

April 15, 1952

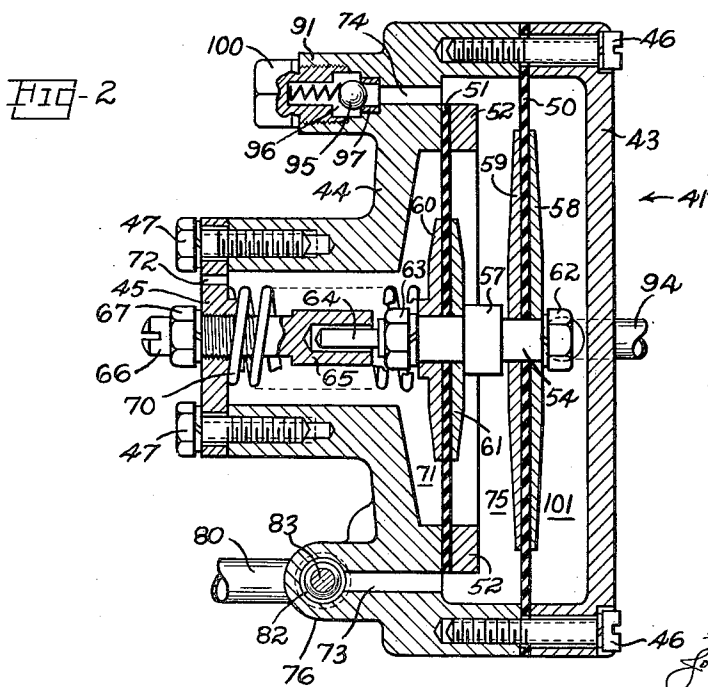
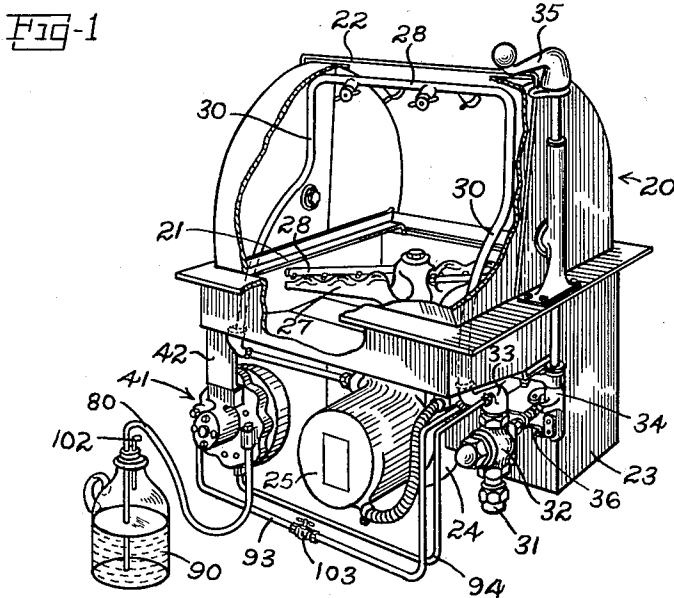
G. B. FOX ET AL

2,592,885

METHOD OF AND APPARATUS FOR WASHING DISHES

Filed May 29, 1946

2 SHEETS—SHEET 1



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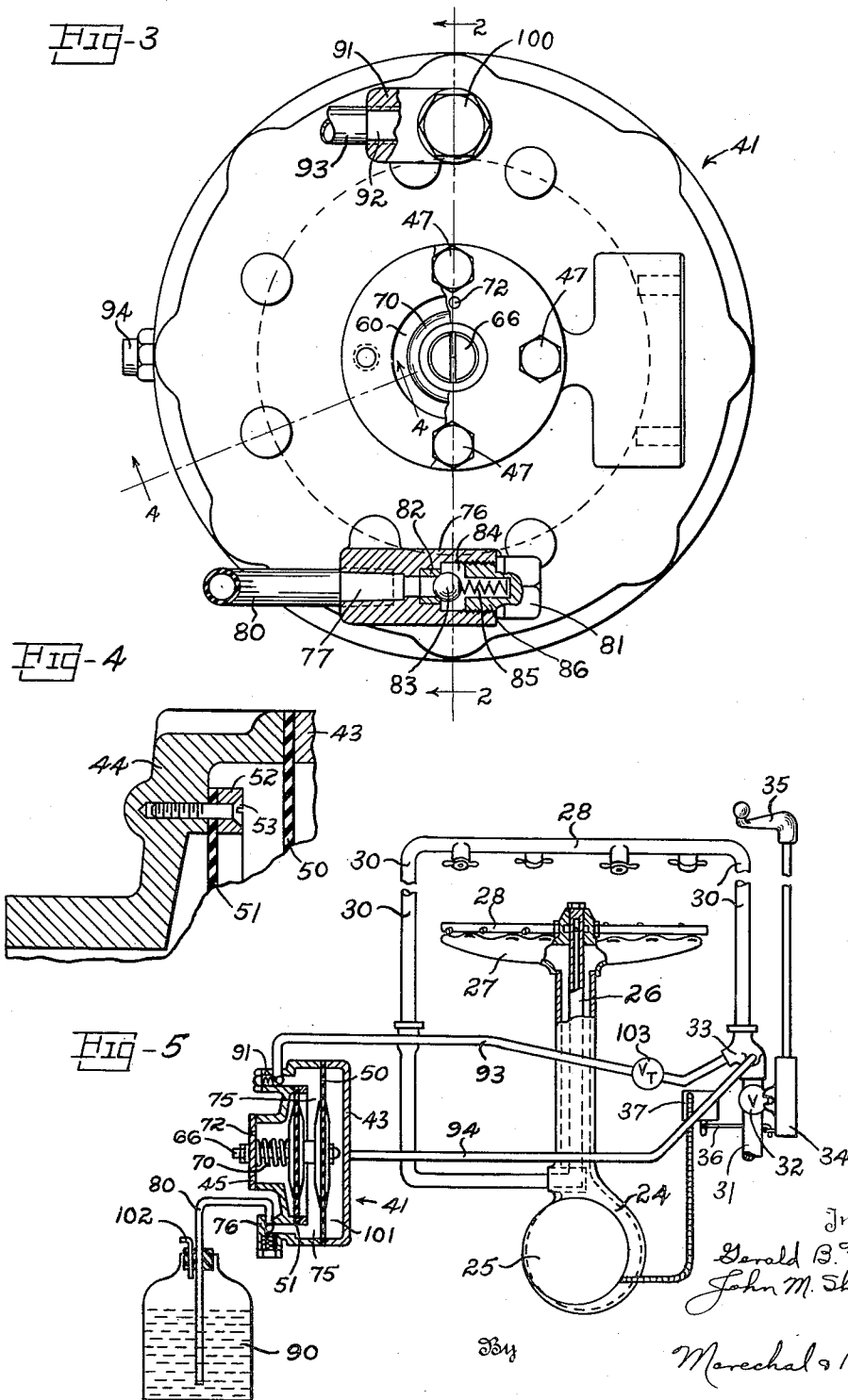
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2 SHEETS—SHEET 2



UNITED STATES PATENT OFFICE

2,592,885

METHOD OF AND APPARATUS FOR
WASHING DISHESGerald B. Fox and John M. Sherman, Troy, Ohio,
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Application May 29, 1946, Serial No. 672,961

11 Claims. (Cl. 134—36)

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This invention relates to washing machines, and more particularly to a method and means for utilizing a disinfectant in a dishwashing machine to provide sanitized dishes.

It is a primary function of a dishwashing machine to provide for the washing and rinsing of dishes, silverware, and the like, to remove food particles therefrom, and it is also highly desirable to provide for the delivery of the washed dishes in a sanitary and health-hazard-free condition. The washing of dishes in a manner to assure a maximum of sanitation, in the sense of minimizing bacteria populations has received considerable attention over a period of time and in many cases special precautions have been taken to assure proper sanitation in the washed dishes. All dishes are potentially contaminated with undesirable bacteria that must be destroyed if the dishes are to be rendered health-hazard-free. The need of good sanitation is well recognized in institutions such as hospitals and the like where care is usually exercised to provide rinses of sufficiently high temperature to assure complete kill of all disease-producing bacteria. The need of good sanitation in commercial establishments, such as restaurants, bars, soda fountains and the like, is usually well recognized by public health officials but is frequently not as well recognized by the trade. Furthermore in most cases it has been either impractical or uneconomical to provide such high temperature water for destroying objectionable bacteria. The customary supply of rinse water usually found available in this type of installation varies from 120° F. to about 140° F., which is below that which will assure the destruction of bacteria and the obtaining of proper sanitation in these instances has heretofore been unsatisfactory.

It is accordingly one of the principal objects of this invention to provide a method and a means for washing dishes which assures the washing of the dishes in a manner which will not only free them of adhering food particles or the like, but will also assure that the dishes will be in a highly sanitary condition and substantially free of bacteria even with the use of lower temperature wash and rinse fluids.

It is another of the objects of this invention to provide a method and means for automatically introducing a relatively small measured quantity of a disinfecting fluid directly into the rinse line connected with the rinse arms and nozzles of a dishwashing machine, so as to insure the proper and efficient use of the disinfectant with every rinse operation and to develop in the lower tem-

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perature water a killing power for disease bacteria equal to or greater than that secured from the use of higher temperature water alone.

Another of the objects of the present invention is to provide a small, ruggedly constructed, quick acting fluid injecting means having few moving parts, which will be automatic in both filling and discharging, and will be operated by the pressure of the fluid in the rinse supply line of a washing machine so that it requires no further attention from the operator.

It is also an object to provide a diaphragm type of disinfectant injector for a dishwashing machine which is designed to operate quietly and rapidly, and to so effectively function in accurately controlling the introduction of a predetermined and relatively small quantity of disinfectant into a relatively large quantity of rinse fluid that even with the operating temperature of the rinse fluid reduced to about 120° F. to 140° F. the bacteria count will be drastically cut down so that it will be within acceptable public health regulations.

Another object resides in the provision for a dish or glass washing machine of a self-filling injector which will provide for the pumping of a measured small charge of a disinfectant fluid from a reservoir followed by a pressure injection of that fluid directly into the line supplying the rinse fluid, the small charge of the disinfectant being thoroughly and substantially uniformly admixed with a considerably larger volume of rinse fluid throughout the entire or substantially the entire time of supply of such fluid.

It is another object to provide a compact, inexpensive disinfectant proportioner and injector for a washing machine wherein diaphragms or pistons of different sizes are utilized to provide an automatic filling and discharge action, and which makes use of the pressure within the rinse supply line to inject a measured portion of disinfecting fluid back into the same line, but at a higher pressure.

Other objects and advantages of this invention will be apparent from the following description, the appended claims, and the accompanying drawings, in which:

Fig. 1 is a perspective view, partly broken away, showing the interior of a washing machine provided with a disinfectant injecting device constructed in accordance with the present invention;

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 3;

Fig. 3 is a front elevational view, partly broken

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away and partly in section, of the disinfectant injecting mechanism;

Fig. 4 is a broken, fragmentary detail view, partly in section, taken on the line 4—4 of Fig. 3; and

Fig. 5 is a schematic diagram showing a preferred arrangement of piping and valves for connecting the rinse arms and the rinse supply line with the disinfectant supply and injector.

Referring to the drawings which illustrate a preferred embodiment of the invention, and to Fig. 1 in particular, there is shown by way of illustrative example a machine for washing dishes or utensils and the like which is generally indicated by the reference numeral 20. A supporting track 21 is provided therein to position a utensil or dish rack (not shown) which is adapted to carry the glasses or dishes to be washed. A semicylindrical cover 22 adapted to enclose the machine is suitably mounted for movement to an open position, providing for the ready insertion and removal of a rack of dishes or utensils, and to a closed position (Fig. 1) when the machine is to be operated. The machine is further provided with a tank or sump 23 communicating with a centrifugal pump 24 driven by a motor 25 and adapted to circulate a wash fluid contained within the tank upwardly through a system of pipes, generally indicated at 26 in Fig. 5, and into a wash distributor or arm 27 shown as located below the rack carrying the dishes or utensils to be washed, and by means of which the wash fluid is forcibly expelled and recirculated to effect a washing and cleansing of the utensils.

To effectively rinse the utensils after they are washed as described, rinse arms or nozzles 28 are located, preferably above and below the rack carrying the utensils, so that a fresh and clear supply of rinse fluid may be sprayed over the utensils as desired. A pipe 30 connecting the rinse arms 28 in a continuous circuit with the main rinse supply pipe 31 is provided so that the rinse fluid may be introduced from an outside source, such as a public water supply system for example, and may also be heated from an outside source to a desired degree of temperature in compliance with public health and sanitary regulations. In this way the wash and rinse operations have been kept separate and independent functions of the machine, the wash fluid being recirculated and reused while the rinse fluid is always fresh. However, it is to be understood that the construction of the machine is such that the rinse fluid drains from the dishes and utensils down into the tank holding the wash fluid to replenish such supply of wash fluid, an overflow pipe being provided therein to prevent overflowing of the tank.

To facilitate rapid and easy operation, a valve 32 of the quick opening and closing type has been provided having a connection into the fitting 33 of the rinse line. This valve is hand-operated by means of a mechanical linkage which has a shaft 34 connecting with the handle 35. There is also a connection 36, Fig. 5, from the lower end of shaft 34 to the switch 37 in the line controlling the energization of the motor 25 driving the pump 24. Handle 35 when turned from neutral to one position thus provides for starting and stopping the flow of wash fluid into the arm 27, and when turned in the other direction provides for starting and stopping the flow of rinse fluid into the arms 28.

It has been found desirable for the reasons

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previously stated to introduce a relatively small quantity of disinfectant into the rinse fluid so that a condition toxic to bacteria will be established under the operating conditions described such that the bacterial content upon the dishes and utensils will be materially reduced. To accomplish this with relatively low temperature rinse fluid, a small quantity of disinfectant is thoroughly admixed with the rinse fluid during each rinse operation. Where, for example, there is a 10 second rinse operation, there may be used approximately 5 to 10 milliliters of about 10% solution of a disinfectant of the type commercially known as quaternary ammonium salt compounds. In this group are classified such compounds described as alkyl dimethyl benzyl ammonium chloride, diisobutyl phenoxy-ethoxy ethyl dimethyl benzyl ammonium chloride, cetyl pyridinium chloride, oleyl dimethyl ammonium bromide and like compounds. These compounds are known by such trade names of Roccal, Hyamine, Quartol, B. T. C., Ceepryn, etc. It is also understood that other types of disinfectants, such as hypochlorites, chloramines, phenol derivatives, heavy metals, etc., varying in amounts and concentrations and which are effective bactericides under conditions of operation encountered may also be used.

The injector mechanism, generally indicated by the numeral 41 in Fig. 1, for introducing the disinfectant into the rinse supply is bolted to a bracket 42 attached at one side of the dishwashing machine and comprises a plurality of casing members 43, 44 and 45 secured together in any suitable way as, for example, by means of bolts 46 and 47, as shown in Fig. 2. Secured between the casing members 43 and 44 is a diaphragm 50 constructed of "neoprene" or any other similar material giving sufficient flexibility under the conditions of operation encountered. A second diaphragm 51, similar to diaphragm 50 except in surface area, is also provided and is held in position by means of the ring 52 secured to the casing 44 by means of the bolts 53 as illustrated in Figs. 2 and 4.

Diaphragms 50 and 51 are secured together at their centers in fixed relationship by means of shaft 54 which passes through suitable apertures provided in the middle of the diaphragms and through the spacing block 57. Washers 58, 59, 60 and 61 are provided on each side of the diaphragms to support them and provide the necessary rigidity required for operation as herein described. As illustrated in Fig. 2, washers 58 and 59 are held in position against diaphragm 50 between the spacing block 57 and a nut 62 upon the end of shaft 54. Washers 60 and 61 are similarly held in position against the diaphragm 51 between the spacing block 57 and a nut 63 on the other end of shaft 54. Shaft 54 terminates in a reduced portion 64 adapted to be slidably mounted within the body portion 65 of an adjusting screw 66 which extends through an aperture in the casing 45.

A nut and washer 67 abutting against the casing 45 secure the adjusting screw in position but permit the body portion 65 to be rotated and advanced or retracted with respect to the reduced portion 64 of shaft 54. Spring 70 coiled about the body portion 65 of the adjusting screw is adapted to seat at one end against casing 45 and at the other end against washer 60 and provides a compressing means which will tend to urge the diaphragms 50 and 51 in one direction and to resist their movement in the

other direction. In this way a construction is provided which permits movement of the diaphragms 50 and 51 to be controlled in either direction. It will be seen from reference to Fig. 2 that the principal parts of the adjusting screw 66, including the spring 70, are enclosed in a compartment 71 which is defined between the diaphragm 51 and the end casing member 45. To insure proper functioning, and to prevent pressure from building up in this compartment, a small port 72 extends through the casing member 45 as most clearly seen in Figs. 2, 3 and 5. Thus there is provided a means for venting this compartment to the atmosphere.

It is to be noted from the construction provided that the effective area of the diaphragm 50 is substantially larger than the effective area of the diaphragm 51, about twice the area in the form shown, and that the two diaphragms are so connected together by means of the shaft 54 as to be moved in unison to perform the functions of a differential diaphragm or piston. Thus the diaphragms 50 and 51 are normally forced toward the right as viewed in Fig. 2 by means of the compression spring 70, and to the left by pressure exerted upon diaphragm 50 from fluid in the rinse supply line as will be presently described.

Passages 73 and 74 formed within the casing 44 communicate with a fluid tight compartment 75 defined between diaphragms 50 and 51. At one end of the passage 73, referring to Figs. 2 and 3, there is provided a suction operated disinfectant inlet check valve, generally referred to by the numeral 76, which has a passage 77 extending therethrough one end of which is adapted to be connected to a flexible conduit 80 and the other end being closed by a valve cap and washer 81. In this passage is mounted a valve seat insert 82 having a ball 83 contained in the chamber 84 adapted to seat therein and close passage 77. Adapted to coact with the ball 83 is a coiled spring 85 which in turn is mounted within the passage 77 and held in position by the guiding ring 86 formed integrally with cap 81. Valve cap and washer 81 completes the check valve assembly.

Discharge check valve 91 is constructed similarly to inlet valve 76 and is provided in connection with the passage 74. It has a passage 92, Fig. 3, adapted to be connected at one end to a pipe 93 which in turn is connected with the rinse fluid supply line at a point on the downstream side from pipe 94, and at its other end with passage 74. As seen in Fig. 2, the ball 95 is so positioned in chamber 96 that it is adapted to seat on a valve insert 97 to close the passage into passage 74. A valve cap and washer 100 is also provided to complete this check valve assembly. This construction thus provides a pressure operated outlet check valve for the disinfectant collected in chamber 75.

A second fluid tight compartment 101 is provided and defined between casing 43 and diaphragm 50, and is in communication with the rinse supply line through a connection with pipe 94. Referring to Fig. 5, it will be seen that the injector mechanism 41 thus has a pressure supply pipe 94 connecting compartment 101 with the rinse supply line 31 through the fitting 33 at a point which is on the upstream side from pipe 93. Compartment 75 is connected at one end through the inlet valve 76 and flexible conduit 80 to the disinfectant supply container 89, which has a breather or vent pipe 102 in the top pro-

vided so that the disinfecting fluid will be under atmospheric pressure while in the container. At the other end, compartment 75 is connected through the outlet valve 91, pipe 93 and the needle valve 103 to the rinse supply line 31 through the fitting 33.

To operate the injector mechanism for the first time, valve 32 is opened so that rinse fluid at line pressure flows through pipe 94 into compartment 101. The pressure thus exerted tends to move or flex diaphragm 50 to the left, as viewed in Figs. 2 and 5, and thereby reduces the volume of compartment 75 since the area of diaphragm 50 is approximately twice that of diaphragm 51. This decreasing of the volume forces the air from compartment 75 through outlet valve 91 and into pipe 93 which in turn communicates with the rinse supply line 31 and the rinse arms 28. It will be clear that the construction of the valves is such that pressure exerted from within the compartment 75 will cause the closing of the inlet valve 76, while the outlet valve 91 is opened thereby.

Upon closing valve 32 pressure is removed from compartment 101, spring 70 thereupon expanding to move the diaphragms to the right and increasing the volume of compartment 75. The resulting reduction in pressure within compartment 75 causes valve 81 to close thus preventing return flow of disinfectant through line 93, and at the same time creates a suction effect on valve 76 and in conduit 80, causing valve 76 to open and drawing fluid from container 89 into compartment 75. Several such operations of valve 32 may be required initially to fill chamber 75 with the disinfectant liquid.

After compartment 75 has been filled with disinfectant for the first time, the injector 41 is ready for normal operation. Further flexing of diaphragm 50, in response to the opening and closing of valve 32, then displaces the predetermined quantity of the disinfecting fluid collected in compartment 75 through the outlet valve 91 and into pipe 93 connecting with the rinse supply line and the rinse arms of the washing machine, and compartment 75 refills automatically with another charge of disinfecting fluid which is discharged on the next rinse operation. Thus it will be apparent that after compartment 75 has been filled for the first time the subsequent filling and discharge therefrom is automatic and corresponds to each closing and opening of the rinse supply valve 32, so that for each rinse operation of the machine there will be injected into the rinse fluid a measured amount of disinfectant. Fluid which has been drawn into compartment 75, as previously described, is displaced through outlet valve 91 at a rate controlled by the opening in the needle valve 103, which is adjusted so that the disinfectant will flow at a predetermined rate depending upon the normal operating pressure existing in the rinse supply line 31. Only occasional adjustment need be made in this valve, depending upon wide variations in the line pressure, it being desired to control such operation so that the disinfectant continues to be uniformly injected over substantially the entire rinse cycle, usually of the order of 10 seconds or the like.

It will be understood that the fluid being discharged from compartment 75 is under a greater pressure than exists in the rinse supply line 31, pipes 93 and 94 and compartment 101 due to the construction and positioning of diaphragms 50 and 51. Thus, it will be seen that although the

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pressure in compartment 75 opposes movement of the diaphragms 50 and 51 to the left, as seen in Fig. 2, by an amount equal to the pressure therein multiplied by the area of diaphragm 50, it will aid movement to the left by an amount equal to the pressure multiplied by the area of diaphragm 51. Also opposing movement of diaphragms 50 and 51 to the left is the force exerted by spring 70. However, the areas of the diaphragms are chosen so that the total forces tending to oppose movement of the diaphragms to the left are overcome by the greater total force exerted to the left by the pressure transmitted through pipe 94 from the rinse supply line upon diaphragm 50, which has a substantially larger effective area than diaphragm 51, and which has such larger effective area than diaphragm 51 that even with a somewhat lesser pressure, the total force acting to move the diaphragms toward the left is greater. There is thus provided a flexing of the diaphragms 50 and 51 to the left which decreases the volume of compartment 75 and thereby produces a pressure on the fluid therein which exceeds the pressure in the rinse supply line 31 and is sufficient to force the disinfecting fluid through outlet valve 91, needle valve 103 and pipe 93 into the rinse supply line 31. It will be apparent also that because the pressure exerted on the fluid in compartment 75 and pipe 93 is greater than the pressure of the rinse fluid in compartment 101 and pipe 94, the disinfectant flows from compartment 75 into the rinse supply line, and being at a higher pressure than exists in that line the disinfectant is thoroughly admixed with the rinse fluid before being discharged from the rinse arms or nozzles 28.

Spring 70, which is compressed by movement of the diaphragms, is adjusted so that its initial and final forces exerted against the diaphragms will not prevent the flow of disinfectant from chamber 75, but will, when the rapid action rinse valve 32 is closed at the end of the rinse period, return the diaphragms to their original position; that is, to the same position they occupy before the rinse valve 32 is opened. Thus it will be apparent that this movement, by increasing the volume of compartment 75, reduces the pressure therein below atmospheric and permits the inlet valve 76 to open and a supply of disinfectant to flow therethrough to fill compartment 75 from the supply in container 90. At the same time the outlet valve 91 is closed by the pressure of its spring tending to seat ball 95. The rinse liquid in compartment 101 is released to the atmosphere through the pipes 94 and 30 and the rinse arms 28.

The following is given as a specific example of the results obtained under normal operating conditions using a dishwashing machine constructed and operated in accordance with this invention. The machine was first operated without the addition of any sanitizing or disinfecting material, the dishes being washed at a temperature of 120° F. for two minutes, and then rinsed in water at 120° F. for 10 seconds. The following bacteria count conditions were then observed:

	Per ml.
Bacteria count of wash water.....	64,000
Bacteria count of rinsed plates.....	224
Bacteria count of rinsed cups.....	231

Thereafter with all other conditions the same, the machine was operated with the introduction of the sanitizing and disinfecting agent as described herein, being adjusted to introduce about 5 to 6 ml. of a 10% solution of a quaternary am-

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monium chloride to provide a final concentration in the rinse water of about 1 part to 10,000. The following bacteria count conditions were observed:

	Per ml.
Bacteria count of wash water (after 8 rinse waters containing the sanitizing agent had entered the wash solution).....	760
Bacteria count of rinsed plates.....	4
Bacteria count of rinsed cups.....	4

A further check of the wash water in the machine after repeated rinse operations during which the concentration of the sanitizing material in the wash water had built up to a condition approaching that in the rinse water, showed a still further reduction in bacteria count to about 12 per ml., at which time the rinsed dishes showed a zero bacteria count.

From the above description it will be apparent that there is provided a compact and automatically operating injector which utilizes pressure in the rinse fluid supply line to introduce a small, measured quantity of a fluid disinfectant directly into the rinse fluid supply line, and at a pressure higher than exists in that line so as to assure a thorough mixing of the disinfectant and the rinse fluid before the latter is sprayed over the dishes and utensils in the dishwashing machine.

While the form of apparatus and method herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus and method, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a device of the character described having rinse nozzles, a rinse supply line connected thereto, a disinfectant supply, and a disinfectant injector controlling the flow of a measured amount of disinfectant from the disinfectant supply into the rinse supply line comprising a plurality of casing members secured together to form an enclosed chamber, a diaphragm positioned on one side of said chamber forming a fluid tight compartment therein, a second diaphragm positioned in said chamber adjacent the first said diaphragm and forming a fluid tight compartment therewith, means connecting said diaphragms for movement in unison, spring means engaging the second said diaphragm and limiting the movement thereof, means for connecting the first said compartment with the rinse supply line, a suction operated inlet valve communicating between the second said compartment and the supply of disinfectant, a pressure operated outlet valve connecting the second said compartment with the rinse supply line, and means for venting said chamber.

2. In a device of the character described having rinse nozzles, a rinse supply line connected thereto, a disinfectant supply, and a disinfectant injector controlling the flow of a predetermined amount of disinfectant from the disinfectant supply into the rinse supply line comprising a plurality of casing members secured together to form an enclosed chamber, a diaphragm positioned in one end of said chamber forming a fluid tight compartment therein, a second diaphragm positioned in said chamber adjacent the first said diaphragm and forming a second fluid tight compartment between said diaphragms, means connecting said diaphragms for movement in unison, adjustable means positioned to engage the second

said diaphragm and limiting the movement thereof, means adjacent said adjustable means for venting said chamber, means for connecting the first said compartment with the rinse supply line, a valve to start and stop the flow from the rinse supply line to the first said compartment, an inlet valve connecting the second said compartment and the supply of disinfectant, an outlet valve and line connecting the second said compartment and the rinse supply line, and an adjustable valve positioned in the line between the outlet of the second said compartment and the rinse supply line for controlling the flow of disinfectant at a predetermined rate depending upon the pressure in the rinse supply line.

3. In combination in a washing machine having rinse outlet means positioned therein, a rinse supply line connected with said rinse outlet means, a separate source of disinfectant, a disinfectant injector connected with said rinse supply line and said supply of disinfectant and comprising means forming a pump responsive to fluid pressure within said rinse supply line to force a measured supply of said disinfectant into said rinse supply line, said rinse supply line having a control valve located at a position on the upstream side of the connection between said injector and said line to cause operation of said pump only when said control valve is open, and means for metering the discharge of said measured supply of disinfectant into said rinse supply line at a substantially uniform rate while said control valve is open.

4. In combination in a washing machine having rinse outlet means positioned therein, a rinse supply line connected to said outlet means and a separate supply of disinfectant, a disinfectant injector connected with said rinse supply line and said supply of disinfectant and having a chamber therein, a plurality of movable members forming a pair of separate fluid-tight compartments in said chamber, means including a one-way valve connecting one of said compartments with said disinfectant supply to provide a flow of disinfectant into said one compartment upon movement of said movable members in one direction, means including a second one-way valve connecting said one compartment with said rinse supply line to provide a flow of disinfectant from said compartment into said rinse supply line upon movement of said movable members in the opposite direction, and controllable means connecting said rinse supply line with the other of said compartments to conduct line pressure into said other compartment for effecting movement of said movable members in the direction to cause said flow of disinfectant from said one compartment into said rinse supply line.

5. In combination in a dishwashing machine having rinse outlet means positioned therein, a rinse supply line connected to said outlet means and having a control valve therein, and a separate supply of disinfectant, a disinfectant injector connected with said rinse supply line and said disinfectant supply and having a chamber therein, means forming a differential piston mounted in said chamber and defining a pair of separate fluid-tight compartments therein, said piston means including a smaller pressure face opposed to the pressure in the first said compartment and a larger pressure face connected to said smaller pressure face for operation in unison therewith and opposed to the pressure in the second said compartment, means including a one-way valve connecting said disinfectant supply with said

first compartment to cause a flow of disinfectant into said first compartment upon movement of said piston in one direction, means including a second one-way valve connecting said first compartment with said rinse supply line at a point on the downstream side of said control valve to cause a flow of disinfectant from said first compartment into said rinse supply line upon movement of said piston in the opposite direction, a pressure supply line connecting said second compartment with said rinse supply line at a position between said control valve and said connection from said first compartment to apply line pressure to said second compartment for movement of said piston in the direction to cause a flow of disinfectant from said first compartment into said rinse supply line, and means for causing return movement of said piston when said control valve is closed.

6. In combination in a washing machine having rinse outlet means positioned therein, a rinse supply line connected with said outlet means, and a separate supply of disinfectant, a disinfectant injector connected with the rinse supply line and the supply of disinfectant and having a chamber therein, means forming a differential piston mounted in said chamber and defining a pair of separate fluid compartments therein, said piston means including a smaller pressure face opposed to the pressure in the first said compartment and a larger pressure face connected to said smaller pressure face for operation in unison therewith and opposed to the pressure in the second said compartment, a communicating passage from said rinse line to said second fluid compartment to supply fluid thereto for developing operating pressure for said piston means, and means including one-way inlet and outlet valves connecting said first fluid compartment with said disinfectant supply and said rinse supply line respectively and cooperating with said piston means to form a pump for delivering disinfectant into said rinse supply line under pressure in excess of the line pressure existing therein upon the application of said line pressure to said second fluid compartment.

7. In combination in a washing machine having rinse outlet means positioned therein, a rinse supply line connected with said outlet means, and a separate supply of disinfectant, a disinfectant injector connected with the rinse supply line and the supply of disinfectant and having a chamber therein, means forming a differential piston mounted in said chamber and defining a pair of separate fluid compartments therein, said piston means including a smaller pressure face opposed to the pressure in the first said compartment and a larger pressure face connected to said smaller pressure face for operation in unison therewith and opposed to the pressure in the second said compartment, a communicating passage from said rinse line to said second fluid compartment to supply fluid thereto for developing operating pressure for said piston means, means including one-way inlet and outlet valves connecting said first fluid compartment with said disinfectant supply and said rinse supply line respectively and cooperating with said piston means to form a pump for delivering disinfectant into said rinse supply line under pressure in excess of the line pressure existing therein upon the application of said line pressure to said second fluid compartment, a control valve for the flow of fluid from the rinse supply line into said second compartment, and control means positioned to oppose

movement of said piston means under said developed pressure and to aid movement of said piston means in the opposite direction upon the termination of said fluid supply to said second compartment.

8. In combination in a washing machine having rinse outlet means positioned therein, a rinse supply line connected with said outlet means, and a separate supply of disinfectant, a disinfectant injector connected with the rinse supply line and the supply of disinfectant and having a chamber therein, means forming a differential piston mounted in said chamber and defining a pair of separate fluid compartments therein, said piston means including a smaller pressure face opposed to the pressure in the first said compartment and a larger pressure face connected to said smaller pressure face for operation in unison therewith and opposed to the pressure in the second said compartment, a communicating passage from said rinse line to said second fluid compartment to supply fluid thereto for developing operating pressure for said piston means, means including one-way inlet and outlet valves connecting said first fluid compartment with said disinfectant supply and said rinse supply line respectively and cooperating with said piston means to form a pump for delivering disinfectant into said rinse supply line under pressure in excess of the line pressure existing therein upon the application of said line pressure to said second fluid compartment, a control valve for the flow of fluid from the rinse supply line into said second compartment, control means positioned to oppose movement of said piston means under said developed pressure and to aid movement of said piston means in the opposite direction upon the termination of said fluid supply to said second compartment, and means for venting said chamber.

9. In combination in a washing machine having rinse outlet means positioned therein and a rinse supply line including a control valve connecting said rinse outlet means with a supply source of rinse fluid under pressure, a supply source of disinfectant, a casing, means connecting said casing with said disinfectant source, means connecting said casing with said rinse supply line on the downstream side of said valve, means in said casing responsive to the flow of fluid under pressure and having a pressure connection with said rinse supply on the downstream side of said valve, and means in said casing cooperating with said flow responsive means to form a pump responsive to said flow of rinse fluid upon the opening of said valve to cause a predetermined quantity of disinfectant to flow from said supply source through said casing and into said rinse supply line.

10. In combination in a washing machine having rinse outlet means positioned therein, a rinse supply line including a control valve connecting said rinse outlet means with a supply source of rinse fluid under pressure, a supply source of

disinfectant in liquid form, a control unit including means responsive to the flow of liquid under pressure, means forming a pressure connection between said control unit and said supply line at a position on the downstream side of said valve to effect operation of said flow responsive means by the flow of rinse fluid from said valve to said rinse outlet means, means in said control unit cooperating with said flow responsive means to form a pump connecting said disinfectant source with said rinse supply line at a position on the downstream side of said valve for effecting injection of said liquid disinfectant into said rinse supply line when said rinse control valve is open, and means cooperating with said pump for controlling the rate of said injection in predetermined relation to the pressure in said rinse supply line.

11. A method of reducing the bacteria count upon articles in a washing machine through application of disinfectant which comprises the steps of applying to said articles a flow of fresh rinse fluid under pressure from a supply line of said fluid having a control station for starting and stopping said flow, connecting a supply of disinfectant in fluid form with said supply line at a location between said control station and the point of application of said flow to said articles, utilizing the line pressure of said supply line at a position downstream from said control station to cause injection of a small quantity of said disinfectant into said supply line against the line pressure thereof at said connecting location in response to starting of said flow of rinse fluid to said articles, and controlling said injection at a metered rate causing said injection to continue during substantially the entire time of said application of said rinse fluid to said articles.

GERALD B. FOX.

JOHN M. SHERMAN.

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