provide a means of introducing a detergent and a rinse additive, and a sterilizing chemical if desired, into dishwashing apparatus with positive control of the amounts of the chemicals admitted.

Specifically, it is an important object of the invention to provide a means of automatically introducing a desired quantity of a liquid detergent into the wash water in the sump during the rinse period and of assuring that the wash water contains a uniform concentration of detergent at all times.

Another specific and important object of the instant invention is to provide a means of introducing a rinse additive into the rinse line of a dishwasher and of controlling the period of time that the additive is admitted in order to positively preclude waste thereof.

Still another specific and important object of the invention is to provide a means of introducing a sterilizing chemical into the rinse line for a controlled time period selected in accordance with the characteristics of the chemical and the required degree of sterilization.

Yet another important aim is to provide the foregoing control of the chemicals introduced into dishwashing apparatus through the use of metering pumps for each chemical which operate only for a predetermined period of time during the rinse period.

In the drawing:

FIGURE 1 is a diagrammatic and schematic diagram of the automatic dispensing apparatus of the instant invention;

FIG. 2 is a diagrammatic representation of a commercial dishwasher showing the coupling of the apparatus of FIG. 1 therewith, and diagrammatically illustrating the housing of the dishwasher in vertical section; and

FIG. 3 is a plan view of a metering pump showing the same with the top plate of its housing removed.

Referring initially to FIG. 2, the housing **10** of a commercial dishwasher is shown provided with a sump **12** for wash water which normally fills the sump to a level indicated by the broken line **14**. An overflow **16** provides a drain for sump **12** to maintain the wash water at the level **14**. The tableware is supported by a rack **18** spaced above sump **12**, the rack **18** being disposed in a washing and rinsing chamber **20** defined by the portion of housing **10** above sump **12**.

A pair of discharge heads **22** and **24** of the rotary type are mounted in the lower portion of chamber **20** one above the other, and supported by radials **26** for rotation about vertical axes. The lower head **24** is the washing head and is communicated with the outlet of an electrically operated pump **28** which has its inlet in fluid communication with the wash water in sump **12**. A hot

waterline **30** communicates with the upper discharge head **22**, the latter being employed to rinse the tableware on rack **18**.

A normally closed solenoid valve **32** in line **30** controls the flow of water to rinse head **22** and, together with pump **28**, is operated by a cycle timer **34**. Radiant heating means (not shown) is also provided for drying the tableware after washing and rinsing, it being understood that such heating means would also be under the control of timer **34**.

A pressure regulator **35** is interposed in line **30** upstream from valve **32** for the purpose of maintaining the rate of flow of the water in line **30** constant when valve **32** is open. Since higher water pressures than necessary for economical operation are normally encountered, the regulator **35** serves to hold the pressure at a desired reduced level, preferably on the order of 20 p.s.i.

In FIG. 1, apparatus is illustrated for introducing liquid detergent, rinse additive, and a sterilizing chemical into the dishwasher of FIG. 2. A container for liquid detergent is illustrated at **36** and communicates with the inlet of a pump **38** via a pipe or hose connection **41**. The pump **38** is driven by an electric motor **40**, and a pipe **42** extends from the outlet of pump **38** and terminates just above the waterline **14** of sump **12**, as illustrated in FIG. 2. A second pump **44** has its inlet in communication with a container **46** for a rinse additive, and is driven by an electric motor **48**. A conduit **50** extends from the outlet of pump **44** to a T in waterline **30** (FIG. 2) downstream from valve **32**. In similar fashion, a third pump **52** is driven by a motor **54** and is employed to pump a suitable sterilizing chemical, such as chlorine, from a container **56** to line **30** via a conduit **58** coupled with line **30** by a T connection.

A pair of power terminals **60** and **62** are connected to a suitable source of electrical energy, such as an available AC outlet. A pair of supply leads **64** and **66** extend from terminals **60** and **62** respectively, a pressure-responsive, normally open switch **68** being interposed in lead **66**. The switch **68** is also illustrated in FIG. 2 where it may be seen that the switch is coupled in pressure-sensing relationship to line **30** downstream from valve **32**. The switch **68** may be diaphragm-operated, and is constructed and arranged to close in response to flow of water under pressure in line **30** caused by the opening of valve **32**.

A normally closed, thermal time delay relay **70** has its heater **70***a* connected across leads **64** and **66**, and contacts **70***b* connected across leads **64** and **66** in series with motor **40**. A normally open, thermal delay relay **72** has its heater **72***a* connected across leads **64** and **66**, and contacts **72***b* connected to motor **48**. In similar fashion, a third thermal delay relay **74** has a heater **74***a* and normally open contacts **74***b*, the latter being connected in a series energizing circuit with motor **54**.

The pump **38** illustrated diagrammatically in FIG. 1 is shown in FIG. 3, it being understood that the other pumps **44** and **52** are identical in construction and operation to pump **38**. The pump **38** is a metering pump having a housing or block **76**, the top plate thereof being removed in FIG. 3. With the plate in place, a flexible, U-shaped tube **78** is sandwiched between the top plate and the illustrated bottom plate of housing **76**, the two halves of the housing having an internal recess **80** of circular configuration into which tube **78** fits, the walls of the housing surrounding tube **78** thereby preventing outward displacement of the tube. A pair of openings **82** in housing **76** permit the legs of tube **78** to pass from recess **80** to the exterior of the housing where they are joined to pipes **41** and **42**, the latter being preferably composed of a flexible plastic material. Although drive motor **40** is beneath pump **38** and hence hidden from view in FIG. 3, its drive shaft **84** is illustrated and has a rotor **86** mounted thereon which carries a pair of diametrically opposed rollers **88**. Each of the rollers **88** is brought to bear against the tube **78** as shaft **84** rotates, the tube **78** being closed at the zone of contact of each roller **88** therewith since tube **78** is sandwiched between the contacting roller **88** and the inside wall of housing **76** formed by recess **80**.

In operation, the timer **34** controls the operational cycle of the dishwasher which, it will be assumed for purposes of illustration, comprises a 45 second wash period, a 12 second rinse period, and then a drying period to complete the cycle. The wash water recirculating pump **28** is thus initially activated by timer **34** to discharge the wash water upon the tableware through head **24**. After the wash period, pump **28** ceases and solenoid valve **32** is energized for 12 seconds to effect the rinsing operation. The flow of water in line **30** downstream from valve **32** is sensed by switch **68**, closing the latter and energizing heaters **70***a* and **72***a* and **74***a* of the delay relays. If desired, switch **68** may comprise the contacts of a relay which would be directly operated by timer **34** at the time of energization of solenoid valve **32**. The pressure-responsive switch illustrated, however, permits the automatic chemical dispensing apparatus to be utilized with dishwashers in which the rinse valve is manually controlled rather than timer controlled.

The contacts **70***b* of delay relay **70** open after a predetermined time duration selected in accordance with the various factors discussed hereinabove with respect to the amount of detergent to be added during each rinse period to compensate for the reduction of the concentration of the detergent in the wash water occasioned by loss of some of the wash water through the overflow **16**. This time duration would normally be 2 seconds or greater. Since liquid detergent is pumped into sump **12**, the problem of preferential solubility encountered with dry detergents is obviated. Furthermore, by virtue of the constant water flow rate provided by regulator **35**, it is assured that the detergent concentration will not vary since both the volume of the water discharged into sump **12** and the amount of detergent added are constants.

The operating time of pump **38** may be readily preset for a particular installation of the instant apparatus in accordance with washing requirements, since thermal delay relays of various time-out periods are commercially available. Alternatively, rather than utilizing the relay **70** to control the dispensing of the detergent and the relays **72** and **74** to control the dispensing of the rinse additive and the sterilizing chemical, three cam operated switches may be employed in place of the three delay relays. The operating cams for the three switches would be driven by a common timing motor activated by the closure of switch **68**, and could be adjustable on the cam shaft and replaceable in order to provide a convenient means of setting the operating times of pumps **38**, **44** and **52**.

The relay **72** controlling pump **44** is normally open to preclude unnecessary dispensing of the rinse additive at the beginning of the 12 second rinse period. Activation of pump **44** for the last 6 seconds of the rinse period, for example, is normally sufficient. Thus, a delay time of 6 seconds for relay **72** would be suitable. Normally, a lesser delay time, and hence a longer dispensing duration, would only waste the additive.

The relay **74** is also of the normally open type, its contacts **74***b* closing after the initiation of the rinse period in accordance with the desired running time for the pump **52**, which would be selected in accordance with the characteristics of the particular sterilizing chemical utilized. Preferably, the sterilizing chemical would be introduced into the dishwasher for a longer period of time than the rinse additive; therefore, the contacts **74***b* would close after such initiation but prior to closure of the contacts **72***b* of the additive controlling relay **72**. As in the dispensing of the detergent, uniform concentrations of the rinse additive and the sterilizer are assured by the constant rate of flow provided by regulator **35**.

At the close of the rinse period, timer **34** de-energizes solenoid valve **32** to effect closure of the latter, and the pressure drop downstream from valve **32** effects reopen-

ing of switch **68** to terminate operation of pumps **44** and **52**. A normally open override switch **90** is provided and is connected in shunt relationship to the pressure-responsive switch **68** in order to provide a means of charging the pipe **42** and the conduits **50** and **58** as may be required from time-to-time, such as might be the case, for example, if one of the containers **36**, **46** or **56** were permitted to become completely exhausted before refilling. Additionally, other override switches may be added to the circuitry in shunt relationship to the contacts of the various relays if desired.

It should be understood, furthermore, that the metering pumps, such as illustrated in FIG. 3, assure that the same amount of liquid is dispensed for a given pump operating time. As rotor **86** revolves, liquid is drawn into tube **78** through inlet pipe **41** and then forced from tube **78** through outlet pipe **42** as rotation continues. The tube **78** is closed at all times by at least one of the rollers **88** to preclude backflow of liquid through the pump. Since, after approximately 90° of rotation of rotor **86** from the position illustrated, both of the rollers **88** are in pressure-closing contact with the tube **78**, the liquid in the tube between the two rollers is discharged into the outlet pipe **42** as rotation continues through the next 180°.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a dishwasher:

a housing having a sump therein for wash water and defining a washing and rinsing chamber for tableware above the sump means for supporting said tableware in said chamber;

said sump being provided with an overflow;

a discharge head in the chamber;

a waterline communicating with the head for delivering rinse water thereto for flow therefrom onto said tableware, through the chamber and into the sump;

regulator means in said line for maintaining the flow of the rinse water from the head at a constant rate;

a valve in the line for controlling the rinse period of the dishwasher;

a pair of electrically responsive pumping devices each having an inlet and an outlet,

the inlet of one of said devices being adapted for communication with a supply of liquid detergent,

the inlet of the other of said devices being adapted for communication with a supply of rinse additive;

a pipe communicating the outlet of said one device with said sump;

a conduit communicating the outlet of said other device with said line;

electrically responsive, time-dependent switching means electrically coupled with said devices for controlling the operation thereof;

terminal means adapted for coupling with a source of electrical energy; and

circuit means coupling said devices and said switching means with said terminal means and responsive to initiation of said rinse period for rendering the switching means operative,

said switch means effecting operation of said other device for a preselected time duration less than said rinse period and commencing after said iniation, whereby to prevent waste of the additive at the beginning of the rinse period.

2. The invention of claim **1**,

said switching means effecting operation of said one device for a predetermined time duration during the rinse period selected to increase the concentration of detergent in the wash water by an amount to compensate for the detergent lost through the overflow.

3. The invention of claim **1**,

said circuit means including a pressure-responsive switch operably coupled with said line downstream from said valve for establishing electrical continuity in said circuit means upon opening of the valve and flow of water under pressure in said line to said head.

4. The invention of claim **1**,

and an additional electrically responsive pumping device having an inlet and an outlet,

the inlet of said additional device being adapted for communication with a supply of a sterilizing chemical,

there being a conduit communicating said outlet of the adidtional device with said line,

said circuit means coupling said additional device with said terminal means,

said switching means being electrically coupled with said additional device for controlling the latter, and effecting operation of said additional device for a preset time duration occurring during said rinse period, whereby to subject the tableware in the chamber to the sterilizing chemical.

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